Fire and Emergency Operations at Buildings Hosting Cell Phone Sites

by Captain Thomas H. Roche (retired)

Fires and emergencies at buildings hosting cell phone sites (CPS) can be divided into two groups, depending on whether the CPS is directly involved and influences the fire or the CPS is remote and not a factor in operations. For example, consider an interior room installation with no rooftop generator. The antennae are attached to the parapet walls and the coaxial cable runs along the parapet and down an exterior wall of the building to the base station room. This would not adversely affect FDNY operations when the cellular phone site is remote from the fire or emergency.

A CPS directly involved in a fire or emergency requires taking steps to reduce or eliminate the hazards. These include removing power to the computer equipment by shutting down the public utility at the CPS meter, preventing battery power from energizing the computers when a shut-off rocker switch is provided and shutting down the diesel or natural gas supply and turning off the generator if present.

Whenever a rooftop installation is located at a top-floor fire--even if the fire has not yet extended into the cockloft--the CPS is considered part of the fire scenario. Likewise, a CPS in an interior location below a heavy body of fire that is expected to experience seepage from water run-off also is directly involved.

Obstacles and hazards

Buildings with cell phone sites present many obstacles and hazards, which are identified below.

Electrocution--The computers operate with high-amperage, direct-current electricity and the battery packs store high-amperage direct current. Both are extremely dangerous and pose the real possibility of electrocution when precautions are not followed.

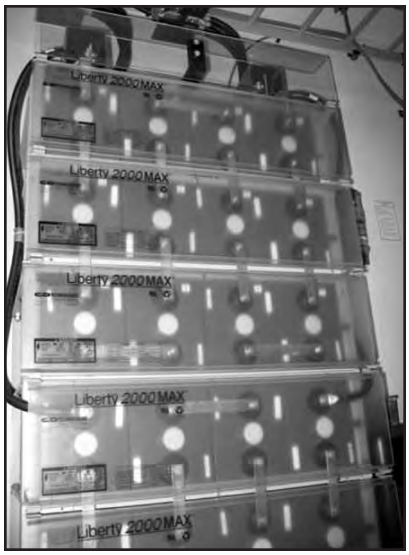
During thunderstorms, Firefighters using aerial ladders and operating on a rooftop that has a roof-mounted installation and/or several antennae must recognize the risk of being struck by lightning. Copper ground wires may be cut and stripped away by vandals and sold as scrap.

Basement and ground-level installations are areas of concern when responding to an emergency for flooding. A site submerged in water must be avoided and poses the same hazards as the building's primary electrical supply.

The electrocution hazard is obvious at the base station, but throughout the building, there may be inherent hazards and hidden dangers. Electrical conduit exposed to high heat or fire can melt the electrical wire's PVC insulation, resulting in an energized metal conduit. These conduits run up the exterior building walls adjacent to fire escapes, along parapets and rooftops and up interior light and air shafts and dumbwaiter shafts, with different designs and methods to supply power to rooftop installations.

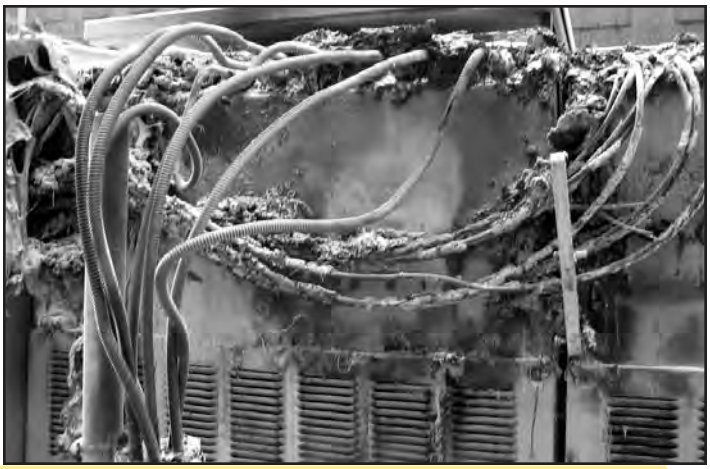
Currently, there are no written rules or codes governing installation methods. These cell phone sites are installed without any regard for the safety or efficiency of firefighting operations.

Radiation exposure--Radio waves are a form of radiation exposure and any antenna that transmits radio frequency (RF) is hazardous. When a cellular phone site is active, the



The battery pack can have as many as 28 12-volt batteries in the base station room. Their output ranges from 150 to 250 amps. The battery never should be disconnected via the terminals.

Cell phone sites present numerous obstacles to firefighting operations. Electrical equipment and generators on the roof increase the dead load and collapse potential of the building. The collapse zone will be the entire perimeter of the building. The presence of natural gas introduces ignition and explosion hazards. Access and egress to the building and on the roof should be limited.



Because of numerous health hazards--radiation, electrocution, explosion, carcinogens released from computer frames on fire and hydrogen chloride released as a product of combustion--at cell phone sites, SCBA use is mandatory for Firefighters.


Collapse hazards are prolific at cell phone sites. They pose an additional dead-weight load on the roof. A substantial cockloft fire weakens the roof supporting system. An I-beam that is exposed to fire will elongate. An expanding I-beam can push the parapet wall outward.

antennae are projecting radio frequency power, putting humans in the horizontal plane of the RF beam in danger of an acute radiation exposure. Usually, the area in front of the antenna is the danger zone, but a malfunctioning antenna can project radiation from the rear.

Exposure to RF power heats the water in the deep tissue of the human body to elevated temperatures. Add this to the effect that bunker gear and strenuous work has on a Firefighter's core temperature and the possibility of a physiological injury will increase.

The antennae usually are attached to the parapet wall by brackets and face outward. This means that the front of the antenna is facing away from the roof upon which the Firefighters are operating. The back of the antenna that faces the roof side of the building is not designed to propagate a radio frequency beam. As a general rule, any member operating on a roof or in a tower ladder bucket or on an aerial ladder closer than four feet to the front of an antenna that is emitting the maximum permissible exposure set by the FCC must use caution.

Conversely, Firefighters operating on a roof behind antennae usually are not exposed to harmful levels of RF. There can be anomalies and, for safety reasons, stay away from an antenna unless operations absolutely require working around them. Limiting the time exposed and keeping the greatest distance possible from these sources of radiation is the most practical way to protect one's health.

Collapse--The dead load created when a cellular phone site is added to the roof of an existing building compromises the stability of the structure. Sizeable loads, consisting of bearing I-beams and cell site equipment, are added to an existing structure (usually the parapet wall) that originally was not designed to support them. Each site can contribute an additional 10 tons of dead-load weight to the roof support system without any substantial reinforcement to provide extra stability. The building code allows up to three sites on one building lot.

Frequently, the I-beam is embedded into the parapet wall. When this beam is exposed to the high temperatures of a cockloft fire, the resulting elongation will push the wall out, causing it to fall to the street level below. Excessive heat may cause the beam to fail, resulting in 20,000 lbs. of steel and equipment crashing through the roof onto the top floor.

Retired Deputy Chief Vincent Dunn stated that a burning building is a structure under demolition. Such a philosophy applies to a fire under a roof-mounted CPS. Incident Commanders (IC) should consider establishing a collapse zone when confronted with uncontrolled top-floor/cockloft fires in buildings with a roof-mounted CPS. Additionally, serious consideration should be given to evacuating all occupants and members from the building.

Tripping hazards--The roof Firefighter has to deal with obstacles previously unknown. *Ladders 3* section 5.1 lists several roof hazards, including soil pipes, clotheslines, television and radio antennae. The Fire Prevention Inspection Guide mentions, "wires and cables must be 10 feet above the roof. Clotheslines are exempt." Now there are coaxial cables, electrical conduit, diesel and natural gas piping, radio frequency radiation from antennae and electrical wiring and equipment powered by more than 200 amps of electrical current. The conduit, piping and cable raceway are tripping hazards because they usually are found six to 12 inches above the roof surface.

Operational strategies

The first thing Firefighters must consider at fires and emergencies involving a CPS is their safety. To safely accomplish their assigned tasks, general information about CPS hazards is required and specific information relative to that particular building is preferred. This is essential to completing assigned tasks efficiently and safely and overcoming the inherent obstacles and hazards associated with buildings hosting cell phone sites.

As a result of prior knowledge, documentation and training, Firefighters know that a rooftop installation can significantly reduce vertical ventilation of a top-floor or cockloft fire under-

For a cell site involved in fire, Firefighters should 1. Shut off the electric supply and disconnect the batteries if possible. 2. Shut down the diesel or gas supply to the generator and then turn off the generator. 3. Use Purple K to extinguish the fire.

Electric Power Sources

The electrical power sources are considered the second component of a cell phone site and consist of utility power supply, a rectifier, a battery pack for back-up power and, possibly, a generator to produce its own power should the public utility fail to supply a source of electricity. While correct to differentiate between the frames of computer equipment and the sources of electricity that energize them, it is important to recognize that the two often are not physically separated. Whether the installation is an interior room, on the roof or in a courtyard, a circuit-breaker panel supplied by the public utility will be present, as will a battery pack serving as a source of back-up power. Only the generator, if available as a tertiary source of electric power, is in a remote location.

Utility power supply

In New York City, either Con Ed or Keyspan provides the commercial electricity necessary to power electrical equipment and they are the primary power source at all CPS. These utility lines usually enter the building at the basement level and that is where Firefighters will find a meter and power shut-off for each cell site in the building.

(Top) Electrical power sources are comprised of four elements--utility power supply, rectifier, battery pack and generator. There may be two or three power sources to shut down at a cell phone site. (Middle) The rectifier, which contains 250 amps of electrical current, has three functions--converts alternating current to direct current, supplies power to computer equipment and continuously charges the battery pack. (Bottom) The generator powers equipment and charges batteries when the utility is off. A permanent generator is powered by diesel or natural gas. A portable generator is diesel-powered.

Occasionally, meters and shut-offs for CPS are found outside on an exterior wall of the building. This power source probably is separate from the house main. The service consists of 208 volts of alternating current, delivered at 200 amps, and is transported via electrical conduit from the meter to the location of the base station circuit breaker panel.

Rectifier

An intricate component in the electric power supply is a rectifier, which can be exceptionally dangerous. The rectifier converts the public utility's supply of alternating current to the direct current used by the computer equipment and battery pack. Therefore, the rectifier is the main source of power to the computer equipment while it continuously charges the batteries. It looks much like the computer equipment it powers and is distinguished by the rectangular instruments containing air vent louvers and an LCD screen visible in the middle of its frame.

This equipment is very dangerous and introduces a serious electrocution hazard. Never use water on a rectifier, even after shutting down utility power, because the back-up battery power automatically starts feeding it with 200 to 300 amps of direct current to continue supplying computers with electricity. An extinguishing medium rated for electrical fires--such as Purple K or dry chemical--is appropriate, but must be used from a safe distance to prevent any arcing, resulting in an accidental electrocution. Depending on the rectifier's location in the base station, applying the Purple K from outside the room can increase Firefighter safety.

Back-up power supply

At every installation (interior rooms in the basement, sites mounted on the roof and any other location), there is a battery pack present as a back-up power supply, found immediately adjacent to the computer frames it energizes. The number and type of batteries in the pack vary; 24 12-volt batteries or 16 13.8-volt batteries are the most common configurations. The battery pack is capable of storing more than 200 amps of direct current that can power the computer equipment for six to eight hours. The battery pack is readily visible in an interior room and hut-style installation and can be detected by the air-conditioning unit in the casing of its frame in the suspended style.

These batteries are far from harmless and must be treated with respect. Most cellular phone companies have opted not to provide their battery packs with a disconnect switch, which means that Firefighters cannot completely shut down power to the computer frames. Never attempt to disengage power by removing the covering and disconnecting each battery terminal. There is a risk of electrocution, creating an explosion or being sprayed with sulfuric acid. Always use extreme care and restrict the use of water and metal tools.

Generator

Besides a battery pack as a back-up for commercial utility loss, some sites also have an on-site generator to produce electricity in case of a power failure. Regardless of the base station location, an on-site generator often is located on the roof, propped on I-beams that are supported by the parapet walls. Diesel or natural gas piping runs from the gas utility entrance to the building to the locale of the generator, whether via an exterior building wall or up an interior shaft. This generator operates when a Firefighter shuts down primary power to the base station. The generator is shut down by closing the petcock valve at the meter, preventing the flow of diesel or natural gas.

Portable generator receptacles

To ensure continued service for sites without an on-site generator, cell phone companies construct their sites with portable generator capacity. An electrical conduit to feed the base station is installed that usually ends at the street level with a receptacle capable of receiving power from a portable generator hauled to the site in case of a blackout. Portable generators run on diesel fuel.

Transfer switches

To allow sites to be powered by generator, the cell phone companies have installed transfer switches within the power distribution system. An on-site generator and sites that have the electrical conduit ending with a generator receptacle contain automatic transfer switches. Older sites without a generator or the conduit with a generator cable receptacle use a manual transfer switch. At such a site, an electrician runs an electrical line from the generator, which was hauled to the site. The electrical line goes into a manual transfer switch located in the base station room. Then, power is activated by throwing the manual transfer knife switch.

A manual transfer switch can look like a power shut-off knife switch. Firefighters must take care not to confuse the two, believing they have shut down utility power when, in reality, they have not. Often, the power shut-off at the meter is a knife switch, but there is a main circuit breaker in an electrical service panel in the base station room.

neath a CPS. Immediately notifying the Incident Commander of a CPS at a fire operation is necessary for fireground situational awareness, the safety of members and any deviations to FDNY SOPs that may be ordered or required.

At CPS fires or emergencies, the life hazard is generally that of the Firefighter attempting to control the situation. On arrival, if the entrance door to the CPS is locked closed, there is an extremely low chance of any life hazard inside. Considering the high-amperage (amps kill) electrical equipment and the fully charged battery pack found in a maze-like configuration at these sites, there is little benefit to entering an interior room base station.

Engine company operations

The extinguishing medium of choice involving a CPS base or any of its electrical components is dry chemical or Purple K. Dry chemical or Purple K extinguishers are expended at a base station door (if a base station is involved in fire) and the door closed to extinguish all fire, pending the arrival of a cell phone site representative.

Hand-line operations into a base station room are restricted until all electrical power is completely shut down. Generally, this is not possible because most battery packs do not have remote disconnect switches. They are not required and usually not found.

Engine tactics at fires involving CPS can be limited to stretching a precautionary fog-/straight-stream line to prevent exposure and collateral damage from fire and/or to protect ladder company members opening the base station door (if necessary). At top-floor and cockloft fires, a hose-line on the roof can protect electrical conduit and gas black pipe from auto-exposure and prevent flame impinge-

Engine companies operating at cell phone site fires must adhere to the following provisos: Restrict use of water and metal tools near electric equipment/conduit. (Disconnecting battery power is a complex procedure that requires a licensed electrician and cannot be done by Firefighters at the scene.) No water use on CPS that have not been de-energized. Use a narrow fog stream. Use water from a safe distance and beware of run-off water because it may become electrically charged.

ment on the CPS rooftop installation and its I-beam supports.

Water run-off and electrical conduit lines are always a concern and water pooling on a rooftop with a rooftop installation may present an electrocution hazard. Water run-off to a room below can seep down onto the computer equipment and cause arcing and/or a secondary electrical fire. Always limit the amount of water (if possible) in and/or around any operation involving a CPS.

Ladder company tactics

The roof Firefighter will encounter additional hazards at any building that has a CPS. Whether the base station is on the roof or in an interior room, there will be antennae at the roof level. An FDNY Bronx survey involving radio frequency emissions from rooftop antennae suggest that Firefighters operating on the roof are not exposed to dangerous levels of radiation when the antennae are attached to the parapet walls and facing away from the roof. However, precautions are necessary.

Certain antennae, such as the one pictured above, emit RF from the sides as well as the front. Caution must be used to prevent a radiation exposure that exceeds the FCC maximum permissible limits.

Different types of antennae include one that is distinguished by its thick, spherical shape. It emits RF peripherally from the sides and front, whereas the flat-panel antenna only emits RF from the front. Therefore, avoid not only the front, but also the sides of these spherical antennae.

Accomplish your task and descend to minimize the possibility of exposure. On rare occasions, cellular phone companies place antennae on the roof in such a way that a Firefighter can walk directly in front of the antenna. Increasing distance at least four feet and limiting time around these antennae are major factors in reducing exposure to potentially dangerous RF radiation.

When the fire building with a rooftop CPS installation is isolated and the aerial or bucket is the chosen route to the roof, the chauffeur (with prior knowledge or from CIDS) can guarantee safe access for the roof Firefighter by placing the turntable in the correct location. Knowledge of your CPS and response area is necessary because sometimes, large huts block access to portions of the roof and will block access to attached adjoining buildings.

Besides CPS blocking access, the cell phone antennae may line the parapet walls, making access onto the roof difficult. Hazards include passing in front of antennae that are emitting RF and/or negotiating the cable, electrical conduit and gas line raceways that are found on building walls, parapets and rooftops.

Where Cellular Phone Sites are Found

The cell site's location within the host building varies from site to site. Because the New York City Building Code allows three different cellular phone companies to construct individual sites on a single building lot and the area required to construct a cell site is relatively small, they can be found almost anywhere in or on a building. The configuration of a site depends on the available space and the objectives of the cellular phone company. The antennae almost always are found at the roof level regardless of the location of the base station that facilitates the phone calls. The antennae and the computers in the base station are connected by coaxial cable.

For economic reasons, rooftop installations are very popular. The landlord is happy to collect money for previously un-rentable space and the cellular phone company appreciates the efficiency of having the base station close to the radio wave antennae, effectively reducing the amount of coaxial cable necessary to connect the two.

There are basically three CPS styles found on the roof:

- The suspended site has the base station computers and back-up battery pack in frames, supported by a metal grating that sits atop I-beams.
- The hut site is a prefabricated combustible room (containing computers, battery pack and an electrical power service panel) that is placed on I-beams by a crane.
- The older cabinet site hangs on a bulkhead wall or rests on a perch. It is being phased out slowly.

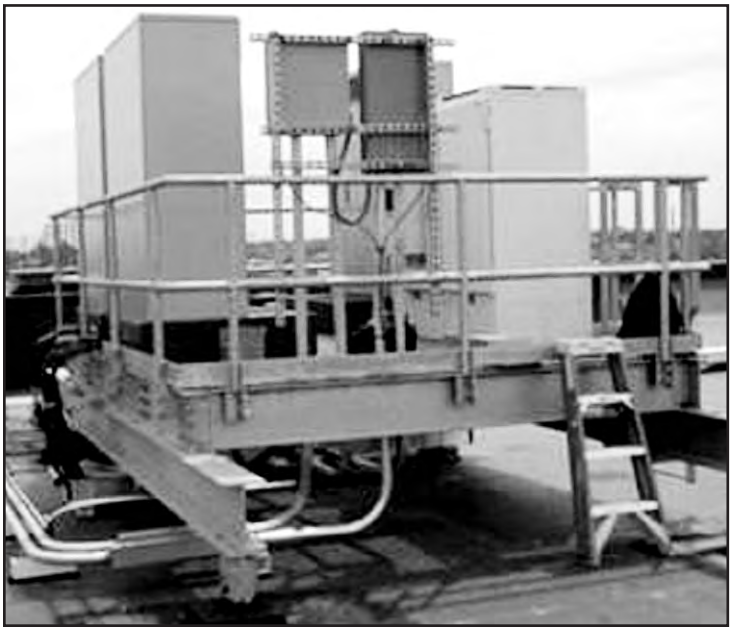
Other areas where cell phone sites are found include interior courtyards or large alleyways. Again, the economic benefit to the landlord makes this an attractive, rentable space, despite the electrical (high amperage) and possible radiation hazards.

When the cellular phone company executives desire to better protect their investment and allow technicians to perform repair work despite inclement weather, they choose an interior occupancy to construct the site. In multiple dwellings, the available space most often is in the cellar, but a Firefighter can find a site on any floor and interior location, including large closets.

Expect sole access to a cellular phone site through a residential (superintendent's) apartment. This is an extremely dangerous scenario for Firefighters conducting searches or operating solid-stream hand-lines, if they crawl into the base station room containing high-amperage electrical equipment unaware of the risk they are encountering.

A storefront also is a possible location for a CPS. The opening for what was a plate-glass window is bricked over or blocked up and the site entrance door is covered by a roll-down gate 24/7, except when a cell technician is working within the site.

Examples of the roof-mounted installation; the hut style is on the left and the suspended style is on the right.



Ladder companies should employ the following ventilation tactics at cell phone site fires: Avoid cutting openings close to equipment. Members should use horizontal ventilation to augment vertical ventilation. Bear in mind that a roof installation can reduce the area available for vertical ventilation. If this is the case, notification to their Officer and Incident Commander is required.

These types of hazards and obstacles are more readily identified and safely resolved prior to the fire or emergency when included in CIDS information and will lead to a more efficient operation.

Ventilation techniques

Rooftop installations--whether suspended or hut-style--present numerous obstacles to fire operations. A roof-mounted cellular phone site severely hampers the ability to cut adequate vertical ventilation holes. Vertical ventilation to prevent mushrooming heat and gases on the top floor at all fires is accomplished by opening the bulkhead. Additionally, at top-floor/cockloft fires, there are instances when the truck Officer will order that a vent hole be cut in the roof. Don't attempt to cut a hole under a roof-mounted CPS.

When a cell site or any of its components prevents a vent hole in the roof from being cut above a fire below and vertical ventilation is limited or non-existent, the Incident Commander must be notified immediately. This critical fireground information will improve situational awareness among all operating units and must be communicated to the unit Officer and Incident Commander as this may necessitate a change in tactics. Anytime Firefighters deviate from SOPs or cannot accomplish the task at hand, immediate notification to the Officer and IC is required.

If a vertical ventilation hole is smaller than usual because of the configuration of the cell site, the use of horizontal ventilation can be helpful to augment the movement of air to release heat, smoke and flammable gases from the fire area. Horizontal ventilation never can occur before an engine company has water and is moving in to extinguish the fire. Using extra hooks and additional manpower at top-floor fires to pull ceilings and expose the cockloft may help ventilation and prevent a smoke explosion in the cockloft.

Once a fire in an interior room CPS installation is controlled, the best way to ventilate the room is with mechanical fans from the outside. Every CPS has to run coaxial cable from the computers to the antennae. This usually is done via the exterior wall adjoining the site. This exterior wall is sealed inside with rubber gaskets where the cables penetrate to the exterior. Frequently, a sheet metal frame is constructed on the outside. By tearing down this frame and removing the gaskets, an opening about the size of FDNY fans allows Firefighters to mechanically vent the room from the exterior of the building. This is especially beneficial if dry chemical or Purple K agents were used to extinguish the fire.

Members are urged to review the following references:
- "Cellular Phone Communication Sites--An Overview," by Deputy Assistant Chief Ronald R. Spadafora, in the 1st/2003 issue of *WNYF*.
- "Cell Phone Stations--New Dangers on New York City Rooftops," by Lieutenant Albert Gonzalez and then-Lieutenant John M. Miles, in the 2nd/2003 issue of *WNYF*.
- AUC 338--Application of Water on Energized Electrical Equipment.
- AUC 331--Cellular Phone Sites, October 13, 2000.
- "A Primer on Purple K," by Battalion Chief Steven San Filippo, on page 24 of this issue of *WNYF*.
- *Collapse of Burning Buildings*, by Vincent Dunn.

Firefighting tactics at fire operations involving CPS

- Shut down the CPS electrical power:

1. Public utility supply shut-off at CPS meter in cellar/basement.
2. Turn off generator and shut off flow of diesel or natural gas.
3. Stop flow of direct current from batteries if the shut-off rocker switch is present.

- "Wet" batteries contain sulfuric acid and release hydrogen gas when charging. Treat the vicinity around the battery pack as a volatile atmosphere.
- Vent, enter and search (VES) apartment/occupancy above, below and adjacent to the base station..
- Request cell phone company representative. Providing unique cell site number increases chances of getting a cell tech responsible for that site. Usually, this unique number is located on the door to the base station.
- Use dry chemical or Purple K to extinguish electrical equipment on fire.

At top-floor fires with rooftop installations:

- Inform IC how site is supported.
- Establish a collapse zone around suspect parapet walls.
- Continuously evaluate parapet stability.
- Evacuate all occupants from entire building at uncontrolled cockloft fires with rooftop CPS installations. A collapse should be anticipated.
- Prevent collapse by protecting steel I-beams from heat and flame impingement.
- Special-call a Battalion Chief for roof sector to monitor operations and structure.
- Once steel supports and the CPS base station are exposed to heat and fire, immediate notification to the IC is required as evacuation and exterior operations may be indicated.

The author thanks Assistant Chief James Esposito, Bronx Borough Commander, for sharing his expertise and providing great assistance with this article.

About the Author...

Captain Thomas H. Roche (retired) was a 25-year veteran of the FDNY. He was assigned to the Bronx Borough Command as the Training Coordinator. Prior to that assignment, he was Captain of Ladder 53, Lieutenant of Ladder 61 and served as a Firefighter with Engines 75 and 46. This is his first article for WNYF.