Loss Control
Quarterly Update

Carbon Monoxide Hazards & Controls

Carbon Monoxide (CO) is a colorless, odorless and tasteless gas that is potentially lethal. It is possible to become exposed to CO gas through equipment and devices that use combustion processes if they are operated improperly.

The main health hazard of CO exposure is asphyxia. CO bonds with the oxygen-carrying hemoglobin in the blood over 200 times easier than with oxygen, rendering the hemoglobin incapable of transporting oxygen, and leading to suffocation. Because of this increased affinity of hemoglobin for CO, the concentration of CO in the blood could reach a much higher concentration than the concentration of CO in the surrounding air. In indoor environments the normal concentration of carbon monoxide is typically 0 to 2 ppm (parts per million) depending on operations and combustion sources. Effects of carbon monoxide exposure include:

- 200 ppm- headache after 2-3 hours
- 400 ppm- headache and nausea after 1-2 hours
- 800 ppm- headache and nausea and unconsciousness after 45 minutes
- 1,600 ppm- headache, nausea in 20 minutes, death in 2 hours
- 3,200 ppm- headache, nausea in 5-10 minutes, death in 30 minutes
- 6,400 ppm- headache, nausea in 1-2 minutes, death in 10-15 minutes
- Over 12,800 ppm- death in 1-3 minutes

In the work environment the OSHA PEL (Permissible Exposure Limit) is 50 ppm as an 8-hour time weighted average. The (ACGIH American Conference of Governmental Industrial Hygienists) recommends that exposures be kept below 25 ppm. These levels were established to prevent adverse health effects for healthy workers.

Inside this Issue

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In the work environment the most common sources of carbon monoxide include:

- Fork-trucks
- Portable generators
- Concrete saws, compressors, power trowels, and other construction equipment using gasoline engines
- Space heaters
- Welding operations

Never use a generator indoors or in enclosed or partially enclosed spaces such as garages, crawl spaces, and basements. Opening windows and doors in an enclosed space may prevent CO buildup. Make sure the generator has 3-4 feet of clear space on all sides and above it to ensure adequate ventilation. Do not use a generator outdoors near doors, windows or vents which could allow CO to enter and build up in occupied spaces. When using space heaters and stoves also ensure that they are in good working order to reduce CO buildup. Consider using tools powered by electricity or compressed air, if available.

Another potential source of carbon monoxide exposure is from contaminated breathing air used with supplied air respirators. Contamination may come from the compressors or from the air drawn into the system. OSHA requires that all breathing air systems include a carbon monoxide alarm and filters to remove oil and other potential contaminants. The CO alarm should be regularly tested according to the manufacturer's requirements to ensure it works properly.

Gasoline, propane and diesel powered fork-trucks are probably the main source of CO exposure in most work environments. This can be a major concern in warehouses and other areas with poor ventilation and a large number of vehicles operating. Exposures are usually highest during the winter months when buildings are shut up more tightly. Older units run less efficiently and can produce very high CO levels. Fork-trucks should be tuned regularly. The fall months before the buildings are closed up is a good time to have all the fork-trucks tuned.

Special catalytic converters and CO sensors that adjust the carburetor can be installed to help reduce CO emissions. Consider replacing the oldest units that produce the highest CO levels with new machines or use electric trucks.

Confined space entry poses a greater risk for CO exposure due to the lack of proper ventilation. Be especially concerned if combustion processes like welding are done in the space. Some chemical reactions can also occur that create CO. For instance caustic cleaning solutions used with some sugars can create CO. Air monitoring equipment used for confined space entry typically includes a carbon monoxide detector along with oxygen, explosive vapors and hydrogen sulfide.

To reduce the risk for CO hazards in the workplace employers should conduct assessments to identify potential sources of exposure. Employees should be educated about the sources and conditions that may result in CO poisoning as well as signs and symptoms of exposure. Exposure monitoring may also be done to quantify exposures to ensure CO levels are below the exposure limits.

Residential Exposures to Carbon Monoxide

CO is a by-product of the incomplete burning of carbon-containing fuels such as: gasoline, natural gas, oil, kerosene, coal and wood. This incomplete burning is usually the result of a lack of sufficient fresh air for the combustion process.

Common sources of CO in the home include fireplaces, wood and coal burning stoves, and any gas fired appliances such as furnaces, hot water heaters, ranges, and dryers. Other sources include exhaust from cars and trucks, personal watercraft, and other gasoline engines that may infiltrate the home from an attached garage or outside area.

- Never leave a car running in an attached garage, even with the garage door open
- Never use a generator inside a home or enclosed structure
- Properly install, maintain, and operate all fuel-burning appliances
- Have heating systems, fireplace chimneys, water heaters, and gas dryers inspected annually by a licensed contractor
- Inspect automobile exhaust systems annually
- Never use a gas range or oven to heat a home
- Never use a charcoal grill, hibachi, gas-fueled lantern or portable camping stove inside a home, tent, or camper
- Never run a generator, pressure washer, or any gasoline-powered engine outside of an open window where exhaust gases can inadvertently flow into an enclosed area

The possibility of CO poisoning should be investigated if anyone complains of symptoms and if they feel better after being exposed to fresh air for several minutes. Those particularly vulnerable to CO include the unborn, infants, and people with anemia or a history of heart disease.

Installing a CO detector/alarm is necessary, even when the above controls are in place, as an appliance could malfunction without notice. The Consumer Product Safety Commission recommends installation of CO detectors in every home. Many state and local ordinances also require installation of CO meters in homes. Most units cost $29 to $59 and are easy to install. Units can be AC or battery operated. CO detectors should be UL (Underwriters Laboratory) listed. Batteries should be replaced semi-annually or according to the manufacturer's recommendations. It is especially important to have the detectors in sleeping areas since many of the deaths associated with residential CO poisoning occur when the victim is sleeping and is unaware of the symptoms of exposure. The installation of a CO detector is not a substitute for preventing the production of the gas in the first place.

Residential CO alarms are designed to sound an alarm depending on the CO level and the amount of time CO is at a given level. Those, who are at an elevated risk of CO poisoning, may begin to experience symptoms prior to a CO detector/alarm activating. A problem with alarms that are too sensitive is that they will always be going off. If this is the case, they may be viewed as a nuisance and the batteries may be removed or the alarm may be ignored. Because of these potential problems, UL alarm requirements include:

- At 70 ppm the alarm must sound no sooner than 60 minutes but no later than 240
- At 150 ppm the alarm must sound no sooner than 10 minutes but no later than 50 minutes
- At 400 ppm the alarm must sound no sooner than 4 minutes but no later than 15 minutes

When an alarm sounds evacuate the home immediately. Call 911 and contact the gas utility or fire department to locate the source of CO. Have a qualified technician inspect and repair the device causing the CO problem. Do not re-occupy the home until the problem has been corrected.

These UL requirements are designed to allow the detectors to give an alarm before critical health issues are encountered as well to avoid the issues of being too sensitive. In the work environment residential CO detectors do not warn workers when occupational exposure limits are exceeded since these levels are much

lower than the alarm levels specified by UL. In workplaces where CO may be a concern alarms should be installed that are designed for the work environment. These alarms sound when CO levels exceed the 50 ppm OSHA PEL or ACGIH 25 ppm Threshold Limit Value.

Persons who suspect they have been exposed to CO gas should immediately leave the area they are in and go outside to breathe fresh air. The effects of initial stage CO poisoning are quickly reversible upon exposure to fresh air. If exposed, you should open doors and windows, turn off combustion appliances, and leave the house. If symptoms persist, see your physician or get to an emergency room immediately. Tell the physician you suspect CO poisoning. If CO poisoning has occurred, it can often be diagnosed by a blood test completed soon after exposure.

Ladder Safety

Ladders present one of the major hazards in the work environment and improper use and care of ladders pose a risk for serious injuries.

Analysis of accidents involving ladders reveals four main sources of accidents. They include:

- Ascending or descending improperly
- Failure to secure ladder top and/or bottom
- Structural failure of the ladder
- Carrying objects in the hands while ascending or descending the ladder

Ladders are designed for specific uses and the first step in establishing a ladder safety program is to choose the right ladder for the job. Ladders are manufactured from wood aluminum or fiberglass. Aluminum ladders are the lightest followed by fiberglass with wood the heaviest. When choosing a ladder, the following should be considered:

- Is there an electrical danger?
- Will the ladder be resting on an uneven surface?
- Are there obstructions overhead?

- How much room will there be to position the ladder?
- How much weight will be required for the user, tools and materials?
- How long does the ladder need to be?

Wood ladders can be used for lower heights since they are heavy. Aluminum ladders are weather resistant but are unsafe around electrical equipment. Fiberglass ladders are durable, weather resistant and should be used when there are electrical hazards.
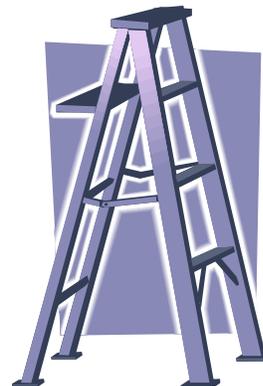
Ladders are rated by ANSI according to duty and range from 200 to 375 lb. capacities. There are five duty ratings. These include:

- Light Duty Household
- Medium Duty Commercial
- Heavy Duty Industrial
- Extra Heavy Duty Industrial
- Special Duty

Ladders should bear warning labels and weight limits along with correct placement angle, safe work environments and step/climb limits.

Ladders should be inspected regularly as well as before each use. Inspection should include:

- Make sure the feet are not broken and the slip resistant pads are secure
- Inspect for cracks, bends and split rails, rungs and steps
- Check rung-side rail connections and hardware

- Test the rope and pulley on extension ladders
- Bolts and rivets should be secure
- Make sure the ladder is free from oil and grease
- Make sure the spreader braces on step ladders are secure and in proper working order.

If ladders are damaged, they need to be tagged and taken out of service. Damaged ladders should be stored away from usable ladders and be promptly repaired. Un-repairable ladders should be destroyed.

Setting up and using a Ladder

Many ladder related accidents are caused by improper set-up and can be avoided with good work practices.

First rid the area of hazards.

- Look for overhead wires and obstructions
- Clear the area around the base of the ladder
- Block off and secure the area
- Put up signs to warn people of your presence
- If there is a door nearby lock it, secure it or block it off

The proper working angle for an extension ladder is 75 ½ degrees. To achieve this angle, place the base one foot away from the wall for every four feet of ladder length to the support point. This is known as the one-quarter rule. To set up the ladder, first position it flat on the ground with the base against the wall. Lift the ladder by walking it up one rung at a time. Pull the base of the ladder slightly from the base of the wall and lift and lock the fly section with the rope and pulley. An extension or straight ladder should be extended at least 3 feet above the point of support if an elevated platform is to be accessed. Bring the base of the ladder to the one quarter point. Make sure the ladder shoes are correctly positioned and the rung locks are secure.

Position step ladders so all four legs are solid on level ground. Lock the spreader in the fully opened position. Never use a self-supporting ladder as a straight ladder. Wind and forces resulting from work on a ladder can cause the ladder to fall. Prevent the ladder from moving by tying it off at the top and bottom. For maximum safety have another employee hold the ladder.

Shoes should be clean when climbing a ladder. Do not carry objects up the ladder. Pull them up a towline or attach them to a tool belt. When climbing a ladder always maintain a three point contact with the ladder. This involves holding on with either two hands and a foot or two feet and one hand. Climb slowly and surely keeping the belt buckle between the rails. Other procedures include:

- Read and follow ladder label instructions
- Do not move a ladder while on it
- Retract the fly section of an extension ladder before moving the ladder
- Only one person should climb a ladder at a time
- Never use a ladder on scaffolding
- Do not leave a ladder unattended
- Always face the ladder when climbing and working
- Do not use the top or top step of a stepladder

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