

**REAL PEOPLE
MAKE UP LIFE SAFETY**

CARBON MONOXIDE:

**THE LATEST CODE AND
TECHNOLOGY UPDATES**



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Carbon Monoxide

- What is Carbon Monoxide**
- State laws, local laws and code adoptions**
- Review the Requirements of the 2018 IBC**
- Review the Requirements of the 2018 IRC**
- Discuss the NFPA 720 / 72 Consolidation**

What is Carbon Monoxide?

- CO is produced by the incomplete combustion of carbon-containing fuels

- Coal

- Charcoal

- Propane

- Wood

- Fuel oil

- Natural Gas

- CO is a colorless, odorless and tasteless gas

- Is CO flammable?

• **The Silent Killer!**

What is Carbon Monoxide

- The dangers of carbon monoxide exposure depend on a number of variables, such as the occupant's health, activity level, time of exposure, and initial carboxyhemoglobin (COHb) level.
 - Due to these variables, time and exposure curves are to be used as general guidelines and might not appear quantitatively consistent.
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Common Sources of Carbon Monoxide

- **Gas ranges or ovens**
- **Heating systems**
- **Combustion engine power tools and portable generators**
- **Charcoal grills**
- **Vehicles running in the garage**

Carbon Monoxide Incidents

- **Centers for Disease Control and Prevention (CDC)**
 - **408 average number of deaths per year**
 - **20K injured**
 - **64% in homes**
 - **21% in public occupancies**

Exposure Limits and Symptoms of Carbon Monoxide

| CO ppm | Effects |
|-----------|--|
| 9 ppm | Minimal. Max allowable concentration for eight hours (EPA and ASHRAE). |
| 35 ppm | Max for continuous exposure for one hour (EPA and ASHRAE). |
| 50 ppm | Max for eight hours (OSHA). |
| 100 ppm | Trips installed CO detectors. UL2034 specifies a max exposure of 100 min. |
| 200 ppm | In two to three hours: slight headache, tiredness, dizziness, nausea. UL2034 specifies a max exposure of 35 min. |
| 400 ppm | In one or two hours: frontal headaches. In three hours: life threatening. UL2034 specifies a max exposure of 15 minutes. |
| 800 ppm | In forty five minutes: dizziness, nausea, and convulsions. |
| 800 ppm | In two to three hours: death. |
| 1600 ppm | In one hour: death. |
| 6400 ppm | In fifteen minutes: death. |
| 12800 ppm | In three minutes: death. |

CO Detector Alarm Thresholds

- **ANSI/UL 2034 and ANSI/UL 2075**
 - No alarm at 30 ppm
 - 70 ppm 1 to 4 hours
 - 150 ppm 10 to 50 minutes
 - 400 ppm 4 to 15 minutes
 - **CO alarms/detectors are designed to activate before potentially life-threatening levels of CO are reached**
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Is CO Lighter or Heavier Than Air?

- Despite the common belief that CO is heavier than air, it is just slightly lighter.

Air Dispersion in Buildings

- **2007 FPRF Study, *Development of a Technical Basis for Carbon Monoxide Detector* Citing that:**
 - **CO dispersion occurs via mechanical ventilation or natural force**
 - **A ventilation system will create the majority of the air flows in a building.**
 - **This results in a well-mixed environment within the room**
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Reliability

- **When CO alarms were first introduced in the early-1990's, they were adequate but easily alarmed in constant low-levels of CO**
- **In 1998, the ANSI/UL 2034 was modified to address the high number of false CO alarms prior to 1998. The Standard added a false alarm resistant requirement to prevent unwanted alarms**

Reliability

- **In December of 2004, UL published a 5-year CO Alarm Field Study that was designed to evaluate the effectiveness of CO alarms**
- **The UL study concluded that CO alarms provide effective signaling protection should there be a dangerous concentration of CO and that CO alarms generally do not false alarm in the field**

Codes and Standards

- **Local ordinances**
- **State Laws**
- **Building Codes**
- **Standards**



Questions ?

2018 I-Code Update

Definitions

IBC Chapter 2

- **CARBON MONOXIDE ALARM.** A single- or multiple-station alarm intended to detect carbon monoxide gas and alert occupants by a distinct audible signal. It incorporates a sensor, control components and an alarm notification appliance in a single unit.
 - **CARBON MONOXIDE DETECTOR.** A device with an integral sensor to detect carbon monoxide gas and transmit an alarm signal to a connected alarm control unit.
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Definitions

IBC Chapter 2

- **Dwelling Unit:**

A single unit providing complete, independent living facilities for one or more persons, including permanent provisions for living, sleeping, eating, cooking and sanitation.

- **Sleeping Unit:**

A single unit that provides rooms or spaces for one or more persons, includes permanent provisions for sleeping, and can include provisions for living eating and either sanitation or kitchen facilities, but not both.

General

IBC: 915.1

- Carbon monoxide detection shall be installed in new buildings in accordance with Sections 915.1.1 through 915.6.
- Carbon monoxide detection shall be installed in existing buildings in accordance with Chapter 11 of the *International Fire Code*.

Where Required

IBC-915.1.1

- **Carbon monoxide detection shall be provided in the following use groups:**
 - I-1, I-2 and I-4
 - R
 - **And in classrooms in Class E in the locations specified in 915.2 where the conditions of 915.1.2 through 915.1.6 exist.**

Fuel-Burning Appliances and Fireplaces

IBC 915.1.2

- Carbon monoxide detection shall be provided in *dwelling units, sleeping units* and classrooms that contain a fuel-burning appliance or a fuel-burning fireplace.
- Carbon monoxide detection shall be provided in *dwelling units, sleeping units* and classrooms served by a fuel-burning forced-air furnace.
 - Exception:

Fuel-Burning , Forced-Air Furnaces

IBC 915.1.3

- **Exception: Carbon monoxide detection shall not be required in *dwelling units, sleeping units* and classrooms if a carbon monoxide detector is provided in the first room or area served by each main duct leaving the furnace..**

...AND, the carbon monoxide alarm signals are automatically transmitted to an approved location.

Fuel-Burning Appliances...

IBC 915.1.4

- **Carbon monoxide detection shall be provided in dwelling units, sleeping units and classrooms located in buildings that contain fuel-burning appliances or fuel-burning fireplaces.**
 - **Exceptions:**
 1. **Carbon monoxide detection shall not be required in dwelling units, sleeping units and classrooms without communicating openings between the fuel-burning appliance or fuel-burning fireplace and the dwelling unit, sleeping unit or classroom. (continued)**

Fuel-Burning Appliances...

IBC 915.1.4

- **Exceptions:**

2. Carbon monoxide detection shall not be required in dwelling units, sleeping units and classrooms where a carbon monoxide detector is provided in one of the following locations:

2.1 in an approved location between the fuel-burning appliance or fuel-burning fireplace and the dwelling unit, sleeping unit or classroom.

2.2 On the ceiling of the room containing the fuel-burning appliance or fuel-burning fireplace.

Private Garages

IBC 915.1.5

- **Carbon monoxide detection shall be provided in dwelling units, sleeping units and classrooms in buildings with attached private garages.**
 - **Exceptions:**
 1. **Detection is not required in these spaces without communicating openings between the private garage and that space.**
 2. **Detection is not required in these spaces located more than one story above or below a private garage. (continued)**
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Private Garages

IBC 915.1.5

- **Carbon monoxide detection shall be provided in dwelling units, sleeping units and classrooms in buildings with attached private garages.**
 - **Exceptions:**
 - 3. Detection is not required where the private garage connects to the building through an open-ended corridor.**
 - 4. Where a carbon monoxide detector is provided in an approved location between openings to a private garage and that space.**
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Exempt Garages

IBC 915.1.6

- For determining compliance with Section 915.1.5, an open parking garage complying with Section 406.5 or an enclosed parking garage complying with Section 406.6 shall not be considered a private garage.
 - 406.5: Open Parking Garages
 - 406.6: Enclosed Parking Garages

Locations

IBC 915.2

- **Where required by Section 915.1.1 carbon monoxide detection shall be installed in the locations specified in Sections 915.2.1 through 915.2.3**
 - **915.2.1: Carbon monoxide detection shall be installed in dwelling units outside of each separate sleeping area, in the immediate vicinity of the bedrooms...**
 - **Where a fuel-burning appliance is located within a bedroom or its attached bathroom, carbon monoxide detection shall be installed within the bedroom.**
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Sleeping Units

IBC 915.2.2

- **Carbon monoxide detection shall be installed in sleeping units.**
 - **Exception: Detection shall be allowed to be installed outside of each separate sleeping area in the immediate vicinity of the sleeping unit...**

...where the sleeping unit or its attached bathroom does not contain a fuel-burning appliance and is not served by a forced-air furnace.

Group E Occupancies

IBC 915.2.3

- Carbon monoxide detectors shall be installed in classrooms in Group E occupancies.
 - Carbon monoxide alarm signals shall be automatically transmitted to an on-site location that is staffed by school personnel.
 - Exception: Carbon monoxide alarm signals shall not be required to be automatically transmitted to an on-site location that is staffed by school personnel in Group E occupancies with an occupant load of 30 or less.
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Carbon Monoxide Detection

IBC 915.3

- **Carbon monoxide detection shall be provided by:**
 - **Carbon monoxide alarms complying with Sections 915.4**
 - **Carbon monoxide detection systems complying with Section 915.5.**

Power Source

IBC 915.4.1

- **Carbon monoxide alarms shall receive their primary power from the building wiring where such wiring is served from a commercial source, and when primary power is interrupted, shall receive power from a battery.**
 - **Wiring shall be permanent and without a disconnecting switch other than that required for overcurrent protection.**
 - **Exception: Where installed in buildings without commercial power battery-powered CO alarms shall be an acceptable alternative.**
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Listing, Locations & Combination Alarms

IBC 915.4.2, 915.4.3 and 915.4.4

- Carbon monoxide alarms shall be listed in accordance with UL-2034.
- Carbon monoxide alarms shall only be installed in dwelling units and in sleeping units. They shall not be installed in locations where the code requires carbon monoxide detectors to be used.
- Combination CO/smoke alarms shall be an acceptable alternative to carbon monoxide alarms. Combination CO/smoke alarms shall be listed in accordance with UL2034 and UL 217.

Carbon Monoxide Detection Systems

IBC 915.5.1, 915.5.2 & 915.5.3

- Carbon monoxide detection systems shall be an acceptable alternative to carbon monoxide alarms and shall comply with Sections 915.5.1 through 915.5.3
 - Carbon monoxide detection systems must comply with NFPA 720.
 - Carbon monoxide detectors must be listed in accordance with UL-2075
 - Carbon monoxide detectors shall be installed in the locations specified in Section 915.2:
 - These locations supersede the locations specified in NFPA 720.
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Combination Detectors

IBC 915.5.3

- **Combination CO/smoke detectors installed in CO detection systems must be an acceptable alternative to carbon monoxide detectors, provided that they are listed in accordance with UL-2075 and UL-268.**

Maintenance

IBC 915.5.6

- Carbon monoxide alarms and carbon monoxide detection systems shall be maintained in accordance with the *International Fire Code*.



Questions ?

2018 IRC

New Construction

- Carbon monoxide alarms shall be provided in *dwelling units* where either or both of the following conditions exist:
 1. The *dwelling unit* contains a fuel-fire appliance
 2. The *dwelling unit* has an attached garage with an opening that communicates with the dwelling unit.

2018 IRC

Location

- Carbon monoxide alarms in *dwelling units* shall be installed outside of each separate sleeping area in the immediate vicinity of the bedrooms.
- Where a fuel-burning appliance located within a bedroom or its attached bathroom, a carbon monoxide alarm shall be installed within the bedroom.

2018 IRC

Carbon Monoxide Detection Systems

- Carbon monoxide detection systems shall be permitted to be used in lieu of carbon monoxide alarms
- Household carbon monoxide detectors systems shall comply with NFPA 720.
- Carbon monoxide detectors shall be listed in accordance with UL-2075

2018 IRC

Carbon Monoxide Detection Systems

- Carbon monoxide detectors shall be installed in the locations specified in R315.3.
 - These locations supersede the locations specified in NFPA-720
- Where a household carbon monoxide detection system is installed, it shall become a permanent fixture of the occupancy and owned by the homeowner.



NFPA-720/72 Consolidation

- In 2015 the NFPA Standards Council approved a project to merge NFPA 720 into NFPA 72 because the two standards have similar requirements
 - With every new edition of NFPA 720 updating of extracts from NFPA-72 has become a very time-consuming effort that is prone to error for both NFPA Staff and the Technical Committee
 - The scope and title of NFPA 72 was intentionally changed in 2010 to be broad enough to include CO and other signaling needs
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Summary



Questions ?

Automatic **Fire** Alarm Association

- **Organized in 1953**
 - **Participate in Code-Making Process**
 - **Classroom Training**
 - **Basic Fire Alarm**
 - **Carbon Monoxide Detection**
 - **Inspection & Testing**
 - **Fire Alarm Plan Review**
 - **IBC or NFPA 101 Fire Alarm Requirements**
 - **NICET Preparation**
 - **User Guide to Simplifying NFPA 72 and NEC**
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