Carbon Monoxide Alarms-- Case Studies

by Lieutenant Christopher Flatley

On November 1, 2004, the NYC Building and Maintenance Code was amended, requiring carbon monoxide detection in one- and two-family homes and multiple dwellings. Since Local Law 7 took effect, the FDNY has responded to thousands of detector activations City-wide.

There is a wealth of information now written on the subject of carbon monoxide detection, from *Fire Fighting Procedures*, HazMat 4, and several issues of *WNYF*. What is not immediately available are the lessons learned from the numerous responses. This article will capture some of that information and pass it along to FDNY members.

Battalion Chief Thomas Meara, *Battalion 9*, has supervised several interesting incidents with carbon monoxide responses. He offers his three favorites for discussion.

Units responded to a call for a CO alarm in a five-story, old law tenement (OLT). Tenants reported that a CO detector woke them up, but it had stopped ringing. They reported symptoms (headache, tired, etc.), but also said they got in from the bar at 0400 hours and were hungover. Members checked several apartments, hallways and basement, all recording 0 ppm.

Members returned an hour later for the same complaint. Again, 0 ppm was recorded. Later in the day, Firefighters were called for a CO condition. The original tenants now were at the emergency room and blood gas tests showed high CO levels. This time, every apartment was checked. (Earlier, some apartments had not been entered because tenants were not home.) Again, initial readings were 0 ppm.

One empty apartment did have a slight oil burner odor to it. While checking that apartment further, the oil burner kicked on and CO ppm in that apartment began to rise. Further investigation found a hole in the brick mortar, which was pushing oil burner exhaust into the apartment. CO was up more than 200 ppm in the area near the leak. This section of wall was part of the oil burner chimney and the hole looked like a nail hole. This apartment had no CO detector. The hole was filling the apartment with CO whenever the oil burner kicked on and CO then filtered into other apartments.

The draft inducer pictured is a device to assist with the drafting of flue gases up the chimney. The counterbalance weight pictured on the right side opens the flap to create a draft. The electrical component above is a roll-out switch. The switch will shut down the boiler if it becomes overheated, indicating that hot flue gases are escaping through the inducer.

The previous night was very cold and the oil burner probably was running all night and CO filled the building. It warmed up during the day, so the oil burner wasn't running when members investigated earlier.

Lessons learned

- Members may need to recreate conditions as they were when the detector activated to determine the source of the CO.
- CO detectors are required in every dwelling unit where fossil fuel heating equipment is used.

In the second incident, members responded to a CO alarm in the same OLT three or four times at approximately the same time (around 0430 hours). Each time, CO meters registered 25 to 30 ppm on Firefighters' arrival, but levels dropped quickly. Violation orders (VOs) to have the oil burner and chimney checked were given and they were found to be okay. Members responded again and this time, forced their way into a deli on the first floor. Members found levels in the kitchen and eventually determined they were from a deep fat fryer that operated on a timer to get fat hot before the deli opened, but before the staff arrived to turn on the exhaust hood.

Lesson learned

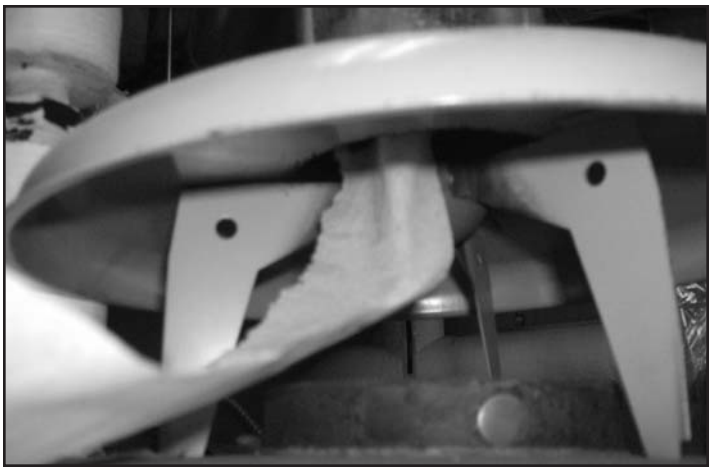
- No cooking equipment is to be operated without the exhaust hood turned on.

The third incident prompts members to look past the obvious. There have been a couple of serious incidents on the Upper East Side due to blocked chimneys. Engine 39 responded on an EMS run a few years ago and found several people passed out in the hallways of a brownstone. A couple of these incidents have been in buildings that recently converted from oil to gas.

I have been told that when a building converts from oil to gas, building management usually needs to install a sleeve in the chimney. If not done, the exhaust may not have the velocity to overcome the stack effect on some days. Additionally, the gas exhaust is drier than the oil burner exhaust and can dry out scale on the interior chimney wall if the chimney hasn't been sleeved or thoroughly swept. This dried-out scale will drop and eventually can block the base of the chimney if it is not cleaned out. I believe this led to the local law requiring CO detectors.

Using a piece of tissue paper, Firefighters can check for a blocked or obstructed chimney or one that is not drafting properly. Place the tissue near the draft hood. If the chimney is drafting properly, the tissue should almost get sucked up into the chimney.

Battalion Chief Richard Callery, Battalion Commander, *Battalion 21*, recaps operations at Box 402 on September 27, 2006, and the lessons of his units.



This water heater has a draft hood. With a piece of tissue paper, Firefighters can check for draft when the unit is operating. If the unit is drafting properly, the tissue will be drawn up the flue pipe.

Engine 153 and Ladder 77 responded to a report of a CO detector activation at 80 Longpond Road. On arrival, Ladder 77 found elevated CO readings (more than 100 ppm) in the building, an attached townhouse-type private dwelling. Engine 153 was informed of a car running in the attached building's garage. The occupant who initially responded to the doorbell at 80 Longpond now was unresponsive.

Ladder 77 members, believing the occupants of 82 Longpond Road were in danger, forced the garage door. Upon opening the garage, Ladder 77 found the occupant lying on the floor of the garage, not breathing. Engine 153 quickly transmitted the Box and began CFR-D aid on the victim. Ladder 77 members continued to search the building and found two additional occupants--not breathing--on the top floor and removed them from the building.

When Battalion 21 arrived, all three victims were being worked on in the street by both Engine 153 and Ladder 77 members. Because of their efforts, all three victims were breathing when EMS personnel arrived on-scene and removed the victims to St. Vincent Hospital. The quick and coordinated efforts by Engine 153 and Ladder 77 members at this Box led to saving three lives that surely would have succumbed to CO poisoning.

Lesson learned

- Not all CO alarm activations are for problems in the building from which the alarm was generated. Units might have to check attached buildings for overcome occupants and defective appliances.

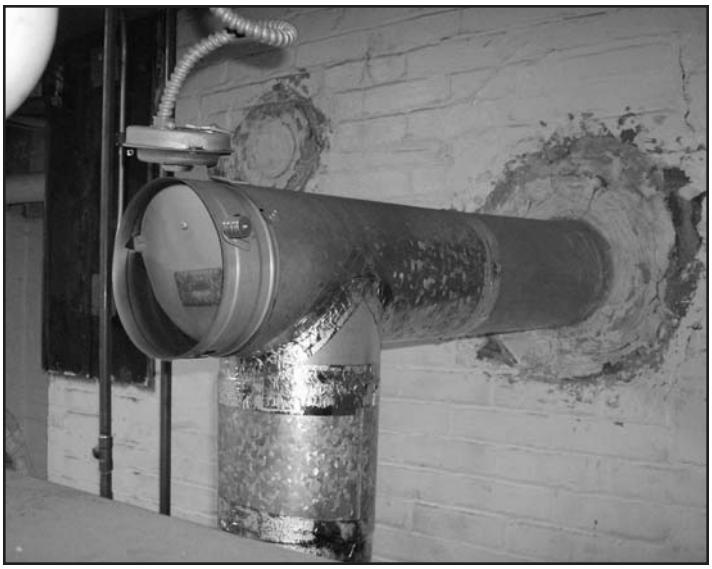
Battalion Chief William Donleavy, *Division 7*, while working in *Battalion 15*, describes an odd CO incident.

On November 7, 2009, Engine 63 received an EMS run for an unconscious person at 4173B Hill Street. On arrival, Lieutenant Eugene Moore, Battalion 27, was met at the front door by an occupant who stated that her 17-year-old nephew was unresponsive. While speaking to her, the Lieutenant's CO meter started to alarm.

Lieutenant Moore advised his members of the situation and ordered the ECC to transmit the Box due to the high levels of CO. The Officer and his members donned SCBA and entered the building to search for the victim.

The occupant was found in the top-floor bedroom. A check of the CO meter recorded readings of between 450 and 500 ppm. Lieutenant Moore ordered his members to remove the victim to the front porch and begin CPR.

At this time, the first-alarm units began to arrive. I assumed command and ordered all members to operate with SCBA. Ladder 39 was directed to search the original building and Ladder 51 to search the exposures.



A draft inducer can be placed in-line or used as an elbow. In this installation, the draft inducer is placed at a right angle to the chimney.

A total of three victims were removed from the premises. They were transported by EMS personnel to Jacobi Hospital, where the 17-year-old ultimately succumbed to CO poisoning.

While searching the original building, Ladder 39 investigated the boiler, which was cherry red and shut down. I requested an inspector from the Buildings Department to respond. The Building Inspector examined the boiler and reported the automatic water feed was shut off and several other *repairs* were made, causing the boiler to malfunction. Later, it was learned that a member of the family was responsible for the work.

Lessons learned

- Unconscious individuals may not be unconscious from medical issues; there may be environmental concerns to consider when evaluating scene safety.
- Ensure members wear proper PPE for the environmental issues.
- CO in high concentrations can be flammable. Only metering can determine if Firefighters are approaching the lower explosive limit (LEL).
- The lower explosive limit of CO is near 1200 ppm.
- Members should always carry the CO detector on the handie-talkie, not the SCBA. As in this case, members may not have entered the premise with SCBA, but Firefighters will always have their radios.

Then-Battalion Chief Kevin Woods, *Battalion 1*, contributes this story about an incident at a Verizon location that involved the battery storage room. The following is his unusual occurrence report to the Chief of Operations.

On June 8, 2009, Battalion 1 responded to 54 Laight Street (a five- story, 75- by 100-foot, Class 3 structure) for a report of overheated batteries in a Verizon equipment building. Upon investigation, units encountered a battery storage room in the cellar with racks of batteries--for the uninterrupted power supply--registering temperatures higher than 160 degrees Fahrenheit (from the overheating batteries) and carbon monoxide levels approaching 500 ppm in the cellar (due to the boiling battery acid). Normally, batteries should be approximately room temperature.

Carbon monoxide levels were higher than 200 ppm on all floors throughout the building. Five workers were evacuated from

Members are urged to review the following references:
- "CO Detector Activation--The New Nuisance Alarm?," by Lieutenant James T. O'Connor, in the 1st/2007 issue of *WNYF*.
- "The Hazards of Carbon Monoxide," by Lieutenant Richard Curiel, in the 3rd/2009 issue of *WNYF*.
- "Carbon Monoxide Investigations--They May Not Be Routine Calls," by Lieutenant Christopher Flatley, in the 3rd/2009 issue of *WNYF*.
- *Firefighting Procedures*, Haz-Mat 4, Carbon Monoxide.
- *EMS CME*, July 2009, Article 1, Molecular Killers.

the building as units ventilated and continued to monitor. At this time, Haz-Mat 1, Squad 18 (Haz-Mat Tech Unit) and the Haz-Mat Battalion, along with a Verizon representative, were requested to respond. Throughout the operation, carbon monoxide levels elevated to 1100 ppm and the temperature of the batteries reached 186 degrees Fahrenheit, approaching the lower explosive limit.

The electricians and battery mechanics could not operate until ventilation procedures were implemented and atmospheric conditions were safe. It took several hours for levels on the first floor to drop in order for electricians to physically disconnect cables from the first-floor rectifiers that were connected to the battery room below.

A simple direct current (DC) disconnect at the location of the batteries could have prevented increased carbon monoxide levels, discharge of hydrogen gas and a possible explosion and release of sulfuric acid from the overheated batteries that continued to cook until the cables were disconnected. Also, the electricians had to operate with live electric. FDNY units operated for more than seven hours at this incident.

With the increased use of battery racks throughout New York City, some measures to consider in regard to battery rooms include:
- Remote DC disconnect for batteries.
- Hydrogen detection device that is connected to a Class 3 system.
- Carbon monoxide detection connected to a Class 3 system.
- Heat detection connected to a Class 3 system.
- Sprinkler protection.
- Ventilation system.

Many buildings throughout the City have uninterrupted power supply (UPS) systems for their computer networks. These UPS systems are battery-powered systems, designed to prevent a surge or dip in power when a building loses utility company power and before the back-up generator comes on-line and picks up the load. The location of UPS systems should be noted on CIDS.

Conclusion

These are just a few of the many lessons learned from a variety of incidents throughout the City. Members with skill sets from a previous life or from certifications held outside the job often are important resources in early identification of potential hazards, especially when the cause of the CO is not obvious. Carbon monoxide has been called the *silent killer*. By sharing the lessons learned, we don't need to be silent about what we have learned.

Officers involved in these unusual occurrences are encouraged to gather as much information as possible and use mechanisms, such as the *Pass It On Program* (ABC 1-97), to share that information with all members of the Department. The author thanks all those who contributed their stories to improve the response of the FDNY to these potentially lethal events.

About the Author...

Lieutenant Christopher Flatley is a 21-year veteran of the FDNY. He is assigned to Tower Ladder 21. Previously, he was assigned to Ladder 2. He is a nationally certified Fire Instructor I and has written articles for several other fire service publications, including Fire Engineering. *He writes frequently for* WNYF.

Taking Up

April -June, 2010

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Battalion Chiefs

Michael P. Borst	Battalion 51
Jack Taddeo	Battalion 8

Captains

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Daniel J. McGovern	Ladder 144
Joseph Petrucci	Engine 263
Robert D. Sohmer	Ladder 85
Thomas J. Thompson	Engine 306

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Stephen J. Carbone	Engine 307
Brian K. Fitzpatrick	Battalion 23
Kevin A. Griffith	Ladder 106
Mark S. Kurtz	Engine 297
Patrick G. Martin	Engine 305
Brian A. McConville	Battalion 46
Stephen E. McNally	Battalion 18
Anthony W. Mikolich	Ladder 155
Patrick D. Murphy	Ladder 135
Anthony T. Nicosia	Ladder 82
Steven J. Nuzzo	Battalion 17
Paul D. Rhodes	Ladder 118
Giancarlo Sini	Engine 163
Stephen J. Wall, Jr.	Engine 42

Firefighters

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Frank E. Barton	Battalion 23
James M. Brzezinski	Ladder 40
Michael A. Callahan	Ladder 26
Joseph D. Cicha	Ladder 104
Anthony S. Cittadini	Ladder 85
Kenneth M. Collins	Engine 216
James G. Corley	Ladder 14
Brian T. Daly	Ladder 173
James Donnelly	Ladder 8
Robert B. Fitzgibbon	Engine 47
Garry G. Giannandrea	Battalion 52
Daniel P. Gilmore	Engine 299
Brian S. Glenn	Ladder 151
John M. Gorman	Ladder 166
Alexander Gryner	Rescue 3
Robert H. Halliday	Ladder 162
Hugo S. Herold	Battalion 13
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Edward Immel	Engine 303
Stephen R. Incarnato	Engine 268
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Robert W. Kelly	Ladder 110
Michael P. Kennedy	Ladder 43
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Mark P. Koetzner	Ladder 143
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John C. Maloney	Engine 250
John G. McAuliff	Ladder 152
Scott D. McClennan	Engine 62
Richard T. McMahon, Jr.	Ladder 146
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Dominic V. Nolan	Engine 71
Kevin R. Nolan	Engine 247
Gregory A. Patsos	Squad 252
Richard R. Pearsall	Engine 233
Kirk T. Pritchard	Ladder 1
Chris Robinson	Engine 286
Michael T. Satriana	Engine 246
Paul M. Scalard	Engine 81
Neil C. Schoer	Engine 164
Jason A. Silver	Engine 307
Harry F. Stefandel	Engine 221
James T. Sullivan	Ladder 142
Charles C. Thompson	Ladder 167
Damean A. Timm	Ladder 48
Robert J. Tomasulo	Engine 239
Dominick A. Tralli	H-M Battalion
Joseph F. Walsh, Jr.	Engine 290
Drew S. Williams	Engine 274
Michael Wolyniec	Ladder 150
Douglas J. Yenzer	Engine 286