The Secret to Success...

Joe Loving and his faithful hunting companion bag another big buck
Overview

- Introduction
- Carbon Monoxide (CO) Properties
- Possible sources of CO
- CO Health Hazards
- CO levels – what they mean
- Initial response procedures
- Atmospheric monitoring equipment
- Carbon Monoxide Detectors
Introduction

Purpose:

- Familiarize personnel with the dangers and properties associated with CO
- Provide a framework on which to base initial response considerations
- Familiarize personnel with equipment used in the detection/monitoring of CO
Introduction

- References:
  - United States Environmental Protection Agency
  - Underwriters Laboratories (UL)
Carbon Monoxide (CO)

- Odorless, colorless, tasteless, non-irritating gas
- CO is a POISION and can be deadly at high levels
- CO can compound pre-existing illnesses and is often times blamed on pre-mature deaths
- Virtually undetectable without specialized equipment
Carbon Monoxide (CO) Properties

- Flammable Gas: DOT Designation
  - Auto ignition temperature = 1128° F
  - Lower Explosive Limit 12.8%
  - Upper Explosive Limit 74%

- Vapor Density of .968
  - Slightly less than that air
  - CO will rise with warm air
  - CO disperses evenly once it cools
Carbon Monoxide (CO) Sources

A natural by-product of incomplete combustion from burning carbon based fossil fuels such as:

- Gasoline
- Wood
- Coal
- Propane
- Oil
- Methane
Carbon Monoxide (CO) Sources

- Attached garages with running automobiles
- Cooking and heating appliances
  - Improperly vented
  - Not serviced
  - Inefficient/improper operation
Carbon Monoxide (CO) Sources

- Appliances
  - Vented: appliances that are designed to be used with a duct, chimney, pipe or other device that carry the combustion pollutants outside the home.
  - Un-vented: appliances that do not vent to the outside, so they release combustion pollutants directly into the home.
Carbon Monoxide (CO) Sources

- Levels of CO in homes: Average levels in homes without gas stoves vary from 0.5 to 5 parts per million (ppm). Levels near properly adjusted gas stoves are often 5 to 15 ppm and those near poorly adjusted stoves may be 30 ppm or higher.
Health Hazards

- Silent Killer: CO will kill before its presence is known
- No early warning signs
- Displaces O2 in the bloodstream
- Victims die from asphyxiation
Health Hazards

- Absorbed into the body through lungs
- Transferred to the blood
- Combines with hemoglobin to become carboxyhemoglobin (COHb)
- CO poisoning is measured by the % of COHb in the blood
Health Hazards

- Reduced O2 reduces functions of the brain, cardiac muscle, and respiratory system
- CO has a greater affinity for hemoglobin than O2 at 210 times to 1
- COHb limits the ability of the blood to carry oxygen and effects all major organs and muscles.
Health Hazards

- Individual CO poisoning levels depend on several factors
  - Initial COHb concentration
  - Concentration of CO inhaled
  - Length of exposure
  - Activity while inhaling CO
  - Body size and physiological factors
Health Hazards

High Risk Groups
- Infants/Children
- Pregnancies (Fetus)
- Elderly
- People with Heart Conditions
- People with Respiratory Conditions
- Anemics
## COHb Levels of Concern

<table>
<thead>
<tr>
<th>%COHb Levels</th>
<th>Symptoms</th>
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<tbody>
<tr>
<td>0-10%</td>
<td>None</td>
</tr>
<tr>
<td>10-20%</td>
<td>Tension in forehead</td>
</tr>
<tr>
<td>20-30%</td>
<td>Headache</td>
</tr>
<tr>
<td>30-40%</td>
<td>Severe headache, nausea, vomiting, dizziness</td>
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<tr>
<td>40-50%</td>
<td>Increased respiratory, pulse rate. Asphyxiation</td>
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<tr>
<td>50-60%</td>
<td>Coma, convulsions, Cheyne-Stokes respirations</td>
</tr>
<tr>
<td>60-70%</td>
<td>Weak respirations and pulse; possible death</td>
</tr>
<tr>
<td>70-80%</td>
<td>Slowing and stoppage of breathing. Poss. death</td>
</tr>
<tr>
<td>80-90%</td>
<td>Death in less that one hour</td>
</tr>
<tr>
<td>90-100%</td>
<td>Death within a few minutes.</td>
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</tbody>
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## Carbon Monoxide (CO) Levels

<table>
<thead>
<tr>
<th>CO Levels</th>
<th>Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>128,000 PPM</td>
<td>12.8 % = LEL</td>
</tr>
<tr>
<td>12,800 PPM</td>
<td>10% of LEL</td>
</tr>
<tr>
<td>10,000 PPM</td>
<td>Un-consciousness &amp; Death 1-3 minutes</td>
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<tr>
<td>6400 PPM</td>
<td>Death or irreversible damage in 10-15 minutes</td>
</tr>
<tr>
<td>3200 PPM</td>
<td>Dizziness &amp; Headache 5-10 minutes</td>
</tr>
<tr>
<td>1500 PPM</td>
<td>IDLH</td>
</tr>
<tr>
<td>1300 PPM</td>
<td>Cherry red skin and violent headache</td>
</tr>
<tr>
<td>400 PPM</td>
<td>STEL 1-2 hour</td>
</tr>
<tr>
<td>35 PPM</td>
<td>TLV-TWA PEL (OSHA) “Gwinnett Standard”</td>
</tr>
<tr>
<td><strong>10 PPM</strong></td>
<td><em>Gwinnett Standard for “Structure Fires” SCBA Removal</em></td>
</tr>
<tr>
<td>9 PPM</td>
<td>EPA: Maximum acceptable level of CO in living space</td>
</tr>
</tbody>
</table>
Initial Response Procedures

- Mental Review
  - Indicators of CO incident
  - Time of Day
  - Location of incident
  - Patients?

- Provide Medical Treatment if CO poisoning suspected
  - Consider transport to Hyperbaric Facility (If available)
    - Contact Medical Control
Initial Response Procedures

- Interview occupant(s)
- Check CO Detector if installed
  - Remove to fresh air; if still alarming consider threat
- Request closest resource with a meter.
  - Sq-23, W-15, P-15, RE-12, W-9, Sq-51, W-51, All SCFR Staff, ALS 107 & 108
- Ventilate Building
  - Haz-Mat can re-create once on-scene
- Secure utilities or appliances as indicated
- Obtain CO readings
- Relay information to receiving hospital if necessary
Atmospheric Monitoring Equipment

- CO Monitors
  - Direct Read
    - What you see is what you get.
    - Firefighter Proof!!!!
Atmospheric Monitoring Equipment

Sampling Techniques

- Zero the instrument in fresh air
- Sample at entrance prior to entry
- Sample at various heights upon entry
- Sample near location of CO alarm and in and around all appliances that use or cause combustion and any other location in which CO may be present
So When Do Our Monitors Alarm Carbon Monoxide?

Based Upon this meter carried on SCFR Vehicles:

- Low Alarm Level  35 ppm
- High Alarm Level  70 ppm
- Time Weighted Average  35 ppm
- Short Term Exposure Limit 400 ppm
  (exposure concentration for 15 minutes)
Where to Sample????

- Sample around all un-vented appliances (stove, ovens & space heaters)
- Sample in heat exchanger exhaust ports of furnace
- Sample under draft diverter of an atmospheric hot water heater
- Sample anywhere you may suspect CO (Garage, basement, etc....)
Carbon Monoxide Detectors – UL Standard

“According to UL Standard 2034, home carbon monoxide detectors must sound a warning before CO levels reach 100 PPM over 90 minutes, 200 PPM over 35 minutes or 400 PPM over 15 minutes. The standard requires the alarm must sound before an average, healthy adult begins to experience symptoms of CO poisoning. The warning provides time to evacuate the premises”
Kidde CO Detector - Example

- **Alarm Limits**
  - 70 ppm CO Concentration 60 – 240 minutes
  - 150 ppm CO Concentration 10 – 50 minutes
  - 400 ppm CO Concentration 4 – 15 minutes

- **Green LED**
  - Flashes every 30 seconds to show proper operation

- **Red LED**
  - Flashes when a dangerous level of CO is present
Summary

Carbon Monoxide (CO) is an ever present danger. To be properly prepared to respond to such an emergency we must have a thorough knowledge of our enemy: what he is, where he lives and how he harms us. Understanding that we must be able to appropriately apply learned response guidelines in order to SAFELY respond to and mitigate the problem at hand. It is essential that we use appropriate procedures when responding to incidents involving CO to ensure that we accomplish our primary mission of “Everyone Goes Home!!!”