



Chapter 6: Work Practices and Site Control

Workers' exposures to hazards at a waste site are controlled using engineering and administrative controls and personal protective equipment (PPE), in that order. Engineering controls are the most effective way to reduce workers' exposure. Personal protective equipment does not control the source of exposure, but it does reduce the amount of substance reaching the body.



Safe work practices are vitally important to protect the workers' safety and health. Standard operating procedures (SOPs) are written instructions for safe work practices. Safe work practices can minimize exposure for workers, the environment, and nearby communities. Each site's SOP contains written instructions for safe work practices.

Chapter Objectives:

After completing this module, you will be able to:

1. Recognize what information is needed about the work site before cleanup work begins.
2. Obtain information from a site-specific health and safety plan.
3. Explain terms used when talking about hazard controls. For example "site map," "buddy system," "communication systems," "work zones," and "site control."
4. Recognize when unsafe methods are being used.
5. Explain the five approaches to controlling hazards.



Case Study

Workers were assigned to cut apart an empty 500-gallon tank. A mixture of benzene, xylene, and toluene had been drained out of the tank and there was no liquid inside. Everything was going fine when they were cutting on the outside of the tank, but once they cut through the metal there was a giant roar and flames shot out of the top of the tank. Luckily, it was a flash fire that went out quickly and no one was hurt. **Why did this happen?**

Some of the chemical vapors were left in the tank and caught fire. In this chapter you will learn about how to do the work safely to prevent this kind of problem.



There is no single description of a hazardous waste site. The contaminants, size of the site, duration of cleanup, and other aspects of hazardous wastes sites vary widely. For example, a hazardous waste site could be a military base contaminated with heavy metals, an abandoned industrial facility contaminated with chlorinated solvents, a chemical spill on a highway, or a chemical plant following an explosion.

Site characterization and analysis identifies the safety and health hazards on a hazardous waste site so that they can be controlled. Site characterization must be done before cleanup begins on a hazardous waste site and conditions must be monitored after site characterization to detect changes. --29CFR1926.65(c)

Experts must determine:

1. What chemicals or hazardous wastes are at the site
2. How much of each hazardous substance is on site
3. Chemical and physical properties of the hazardous substances
4. Safety and health hazards on the site
5. Appropriate controls, including PPE, to protect employees from the hazards

Hazardous waste site characterization and analysis requirements can be divided into seven parts.



Part 1: Required Information

Before workers can enter a site, the following information must be obtained:

1. Location and approximate size of the site
2. Description of the tasks to be performed
3. Time required to do the tasks
4. Site layout and accessibility by air and roads
5. Safety and health hazards expected at the site
6. Pathways for movement of released hazardous substances
7. Capabilities of emergency response teams
8. Expected hazardous substances and their chemical and physical properties



Potential Hazards

Chemical	Biological
• Acids • Bases (caustics) • Solvents • Chemical hazards may be in the form of gases or vapors, liquids, solids, dusts, and fumes	• Bacteria - <i>Salmonella</i> • Parasites - ticks, chiggers, mites • Plants - poison ivy, poison oak • Animals - snakes, rodents, wild dogs • Viruses - AIDS, hepatitis • Animal waste - hanta virus, psittacosis, histoplasmosis
Physical	Physiological or Psychological
• Radiation • Noise • Vibration • Electricity • Temperatures - heat and cold • Slips, trips, falls • Punctures - needle sticks • Trenches and excavations • Confined spaces • Utilities (above and below ground) • Site run-off	• Claustrophobia (fear of closed or narrow spaces) • Acrophobia (fear of heights) • Monotonous jobs • Disorientation in PPE • Anxiety (fear of hazardous waste) • Fatigue • Dehydration



Part 2: Personal Protective Equipment (respirator, suits, gloves, etc.)

Personal protective equipment must be provided for workers engaged in initial site entry. If this initial survey cannot establish airborne concentrations, all employees must use a high level of protective gear called Level B or higher (see Chapter 5).

Once further information on the hazards is available, the protective equipment will be reevaluated by the health and safety specialist and adjusted to be more or less protective.

Part 3: Preliminary Evaluation--History and Background

The preliminary site evaluation determines the level of protection to be worn by the entry team.

Information is obtained prior to the initial entry through observations and monitoring from the perimeter, interviews, and review of records, Safety Data Sheets (SDSs), and other documents regarding materials at the site.

After the preliminary evaluation, the entry and back-up teams evaluate the site's specific characteristics to identify existing hazards and help select the appropriate engineering controls and personal protective equipment for the tasks to be performed.

Until contaminant concentrations are known, Level B is the minimum level of PPE required for entry and back-up teams.





Part 4: Hazard Identification--A List of Dangers

Hazard identification documents all conditions that may cause death or serious harm, including those that may pose inhalation or skin absorption hazards that are immediately dangerous to life or health (IDLH). Hazards include but are not limited to confined spaces (including trenches and low spots), potentially explosive or flammable situations, and other construction hazards (falls, electrocution, noise, etc.).

Some of the dangers on a hazardous waste site are the same as on a regular construction job, and some of them are different. Even the simplest task can become hazardous while wearing a respirator and other PPE.

Part 5: Monitoring--Air Tests and Chemical Samples

Monitoring must be conducted during the initial entry when the site evaluation shows the potential for IDLH conditions or ionizing radiation or if the evaluation provides insufficient information to eliminate the possibility of these conditions. Hazardous levels of ionizing radiation are measured with direct-reading instruments. Direct-reading instruments are also used to identify IDLH conditions such as flammable or explosive atmospheres, oxygen deficiency, and toxic substances.

In addition to the monitoring required for initial entry, periodic monitoring is required when there is a possibility that exposures may exceed the Permissible Exposure Limits. Additional monitoring may be required when work begins in a different area, when work involves new contaminants, when different task are performed, or when working with obvious contamination.



Part 6: Risk Identification--How Great Are the Dangers?

Once hazards (specific hazardous materials or conditions) are identified, the risks associated with these hazards must be determined. Employees must be informed of any risks, including:

- Exposures exceeding OSHA PELs or other occupational exposure limits recommended by NIOSH or ACGIH;
- IDLH concentrations;
- Potential sources of skin and eye irritation or absorption;
- Explosion and flammability risks; and
- Oxygen deficiency or enrichment.

Part 7: Worker Notification

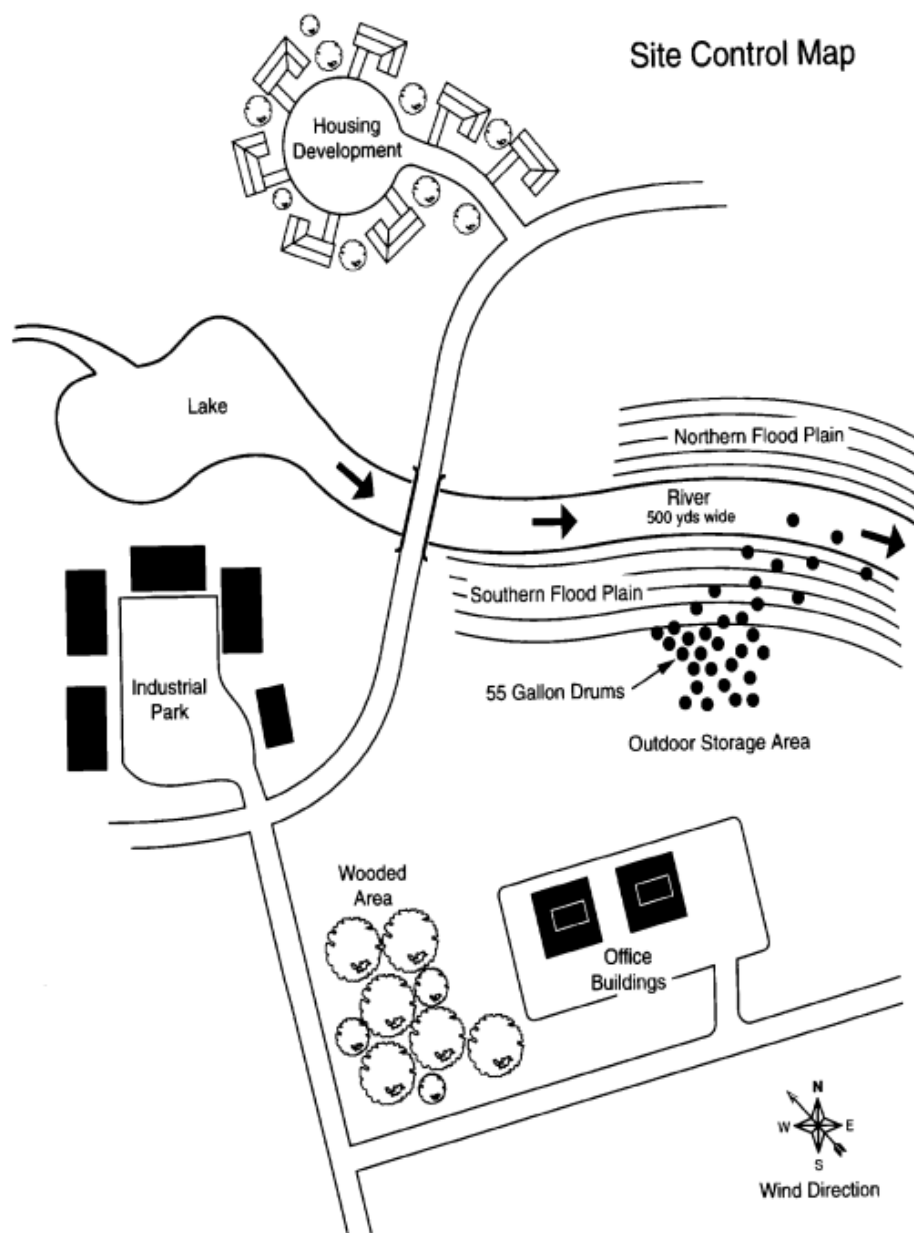
Before work begins, each site worker must be told about the substances known or expected to be present on the site. The employer must make information including chemical and physical properties and health effects available to workers so that they understand the hazards of doing their job.

A site control program for protecting employees must be implemented before cleanup begins on a hazardous waste site.--1926.65, Paragraph (d)

The program must include:					
Site maps	Work zones	Use of a "buddy system"	Site communications	Standard operating procedures	Location of the nearest medical assistance



A site map should show the lay of the land, prevailing wind direction, drainage, and the location of buildings, containers, impoundments, pits, ponds, and tanks. Site maps are helpful for planning PPE use, assigning personnel to work zones, and identifying evacuation routes. A site map should be modified during work to reflect changes in activities. Computer software or clear overlays can be used to help prevent information from cluttering the map.





Most hazardous waste sites have three work zones: Hot, Warm, and Cold.

The hazards, potential for exposure, and level of personal protective equipment needed is different for each zone. These zones are used to control the spread of hazardous substances, restrict the number of people in high-risk areas, and to ensure that the people in each area have appropriate training and PPE. You may hear each zone called several different names.

The Hot Zone, or Exclusion Zone, is the contaminated area and presents a high potential for exposure to hazards. Personnel working in this area wear the highest level of PPE required on the site. Workers must be decontaminated every time they leave the Hot Zone.

Activities performed in the Hot Zone include:

- Site characterization (e.g., mapping, photographing, sampling);
- Installation of wells for ground water monitoring or treatment; and
- Clean-up work such as drum movement and staging.

The boundary between the Hot Zone and Warm Zone is called the hot line. It must be clearly marked by lines or hazard tape or enclosed with physical barriers such as chains, fences, or ropes.

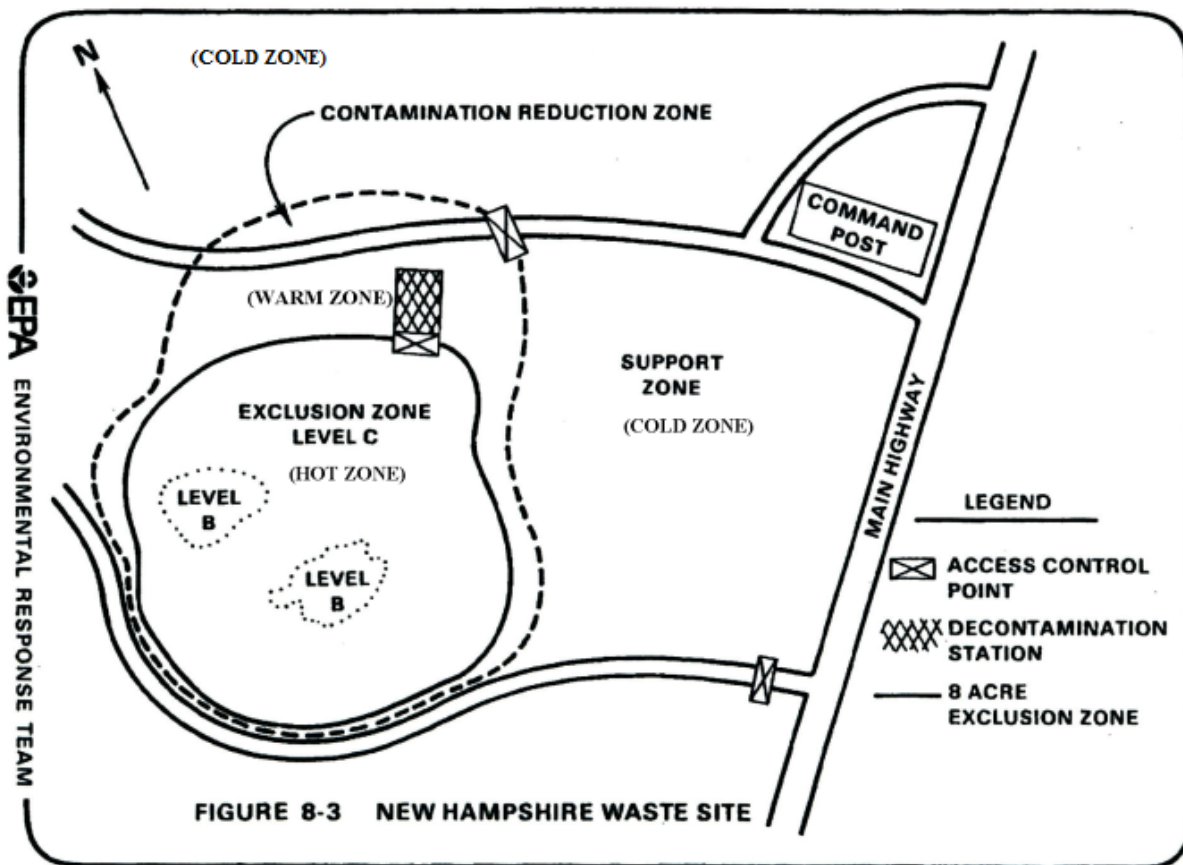
The Warm Zone is between the Hot and Cold Zones and where decontamination activities take place. The site safety officer, personnel decontamination station operator, and emergency response personnel are usually stationed in the Warm Zone. Equipment, supplies and workers' rest areas are also located here. The Warm Zone, or Contamination Reduction Zone, contains the Decontamination Line or Contamination Reduction Corridor. The decontamination line is made up of a series of stations, arranged in order of decreasing contamination, that reduce contamination. Personal protective equipment and clothing are removed and decontamination procedures take place in the warm zone to prevent the transfer of hazardous substances to cleaner areas. There are often two Decontamination Lines; one for workers and, if necessary, one for heavy equipment, tools, and machinery. Decontamination will be discussed in detail in Chapter 7.



The Contamination Control Line is the boundary between the Cold and the Warm Zone. Everything located outside of the Contamination Control Line is in the Cold Zone.

The Cold Zone, or Support Zone, is free of contamination and personnel should have no exposure. The command post supervisor, project team leader, and support field team members are usually stationed in the Cold Zone. The location of the Cold Zone is chosen for accessibility (emergency vehicles), resources (power lines, water, shelter), visibility (line of sight to the Hot Zone), wind direction (upwind of the Hot Zone), and distance (as far from the highest hazard as practical).

A Typical Arrangement of the Three Work Zones





Hazardous waste workers must always use the buddy system and work in teams of two or more. The “buddy system” requires teams of workers to watch out for each other’s safety and health.

A buddy provides assistance, observes his or her partner for signs of chemical exposure or heat stress, periodically checks the partner(s)’ PPE, and notifies the command post supervisor if help is needed.

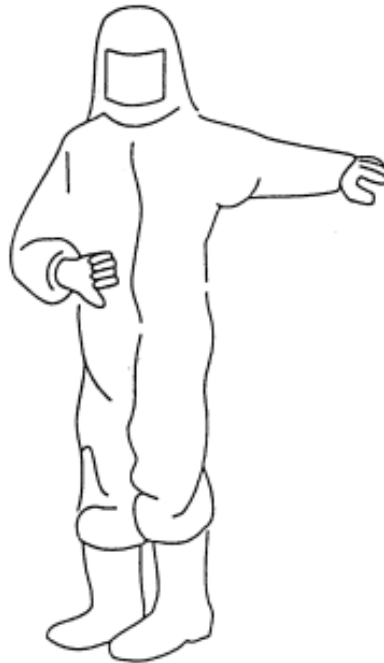
Buddies should maintain line-of-sight contact and communication with each other and the command post supervisor. Workers must make sure that hand signals are understood before entering the Hot Zone.



Communication systems need to be established prior to the start of work so that team members can alert each other to emergencies, pass along safety information (i.e., time available in air cylinder), initiate changes in work tasks, and maintain site control. **The system must address communication with individuals on the site and at other locations (for example, with emergency responders).** Internal communication systems include 2-way radios, walkie-talkies, audio and visual alarms, hand-signals, and cell phones. External communication systems include telephone, computer or email, 2-way radios, audio and visual alarms, including sirens, horns, flags or pennants, and strobe or other flashing lights. Any communication device that is electric or electronic must be intrinsically safe. Flares and smoke should only be used in the Cold Zone. **Site-specific training on communication and warning systems is required. Some common hand signals are shown on the following page.**



In trouble and need
help getting out of
suit!



Task cannot be completed
with remaining air.



Out of air!



This is an example of a basic communication plan

Channel 2 has been designated as the radio frequency for personnel in the Hot Zone. All other on-site communications will be on channel 3.

Personnel in the Hot Zone should remain in constant radio communication or within sight of the Project Team Leader. Any failure of radio communication requires an evaluation of whether personnel should leave the Hot Zone.

A horn blast is the emergency signal to indicate that all personnel should leave the Hot Zone. In addition, a loud speaker is available if required.

The following hand signals will be used in case of failure of radio communications:

Hand gripping throat = Out of air, cannot breathe

Grip partner's wrist or hands around the waist = Leave area immediately

Hands on top of head = Need assistance

Thumbs up = OK, I'm All right

Telephone communication to the Command Post should be established as soon as possible. The phone number is 555-555-5555.

Nearby medical facilities must be identified before cleanup begins on a hazardous waste site. The facility should be made aware of the cleanup activities and procedures for requesting medical assistance. All employees must be informed of the location the medical facility and how to notify them in the event of an emergency or when treatment is needed. The location of the nearest prepared medical facility and notification procedures must be included in the site control plan.



Safety and Health Program

OSHA [29CFR1926.65(b)] requires a safety and health program. The program must be written and identify, evaluate, and control safety and health hazards and provide for emergency response at hazardous waste sites. The written safety and health program and the site-specific safety and health plan, contained in the program, must be kept on site and available to anyone involved with the hazardous waste operation.

The safety and health program must describe:

1. An organizational structure for the operation;
2. A comprehensive workplan;
3. A site-specific safety and health plan;
4. The safety and health training program;
5. The medical surveillance program;
6. The standard operating procedures for safety and health; and
7. Any connection between the general program and site-specific activities.

The organizational structure section of the program must describe lines of authority (who reports to whom), **responsibilities of supervisors and employees, and communication between all personnel involved in the cleanup operation.** This information must be in writing and covered during the site-specific training. The lines or authority or organizational chart must identify a general supervisor who has overall responsibility and authority for clean-up activities. This section must also identify the safety and health supervisor who develops the site safety and health plan and makes sure it is followed. The components of the organizational structure section should be reviewed and updated as necessary to ensure that they are accurate and effective. Site-specific training is needed whenever there is a change in work location or process.



The comprehensive workplan must include activities, logistics, and use of resources. The comprehensive work plan should be reviewed during the site-specific training. The work plan must include specific details about:

- The tasks to be done;
- How they will be done;
- Who will do them;
- What equipment and resources will be needed;
- What training will be needed; and
- What medical tests will be needed.

How are hazardous wastes cleaned up?

Just as there is no single description of a hazardous waste site, there isn't one universal cleanup method. In the early days of hazardous waste cleanup, rusty barrels of chemicals were put into new drums and buried again in pits lined with plastic sheets. Tons of contaminated dirt were also dumped over the drums in these "safer" landfills. In 1984 EPA made it illegal to put hazardous waste in common landfills (the land ban). Since that time, scientists have been coming up with new ways to treat hazardous waste and to clean up water or soil. **Treatment methods include:**

Free-product recovery - Pump pools of waste out of the ground. The waste has to be treated with one of the methods below or the chemical may be purified and reused.

Filtration - Filter out solid hazardous waste from water with sand beds or other filters. The waste has to be treated with one of the methods below.

Incineration - Burn the hazardous waste in a high-temperature incinerator.

Solidification - Mix waste with cement and ashes to turn it into a solid block that can be buried in a regular landfill.





Chemical decontamination - Wash buildings or pipes or treat waste with chemicals to remove, transform, or neutralize the contaminant. The resulting solution may need to be treated with one of the above methods before disposal.

Mechanical decontamination - Scrape, blast, or grind buildings to remove chemicals. Sometimes special peel-off coatings are used. The dust and debris has to be treated with one of the above methods.

Dismantling - Cut machines or building components apart with saws, cutters, grinders, torches, explosives, or water jets. Dust must be treated with one of the above methods.

These treatment methods can cause serious health and safety problems without the proper precautions and controls.

The site-specific safety and health plan addresses the hazards during each phase of the work and the procedures and controls required to protect workers.

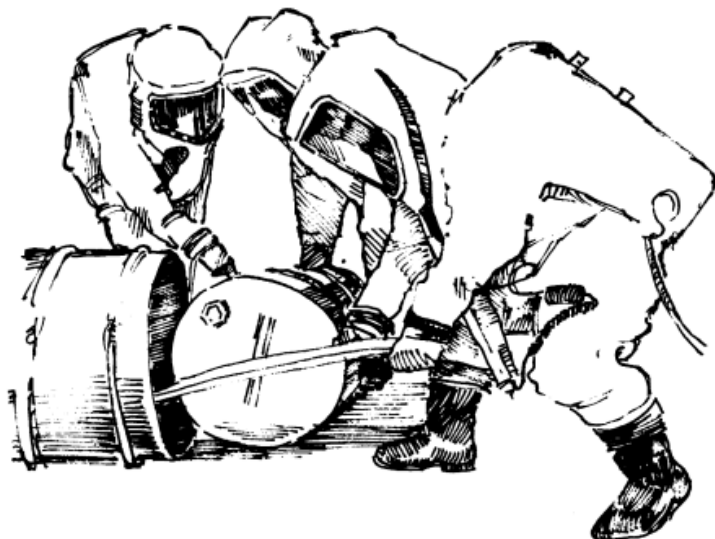
To the extent possible, the plan should be detailed enough to avoid language that is generic or requires interpretation. The site-specific safety and health plan should be used as a planning guide before site work begins and a reference tool throughout the site work. When new information is obtained during site inspections, the plan should be updated. Each of the following topics must be covered:

- Safety and health hazard analysis for each task or operation
- Employee training
- Personal protective equipment
- Medical surveillance
- Air monitoring
- Site control
- Decontamination
- Emergency response
- Confined-space entry
- Spill-containment



Under the OSHA standard [29CFR1926.65(e)], **training must be provided for all hazardous waste workers who are exposed to hazardous substances, health hazards, or safety hazards.** Supervisors and management responsible for the site must also receive training. All hazards at a site and methods which will be used to control them must be described in writing. The safety and health program must address on-site training. Training should include the following as required based on the job description:

- Names of personnel and alternates;
- Safety and health hazards present;
- Use of personal protective equipment;
- Safe work practices;
- Engineering controls and equipment;
- Medical surveillance, including recognition of symptoms which may indicate overexposure;
- Decontamination;
- Emergency response;
- Confined-space entry; and
- Spill-containment program.





General site workers must have a minimum of 40 hours of instruction and a minimum of three days of site-specific training under the direct supervision of a trained, experienced supervisor. Supervisors are required to complete the 40-hour general program, three site-specific training days, and an additional 8 hours of training designed for managers. Treatment, storage and disposal (TSD) facility workers and workers on site for a specialized operation must have a minimum of 24 hours of instruction and a minimum of one day of site-specific training.

Eight hours of refresher training is required every year for all site workers and supervisors. Workers who will assist with emergency response (ER) activities must receive site-specific ER training.

The medical surveillance program must provide for monitoring of workers' health before, during employment, and at the end of employment (if the last exam was more than 6 months before the job ends). **The medical surveillance program must be provided by the employer for the following employees:**

- All employees who are or may be exposed to hazardous substances or health hazards at or above the PEL or another published exposure level (if no PEL) for 30 days or more a year;
- All employees who wear a respirator for 30 days or more a year or as required by 1910.134;
- All employees who are injured, become ill, or show symptoms due to overexposure to hazardous substances from an emergency response or clean-up; and
- Members of hazardous materials response teams.

NOTE: Medical clearance must be obtained before using a respirator.



Medical exams must be conducted:

- Before a new job assignment;
- At least once every year unless a physician determines that a longer period, up to two years, is appropriate;
- More than once each year if the doctor decides it is necessary;
- When a job ends; and
- If an employee has symptoms which may have been caused by exposure to hazardous substances or if the employee has been injured or exposed above the PEL or other occupational exposure limit in an emergency situation.

All medical examinations and procedures must be performed by or under the supervision of a licensed physician, preferably one knowledgeable in occupational medicine. The exam is provided without cost to the employee, without loss of pay, and at a reasonable time and place. A physician will decide on the content of the examination.

Your employer must give the physician:

- A copy of OSHA's HAZWOPER standard (29CFR1926.65);
- Your job description and exposures;
- Your current or anticipated exposure levels;
- A description of personal protective equipment used or to be used;
- Information from previous examinations that the physician may not have; and
- Information required by the respirator standard (29CFR1910.134).



Your employer must give you a copy of the physician's written opinion, including:

- Medical conditions that would make hazardous waste work or respirator use particularly risky to you;
- Recommended limitations on your assigned work;
- Results of the exam and tests, if you request them; and
- A statement that the doctor has told you about the exam results and any conditions which require further examination or treatment.

The report your employer gets from the physician can discuss only findings related to your work. Any medical conditions unrelated to your job must not be revealed to the employer. You have the right to request and be given a copy of the physician's full report. **Your employer must keep medical and exposure records for as long as you are employed plus another 30 years.** If you work for your employer for less than a year, he does not have to keep your records provided that he gives them to you when you leave.

Standard operating procedures (SOPs) ensure that site characterization and cleanup are conducted according to a plan. SOPs provide guidelines for routine operations and for emergency response, must be written, and must be site-specific. Your site may have SOPs for the use of specialized air monitoring equipment, discovering underground cables, and communicating with neighborhood groups or organizations. Examples of tasks, tools, and hazards that may require SOPs are discussed in this chapter.



Hazard Control

The safety and health program must include a standard operating procedure (SOP) for introducing effective new technologies and equipment for improved worker protection. Some new methods make the cleanup easier or more effective, some reduce worker exposures, and some do both.

New technologies must be evaluated before they are used on a large scale. Data from the manufacturer or supplier may be included in the evaluation. The process and all data must be available to OSHA.

From most effective to least effective, the five approaches to hazard control are:

1. **Elimination** removes the hazard from the workplace
2. **Substitution** replaces hazard with a less hazardous alternative
3. **Engineering controls** prevent hazard from reaching the worker
4. **Administrative controls** use work practices, training, procedures, and scheduling to reduce exposure
5. **Personal protective equipment (PPE)** is worn by workers to prevent the hazard from reaching the worker

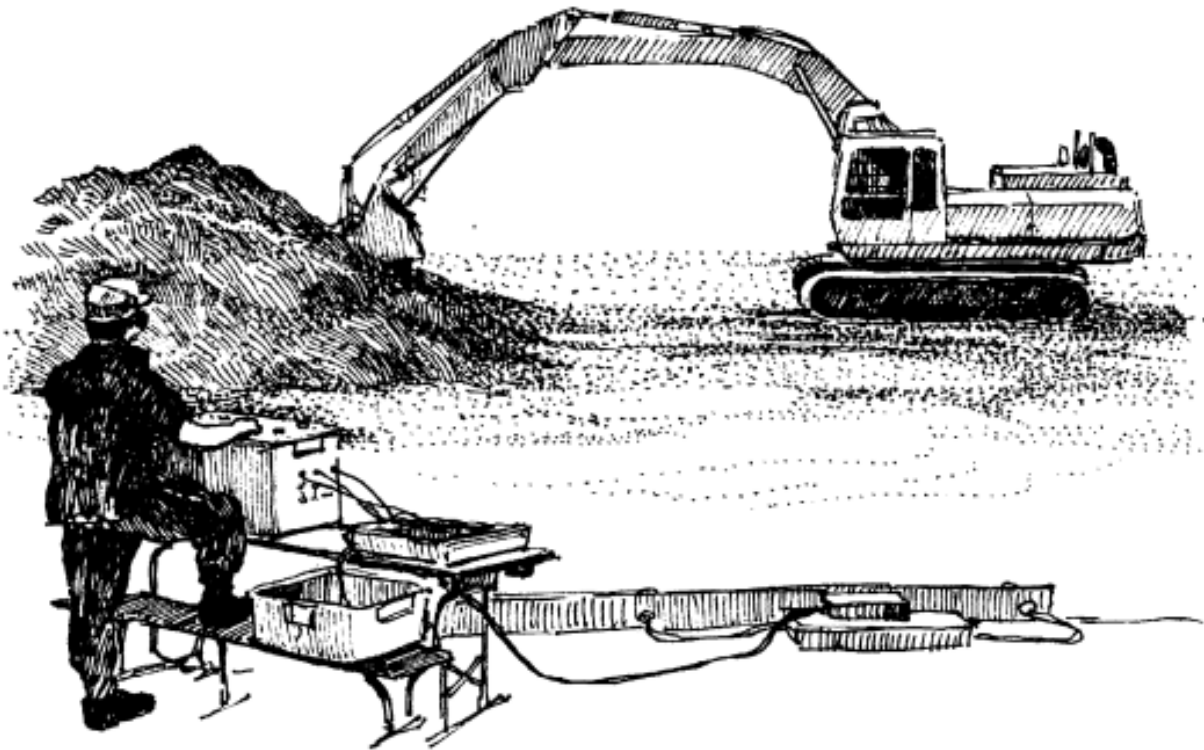
Personal protective equipment (PPE) is the last line of defense and only used when other controls cannot provide adequate protection.

Eliminating hazards or substituting less hazardous alternative are effective controls but are often difficult, especially on hazardous waste sites.

Engineered controls such as remotely operated drum punchers, ventilation of confined spaces, and sealed cabs on earth moving equipment control the hazard to prevent exposure. **Engineering controls are usually the most reliable way to control hazards that can not be eliminated.**



Engineering Controls: This operator is reducing exposure using a backhoe that can be operated from a distance.





Administrative controls use policies and work practices to reduce worker exposure to hazards and must be written before the work begins. They may include a scheduling system to limit time in a workspace or access to the space. Examples of administrative controls include industrial hygiene monitoring programs, medical surveillance programs, confined-space entry permits, lock-out procedures, training, work practices, and limiting exposure time. Administrative controls can be less reliable than elimination or engineering controls because they require workers to know and follow procedures.



Personal protective equipment (PPE) is the last resort and must be used to reduce worker exposures when the hazard cannot be eliminated or controlled with engineering or administrative controls. Examples of personal protective equipment include respirators, gloves, steel-toed boots, chemical-protective suits, and face shields. PPE is discussed in more detail in Chapter 5.





Standard Operation Procedures (SOPs)

There are many hazardous conditions, substances, and tasks that may be present on hazardous waste sites and require specific controls.

SOPs detail safe work practices for the activities on a particular hazardous waste site and should be covered in site-specific training. The following pages contain examples of tasks, tools, and hazards that may require SOPs:

- Fire prevention
- Hot-work permit
- Electrocution
- Power tool use
- Soil excavation
- Equipment and vehicle operation
- Maintenance activity
- Ladder and scaffolding use
- Loading and unloading procedures
- Drum handling, storage, and sampling procedures
- Spill control
- Illumination/Sanitation
- Heat and cold stress
- Radiation
- Noise
- Slips, Trips, Falls
- Confined-space entry
- Lock-out



Fire Prevention

Fire and explosions are serious hazards on hazardous waste sites. Flammable materials, incompatible and unstable chemicals, and other fuel sources are present and equipment, hot work, and other ignition sources can trigger a fire or explosion.

Constant attention must be given by everyone onsite to preventing fires and explosions.

To help prevent fires, you should:

1. Use non-sparking tools and intrinsically safety equipment
2. Participate in training, drills, and practice
3. Follow other safety rules to reduce the possibility of fire.
4. Store and handle compressed gases and explosive/flammable chemicals properly
5. Conduct frequent fire safety inspections
6. Train employees in hazard recognition



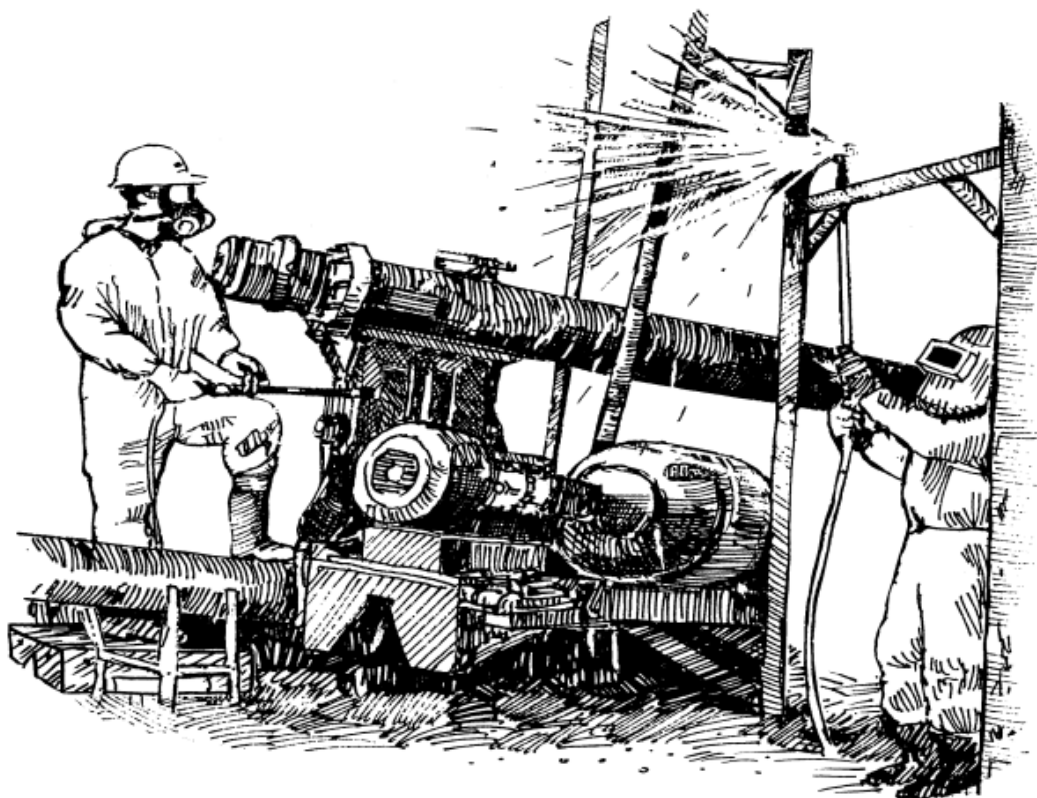
To prevent and control fires your employer should:

1. Maintain supplies of fire-extinguishing media (foam, water, powder)
2. Locate fire-fighting equipment in strategic areas
3. Train fire brigade crews and allow them adequate practice time
4. Conduct fire drills and site evacuations
5. Conduct frequent fire safety inspections
6. Inspect and maintain fire-suppression equipment
7. Post evacuation routes
8. Train employees in hazard recognition
9. Store and handle compressed gases and explosive/flammable chemicals properly
10. Provide non-sparking tools and intrinsically safe radios, electronic and electrical equipment, and power tools



Hot-Work Permit

Cutting, welding, and grinding are common activities at hazardous waste sites and require hot-work permits. Before welding begins, remove any extra air cylinders or other cylinders from the area to prevent fires and explosions. Welding on equipment or vessels that may contain traces of heavy metals or chlorinated solvents must be done with adequate ventilation and personal protective equipment. OSHA's Subpart J--Welding and Cutting provides minimum safety requirements for all cutting and welding activities. Hot-work SOPs should include a permit system



The fire-watch buddy system during cutting



Electrocution

Electrocution is one of the most common causes of death among construction workers.

Electrical shock and electrocution are often the result of:

1. Contact with energized equipment and live lines, especially overhead lines
2. Use of electrical equipment in wet areas
3. Failure of equipment

Electrical hazards can be controlled by:

1. Lock-out/tag-out;
2. Ground-fault circuit interrupter (GFCI) equipment; and
3. Double-insulated tools and grounded tools kept in good repair.



Power Tool Use

Improperly used or maintained power tools can cause electrical shocks, fires, and explosions. On hazardous waste sites, power tools can spread contamination too.

The following general guidelines should be incorporated into site-specific SOP's for power tool use.



1. Use ground-fault circuit interrupter (GFCI) protection when working with power tools
2. Use non-sparking hand tools near flammable and combustible material
3. Use specially-designed explosion-proof power tools (called intrinsically safe) near flammable material
4. Keep guards and other safety devices in place and operational at all times
5. All electric power tools must be UL approved double insulated or grounded
6. All tools must be inspected before use
7. Decontaminate tools after each use, and return them to proper storage



When GFCIs are not used, a construction site must have an Assured Equipment Grounding Conductor Program for cords and receptacles that are not part of the building. This program must:

1. Be written
2. Name a competent person to run the program
3. Include inspections of all cords, plugs, and receptacles before each day's use
4. Include continuity tests and polarity test every 3 months and after repairs
5. Maintain records of tests and keep them on site



Soil Excavation

At a minimum, soil excavation SOPs must comply with all OSHA requirements listed in 1926 Subpart P--Excavations.

These include:

1. Excavations 5 feet or more deep (in stable soil) must be shored or sloped.
2. Excavations 4 feet or more in depth must have a stairway, ramp, ladder or other safe ways to exit to prevent more than 25 feet in lateral travel for employees.
3. Locations of utility lines must be determined before excavation begins.
4. Air monitoring must be conducted if oxygen deficient or hazardous atmospheres exist or could exist in an excavation that is more than 4 feet deep.



The soil excavation SOP needs to address these questions.

1. What is the contaminant? What are the physical properties of the soil?
2. How much has to be removed?
3. What equipment is needed for excavating and loading soil?
4. Will personal monitoring be necessary?
5. What is needed to prevent a collapse or cave in?
6. What PPE is required?

The SOPs should contain these or similar directions.

1. Use shoring and sloping as required by OSHA;
2. Excavate clean areas first, then dirty areas to avoid spread of contamination on machinery.
3. Set up soil loading and stockpile area with:
 - a. Bermed, plastic-lined area to hold soil;
 - b. A method to cover the pile in case of rain or wind; and
 - c. Catwalks and platforms from which to work when lining and tarping trucks.
4. Take soil samples when excavation reaches required depth to determine if the excavation is clean.
5. Decontaminate all equipment that was used for removal and will be used for restoration.



Equipment and Vehicle Operation

Even though a worker may not operate equipment or vehicles, the presence of heavy equipment and vehicles can endanger everyone on a hazardous waste site.

Keep the following in mind:

1. All equipment in the Hot Zone must stay there until it is thoroughly decontaminated.
2. Equipment and vehicle operators who wear protective clothing and respirators may not be able to hear or see as well as they normally do and their reactions may be slower.
3. Never work or stand underneath loads handled by lifting or digging equipment.
4. If you are working in an excavation, pay close attention to any nearby vehicles or equipment.
5. Workers near or around vehicles must be given highly visible vests or clothing. This is especially true on hazardous waste sites where an operator's vision and hearing may be impaired.
6. Always check vehicles entering and exiting the site for leaks and spills. Direct vehicles to decontamination if needed.

Maintenance Activity

Equipment maintenance is an ongoing process at any hazardous waste site. Equipment should be removed from the Hot Zone, decontaminated and taken to the Cold Zone for maintenance and repairs unless:

1. Repairs are minor; or
2. Equipment cannot be moved or cannot be moved without causing additional damage.



If repairs must be done in the Hot Zone, then the mechanics must be qualified for entry and must wear the required PPE.

Equipment in the Cold Zone should be repaired away from site activity, traffic and flammable and combustible materials, especially if welding, cutting, or heating is needed. Equipment, blades, end-loader buckets, dump bodies, and similar equipment must be either fully lowered or blocked when being repaired, as described in OSHA's **Subpart O** (motor vehicles, mechanized equipment) **1926.600(a)(3)(i)**. All controls must be in a neutral position, with the motor stopped and brakes set, unless the work requires otherwise.

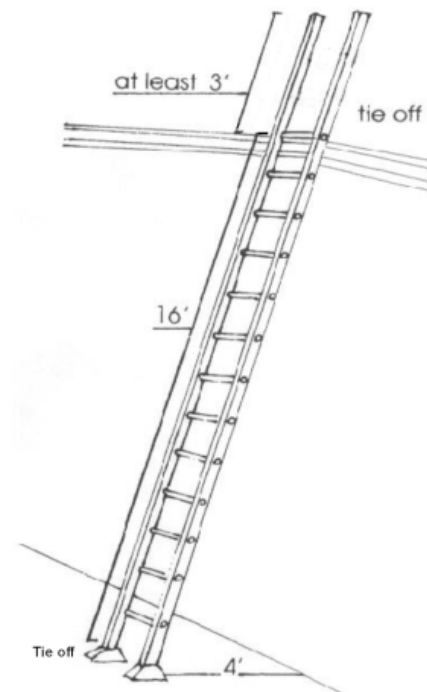
Ladder and Scaffolding Use

Ladders must not be moved, shifted or extended while occupied. At a minimum ladders must comply with the requirements of OSHA's 1926 Subpart X Stairways and Ladders.

You must take extra care when using ladders while wearing PPE. Restricted motion and visibility make these regulations especially important.

1926.1053 Ladders

1. Ladders must have non-conductive side rails if used around energized electrical equipment.
2. You must hold the ladder with at least one hand when going up or down the ladder.
3. You must not carry any object or load that could obstruct or hamper a climb, or cause loss of balance.
4. Portable ladders must be capable of supporting at least 4 times the intended load.
5. The horizontal distance between the bottom of the ladder and the wall should be $\frac{1}{4}$ the length of the ladder.
6. Ladder must extend 36 inches above a landing platform.



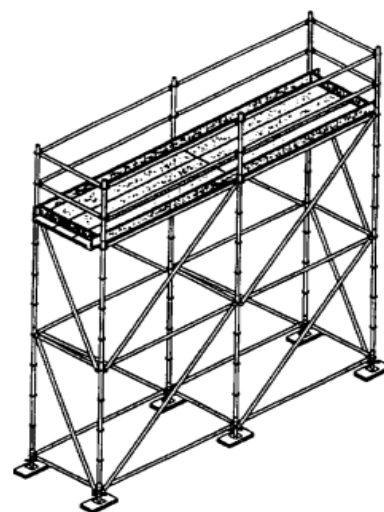


Everyone who works on a scaffold must be trained to be able to recognize and control the hazards of working on scaffolds (1926.454). Anyone who erects, dismantles, moves, repairs, or inspects scaffolds must be trained on the procedures for those tasks.

At a minimum, the use of scaffolds must be in compliance with OSHA's Subpart L (1926.450-454). Working on, erecting or dismantling scaffolds in a hazardous atmosphere or while wearing PPE requires extra caution.

The following are a few of the basic scaffold safety requirements which must be met:

1. Scaffolds must be able to support their own weight plus at least four (4) times the maximum intended load.
2. Personal falls arrest systems or guardrails are required on scaffolds when workers are exposed to falls above 10 feet.
3. Supported scaffolds with a base to height ratio above 4:1 must be restrained by guying, tying, bracing, etc. Supported scaffolds must be plumbed and braced.
4. Supported scaffolds must rest on base plates and either mud sills or other firm foundations.
5. Scaffold platforms must be fully planked or decked. Planks and decking must meet minimum loading and other requirements.



The five most serious scaffold hazards are:

1. Falls
2. Unsafe access
3. Struck by falling objects
4. Electrocution when scaffold components become energized or contact live lines
5. Scaffold collapse



Loading and Unloading Procedures

To reduce the risk of musculoskeletal injuries during lifting, loading and other manual materials handling:

1. Use carts, dollies, hoists, and pulleys whenever possible. Repetitive lifting of even light loads can cause damage to the spine.
2. Get help when lifting heavy and awkwardly shaped loads.
3. Lift by squatting and keeping the object as close to your body as possible, if the load is compact enough to fit between your knees.
4. Store materials at waist height to avoid excessive bending and reaching.
5. Keep the distance of the lift between knee and shoulder height. Lifting above the shoulders places extra stress on the spine and back muscles as well as the neck, shoulders and arms.
6. Avoid uneven, one-sided lifting. Never twist and lift at the same time.
7. Do not try to catch falling objects.
8. Push instead of pulling – it is less stressful to your back, arms, and shoulders and gives you the advantage of using your own weight.
9. Get adequate rest and take breaks.



Drum Handling, Storage, and Sampling Procedures



Unidentified drums can be very dangerous and should be inspected, sampled, and handled by experts. If you discover a drum, report it immediately to your supervisor. Assume that a drum or container is hazardous until tested. Do not rely on outdated or questionable drum markings or labels alone to identify hazards.

Special instruments or probes should be used to detect buried drums. Drums which may contain radioactive wastes must not be handled until specially trained personnel can assess the hazards.

Only workers trained to do so should move drums. They should use remote handling equipment whenever possible. Fire-extinguishing equipment must be on hand and ready to use. They will move the contents of deteriorated drums to clean drums when they cannot fix the drums. The clean container must meet DOT, OSHA, and EPA requirements.



OSHA lists minimum special handling precautions which must be taken if a container is known or suspected of holding shock sensitive wastes [29CFR1926.65(j)(5)]. You should **assume that a container of packaged laboratory wastes contains shock sensitive or explosive material until the contents have been characterized.**



OSHA also lists special requirements for handling drums with mixed wastes from laboratories, which are called lab packs [(1926.65(j) (6))].

These requirements include:

- Lab packs are only opened when necessary
- Only persons with the knowledge to inspect, classify, and segregate the contents of a lab pack may open it
- Unless the contents are otherwise identified, handle as shock-sensitive waste (especially if you see crystals on any container)





Even if your job does not involve drum handling, you may work near large numbers of drums containing known or unknown chemicals. **Use the chart below, to figure out what type of material is supposed to be in a drum.**

Type of Drum	Construction	Contents
Closed-top*	Metal (unlined)	Non-corrosive products in liquid form
Closed-top	Plastic or composite (plastic inside metal or lined cardboard)	Corrosive liquids (acids or bases)
Open-top	Metal (unlined)	Non-corrosive solids or sludges
Open-top**	Plastic (lined)	Corrosive solids or sludges
Special	Stainless steel, nickel, and Monel TM	Extremely hazardous materials
Overpack--Large Outside Drum with a Leaking Drum Inside	Metal or plastic	Any leaking drums listed above
Closed-Top Drums with Fittings	Fittings for pressurizing with inert gas	Reactive, flammable, or explosive liquids
Open-top	Plastic or metal	Lab packs of a variety of potentially dangerous and incompatible materials

* Closed-top drums are sealed and have small openings (bungs) in the top.

** Open-top drums have removable lids and may or may not have bungs.



Staging means placing drums with similar contents alongside each other. This is one step toward remedial action. When staging drums, place them no more than 2 wide with an aisle between. This allows access to all drums without standing on, or leaning over, drums.

Activities in staging areas may include:

- Opening drums and sampling the contents;
- Holding materials until test results come back;
- Bulking or mixing compatible materials; and
- Loading and shipping.

The number of staging areas should be kept to a minimum. There must be adequate access and exit routes must be maintained at all times.

Drum sampling requires specific precautions and is usually carried out by trained engineers or technicians. The drum sampling procedures must be included in the safety and health plan.

If any of the following conditions are present, the drum should not be sampled until special precautions are taken:

- A bulging top warns of pressure build up within the drum
- Damaged or dented drum could also mean a buildup of pressure
- Vapor or mist coming from the top of the drum, usually near the bung hole
- Obvious leak



These sampling safe work practices should be included in the drum sampling SOP:

1. Drum tops should be covered with plastic sheeting to avoid worker contact
2. Never stand on drums, use ladders and platforms to reach stacked drums
3. Do not lean over drums to reach the one being sampled
4. Dispose of or decontaminate sampling equipment according to the sampling plan





Spill Control

Your site must have a spill control plan that describes actions to take if either a minor or major spill occurs. Depending on the chemical, the spill control plan may include:

1) Containment includes:

- **Plugging** — The leaking drum is plugged to prevent or limit further release. Common plugging materials include wood, soap, rags, and commercial products. Plug materials must be compatible with the chemical that is leaking.
- **Patching** — A patch is applied over the leaking area. Patching materials include rubber, patching mud, and tape. Patching materials must be compatible with the chemical that is leaking.
- **Over packing** — Placing a leaking drum into a compatible larger drum to contain the contents.

2) Confinement keeps the spill in a defined area and includes:

- **Diking** — Dikes may be built around the perimeter of the leak with sand, earth, straw, sorbent, or other materials. The diking material must be compatible with the spilled material. Plastic sheeting can be used as an additional barrier.
- **Blocking** — Drains, ditches, or storm sewers should be covered and blocked to prevent run-off of spilled materials. This blocking can be done with a sorbent pad, a piece of plastic, or a rubber pad. If flammable or toxic materials enter these systems, the potential for damage to property or people is increased.
- **Absorption** — Run-off can be absorbed with dirt, sand, soda ash, saw dust, wood chips, peat moss, vermiculite, foam, or other materials. The sorbent must be compatible with the spill. For example, wood chips and an acid can start a fire.
- **Collection** — Run-off can also be collected in containers such as drums or buckets.





Drums should be stored with compatible chemical groups to prevent hazardous reactions and errors in shipping.

If drums are stored on pallets:

- Store only compatible substances on the same or adjacent pallets.
- Use only intact pallets without broken or damaged boards;
- Set drums squarely on pallets and band drums together if possible;
- Place drums with labels and numbers facing outward; and
- They may be placed no more than 2 high and 2 wide with an aisle in between (in contrast with staging from the previous page where they cannot be stacked).

Drum inspections should be conducted daily, or according to the site SOP, to look for:

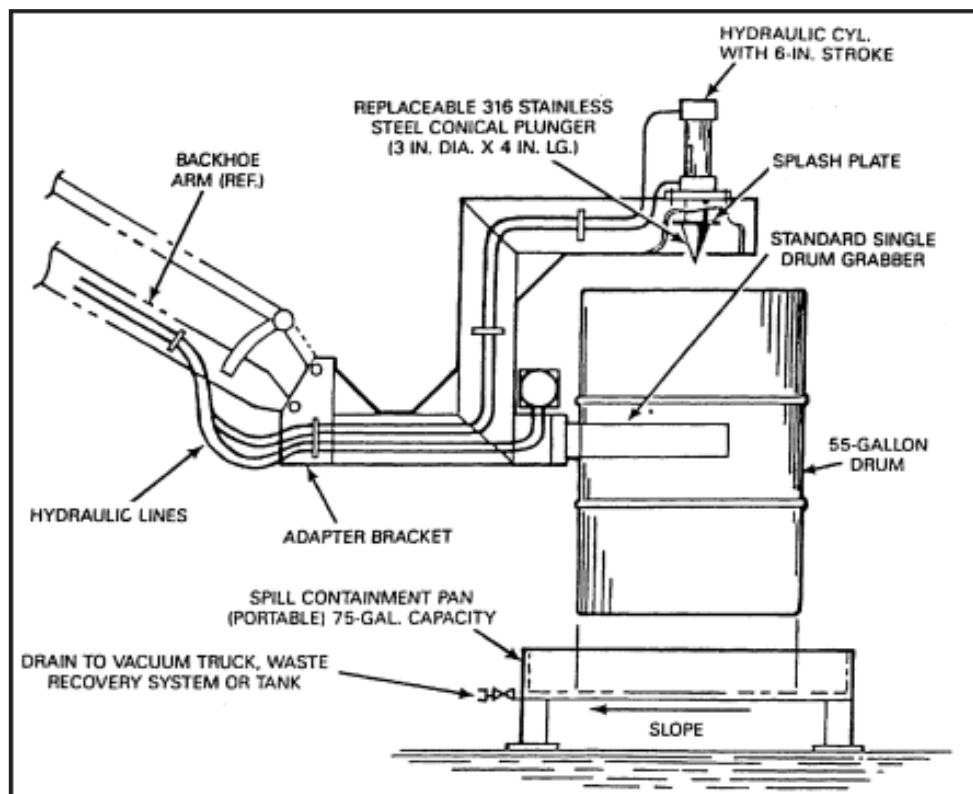
- Leaking
- Swelling or bulging
- Rust or other signs of deterioration
- Exterior corrosion or crystallization
- Damage

Report these or other identified conditions to the supervisor.



Opening drums puts workers at serious risk and should be done with a remote drum punch or other remotely operated equipment if possible. OSHA 29CFR1926.65(j)(2) requires certain procedures where drums or containers are being opened. Anyone who opens drums must use non-sparking and intrinsically-safe tools and grounding may be necessary. Never stand on drums or containers.

Backhoe-mounted drum puncture device.





Ponds and lagoons store large volumes of waste materials and may also be used for treating waste materials. The hazards around ponds and lagoons may include:

1. Drowning
2. Corrosive and toxic gases, vapors, and liquids
3. Unstable walking surfaces

The precautions that should be used around ponds and lagoons include:

1. Safety equipment such as life jackets, safety belts, or life lines when working close to unguarded areas;
2. Chemical protective equipment to prevent skin contact and inhalation of chemicals;
3. Limit access and keep barricades secure; and
4. Train workers.

Illumination/Sanitation

Adequate lighting must be provided so that the work activities can be performed in a safe manner. OSHA sets out minimum illumination requirements in the HAZWOPER standard, **1926.65(m)**. The site safety officer should ensure that illumination meets the requirements of the standard.

Employers must ensure adequate sanitation at temporary workplaces, including hazardous waste sites. 1926.65(n)

An adequate supply of drinking (potable) water must be provided at the site and kept clean and free of contamination. If water unfit for drinking (non-potable) is available at the site for firefighting or other purposes, the water lines and hose connections must be clearly marked to indicate that it not safe for drinking, washing, or cooking.



HAZWOPER **1926.65(n)(3)** requires a minimum number of toilet facilities based on the number of workers. Hazardous waste sites that do not have sewers must be provided with chemical, recirculating, combustion, or flush toilets, unless these are prohibited by local codes.

Employers must provide enough nearby washing and showering facilities to ensure that workers can remove hazardous materials from themselves.

Showers and change rooms for all workers exposed to hazardous substances and health hazards must meet the following requirements.

- Showers must be provided in accordance with **29CFR1926.51(f)(4)**.
- Change rooms must have two separate areas, one for removal and storage of clean clothes and one for the removal and storage of work clothing. Change rooms must meet the requirements of **29CFR1926.51(i)**.
- Showers and change rooms must be located in areas where exposures are below the PEL. If this is not possible, then a ventilation and supplied-air system must be provided to reduce exposures to the required levels.
- Employers must ensure that all workers shower at the end of the work shift and when leaving the site.
- Showers are not required for jobs lasting less than 6 months. If the job lasts longer than 6 months, showers and change rooms must be provided in accordance with **29CFR1926.65(n)(7)**.



Heat and Cold Stress

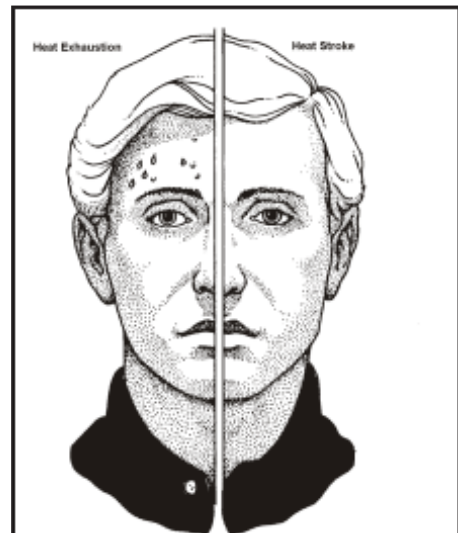
High temperatures put extra physical stress on the body and over time, this heat stress can cause illness, particularly if you are not accustomed to it. Wearing chemical protective clothing and equipment greatly increases the risk of heat illness even if outside temperatures are moderate.

Heat stress is a serious problem on hazardous waste sites and requires careful monitoring and training for all at risk workers. These factors can increase your risk of heat-related illness:

1. Lack of physical fitness and heat acclimation (adjustment)
2. Temperature and humidity
3. Wearing heavy and impermeable clothing
4. Age
5. Lack of fluid intake
6. Alcohol and drug use
7. Sunburn, diarrhea, infection

To help prevent heat-related illnesses:

1. Work in the shade
2. Wear light permeable clothing
3. Drink more fluids than your thirst tells you to (especially water);
4. Avoid alcohol;
5. Take additional breaks until you've worked in the heat for two week ; and
6. Take regular cool-off breaks, in an air-conditioned space if possible, but at least out of direct sunlight.





Heat-Related Illnesses

Heat Cramps

Symptoms:	painful muscle spasms
Cause:	profuse sweating and drinking large amounts of water
Treatment:	provide water and electrolytes (sodium, potassium) like diluted Gatorade™

Heat Exhaustion

Symptoms:	Weakness, fatigue, dizziness, pale, cool, moist skin, heavy sweating, headache, nausea
Cause:	Dehydration from profuse sweating and insufficient intake of water and salts
Treatment:	Replace water and electrolytes lost in sweat, provide rest in a cool place. Do not send the worker back into a hot environment that day

Heat Stroke

Symptoms:	Very dry, hot skin with red mottled or bluish appearance; confusion; convulsions; unconsciousness; rapidly rising temperature
Cause:	Body becomes overheated because the worker does not sweat; can be fatal
Treatment:	Call for medical help immediately. Move person to cool place. Remove protective equipment. Use wet towels to reduce the victim's temperature. Fan rapidly to cool while waiting for help Heat stroke is a life-threatening emergency. Medical attention is required.



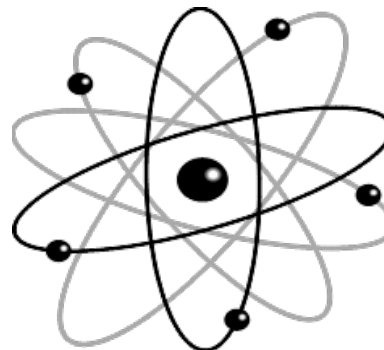
Prolonged exposure to cold environments can cause hypothermia and frostbite (freezing of tissues, usually on the extremities such as the hands, toes, nose, cheeks, and ears). Parts of the body with frostbite appear red and tingling, then turn pale and numb. Frostbitten tissue should be gently warmed slowly by a trained medical person. The victim should be given hot liquids to drink and not allowed to smoke because it interferes with blood flow. Hypothermia is when the body is losing heat faster than it can make it and the body temperature falls below 95 degrees. Mild hypothermia begins with shivering, progresses to stumbling, lack of coordination, and difficulty speaking, and in severe cases can result in loss of consciousness and death.

Cold, wet conditions can increase your risk of muscle strain and other musculoskeletal injuries. Using vibrating tools in cold weather can lead to hand-arm vibration syndrome, which causes the blood vessels in your fingertips to collapse. This causes your fingertips to go white and numb.



Radiation

The three types of radiation, alpha, beta, and gamma, are capable of causing serious health effects including reproductive and developmental problems, cancer, and death. The degree of damage depends upon the dose and type of radiation.



Alpha radiation particles are relatively large and do not travel far (about 3 inches in air). They can be stopped by material as thin as a sheet of paper or your outermost layer of skin. **If taken into the body (swallowed or breathed in), alpha particles are an extreme health hazard.** Respiratory protection is required. Sources include radon, uranium, polonium and plutonium.

Beta radiation particles are small and travel farther than alpha particles (a few feet in air). Beta particles will travel through clothes and skin but are somewhat stopped by plastic. They are most dangerous if swallowed or breathed in. Sources include radioactive phosphorus and radioactive carbon.

Gamma radiation can pass deep into the body, damage inner organs, and cause burns, cancer, and death. It takes a thick lead or concrete shield to stop gamma rays. Sources include radioactive cobalt and cesium.

Areas controlled for radiological purposes will be designated with a magenta (or black) standard three-bladed radiological warning symbol on a yellow background.

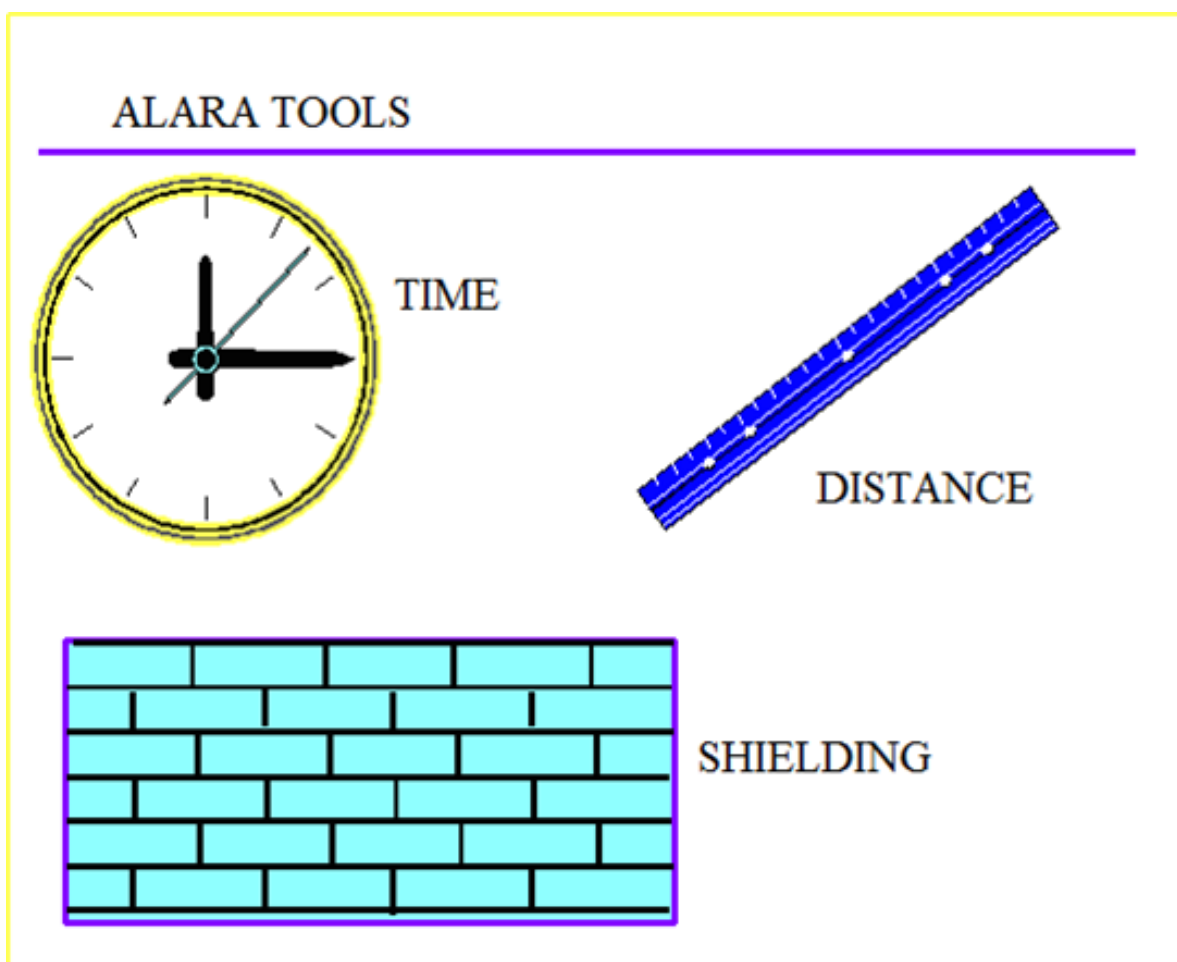
Entrance points to radiation areas must have signs (or equivalent postings) indicating the presence of radiation or radioactive materials and stating the entry requirements, such as “Personnel Dosimeters, Radiation Work Permit RWP, and Respirator Required.” Remember, conditions can change quickly so do not assume the sign is the same as the one you saw before.





This is not a RADWORKER course! If you see this symbol on your worksite, leave the area unless you have been specially trained to deal with the hazards of radiation

Exposure to radiation must be kept ALARA (as low as reasonably achievable). Site-specifics will teach you how to use time, distance, and shielding to protect yourself from radiation. In general, you should minimize your exposure time, stay as far away from the radiation source as possible, and use protective barriers or shield to keep radiation from reaching you.





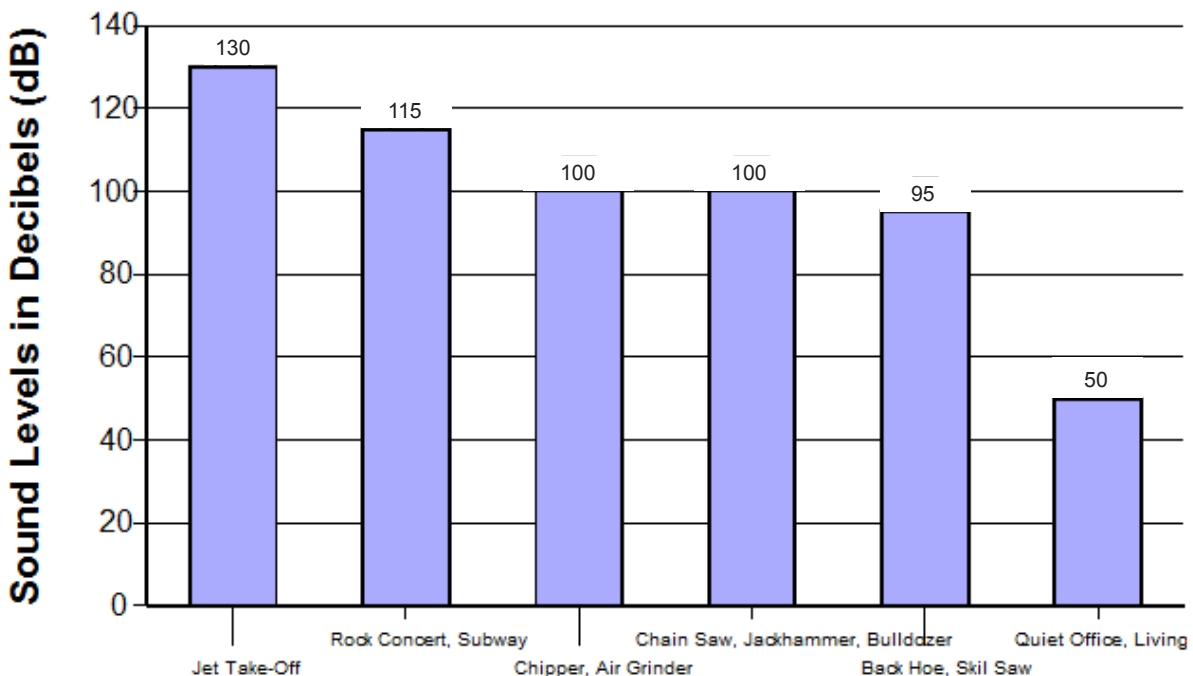
Noise

Imagine if you could not hear your child speak to you or hear the phone ring.

Repeated exposure to excessive noise can cause permanent hearing loss.

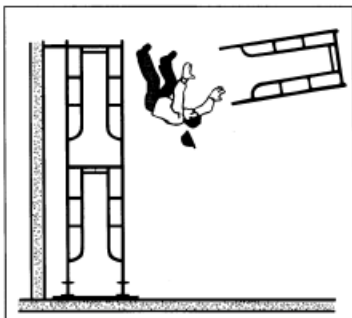
High-volume sound is also linked to high blood pressure, stress, insomnia, anxiety, and headaches. **While the OSHA PEL is 8 hours at 90 decibels (dB), noise levels above 85 decibels are considered dangerous by most organizations.** Building trades workers are at high risk for hearing damage from workplace noise. **Data have shown that 73 percent of construction workers are exposed to noise levels above the NIOSH REL (data collected between 1999 and 2009) and 58 percent of construction workers on DOE sites have noise-induced hearing loss (data collected between 1996 and 2010).**

The decibel scale is logarithmic, like the Richter scale for earthquakes, not linear. NIOSH uses a doubling rate of 3 dB meaning that every increase of 3 dB doubles the noise level so 88 dB is twice as powerful and damaging as 85 dB. A 115 dB sound is more than 300 times as powerful as a 90 dB sound.





Slips, Trips, Falls



Falls are a leading cause of death and injury among construction workers. In 2010, falls lead to 267 deaths and about 18,000 nonfatal injuries among construction workers. This means that in 2010, 33% of construction worker deaths and 24% of construction worker injuries were due to falls.

OSHA's scaffolding safety standard, Subpart L of 1926, mandates training for scaffold erectors and users. **Fall protection is required when working 6 feet above a lower level (10 feet for workers on scaffolding).**

Slips and trips are caused mainly by poor housekeeping. Slippery surfaces, poor lighting, and weather conditions also contribute to slip/trip hazards. Slips and trips may sound minor but they cause enormous back and other musculoskeletal injuries. A clean worksite helps to prevent injuries and increases productivity.

Being struck by a vehicle, construction equipment or material is another leading cause of injuries for construction workers. Personal protective equipment can limit your vision and hearing and create a sense of isolation. To prevent struck-by injuries:

- Pay close attention to all activities around you
- Watch out for others
- Use and listen for vehicle back-up alarms
- Watch for improperly stacked drums
- Do not use damaged pallets
- Wear high visibility clothing



Confined-Space Entry

Every year approximately one hundred (100) workers in the United States die in confined spaces and several thousand are injured. About one-third of confined space fatalities are would-be rescuers. In many confined space fatalities, employers did not have a written confined space program or a confined space permit system.

According to OSHA, **confined spaces have three defining properties:**

1. Limited or restricted ways to get in and out of the space;
2. Not intended for continuous human occupancy; and
3. Large enough to fit a person.

Confined spaces found at hazardous waste sites include:

1. Ditches, culverts, and ravines
2. Incinerators and scrubbers
3. Tank trucks and rail cars
4. Vaults and silos
5. Sewer system with manhole entrance



SAR-supplied entrant with 7' tripod, attendant, supervisor, and mechanical ventilation.



Permit-required confined spaces (PRCS) are confined spaces with at least one additional hazard.

1. Hazardous atmosphere (or the potential for one)
2. Material that could engulf a person. The material could be stored in the space (for example, grain) or enter the space through pipes (such as water or chemicals)
3. A shape (tapers, slopes or converges) that could trap or asphyxiate someone
4. Any other recognized serious safety or health hazard

Confined spaces do not always look dangerous. It may even be hard to recognize that a particular space is a confined space. For example, settling tanks and excavations are confined spaces even though they are open on top.

The potential hazards of confined spaces can become life-threatening conditions very quickly. Lack of ventilation can allow toxic gases and vapors to accumulate. Materials stored in the space or brought in through pipes can instantaneously engulf entrants. Energy sources which are not locked out can be turned on by people outside the space. **All potential hazards must be evaluated and controlled before work inside the space begins.**

A large portion confined space deaths are due to atmospheric hazards (toxic gases or vapors, asphyxiants, flammable or explosive atmospheres). The trouble is that you can't see atmospheric (air) hazards. You can't see when there is too little (less than 19.5% oxygen) or too much oxygen (greater than 23.5%) in the air. Nor can you see toxic or flammable gases or vapors that accumulate in confined spaces (except for very rare cases).





What causes oxygen deficiency?

1. Other gases in the confined space can displace the oxygen in the air
2. Activities such as welding and burning can “use up” oxygen in the confined space
3. Chemical reactions such as rusting or the drying of certain paints and cements can also “use up” the oxygen

Toxic, flammable, or explosive gases or vapors may be present in a confined space or introduced by work activities. **The acute (immediate) hazards that could impair your ability to leave a space are the greatest concern.** These hazards include central nervous system effects from solvents and chemical residues, asphyxiation from carbon monoxide or hydrogen sulfide, and fire or explosion of gasoline or solvents.

Monitor the inside of a confined space before entering the space and while inside. Collect the initial air sample through a sampling probe inserted into the space.

Ventilation can be used to bring air into the space and eliminate hazards from oxygen deficiency and gases and vapors that are toxic, flammable, and explosive.

Note: Using welding or medical oxygen to “ventilate” a space can cause oxygen levels to become dangerously high (greater than 23.5%).

Remember:

- Always monitor to find the oxygen and chemical content of air in a confined space.
- Do not operate heaters or motors in confined spaces without special precautions limit carbon monoxide and other contaminants in exhaust.
- Rust, drying paint, cement, or caulking can increase the chances of oxygen deficiency.
- Welding or burning inside confined spaces present major hazards and require special precautions as well as special hot work permits.



All confined space SOP's should be in compliance with OSHA's confined spaces standard (29CFR1910.146 for General Industry and 29CFR1926 Subpart AA for Construction) and permits must include the required elements. This should be the case even if the space is not a permit-required confined space.

Confined space permits must include:

1. A description of the space that will be entered
2. Why the space needs to be entered (description of the work to be done)
3. The date, length of time the permit is good for
4. Names and/or identification of the authorized entrants
5. Names of the attendants who will remain outside the space
6. Name of the entry supervisor - A space for the initials /signature of the supervisor who originally authorized entry
7. The hazards of the space
8. How the hazards in the space will be eliminated or controlled (for example, with ventilation or lock-out of hazardous energy sources)
9. The conditions that must exist for entry to begin
10. Air monitoring results and the names/initials of the people who did the monitoring.
11. When air monitoring was done
12. Who to call for emergencies and rescue and how to contact them
13. How entrants and attendants will communicate with each other
14. All the equipment that has to be provided to comply with the standard. This includes alarms and monitoring, personal protective, communication, and rescue equipment
15. Any other information which is needed to ensure worker safety during confined space entry
16. Other permits, such as hot work permits, which are needed for the work to be done



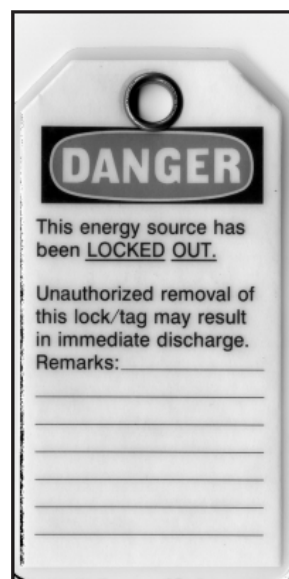
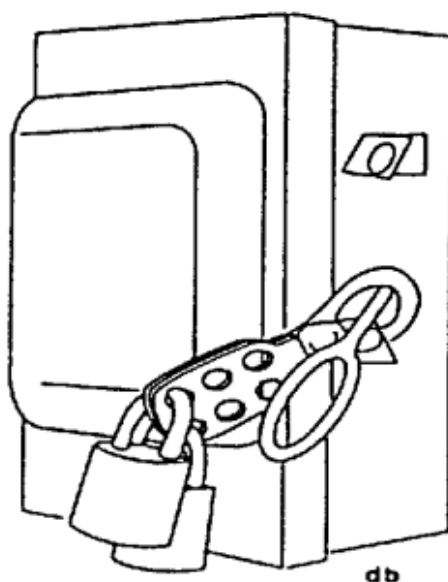


Lock-Out

Electrical power, mechanical equipment, pipes and valves must be locked-out to prevent operation and the release of energy during repair or cleaning. It is not enough to just turn off an electrical switch or close a valve. You must lock-out energy sources to prevent someone who is unaware of the work being done from turning the power on. When locking out steam or fluid transfer pipes, release the pressure before unbolting and separating pipes.

- Know the site lock-out procedure before any operation is attempted.
- Never assume a machine, circuit, or pipe is locked out just because it should be.
- When in doubt, lock it out!

Lock-out tags should be placed on all locked-out equipment.





A variety of lock-out device are available, depending on the power source and equipment.





Summary: Work Practices and Site Control

Before you ever come on site, experts have done a lot of work to determine what chemicals and dangers are present, how to do the cleanup work, and how to protect you--this is called **site characterization**.

There are five approaches to hazard control at hazardous waste sites:

1. **Elimination** removes the hazard from the workplace
2. **Substitution** replaces the hazard with a less hazardous alternative
3. **Engineering controls**, such as ventilation, prevent the hazard from reaching the worker
4. **Administrative controls** use work practices, training, and scheduling to reduce exposure
5. **Personal protective equipment (PPE)** worn by workers to prevent the hazard from reaching the worker

Elimination and substitution are difficult to implement on hazardous waste site but most cleanup jobs will use the other three methods. PPE should always be the last resort.

The safety and health plan is a written document that includes site-specific information designed to identify, evaluate, and control exposures to hazards.

The plan must include: organizational structure on the site; a comprehensive work plan; a site-specific safety and health plan; standard operating procedures (SOPs); safety and health training; a medical surveillance and exam program; and any information necessary to link the overall company plan to the site-specific plan.

Hazard control procedures must be written and put in place before workers enter the site. These procedures must include a site map, work zones, buddy system, site communication (routine and emergency, hand signals, alarms, etc.), standard operating procedures, and identifying the nearest appropriate medical facility.



Special work methods are needed to protect worker safety and health. Carefully planned, detailed written work instructions called Standard Operating Procedures (SOPs) tell you how to do the work safely. SOPs lay out work practices that are needed to protect worker safety and health. At each hazardous waste site, workers must be trained on the SOPs that relate to their work.

Sampling or moving drums is one of the most dangerous jobs you can do. Extra precautions must be taken before moving or sampling any drums that are damaged, leaking, unstable, or have any crystals around the edge. Keep absorbents and overpack drums handy any time you move a drum in case there is a spill or leak.

General site workers must receive at least 40 hours of off-site training before entering the site and three days of on-site training before beginning work. TSD and specialized workers must receive 24 hours of training with one day of site-specific training. Supervisors receive an additional 8 hours of off-site training. All employees attend an additional 8-hour refresher training course each year.

Every site is divided into three areas: a hot zone (chemical cleanup), warm zone (buffer & decon), and cold zone (support & rescue) to ensure proper PPE, minimize exposure, and keep chemicals from spreading outside of the work area. The zones are set up depending on monitoring results and the layout of the site.



Background Reading Material: Work Practices and Site Control

NIOSH Workplace Safety and Health Topics – Hierarchy of Controls
<http://www.cdc.gov/niosh/topics/hierarchy/>

NIOSH Workplace Safety and Health Topics – Prevention Through Design
<http://www.cdc.gov/niosh/topics/ptd/>

Hazardous Waste Operations and Emergency Response Standard, Federal Register, Final Rule - March 6, 1989, 29CFR1926.65 Drums and Containers.

Occupational Safety and Health Guidance Manual for Hazardous Waste Sites, (NIOSH # 85-115) 1984, Chapter 11, Handling Drums and Other Containers, p. 1-12.

EPA's Standard Operating Safety Guides, July 1988, Part 2, Standard Operating Safety Procedures.

