

What You Should Know About 10-25 Responses

by Battalion Chief Frank C. Montagna

FDNY units are dispatched to a reported smoking manhole. When they arrive on the scene, black smoke is boiling out of a round manhole in the middle of the street. The cover is dislodged, but partially covering the opening. Lights flicker in the nearby houses. Bystanders in the street talk excitedly and point to the smoking manhole. One of them tells the Battalion Chief that he heard a loud explosion that shook his house, breaking his front window. Then, his lights started blinking. When he came outside, he saw the smoking manhole and called the Fire Department. He asks the Chief if it is okay for him to go back into his house.

As the Incident Commander (IC), do you know enough about the dangers associated with the underground electric system to accurately answer the following questions?

- What hazards are associated with a smoking manhole?
- What precautions should you take?
- What actions should you take?
- What help do you need?
- Should you let the homeowner re-enter his house?

Con Edison's underground electrical system

In Consolidated Edison's (Con Ed or Con Edison) electrical

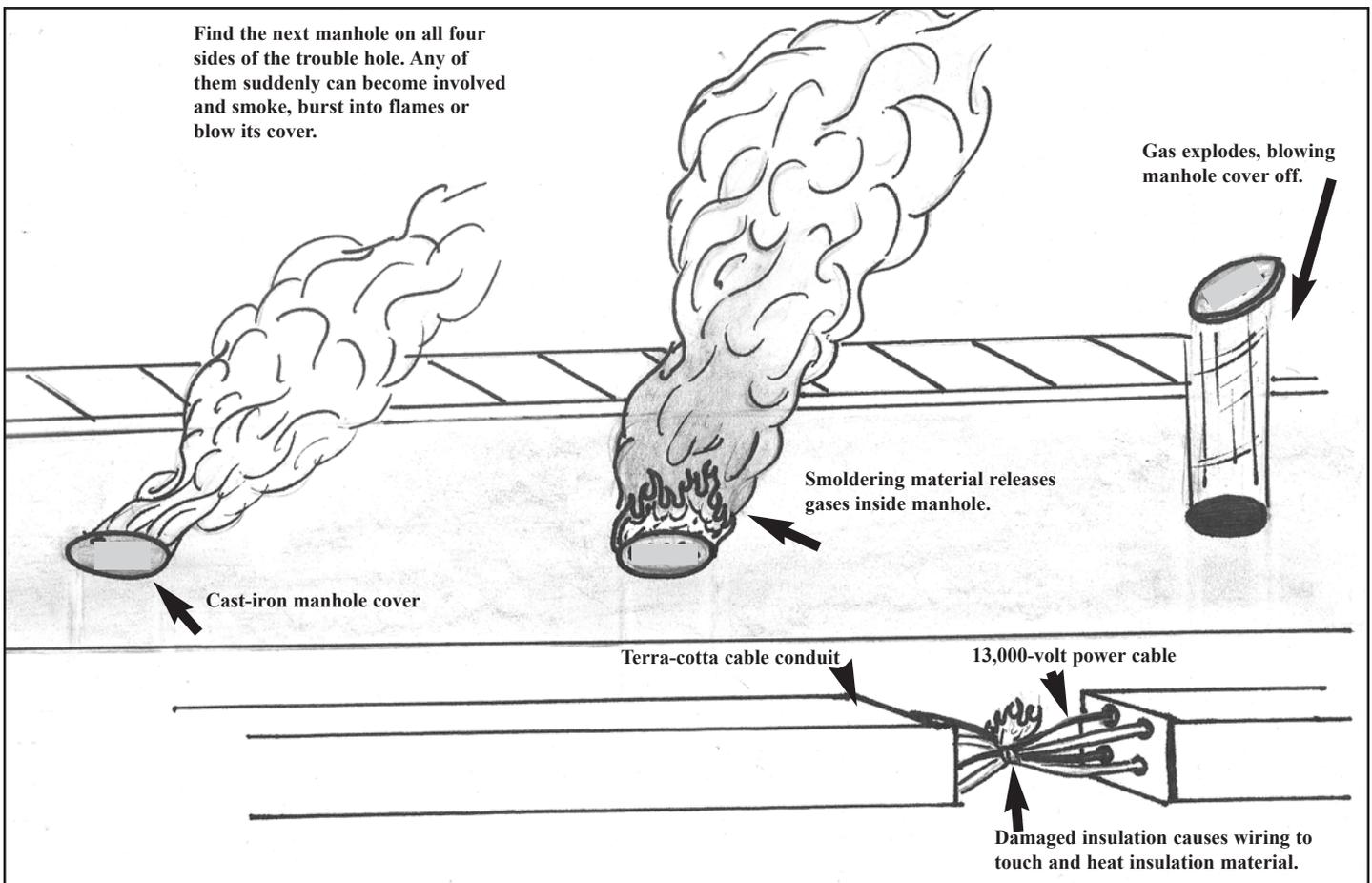
system, there are 30,000 miles of high-voltage primary feeder cable carrying 4kv, 13kv or 27kv of alternating current (AC), as well as 60,000 miles of low-voltage secondary cable carrying 120v to 125v. Direct current (DC)--still supplied in some areas of Brooklyn and below 135th Street in Manhattan--is used mostly to run older elevators. In these areas, a manhole may contain high and low voltage alternating and direct current.

Electric manholes

Electric manholes are large vaults in the ground and can be found both under the street and the sidewalk. The covers can be round, square or rectangular in shape. They are interconnected by ducts through which cable passes into other manholes, as well as out to above-ground structures. These ducts permit the migration of water, air and gases between manholes.

Transformers

Some manholes contain transformers. They are found in large rectangular-shaped underground vaults located under the street or sidewalk. Transformers must be vented, so they typically have grated covers. Used to step up or down voltage and carry high



artwork by FF Christopher Callan

voltages, they are filled with as much as 500 gallons of flammable oil, which acts both as an insulator and a coolant. The ignition temperature of the oil is 295 degrees Fahrenheit.

The older transformers were contaminated with polychlorinated biphenyls (PCBs). PCBs are a suspected carcinogenic which, when burning, produce dioxins, which are a known carcinogen. Con Edison is retro-filling these older transformers. However, members may encounter transformers that are not owned and, therefore, not retro-filled and serviced by Con Ed. These may contain PCBs. To avoid unpleasant surprises, members should treat all transformers as PCB-contaminated until verified otherwise.

In certain areas, the overhead and underground systems are interconnected by a conduit that runs up the side of an electric pole. Electrical problems in either the overhead or underground system can spread via this conduit.

Manhole fires

The vast majority of the 10-25s FDNY members respond to harm no one and quickly are brought under control by Con Edison personnel. At these incidents, the Fire Department operation entails little more than taping off the area, keeping vehicles and pedestrians out of the danger zone, checking nearby buildings for carbon monoxide (CO) and fire extension and waiting for Con Edison personnel to indicate that the hazard is mitigated. This fact may lead members to believe that these are *routine responses*. Don't be fooled. There are a number of serious hazards associated with manhole fires that must be considered before taking action at these incidents.

Hazards

Toxic/Explosive Smoke: The smoke from a manhole fire is both toxic and potentially explosive. The fire burning in the manhole and/or in the conduit underground is oxygen starved, so the resulting smoke is high in toxic carbon monoxide. This toxic gas can and has made many people ill, even killing unsuspecting building occupants.

The explosive range of CO is 12.5 to 74 percent. These levels can be reached at manhole incidents and, as a result, explosions may occur at any time in the manhole. Because manhole smoke can disperse via an underground conduit into nearby buildings and structures, CO explosions can occur in buildings as well. The CO-laden smoke also can enter the sewer system, telephone vaults, travel along telephone conduit into buildings or infiltrate the ground and migrate through the dirt into structures.

Some older ducts are made of wood and can ignite and smolder underground, causing high CO levels in the duct, even after the manhole fire has been extinguished. Whenever more than three manholes are involved in an electrical event, Con Edison notifies its gas department to monitor for CO.

10-25 Manhole or Transformer Fire or Emergency
 Any kind of manhole or transformer fire or emergency.
Without Code: Situation other than as described in Codes 1, 2, 3 or 4.
Code 1: Fire has extended from a manhole or conduit into a building.
Code 2: Fire has blown one or more manhole covers or smoke is issuing from a manhole under pressure.
Code 3: Smoke is seeping from a manhole.
Code 4: Fire or smoke condition from a transformer at any location; i.e., pole, vault, room, etc.
 Note: Utility company will dispatch an emergency crew immediately upon receipt of a Code 1 or Code 4 signal.

CO Explosions: They have been triggered in electrical service boxes in structures during a manhole fire when an attempt was made to open the house main. A spark is generated by opening the main or pulling the meter, which--under the right conditions--can and has resulted in explosions. Explosions have occurred in nearby light poles, traffic control boxes and sewers as a result of the movement into and ignition of CO in these structures.

Manhole Explosions: Such events may result in shattering nearby windows. Members should take positions that shield them from falling glass.

Wire Insulation: The insulation is made of ethylene propylene rubber (EPR), a substance that is similar to polyvinyl chloride (PVC). When burning, it adds to the toxic witches' brew that comprises the smoke from a manhole fire.

Primary Cable: In manholes, the cable usually is covered in a white wrapping called arc proofing, which acts as a fire retardant. The older type of arc proofing can be asbestos-containing material (ACM). If the hole contains older feeder cable, it may contain asbestos. An explosion before or after FDNY arrival may release ACM into the air, transforming it into an asbestos incident.

Manhole Covers: The covers can weigh as much as 300 lbs. They can be blown into the air with little or no warning. As a result of an explosion, they have been found on the roof of a six-story building and others have crashed down on passing vehicles. In one instance, the cover was blown into the air where it hit overhead wires, bounced off them and then came crashing back down to the ground.

Additionally, an explosion in a manhole can cause rocks, pebbles and other debris embedded in the cracks around the cover to become dangerous projectiles that can injure anyone near the hole. There have been instances where exploding manholes have flipped over cars parked above them. As the result of an explosion in a manhole, part of the subsurface vault can be pushed up above the surface as if an earthquake had occurred.

Transformers: These can fail internally, sometimes violently. A violent rupture of a transformer can spray burning oil out onto the surrounding area. It is also possible for parts of the damaged transformer to be projected from the vault. Since there is always the possibility that the oil contains PCBs, it must be treated as a haz-mat incident until responding utility personnel or environmental agency representatives sample it and determine it to be non-hazardous oil.

As a result of a rupture or leak, the coolant oil can ignite. If the burning oil is PCB-contaminated, dioxins will be entrained in the smoke. It is also possible for some feeder cables to contain a small amount of PCB-contaminated coolant oil, so PCBs may be present even if a transformer is not involved. Again, treat all manhole fires as PCB incidents until informed otherwise by Con Edison or environmental agencies.

Fire in a Manhole: Typically, FDNY members are called to these incidents when someone hears an explosion or sees smoke or fire emanating from the hole. This may be accompanied by a local or widespread power disruption. On arrival, members may see wispy white smoke drifting out of the manhole, heavy black smoke pulsating out under pressure, flames coming

Manhole, Service Box or Vault Fires/Explosions

Year	Incidents
1999	2062
2000	2309
2001	3274
2002	2503
2003	4602*

* Includes 1264 incidents in which manhole covers blew off.

Data from Con Edison and FDNY seem to indicate a correlation between the amount of rock salt spread and an increase in the above kinds of incidents.

Recent Manhole Incidents

Week of March 7, 2004--A manhole fire on 44th Street--east of Times Square--forced the evacuation of several restaurants and halted traffic on the Times Square, Manhattan, block.

March 16, 2004--Two manhole fires in the East Village, Manhattan, spread into the basement of a building on Avenue B, near East 11th Street.

March 18, 2004--A manhole fire released high levels of carbon monoxide and forced the evacuation of 200 people from the Hunters Point Boulevard/31st Place area in Long Island City, Queens.

April 13, 2004--Manhole explosions ignited 20 to 30 feet of electrical cables, sending dangerous carbon monoxide fumes into Brooklyn homes, forcing the evacuation of more than 120 people and causing a partial loss of power on the block. The CO levels ranged from 100 to 1000 parts per million (PPM), above the safe level of 10 ppm.

September 20, 2004--A transformer vault fire with numerous blown manhole covers forced hundreds in the area of 306 West 38th Street/8th Avenue, Manhattan, to flee. Several people were injured.

from the manhole, a blown-off or dislodged cover or no indication at all that there is a problem in the manhole.

At manhole fires involving DC current, the DC current may be fed onto the AC service as a result of fire damage. Though not a common occurrence, the result could be fires in normally AC-powered appliances and equipment.

Be aware that conditions at manhole fires can change drastically without warning. A burning manhole may become inactive for a time, only to suddenly erupt into flames or blow its cover just when it seems that conditions are improving. FDNY members should never let their guard down at a manhole incident.

Tactics

When responding to a smoking manhole or manhole on fire, members always should stay away from the trouble hole and the holes on all sides of it. Additionally, members should stay upwind to protect themselves from any respiratory hazards and keep themselves and their Company apparatus away from potential PCB or asbestos contamination.

When a manhole cover "blows," watch the cover and avoid its descent path. A flying manhole cover is a real danger and always should be considered when determining safe distances and whether to stop traffic at manhole incidents. When arriving at a manhole incident, always find the next manhole on each side in all four directions of the trouble hole. Any of them suddenly can become involved and smoke, burst into flames or blow its cover. The next hole might be covered by a parked car or pile of snow. Not finding it puts everyone in the area at risk of being too close to it. FDNY members also must consider the possibility that CO has traveled along the underground ducts and into aboveground structures. Consider possible exposure problems with apparatus positioned at hydrants located in proximity to adjoining manholes.

In some areas, the underground electrical system feeds or is fed by the overhead system. A burning cable or wire can burn up to the overhead wires or burn down into the underground system. Always check nearby poles for a duct running up the side of the pole. A manhole fire quickly might escalate into burning and falling overhead wires. Consider this possibility when positioning apparatus and don't place vehicles underneath overhead wires.

Consult with the Con Edison "white hat." This person--who is akin to an FDNY Incident Commander and responds to every major Con Ed incident--will be able to advise FDNY members regarding any electrical, environmental or other hazards presented by the manhole incident. The Incident Commander should

request written documentation about the particular incident for presence of haz-mat materials, particularly PCBs. Then, the IC can use the Haz-Mat Battalion and/or Haz-Mat 1 for technical assistance.

If an involved manhole has a car parked on it, have the NYPD arrange to tow the car if possible. Allowing a civilian or Firefighter to enter the car to move the vehicle puts him/her at risk from the toxic smoke. Should an explosion occur or the smoke ignite, the individual could sustain serious injury.

Check the buildings in the immediate vicinity of the trouble hole for CO and evacuate if necessary. Initially check the room where the electrical service enters the building and expand this search to the rest of the building. CO from a burning manhole has been known to migrate into buildings more than a block away from the incident--into telephone manholes and the sewer--all of which should be checked. Once the buildings are checked, they must be monitored constantly until the electrical fault is cleared and there no longer are any gases migrating into the buildings.

If there are numerous buildings to monitor (and this includes monitoring buildings adjacent to those suspected of having CO), FDNY members may need multiple CO meters to effectively perform this task. Con Edison personnel on the scene are trained to monitor for CO and can help with this responsibility. Do not allow residents back into the buildings until they have been vented adequately and the CO readings are at safe levels.

Flickering building lights are not a reason to shut down the building electric at the panel or meter. Monitor the electric panel for heat and check for CO. Remember, a spark and CO are a formula for disaster.

Check with Con Edison to see if there are wood or fiber ducts coming from the trouble hole. If so, CO generation and migration may continue after the manhole fire is extinguished.

When responding to a burning manhole, transmit the appropriate signal to the dispatcher. If conditions worsen or improve, let Con Edison know right away so they can prioritize their response. Con Edison will pull a crew from another incident to respond to a 10-25 code 1 or 4. Unfortunately, this does not mean an immediate response because they might be coming from a great distance and do not respond with lights and sirens. Correctly coding the incident allows Con Edison to accurately dispatch crews to the most serious incidents first.

Flooding manholes generally is not a good idea. Doing so puts Firefighters at risk because cables and equipment in the manhole still may be energized. Additionally, the water will push CO-laden smoke into the ducts and other manholes and structures. On several occasions, it also has resulted in an explosion in the manhole, injuring Firefighters.

When requested by Con Edison to flood a manhole with water, do not apply water directly into the manhole. Direct a fog stream onto the ground and allow the water to flow into the manhole. Or, lay an open butt on the street, allowing the water to flow from it into the manhole. In either case, stand back as far as practical. If possible, have the power to the manhole cut and tested before applying water into the manhole.

Problems in the Con Edison underground electric system occasionally have resulted in manhole covers and grates being electrically charged. Also, there have been incidents where a metal curb strip, a bus shelter and even a hydrant became charged. Proceed cautiously at all manhole incidents.



Manhole fire at Boston Road and 168th Street in the Bronx.

Considerations for the Incident Commander

- Request the response of Con Edison, accurately report existing conditions to the dispatcher and update them as necessary.
- Determine the danger area as quickly as possible. The danger area can include manholes on all sides of the trouble hole, overhead wires, nearby structures and light poles.
- Keep Firefighters, Department vehicles and the public away from the trouble hole and away from manholes on all sides of it while awaiting Con Edison's response.
- Continually monitor the nearby structures to make sure that fire or smoke is not entering the building. Monitor nearby manholes, sewers, light poles and overhead wires.
- Ensure an adequate response to secure the area, stretch needed lines and search and monitor structures. Have enough units on the scene to deal with unexpected escalations of the incident.
- Minimize injury potential by evacuating buildings when necessary and protect members by keeping them upwind of the smoke.
- Secure the area with fire line tape and, if necessary, with NYPD assistance. Use apparatus to block off the street if necessary.
- Stretch precautionary lines and stand by at a safe location.
- When Con Edison responds, inquire regarding the hazards present, additional safety precautions needed, what assistance they need from the Fire Department and any expected complications. Deal directly with the Con Edison "white hat." Large or complex incidents include a response from Con Edison's Emergency Response Group, which is analogous to Field Comm. Modeled after FDNY, this group sets up its command board and may become the liaison with FDNY, obtaining and providing all requested information and situational updates. If they are not responding, FDNY's IC can request them.
- If at any time during a manhole incident natural gas involvement is suspected, notify the appropriate gas utility to respond.
- The Fire Department must maintain a presence at the scene until the danger posed by the burning manhole has been removed. Check with the Con Edison "white hat" on the scene before allowing FDNY units to take up. A minimum FDNY presence on the scene while Con Edison concludes its hazard mitigation may be requested. As the Officer in command, the Incident Commander will decide when FDNY leaves the scene, but he/she first should verify with the Con Edison "white hat" that FDNY assistance no longer is necessary before taking up.

The majority of manhole incidents are concluded without harm to Firefighters, Con Edison employees or the people protected by both entities. However, FDNY members always must consider the possible dangers and take the appropriate steps--in advance--to keep everyone safe.

What we don't know about manhole fires can hurt us. The

goal is to keep the public secure and ensure that all Firefighters return home safely. Knowledge, caution and attention to detail go a long way toward meeting that goal. Form a working relationship with the Con Edison personnel on-scene. Their expertise often will provide FDNY members with the answers to our questions, resulting in a safer operation for all.

The New York City Fire Department has formed a "partnership in safety" with Consolidated Edison of New York. They train Firefighters, Company Officers and Chiefs on safely handling utility emergencies. This is the second in a series of articles about utility hazards. (See "Natural Gas Hazards," by Battalion Chief Frank C. Montagna and Matthew Palmer, in the 3rd/2003 issue of WNYF.) Additionally, Con Edison provides utility training for FDNY members at Con Edison's Learning Center; their training academy, Division staff meetings, firehouse training to discuss hazards, joint familiarization drills and lessons learned discussions held after significant incidents. Con Edison, in conjunction with FDNY, has produced a Manhole Emergencies video that should be available in your firehouse.

Con Edison has an Incident Command system modeled after FDNY's. Their Incident Command team can be requested at large, complex or escalating incidents. While FDNY is in charge of manhole and other utility incidents, it is the utility workers who have the needed expertise. Use them as a resource and together, we can keep everyone safe.



For more information on manhole fires, see "A manhole fire...and unexpected problems encountered," by Battalion Chief William J. Morrissey, in the 2nd issue/1969 of WNYF.

Also, see *All Unit Circulars* (AUC) 266 and 280.

Additionally, review *Haz-Mat Bulletins* 3 and 4 (the second of which provides the Department's CO policy).

About the Author...

Battalion Chief Frank C. Montagna is a 34-year veteran of the FDNY, the past 17 years of which have been as a Chief Officer. He is assigned to Battalion 58. Currently, he is working in the Bureau of Training, where he is responsible for curriculum development. He holds a degree in Fire Science from John Jay College, where he has taught fire science courses. He is a member of the editorial advisory board of Fire Engineering and has published articles in that publication and contributes frequently to WNYF. He is the author of Responding to "Routine" Emergencies.

