

**PURPOSE:** To establish a standard method of responding to incidents where a Carbon Monoxide (CO) detector has been activated or an occupant suspects that there is a dangerous level of CO inside a structure.

**SCOPE:** These guidelines contain response parameters for regional response to Carbon Monoxide (CO) emergencies. The Fire Department is primarily responsible for confirming a CO problem exists. The Fire Department is not there to repair the problem, but rather to provide rescue, ensure emergency medical care is provided and advise the occupant of the nature of the problem.

## 1. DEFINITIONS

- 1.1 CO - Carbon Monoxide
- 1.2 FAS - Fresh Air Setup
- 1.3 IC - Incident Commander
- 1.4 IDLH - Immediately Dangerous to Life and Health
- 1.5 LEL - Lower Explosive Limit
- 1.6 MGD - Multi Gas Detector
- 1.7 OIC - Officer-In-Charge
- 1.8 OND - On Deck Crew
- 1.9 SCBA - Self-Contained Breathing Apparatus
- 1.10 SEACOM - Southeastern Arizona Communication

## 2. BACKGROUND

- 2.1 Carbon monoxide is an odorless, colorless, and tasteless gas that is deadly. It is a non-irritating byproduct of the fuel burning process. CO has a vapor density of 0.97, which is slightly lighter than air; therefore, the tendency of this product is to rise. CO has a flammable range from 125,000 ppm to 740,000 ppm. Entry crews shall be aware of this when metering the structure for CO.
- 2.2 While CO is often associated with fossil fuels, it is important to remember it also results from incomplete combustion of wood and charcoal. Many appliances such as furnaces, kitchen stoves, hot water heaters, automobiles, etc., can produce carbon monoxide. When a faulty or unusual condition exists, carbon monoxide may be vented into areas where people are present.
- 2.3 Carbon monoxide poisoning may be difficult to diagnose since symptoms are like the flu and may include headache, nausea, dizziness, fatigue, confusion, and shortness of breath. Cardiac patients are highly susceptible to CO poisoning and may experience chest pain.

## 3. PROCEDURE

### 3.1 Response

#### 3.1.1 CO Detector Sounding with No Symptoms (Hazmat / Fire Alarm):

3.1.1.1 For incidents where a CO detector is sounding and SEACOM has determined that no one in the structure is feeling ill, 1 Engine will be dispatched.

#### 3.1.2 CO Poisoning and Detector Sounding with Symptoms (Hazmat Upgraded):

3.1.2.1 Upon receipt of any report of a CO incident where the occupants of the structure are reported as ill, or any reported CO poisoning, 2 Engines, 1 Chief Officer, and a Tac Channel will be dispatched.

- 3.1.3** When CO levels are 35 ppm or greater, firefighters shall wear Turnout Gear and Self-Contained Breathing Apparatus (SCBA) on-air until such time as the level decreases below 35 ppm.
- 3.1.4** When operating inside a structure with CO readings greater than 35 ppm, an On Deck Crew (OND) with RIT responsibilities shall be assembled to comply with the OSHA 2-in/2-out requirement for operations in an IDLH atmosphere.
- 3.1.5** All persons complaining of any discomfort or illness shall be evaluated for possible CO poisoning and treated according to EMS protocols. Signs and symptoms of CO poisoning or exposure include, but are not limited to:
- Flu-like symptoms
  - Headache
  - Nausea
  - Dizziness
  - Light-headedness
  - Convulsions
  - Unconsciousness

### **3.2 ARRIVAL**

- 3.2.1** Upon arrival, the OIC will give a size-up, establish fire command and declare operational strategy.
- 3.2.2** Interview occupant/caller: Why were we called? Obtain as detailed a complaint as possible.
- 3.2.3** If anyone present displays symptoms of CO poisoning, they shall be immediately evaluated and provided with medical care according to EMS protocols.
- 3.2.4** Firefighters shall run the MGD through a FAS and Bump Test (if needed) prior to use. A firefighter will proceed a distance away from the apparatus to a fresh air environment to perform the FAS.
- 3.2.5** Evacuate all remaining occupants if necessary.
- 3.2.6** Institute primary search if necessary.
- 3.2.7** Call for additional units if necessary.
- 3.2.8** Observe and complete a complete check around structure for signs of improper conditions which could be causing problem (e.g. blocked vent).

*Note: This task may be completed by an Exterior Firefighter in proper PPE.*

### **3.3 ENTERING THE STRUCTURE**

- 3.3.1** No one shall enter the structure until the CO level has been checked just inside the door. Besides being toxic, CO is also flammable. When high CO readings are obtained it is possible that a LEL reading may exist therefore, we want to limit the amount of oxygen introduced to the environment.
- 3.3.1.1** Open door 6" - 8" inches and place MGD on floor, close door and wait approximately 1-minute. If no LEL exists proceed with entry.

**3.3.2** Sample air at ground level, mid-height and ceiling height. Monitor all levels-basement, first floor, second floor, and any additional floors.

**3.3.3.1** Measure each air sample for a minimum of 15-seconds.

**3.3.3** When entering the structure firefighters shall have donned SCBA:

- If CO reading is less than 35 ppm, going on-air not required.
- If CO reading is 35 ppm or greater, going on-air required.
- If CO reading over 100 ppm it shall be considered an IDLH situation.

**3.3.4** Upon completion of any necessary rescue, attempt to duplicate conditions which existed prior to alarm activation or suspicion of CO present. Check those areas related to the suspected source.

**3.3.4.1** Check all gas-fired appliances:

- Check all furnaces, boilers, space heaters (installed or portable):
- Inspect to ensure flue is connected.
- Hold meter near furnace and flue and take readings.
- Obtain readings while furnace is fired, and furnace blower is operating.
- Ensure flue is unobstructed from exterior-check flue cap. High efficiency furnaces have PVC vents at grade level that can easily be obstructed by debris or animals building nests in intake or exhaust pipes.

**3.3.4.2** Check gas hot water heater:

- Inspect to ensure flue is connected.
- Hold meter near flue and take readings.
- Obtain readings while hot water heater is fired.
- To fire hot water heater advance thermostat control or run hot water to deplete tank.

**3.3.4.3** Check gas clothes dryer:

- Inspect to ensure flue is connected.
- Hold meter near flue and take readings.
- Obtain readings while dryer is operating.

**3.3.4.4** Check fireplace:

- Hold meter in front of hearth and take reading.
- Ensure flue is drafting.
- If wood-burning, extinguish the fire.
- If gas-log, shut off gas.
- Inspect chimney to ensure it is unobstructed.

**3.3.4.5** Ensure improper conditions do not exist:

- Building is too air-tight/over sealed, such as plastic over windows/doors, new energy-efficient features installed, such as windows, doors, furnace.
- Barbecuing indoors, including in a garage, on a porch, or adjacent to a window/door.
- Gasoline or diesel engine operating in a garage or adjacent to a window/door.

**3.3.5** If CO is detected on an abnormally cold day the furnace may be taxed and producing CO.

**3.3.6** Besides being toxic, CO is also flammable. When high CO readings are obtained it is possible that a LEL reading may also be obtained.

### 3.4 CO Reading Greater Than 9 PPM:

- 3.4.1 Any reading above 9 PPM shall be considered above normal levels.
- 3.4.2 Inform the occupants and responsible party that the detected CO level is potentially dangerous.
- 3.4.3 If the CO level is above 9 PPM, but below 35 PPM, all occupants shall be recommended to leave the premises.
- 3.4.4 If the CO level is above 35 PPM, all occupants shall be ordered to leave the building immediately. No one shall be allowed back into the building without Turnout Gear and SCBA (on-air) until the CO level is below 35 PPM and the oxygen level is greater than 20%.
- 3.4.5 If the source of the CO can be easily identified:
  - Shut off fuel supply.
  - Ventilate the building as necessary.
- 3.4.6 If the source of the CO cannot be easily identified, or is not easily rendered harmless, LPG shall be turned off, and the building ventilated as necessary.
- 3.4.7 Once ventilation has started, take readings every 5 minutes, and document the CO levels found. Continue ventilation until the CO level is dissipated. Cease ventilation when a safe CO level is achieved.
- 3.4.8 Re-sample the air 5 minutes after ventilation has ceased to ensure the CO level remains safe.
- 3.4.9 Once the building has been reduced to a safe level of CO, the premises may be occupied at the discretion of the occupants.
- 3.4.10 Ask the occupant or responsible party to reset CO detector (FD may perform reset).
- 3.4.11 Inform occupants to call 9-1-1 if the detector activates again, or if they have further concerns.
- 3.4.12 If the property is a rental property, the name, phone number, address, and other pertinent information about the property owner shall be obtained if possible. The IC or his/her designee shall contact the property owner as soon as possible to ensure that he/she is aware of the situation.
- 3.4.13 Upon departure from the scene, the IC will inform the occupants of what the fire department found, and the actions taken by the fire department.
  - If indicated, advise them to pursue a new detector that meets the most current UL 2034 Standard.
  - Advise them to contact a qualified individual to examine and repair any suspect appliance.
  - Advise them to call 9-1-1 immediately if the CO detector activates again and to evacuate the building and wait for the arrival of the fire department.
  - If gas company has been notified and why.
  - If source unfounded and levels remain elevated even after attempts at ventilation, advise occupants to not occupy structure.

**3.5 CO Reading Less Than 9 PPM:**

- 3.5.1 Inform the occupants and responsible party that the fire department MGD did not detect any elevated CO level. Note that this does not necessarily indicate that CO was not present at the time the detector sounded, but that the CO may have dissipated before the fire department arrived. It is also possible that the detector malfunctioned or is not working properly.
- 3.5.2 Recommend that the occupants and the responsible party check their CO detector per manufacturer recommendations. CO detectors have a lifespan of 5 to 10 years. If the detector is older than that, recommend that the occupants replace the CO detector.
- 3.5.3 Check the location of the CO detector. CO detectors should be mounted at least 15 feet away from fuel-burning appliances. Recommend that the occupant relocates the detector if it is too close to CO producing sources.
- 3.5.4 Ask the occupant or responsible party to reset CO detector (FD may perform reset).
- 3.5.5 Inform the occupants or responsible party to call 9-1-1 immediately if the detector activates again, or if they have further concerns.

**Questions to ask occupants:**

- Are any members of the household feeling ill?
  - ✓ Headache?
  - ✓ Nausea?
  - ✓ Shortness of Breath?
  - ✓ Fatigue?
  - ✓ Dizziness?
  - ✓ Confusion?
  - ✓ Other complaints?
- Do you feel better when away from the house?
- What appliances were on at the time of the activation?
- What appliances were in use during the last 24 hours?

**Areas that may need to be checked:**

- Outside house
- Upon entering
- Garage
- Space heater
- Furnace
- Water heater
- Chimney
- Fireplace
- Ash Bucket
- Gas refrigerator
- Gas dryer
- Stove / over
- BBQ grill
- Sump pump pits
- Sump pump battery packs (for false readings)
- At CO detector

**Carbon Monoxide Levels and their Symptoms**

**Note:** *These limits are for healthy adults, not children or older adults or those of any age with underlying medical conditions*

CO Level	Health Effects
9 PPM	Maximum indoor CO level. Maximum outdoor CO level in 8-hour exposure.
10-24 PPM	Possible health effects if exposed for a long period of time
50 PPM	Maximum exposure allowed in the workplace
100 PPM	Slight headache after 1-2 hours of exposure
200 PPM	Fatigue, headaches, and dizziness may occur after 2-3 of exposure
400 PPM	Nausea, dizziness, and headaches after 1-2 hours of exposure. May be life threatening at approximately 3 hours of exposure
800 PPM	Headaches, dizziness, and nausea after 45 minutes of exposure. Unconsciousness after 1 hour of exposure
1000 PPM	Loss of consciousness in 1 hour of exposure
1600 PPM	Death within 1-2 hours of exposure
3200 PPM	Death within 1 hour of exposure
6400 PPM	Death within 30 minutes of exposure
12,800 PPM	Physiological effects; Death within 1-3 minutes after exposure