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## Fact sheet

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### Carbon monoxide monitoring

Carbon monoxide is a colorless, odorless gas generated by combustion processes, such as those found in heating units and internal combustion engines. Examples of workplace sources of carbon monoxide include propane- and gasoline-powered fork lifts, temporary heating units and gasoline-powered pressure washers, compressors, pumps and other tools and small engines. Excessive exposure to carbon monoxide results in human tissue being deprived of oxygen. Carbon monoxide overexposure may cause chronic effects such as heart damage or acute effects such as headaches or, in extreme cases, death by asphyxiation.

Because of these health hazards, Minnesota OSHA (MNOSHA) established requirements for carbon monoxide monitoring for both general industry and construction (see reverse side for details). There are three types of carbon monoxide monitoring devices that are most suitable for determining worker exposure to carbon monoxide. There are advantages and disadvantages with each device.

Electronic sensing instruments, which display a digital readout of carbon monoxide in parts per million, are the most accurate, expensive and difficult to maintain. They need to be calibrated frequently to ensure their accuracy.

Colorimetric detector tubes with a hand pump can be used to sample over a time period of about two to 12 minutes with an error of  $\pm 25$  percent. These colorimetric tubes change color based on the concentration of carbon monoxide in the air and can be read in parts per million of carbon monoxide. This sampling method involves very low maintenance and is simpler to use. The detector tubes have a limited shelf life (typically 12 to 18 months) and the hand pump should be leak-tested before each use. If the hand pump leaks, the repair usually involves greasing components or replacing rubber gaskets. The detector tubes are typically \$35 to \$45 for a box of 10 tubes. The hand pump costs about \$300.

The third carbon monoxide measuring device is a passive colorimetric detector tube. They are similar to the colorimetric detector tube that is used with a pump, because carbon monoxide levels are indicated by a color change in the tube giving readings in parts per million hour with an error factor of  $\pm 25$  percent. The passive dosimeter tube is useful for sampling over time periods of several hours and determining time weighted average exposures. After the seal is broken, the tube can be attached to a worker's collar or lapel. The passive dosimeter tubes cost about \$50 to \$55 for a box of 10 tubes and have a limited shelf life (typically 12 to 18 months).

There have been many questions about residential carbon monoxide detectors in the workplace. The voluntary manufacturing standard, UL 2034, allows alarm points to be set at carbon monoxide

concentration levels that would result in blood levels between 2.5 and 10 percent, and requires that alarms not be activated by low or intermittent levels of carbon monoxide in air. The purpose of the UL standard is to ensure the detectors alarm before potentially life-threatening levels of carbon monoxide occur. This means each detector can have a different alarm point and, under certain workplace conditions, employees could be exposed to carbon monoxide at levels above OSHA limits and still not hear an alarm. Residential carbon monoxide detectors are not intended to be used as survey instruments in workplace settings.

## **Minnesota Rules for carbon monoxide monitoring**

*General industry:* Minnesota Rules § 5205.0116 Carbon Monoxide Monitoring

Subpart 1. Internal combustion engine powered industrial trucks. The employer shall monitor environmental exposure of employees to carbon monoxide whenever internal combustion engine powered industrial trucks as defined in Code of Federal Regulations, Title 29, section 1910.178(a)(1) are operated indoors to ensure that carbon monoxide levels do not exceed those given in Code of Federal Regulations, Title 29, section 1910.1000, Table Z-1-A. The air monitoring shall be done at least quarterly and represent exposures during a day of highest usage in the areas where employee carbon monoxide exposure is most likely.

Subpart 2. Tailpipe exhaust gas analysis. The employer shall ensure that powered industrial truck engine exhaust gases do not contain more than one percent carbon monoxide for propane fueled trucks or two percent carbon monoxide for gasoline fueled measured at idle and at three-fourths throttle during final engine tuning in a regular maintenance program.

*Construction industry:* Minnesota Rules § 5207.0310 Carbon Monoxide Monitoring

The employer shall monitor environmental exposure of employees to carbon monoxide whenever internal combustion engines discharge engine exhaust gases indoors or unvented space heaters are operated indoors to ensure that carbon monoxide levels do not exceed those given in Code of Federal Regulations, Title 29, section 1926.55, Appendix A. The air monitoring shall be done during initial operation and at least quarterly thereafter and during a period representing highest usage in areas where carbon monoxide exposure is most likely.

**Note:** In 1989, MNOSHA adopted an eight-hour time weighted average (TWA) air exposure limit for carbon monoxide in general industry of 35 ppm and a five-minute ceiling limit of 200 ppm. The eight-hour TWA exposure limit for carbon monoxide in the construction industry in Minnesota is 50 ppm.

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