

## Carbon Monoxide Exhaust Hazards

*The potential for a build-up of carbon monoxide (CO) exists with the indoor operation of ambulances, fire trucks, police cruisers, portable generators, tools and any other equipment that burn fuel. Each year, approximately 200 people in New York are hospitalized because of accidental CO poisoning. About one-third of these victims are poisoned by CO from a fire and about two-thirds are poisoned from CO that is produced by fuel burning sources<sup>1</sup>. In recognition of this exposure the state of New York passed "Amanda's Law" in 2009 after a 16-year-old died of CO poisoning from a leak in a defective boiler. This law requires CO detectors be installed in dwellings and other places where individuals may be resting and have an attached garage or have other sources that may emit CO<sup>3</sup>.*

### Health Hazard

The odors and irritating properties of unburned fuel frequently cause employees to become aware of a potential carbon monoxide exposure. It is difficult for an individual to detect "clean" smelling exhaust to verify that CO since it is odorless, tasteless, colorless and non-irritating. Carbon monoxide inhibits oxygen uptake by the blood, which limits the oxygen supply to the brain. The health effects and associated airborne concentrations are described below.

<b>Effects and Symptoms<sup>2</sup></b>	<b>CO Concentration (ppm)</b>	<b>Duration of Exposure (Hours)</b>
Slight headache, discomfort	200	3
Headache, discomfort	400	2
Headache, discomfort	600	1
Confusion, headache, nausea	1000 – 2000	2
Tendency to stagger	1000 – 2000	1.5
Slight palpitation of the heart	1000 – 2000	0.5
Unconsciousness	2000 – 2500	0.5
Fatal	4000	<1
ACGIH TLV	25	8
OSHA PEL	50	8
NIOSH REL (ceiling limit)	200	N/A

**ppm** – parts per million

**ceiling limit** – exposure that shall not be exceeded during any part of the workday

**TLV** – Threshold Limit Value recommended by the American Conference for Governmental Industrial Hygienists (ACGIH).

**PEL** – Permissible Exposure Limit enforceable by the Occupational Safety and Health Administration (OSHA).

**REL (Ceiling Limit)** – The ceiling limit recommended by the National Institute of Occupational Safety and Health (NIOSH).

## Carbon Monoxide Exhaust Hazards

Carbon monoxide concentrations can often be controlled by:

- Eliminating the source of the emissions.
- Capturing the emissions through local ventilation at the source and exhausting to the outside.
- Diluting the emissions with fresh air adequately distributed to the work area and exhausted to the outside.
- Reducing the concentration of the emissions from the source.

Municipal entities have some common activities and equipment that present potential carbon monoxide exposure. Listed below are some ideas to consider for controlling the exposures.

### **Fire Trucks, EMS, Police and Road Crew Vehicles**

It is not uncommon for a rig to be started and idle for a period of time while waiting for staff, getting equipment, inspecting the vehicle or just keeping warm. During this time, the vehicle emission concentrations can build up quickly in a closed garage space.

- Idling inside of garages is not recommended
- There are three design approaches to installing ventilation systems in garages\*:
  - Ceiling mounted general exhaust ventilation, which does not provide point of exhaust capture, thus the emissions still go into the building.
  - Ceiling mounted local exhaust with tubing that drops down and is connected directly to the exhaust pipe.
  - Floor mounted local exhaust with direct hook-ups to the exhaust pipe (requires cutting into the floor if not built into the design).

*\*Some of these systems may be paid for with FEMA Assistance to Firefighter Grant funds.*

- Keep vehicles tuned-up so they run efficiently.
- Consider replacing some of the fleet with propane and/or electric powered engines.

### **Portable Generators**

Building power failures and supplying power at a remote worksite are typically the reasons that portable generators are used. Many portable generators are gasoline powered and can generate considerable amounts of CO in a short period of time.

- Running a portable generator inside is not recommended.
- Move the generator outside, far enough from the building and worksite to try and keep the exhaust from re-entering the building or work area.
- Locate the generator down wind from the workers.

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### **Portable Tools and Equipment**

Fuel-powered tools and equipment, such as lawn mowers, snow blowers, chain saws and pressure-washers are a significant source of CO.

- It is not recommended to start or operate these devices in an enclosed space such as a garage.
- Locate bench repair areas conveniently near doors so the tools can be tested outdoors.
- Replace tools with electric powered options where practical.

### **Portable Heaters**

Propane powered “salamanders” are commonly used on jobsites to keep workers warm and occasionally they are used in municipal garages to warm up a maintenance bay work area. Some individuals mistakenly assume that these heaters are not a CO hazard but these units can also generate CO exhaust.

- Operating “salamanders” inside is not recommended.
- Replace portable fuel powered heaters with electric convection and/or radiant heaters.

### **Boilers, Furnaces, Hot Water Heaters**

The equipment used to heat air and water in municipal buildings is often fueled by heating oil, natural gas or propane, which can generate CO when burned.

- Design and install these units with local exhaust ventilation in accordance with the manufacturer’s instructions.
- Inspect the systems regularly to maintain the exhaust systems.

### **Other Control Options**

- Install catalytic converters on large sources of vehicle and equipment emissions.
- Keep equipment properly tuned-up for more efficient burning of the fuel.
- Install UL certified CO monitoring alarms in areas where elevated emissions may occur. Inspect, test and maintain the monitors in accordance with the manufacturer’s instructions.
- Educate employees in the signs and symptoms of exposure and the means to help prevent exposure to carbon monoxide.

Exhaust from vehicles and equipment operated inside can pose a potential health hazard to municipal employees due to high concentrations of carbon monoxide. Evaluate the activities and equipment associated with various municipal services to identify hazards and make changes in the equipment, activities and procedures to control the potential for a build-up of carbon monoxide inside municipal buildings.

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#### References:

1. NY State Dept of Health, Fact Sheet, “What you need to know about carbon monoxide”, Rev. January, 2010
2. Spear, JE(2006)Carbon Monoxide Exposure from Lift TrucksRetrieved December 1, 2011, from J.Espear Consulting, LP: <http://jespear.com/articles/06-02-co-liftrucks.pdf>
3. NY DeptOf State, Installation of Carbon Monoxide Alarms in Residential Buildings, IDNo, DOS-45-10-00007-E, 11/10/2010