Introduction to Water System Safety

Chapter 8

What Is In This Chapter?

1. Major elements of a safety program
2. General description of safety considerations associated with water systems:
    - Electrical measurements
    - Traffic control
    - Hazardous material communication
    - Competent person/shoring
    - Confined space
    - Lockout/Tagout
    - Handling chemicals
    - How to lift a load properly
    - First aid for exposure to chlorine
    - General hygiene to prevent contracting waterborne diseases
    - Types of fires and methods of handling them

Key Words

- Adjacent
- Cave-in
- Competent Person
- Confined Space
- Excavation
- Lockout/Tagout
- MSDS
- OSHA
- Permit-required Confined Space
- Trench

Introduction

Accidents don't just happen. They are caused. Most accidents are caused by an unsafe act and/or an unsafe condition. The following information is a brief discussion of the major components of a water utility safety program. This material is not intended as a comprehensive review of safety, but as an introduction to the more important aspects of a water utility safety program.

Responsibility

Everyone is responsible for providing safe working conditions, including the operator, superintendent, and management. The management has the responsibility to develop a safety program, set policy, provide rewards, and provide safety equipment. The superintendent has the responsibility to see that the safety program is carried out, that operators use safety equipment, and that unsafe conditions are identified and corrected. The operator has the responsibility to use safety equipment properly, follow safety policies and procedures, and provide information to the superintendent when an unsafe condition is identified. Remember, only YOU can be responsible for your own safety.

Regulations – Federal

[1] OSHA – Occupational Safety and Health Act.

The Williams-Steiger Occupational Safety and Health Act of 1970 (**OSHA**[1]) required the federal government to establish minimum health and safety standards. The standards and regulations developed under this act require that employers furnish employees a place of employment free from recognized hazards that are likely to cause death or serious physical harm. The act provides for up to one year of prison and up to $70,000 penalty on conviction of a violation of the regulations associated with this act.

Regulations – State of Alaska

The State of Alaska Department of Labor is responsible for implementing most of these regulations. In some cases, the Alaska regulations are more stringent than the federal regulations. These regulations pertain to private and public employers alike. An excellent resource for developing and maintaining your safety program is the Department of Labor web site: http://labor.state.ak.us/lss/oshhome.htm. Here you can find information you need to develop your own safety program and the required recordkeeping requirements.

Workplace Injury and Illness Prevention Program

Every organization is required to have a safety program, or as it is officially called, a Workplace Injury and Illness Prevention Program. Why have a safety program? Taking risks is a part of running any business, particularly for small water utility. Some risks are just not worth the gamble. One of these is risking the safety and health of those who work with you.

Accidents Cost Money

Safety organizations, states, small business owners, and major corporations alike now realize that the actual cost of a lost workday due to injury is substantial. For every dollar spent on the direct costs of a worker's injury or illness, much more will be spent to cover the indirect and hidden costs.

Consider what one lost workday injury costs:

- Productive time lost by an injured employee
- Time to hire or to retrain other individuals to replace the injured worker until his/her return
- Time and cost for repair or replacement of any damaged equipment or materials
- In addition to compensation, the cost of continuing all or part of the employee's wages
- Reduced morale and perhaps lower efficiency among employees
- Increased workers' compensation insurance rates
- Cost of completing paperwork generated by the incident

Injury and Illness Prevention Program

Your Injury and Illness Prevention Program must be a written plan that includes policies and procedures and is put into practice. These key elements are required:

- Management commitment/assignment of responsibilities
- Safety communications system with employees
- System for assuring employee compliance with safe work practices
- Scheduled inspections/evaluation system
- Accident investigation
- Procedures for correcting unsafe/unhealthy conditions
- Safety and health training and instruction
- Record keeping and documentation

Management Commitment/Assignment of Responsibilities

The person or persons with the authority and responsibility for your safety and health program must be identified and given management's full support. Your management must commit itself and your agency by building an effective Injury and Illness Prevention Program and integrating it into your entire operation. This commitment must be backed by strong organizational policies, procedures, incentives, and disciplinary actions as necessary to ensure employee compliance with safe and healthful work practices.

Safety Communications

Your program must include a system for communicating with all employees - in a form readily understandable by all affected employees - on matters relating to occupational safety and health, including provisions designed to encourage employees to inform the employer of hazards at the worksite without fear of reprisal. This is usually in the form of monthly safety meetings designed to discuss and advise management on safety and health issues.

Schedule general employee meetings at which those present may freely and openly discuss safety. Such meetings should be regular, scheduled, and announced to all employees so that maximum employee attendance can be achieved. Many employers find it cost-effective to hold such meetings at shift change time, with a brief overlap of schedules to accomplish the meetings. If properly planned, effective safety meetings can be held in a 15 to 20-minute time frame.

Concentrate on:

- Occupational accident and injury history at your own worksite, with possible comparisons to other locations in your company.
- Feedback from the employee group.
- Guest speakers from your workers' compensation insurance carrier or other agencies concerned with safety.
- Brief audio-visual materials that relate to your industry.

Controlling meetings:

- Stress that the purpose of the meeting is safety. Members of management should attend this meeting.
- Training programs are excellent vehicles for communicating with employees.
- Posters and bulletins can be very effective ways of communicating with employees. You may obtain useful materials from OSHA, the Alaska Department of Labor, your workers' compensation insurance carrier, the National Safety Council, or other commercial and public service agencies.
- Newsletters or similar publications devoted to safety are also very effective communication devices. If you cannot devote resources to an entire publication, make safety a featured item in every issue of your agency's newsletter.
- Provide a safety suggestion box for employees, anonymous if desired, to communicate their concerns to management.
- Publish a brief company safety policy or statement informing all employees that safety is a priority issue with management, and urge employees to actively participate in the program for the common good.
- Communicate your concerns about safety to all levels of management.
- Document all communication efforts, as you will be required to demonstrate that a system of effective communication is in place.

Hazard Assessment and Control

Periodic inspections of the workplace and procedures for correction of safety hazards provide a method of identifying existing or potential hazards in the workplace, as well as eliminating or controlling them. Hazard control is the heart of an effective Injury and Illness Prevention Program. Hazards that occur or recur reflect a breakdown in the hazard control system. The hazard control system is also the basis for developing safe work procedures and injury/illness prevention training.

A qualified person must make the required hazard assessment inspection of your workplace. This survey can provide the basis and guide for establishing your hazard assessment and control system. The inspection can produce knowledge of hazards that exist in the workplace, as well as conditions, equipment, and procedures that could be potentially hazardous.

An effective hazard control system will identify hazards that exist or develop in your workplace, how to correct those hazards, and steps you can take to prevent their recurrence. If you have an effective system for monitoring workplace conditions, you will be able to prevent many hazards from occurring through scheduled and documented self-inspections. Make sure established safe work practices are being followed and any unsafe conditions or procedures are identified and corrected properly.

Scheduled inspections are in addition to the everyday safety and health checks that are part of the routine duties of managers and supervisors. The frequency of these inspections depends on the operations involved, the magnitude of the hazards, the proficiency of employees, changes in equipment or work processes, and the history of workplace injuries and illnesses. Inspections should be conducted by personnel who, through experience or training, are able to identify actual and potential hazards and understand safe work practices.

Management and/or the agency's safety committee must review written inspection reports. The review should assist in prioritizing actions and verify completion of previous corrective actions, and the overall inspection program results should be reviewed for trends.

Employees should be encouraged to tell their supervisors of possibly hazardous situations, knowing their reports will be given prompt and serious attention without fear of reprisal. When everyone knows that the situation was corrected (or why it was not hazardous), you create a system by which employees continue to report hazards promptly and effectively.

Workplace equipment and personal protective equipment should be maintained in safe and good working condition. In addition, your own program monitors the operation of workplace equipment and can also verify that routine preventive maintenance is conducted and personal protective equipment is reliable. Proper maintenance not only makes good safety sense, it can prevent costly breakdowns and undue exposures.

Hazards should be corrected as soon as they are identified. For any that cannot be immediately corrected, set a target date for correction based on such considerations as the probability and severity of an injury or illness resulting from the hazard; the availability of needed equipment, materials, and/or personnel; time for delivery, installation, modification, or construction; and training periods.

Provide interim protection to employees who need it while the correction of hazards is proceeding. A written tracking system such as a log helps you monitor the progress of hazard correction. You should review and prioritize your program based on the severity of the hazard.

Accident Investigation

A primary tool you should use in an effort to identify and recognize the areas responsible for accidents is a thorough and properly completed accident investigation. It should be in writing and adequately identify the cause(s) of an accident or near-miss incident.

Accident investigations should be conducted by trained individuals whose primary focus is to understand why the accident or near miss occurred and what actions can be taken to prevent recurrence. In smaller organizations, the responsibility may lie directly with the supervisor responsible for the affected area or employee.

Questions to ask in an accident investigation include the following:

- What happened? The investigation should describe what took place that prompted the investigation: an injury to an employee, an incident that caused

a production delay, damaged material, or any other conditions recognized as having a potential for losses or delays.

- Why did the incident happen? The investigation must obtain all the facts surrounding the occurrence: what caused the situation to occur; who was involved; whether the employee(s) was/were qualified to perform the functions involved in the accident or near miss; whether they were properly trained; whether proper operating procedures were established for the task involved; whether these procedures were followed, and if not, why not; where else this or a similar situation might exist; and how it can be corrected.
- What should be done? The person conducting the investigation must determine which aspects of the operation or processes require additional attention. It is important to note that the purpose here is not to assess blame, but to determine what type of constructive action can eliminate the cause(s) of the accident or near miss.
- What action has been taken? Action already taken to reduce or eliminate the hazard being investigated should be noted, along with any hazards remaining to be addressed. Any interim or temporary precautions should also be noted. Any pending corrective action and reason for delaying its implementation should be identified.

Corrective action should be identified in terms of not only how it will prevent a recurrence of the accident or near miss, but also how it will improve the overall operation. This will assist the investigator in reporting his/her solutions to management. The solution should be a means of not only achieving accident control, but also improving overall operations.

If you have a safety committee, its members should review investigations of all accidents and near-miss incidents to assist in recommending appropriate corrective actions to prevent similar recurrence.

Thorough investigation of all accidents and near misses will help you identify causes and needed corrections, as well as can help you determine the reasons accidents occur, the locations where they happen, and any accident trends. Such information is critical to preventing and controlling hazards and potential accidents.

Safety Planning, Rules, and Work Procedures

Planning for safety and health is an important part of every business decision, including purchasing, operations, changes in work processes, and planning for emergencies.

Your safety and health planning are effective when your workplace has the following:

- Rules written to apply to everyone and address such areas as personal protective equipment, appropriate clothing, expected behavior, and emergency procedures. You and your employees should periodically review and update all rules and procedures to make sure they reflect present conditions.
- Rules and procedures written for new exposures when they are introduced into the workplace.
- Safe and healthful work practices developed for each specific job.
- Discipline or reward procedures to help assure that safety rules and work procedures are put into practice and enforced. Reward or positive reinforce-

ment procedures such as bonus, incentive, or employee recognition programs should provide positive motivation for compliance with safety rules and procedures.

- A written plan for emergency situations. Your plan must include a list of emergencies that may arise, as well as a set of procedures to respond to each situation. Some emergency procedures, such as those covering medical emergencies or fire evacuation, are mandated by OSHA regulations.
- If you have operations involving hazardous substances, procedures, or processes, you must designate emergency response teams to be specifically trained and equipped to handle possible imminent hazards.

Safety and Health Training

Training is one of the most important elements of any Injury and Illness Prevention Program. It allows employees to learn their job properly, brings new ideas into the workplace, reinforces existing ideas and practices, and puts your program into action.

Employees benefit from safety and health training through fewer work-related injuries and illnesses, as well as reduced stress and worry caused by exposure to hazards. The agency benefits from reduced workplace injuries and illnesses, increased productivity, lower costs, and a more cohesive and dependable work force.

An effective Injury and Illness Prevention Program includes training for both supervisors and employees. Training for both is required by OSHA safety orders. You may need outside professionals to help you develop and conduct your required training program. Help is available from the OSHA Consultation Service, the Alaska Department of Labor, your workers' compensation insurance carrier, private consultants, and vendor representatives.

Outside trainers should be considered temporary. Eventually you will need your own in-house training capabilities, so you can provide training that is timely and specific to the needs of your workplace and your employees.

To be effective and also meet OSHA requirements, your training program needs to:

Let your supervisors know:

- They are key figures responsible for the establishment and success of your Injury and Illness Prevention Program.
- The importance of establishing and maintaining safe and healthful working conditions.
- They are responsible for being familiar with safety and health hazards to which their employees are exposed; how to recognize these hazards; the potential effects these hazards have on their employees; and the rules, procedures, and work practices for controlling exposure to those hazards.
- How to convey this information to employees by setting a good example, instructing them, and making sure they fully understand and follow safe procedures.
- How to investigate accidents and take corrective and preventive action.

Let your employees know:

- The success of the company's Injury and Illness Prevention Program depends on their actions as well as yours.
- The safe work procedures required for their jobs and how these procedures protect them against exposure.
- When personal protective equipment is required or needed, as well as how to use and maintain it in good condition.
- What to do if emergencies occur in the workplace.

A safety and health-training program must, at a minimum, provide training and instruction:

- To all employees when your program is first established.
- To all new employees.
- To all employees given new job assignments for which training has not been previously received.
- Whenever new substances, processes, procedures, or equipment are introduced to the workplace and present a new hazard.
- Whenever you or your supervisors are made aware of a new or previously unrecognized hazard.
- For all supervisors to assure they are familiar with the safety and health hazards to which employees under their immediate direction and control may be exposed.

Safety and Health Recordkeeping

No operation can be successful without adequate recordkeeping, which enables you to learn from past experience and make corrections for future operations. Records of accidents, work-related injuries, illnesses, and property losses serve a valuable purpose.

Under OSHA recordkeeping requirements, information on accidents is gathered and stored. Upon review, causes can be identified and control procedures instituted to prevent the illness or injury from recurring. Keep in mind that any inspection of your workplace may require you to demonstrate the effectiveness of your program.

Injury and Illness Records

Injury and illness recordkeeping requirements under OSHA require a minimum amount of paperwork. These records give you one measure for evaluating the success of your safety and health activities: success would generally mean a reduction or elimination of employee injuries or illnesses during a calendar year.

You must report industrial deaths and accidents to the Alaska Division of Labor Standards and Safety. Alaska Statute 18.60.058 requires employers to report to the Division of Labor Standards and Safety any employment accident that is fatal to one or more employees or that results in the overnight hospitalization of one or more employees. The report, which must be made immediately but no later than eight hours after the employer learns that the accident has occurred, must relate the circumstances of the accident, the number of fatalities, and the extent of the injuries.

Additional information on recordkeeping can be found on the Department of Labor web site at:

http://labor.state.ak.us/lss/oshhome.htm

During the year, regularly review these records to see where your injuries and illnesses are occurring. Look for any patterns or repeat situations. These records can help you to identify hazardous areas in your workplace and to pinpoint where immediate corrective action is needed. Since the basic OSHA records are for reportable injuries and illnesses only, you may expand your system to include all incidents relating to workplace safety and health, even those where no injury or illness resulted. Such information can assist you in pinpointing unsafe acts, conditions, or procedures.

Exposure Records

Injury and illness records may not be the only records you need to maintain. OSHA standards concerning toxic substances and hazardous exposures require records of employee exposure to these substances and sources, physical examination reports, employment records, and other information.

Documentation of Your Activities

Essential records, including those legally required for workers' compensation, insurance audits, and government inspections must be maintained for as long as required. For most employers, OSHA standards also require that you keep records of steps taken to establish and maintain your Injury and Illness Prevention Program:

- Records of scheduled and periodic inspections as required by the standard to identify unsafe conditions and work practices. The documentation must include the name(s) of the person(s) conducting the inspection, the unsafe conditions and work practices identified, and the action taken to correct the unsafe conditions and work practices. The records are to be maintained for at least one year. However, employers with fewer than 10 employees may elect to maintain the inspection records only until the hazard is corrected.
- Documentation of safety and health training required by standards for each employee. The documentation must specifically include employee name or other identifier, training dates, type(s) of training, and the name of the training provider. These records must also be kept for at least one year, except that training records of employees who have worked for less than one year for the employer need not be retained beyond the term of employment if they are provided to the employee upon termination of employment.

In addition, employers with fewer than 10 employees can substantially comply with the documentation provision by maintaining a log of instructions provided to the employee with respect to the hazards unique to the employees' job assignment when first hired or assigned new duties. Keeping such records fulfills your responsibilities under General Industry Safety Order 3203. It also affords an efficient means to review your current safety and health activities for better control of your operations and to plan future improvements.

Review

1. The department in Alaska responsible for implementing OSHA regulations is the Department of :

2. What eight key elements must be in a safety program?

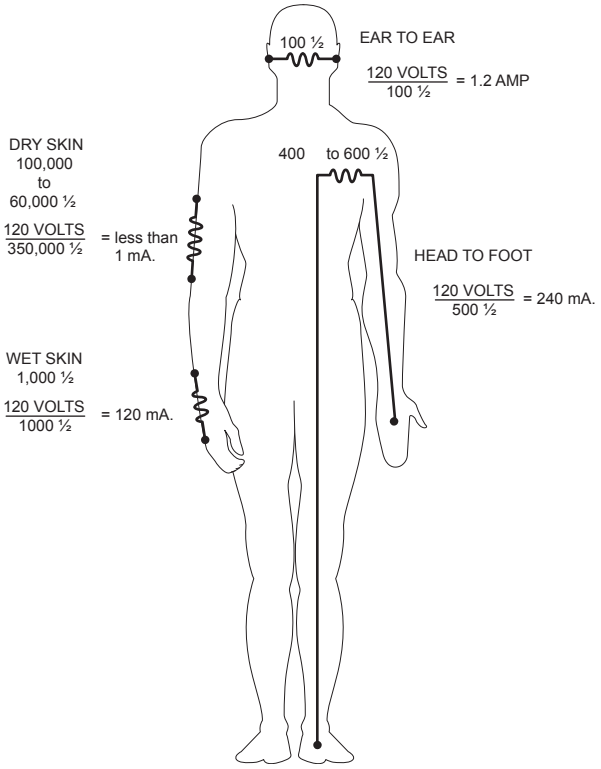
Major Safety Concerns

The following is a brief discussion of major safety concerns in small water utilities.

Electrical Measurements

Electrical measurements should be taken by a qualified electrician. When one is not available and the operator has to make these measurements, the following safety precautions should be followed:

- Remove all jewelry, including earrings, rings, watches, necklace, metal-rimmed glasses, and large belt buckles
- Wear shirts with tight-fitting sleeves
- Fasten the panel door open
- Wear safety goggles
- Wear electrical safety gloves
- Have a second person standing by when making the measurements
- Make the measurements with one hand; keep the second hand in your pocket



Amperage flow through various portions of the body with 120 volts applied

Traffic Control

Introduction

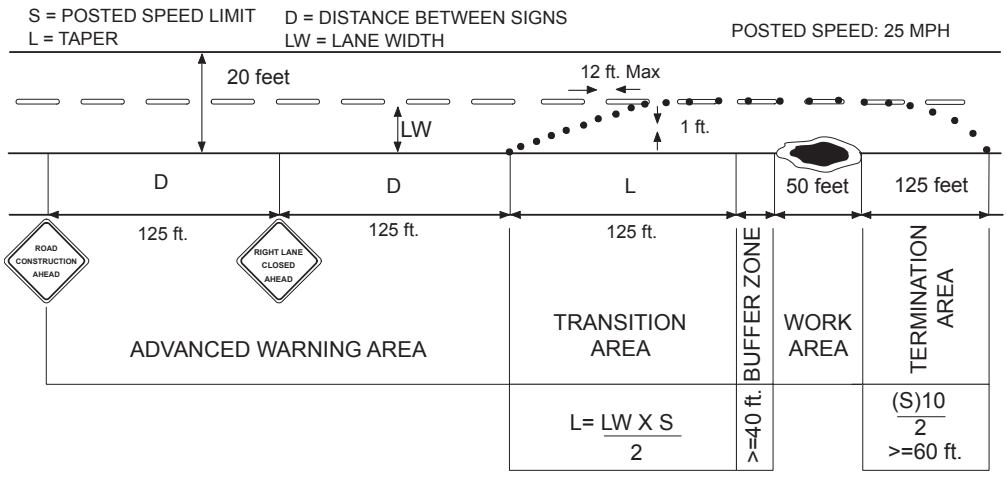
Traffic control includes protection for vehicles, snow machines, ATVs, and pedestrians. When work is being performed on a street or sidewalk, the proper number of signs and cones should be in place. The number of signs and cones needed depends on the speed of the traffic.

Zones

When setting up traffic control, you should consider the following four zones:

- Advance Warning Zone – The zone prior to the work site. Here signs such as UTILITY WORK AHEAD, RIGHT LANE CLOSED, and CONSTRUCTION AHEAD are used.

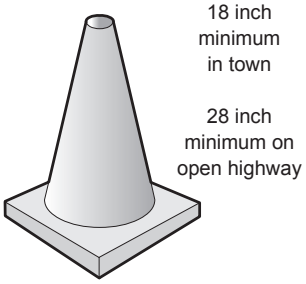
- Transition Zone – The zone used to move the traffic away from the work area and into a selected lane. Cones are often used to define the transition zone.
- Buffer and Work Area – A buffer area of 40 to 50 feet is desirable in front of the work area. This allows the placement of equipment without being in the traffic area.
- Termination Zone – The area after the work area where traffic is allowed to come back into its normal flow pattern.



Sign Placement

When the traffic speed is 25 mph or less, a typical traffic control setup would include the following:

- At least two advanced warning signs 125 feet apart
- Cone taper of 125 to 150 feet
- Twelve cones
- Cones spaced 12 feet apart



TRAFFIC CONE

Review

1. Describe four safety precautions to follow when making electrical measurements.

2. Traffic control means to control what?

3. How far apart should the advance warning signs be when the posted speed is 25 mph? How far apart should the cones be placed?

Hazardous Material Communication

OSHA has developed a hazardous communication standard to make sure that the proper information on handling hazardous materials reaches each worker required to handle the material. This program addresses five main areas:

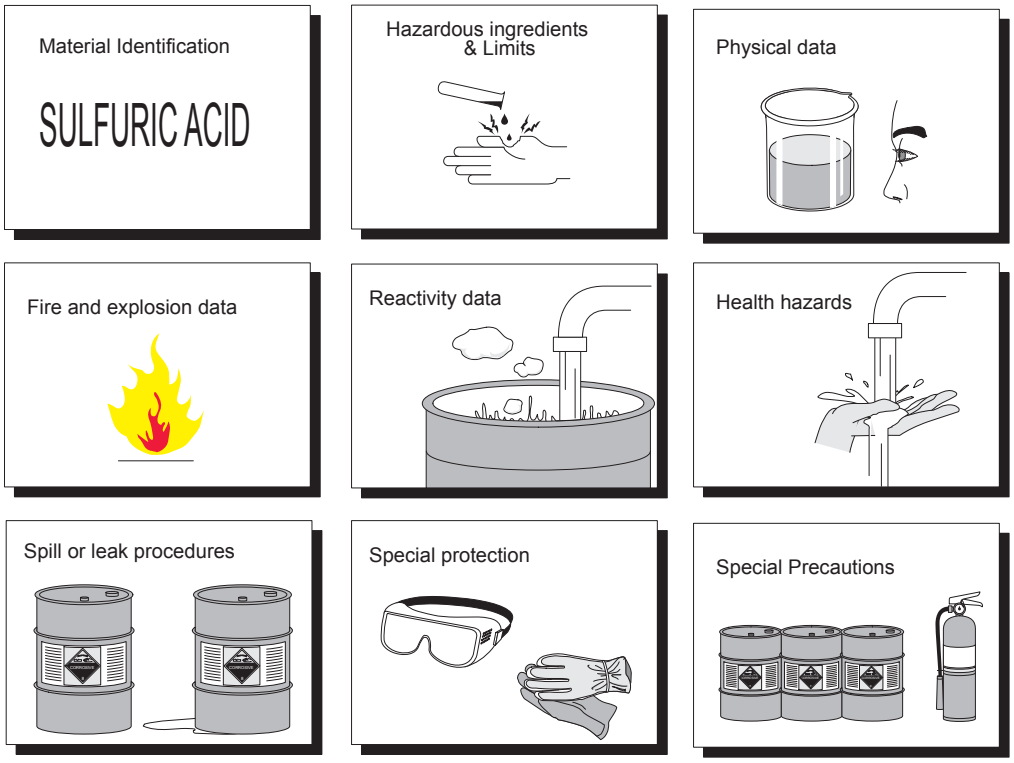
- The identification of hazardous chemicals
- A product warning label system
- The development of **Material Safety Data Sheets (MSDS[2])**
- The development by each organization of a hazard communication program
- Employee training program on how to handle hazardous materials and how to read the hazardous material labels and MSDS

[2] MSDS (Material Safety Data Sheet) – Written material produced by the chemical manufacturer describing properties and safe-handling procedures.

MSDS Components

An MSDS is a written document provided by the manufacturer and supplier of the chemical. Each chemical (alum, chlorine, paint, cleaners, etc.) must have a MSDS. Your organization is required to have available copies of the MSDS for the chemicals handled by the workers. Each MSDS has information concerning nine specific areas:

- Chemical identification information
- Hazardous ingredients and safe exposure levels
- Physical data
- Fire and explosion data, including flash point and how to extinguish a fire
- Health hazards, including first aid requirements
- Reactivity data – the incompatibility and instability of the material with other chemicals
- How to handle a spill or leak
- Special protective equipment required for handling
- Special precautions concerning posting, handling, and clean-up

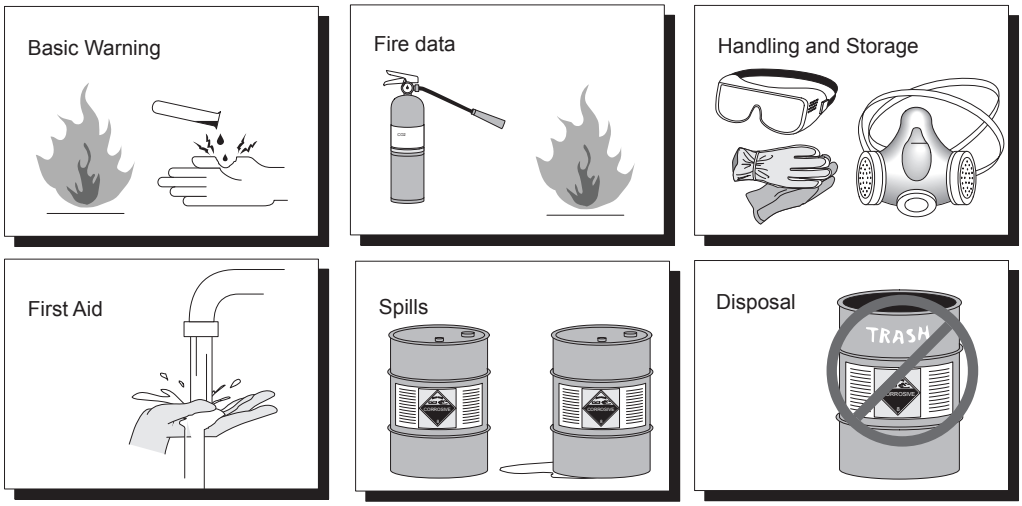


Label Components

Each manufacturer of a chemical is required to place a label on the container of that chemical. The label contains information on six specific areas:

- Basic warnings, including chemical name, hazardous ingredients, and name and address of manufacturer
- First aid for exposure to the chemical
- How to handle a fire involving the chemical
- How to handle a spill of the chemical
- Equipment necessary for proper handling and storage of the chemical
- Cautions regarding proper disposal of the container

In addition, a placard indicating special precautions is commonly included. Typical placards are for flammable, corrosive, oxidizer, poison, irritant, explosive, and combustible.



Written Program Content

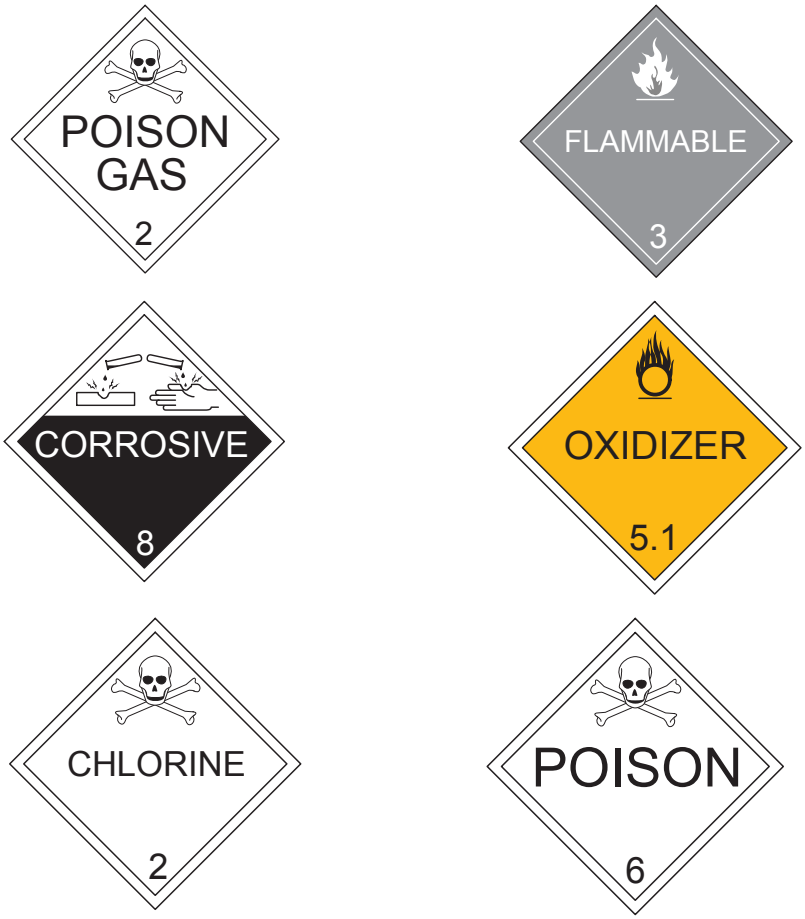
Each organization is required to have a written program that contains the following elements:

- A listing of all hazardous chemicals in the workplace
- How the needed labels will be provided
- The location of MSDS
- How employee training will be provided
- How employees will be informed of hazards from unlabeled pipes
- How workers will be told the hazards of non-routine tasks

Training Requirements

The training program must contain the following elements:

- How to detect the release of a hazardous chemical
- The hazards of all chemicals in your work area and the dangers of any job you may have to do
- How to protect yourself from these dangers
- The details of the Hazardous Communication Program developed by the employer

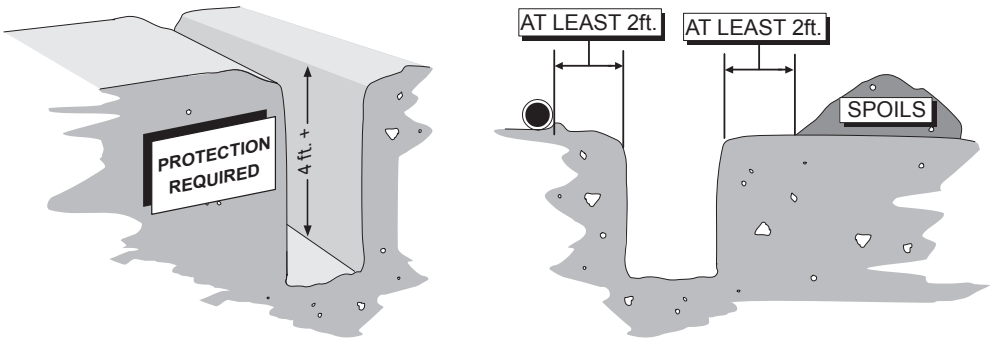


Competent Person/Shoring

When a **trench**[3] is dug for construction or repair, a person with the proper training to be considered a **competent person**[4] must be on hand to do the following:

- Inspect the site for potential hazards, and re-inspect regularly.
- Test the soil to determine its classification.
- Determine the proper method of preventing a **cave-in**[5]. Any trench in Alaska that is four feet deep or deeper is required to have some form of cave-in protection.
- Assure that no materials that may present a hazard to those in the trench are on the surface **adjacent**[6] to the trench.
- Determine that all other underground utilities in the vicinity of the **excavation**[7] are located.
- Determine that proper access and egress is available for workers to enter and exit the trench. A ladder must be within 25 feet of any person working in a trench that is three feet deep or deeper.
- Determine that all traffic control is properly installed.
- Assure that no load can fall on those working in the trench.
- Ensure that back-up warning systems are in place and working on all equipment at the work site.
- Make sure that workers are protected from the accumulation of water.
- Ensure that all adjacent structures are stable and do not represent a hazard to the workers.
- Make sure that the spoils are placed at least 2 feet back of the trench wall.
- Assure that adequate protection to prevent persons from falling into the excavation is in place.
- Ensure that proper procedures are used to test the trench for the presence of combustible and toxic gasses in addition to oxygen. The oxygen level must remain above 19.5 percent. This includes keeping internal combustion engines far enough away to avoid CO accumulation in the trench.
- Assure that proper emergency rescue equipment is on the job site.

The "competent person" should inspect the excavation at least once a day and record the findings of that inspection.



[3] Trench – A narrow excavation made below the surface of the ground. In general, the depth is greater than the width, but the width of a trench should not be greater than 15 feet.
[4] Competent Person – One who is capable of identifying existing and predictable hazards in the surroundings or working conditions which are unsanitary, hazardous, or dangerous to employees and who has authorization to take prompt corrective measures to eliminate them.
[5] Cave-in – 1) The separation of a mass of soil or rock material from the side of an excavation or 2) the loss of soil from under a trench shield or support system and its sudden movement into the excavation, either by falling or sliding, in sufficient quantity so that it could entrap, bury, or otherwise injure or immobilize a person.
[6] Adjacent – As used with trench protection systems, the area within a horizontal distance from the edge of the trench equal to the depth of the trench.
[7] Excavation – Any man-made cavity or depression in the earth's surface, including its sides, walls, or faces, formed by earth removal and producing unsupported earth conditions by reason of the excavation.

Review

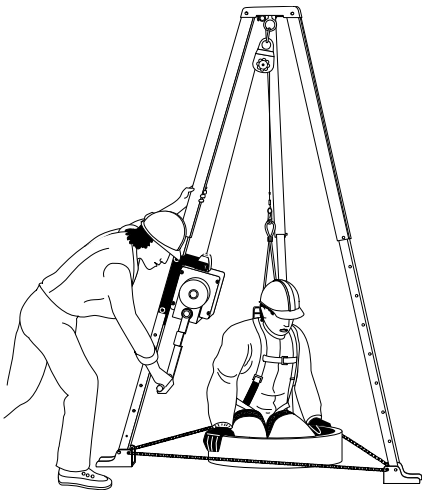
1. What is the function of the MSDS?

2. What is the function of the Hazardous Material Communication Program?

3. In Alaska, the soils associated with any trench must be tested by a _____ _____ if the trench is more than _____ deep, and protection must be provided.

Confined Space

A **confined space**[8] is any space where the entrance and exit is restricted, is not made for human habitation, and may have a hazardous atmosphere. A **permit-required confined space**[9] is a confined space that contains or has the potential to contain a hazardous atmosphere, contains a material that has the potential for engulfing an entrant, has an internal configuration such that an entrant could be trapped, or contains any other recognized serious safety hazard. Always assume a space is a permit-required confined space until proven otherwise!



Typical confined spaces include manholes, valve pits, the inside of a pressure filter, wet well of a sewage lift station, and reservoirs. In Alaska, any trench 3 feet deep or deeper is considered a confined space. When an area is identified as a permit-required confined space, the following must be in place:

- The organization must have a written policy, procedure, and permit system for confined spaces.
- Entrance can be gained only if a permit is obtained and signed by the entry supervisor.
- The air must first be tested for explosive and hazardous gases, then for oxygen concentration.
- It is best to ventilate the confined space for at least 10 minutes before entering and to maintain the ventilation system during occupancy.
- The air in the confined space should be tested every 30 minutes for combustible and toxic gases.
- There must be two people on hand to enter a confined space: the entrant and an attendant. The two must be in constant communication with each another.
- In most confined spaces, the entrant must use a safety harness connected to a retrieval tripod.

[8] Confined Space – As defined by NIOSH, a space that by design has limited openings for entry and exit; has unfavorable natural ventilation that could contain or produce dangerous air contaminants; and that is not intended for continuous employee occupancy.

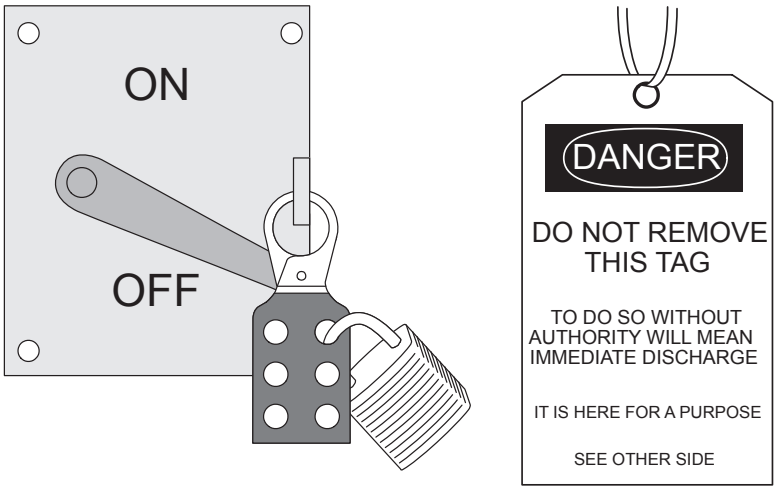
[9] Permit-required confined space – A confined space that contains or has the potential to contain a hazardous atmosphere, that contains a material that has the potential for engulfing an entrant, that has an internal configuration such that an entrant could be trapped, or that contains any other recognized serious safety hazard.

Lockout/Tagout

All energy sources that supply motors, valves, air compressors, and other equipment need to be secured and locked-out and tagged-out prior to any maintenance work on this equipment. This is typically done at breaker panels to secure electrical energy, but any source of energy, such as air or water pressure, spring tension, or steam, must be secured also. A **lockout/tagout**[10] program must include the following:

- A written policy and procedure
- Individual keyed locks for each person who may shut down a piece of equipment
- Tags that allow the individual to identify who locked out the device as well as when and why it was locked out

[10] Lockout/Tagout – A process of physically locking and tagging hazardous energy sources to prevent energy during maintenance.



Handling Chemicals

The most common chemicals handled by small water system operators include the following:

- Gas chlorine
- Aluminum sulfate (alum)
- Lime
- Soda ash
- Calcium hypochlorite
- Sodium hypochlorite
- Potassium permanganate
- Sodium fluoride

The chemicals should be stored and marked in accordance with the MSDS.

General Guidelines for Personal Protective Equipment

The following are general guidelines for personal protective equipment for these common chemicals. For more detailed information, see the MSDS for the specific chemical.

Safety Equipment	Chemical
Chemical Safety Goggles	Required for all but gas chlorine
Cartridge Respirator	Calcium hypochlorite, sodium hypochlorite, potassium permanganate, and sodium fluoride
Dust Mask	Alum, lime, and soda ash
Rubberized Gloves	Calcium and sodium hypochlorite, potassium permanganate, and sodium fluoride
Self-Contained Breathing Apparatus	Gas chlorine

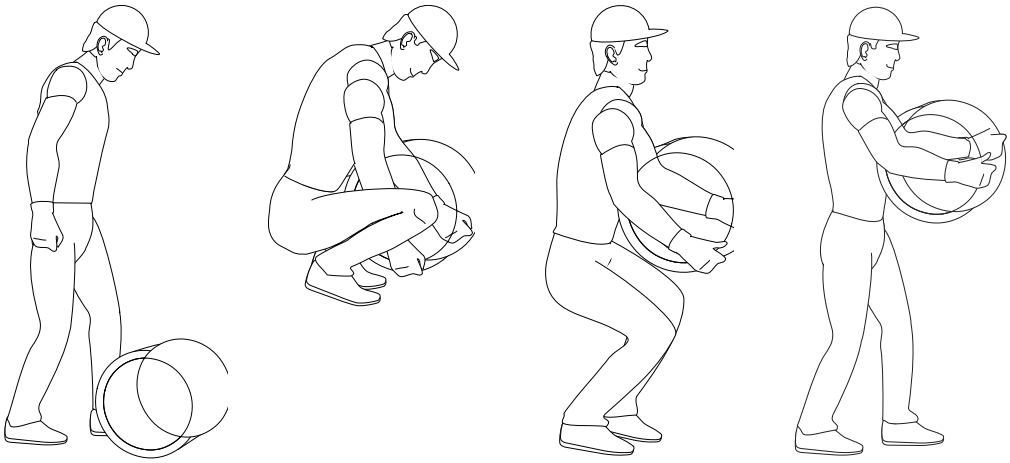
Gluing PVC

The cleaning solvent used to prepare PVC for gluing contains Methyl Ethyl Ketone (MEK). This solvent can enter the blood stream by passing directly through the skin or by breathing the fumes. Butyl rubber gloves and a cartridge respirator are recommended when using this material.

Lifting

Working in a water system, by its nature, requires lifting. We all tend to lift too much and ignore the proper techniques of lifting. The result is a high rate of back injuries in people who perform construction work. Here are a few simple steps that, if followed, will reduce the possibility of a back injury:

1. Get on firm, flat footing. Keep your knees apart and your toes pointed slightly out.
2. Bend at the knees, not at the hips.
3. Tighten your stomach muscles. This will help to support your back.
4. Lift with your legs. This puts less pressure on your back.
5. Keep the load close to your body.
6. Think before your start the lift. Here are a few basic questions to ask:
   - What is the size of the load?
   - Can I safely lift this load?
   - Can I get help if the load is beyond by capabilities? A “He-Man” is of very little value with a bad back!
   - Is there a better way?
   - Can I use a hand truck, backhoe, or other device to do this job?
   - Is the pathway clear? Most accidents in this industry are slips, trips, and falls.
7. Keep in shape. Exercising at least three times a week will keep both your back and stomach muscles in tone and thus will reduce the possibility of back injury.



First Aid

The following is a brief review of common first aid practices for accidents likely to occur in the water works industry.

Chlorine on Skin

For exposure of your skin to sodium hypochlorite, calcium hypochlorite solution, or gas chlorine, flush the area for 15 minutes with clean fresh water. If burning persists, see a doctor.

Chlorine in Eye

If sodium hypochlorite, calcium hypochlorite solution, or gas chlorine enters the eye, flush the eye for 15 minutes with clean, warm fresh water. See a doctor.

Overcome by Chlorine Gas

If someone is overcome by gas chlorine, remove the person from the contaminated area, and treat for shock. If the person is not breathing, give mouth-to-mouth resuscitation. If their heart has stopped, give CPR.

Shock

In the case of shock due to injury, illness, or poison, the symptoms will be a pale, mottled face, cold sweat, fast breathing, and a weak pulse. Keep the person warm and lying down with their feet raised. Do not give fluids or food.

Frostbite

Among the symptoms of frostbite are skin that is flushed before changing to white or grayish yellow, blisters, coldness, numbness, and pain. Do not rub the area. Quickly warm by immersing the area in tepid water (102° F to 105°F).

Burns

The symptoms of burns are redness and pain. Moderate burns will blister. A severe burn will show tissue destruction. Treat small burns with ice. Use cool water (not ice) for big burns. Wash with cool water and soap. Apply a sterile dressing but no ointment. Do not remove clothing stuck to a burn. Seek medical help if there is extensive blistering or if the skin is white, dry, and painless.

Electric Shock

The symptoms of electric shock are unconsciousness and pale, blushed skin that is clammy and mottled in appearance. If the victim is not breathing, give mouth-to-mouth. If there is no pulse, give CPR, but only if you are trained to do so. Elevate feet and keep warm.

Mouth-to-Mouth Resuscitation

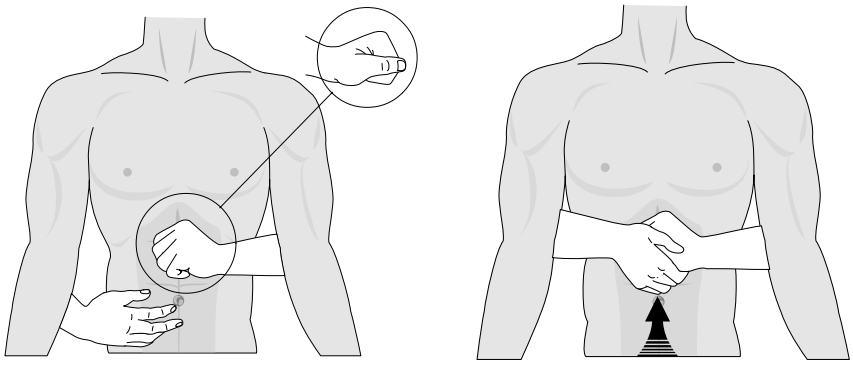
Use this procedure only when the victim is not breathing. Lack of consciousness is not a symptom that breathing has stopped.

1. Remove any foreign matter from the mouth.
2. Tilt the victim's head backward so that their chin is pointing upward. This is accomplished by placing one hand under the person's neck and lifting while placing your other hand on their forehead and pressing. Tilt the head without closing the person's mouth.
3. Move their tongue away from the back of their throat to provide an open airway.
4. While maintaining a backward head-tilt position, pinch the person's nostrils with the fingers of the hand that is pressing on their forehead to prevent leakage of air.
5. Open your mouth wide, take a deep breath, seal your mouth tightly around the person's mouth in a wide-open circle, and blow.
6. Watch the victim's chest. When you see it rise, stop inflation, raise your mouth, turn your head to the side, and listen for exhalation. Watch the chest to see that it falls.
7. Repeat this process at a rate of one breath every five seconds for adults (12 per minute), one every three seconds for infants and small children (20 per minute).

Choking

This procedure is commonly used when a person is choking but still conscious:

1. Stand behind the victim.
2. Wrap your arms around their waist.
3. Make a fist with one hand, and place the thumb side against the person's abdomen in the midline slightly above their navel and well below the tip of their sternum.
4. Grasp your fist with your other hand.
5. Press into the victim's abdomen with a quick upward thrust. Each thrust should be distinct and delivered with the intent of relieving the airway obstruction. Exert no pressure against their rib cage with your forearms.



Review

1. In order to protect your back, you should always lift with your:

2. What is the first aid for a spill of chlorine on your skin?

3. What is the key condition that will tell you it is all right to give mouth-to-mouth to a person?

General Hygiene

Disease Potential

People are one of the most significant carriers of diseases. In fact, most of the waterborne diseases discussed in this text are carried by people. Often operators of water systems in small communities must also operate the wastewater facility and make repairs to pipes in soils that are contaminated by human waste.

Protection

There are precautions that you can take to maintain a level of protection from diseases such as hepatitis and gastroenteritis:

- When possible, use rubberized gloves to handle contaminated material.
- Never smoke while working in a contaminated area.
- Never eat food in a contaminated area.
- Keep your hands away from your face while working in a contaminated area.
- Wash with soap and water after handling contaminated material.
- Always wash your hands with soap and water after using the rest room.
- If possible, shower and change clothes before going home.

Bloodborne Pathogens

In 1992, OSHA Bloodborne Pathogens Standards (BBPS) became law. Bloodborne Pathogens are pathogenic microorganisms that are present in human blood and other body fluids and can cause disease in humans. These pathogens include, but are not limited to, Hepatitis B Virus (HBV) and Human Immunodeficiency Virus (HIV). Other potentially infectious materials include the following human body fluids: mucus, semen, vaginal fluid, saliva, and any body fluid that is visibly contaminated with blood.

Although the Center for Disease Control (CDC) has determined that HIV and other bloodborne pathogens are not waterborne diseases, the CDC warns that persons who provide emergency first aid/CPR could become contaminated. For example, if a worker finds another worker or other person unconscious and not breathing, the worker could become contaminated with a bloodborne pathogen disease if the worker renders CPR to the victim without proper personal protection. If a worker attempts to aid another worker or other person who is bleeding, again the worker could become contaminated with a bloodborne pathogen disease.

To protect employees from bloodborne pathogens (HIV and Hepatitis B), all employers must do the following:

- Train all employees on the hazards of bloodborne pathogens.
- Equip all first aid kits with rescue barrier masks to prevent mouth-to-mouth contact, with latex protective gloves to prevent contact with body fluids, and with eye protection and a biohazard bag to dispose of cleanup materials.
- Provide the exposed employee medical attention, including immunizations for self-protection, such as the Hepatitis B vaccine, at no cost to the employee as mandated by 29 CFR 1910.1030.

Fire Safety

Classification of Fires

There are four classifications of fires based on the type of material involved:

Classification	Material Involved
CLASS A	A Class A fire is ordinary combustibles or fibrous material, such as wood, paper, cloth, paper, and some plastics.
CLASS B	A Class B fire is flammable or combustible liquids such as gasoline, diesel, kerosene, paint, paint thinners, and propane.
CLASS C	A Class C fire is energized electrical equipment, such as motors, motor controls, switches panel boxes, and power tools.
CLASS D	A Class D fire is certain combustible metals, such as magnesium, titanium, potassium, and sodium. These metals bum at high temperatures and give off sufficient oxygen to support combustion. They may react violently with water or other chemicals and must be handled with care.

Extinguishing Small Fires

Classification	Method of Extinguishing
CLASS A	Extinguish with pressurized water, foam, or multipurpose dry chemical extinguishers. Do not use carbon dioxide or ordinary dry chemical extinguishers on Class A fires.
CLASS B	Extinguish Class B fires by removing oxygen, by preventing vapors from reaching ignition sources, or by inhibiting the chemical chain reaction. Use foam, carbon dioxide, ordinary dry chemical, multipurpose dry chemical, and halon extinguishers.
CLASS C	Extinguish Class C fires by using carbon dioxide, ordinary dry chemical, multipurpose dry chemical, and halon-free extinguishers.
CLASS D	Extinguish Class D fires by using dry powder extinguishers made especially for this type of fire.

Special Note: Production of Halon has been banned since January 1, 1994 because Halon contributes to ozone depletion. Its reuse is still permitted.

Introduction to Water System Safety Quiz

1. What is the intent of this safety chapter?
   A. To determine how to be in compliance with safety regulations.
   B. To provide you with standard procedures for working safely.
   C. To make you aware of the hazards that may be encountered at your workplace.
   D. To present approved rules.

2. Who has the responsibility for your safety?
   A. Safety director
   B. OSHA
   C. You
   D. Your supervisor

3. Which type of ladder should never be used when working around electrical equipment?
   A. Fiberglass
   B. Metal
   C. Plastic
   D. Wooden

4. What is a "non-permit required confined space"? A confined space that
   A. Contains a material that has the potential for engulfing an entrant
   B. Contains or has the potential to contain a hazardous atmosphere
   C. Does NOT contain or have the potential to contain any atmospheric hazard capable of causing death or serious physical harm
   D. Has an internal configuration such that an entrant could be trapped or asphyxiated by inwardly converging walls

5. When testing the atmosphere in a confined space, which is the correct testing sequence?
   A. First test for combustible gases and vapors, then oxygen, and then toxic gases and vapors
   B. First test for combustible gases and vapors, then toxic gases and vapors, and then oxygen
   C. First test for oxygen, then combustible gases and vapors, and then toxic gases and vapors
   D. First test for toxic gases and vapors, then oxygen, and then combustible gases and vapors

6. If someone is suffering from electric shock, what is the first step that should be taken?
   A. Check for breathing and pulse.
   B. Free the victim from a live power source.
   C. Shut off power.
   D. Survey the scene and see if it is safe to enter.

7. What type of fire extinguisher should be provided in a pumping station?
   A. All-purpose, ABC chemical type
   B. Gas type
   C. Portable type
   D. Water-fed extinguisher type

8. When any piece of electrical equipment is being worked on, the circuit breaker should be:
   A. Painted when repair is complete
   B. Recorded for future reference
   C. De-energized and locked out/tagged out
   D. Replaced

9. What is the only acceptable breathing device to wear while handling gas chlorine leaks?
   A. Activated carbon canister type
   B. Potassium tetroxoide canister type
   C. Self-contained breathing apparatus
   D. Organic filter respirator

10. Of the following types of extinguishers, which should be used on electrical fires?
    A. Water
    B. Soda-acid
    C. Blanket
    D. Carbon dioxide

11. Wear safety goggles when:
    A. Handling acid
    B. In the office
    C. Driving vehicles
    D. Measuring turbidity

12. OSHA is the acronym for:
    A. Organization for Safe Health Administration
    B. Occupational Safety and Health Administration
    C. Occupation, Safety, and Health Act
    D. Organization of State Health Administrators

13. Which of the following is a method of preventing trench cave-in during pipeline installation or maintenance?
    A. Sloping
    B. Scanning
    C. Sequestering
    D. Surging

14. When handling fluoride chemicals, personnel should wear a respirator or mask approved by:
    A. OSHA
    B. MSA
    C. EPA
    D. NIOSH

15. What information must be on a warning tag attached to a breaker that has been locked out?
    A. Name of the person who locked out the breaker
    B. Exact time the breaker was locked out
    C. Date the breaker can be unlocked
    D. Name of the shift supervisor

16. When a permit is required to enter a confined space, who may sign the permit?
    A. Entrant
    B. Anyone at the job site
    C. Entry supervisor
    D. OSHA representative

17. What type of personal protective equipment (PPE) should an operator wear when handling hypochlorites?
    A. Reflective vest
    B. Dust mask
    C. Ear plugs
    D. Eye goggles

18. An atmosphere is defined as oxygen deficient if it contains less than what percent oxygen by volume?
    A. 19.5 percent
    B. 19.0 percent
    C. 20.5 percent
    D. 21.0 percent

19. Under any soil conditions, cave-in protection is required for trenches or excavations that are how many feet deep?
    A. 2 feet
    B. 3 feet
    C. 4 feet
    D. 5 feet

20. Material Data Safety Sheets (MSDS) are required for:
    A. All chemicals used in the workplace, regardless of hazard
    B. Only chemicals with known health hazards
    C. Only flammable or explosive chemicals
    D. Only chemicals with suspected health hazards

21. All occupied trenches three or more feet deep must provide exits at:
    A. 15-feet intervals
    B. 20-feet intervals
    C. 25-feet intervals
    D. 30-feet intervals

22. What class of fire involves oil or grease?
    A. Class A
    B. Class B
    C. Class C
    D. Class D

23. What type of information is available on a Material Safety Data Sheet (MSDS)?
    A. Effects of exposure
    B. Flammability rating
    C. Safe exposure level
    D. Where to purchase the chemicals

24. Which items should NOT be accomplished by a formal hazard communication training program?
    A. Explain how to read and interpret MSDS forms.
    B. Train employees on basic safety rules.
    C. Inform employees of the measures they can take to protect themselves from the physical and health hazards of chemicals in the work area.
    D. Make employees aware of the hazard communication standard and its requirements.

25. In Alaska, the agency that regulates safety in the workplace is:
    A. Alaska Department of Environmental Conservation
    B. Environmental Protection Agency
    C. Rural Utility Business Advisor
    D. Alaska Department of Labor

26. Which OSHA program requires the employer to provide the Hepatitis B vaccination to employees?
    A. Hazardous Infectious Disease (HID) Program
    B. Personal Protective Exposure (PPE) Program
    C. Bloodborne Pathogen (BBP) Program
    D. Carcinogen Protection (CPP) Program