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**GUIDELINES FOR CARBON MONOXIDE GAS ALARMS AND DETECTION SYSTEMS IN OCCUPANCY GROUP E AND R-2 STUDENT LIVING BUILDINGS, INCLUDING COMMERCIAL KITCHENS AND ATTACHED/INTEGRAL PARKING GARAGES**

Carbon monoxide (CO) is a colorless, odorless and tasteless toxic and flammable gas. CO gas is produced when there is incomplete combustion of carbon containing fuels (e.g. gasoline, wood, coal, natural gas, propane, coals, petroleum-based oils).

CO gas has a flammable fire rating of 4 and a health hazard rating of 3, which designates it as a serious health hazard. Inhalation of CO can cause headache, dizziness, mental dullness, weakness, sleepiness, nausea, vomiting, unconsciousness and death.

Based on CO's molar mass, it is slightly *lighter* than air and the density of the air in the room can affect the dispersal of CO. Because of this, CO tends to evenly diffuse throughout the room or space, and distribution can also be affected by air current created by convection. CO can accumulate in enclosed or poorly ventilated spaces in buildings.

Potential sources of CO consist of fuel fired appliances such as commercial and residential kitchen cooking appliances, heaters, boilers, hot water tanks, laundry clothes dryers, blocked flues, fireplaces, interior emergency generators and parking garage vehicle exhaust.

Preventative measures include installing CO alarms/detectors, proper ventilation, and the inspection, maintenance and testing of all detection devices, alarm systems, ventilation systems and CO producing equipment and appliances.

**CO EXPOSURE THRESHOLDS AND ALARM ACTIVATION LEVELS**

Understanding CO concentration thresholds is essential for occupants, facilities staff, and emergency responders to assess the urgency of a CO alarm event and take appropriate action. The following regulatory exposure limits and alarm activation levels apply:

<b>Standard / Authority</b>	<b>Limit / Level</b>	<b>Notes</b>
OSHA Permissible Exposure Limit (PEL)	50 ppm	8-hour time-weighted average (TWA). The maximum allowable worker exposure over a standard workshift.
NIOSH Recommended Exposure Limit (REL)	35 ppm (ceiling: 200 ppm)	35 ppm as a TWA; 200 ppm is an absolute ceiling that must never be exceeded at any time.
NIOSH Immediately Dangerous to Life or Health (IDLH)	1,200 ppm	Concentration at which exposure poses an immediate threat to life or causes irreversible health effects. Requires immediate evacuation and use of supplied-air respirator by responders.

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<b>Standard / Authority</b>	<b>Limit / Level</b>	<b>Notes</b>
<b>UL 2034 Alarm Activation — Level 1</b>	70 ppm	Alarm must activate within 1–4 hours of continuous exposure. Represents a lower-urgency but sustained exposure risk.
<b>UL 2034 Alarm Activation — Level 2</b>	150 ppm	Alarm must activate within 10–50 minutes. Represents an elevated and rapidly dangerous exposure level.
<b>UL 2034 Alarm Activation — Level 3</b>	400 ppm	Alarm must activate within 4–15 minutes. Life-threatening concentration; immediate evacuation required.

*Note: CO alarm activation does not solely reflect instantaneous concentration — UL 2034-listed alarms use a time-weighted algorithm that considers both concentration level and duration of exposure. A CO reading well below the IDLH can still trigger an alarm if sustained over time. Responders should not dismiss an alarm solely because measured concentrations appear low at the time of response.*

The following requirements are primarily concerned with life safety regarding the selection, design, application, installation, location, performance, inspection, testing, and maintenance of equipment and systems to help assure that CO is detected at concentrations that could pose a life safety risk. When CO is detected, the occupants will be alerted in sufficient time to allow prompt evacuation to fresh air, and to seek aid or medical assistance as necessary.

Applicable codes and standards referenced below consist of the following: International Building Code (IBC 2021), International Fire Code (IFC 2021), International Mechanical Code (IMC 2021), National Fire Protection Association (NFPA) NFPA 54 (2021), 72 (2019), NFPA 96 (2021), and NFPA 720 (2015).

This guideline applies to Group E Occupancies (University Child Development Center, Falk School) and Group R-2 Student Living Buildings.

The storage and usage of CO in a laboratory environment is covered in EH&S Guideline 04-014.

## **DEFINITIONS**

**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 operated from a power source either located in the unit or obtained at the point of installation. (IBC/IFC and NFPA 720)

**SINGLE-STATION CARBON MONOXIDE ALARM.** A detector comprising an assembly that incorporates a sensor, control components, and an alarm notification appliance in one unit operated from a power source either located in the unit or obtained at the point of installation. (NFPA 72 and 720)

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**MULTIPLE-STATION CARBON MONOXIDE ALARM.** A single-station carbon monoxide alarm capable of being interconnected to one or more additional alarms so that the actuation of one causes the appropriate alarm signal to operate in all interconnected alarms. (NFPA 72 and 720)

**CARBON MONOXIDE ALARM SIGNAL.** A signal indicating a concentration of carbon monoxide at or above the alarm threshold that could pose a risk to the life safety of the occupants and that requires immediate action. (NFPA 72)

**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. (IBC/IFC)

**CARBON MONOXIDE DETECTION SYSTEM.** A system or portion of a combination system that consists of a control unit, components, and circuits arranged to monitor and annunciate the status of carbon monoxide alarm initiating devices and to initiate the appropriate response to those signals. (NFPA 72)

**COMBINATION CARBON MONOXIDE DETECTION SYSTEM.** A carbon monoxide detection system in which components are used, in whole or in part, in common with a non-carbon monoxide signaling system, and in which components are not used as part of a fire alarm system. (NFPA 72)

**CARBON MONOXIDE CONTROL INTERFACE DEVICE.** A listed carbon monoxide detection system component that directly interfaces with the system that operates the carbon monoxide control function. (NFPA 72 and 720)

**CARBON MONOXIDE CONTROL FUNCTIONS.** Carbon monoxide control elements or systems that are initiated by the carbon monoxide detection system and either increase the level of life safety for occupants or control the spread of the harmful effects of carbon monoxide. (NFPA 72 and 720)

**SUPERVISORY SIGNAL.** A signal indicating the need for action in connection with a pre-alarm condition, or in connection with the supervision of protected premises carbon monoxide safety functions or equipment, or the maintenance features of related systems. (NFPA 72 and 720)

### **GENERAL GUIDELINES**

- 1) A database should be established for all existing CO alarms and detection devices in Group E occupancies and Group R-2 student living buildings. The database should include the following:
  - a) Building name.
  - b) Identification of CO sources.
  - c) Location of CO alarms/detectors
  - d) The manufacture date. Although most devices will provide an end-of-life warning notification, the manufacture date will help identify and prepare for anticipated replacement.
  - e) Annual battery replacement.
  - f) The database should be updated as new devices are installed, or existing devices are replaced and/or upgraded.
- 2) Preventative measures include installing CO alarms/detectors, maintaining required ventilation systems, and the inspection, testing and maintenance of all detection devices, alarm systems, ventilation equipment, CO producing equipment and appliances.
- 3) Emergency procedures in the event of CO alarm or CO detection activation, consist of the following:

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- a) Where the following code and standards sections reference supervisory signals that are continuously monitored by an off-premises communications center location, the Emergency Management Operations Center (EMOC) would be considered to meet this intent and to provide notification to designated responders.
- b) Occupants in the zone of CO alarm or detection activation in the building should promptly evacuate the area, moving to fresh air on their own accord and/or at the direction of responding engineers, management staff, UPPD officers or EH&S staff.
- c) Do not re-enter the area or move away from a source of fresh air such as an open door or window until the responders have arrived, the premises have been aired out, and the alarm returns to its normal condition.
- d) In the case of suspected CO exposure, individuals should seek immediate medical attention.

**INTERNATIONAL BUILDING CODE (IBC)/INTERNATIONAL FIRE CODE (IFC) SECTION 915  
CARBON MONOXIDE DETECTION REQUIREMENTS**

- 4) CO alarms and CO detection shall be provided in accordance with all applicable requirements listed in the IBC/IFC Section 915.
- 5) CO detection shall be installed in new buildings in accordance with Sections 915.1.1 through 915.6 including but not limited to the following: Sections 915.1.2, 915.1.3 and 915.1.4 fuel burning appliances, 915.2 locations in dwelling and sleeping units, 915.3 CO detection, 915.4 CO alarms, 915.5 CO detection systems.
- 6) For existing buildings where CO sources are identified to exist and no CO detection/alarms are provided, CO detection shall be installed in existing buildings in accordance with IFC Section 1103.9 with requirements covered in Sections 915.1.2 through 915.1.6. The CO alarms shall be installed in the locations specified in Section 915.2 and the installation shall be in accordance with Section 915.4. Exceptions:
  - a) CO alarms are permitted to be solely battery operated where the code that was in effect at the time of construction did not require carbon monoxide detectors to be provided.
  - b) CO alarms are permitted to be solely battery operated in dwelling units that are not served from a commercial power source.
  - c) A CO detection system in accordance with Section 915.5 shall be an acceptable alternative to CO alarms.
- 7) Due to increased inspection, testing and maintenance requirements for CO alarms, for all new construction and as renovations or fire alarm system upgrades are made, CO detection should be provided in lieu of stand-alone battery powered CO alarm devices in the locations specified in Section 915.2 where any of the conditions in Sections 915.1.2 through 915.1.6 exist.
- 8) The following applies to combination CO/smoke alarms and CO/smoke detection:
  - a) Combination CO/smoke alarms shall be an acceptable alternative to CO alarms. Combination CO/smoke alarms shall be listed in accordance with UL 217 and UL 2034. (Section 915.4.4)
  - b) Combination CO/smoke detectors installed in CO detection systems shall be an acceptable alternative to CO detectors, provided that they are listed in accordance with UL 268 and UL 2075. (Section 915.5.3)
- 9) The inspection, maintenance and testing of CO alarms and CO detection systems per Section 915.6 shall be maintained in accordance with NFPA 72, Chapter 14 and NFPA 720, Chapter 8. Any CO

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alarms and CO detectors that become inoperable or begin producing end-of-life signals shall be replaced.

- 10) The operation, installation and placement of CO alarms and CO detection devices shall be in accordance with NFPA 72, NFPA 720 and the manufacturers' requirements.

**NFPA 72: NATIONAL FIRE ALARM AND SIGNALING CODE REQUIREMENTS AND NFPA 720 STANDARD FOR THE INSTALLATION OF CARBON MONOXIDE (CO) DETECTION AND WARNING EQUIPMENT REQUIREMENTS**

The purpose of CO detection systems shall be primarily to provide notification of predetermined exposure levels of CO. The basic functions of a complete signaling system shall comply with the requirements of NFPA 72 Including but not limited to Chapters 10, 18, 23 and 29 and NFPA 720 including but not limited to Chapters 4, 5, 6, 7 and 9 as follows:

**Installation and Design**

- 11) The requirements of the following shall not preclude the use of separate fire, life safety, and CO detection systems, provided that the systems do not generate simultaneous conflicting notification to building occupants or conflicting activation of safety functions.
- a) The features required for a protected premises CO detection system shall be documented as a part of the system design and shall be determined in accordance with [5.3.1](#) through [5.3.3](#). (NFPA 720 Section 5.3)
  - b) Features for required systems shall be based on the requirements of other applicable codes or statutes that have been adopted by the enforcing jurisdiction. (NFPA 720 Section 5.3.1)
  - c) Protected premises CO detection systems that serve the general CO alarm needs of a building or buildings shall include one or more of the following systems or functions (NFPA 720 Section 5.3.3):
    - i) Automatic alarm signal initiation
    - ii) Activation of CO safety functions
    - iii) Activation of alarm notification appliances
    - iv) Emergency voice/alarm communications
    - v) Activation of off-premises signals
    - vi) Combination CO detection systems
    - vii) Integrated systems
  - d) CO detectors shall be installed as specified in the manufacturer's published instructions in accordance with [5.8.5.3.1\(1\)](#) and [5.8.5.3.1\(2\)](#), or [5.8.5.3.1\(3\)](#) (NFPA 720 Section 5.8.5.3.1):
    - i) On the ceiling in the same room as permanently installed fuel-burning appliances
    - ii) Centrally located on every habitable level and in every HVAC zone of the building
    - iii) A performance-based design in accordance with [5.8.5.3.2](#)
  - e) Performance-based designs submitted to the authority having jurisdiction for review and approval shall include documentation, in an approved format, of each performance objective and applicable scenario, together with any calculations, modeling, or other technical substantiation used in establishing the proposed design's life safety performance. (NFPA 720 Section 5.8.5.3.2.1)

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- f) The authority having jurisdiction shall determine whether such identified performance objectives are appropriate and have been met. (NFPA 720 Section 5.8.5.3.2.2)
  - g) The authority having jurisdiction shall approve modifications to or variations from the approved design or design basis in advance. (NFPA 720 Section 5.8.5.3.2.3)
  - h) CO warning equipment shall be installed in accordance with the listing and manufacturer's published instructions. (NFPA 720 Section 9.3.2)
  - i) The installation of CO alarms or CO detection systems, or combinations of these, shall comply with the requirements of this chapter and shall satisfy the minimum requirements for number and location of CO alarms or CO detectors by one of the following arrangements (NFPA 720 Section 9.3.3):
    - i) The required minimum number and location of CO detection devices shall be satisfied (independently) through the installation of CO alarms. The installation of additional CO alarms shall be permitted. The installation of additional system-based CO detectors, including partial or complete duplication of the CO alarms satisfying the required minimum, shall be permitted.
    - ii) The required minimum number and location of CO detection devices shall be satisfied (independently) through the installation of system CO detectors. The installation of additional CO detectors shall be permitted. The installation of additional CO alarms, including partial or complete duplication of the CO detectors satisfying the required minimum, shall be permitted.
  - j) Alarms and detectors shall be replaced when either the end-of-life signal is activated or the manufacturer's replacement date is reached. (NFPA 720 Section 9.6.1.6)
  - k) Combination smoke/CO alarms shall be replaced when the end-of-life signal activates or 10 years from the date of manufacture, whichever comes first. (NFPA 720 Section 9.6.1.7)
  - l) Combination smoke/CO detectors shall be replaced when the end-of-life signal activates or when the manufacturer's replacement date is reached. (NFPA 720 Section 9.6.1.8)
  - m) The requirements shall not preclude the use of separate fire, CO, or other life safety systems provided the systems do not generate simultaneous conflicting notification to the building occupants or conflicting actuation of safety functions. (NFPA 72 Section 23.2.3)
  - n) Protected premises systems that serve the alarm and signaling needs of a building or buildings shall include one or more of the following systems or functions (NFPA 72 Section 23.3.3.1):
    - i) Automatic CO alarm and supervisory signal initiation.
    - ii) Actuation of CO notification appliances.
  - o) Fire alarm system processing for and occupant response to CO alarm signals shall be in accordance with the emergency response plan, evacuation plan, fire safety plan, or similar documentation. (NFPA 72 Section 23.8.4.9.2)
  - p) The boundaries of CO alarm notification zones shall be coincident with the area where the alarm initiation originated and other notification zones in accordance with the building's emergency response plan. (NFPA 72 Section 23.8.6.3.3)
- 12) Provision of Control Functions as follows:**
- a) System designers shall consider the spread of CO through an occupancy through the HVAC system. (NFPA 72 Section 17.12.9.1 and NFPA 720 Section 5.8.5.4.1)
  - b) Where provided, CO control functions shall comply with the requirements of NFPA 72 Section 21.7.6. (NFPA 72 Section 23.15.6)

### **Distinctive Audible and Visual Notification Devices**

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- 13) For the purpose of alarm annunciation, each floor of the building shall be considered as a separate zone. (NFPA 720 Section 4.12.5.1)
- 14) In combination CO detection systems, CO alarm signals shall be distinctive, be clearly recognizable, and take priority over signals associated with property protection. (NFPA 720 Section 5.8.4.6)
- 15) Combination CO detectors and visible notification appliances or combination CO alarms and visible notification appliances in sleeping areas shall be installed in accordance with the applicable requirements of NFPA 720 Chapters 5, 6, and 9. (NFPA 720 Section 6.5.5.7.1)
- 16) The boundaries of notification zones shall be coincident with the area where the CO alarm initiation originated and other signaling zones in accordance with the building's emergency response plan. (NFPA 720 Section 5.8.6.3.2)
- 17) When two or more alarms are installed within a dwelling unit, suite of rooms, or similar area, they shall be arranged so that the operation of any alarm causes all alarms within these locations to sound. (NFPA 720 Section 9.6.4)
- 18) The following requirements shall be provided for distinctive audio CO notification devices:
  - a) The designer of the audible notification system shall identify the rooms and spaces that will have audible notification and those where audible notification will not be provided. (NFPA 720 Section 6.4.1.4.1)
  - b) Audible alarm notification appliances for a CO alarm system shall produce signals that are distinctive from other similar appliances used for other purposes in the same area that are not part of the CO, fire alarm, or emergency communications system. (NFPA 72 Section 10.10.3 and NFPA 720 Section 4.6.2)
  - c) Where a CO detector or alarm is required by other codes or standards or by the authority having jurisdiction and where an audible signal is required, a distinctive signal pattern shall be required that is different from a fire evacuation signal. (NFPA 72 Section 18.4.3.1)
  - d) Audible notification appliances for alert and evacuation signal tones shall meet the requirements of 6.4.2 (Public Mode Audible Requirements), 6.4.3 (Private Mode Audible Requirements), 6.4.4 (Sleeping Area Requirements), or 6.4.5 (Narrow Band Tone Signaling for Exceeding Masked Thresholds), as applicable. (NFPA 720 Section 6.4.1.4)
  - e) All alarm-sounding appliances shall have a minimum rating of 85 dBA at 10 ft (3 m). (NFPA 720 Section 9.6.2.1)
  - f) The audible alarm signal for CO alarms shall comply with the requirements of NFPA 720 Section 5.8.6.5.1. (NFPA 720 Section 9.6.2.2)
  - g) Distinctively different audible alarm signals including combination system shall be provided for each of the following (NFPA 720 Section 9.6.3.2 and Section 9.6.6.2):
    - i) Fire alarms. A fire alarm signal shall take precedence or be distinctively annunciated over any other signal, even when the nonfire or CO signal is initiated first.
    - ii) Carbon monoxide alarms
    - iii) Other alarms
    - iv) In combination systems, the use of a common audible notification appliance shall be permitted if distinctive signals are obtained.
- 19) The following requirements shall be provided for distinctive visual CO notification devices:
  - a) The designer of the visible notification system shall document the rooms and spaces that will have visible notification and those where visible notification will not be provided. NFPA 720 Section 6.5.2.1)

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- b) Visible notification appliances shall be installed in the affected areas in accordance with NFPA 720 Sections 6.5 or 6.6 (NFPA 720 Section 6.4.2.5.2)
- c) Visual notification appliances used for CO signaling shall be as required by the emergency plan and the authority having jurisdiction for the area or building and shall not exceed 1000 cd effective intensity. (NFPA 72 Section 18.5.3.8 and NFPA 720 Section 6.5.3.4)
- d) The coverage area for visible occupant notification shall be as required by other governing laws, codes, or standards. Where the other governing laws, codes, or standards require visible occupant notification for all or part of an area or space, coverage shall only be required in occupiable areas as defined in NFPA 720 Section 3.3.19. (NFPA 720 Section 6.5.1.2)
- e) Combination CO detectors or alarms with visual notification appliances shall be located in accordance with the applicable requirements for the visual notification appliance and the applicable requirements for the CO detector or alarm of NFPA 72 Chapters 17, 18, 23, and 29. (NFPA 72 Section 18.5.5.8.2)

### **Supervisory Signals and Remote Monitoring**

**20)** The following requirements are listed in NFPA 72:

- a) When in accordance with the emergency response plan, evacuation plan, fire safety plan, or similar documentation, signals from CO detectors and CO detection systems transmitted to a fire alarm system shall be permitted to be supervisory signals. (NFPA 72 Section 23.8.4.9.1)
- b) Fire alarm system processing for and occupant response to CO alarm signals shall be in accordance with the emergency response plan, evacuation plan, fire safety plan, or similar documentation. (NFPA 72 Section 23.8.4.9.2)
- c) Where CO warning equipment is connected to a protected premises fire alarm system, receipt of signals shall initiate the signal required by NFPA 72 Section 18.4. (NFPA 72 Section 23.8.4.9.3)
- d) Operation of CO alarms or detectors shall not cause fire alarm or combination control units to actuate either protected premises or supervising station fire alarm signals. (NFPA 72 Section 23.8.4.9.4)
- e) Where CO alarm signals are transmitted to a constantly attended on-site location or off-premises location in accordance with NFPA 72 Chapter 23, selective public mode occupant notification shall be permitted to be limited to the notification zone encompassing the area where the CO alarm signal was initiated. (NFPA 72 Section 23.8.6.1.3)

**21)** The following requirements are listed in NFPA 720:

- a) CO alarm signals and CO detection system supervisory and trouble signals shall be distinctively and descriptively annunciated. (NFPA 720 Section 4.6.1)
- b) An audible notification appliance on a control unit, or on multiple control units that are interconnected to form a system, or at a remote location, shall be permitted to have the same audible characteristics for all alerting functions including, but not limited to, alarm, trouble, and supervisory, provided that the distinction between signals shall be by other appropriate means, such as visible annunciation. (NFPA 720 Section 4.6.3)
- c) Supervisory signals shall be distinctive in sound from other signals, and their sound shall not be used for any other purpose except as permitted in NFPA 720 Section 4.6.3. (NFPA 720 Section 4.6.4)
- d) Visible and audible indication of supervisory signals and visible indication of their restoration to normal shall be indicated within 90 seconds at the following locations (NFPA 720 Section 4.8.1):

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- i) Control unit for local CO detection systems
  - ii) Building command center for emergency voice/alarm communications systems
  - iii) Supervising station location for systems installed in compliance with NFPA 720 Chapter 7
  - e) All required annunciation means shall be located as required by the authority having jurisdiction to facilitate an efficient response to the situation. (NFPA 720 Section 4.12.3.2)
  - f) Signals from CO detectors and CO detection systems transmitted to another alarm system shall be as a distinct CO alarm signal unless otherwise required by the authority having jurisdiction. (NFPA 720 Section 5.8.4.7)
  - g) Where CO alarm signals are transmitted to a constantly attended on-site location or off-premises location in accordance with NFPA 720 Chapter 7, selective public mode occupant notification shall be permitted to be limited to the notification zone encompassing the area where the CO alarm signal was initiated. (NFPA 720 Section 5.8.6.2.2)
  - h) Systems requiring transmission of off-premises signals to continuously attended locations providing supervising station service (e.g., central station, proprietary supervising station, remote supervising station) shall also comply with the applicable requirements of NFPA 720 Chapter 7. (NFPA 720 Section 5.10)
- 22)** The performance, installation, and operation of CO detection systems at a continuously attended supervising station or a communications center and between the protected premises and the receiving station shall comply with the requirements of NFPA 720 Chapter 7 Off-Premises Signal Transmission including but not limited to the following:
- a) The requirements of NFPA 720 Chapters 4, 5, and 8 shall also apply unless they are in conflict with this chapter. (NFPA 720 Section 7.1.2)
  - b) The actuation of a CO detector or system shall be distinctively indicated as a CO alarm signal. (NFPA 720 Section 7.2.1.2.1)
  - c) Emergency Response Agency (ERA). Where a CO alarm signal is transmitted directly to a communications center, communications center personnel shall perform the following actions in the order listed (NFPA 720 Section 7.2.3):
    - i) Follow standard operating procedures
    - ii) Contact the responsible party(s) in accordance with the notification plan.
- 23)** CO warning equipment for residential occupancies shall provide a reliable means to notify the occupants of the presence of levels of CO that constitute a potential life safety risk and the need for action as a consequence of those levels in accordance but not limited to the following:
- a) Operation of CO alarms or detectors shall not cause fire alarm or combination control units to activate either protected premises or supervising station fire alarm signals. (NFPA 720 Section 9.6.7.1)
  - b) Where CO warning equipment is connected to a protected premises fire alarm system, receipt of signals shall initiate the signal required by NFPA 720 Section 9.6.2. (NFPA 720 Section 9.6.7.2)
  - c) Supervising Station Systems. CO warning equipment signals that are transmitted off-premises shall comply with the requirements of NFPA 720 Chapter 7 and the following (NFPA 720 Section 9.6.8.1):
    - i) Where required, immediately retransmit indication of the CO alarm signal to the communications center.  
Exception: The immediate retransmission shall be permitted to be delayed by not more than

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90 seconds where the jurisdiction permits the supervising station to first contact the protected premises to determine if the alarm was initiated by the activation of a test.

- ii) Contact the responsible party(s) in accordance with the notification plan.
- d) Remote annunciation from single- and multiple-station alarms shall be permitted provided the devices comply with 9.4.2.1 and 9.6.4. (NFPA 720 Section 9.7.2.2)
- e) Remote annunciation shall be permitted provided the signal is identifiable for the hazard it annunciates. (NFPA 720 Section 9.7.2.3)

**COMMERCIAL KITCHENS WITH FUEL FIRED APPLIANCES: NFPA 72, NFPA 720, NFPA 54: ANSI Z223.1–2024 NATIONAL FUEL GAS CODE, NFPA 96: STANDARD FOR VENTILATION CONTROL AND FIRE PROTECTION OF COMMERCIAL COOKING OPERATIONS AND INTERNATIONAL MECHANICAL CODE (IMC) REQUIREMENTS**

- 24) If the heat source is non-electric and open flames are used, a CO detector shall be installed in both the kitchen and dining areas. (NFPA 96 Section 9.3.7)
- 25) To supplement the function of the CO detection system, the following shall be provided as a means for proof of sufficient exhaust and/or control the potential spread of CO. The required kitchen appliance ventilation hoods must be in operation to safely remove CO. In the event of insufficient flow or failure of the ventilation, the system must be interlocked to automatically close the appliances natural gas supply piping Safety Shutoff Valve (SSOV) based on the following:
  - a) Lower exhaust air volumes shall be permitted during no-load cooking conditions, provided they are sufficient to capture and remove flue gases and residual vapors from cooking equipment. (NFPA 96 Section 8.2.2.3)
  - b) The exhaust fan shall be provided with a means so that the fan is activated when any heat-producing cooking appliance under the hood is turned on. (NFPA 96 Section 8.2.3.3)
  - c) Where corrosive or flammable process fumes or gases, such as carbon monoxide, hydrogen sulfide, ammonia, chlorine, and halogenated hydrocarbons, are present, means for their safe disposal shall be provided. (NFPA 54 Section 9.1.6.1)
  - d) Each of the appliances served shall be interlocked to the mechanical air supply system to prevent main burner operation where the mechanical air supply system is not in operation. (NFPA 54 Section 9.3.6.2)
  - e) Where a mechanical draft system is employed, provision shall be made to prevent the flow of gas to the main burners when the draft system is not performing so as to satisfy the operating requirements of the appliance for safe performance. (NFPA 54 Section 12.4.3.5)
  - f) Commercial kitchen exhaust hoods shall comply with the requirements of the International Mechanical Code (IMC). (IFC Section 606.1)
  - g) Commercial kitchen exhaust hood systems shall operate during the cooking operation. The hood exhaust rate shall comply with the listing of the hood or shall comply with IMC Section 507.5. The exhaust fan serving a Type I hood shall have automatic controls that will activate the fan when any appliance that requires such Type I Hood is turned on, or a means of interlock shall be provided that will prevent operation of such appliances when the exhaust fan is not turned on. (IMC Section 507.1.1)
- 26) As a potential additional support function or as an alternative option to proof of hood ventilation requirements above, consider interlocking the CO detection to automatically close the appliances natural gas supply piping SSOV based on the following:

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- a) Methods to limit the spread of CO including the following (NFPA 72 Section 17.12.9.1 and NFPA 720 Section 5.8.5.4.1):
- b) Activation of CO safety functions. (NFPA 720 Section 5.3.3 Item (2))
- c) CO control functions shall be permitted to be performed automatically. (NFPA 720 Section 5.11.1)
- d) A CO control function interface device shall be located within 3 ft (1 m) of the component controlling the CO control function. (NFPA 720 Section 5.11.2)
- e) The method(s) of interconnection between the CO control function interface device and the component controlling the CO control function shall be achieved by one of the following recognized means (NFPA 720 Section 5.11.8):
  - i) Electrical contacts listed for the connected load.
  - ii) Data communications over a signaling line circuit(s) dedicated to the CO detection or shared with other premises operating systems.
  - iii) Other listed methods

**ATTACHED/INTEGRAL ENCLOSED PARKING GARAGES: INTERNATIONAL BUILDING CODE (IBC), INTERNATIONAL FIRE CODE (IFC) AND INTERNATIONAL MECHANICAL CODE (IMC) REQUIREMENTS**

- 27) CO detection shall be provided in dwelling units, sleeping units and classrooms in buildings with attached private garages. (IBC/IFC Section 915.1.5) Exceptions:
  - a) CO detection shall not be required in dwelling units, sleeping units and classrooms without communicating openings between the private garage and the dwelling unit, sleeping unit or classroom.
  - b) CO detection shall not be required in dwelling units, sleeping units and classrooms located more than one story above or below a private garage.
  - c) CO detection shall not be required where the private garage connects to the building through an open-ended corridor.
  - d) Where a CO detector is provided in an approved location between openings to a private garage and dwelling units, sleeping units or classrooms.
- 28) Exempt garages. For determining compliance with Section 915.1.5, an open parking garage complying with Section 406.5 of the IBC or an enclosed parking garage complying with Section 406.6 of the IBC shall not be considered a private garage. (IBC/IMC Section 915.1.6)
  - a) Open parking garages shall comply with IBC Sections 406.2, 406.4 and 406.5. (IBC Section 406.5)
  - b) Enclosed parking garages shall comply with IBC Sections 406.2, 406.4 and 406.6. (IBC Section 406.6)
- 29) A mechanical ventilation system and exhaust system shall be provided in accordance with IMC Chapters 4 and 5. (IBC Section 406.6.2)
- 30) Mechanical ventilation systems for enclosed parking garages shall operate continuously or shall be automatically operated by means of carbon monoxide (CO) detectors applied in conjunction with nitrogen dioxide (NO<sub>2</sub>) detectors. Such detectors shall be listed in accordance with UL 2075 and installed in accordance with their listing and the manufacturer's instructions. Automatic operation shall cycle the ventilation system between the following two modes of operation (IMC Section 404.1):
  - a) Full-on at an airflow rate of not less than 0.75 cfm per square foot of the floor area served.
  - b) Standby at an airflow rate of not less than 0.05 cfm per square foot of the floor area served.

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- 31)** CO and NO<sub>2</sub> detectors installed in enclosed parking garages in accordance with Section 404.1 of the IMC 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. (IBC/IFC Section 915.6.1)