



N A S C S P

NATIONAL ASSOCIATION FOR STATE COMMUNITY SERVICES PROGRAMS



# Sounding the Call CO – what You Need to Know

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## CO Alarms



First Alert  
model



Kidde Nighthawk  
model



CO Experts  
model



# CO Overview

## What We Will Talk About

- What is CO?
- What are the effects and at what levels?
- What are the symptoms?
- What are the sources?
- Testing
- CO Alarms
- Recommendations



## **Benjamin Franklin said-**

“I considered fresh air as an enemy and closed with extreme care every crack and crevice in the room I inhabited.

Experience has convinced me of my error. I am certain that no air is so unwholesome as the air in a closed room that has been often breathed and not changed.”



## What is Carbon Monoxide (CO)?

- Odorless, colorless, and tasteless
- Can be created whenever there is a burning fuel
- Product of incomplete combustion
- Slightly lighter than air



## What causes Carbon Monoxide ?

### ***Incomplete combustion***

- The ratio of fuel to oxygen is too high for complete formation of CO<sub>2</sub>  
*or*
- Combustion temperature is too low



## What causes Carbon Monoxide ?

### ***Ratio of fuel too high -***

- Too much fuel for the amount of oxygen

*Or*

- Not enough oxygen for the amount of fuel
  - Air not adjusted right
  - Dirty or poorly aligned burners
  - LP gas for natural gas setup



## What causes Carbon Monoxide ?

***Combustion temperature is too low-***

- Flame impingement
- Too much air



## Combustion Formula (Simplified)



- This is ideal – complete combustion
- A lot can go wrong and often does!

Insufficient O<sub>2</sub> can produce CO instead of CO<sub>2</sub>



## What are the health effects?

### *Non-medical terms –*

- Prevents oxygen from being used by your body
- Poisonous
- Can harm central nervous system
- Can make you sick and cause death
- Long term exposure to low levels can have serious health consequences



## What are the symptoms?

- Headaches
- Flu-like symptoms
- Nausea
- Rapid heartbeat
- Loss of consciousness
- Cardiac arrest
- Dizziness
- Loss of hearing
- Vomiting
- Disorientation
- Seizures
- Coma
- Respiratory failure



## What are the danger levels?

### *Slightly varying standards from different organizations*

#### **ASHRAE (62-89)**

**009 PPM**: The maximum allowable concentration for continuous (24 hr) exposure. ASHRAE states the ventilation air shall meet the outdoor air standard.

#### **EPA**

**009 PPM**: This level or lower as an ambient air quality goal averaged over eight (8) hours. This outdoor air standard is exceeded in many urban areas due to auto exhaust.



## What are the danger levels?

### ***Building Performance Institute (BPI)***

**10 to 35 PPM** - marginal level in reference to potential or foreseeable problems in some situations. Occupants should be advised of a potential health hazard to infants and small children, elderly people, and persons suffering from respiratory or heart problems.

**36 to 99 PPM** - excessive. Medical alert. Conditions must be mitigated. Ventilation required. Always test garage space. Individually test combustion appliances. All repair is to be conducted by a qualified technician with proper test equipment.

**100 to 200 PPM** - dangerous (**and is a common building evacuation standard.**) Medical alert conditions. Suggested occupant health inquiry. Advise that someone else drive them to seek medical help; 15 minute maximum exposure upon discovery. Report incident to authority of jurisdiction.

**200+ PPM** – extremely dangerous. Evacuation action level



# What are the danger levels?

## ***Medical source***

**200 PPM** - Slight headache, fatigue, dizziness, and nausea after 2-3 hours

**400 PPM** - Frontal headache within 1-2 hours, life threatening after 3 hours

**800 PPM** - Dizziness, nausea and convulsions within 45 minutes. Unconsciousness within 2 hours. Death within 2-3 hours.

**1600 PPM** - Headache, dizziness and nausea within 20 minutes. death within 1 hour.

**3200 PPM** - Headache, dizziness and nausea within 5-10 minutes. Death within 30 minutes.

**6400 PPM** - Headache, dizziness and nausea within 1-2 minutes. Death within 10-15 minutes



## What are the danger levels?

- Any increase in PPM from outside to inside warrants further source investigation
- Unacceptable levels from vented combustion appliances (many WAP programs use 100 PPM) should be corrected
  - ***Potentially dangerous if conditions worsen***

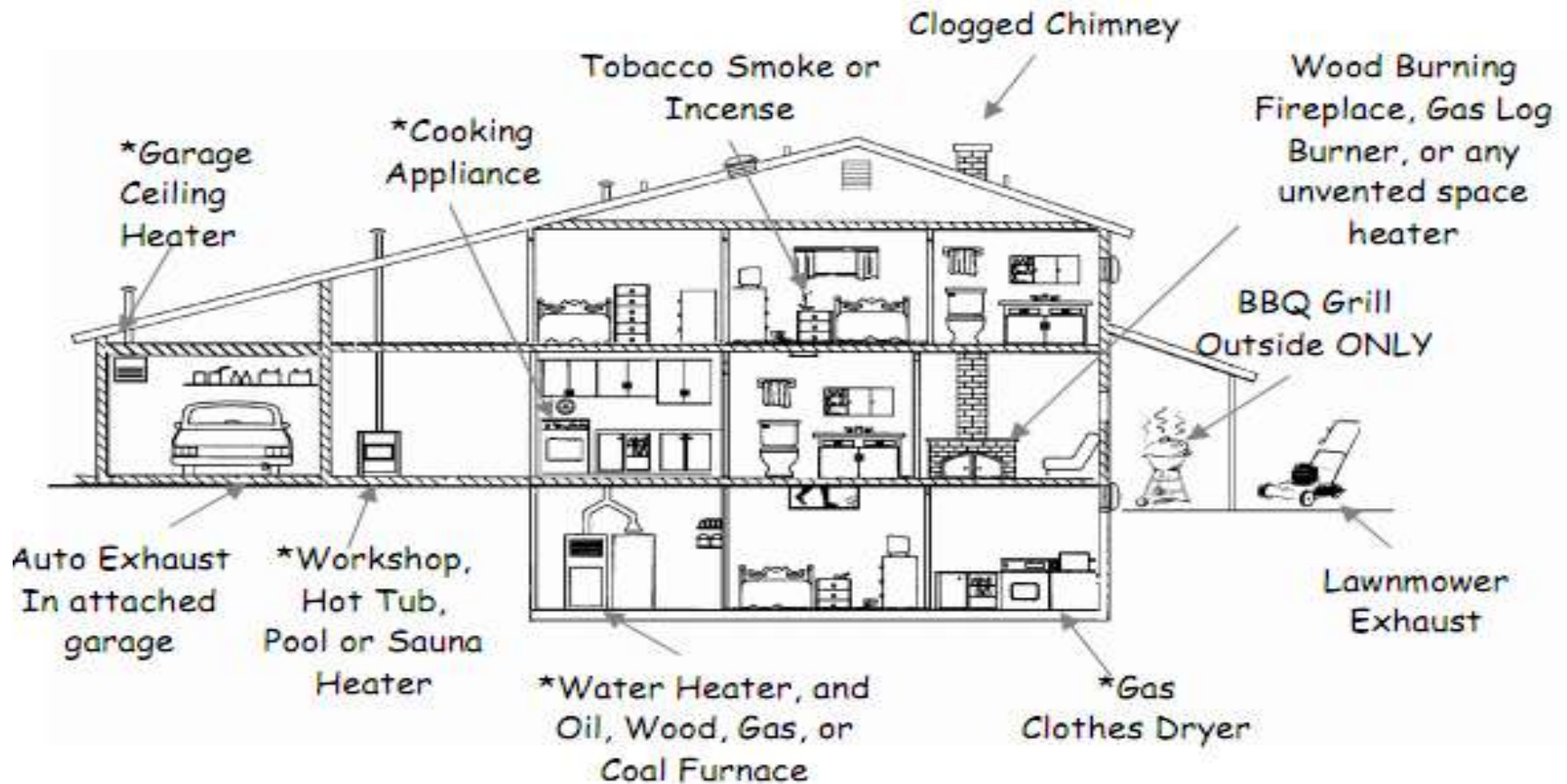


## What are the danger levels?

- Very small amounts of CO are dangerous –
  - 35 PPM is not much!
- CO concentrations can be easily diluted –
  - Opening and closing a door can dilute low levels
- Unacceptable levels from vented combustion appliances (many WAP programs use 100 PPM) should be corrected
  - ***Potentially dangerous if conditions worsen***



# What are the sources?





## What are the sources?

### Combustion appliances

- Furnaces
- Space heaters
- Gas ranges
- Water heaters
- Clothes dryers
- Fireplaces

### Vehicles

- Attached garages





## What are the sources?

Combustion appliances in low-income homes tend to be older, poorly maintained, and perhaps were initially poorly installed





## What are the sources?

### Combustion appliances

- Atmospheric – get combustion air from the space they are in
- Direct vents are a better option – get combustion air from outside



## Atmospheric appliances

- Get their combustion air from the inside air
- Burners usually visible to eye
  - Creates several issues





## Space Heaters

Multiple space heaters often a problem with combustion air





# Unvented Space Heaters

## WAP Public Enemy # 1

- Much greater risk since combustion byproducts are not vented outside
- Also produce excessive moisture





## Gas Ranges

- Unvented combustion appliance
- Often burners are clogged increasing CO potential





## Gas Ranges

- Ovens - potentially high CO
- People often use ovens as a heat source





## Water Heaters

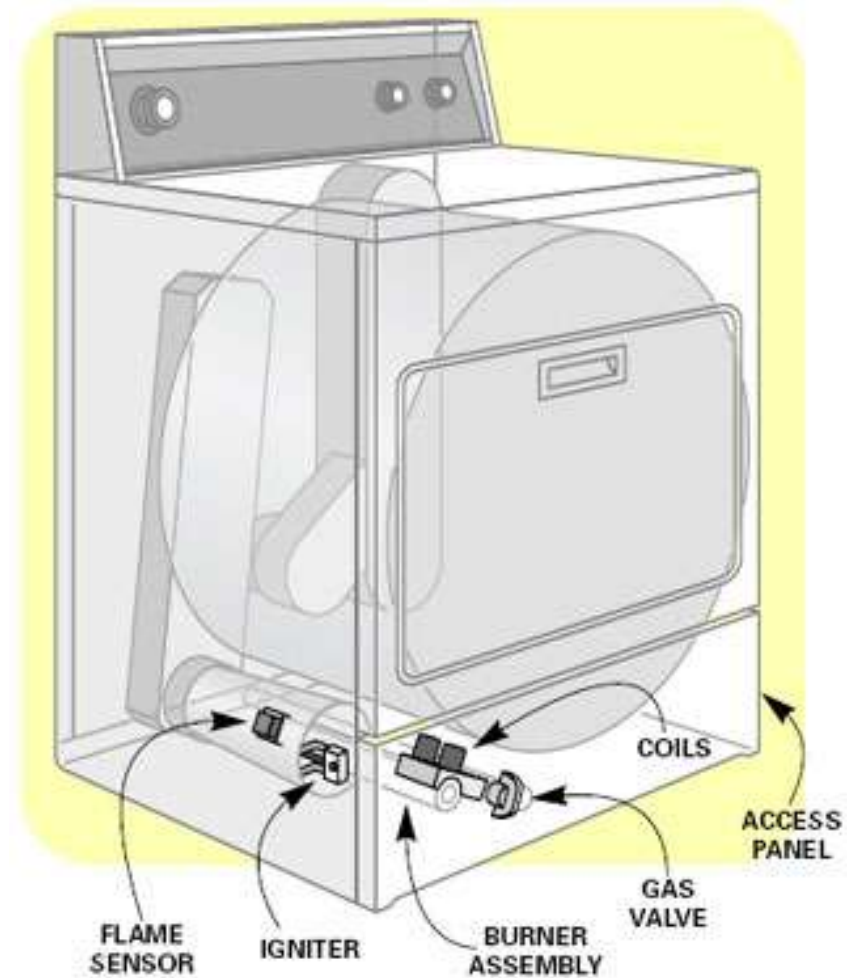
- Often ignored as long as there is hot water





## Gas Clothes Dryers

- Often not well maintained!
- Burners can get dusty
- Venting can be an issue





## Fireplaces

- Looks pretty (but no other redeeming qualities!)
- More of a heat loss than gain
- Can be unsafe





## Attached Garages

- Some estimates say 60% of CO problems in a house are a result of cars in a garage
- ***Is the garage part of the house?***





## Attached Garages

- Garages are often interconnected with the rest of the house by air passageways
- In WAP terms – there may not be a continual air barrier between the house and garage
- The gaps in the air barrier can allow CO from exhaust (and other garage pollutants) into the house
- In terms of air movement and pressure boundaries, an attached garage needs to be the same as a detached garage



## Funky Vents

- **May be the #1 cause of poorly operating combustion appliances in L-I homes**





## Vent Problems



Poor vents = poor draft



## Vent Problems



Vents should have continual rise



## Vents Should -

- Carry all combustion gases outside
- Be sized properly
- Be the correct material for the fuel
- Have adequate clearance from combustible materials
- Have adequate and continual rise
- Terminate above the roof line as per code



## Adequate Combustion Air -

### ***If atmospheric appliances -***

- Source of combustion air should be identified and the volume measured to insure it is sufficient
- Should test for draft, spillage, and CO under worse case conditions

### ***Direct vent combustion appliances are safer!***

- Do not use house air for combustion
- Do not use a chimney



## Direct Vent appliances

***Combustion air comes from the outside***





## CO Testing

**There are certainly warning signs but -**

***You cannot be certain unless you test***

- Occasionally new systems produce unacceptable levels and need to be adjusted
- Should be tested by trained professionals with quality, digital, calibrated equipment
- Best to test undiluted flue gases vs. ambient air –
  - ambient air is easily diluted
  - flue gases show potential for problems



# If You Don't Test, You're Guessing!



BACHARACH, INC  
PCA 25  
SN: BQ1007

TIME 05:44:12 pm  
DATE 03/16/99

FUEL  
OIL NO. 2

|            |        |
|------------|--------|
| STACK-TEMP | 305°F  |
| AMB. -TEMP | 75.0°F |
| O2         | 6.5%   |
| CO2        | 10.8%  |
| CO         | 28ppm  |
| 0% COR CO  | 41ppm  |
| EFFICIENCY | 87.7%  |
| EX. AIR    | 33.2   |

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COMMENTS:



# Combustion Analyzers



Testo 325-1



Bacharach Fyrite  
Tech



Bacharach  
PCA 3



# CO Test Equipment



Extech model



Testo CO Stick



Bacharach  
Monoxor III



## CO Alarms

- Not all are created equal
- Many models and various costs
- Plug in types
- Battery types
- Plug in with battery back up
- Some with digital readouts
- Some combo CO / smoke alarms



## CO Alarms

### ***UL (Underwriter Laboratories) listed –***

- Audible - so you are warned when asleep
- Manual reset/silence button – if CO level continues to be high, will sound again in six minutes
- Has certain standards on when alarm must activate at various CO concentrations

***But the UL levels are arguably very high!!!***



# CO Alarms



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## CO Alarms

### ***Placement is important –***

- One per sleeping floor
- One in area of major combustion appliances
- Should be placed high rather than low
- Should not be within 5' of appliances



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