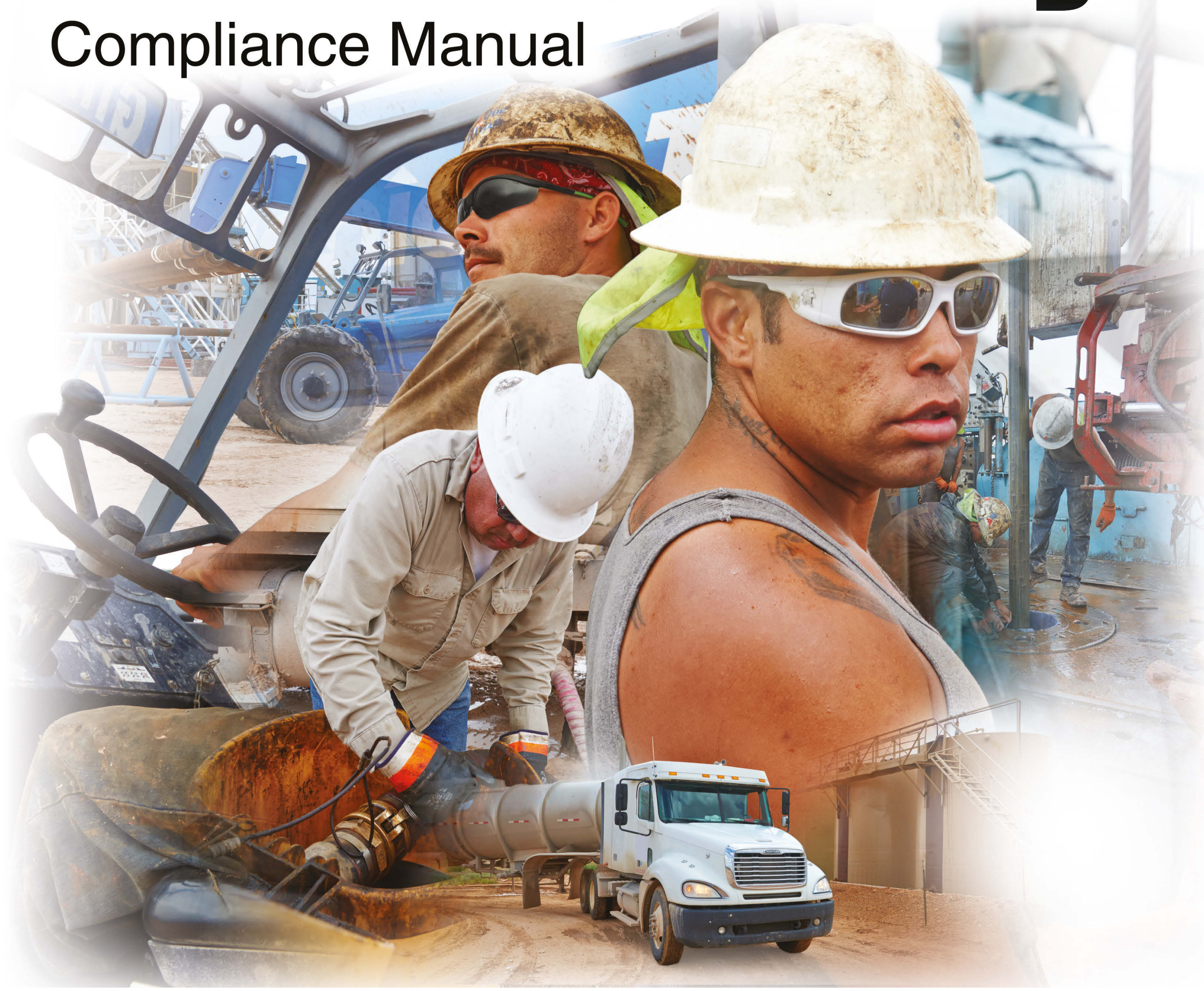
Oil & Gas Safety

Compliance Manual



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Introduction

The oil and gas extraction and support industries employ workers are engaged in many different industrial processes needed to successfully drill and service a well. These processes frequently require the use of specialized equipment and specialized work crews.

The *Oil & Gas Safety Compliance Manual* provides regulatory and best practice information for the most relevant Occupational Safety and Health Administration (OSHA), Environmental Protection Agency (EPA), and Department of Transportation (DOT) regulations and select state regulations from twenty-six key oil and gas producing states. It provides key regulatory explanations, safety best practices, and training requirements for topics impacting oil and gas field operations.

This manual covers safety issues related to working on an oil and gas drilling and production site, as well as transport safety and compliance, on-road and off-road safety, loading and unloading, handling hazardous materials, and safe transport operations.

The *Oil & Gas Safety Compliance Manual* also discusses the main federal environmental laws affecting the onshore exploration and production of oil and natural gas:

- The Clean Air Act (CAA)
- The Clean Water Act
- The Safe Drinking Water Act
- The Resource Conservation and Recovery Act (RCRA)
- The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)
- The Emergency Planning and Community Right-to-Know Act (EPCRA)

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State information

The depth of knowledge goes further than the above bullet items when individuals are expected respond to releases or potential releases for the purpose of stopping the release or control the situation. The object is for the team to perform its job with minimal risks. If you are a team member, you must know your limits and the limits of your equipment. You need to know how to safely avoid or escape emergency situations. And, you need to use the buddy system. Never enter a chemical emergency situation alone.

Evacuation during response

On scene incident commanders will consider evacuation as soon as a release is evaluated. The decision to evacuate will depend on the substance and the hazards involved.

Evacuation can be as simple as clearing people from the immediate area of the release or as complicated as total evacuation of the facility, surrounding area, and community. In total evacuations involving the community, proper public safety personnel must be involved.

PPE for handling a release

The hazardous substances used at your site determine the level of PPE and clothing. Emergency response team members receive necessary instruction and training on PPE and clothing.

For H_2S, it is recommended that responders use the most protective PPE consisting of the positive pressure self-contained breathing apparatus (SCBA); a fully encapsulating, chemical-type resistant suit; inner and outer chemical-resistant gloves; and chemical-resistant steel toe and shank safety boots. The *Emergency Response Guidebook* further points out that firefighter's protective clothing provides limited protection in fire situations ONLY; it is not effective in spill situations where direct contact with the substance is possible.

Decontamination procedures

A decontamination plan needs to be part of every site's emergency response effort. Equipment and PPE must be decontaminated after use. Your facility must dispose of contaminated waste properly.

Emergency follow-up

The final duty of the emergency response team is to review and evaluate all aspects of what happened and what may happen as a result. An account of the incident must be accurate, authentic, and complete, so be prepared to cooperate.

Beyond this information, the emergency response plan should contain action steps that must be taken, such as immediate measures to eliminate the release, notification of supervisors, establishment of a restricted access zone, and evacuation procedures. Know what that plan is and follow it!

Bottom line

Choose to understand the risks and follow safety procedures when there is a possibility of exposure to H_2S. Taking the time to identify risks, gathering as much information as possible, and knowing your desired outcome can prevent you and your employees from becoming victims.

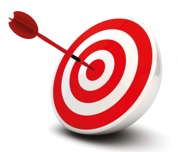
Silica

Controlling silica exposures at the well site

Silica is a mineral that is found in stone, soil, and sand. The amount of silica in soil and rock may vary widely depending on the local geology. Breathing in silica dust can cause silicosis, a serious lung disease.

There are two ways that employees can be exposed to silica at a well site:

- When silica sand is used as a proppant in hydraulic fracturing; and
- When using rock-drilling rigs to drill into rock, soil, or concrete.



Compliance Point

OSHA's new final rule Occupational Exposure to Respirable Crystalline Silica was published in the *Federal Register* March 25, 2016. For companies that use silica sand in hydraulic fracturing operations there is a phase-in period for full compliance. These companies have until June 23, 2018, to comply with the requirements in 1910.1053. However, the medical surveillance obligations for employees who will be exposed to respirable crystalline silica at or above the action level for 30 or more days per year do not have to be complied with until June 23, 2020. Plus, the requirements for the engineering controls in paragraph 1910.1053(f)(1) do not start until June 23, 2021.

Controlling silica exposures while performing hydraulic fracturing

Hydraulic fracturing is a process used to extract natural gas and oil deposits from shale and other tight geologic formations. While hydraulic fracturing has been in existence for around 60 years, innovative technology has emerged in the last 10 to 15 years that has made hydraulic fracturing a viable option for the extraction of gas or oil. Workers in the oil and gas industry pump fracturing fluid, composed of a base fluid (usually water with chemical additives) and a proppant (usually sand with a high crystalline silica content) into the well bore under extremely high pressures (e.g., 7,000 psi to 9,000 psi) to hold the fractures in the shale formation open after the pressure is released.

The high pressures fracture the shale or rock formation, allowing the gas and oil trapped in the formation to flow into the well. Use of this process has increased significantly in recent years due to new horizontal drilling and multistage hydraulic fracturing technologies that improve access to natural gas and oil deposits. At the same time, there is increasing awareness of the hazards of this process, particularly that of exposure to respirable crystalline silica, which first came to widespread attention in 2010 as a result of a NIOSH report, Field Effort to Assess Chemical Exposures in Gas and Oil Workers.

Once well drilling is complete, the delivery of proppant to the wellhead used for hydraulic fracturing occurs in steps. Initially, sand truck drivers deliver sand to the site and pneumatically pump it from trucks into sand movers that store sand. Once the sand is placed in the sand movers, workers regulate the flow of sand out of the sand mover onto a series of associated conveyor belts, which carry the sand to a hopper from which the sand is metered into a blender. At the end of the process, the sand, water, and chemical additives are mixed together in the blender before the sand-laden fracturing fluid is pumped through a high-pressure manifold into the well.

Did You Know

There are several important OSHA definitions: **Action level** means a concentration of airborne respirable crystalline silica of 25 μg/m^3 (micrograms of silica per cubic meter of air), calculated as an 8-hour TWA (typical 8-hour work day). The **permissible exposure limit (PEL)** is the limit where an employer must ensure that no employee is exposed to an airborne concentration of respirable crystalline silica in excess of 50 μg/m^3, calculated as an 8-hour TWA.

Silica sand used as a proppant contains a high percentage of crystalline silica, typically ranging from 60 to 100 percent depending on the source. When silica sand is used as a proppant in hydraulic fracturing, high airborne concentrations of respirable silica dust can occur as workers deliver, convey, and mix large volumes of sand with fracturing fluid.

Hydraulic fracturing crews frequently spend several days performing active hydraulic fracturing at a site where a well has several zones, with additional days for equipment setup and removal on the days before and after hydraulic fracturing. The time spent in this process can be longer when multiple wells are located at the same site. Once the job is complete, the crew moves to another site, where the process is repeated. During hydraulic fracturing several dozen workers can be on the site, but most work occurs outside the central sand-handling zone, which is only occupied by fracturing sand workers. The number of fracturing sand workers typically ranges from a half-dozen to two dozen, depending on the size of the project and whether multiple hydraulic fracturing crews are involved. A crew of 10 to 12 workers is typical.

Job categories

For the purpose of characterizing exposures to respirable crystalline silica, OSHA has organized activities at hydraulic fracturing sites into three main job categories:

- Fracturing sand workers,
- Ancillary support workers, and
- Remote/intermittent support workers.

Fracturing sand workers have the highest potential for exposure and include approximately half of the crew, while ancillary support and remote/intermittent workers spend limited time in the immediate area where sand is being handled and thus have lower exposure levels.

Primary points of dust emissions

Based on workplace observations and air monitoring surveys at 11 hydraulic fracturing sites, NIOSH researchers identified seven primary points of dust emissions from hydraulic fracturing equipment or operations. These included the following locations or equipment:

- Dust emitted from "thief" hatches (open ports on the top of the sand movers used to allow access into the bin);
- Dust ejected and pulsed through side fill ports on the sand movers during refilling operations;
- Dust released from the transfer belt under the sand movers;
- Dust released from operations of transfer belts between the sand mover and the blender;
- Dust released from the top of the dragon's tail (end of the sand transfer belt) on sand movers;
- Dust created as sand drops into, or is agitated in, the blender hopper and on transfer belts;
- Dust generated by on-site vehicle traffic, including sand trucks and crew trucks, by the release of air brakes on sand trucks, and by winds.

The descriptions of working conditions from the NIOSH reports indicate that baseline operating conditions involve very high exposures with few engineering controls in place. From their field studies, Esswein et al. observed that dust controls for hydraulic fracturing operations are "only now emerging" given that the nature and severity of the hazard was just recently recognized by the industry.

NIOSH found that 69 percent (79 out of 114 samples) of workers sampled in the hydraulic fracturing industry have exposures above the final PEL of 50 μg/m^3. OSHA determined that additional controls will be necessary to achieve the PEL for these overexposed workers. The workers with the highest baseline exposure are fracturing sand workers: Eighty-three percent (58 out of 70) of fracturing sand workers are currently exposed to 8-hour TWA levels above 50 μg/m^3, while 48 percent (21 out of 44) of the ancillary support workers and remote/intermittent workers are currently exposed at levels above 50 μg/m^3.

Effective control methods

To limit workers' exposure to silica, emissions need to be eliminated or reduced from each source of dust emissions. OSHA has determined that effective control methods include:

- Local exhaust ventilation (LEV) systems,
- Enclosure and partial enclosure of material transfer points and conveyors,
- Enhanced material transfer systems,
- Use of dust suppressants,
- Use of control booths,
- Improved work practices,
- Administrative controls, and

- Substitution of silica sand with ceramic proppant may also be feasible in some cases.

Read the Reg

1910.1053(f) Methods of compliance — (1) Engineering and work practice controls. The employer shall use engineering and work practice controls to reduce and maintain employee exposure to respirable crystalline silica to or below the PEL, unless the employer can demonstrate that such controls are not feasible.

Wherever such feasible engineering and work practice controls are not sufficient to reduce employee exposure to or below the PEL, the employer shall nonetheless use them to reduce employee exposure to the lowest feasible level and shall supplement them with the use of respiratory protection that complies with the requirements of paragraph 1910.1053(g).

Controlling silica exposures while operating vehicle-mounted drilling rigs

Using rock-drilling rigs mounted on trucks, crawlers, or other vehicles to drill into rock, soil, or concrete may expose workers to hazardous levels of airborne silica. The small particles easily become suspended in the air and, when inhaled, penetrate deep into workers' lungs. The following are some ways to protect workers from silica dust when using vehicle-mounted drilling rigs.

Control methods for silica dust

There are three main methods used to control silica dust during earth and rock drilling. OSHA recommends that drill operators always use a combination of these dust-control techniques. They are:

- Dust collection systems,
- Wet methods, and
- Operator isolation.

Dust collection systems

Best practices when using dust-collecting equipment for rock drills include using a movable duct attached to a shroud, a flexible rubber skirt that encloses the drill hole opening, and captures cuttings that come through the hole. Equipment without these controls can be retrofitted by the manufacturer or a mechanical shop.

Dusty air is pulled from inside the deck shroud through a flexible duct to primary and secondary filter media. The primary filter or dust separator often includes a self-cleaning back-pulse feature that dumps the collected particles to the ground. Secondary release of particles to the air is minimized by a dump shroud. The dust collection system works best when good design and maintenance practices are implemented by skilled and properly trained operators:

- **Deck shroud design:** Use a one-piece shroud that fully encloses the area around the drill bit. Repair or replace torn or missing pieces and make sure that gaps are sealed.
- **Adequate airflow:** The dust collector must be designed to draw more air than the bailing air used to flush out cuttings from the drill hole. A rule of thumb is that dust collector air volume should be three times the bailing air volume.
- **Discharge or dump shroud:** A shroud or sleeve enclosing the dust collector discharge area guides particles to the ground, thereby reducing dust that would otherwise become airborne.
- **Fan exhaust placement:** Extend the dust collection system exhaust port so the dusty air releases away from workers. Clogged ducts and filters restrict dust collector airflow. Remove dust that collects on filters and in flexible ducts.
- **Fan maintenance:** Dust can damage the fan motor, blades, and drill bits. Replace worn parts. Check for too much vibration in fan belts, coupling and belt alignment, and worn or broken belts, blades, mounting bolts, and bushings.
- **Filters:** Replace clogged or damaged air filters and avoid exposure to dust when cleaning or replacing filters.

Wet methods

The proper use of wet methods requires a trained and skilled operator. In wet drilling, too much water can create mud slurry at the bottom of the hole that can trap the bit, coupling and steel extensions. Too little water will not effectively control escaping dust.

- **Water injection at bit:** In wet drilling systems that use forced air (bailing air) to flush cuttings from the hole, water is added to the bailing air at the drill head. Small particles join to form larger particles, thus reducing escaping respirable dust.
- **Water injection at dust collector exhaust:** Adding small amounts of water into the air discharge duct can significantly reduce the release of silica dust in the dump area. When adding water to the discharge duct, slowly increase the rate until there is no visible dust. Check the duct interior daily and clear dust deposits that may form in it.

Operator isolation

Drill operators using rigs with enclosed cabs can reduce their silica exposure by staying inside the cab as much as possible during drilling. To be effective, the cab must be well-sealed and well-ventilated. Ensure that door jambs, window grooves, powerline entries and other joints are tightly sealed.

Enclosed cabs should have air conditioning so that operators can keep windows and doors closed. Use a high-efficiency particulate air (HEPA) filter. Upgrade equipment by installing aftermarket ventilation and air conditioning systems if needed.

If possible, position equipment so that operators and others are upwind of escaping visible dust.

Respiratory protection

Operators of rock-drilling rigs working in enclosed, well-ventilated and well-sealed cabs should not have elevated silica exposures. Operators and helpers working outside a sealed cab may need to wear respirators even where wet methods and dust collection systems are used. The level of respiratory protection needed depends on the time spent outside the cab, wind direction and speed, and the amount of silica found in the rock or soil.

Where control methods do not reduce silica exposures to OSHA's permissible exposure limit, respirators are required, and employers must have a written respiratory protection program in accord with OSHA's Respiratory Protection standard. It must include the following:

- How to select a respirator;
- Fit testing;
- Directions on proper use, maintenance, cleaning and disinfecting;
- Medical evaluations of workers; and
- Training.

Take necessary precautions

Always take the necessary precautions when you have employees working in an environment where silica is present. Adhere to one of the three main methods used to control silica dust to protect you and your workers. Knowing the health effects of silica dust and implementing good work practices that reduce dust can prevent silicosis.

Diesel exhaust

Diesel engines provide power to many types of equipment used in a large number of industries, including transportation, mining, construction, agriculture, as well as many manufacturing operations. Occupations with potential exposure to diesel exhaust and diesel particulate matter (DE/DPM) include oil and gas workers, miners, construction workers, heavy equipment operators, bridge and tunnel workers, railroad workers, loading dock workers, truck drivers, material handling operators, farmworkers, long-shoring workers, and auto, truck and bus maintenance garage workers.

Diesel exhaust is a mixture of gases and particulates produced during the combustion of diesel fuel. The very small particles are known as diesel particulate matter (DPM), which consists primarily of solid elemental carbon (EC) cores with organic carbon (OC) compounds adhered to the surfaces. The organic carbon includes polyaromatic hydrocarbons (PAH), some of which cause cancer when tested in animals. Workers exposed to diesel exhaust face the risk of health effects ranging from irritation of the eyes and nose, headaches and nausea, to respiratory disease and lung cancer.

What is Diesel Particulate Matter (DPM)?

DPM is a component of diesel exhaust (DE) that includes soot particles made up primarily of carbon, ash, metallic abrasion particles, sulfates and silicates. Diesel soot particles have a solid core consisting of elemental carbon, with other substances attached to the surface, including organic carbon compounds known as aromatic hydrocarbons.

What are the health effects of DE/DPM?

Short term exposure to high concentrations of DE/DPM can cause headache, dizziness, and irritation of the eye, nose and throat severe enough to distract or disable miners and other workers. Prolonged DE/DPM exposure can increase the risk of cardiovascular, cardiopulmonary and respiratory disease and lung cancer. In June, 2012, the International Agency for Cancer Research (IARC) classified DE (including DPM) as a known human carcinogen (Group 1).

How can exposures to DE/DPM be controlled?

Engineering controls are the most effective strategy for minimizing worker exposure to DE/DPM. A combination of controls is often required. Examples include:

- Performing routine preventive maintenance of diesel engines to minimize emissions,
- Installing engine exhaust filters,
- Installing cleaner burning engines,
- Installing diesel oxidation catalysts,
- Using special fuels or fuel additives (e.g., biodiesel),
- Providing equipment cabs with filtered air, and
- Installing or upgrading main or auxiliary ventilation systems, such as tailpipe or stack exhaust vents to capture and remove emissions in maintenance shops or other indoor locations.

Administrative controls refer to changes in the way work tasks are performed to reduce or eliminate the hazard. Examples include:

- Limiting speeds and using one-way travel routes to minimize traffic congestion,
- Prohibiting and/or restricting unnecessary idling or lugging of engines,
- Restricting the amount of diesel-powered equipment and total engine horsepower operating in a given area and ensure that the number of vehicles operating in an area does not exceed the capacity of the ventilation system, and
- Designate areas that are off-limits for diesel engine operation and/or personnel travel.

General industry and construction operations

OSHA does not have a permissible exposure limit (PEL) for DPM. However, OSHA has PELs for other components of diesel exhaust. Monitoring for these gases can provide an indication of the presence of DE, and can be of help in evaluating the effectiveness of engineering and administrative controls implemented to minimize the potential for exposure to DE when working with or around diesel-powered equipment.

Substance	PEL
Carbon Monoxide (CO)	50 ppm
Nitric Oxide (NO)	25 ppm
Nitrogen Dioxide (NO2)	5 ppm (ceiling)

Adverse weather conditions

Weather factors

Weather factors at oil and gas drilling sites have significant impact on the health and safety of workers. Conditions such as extreme heat, extreme cold, high winds, electrical storms, and rain or snow all present unique problems for your employees.

Extreme heat can cause heat stroke, heat exhaustion, heat cramps, fainting, or prickly heat, and these conditions can be intensified by certain medications and over-the-counter drugs, or the use of social drugs and/or alcohol.

Cold weather, especially when coupled with wet and/or windy conditions can cause hypothermia or frostbite. Extreme cold weather can make touching bare metal hazardous, and can freeze water pipes and sprinklers in the fire suppression system. Workers handling gasoline, kerosene, or similar liquids can develop immediate frostbite. Heating systems can malfunction or create noxious fumes in confined spaces.

High winds can cause materials such as sheets of plywood or insulation to “sail” and can create hazardous conditions. Makeshift wind breakers on lifts can catch the wind and cause tipping. Exposed workers can be made to lose their balance when working on elevated surfaces, and winds can make the use of cranes dangerous.

Read the Reg

Employee alarm system

Storms can product high winds which can cause injury, death, and damage. Your employee alarm system should be activated before the storm hits. See the requirements in the Overview tab, page 7.

Electrical storms pose a threat of electrocution in some situations. Severe storms must be monitored, and when necessary and prudent, workers are to be moved to safer locations.

Rain, sleet, and snow can make walking surfaces slick, and cause potential electrical hazards if equipment or cords get wet. If trenching or digging is going on, excessive dampness can create the possibility of a cave-in, or if water build-up is great, a drowning hazard.

It may be a good idea to provide employees with adequate weather warning and address weather conditions in your emergency action plan.

Employee training

You should train employees in:

- Recognizing signs and symptoms of heat stress, hot weather first aid procedures, and taking precautions for working in heat stress areas. Explain heat abatement procedures used at the site.
- Recognizing signs and symptoms of hypothermia and frostbite, how to examine the body for signs of frostbite, cold weather first aid procedures, and taking precautions for working in cold stress areas. Explain the operation of heating equipment used at the site.
- The hazards posed by excessively windy conditions, and proper precautions to take to prevent injury or damage to the work-site. Trainees must know how to use fall protection equipment. They should understand how wind indicators work and procedures for reporting high wind conditions.
- The hazards posed by electrical storms, and appropriate precautions to take to avoid those hazards.
- The hazards posed by rain, sleet, or snow on a jobsite, how to recognize potential problem areas, and appropriate safety precautions for working in wet environments.

Working in cold temperatures

In many parts of the country workers who brave outdoor conditions face the hazard of exposure to cold temperatures. Prolonged exposure to cold temperatures can result in health problems like trench foot, frostbite, and hypothermia. Employers need to be especially mindful of the weather, its effects on workers, and techniques to prevent injuries.