CO Detector Activation-- The New Nuisance Alarm?

by Lieutenant James T. O'Connor

Has the CO detector activation become the new nuisance alarm for FDNY units? Many would tend to believe so. Members have all responded to CO detectors that were sounding merely because the battery was low. Much of the public is ignorant regarding the functioning of these detectors. As first responders, we cannot allow ourselves to be equally as ignorant.

FDNY members are familiar with the insidious nature of carbon monoxide. It is the deadly nature of CO that compels members to treat these responses as the emergencies that they have the potential to become, as opposed to simple nuisances. There are now millions of CO detectors in the City of New York and the technology of the detectors themselves makes them very reliable devices. If they are alarming, the cause of the alarm must be investigated and not underestimated. This article will explain the CO detector and the reasons why it is a mistake to underestimate the danger of carbon monoxide.

Local Law 7, which went into effect on November 1, 2004, amended the New York City Building and Housing Maintenance Codes to require the owner of every dwelling who uses fossil fuel-burning equipment to provide and install at least one approved and operational CO detector. The CO alarms must be installed within 15 feet of the primary entrance to each sleeping room. This applies to multiple dwellings, as well as one- and two-family private dwellings.

The detector can be battery-operated or plugged into an electrical outlet, provided it is equipped with a battery back-up in case of power interruption. New and substantially altered buildings are required to have the units hard-wired into the building's electrical system. Many office buildings, hospitals and schools have interconnected detector systems that are combination CO and smoke alarms. Each will be described separately later.

The new law requires that each occupant be provided with operating instructions for the detectors. It seems, however, by the sheer number of calls to which FDNY responds that the occupants either have not received or not read the operating instructions. If they had, members would not be responding to the large number of low battery/malfunction calls.

The most common calls that units receive are for detectors chirping once every 15 to 30 seconds. The chirps are misconstrued by homeowners/tenants as an alarm. FDNY members take readings with the Gasalert Extreme CO monitor and show the worried party that the CO detector reads 0 ppm. Members generally recommend that the occupant replace the battery. We transmit the 10-38-1 and go 10-8. It is important to recognize what the different chirps and beeps of the detector actually mean and why FDNY's detector differs from the occupant's.

The majority of detectors available in New York City most often seen by FDNY are made by two companies--Kidde and First Alert. All must meet UL Standard 2034 (see Table 1). A chirp every 15 to 30 seconds in these detectors is meant to alert the occupant that the battery needs replacement.

Many Officers and Firefighters often share in the homeowner's confusion about these CO alarms and possible reasons for their activation. The large influx of low battery/malfunction alarms may lull operating units into a false sense of security when responding to these alarms. Always ensure that all FDNY members are wearing their SCBA when entering any occupancy for a CO detector activation.

Table 1

Detector response time requirements under UL2034:
- At 70 ppm, unit must alarm within 60-240 minutes.
- At 150 ppm, unit must alarm within 10-50 minutes.
- At 400 ppm, unit must alarm within 4-15 minutes.

When inspecting an occupancy that requires a CO detector, units are required to inspect maintenance records for the detectors. AFID is a good time to ensure that the occupants are knowledgeable about these alarms and what they should do in case of activation. This article will provide information about the most common detectors and how to differentiate between an alarm and a low battery/malfunction.

The silent killer

Carbon monoxide kills several hundred people and injures thousands each year in this country. It is the leading cause of accidental poisoning death in the United States. CO is only slightly lighter than air. (Molecular weight of CO is 28; air is 29.) Generally, it will mix readily with the atmosphere.

CO is a by-product of the incomplete combustion of fossil fuels. High levels of CO can arise from various sources, such as automobiles, furnaces, water heaters, fireplaces, wood stoves, charcoal grills, gas appliances, space heaters and portable generators. If these appliances are in good working condition with proper ventilation, gas is vented outdoors where it quickly dissipates into the atmosphere.

The malfunction or misuse of any of the above sources can lead to a deadly build-up of carbon monoxide in the home. (But even properly functioning appliances can create CO if too many are running at the same time in an enclosed area, competing for available oxygen.) Energy-efficient windows and better-insulated new homes will exacerbate the problem, promoting a build-up of this toxic gas.

Proper maintenance is the key to avoiding problems with CO-generating appliances. If it is determined that the gas-heating sys-

Concentration of CO in air (ppm)	Approximate inhalation time and symptoms developed in healthy adults
50 ppm	The maximum allowable concentration for continuous exposure for healthy adults in any eight-hour period, according to OSHA.
200 ppm	Slight headache, fatigue, dizziness, nausea after two to three hours.
400 ppm	Frontal headaches within one to two hours; life-threatening after three hours.
800 ppm	Dizziness, nausea and convulsions within 45 minutes; unconsciousness within two hours; death within two to three hours.
1200 ppm	IDLH (Immediately Dangerous to Life and Health)
1600 ppm	Headache, dizziness and nausea within 20 minutes; death within one hour.
3200 ppm	Headache, dizziness, nausea within five to 10 minutes; death within 25-30 minutes.
6400 ppm	Headache, dizziness, nausea within one to two minutes; death within 10-15 minutes.
12,800 ppm	Death within one to three minutes; within explosive range.

Note: *These times are based on the average healthy adult. Times for children and the elderly may be significantly lower.*

From Responding to *Routine* Emergencies, *by Battalion Chief Frank C. Montagna, 1999, Fire Engineering Books, page 198*

tem is responsible for the leak, a simple first question to ask the homeowner is if the heating systems/chimneys have been cleaned and serviced recently. Take readings on the top floor as gas heat-generated CO has a tendency to travel along the path of the radiators. A common cause of CO leaks is faulty ductwork improperly installed during renovations to a home involving gas/hot water heaters or appliances.

The occupant often can provide clues about the origin of the CO leak. Asking the following questions might help locate the source:

- Have you noticed a decrease in hot water supply?
- Is your furnace running constantly or unable to heat the house?
- Have you noticed an unfamiliar odor, especially when just entering the home?
- Is the furnace flame yellow or orange?
- Have you noticed soot anywhere on or near appliances?

If there is no CO according to Fire Department CO detectors, but the occupant's detector continues to show elevated readings, members can suspect that the levels that activated the detector have dissipated. The sensor within the detector probably has not yet cleared (because of an open window, etc.), a malfunction or a false positive reading. There are many substances that will give a false reading on a detector. Fumes from fresh paint, floor refinishing and floor or furniture stain can affect the detector by contaminating the sensor. Simple household items, such as hair spray, aerosols, alcohol-based products, perfumes and after-shaves, some cleaning agents and even methane gas from a diaper pail, can detrimentally affect the sensor of the unit.

Carbon monoxide detectors measure CO continuously and over a period of time. This may lead to a false reading if the detector is situated in the kitchen or near the furnace or garage. CO is emitted in small amounts as a natural by-product of gas-cooking appliances, exhaust from automobiles (especially when cold starting) or firing of burners, which can coat the sensor if the detector is situated too close to these appliances. The sensor eventually will reach alarm levels and activate although there really is not a high level of CO in the occupancy.

This may be the reason the gasalert detector detects no readings when FDNY arrives. FDNY detectors measure CO that is immediately in the atmosphere. It does not measure cumulatively as the home detectors do. It is recommended that detectors be placed approximately 15 to 20 feet from such appliances to avoid unwarranted alarm activation.

If the detector is continuing to activate and none of the above conditions exists to explain the activation, suspect a detector malfunction and have the occupant call the manufacturer and state the serial number posted on the unit. If the detector has malfunctioned, it is the responsibility of the owner to replace the unit.

Often, simply re-setting it will silence an operative alarm. If the CO levels have dropped, the alarm no longer will activate. To re-set most detector models, the re-set/test button must be held between five and 30 seconds. The alarm will resound after four to six minutes if CO is still present within the unit's alarm range.

Types of detectors and activation

There are several types of activation that members will encounter in the field. Figure 1 shows the most common detector, battery-operated with no digital display. (See Figure #1.) One chirp every 15 (Kidde) to 30 (First Alert) seconds indicates a low battery. One chirp every 30 seconds in the Kidde models indicates a malfunction of the unit.

An actual CO alarm is indicated by a series of four beeps, followed by several seconds of silence and then another series of four chirps. This cycle repeats until it is re-set or the CO levels drop. On many models, you may see the words, "move to fresh air" beneath one of the red LED lights that flash during an alarm. This is a warning for the *occupants* to move to fresh air, ***not move the detector to fresh air***. To silence the alarm, use the reset/test button.

Figure #1--A battery-operated carbon monoxide alarm with no digital display.

all photos by or courtesy of Lieutenant James T. O'Connor

Another popular type of detector is electrically powered with or without a battery back-up. It has an LED and some have a digital display. (See Figure #2.) The display will show the CO reading in parts per million (ppm). The display will operate on back-up battery power (if equipped) when unplugged or power is interrupted, but only for a short period of time (usually fewer than 20 hours).

It is imperative that occupants realize that these types of detectors must receive electric power as soon as possible. These models should not be plugged into an outlet controlled by a wall switch to avoid accidentally turning the unit off. They are not designed to run on battery power alone. When running on battery back-up power, the numbers on the display will not operate unless there is a CO reading. This is the unit's way of conserving power.

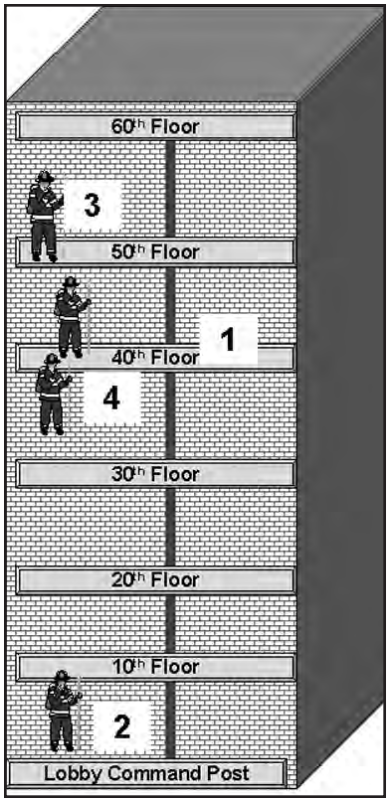
If the unit was unplugged and the battery begins to lose power, the digital display will show "Lb" (Kidde) or "bat" (First Alert). A low back-up battery will cause the unit to chirp every 15 to 30 seconds. In the First Alert models, "bat" will flash. If the battery is close to dying, an alarm will sound (usually three chirps).

If there is a malfunction of the unit, the display will show "Err" and chirp every 30 seconds while plugged in and receiving power. If this condition is noted, explain the reason to the occupant and have the occupant call customer service (the phone number is on the back of the detector) and/or replace the unit.

When the unit is operated on temporary battery power, an "Err" still may show on the display, even if the battery is good. This serves to remind occupants to supply electric power as soon as possible. If there is no numeric display or LED dot and the unit is sounding an alarm, suspect a completely dead battery or a malfunction.

Figure #2--An electrically powered detector, featuring a digital display.

According to Local Law 7 of 2004, all new and significantly altered buildings are required to have their detectors hard-wired into the building's electrical system. A particular type of hard-wired detector is the inter-connected installation commonly found in hospitals, schools, group homes and similar occupancies. (See box on page 40.)



(***Hart,*** continued from page 37)

After the second Battalion Chief arrives and as additional Chiefs arrive, Post radios are taken to their respective posts. Communications on the command channel can be conducted "post to post." 1 = Operations Post; 2 = Lobby Command Post; 3 = Search & Evacuation Post; and 4 = Staging.

leaves the lobby for the upper floors, the Chief then shall take his/her Post radio to the upper floors and establish the Operations Post. The engine Officer performs regular assigned duties.

Note: There are times when a vehicle repeater may not be used at a high-rise fire. This would be when there already is a high-rise operation using a repeater or there are no vehicle repeaters available. At operations such as these, *post to post* communications shall be used.

Although the Post radio was created out of a necessity to improve high-rise communications, applications for its use have been numerous. The primary design was for high-rise buildings. Other uses for the Post radio are large gatherings or incidents that require FDNY units to be deployed over an extensive area. Some examples of this are street fairs, New Year's Eve in Times Square, airports, large brush fires, sporting events at stadiums and parades. Because of the Post radio's signal strength, FDNY teams can communicate with each other via selected channels over long distances. This is something that cannot always be done with handie-talkies, even when using a five-watt channel. Post radios now are carried by all Battalions, Divisions, Field Comm, Haz-Mat and EMS Chiefs.

The concept of the Post radio can be thought of as a home-grown tool. The need was there and the creative talents of the uniformed members were largely responsible for devising the radio and instituting a set of procedures that greatly enhance high-rise communications. Firefighters and company and Chief Officers spent days, nights and weekends testing and drilling with the radio. A debt of gratitude is owed to Captain Stein and the many members of the 1st and 3rd Divisions, whose participation in testing the Post radio contributed to the success of the program.

Note: Research currently is underway to make some possible design changes to the Post radio. These would include a lighter battery and a new bi-directional antenna. However, the basic deployment and use of the Post radio will remain the same.

About the Author...

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Local Law No. 7 of 2004 amended the New York City Building Code and Housing Maintenance Code to require carbon monoxide (CO) detectors in private residences, multiple dwellings and educational and institutional occupancies that utilize fossil fuel-burning furnaces, boilers or water heaters or other fossil fuel-burning equipment. Fossil fuels include coal, kerosene, oil, wood, fuel oil and other petroleum-based products.--*Fire Prevention Manual,* chapter 12, FPIB 40

Many are combination smoke/CO detectors. (See Figure #3.) When one unit senses either CO or smoke, all of the units activate to warn occupants of the danger.

An amber LED will illuminate on the original activating alarm to show where the alarm originated. Again, an alarm of four successive beeps, followed by five seconds of silence, indicates a CO alarm. In comparison, three long beeps and one second of silence indicates a smoke alarm.

Reducing the nuisance

All detector sensors reach a point after which they must be replaced. Many of these units are designed to alert occupants of the need to replace the unit--in most cases--by a chirp every 30 seconds. First Alert has a shelf life of five years. Many of the Kidde units are pre-programmed to alarm between five and seven years after initial power up.

FDNY members must take the time to learn to recognize the types of detector and alarm patterns. The technology is continually developing and changes are inevitable. It is important for members to stay current on the operation of these detectors. Unless members remind the occupants how to address a chirping or alarming detector, they will have a couple of very busy years in 2009 and 2011, responding to all the chirping alarms that will need replacement.

Figure #3--A combination smoke/CO detector, frequently found in hospitals, schools and similar occupancies.

Take the time to help the public understand their CO detectors by explaining the difference between low battery/malfunction chirps and full-alarm mode. Remind them to call 911 if the detector is alarming as described above or if anyone is feeling the symptoms of CO poisoning. Have them take action by venting, turning off gas appliances and leaving the affected area. Addressing the misconceptions and ignorance about these detectors will increase safety and significantly reduce the number of "nuisance" alarms.

Members are urged to review the following:
- FP Manual, chapter 12, FPIB 40, for more information about the CO Detecting Device Act of 2004. (See excerpt above.)
- Fire Tactics and Procedures, Hazardous Materials, chapter 4.
- Part Two of *Responding to* Routine *Emergencies,* by Battalion Chief Frank C. Montagna, 1999, Fire Engineering Books.
- Communications Manual, 10-38 Signal, chapter 8, page 10.

About the Author...

Lieutenant James O'Connor was appointed in 1994 and currently is assigned to Ladder 150. Previous assignments include Engine 252 and Squad 252 in Brooklyn. He holds a BA degree in Multi-disciplinary Studies from Stony Brook University, with minors in Biology, History and Chemistry. This is his first article for WNYF.