# F102-21

## *Proposed Change as Submitted*

**Proponents:** Kris Hauschildt, representing self (krishauschildt@yahoo.com)

## 2021 International Fire Code

### CHAPTER 9
### FIRE PROTECTION AND LIFE SAFETY SYSTEMS

**SECTION 915 CARBON MONOXIDE DETECTION.**

**915.1 General.** 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 Section 1103.9.

**Revise as follows:**

**915.1.1 Where required.** Carbon monoxide detection shall be provided in Group A, B, E, F, H, I, M, ~~I-1, I-2, I-4~~ and R occupancies ~~and in classrooms in Group E occupancies~~ in the locations specified in Section 915.2 where any of the conditions in Sections 915.1.2 through 915.1.6 exist.

**915.1.2 ~~Fuel-burning appliances and f~~uel-burning fireplaces.** Carbon monoxide detection shall be provided in rooms, areas, *dwelling units*, *sleeping units* and classrooms in Group E occupancies that contain ~~a fuel-burning appliance or~~ a fuel-burning fireplace.

**915.1.3 Fuel-burning forced-air furnaces.** Carbon monoxide detection shall be provided in ~~*dwelling units*, *sleeping units* and classrooms~~ the following locations served by a fuel-burning, forced-air furnace:

1. In a central or otherwise approved location in each HVAC zone on every floor level that is served by a fuel-burning forced air-furnace.
2. In dwelling units, sleeping units, classrooms in Group E occupancies and areas containing a swimming pool that are served by a fuel-burning forced-air furnace.

**Exception:** Carbon monoxide detection shall not be required to be installed in accordance with Section 915.1.3, Items 1 or 2, ~~in *dwelling units*, *sleeping units* and classrooms~~ where 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* onsite location or to an approved off-premises location in accordance with NFPA 72.

**915.1.4 Fuel-burning appliances~~ outside of dwelling units, sleeping units and classrooms~~.** Carbon monoxide detection shall be provided in ~~*dwelling units*, *sleeping units* and classrooms located~~ the following locations in buildings that contain fuel-burning appliances~~ or fuel-burning fireplaces~~.

1. In rooms, areas, dwelling units, sleeping units and classrooms in Group E occupancies that contain a fuel-burning appliance.
2. In rooms, areas, dwelling units, sleeping units and classrooms in Group E occupancies that have communicating openings between the fuel-burning appliance and the room, area, dwelling unit, sleeping unit or classroom; or in an approved location between the fuel-burning appliance and the room, area dwelling unit, sleeping unit or classroom.
3. In dwelling units, sleeping units, classrooms in Group E occupancies, and areas containing a swimming pool.

**Exception~~s~~:** Carbon monoxide detection shall not be required to be installed in accordance with Section 915.1.4, Item 3, where a carbon monoxide detector is provided in each room, area, dwelling unit, sleeping unit, or classroom in Group E occupancies that shares a common wall, ceiling or floor with the room or area containing the fuel-burning appliance, and the carbon monoxide alarm signals are automatically transmitted to an approved onsite location or to an off-premises location in accordance with NFPA 72.

~~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.~~

~~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.~~

**915.1.5 Private garages.** Carbon monoxide detection shall be provided in rooms, areas, *dwelling units*, *sleeping units* and classrooms in Group E occupancies in buildings with attached private garages.

**Exceptions:**

1. Carbon monoxide detection shall not be required in rooms, areas, *dwelling units*, *sleeping units* and classrooms in Group E occupancies without communicating openings between the private garage and the room, area, *dwelling unit*, *sleeping unit* or classroom.
2. Carbon monoxide detection shall not be required in rooms, areas, *dwelling units*, *sleeping units* and classrooms in Group E occupancies located more than one story above or below a private garage.
3. Carbon monoxide detection shall not be 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 rooms, areas, *dwelling units*, *sleeping units* or classrooms in Group E occupancies.

**915.1.6 Exempt garages.** For determining compliance with Section 915.1.5, an open parking garage complying with Section 406.5 of the International Building Code or an enclosed parking garage complying with Section 406.6 of the International Building Code shall not be considered a private garage.

**Revise as follows:**

**915.2 Locations.** 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~~4.

**915.2.1 Dwelling units.** 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.

**915.2.2 Sleeping units.** Carbon monoxide detection shall be installed in *sleeping units*.

**Exception:** Carbon monoxide 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.

**Revise as follows:**

**915.2.3 Areas containing a swimming pool.** Carbon monoxide detection shall be installed in areas containing a swimming pool.

**Exception:** Where there is a conflict between the requirements of this code and the manufacturer's installation instructions, the manufacturer's installation instructions shall govern.

**915.2.~~3~~ 4 Group E occupancies.** 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.

**915.3 Carbon monoxide detection.** Carbon monoxide detection required by Sections 915.1 through 915.2.~~3~~ 4 shall be provided by carbon monoxide alarms complying with Section 915.4 or carbon monoxide detection systems complying with Section 915.5.

**915.4 Carbon monoxide alarms.** Carbon monoxide alarms shall comply with Sections 915.4.1 through 915.4.~~4~~ 5.

**915.4.1 Power source.** 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~~ carbon monoxide alarms powered by a 10-year battery shall be an acceptable alternative.

**915.4.2 Listings.** Carbon monoxide alarms shall be *listed* in accordance with UL 2034.

**915.4.3 Locations.** 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.

**915.4.4 Combination alarms.** Combination carbon monoxide/smoke alarms shall be an acceptable alternative to carbon monoxide alarms. Combination carbon monoxide/smoke alarms shall be *listed* in accordance with UL 217 and UL 2034.

**Revise as follows:**

**915.4.5 Installation requirements.** Where required by Sections 915.1.1 through 915.5.3, carbon monoxide alarms shall be installed in accordance with Sections 915, NFPA 72, and the manufacturer's installation instructions. Where there is a conflict between the requirements of this code, NFPA 72, and the manufacturer's installation instructions, the manufacturer's installation instructions shall govern.

**915.5 Carbon monoxide detection systems.** 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.

**915.5.1 General.** Carbon monoxide detection systems shall comply with NFPA 720. Carbon monoxide detectors shall be *listed* in accordance with UL 2075.

**915.6 Maintenance.** Carbon monoxide alarms and carbon monoxide detection systems shall be maintained in accordance with NFPA 720. Carbon monoxide alarms and carbon monoxide detectors that become inoperable or begin producing end-of-life signals shall be replaced.

**915.5.2 Locations.** Carbon monoxide detectors shall be installed in the locations specified in Section 915.2. These locations supersede the locations specified in NFPA 720.

**915.6.1 Enclosed parking garages.** Carbon monoxide and nitrogen dioxide detectors installed in enclosed parking garages in accordance with Section 404.1 of the International Mechanical Code shall be maintained in accordance with the manufacturer's instructions and their listing. Detectors that become inoperable or begin producing end-of-life signals shall be replaced.

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

**Reason:** This proposal seeks to establish uniform baseline requirements for CO detection in all occupancies with permanently installed fuel-burning appliances, fuel-burning fireplaces or attached garages. CO poisoning incidents resulting in deaths and injuries continue to happen with alarming regularity in occupancies not covered by the current IFC as well as those that are, demonstrating that current code requirements are not adequately inclusive and are not effectively targeting problem areas within specific occupancies.
The suggested revisions contained in this proposal are based on *"Development of a Technical Basis for CO Detector Siting," "Diffusion of CO Through Gypsum Wallboard,"* the New York State Fire Code which has required CO detection in all commercial occupancies since 2015, and data from individual case examples (see attachment and bibliography).

Requiring CO detection in all occupancies that contain known CO hazards will prevent an untold number of deaths and injuries.

**Substantiation for Uniform Baseline Requirements for CO detection in All Occupancies**

**The lethality of CO is undisputed.** The severity of poisoning injury depends not only on the level and duration of CO exposure, but also on the individual. Those most at risk from the effects of CO: infants and children, older people, pregnant women/unborn babies, and those with underlying health conditions. There is no formula that can accurately predict how CO will impact a particular person nor what level or duration of exposure can be tolerated without suffering prolonged harm, irreversible brain damage, or death. For many victims who survive a CO exposure, the effects do not end with the poisoning incident. They can be severe enough to cause death weeks to months later. They can also cause irreversible effects, including life-altering brain injury.

*"In addition to the immediate onset effects of exposure, delayed-onset development of neuropsychiatric impairment typically occurs from several days to approximately 3–4 weeks after exposure, with symptoms including inappropriate euphoria, impaired judgment, poor concentration, memory loss, cognitive and personality changes, psychosis, and Parkinsonism. Symptoms of acute carbon monoxide poisoning in children are the same as those in adults. Acute carbon monoxide poisoning during pregnancy has been associated with spontaneous abortion and fetal death."*

*- Agency for Toxic Substances & Disease Registry, CDC*

**The lifesaving value of CO detection is undisputed.** CO detection has been commercially available for at least 30 years and has proven reliability. There is no substitute for the early detection that these devices provide, alerting to danger before conditions escalate to a level of causing harm. In the absence of detection, it is the building occupants who are providing the alert to CO leaks, becoming ill or dying before building staff are even aware there is a problem. Some examples:

**2013, North Carolina**: My parents both died in a **hotel** room from a CO leak while they were on vacation. They lost consciousness and lay helpless all night, inhaling poison for over 14 hours until they died. No one in the building was even aware they were in danger. There was no CO detection onsite despite there being gas fireplaces in the guest rooms, a gas pool heater, gas dryers and gas water heaters. First responders (EMS, police, fire dept) suspected CO but thought it was more likely they both died of heart attacks so didn't bother to test the room, opting instead to wait weeks for autopsy toxicology results. The leak continued for another seven weeks, killing an 11-year-old boy and causing permanent injury to his mother in the same room before it was finally detected. Multiple people were ill at the hotel during those seven weeks, including guests and a repairman servicing the elevator which was located next to the leaking exhaust system.

**2017, Michigan**: A 13-year-old boy at a spring break swim party with his friends died on the deck of a **swimming pool** from CO leaking from a pool

heater in an adjacent room. His friends suffered CO injury as well as head injuries when they lost consciousness and fell onto the concrete pool deck. An employee along with multiple firefighters suffered CO injuries responding to the incident.

** There is specific concern over the number of incidents in **indoor swimming pool areas** that have resulted in poisoning injuries to children. CO exposure in a pool also leads to an increased risk of drowning. These incidents are detailed on the attached spreadsheet.

**2014, New York**: A **restaurant** manager died from CO leaking from a fuel burning appliance in the room adjacent to his office. The assistant manager lost consciousness and suffered CO injury when she went looking for him. Multiple rescue personnel became injured as well when they rushed in to render aid, unaware they were entering a CO contaminated environment. 24 people were hospitalized including restaurant patrons. The manager had reportedly been ill for weeks prior, but neither he nor his doctors suspected it as being CO-related.

**1995, California**: A woman and her husband were poisoned in a **hotel** room, not found until 36 hours later – he died, she survived with permanent injury to her brain, so severe she was prevented from ever being able to work or live independently again. 25 years later, she lives in a specialized group home.

**2006, Maryland:** 20 **restaurant** workers suffered long term brain injury after being exposed to a CO leak that had gone unnoticed for weeks and progressed to a level of 700ppm in the dining area before problem was discovered.

**2019, Ohio:** CO leak at **correctional facility** caused poisoning injuries to 4 staff and 29 inmates

**2019, Illinois:** CO leak at a **dry cleaners**, 3 people taken to the hospital including a police officer

**2019, Utah**: 60 people were poisoned at a **church** from CO leaking from a boiler, having spent several hours breathing in CO levels measured at 200-500ppm. Many were projected to have long term health effects.

**2021, Nebraska**: 10 people poisoned at a **bowling alley**, 4 hospitalized.

According to NFIRS (National Fire Incident Reporting System) data, there were a total of 10,715 CO incidents in hotels/motels, churches, restaurants/cafeterias, bars/taverns, and K-12 schools between 1999 and 2018. This is a minimum number. Participation in the NFIRS system is voluntary and not all fire departments participate.

Further, deaths and injuries are occurring even in buildings equipped with CO detection, demonstrating the need for occupancy specific focus for future improvements beyond a baseline requirement:

**2017, Texas**: A couple was poisoned and found unconscious in their hotel room from CO leaking from a pool heater. The hotel was equipped with unmonitored CO detection. A couple staying a few doors down had removed the batteries from the CO alarm in their room after it had gone off multiple times during the night. The couple found unconscious later died of their CO related injuries.

**2018, Tennessee**: Several people were poisoned in a hotel exercise room, located on a floor with a pool but no guest rooms. The hotel reportedly had CO detection, but only on floors with guest rooms.

**2019, Illinois**: A couple was poisoned in their hotel room equipped with a CO alarm that was alarming, but a hotel maintenance worker told them to disregard the alarm. They ended up calling the fire department themselves and were treated at a hospital for CO poisoning.

As a homeowner it is a reasonable expectation to be aware of the hazards of CO and take responsibility to install CO detection to protect yourself. However, as an occupant of a building that is under someone else's charge, there is no way to know of equivalent hazards nor whether action has been taken to install safeguards. Combined with no human ability to detect CO, this leaves occupants critically vulnerable during any type of CO exposure incident. Their life safety is entirely at the mercy of circumstances they have no knowledge of and no control over, assuming a risk they did not choose to take.

Building and business owners rely on guidance from this code to provide basic life safety provisions for occupants. States rely on guidance from this code to pass safety legislation. People rely on this code to stay safe and keep their families safe from preventable death and harm. Emergency responders rely on this code to keep them safe from unnecessary risk in performing their already hazardous jobs.

Please act to protect people from unnecessary death and injury by approving this proposal to provide a baseline level of safety from carbon monoxide danger in all occupancies.

*2021 IFC – Chapter 1 Scope and Administration*

*101.3 Intent.*

*The purpose of this code is to establish the minimum requirements consistent with nationally recognized good practice for providing a reasonable level of life safety and property protection from the hazards of fire, explosion, or dangerous conditions in new and existing buildings, structures and premises, and to provide a reasonable level of safety to fire fighters and emergency responders during emergency operations.*

**Bibliography:** **SUPPORT DOCUMENTS FOUND AT THE FOLLOWING LINK**

- **https://thejenkinsfoundation.com/category/ifc-2024-proposal-support-do**cuments/

- Swimming Pool CO Incident Log
- Toxicological Profile for Carbon Monoxide - Agency for Toxic Substances & Disease Registry, CDC
- Development of a Technical Basis for Carbon Monoxide Detector Siting, NFPA Fire Protection Research Foundation, 2007
- 2020 Fire Code New York State
- Diffusion of Carbon Monoxide Through Gypsum Wallboard, Neil Hampson, MD
- Carbon Monoxide Poisoning, Lindell Weaver, MD, 2020
- Hotel/Motel CO Incident Log 1967-to date, Jenkins Foundation
- Commercial Building CO Incidents, Jenkins Foundation
- CO Detection and Alarm Requirements: Literature Review, NFPA Fire Protection Research Foundation, 2021
- Cost of Accidental Carbon Monoxide Poisoning: A Preventable Expense, Preventive Medicine Reports, 2016
- CO Incidents - NFIRS (National Fire Incident Reporting System) Data - REM Risk
- Carbon Monoxide Poisonings in Hotels and Motels: The Problem Silently Continues, Prev. Medicine Reports, 2019
- Carbon Monoxide Poisoning at Hotels, Motels and Resorts, Amer. Journal of Prev. Medicine, 2007
- NEMA - Life Fire Safety - Carbon Monoxide

**Cost Impact:** The code change proposal will increase the cost of construction
This code change proposal will increase the cost of construction but is crucial for life safety.

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# ***Public Hearing Results***

**Committee Action:** **Disapproved**

**Committee Reason:** The committee stated that the reason for disapproval was that it is proposing an all-encompassing requirement to put carbon monoxide alarms everywhere without statistical data for all these other occupancies than what is currently covered in the code. Additionally, it was noted that the expansion of carbon monoxide detection throughout all the different occupancies will have very little impact to the majority of the deaths due to carbon monoxide poisoning since 54% of carbon monoxide deaths occurred in a home and over 60% of carbon monoxide poisoning deaths were due to suicide. The current minimum requirements in the IFC and IBC are helping to continue to reduce these incidents, but the leading cause is in education of the general public, increasing the cost of construction requiring these devices is not going to provide much benefit as increasing education will. An apology was given to everybody who spoke about their losses and as stated it is an awful thing to happen but the incidents that were presented were in occupancies that, the overwhelming majority, are already required by the IBC and IFC to have these devices and in existing buildings which are also already required to have these devices. Several states, including New Jersey and Washington, were discussed by the committee as examples of jurisdictions that already had specific requirements in place. In closing it was stated that this proposal is a good start in a good direction, and the committee applauded the proponents that put the proposal together. (Vote: 12-0)

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# ***Individual Consideration Agenda***

## *Public Comment 2:*

**IFC: (New); IBC: (New)**

**Proponents:** Michael O'Brian, representing FCAC (fcac@iccsafe.org) requests As Modified by Public Comment

**Modify as follows:**

## 2021 International Fire Code

**CARBON MONOXIDE SOURCE .** A piece of commonly used equipment or permanently installed appliance, fireplace or process that produces or emits carbon monoxide gas.

## 2021 International Building Code

**CARBON MONOXIDE SOURCE .** A piece of commonly used equipment or permanently installed appliance, fireplace or process that produces or emits carbon monoxide gas.

**Commenter's Reason:** This is the second of 3 related proposals. This proposal simply adds a definition for Carbon Monoxide Source. This will clarify that only permanently installed or used sources in a building such as gas fired heaters or propane powered forklifts that are part of the daily operations of a space are included, and that things like candles and floor polishers are not intended to be captured. Additionally, this shortens the code language so that not every iteration of something that produces CO is written in several places in the code.
This Public Comment is submitted by the ICC Fire Code Action Committee (FCAC). The FCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance assigned International Codes with regard to fire and life safety in new and existing buildings and facilities as well as the protection of life and property in wildland urban interface areas. In 2020 and 2021 the Fire-CAC held multiple virtual meetings that were open to any interested party. In addition, there were numerous virtual specific working group meetings that were also open to any interested parties, to develop, discuss and debate the proposed changes. Related documentation and reports are posted on the FCAC website at: FCAC.

**Cost Impact:** The net effect of the public comment and code change proposal will increase the cost of construction
The overall proposal will increase the cost of construction. This PC is merely adding a new definition to the IFC and IBC to clarify how the provisions are intended to apply. This PC in and of itself does not further impact cost as it is only a definition.