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37
NIOSH
Fire Fighter Fatality Investigation and Prevention Program

Death in the line of duty...

A summary of a NIOSH fire fighter fatality investigation *August 5, 2010*

Two Career Fire Fighters Die Following a Seven-Alarm Fire in a High-Rise Building Undergoing Simultaneous Deconstruction and Asbestos Abatement—New York

SUMMARY

On August 18, 2007, a 53-year-old male career fire fighter (Victim #1) and a 33-year-old male career fire fighter (Victim #2) became trapped in the maze-like conditions of a high-rise building undergoing deconstruction. The building's standpipe system had been disconnected during the deconstruction and the partitions constructed for asbestos abatement prohibited fire fighters from getting water to the seat of the fire. An hour into the incident, the fire department was able to supply water by running an external hoseline up the side of the structure. Soon after the victims began to operate their hoseline, they ran out of air. The victims suffered severe smoke inhalation and were transported to a metropolitan hospital in cardiac arrest where they succumbed to their injuries. By the time the fire was extinguished, 115 fire fighters had suffered a variety of injuries.

Key contributing factors to this incident include: delayed notification of the fire by building construction personnel, inoperable standpipe and sprinkler system, delay in establishing water supply, inaccurate information about standpipe, unique building conditions with both asbestos abatement and deconstruction occurring simultaneously, extreme fire behavior, uncontrolled fire rapidly progressing and extending below the fire floor, blocked stairwells preventing fire fighter access and egress, maze-like interior conditions from partitions and construction debris, heavy smoke conditions causing numerous fire fighters to become lost or disoriented, failure of fire fighters to always don SCBAs inside structure and to replenish air cylinders, communications overwhelmed with numerous Mayday and urgent radio transmissions, and lack of crew integrity.

Two Career Fire Fighters Die Following a Seven-Alarm Fire in a High-Rise Building Undergoing Simultaneous Deconstruction and Asbestos Abatement—New York

NIOSH has concluded that, to minimize the risk of similar occurrences, fire departments should:

- ***review and follow existing standard operating procedures on high-rise fire fighting to ensure that fire fighters are not operating in hazardous areas without the protection of a charged hoseline.***
- ***be prepared to use alternative water supplies when a building's standpipe system is compromised or inoperable.***
- ***develop and enforce risk management plans, policies, and standard operating guidelines for risk management during complex high-rise operations.***
- ***ensure that crew integrity is maintained during high-rise fire suppression operations.***
- ***train fire fighters on actions to take if they become trapped or disoriented inside a burning high-rise structure.***
- ***ensure that fire fighters diligently wear their self-contained breathing apparatus (SCBA) when working in environments that are immediately dangerous to life and health (IDLH).***
- ***train fire fighters in air management techniques to ensure they receive the maximum benefit from their self-contained breathing apparatus (SCBA).***
- ***use exit locators (both visual and audible) or safety ropes to guide lost or disoriented fire fighters to the exit.***
- ***conduct pre-incident planning inspections of buildings within their jurisdictions to facilitate development of safe fireground strategies and tactics.***
- ***encourage building owners and occupants to report emergency situations as soon as possible and provide accurate information to the fire department.***
- ***consider additional fire fighter training using a high-rise fire simulator.***

Manufacturers, equipment designers, and researchers should:

- ***conduct research into refining existing and developing new technology to track the movement of fire fighters in high-rise structures.***

- ***continue to develop and refine durable, easy-to-use radio systems to enhance verbal and radio communications in conjunction with properly worn self-contained breathing apparatus (SCBA).***

Municipalities should:

- ***ensure that construction and/or demolition is done in accordance with* NFPA 241: Standard for Safeguarding Construction, Alteration, and Demolition Operations.**
- ***develop a reporting system to inform the fire department of any ongoing, unique building construction activities (such as deconstruction or asbestos abatement) that would adversely affect a fire response.***
- ***establish a system for property owners to notify the fire department when fire protection/suppression systems are taken out of service.***

INTRODUCTION

On August 18, 2007, a 53-year-old male career fire fighter (Victim #1) and a 33-year-old male career fire fighter (Victim #2) were fatally injured after suffering severe smoke inhalation while operating in a high-rise building undergoing deconstruction. On August 20, 2007, the U.S. Fire Administration notified the National Institute for Occupational Safety and Health (NIOSH) of this incident. On October 28–November 1 and December 7–13, 2007, a safety and occupational health specialist from the NIOSH Fire Fighter Fatality Investigation and Prevention Program investigated this incident. The NIOSH investigator met with officials of the fire department and with representatives from the Uniformed Fire Officers Association and the Uniformed Firefighters Association, which are affiliated with the International Association of Fire Fighters. The investigator reviewed witness statements of fire fighters and officers involved in the incident, examined photographs and video of the fireground, and reviewed the victims' training records and death certificates. The NIOSH investigator also reviewed the department's fireground standard operating procedures[1] and listened to the dispatch tapes of this incident. The exterior of the incident site was visited and photographed. Due to ongoing litigation, the NIOSH investigator was unable to access the structure or interview building construction personnel.

FIRE DEPARTMENT

The fire department involved in this incident consists of approximately 11,500 career fire fighters from over 300 fire stations and buildings and serves a population of over eight million in a geographic area of approximately 322 square miles.

The fire department has extensive written standard operating procedures.

TRAINING and EXPERIENCE

The state of New York requires that fire departments train career fire fighters to a level equivalent to National Fire Protection Association (NFPA) 1001 *Standard for Fire Fighter Professional Qualifications* Level II. The state also requires 100 hours of annual in-service training.

The fire department requires all fire fighters to complete a 23-week training program at the department's fire academy. *Note: When the victims graduated from the academy, the program consisted of 13 weeks of training.* Fire fighter recruits are instructed in the basics of fire suppression systems and fire fighting tactics. After graduating from the fire academy, the recruits go through a one-year probationary period working as part of a company.

Victim #1 graduated from the department's fire academy in 1983 and had 23 years of fire fighting experience with an engine company.

Victim #2 graduated from the department's fire academy in 1999 and had 8 years of fire fighting experience, 7 years with an engine company and 8 months with a truck company.

Incident command was fully implemented, following department standard operating procedures, and each officer within the command structure was fully trained in accordance with departmental guidelines.

EQUIPMENT and PERSONNEL

Although this incident required a seven-alarm response to extinguish the fire, this investigation focused on the events which occurred from the 1st alarm through the time of the fatal injuries.

The 911 call was received at 1536 hours and the 1st alarm was dispatched at 1537 hours. After second-source verification, additional units were dispatched to fill out the 1st alarm response, and a 2nd alarm was dispatched at 1542 hours. A 3rd alarm was dispatched at 1654 hours, and a 4th alarm was dispatched at 1713 hours after the victims were located.

There were approximately 40 apparatus and 200 fire fighters on scene from the first two alarm assignments at the time of the fatal injuries. See Appendix A for a listing of responding apparatus and personnel.

TIMELINE

See Appendix B for a timeline of events that occurred as the incident evolved, such as dispatch, arrival of companies, sentinel communications and tactical actions. *Note: Not all events are included in this timeline. The times are approximate and were obtained by studying the dispatch records, witness statements, and other available information. In most cases, the times are rounded to the nearest minute.*

PERSONAL PROTECTIVE EQUIPMENT

At the time of the incident, the victims were wearing the fire department's full array of personal protective clothing and equipment, consisting of turnout gear (coat and pants), helmet, Nomex® hood, gloves, boots, and a self-contained breathing apparatus (SCBA) with an integrated personal alert safety system (PASS). Both victims were equipped with portable radios, flashlights, safety harnesses, and personal safety ropes. Both victims were found with their facepieces removed and their PASS alarms activated. Victim #1's 45-minute SCBA cylinder contained 800 psi of compressed air, and Victim #2's cylinder had 0 psi of compressed air when tested after the incident. The victims' SCBAs were both tested by the fire department and an independent testing lab following the incident. Both units passed the department's visual inspection and functional tests (including the PASS alarm). When tested by an independent testing laboratory, both units were found to be fully compliant with NFPA standards.

STRUCTURE

The structure involved in this incident was a Class 1 fire resistive, 40-story high-rise building, which opened in 1974 (see Photo 1). The building was used as commercial office space for a financial institution. The building occupied one city block with a footprint of 182 x 182 ft (see Diagram 1). The curtain-wall building had a steel-framed internal structure with two sublevels below grade. The exterior façade was covered in glass and the aluminum curtain-wall was attached to the building between each floor.

The structure was heavily damaged on September 11, 2001, when a multistory gash was torn into the north façade (A-side) by the collapse of surrounding buildings (see Photo 2). The structure remained abandoned and open to the elements allowing it to become contaminated with mold. Other contaminants (toxins such as asbestos, dioxin, lead, silica, polyaromatic hydrocarbons) and human remains were also present in the building.

Deconstruction and Asbestos Abatement

The structure was undergoing floor-by-floor asbestos abatement and deconstruction that began in March 2007.[2] On the day of the fire, the structure had been reduced to 26 stories. Scaffolding had been

installed around the building perimeter with a black-mesh enclosure on the outboard side of the scaffolding (see Photo 3). The mesh enclosure was meant to contain falling debris. The building's original elevators had been removed and two external construction elevators were installed on the A and C-sides. Each construction elevator had dual cars and was used to hoist construction workers and building materials/equipment to the floors. Due to the location of the fire, only the A-side construction elevator was used to transport fire fighters during the incident.

In order to temporarily repair the A-side damage, structural steel was installed with a metal deck (Q-Deck) floor. This Q-decking area was open to the exterior near the construction elevator but lined with a plywood wall and hanging plastic sheeting on three sides for the asbestos containment on each floor. Numerous exhaust fans were set up on the 13th, 14th, and 15th floors to maintain negative pressure in the partitioned zones on each floor for the asbestos abatement. Twenty-five 2,000 cfm (cubic foot of air per minute) exhaust fans were positioned and operating on the A-side of the building on the 13th, 14th, and 15th floors. On the 16th and 17th floors the fans were distributed on each floor in clusters of five. Three clusters of five fans were on the A/B-side, one cluster of 5 fans was on the A/D-side, and one cluster of five fans was on the C/D-side. Round flexible ductwork was connected to each fan and ran to the asbestos decontamination zones. Due to the asbestos remediation, access to every other floor was sealed in the stairwell by wooden hatches covered in plastic sheeting. Hatches covered both A- and B-stairwells on the 10th, 12th, 14th, 16th, and 18th floors.

Standpipe and Sprinkler System

The building was originally equipped with a sprinkler system that was operational and activated, flowing water on September 11, 2001. The system was disconnected and had been inoperable since 2001.

The Class III standpipe system was originally constructed with a fire department connection (FDC) on each side of the building. There were 6-inch standpipe risers in each stairwell extending from sublevel B to the top floor. Sections of standpipe in sublevel A had portions of the supply pipe missing; this prevented supplying any water to the system from any FDC. The standpipe FDC connection on the A-side was severely damaged and had been previously removed. Fire fighters connected to the B-, C-, and D-side FDCs on the day of the fire, and water flowed out the missing sections of pipe into sublevel A (see Photo 4). The standpipe riser in the A-stairwell was intact but the hose outlets used for fire fighting were either removed or capped. The standpipe riser in the B-stairwell was disabled. Building construction personnel had modified the system for construction use to only supply water from garden-type hoses on certain floors. The standpipe system was supplied by a manual 750-gallon-per-minute (gpm) fire pump and an automatic 500-gpm fire pump, both of which were out of service on the day of the fire.

WEATHER

The weather at the time of the incident was clear with a temperature of 73°F.[3] During the incident, the average wind speed ranged from 3.5 to 6.9 miles per hour (mph) with gusts up to 16.1 mph. Wind direction was initially variable then changed to west northwest.

INVESTIGATION

On August 18, 2007, at 1536 hours, a fire was reported on the scaffolding of an abandoned high-rise structure undergoing asbestos abatement and deconstruction. Dispatch assigned Engine 10 and Ladder 10, and Engine 4 and Ladder 15, and Battalion Chief 1 to the fire scene. Engine 10 and Ladder 10 responded together from the same fire station and were first to arrive. Engine 4 and Ladder 15 responded together and arrived after Engine 10 and Ladder 10. At 1538 hours, dispatch filled out the alarm, assigning Engines 6 and 7, Squad 18, and Rescue 1. At 1539 hours, Hazardous Materials (HazMat) 1 and the HazMat Battalion Chief 1 were assigned and responded.

At 1539 hours, Engine 10 arrived on scene and positioned near the hydrant at the C-D corner of the structure. *Note: At this time, fire was observed through the scaffolding midway up the structure on the C-side*. As the Engine 10 crew attempted to connect their hoseline to the fire department connection (FDC) nearest the C-D corner, they were told by a civilian worker that it would not supply the standpipe. The worker said that another standpipe 100 ft east of their location would supply the system. The Engine 10 officer ordered one of his fire fighters to connect to the operational FDC, and then he and the rest of his crew followed the worker to the construction elevator on the exterior of the A-side. The civilian worker reported that the fire was on the 17th floor. The worker operated the construction elevator, taking the crew to the 15th floor. At 1541 hours, the Ladder 10 officer after arriving on scene saw fire out the C-side and transmitted a 2nd alarm.

When the Engine 10 crew arrived on the 15th floor, conditions were clear and the worker informed the crew of the basic layout of the floor, noting the location of the stairwells. *Note: Since the building was undergoing asbestos remediation, white plastic sheeting was used to partition the floor area into separate zones, each with a separate high-efficiency particulate (HEPA) air filtering unit (see Photo 5). All these partitions created maze-like conditions for the fire fighters*. The Engine 10 officer tried to locate the standpipe riser in the B-stairwell, but there was no outlet on either the 14th or 15th floor. When he attempted to check on the 16th floor, he found the stairwell was blocked over with a wooden hatch. The Engine 10 crew then went to the A-stairwell and found an outlet on the standpipe riser. They connected their 2½-inch hoseline to the outlet and waited for the system to be charged. The Engine 7 crew assisted Engine 10 with flaking out hose and had five lengths connected, waiting for water supply.

The Ladder 10 crew was working in the 15th floor A-stairwell opening the hatch leading to the 16th floor. While the hatch was being opened, an Engine 10 fire fighter tried to locate another stairwell or means of egress. He went toward the B-side, broke a window, and exited onto the scaffolding. He

walked around to the C-side and saw fire on the floors above. He turned around and returned to the 15th floor A-stairwell and told his officer what he had observed.

The Ladder 15 crew was working on the hatch in the B-stairwell, and once opened, they stretched a search line to the 16th floor. The Ladder 1 crew was designated as the rapid intervention team (RIT) and set up in the interior lobby area on the 15th floor. Since Ladder 1 had a saw, the Ladder 10 officer requested that it be used to open the A-stairwell hatch. A Ladder 1 fire fighter ran the saw approximately 15 minutes with other fire fighters assisting to open the hatch. The RIT officer was going to deploy a search rope from the stairwell to the A-side exterior construction elevator but decided not to in case it was needed on the 16th floor. The RIT team surveyed the 15th floor and found the window that the Engine 10 fire fighter had broken earlier. They went on the scaffolding toward the C-side and were looking into the building through the windows and only saw a light haze. They returned to the interior lobby and began to stage for RIT duties.

Squads 1, 18, and Rescue 1 were operating on the 15th floor conducting searches for any potentially trapped construction workers. An Engine 10 fire fighter saw that the decon shower area on the C-side was on fire. He used a fire extinguisher on the plywood wall but was unable to control the fire. He returned to the stairwell and told the Engine 10 officer. A few minutes later, Squad 1 fire fighters reported fire from floor to ceiling in the rear corner of the decon shower.

At 1604 hours, the Ladder 10 officer reported to command that the 15th floor A-stairwell hatch was opened and there were heavy smoke conditions on the 16th floor. By this time, smoke was beginning to fill the stairwell and a search rope was deployed. The Ladder 10 officer used his thermal imaging camera (TIC) to locate fire, but the camera showed little heat on the 16th floor. The Rescue 1 crew used a search rope and began searching the 16th floor. The Rescue 1 officer and Ladder 10 crew continued up to the 17th floor to locate the fire. In the 15th floor B-stairwell, Ladder 15 and Squad 18 gained access through the hatch and began searching on the 16th floor using a search rope.

The Rescue 1 officer led the way to the 17th floor. The Ladder 10 officer dropped his TIC in the stairwell and could not locate it in the heavy smoke. At 1607 hours, the Rescue 1 officer reported to command that he could not see any flame but could hear fire crackling on the 17th floor A-stairwell landing. Battalion Chief 2 acknowledged and said to keep back since there was no water supply. At 1607 hours, command assigned units to check on the standpipe. Command ordered Ladder 15 to go below the 15th floor and check the standpipe riser. At 1611 hours, Battalion Chief 2 ordered Rescue 1 to the 14th floor since there was now fire on the 15th floor and no water. Rescue 1 and Ladder 10 both began to back down the A-stairwell. This was a very slow process since the hatches were small and only one fire fighter could pass at a time (see Photo 6). Fire fighters on the 16th floor were also backing down the B-stairwell.

The fire conditions on the 15th floor were rapidly changing from a light haze to heavy, black smoke overhead. Engine companies 4, 6, and 24 (with the victims), operating on the 15th floor, descended to the 14th floor and discussed stretching an exterior hoseline. Ladder 1 gathered up their RIT gear and

headed to the A-side external construction elevator. Engines 7 and 10 disconnected their hoseline from the A-stairwell standpipe on the 15th floor and headed toward the B-stairwell, intending to hook up on the 14th floor. At this time, fire fighters began donning their SCBA facepieces and operating on air.

Heavy Smoke Conditions on the 15th Floor and Mayday

At 1613 hours, visibility on the 15th floor dropped to zero as Engine 7 and 10 were headed to the B-stairwell. The fire fighters became disoriented when they tried to traverse a large debris pile and were stopped by a plywood wall. An Engine 10 fire fighter transmitted a Mayday at 1614 hours. Battalion Chief 2, operating on the 15th floor near the A-side construction elevators, acknowledged the Mayday and ordered Squad 1, 18, and Rescue 1 to search for the lost fire fighters. The Engine 10 officer decided to return to the A-stairwell, but he felt heat in front of him and behind him so he transmitted a Mayday at 1615 hours. The Engine 10 officer finally made his way to the A-stairwell and descended to the 14th floor at 1624 hours. On the 14th floor, he again became disoriented when he encountered a turnstile and radioed an update of his position.

At 1617 hours, another Engine 10 fire fighter became separated and transmitted a Mayday from the internal elevator area near the debris pile on the 15th floor. Three other Engine 10 fire fighters made it to the outside of the plywood wall near the A-side construction elevator. They started to bang on the wall to alert other fire fighters of their location.

Squad 18 after Maydays

At 1612 hours, the Squad 18 officer asked command about dropping a line down from the A-side of the 15th floor to pull a hoseline up the side of the building. He was told by Division 1 to stand by because the standpipe should soon be operational. As soon as he heard the Mayday, he and his crew began searching the 15th floor and found three Engine 10 fire fighters banging on the wall. They directed the fire fighters back to the construction elevator and continued searching. By the time they reached the end of the plywood, they found other lost fire fighters. *Note: The exact identity of some of the lost fire fighters was unknown to Squad 18 due to the smoke conditions*. The plywood wall had been breached at the end, and Squad 18 exited back to the construction elevator area.

Squad 1 after Maydays

When Squad 1 first heard the Mayday transmission they were near the A-side construction elevator on the 15th floor. The crew deployed a search rope and half the crew entered the 15th floor. *Note: This is the same location that Squad 18 had entered to search*. The Squad 1 crew saw 4 or 5 fire fighters exit along the search rope. It was beginning to get very hot and a Squad 1 fire fighter yelled to the crew

searching on the 15th floor to come back. The search crew exited through the breach in the plywood wall.

Fire Fighters Descending to the 14th Floor

The Engine 7 officer and an Engine 7 fire fighter made it down the B-stairwell to the 14th floor and made their way out to the plywood wall on the A-side. The Ladder 10 officer and 2 fire fighters made it down the A-stairwell and, once on the 14th floor, encountered the turnstile. Since they could not make it past the turnstile, they returned to the A-stairwell. They saw daylight coming from the C-side and decided to make it to the C-side windows. They left the stairwell as a team, following along an interior wall. About halfway, they found two other fire fighters (TAC 1 and Squad 1) trying to find their way off the 15th floor. The TAC 1 fire fighter told the Ladder 10 officer that there was heavy fire in the decon area behind the plywood wall (see Photo 7). Together they advanced toward the C-side. At 1619 hours, the Ladder 10 officer radioed an urgent message: "Ladder 10 to Battalion. Be advised that we had to drop down to 14. We're blowing windows out on the, ah, I'm not sure which side I'm on, but we're blowing windows out. We're out of air…south side of building." At 1639 hours, the Ladder 10 officer transmitted another urgent message that fire blew through the plywood wall in the decon shower area and that they were exiting onto the scaffolding on the C-side. Both transmissions were acknowledged by command.

Rescue 1, positioned on the 15th floor, went down the A-stairwell to the 14th floor. The Rescue 1 officer exited the stairwell and encountered the turnstile and returned to the stairwell. One of his fire fighters had a small saw and was trying to open the hatch leading to the 13th floor. The saw would not run due to the heavy smoke conditions. Another Rescue 1 fire fighter realized that there was an opening in the wall *(Note: The wall was plastic sheeting)* on the D-side from the stairwell. They saw light coming from the A-side and the entire Rescue 1 crew exited the stairwell and made their way to the Q-decking area near the construction elevator.

Dry Standpipe

Realizing that the standpipe was dry, the Engine 4, 6, and 24 crews on the 14th floor Q-decking area near the construction elevators began an exterior hoseline stretch. They were connecting their 2½-inch hoselines together when they heard the first Mayday from Engine 10. They heard the banging on the plywood wall and began breaching the wall to assist the fire fighters on the other side. After opening the plywood wall and assisting the Engine 10 fire fighters, they continued with the exterior line stretch. The Engine 4 officer was trying to determine the best location to drop the exterior line down. He saw a clear path to the ground beside the construction elevator. A construction worker operating the elevator told the fire fighters that the top of the elevator had a caged platform, which was sometimes used to transport supplies and equipment. The Engine 4 officer decided to put a fire fighter on top of the elevator to help flake out the hoseline as the elevator descended to the ground. An Engine 4 fire fighter

rode the elevator to the ground as fire fighters on the 14th floor fed him hose. Once the external line was hooked up to a satellite water manifold, only two lengths of hose remained on the 14th floor, which they stretched back to the stairwells. At some point, an Engine 24 fire fighter attached their nozzle to the end of the hoseline and said it was Engine 24's line.

The Engine 3/Hi-Rise Unit officer and two fire fighters brought extra SCBA cylinders to the 14th floor. Battalion Chief 41 told the Engine 3 officer to report back on the status of the hoseline stretch. He followed the hoseline back to the stairwell area, where the Engine 24 crew (with Victims #1 and #2) told him they needed more hose. He returned to the elevator area and told Battalion 41 that Engine 24 was on the nozzle and they needed more sections of hoseline. Battalion 41 radioed command and other units began to bring more hose to the 14th floor. After flaking out more hoseline, the Engine 3 officer followed the hoseline back to the B-stairwell and saw that it was at the doorway leading to the 15th floor. The line was charged at 1644 hours.

Engine 24 Operating the Hoseline

As the Engine 24 crew (with Victims #1 and #2) advanced the hoseline from the 14th floor up the B-stairwell to the 15th floor, Rescue 2 was finishing their search of the 15th floor. A Rescue 2 fire fighter was stationed at the stairwell to monitor conditions while the rest of the crew used a search rope. At 1644 hours, the Rescue 2 fire fighter at the stairwell was ordered by the Rescue 2 officer to descend to the 14th floor. The stairwell had zero visibility as he started down; he remembers bumping into at least one Engine 24 fire fighter. Victim #1 was on the nozzle and another Engine 24 fire fighter was on backup. Both were at the doorway of the 15th floor stairwell when the Engine 24 officer began to search for the fire. As soon as the officer began his search, his low-air alarm activated. He returned to the stairwell and told a fire fighter (possibly Victim #1) that he was low on air and was going down to the 14th floor. He reached the half landing between the 14th and 15th floor and became disoriented and could not find his way out of the stairwell. At 1648 hours, he transmitted, "Mayday-Mayday-Mayday. Engine 24 to anybody!" Command responded, "Unit with the Mayday." Engine 24 officer responded "I'm lost. I'm trying to exit on the charged hoseline, running out of air." A few seconds later, an Engine 24 fire fighter responded, "…look for the hoseline. We're in the stairs." *Note: The Engine 24 fire fighter thought his officer was still on the 15th floor searching for fire. He didn't realize his officer was actually in the stairwell behind him.* The Engine 24 officer was able to find his way out of the stairwell to the 14th floor and make his way back to the Q-decking area.

Shortly after the Engine 24 officer left the 15th floor, Victim 1 and the backup fire fighter decided to back the hoseline down to the 14th floor. As they reached the 14th floor, they found Victim #2 standing and gasping for air. *Note: At this point, Engine 24 backup fire fighters lost contact with Victim #1.* Victim #2 told them he was out of air. *Note: Victim #2 was standing up even though smoke conditions were extremely heavy.* The Engine 24 backup fire fighter removed his regulator to buddy breath, but Victim #2 did not have his facepiece on. He opened the purge valve to give him some air, but since his throat was hurting, he put his regulator back on. *Note: Since the Engine 24 fire fighter was affected by*

smoke, he had some difficulties reattaching his regulator. The Engine 24 fire fighter tried pulling Victim #2 to the ground, but he was resisting. The Engine 24 fire fighter lost his grip and fell forward through the door leading to the 14th floor. His hand landed on a garden-type hose that led to the construction elevator. He yelled back to Victims #1 and #2 to follow him out. At 1650 hours, he transmitted a Mayday, "Mayday-Mayday. (Engine) 24 backup with a Mayday!" Command responded "Unit with the Mayday, go ahead." He responded, "(Engine) 24 backup. There were two members on the 14th floor, out of air…at the stairwell…going to make some noise by the entrance…in the A-stairwell." He made his way out to the Q-decking area and told other fire fighters that two Engine 24 fire fighters were still inside. See Photo 8 for the building and fire conditions at 1658 hours.

Victims Located

Fire fighters stationed near the 14th floor Q-decking area were completely exhausted. *Note: This may have been due to the heavy smoke conditions and the fact that fire fighters were only intermittently wearing their SCBAs to conserve air.* The Engine 24 fire fighter met up with his officer and told him what happened. The Rescue 1 officer, a Rescue 1 fire fighter, and the Rescue Battalion Chief 1 went through the breach in the plywood wall to search for the missing fire fighters. After crawling about 15 feet, the Rescue 1 officer yelled back that he heard a PASS alarm. The Rescue Battalion chief went back to the Q-decking area and told the fire fighters there to assist. At 1701 hours, Victim #2 was located. He was found unconscious, not wearing his facepiece. He was transported to the Q-decking area where CPR was started and he was taken down the elevator.

The Rescue 1 officer made sure that everyone was out before returning to the Q-decking area. After returning he was told by the Engine 3 officer that another fire fighter was still missing. At 1707 hours, they heard another PASS alarm. They both followed a search rope back and began searching. The Engine 3 officer found Victim #1 unconscious without his facepiece on, in the core area between the north and south turnstiles. He was on the edge of the platform that covered the original building elevator shafts on the east side of the core area. He was brought out to the Q-decking area where fire fighters began CPR and he was taken down the elevator.

Fire fighters on the ground continued administering CPR/stabilization and rushed the victims to awaiting ambulances. The victims were transported to a metropolitan trauma center where they succumbed to their injuries. Victim #1 was pronounced dead at 1810 hours and Victim #2 was pronounced dead at 1809 hours.

FIRE BEHAVIOR and SPREAD

According to the fire marshal, the origin and cause of the fire was from a burning cigarette discarded by a construction employee in the decontamination shower area on the 17th floor.

Significant factors related to the fire's uncontrolled spread:

- Fire began on the 17th floor, C-side in the decontamination shower area.
- Window and plywood coverings, C-side, were self-venting 15 minutes after arrival.
- Ventilation of 14th and 15th floors, B- and C-sides, occurred early in operations.
- Excessive reflex time - water supply was not established for over 1 hour into operations.
- External fire extended laterally from the 17th floor downward.
- Smoke conditions changed dramatically when the fire on the 15th floor escalated.
- Fire fighters described unusual smoke conditions as a "wall of smoke" descending on them.
- Smoke conditions were dark black and fuel-rich.
- Numerous compartmentalized zones were under negative pressure for asbestos abatement.
- Plastic sheeting, construction debris, and exposed lumber in partitions provided additional fuel.

The fire department hired an engineering consulting firm to conduct a fire model of the fire. The results of the modeling were not available at the time of this report.

CONTRIBUTING FACTORS

Occupational injuries and fatalities are often the result of one or more contributing factors or key events in a larger sequence of events that ultimately result in the injury or fatality. NIOSH investigators identified the following items as key contributing factors in this incident that ultimately led to the fatality:

- Delayed notification of the fire by building construction personnel.
- Standpipe and sprinkler system inoperable.
- Delay in establishing water supply.
- Inaccurate information about standpipe.
- Unique building conditions with both asbestos abatement and deconstruction occurring simultaneously.
- Extreme fire behavior.
- Uncontrolled fire rapidly progressing and extending below the fire floor.
- Blocked stairwells preventing fire fighter access and egress.
- Maze-like interior conditions from partitions and construction debris.
- Heavy smoke conditions causing numerous fire fighters to become lost or disoriented.
- Failure of fire fighters to always don SCBAs inside structure and replenish air cylinders.
- Communications overwhelmed with numerous Mayday and urgent radio transmissions.
- Lack of crew integrity.

CAUSES OF DEATH

According to the medical examiner's findings, the cause of death for Victim #1 was smoke inhalation with a carboxyhemoglobin level (COHb) of 20% saturation at the time of autopsy. Victim #1 had marked soot in the oral cavity, larynx, and bronchi with pulmonary edema (indicating a burned airway). Victim #1 also had blunt trauma to the head with facial abrasions believed to be caused by rescue efforts.

The cause of death for Victim #2 was smoke inhalation with a carboxyhemoglobin level (COHb) of 27% saturation at the time of autopsy. A slight amount of soot was found in the trachea and bronchi.

FIRE FIGHTER INJURIES

By the time the fire was contained, 115 fire fighters had suffered injuries, 46 seriously enough to require medical leave. The majority of the injuries were respiratory complications from smoke inhalation and musculoskeletal injuries.

RECOMMENDATIONS

Recommendation #1: Fire departments should review and follow existing standard operating procedures on high-rise fire fighting to ensure that fire fighters are not operating in hazardous areas without the protection of a charged hoseline.

Discussion: In this incident there was a major delay in establishing water supply, and fire fighters were operating within the structure without charged hoselines. Fire departments should ensure that a hoseline is in position prior to entering hazardous or potentially hazardous areas. At this point, the hoseline can be charged and entry made. If the hoseline doesn't charge or flow is restricted, fire fighters will still have time and space to escape.

According to Dunn, the most important fire fighting operation at a structure fire is stretching the first attack hoseline to the fire. [4,5] A properly positioned and functional fire attack hoseline saves the most lives during a fire.[4] "It confines the fire and reduces property damage. Searches will proceed quickly, rescues will be accomplished under less threat, sufficient personnel will be available for laddering, ventilation will be effective, and overhaul above the fire room will be unimpeded."[5] To ensure successful interior attacks, firefighters should continually train on establishing effective water supply, proper hose deployment, and advancing and operating hoselines. In this incident, water supply was not established for a full hour into the incident, and at the time of the fatal event the victim's hoseline had just been charged.

Recommendation #2: Fire departments should be prepared to use alternative water supplies when a building's standpipe system is compromised or inoperable.

Discussion: Establishing adequate water supply on the fireground is an integral part of fire suppression. Regardless of the choice of attack method or the type of fire stream used, successful fire suppression depends upon discharging a sufficient quantity of water to remove the heat being generated and ensuring that the water stream reaches the fire rather than being turned into steam or being carried away by convective currents.[5] In preparation for potential issues, fire departments should develop and enforce standard operating procedures to establish an alternate water supply when a high-rise building's standpipe system is inoperable. In this incident, fire fighters ran an external hoseline up the side of the structure after struggling with the inoperable standpipe system.

Recommendation #3: Fire departments should develop and enforce risk management plans, policies, and standard operating guidelines for risk management during complex high-rise operations.

Discussion: According to NFPA 1500 §A.8.3.3, "the acceptable level of risk is directly related to the potential to save lives or property. Where there is no potential to save lives, the risk to the fire department members should be evaluated in proportion to the ability to save property of value. When there is no ability to save lives or property, there is no justification to expose fire fighters to any avoidable risk, and defensive fire suppression operations are the appropriate strategy."[6] Retired New York City Deputy Fire Chief Vincent Dunn states the following: "When no other person's life is in danger, the life of the firefighter has a higher priority than fire containment." [4] Chief Dunn also states "The protection of life is the highest goal of the fire service…When a life is clearly threatened, there is no risk too great. At most fires, however, lives are not clearly endangered. At most fires, then, the priority of firefighting is the protection of the fire fighters' lives." The risk management plan must consider the following: (1) risk nothing for what is already lost—choose defensive operations; (2) extend limited risk in a calculated way to protect savable property—consider offensive operations; (3) and extend very calculated risk to protect savable lives—consider offensive operations.[7,8]

Recommendation #4: Fire departments should ensure that crew integrity is maintained during high-rise fire suppression operations.

Discussion: Fire fighters should always work and remain in teams whenever they are operating in hazardous environments.[9] Team continuity means team members know who is on their team and who is the team leader; team members stay within visual contact at all times (if visibility is low, teams must stay within touch or voice distance of each other); team members communicate needs and observations to the team leader; and team members rotate together for team rehabilitation, staging, and accountability (e.g., watching out for each other, practicing a strong buddy system). Following these basic rules helps prevent serious injury or even death by providing personnel with the added safety net

of fellow team members. Teams that enter a hazardous environment together should leave together to ensure that team continuity is maintained.[5] Fire departments should also consider adding implementation of a crew accountability system during complex high-rise incidents. In this incident, there were numerous instances where fire fighters became disoriented while working independently.

Recommendation #5: Fire departments should train fire fighters on actions to take if they become trapped or disoriented inside a burning high-rise structure.

Discussion: Fire fighters must act promptly when they become lost, disoriented, injured, low on air, or trapped.[10–15] First, they must transmit a Mayday distress signal while they still have the capability and sufficient air, noting their location if possible. The next step is to manually activate their PASS device. To conserve air while waiting to be rescued, fire fighters should try to stay calm, be focused on their situation, and avoid unnecessary physical activity. They should survey their surroundings to get their bearings and determine potential escape routes (e.g., windows, doors, hallways, and changes in flooring surfaces); they should stay in radio contact with command and other rescuers. Additionally, fire fighters can attract attention by maximizing the sound of their PASS device (i.e., by pointing it in an open direction), pointing their flashlight toward the ceiling or moving it around, and using a tool to make tapping noises on the floor or wall. A crew member who initiates a Mayday call for another person should quickly try to communicate with the missing member via radio and, if unsuccessful, initiate another Mayday providing relevant information on the missing fire fighter's last known location. In an emergency situation, fire fighters need to rely on their training so that they take the correct personal safety actions when they become trapped or disoriented. Repetitive skills training can instill knowledge necessary to provide a more self-controlled, composed response to a potentially life-threatening situation.

Recommendation #6: Fire departments should ensure that fire fighters diligently wear their self-contained breathing apparatus (SCBA) when working in environments that are immediately dangerous to life and health (IDLH).

Discussion: NFPA 1500 *Standard on Fire Department Occupational Safety and Health Program*, Section 7.9.7, states, "When engaged in any operation where they could encounter atmospheres that are immediately dangerous to life or health (IDLH) or potentially IDLH, or where the atmosphere is unknown, the fire department shall provide and require all members to use SCBA that has been certified as being compliant with NFPA 1981 Standard on Open-Circuit Self-Contained Breathing Apparatus for Fire and Emergency Services."[6,16] NFPA 1500 Section 7.9.8 restricts fire fighters from removing their facepieces anytime while operating in an IDLH or potentially IDLH atmosphere. Additionally, the OSHA Respirator Protection Standard requires that all employees engaged in interior structural fire fighting use SCBAs.[17] During this incident, there were multiple instances where fire fighters inside the burning structure, which was contaminated with asbestos, operated without donning their facepiece.

Recommendation #7: Fire departments should train fire fighters in air management techniques to ensure they receive the maximum benefit from their self-contained breathing apparatus (SCBA).

Discussion: Victim #2 and numerous other fire fighters ran out of air during this incident. SCBA air cylinders contain a finite volume of air, regardless of the size. Air consumption will vary with each individual's physical condition, the level of training, the task performed, and the environment. Depending on the individual's air consumption and the amount of time required to exit an IDLH environment, the low-air alarm may not provide adequate time to exit. Working in high-rise structures requires that fire fighters be cognizant of the distance and the time required to reach the point of suppression activity from the point of entry/egress. When conditions deteriorate and visibility becomes limited, fire fighters may find that it takes additional time to exit when compared to the time it took to enter the structure.[14,18] NFPA 1404 *Standard for Fire Service Respiratory Protection Training*, Paragraph 5.1.4(2), requires fire departments to train fire fighters on air management techniques so that the individual fire fighter will develop the ability to manage air consumption while wearing a SCBA. NFPA 1404 A.5.1.4(2) specifies that the individual air management program should include the following directives: (1) fire fighters should exit an IDLH atmosphere before consumption of reserve air supply begins, (2) the low-air alarm is notification that the individual is consuming the reserve air supply, and (3) the fire fighter and his/her crew should take immediate action when a crew member's reserve air alarm is activated.[19]

Fire departments should regularly conduct training exercises in which fire fighters perform various exercises and work tasks at different work rates until their SCBA cylinder air is exhausted. With this type of training, fire fighters will understand the length of time they can expect to work before the low-air alarm sounds and how long they have to exit once the alarm sounds. In order to comply with NFPA 1404, fire departments and fire fighters should follow the rule of air management which states "Know how much air you have in your SCBA and manage that air so that you leave the hazardous environment before your low-air alarm activates."[19,20] By being aware of these time parameters, fire fighters can make educated decisions on the time they can safely spend in IDLH atmospheres. It is dangerous for fire fighters to attempt to conserve air by intermittently removing their facepiece and "taking a blow" of air.

Recommendation #8: Fire departments should use exit locators (both visual and audible) or safety ropes to guide lost or disoriented fire fighters to the exit.

Discussion: During this incident, numerous fire fighters inside the structure became disoriented as the fire conditions deteriorated. The use of a combination of visual (high-intensity floodlights, flashing strobe lights, or other high visibility beacons) and audible alerts can be set up at the entry portals of burning structures as an aid to assist fire fighters in situations requiring emergency escape.[21] Reliance on a visual indicator alone does not account for the vision limitations that may be present under extreme smoke conditions. The combined visual and audible alerts provide increased indication of egress within a complex or large floor space building layout. If staffing permits, a fire fighter can be

stationed at the doorway to assist with advancing hoseline through the entrance and to assist exiting fire fighters. Hoselines can be marked with raised chevrons pointing in the direction of the pump (to the outside). Another option for locating exits is the deployment of safety rope lines as crews enter a structure. The end of the safety rope is secured outside the doorway, and the rope is laid out as the crew advances inside.

Recommendation #9: Fire departments should conduct pre-incident planning inspections of buildings within their jurisdictions to facilitate development of safe fireground strategies and tactics.

Discussion: NFPA 1620 *Recommended Practice for Pre-Incident Planning*, 2010 Edition, § 4.4.1, states, "The pre-incident plan should be the foundation for decision making during an emergency situation and provide important data that will assist the incident commander in developing strategies and tactics for managing the incident."[22] Pre-incident planning inspections identify deviations from normal emergency operations and can be complex and formal or simply a notation about a particular problem with a building such as the presence of flammable liquids, explosive hazards, modifications to structural building components, or structural damage from a previous fire.[22–24]

In addition, NFPA 1620 outlines the steps involved in developing, maintaining, and using a pre-incident plan by breaking an incident down into pre-, during-, and post-incident phases.[22] In the pre-incident phase, for example, inspections cover factors of the building such as physical elements and site considerations, occupant considerations, protection systems and water supplies, hydrant locations, and special hazard considerations. Building characteristics, including type of construction, materials used, occupancy, fuel load, roof and floor design, and unusual or distinguishing characteristics, should be recorded. Information gathered in the pre-incident inspections should be shared with other departments who provide mutual aid, and, if possible, entered into the dispatcher's computer so that the information is readily available if an incident is reported at the noted address. Metropolitan fire departments have thousands of structures within their jurisdiction, making it necessary to develop a prioritization system for conducting preplans. Priority should be given to those having elevated or unusual fire hazards and safety considerations.

In this incident, the fire department had not conducted any recent preplan inspections of the structure since it was undergoing asbestos abatement. A pre-incident inspection of the building in this incident would have necessitated that fire fighters conducting the inspection wear the appropriate personal protective equipment (PPE) and be decontaminated following the inspection. Fire departments should ensure additional resources are available so that pre-incident inspections in buildings undergoing deconstruction and/or asbestos abatement are fully inspected. The additional resources would include personnel, service time, appropriate PPE, and decontamination.

Recommendation #10: Fire departments should encourage building owners and occupants to report emergency situations as soon as possible and provide accurate information to the fire department.

Discussion: Building construction personnel should have immediately reported the fire to 911 dispatch. One of the simplest and most effective methods of achieving the goal of the preservation of life and property is prevention.[9] The importance of citizens reporting an emergency situation as soon as possible to the proper authorities cannot be overemphasized. Any delay allows the fire a chance to increase in intensity and to spread to uninvolved areas. Brannigan states, "Make it clear that the fire department should be called if smoke is even smelled. This might indicate a hidden fire."[25] As stated in the *Firefighter's Handbook*, "Teaching our citizens to recognize life safety hazards and to react appropriately is clearly a fire department function and responsibility."[10]

In this incident, fire command received inaccurate information about the structure from construction personnel, and, as a result, fire fighting operations were adversely effected. Construction personnel erroneously reported that the standpipe system was operational and command assumed that water supply could be established by the system. This resulted in delay before water was supplied and fire suppression operations began.

Recommendation #11: Fire departments should consider additional fire fighter training using a high-rise fire simulator.

Discussion: Following this incident, the fire department constructed a high-rise fire simulator at its fire academy and has trained all engine and ladder companies using the new simulator. The 4,000-square-foot, four-story training structure reproduces the unique conditions fire fighters would face while responding to high-rise building fires, such as roll-over fire conditions and a dry standpipe system. Other metropolitan fire departments with high-rise structures should also consider using a high-rise fire simulator as a fire fighter training tool to increase safety and proficiency during high-rise fires.

Recommendation #12: Manufacturers, equipment designers, and researchers should conduct research into refining existing and developing new technology to track the movement of fire fighters in high-rise structures.

Discussion: Fire fighter fatalities often are the result of fire fighters becoming lost or disoriented on the fireground. The use of systems for locating lost or disoriented fire fighters could be instrumental in reducing the number of fire fighter deaths on the fireground. The National Institute for Standards and Technology (NIST) has been evaluating the feasibility of real-time fire fighter tracking and locator systems. [26,27] Research into refining existing systems and developing new technologies for tracking the movement of fire fighters on the fireground should continue.

Recommendation #13: Manufacturers, equipment designers, and researchers should continue to develop and refine durable, easy-to-use radio systems to enhance verbal and radio communication in conjunction with properly worn self-contained breathing apparatus (SCBA).

Discussion: The use of PPE and a SCBA make it difficult to communicate, with or without a radio.[26,28] Faced with the difficult task of communicating while wearing a SCBA, fire fighters sometimes momentarily remove their facepieces to transmit a message directly or over a portable radio. Considering the toxic and oxygen-deficient hazards posed by a fire and the resulting products of combustion, removing the SCBA facepiece, even briefly, is a dangerous practice that should be prohibited. Even small exposures to carbon monoxide and other toxic agents present during a fire can affect judgment and decision-making abilities. To facilitate communication, equipment manufacturers have designed facepiece-integrated microphones, intercom systems, and throat mics and bone mics worn in the ear or on the forehead.[28,29]

Recent testing of portable radios in simulated fire fighting environments by the National Institute of Standards and Technology (NIST) has identified that radios are vulnerable to exposures to elevated temperatures. Some degradation of radio performance was measured at elevated temperatures ranging from 100°C to 260°C, with the radios returning to normal function after cooling down. Additional research is needed in this area.[30]

During this incident, fire fighters experienced intermittent radio communication problems and some high priority transmissions were not heard by fire command. Effective radio communication is an important part of safe fireground operations.

***Recommendation 14: Municipalities should ensure that construction and/or demolition is done in accordance with NFPA 241:* Standard for Safeguarding Construction, Alteration, and Demolition Operations.**

Discussion: Building deconstruction should be conducted in accordance with NFPA 241: *Standard for Safeguarding Construction, Alteration, and Demolition Operations*.[31] Municipalities should ensure the construction companies conducting deconstruction have a demolition fire safety plan in accordance with NFPA 241. The following provisions of NFPA 241 were applicable to this incident.

Section 7.6 "Fire Protection: Standpipes" states, "In all new buildings in which standpipes are required or where standpipes exist in buildings being altered or demolished, such standpipes shall be maintained in conformity with the progress of building construction in such a manner that they are always ready for use."[31] In this incident, the building's standpipe system was completely inoperable.

Section 10.4 "Safeguarding Demolition Operations: Smoking" states, "Smoking shall be prohibited throughout the demolition areas."[31] It is believed the construction employees were smoking in the area where the fire began.

Section 10.8.2 "Safeguarding Construction and Alteration Operations: Fire Protection During Demolition, System Operation" states, "Where a building is equipped with sprinklers, the sprinkler protection shall be retained in service as long as the condition requiring the use of sprinklers exists."[31] The incident structure was originally equipped with sprinklers, but, subsequent to the demolition, the sprinkler system was partially removed and made inoperable.

Section 10.8.4 "Safeguarding Construction and Alteration Operations: Standpipes" states, "Standpipes shall be maintained in conformity with the progress of demolition activity in such a manner that they are always ready for fire department use."[31] In this incident, the building's standpipe system was completely inoperable.

Recommendation 15: Municipalities should develop a reporting system to inform the fire department of any ongoing, unique building construction activities (such as deconstruction or asbestos abatement) that would adversely affect a fire response.

Discussion: Municipalities should develop a reporting system to inform the fire service of any unique building construction activities for fire inspectors to target during preplans and inspections. This would include activities such as construction, extensive renovations, deconstruction, or ongoing asbestos abatement that would affect the strategies and tactics used during a fire response. Fire departments should also be notified as the stages of these activities progress.

Recommendation 16: Municipalities should establish a system for property owners to notify the fire department when fire protection/suppression systems are taken out of service.

Discussion: Municipalities should establish a system for property owners to notify the fire department when fire protection/suppression systems are taken out of service. NFPA 25: *Standard for the Inspection, Testing and Maintenance of Water Based Fire Protection Systems*, Chapter 15 Impairments, requires the building owner to establish a procedure for reporting impairments in sprinkler and standpipe system to the local fire department.[32] It is also the responsibility of the building owner to mark all the systems within the structure that are out of service.

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INVESTIGATOR INFORMATION

This investigation was conducted by CDR Steve Berardinelli, Safety and Occupational Health Specialist with the Fire Fighter Fatality Investigation and Prevention Program, Fatality Investigations Team, Surveillance and Field Investigations Branch, Division of Safety Research, NIOSH, located in Morgantown, WV. A technical review was provided by Christopher J. Naum, Society of Fire Protection Engineers; Chief of Training, Command Institute, Washington, D.C. and member of the Board of Directors, International Association of Fire Chiefs (IAFC) Safety, Health & Survival Section. A technical review was also provided by the National Fire Protection Association, Public Fire Protection Division.

Two Career Fire Fighters Die Following a Seven-Alarm Fire in a High-Rise Building Undergoing Simultaneous Deconstruction and Asbestos Abatement—New York

Photo 1. Aerial view of B-side of the incident structure.
Photo taken in 1997.
(Photo courtesy of fire department.)

Photo 2. View of the damage sustained to A-side of the incident structure following September 11, 2001.
(Photo courtesy of NOAA.)

Photo 3. Incident structure beginning deconstruction in December 2006.
(Photo courtesy of fire department.)

Photo 4. Standpipe system was inoperable due to missing sections of pipe.
(Photos courtesy of fire department.)

Photo 5. Plastic sheeting, ductwork and fans used for asbestos abatement.
(Photos courtesy of fire department.)

Photo 6. Stairwell hatches.
(Photos courtesy of fire department.)

Photo 7. Fire conditions on C-side.
(Photo courtesy of fire department.)

Photo 8. Fire conditions at 1658 hours.
(Photo courtesy of fire department.)

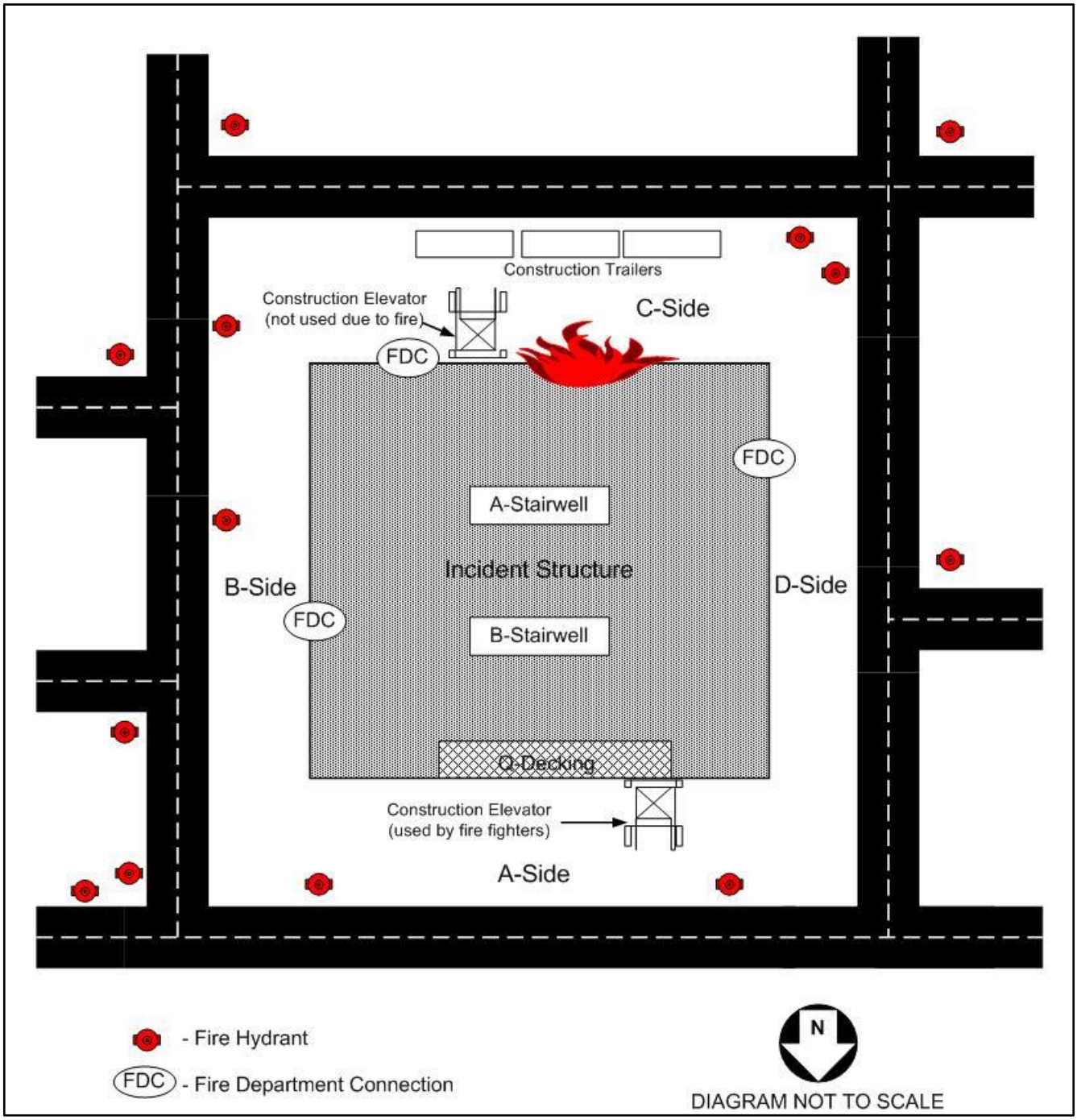

Diagram 1. Aerial view of the incident scene.
(NIOSH diagram.)

Two Career Fire Fighters Die Following a Seven-Alarm Fire in a High-Rise Building Undergoing Simultaneous Deconstruction and Asbestos Abatement—New York

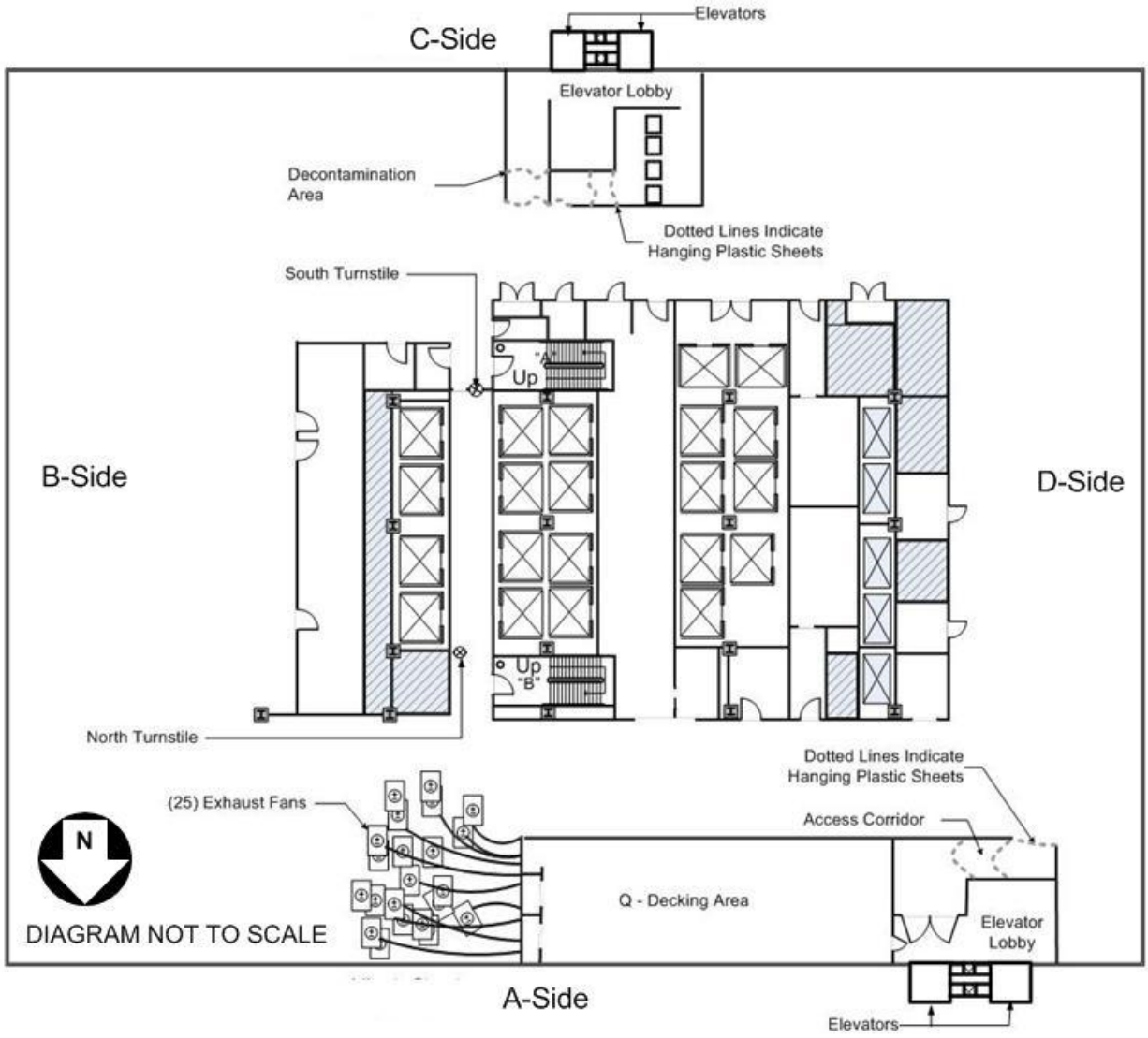

Diagram 2. Layout of the 14th floor.
(Diagram courtesy of the fire department and annotated by NIOSH.)

Two Career Fire Fighters Die Following a Seven-Alarm Fire in a High-Rise Building Undergoing Simultaneous Deconstruction and Asbestos Abatement—New York

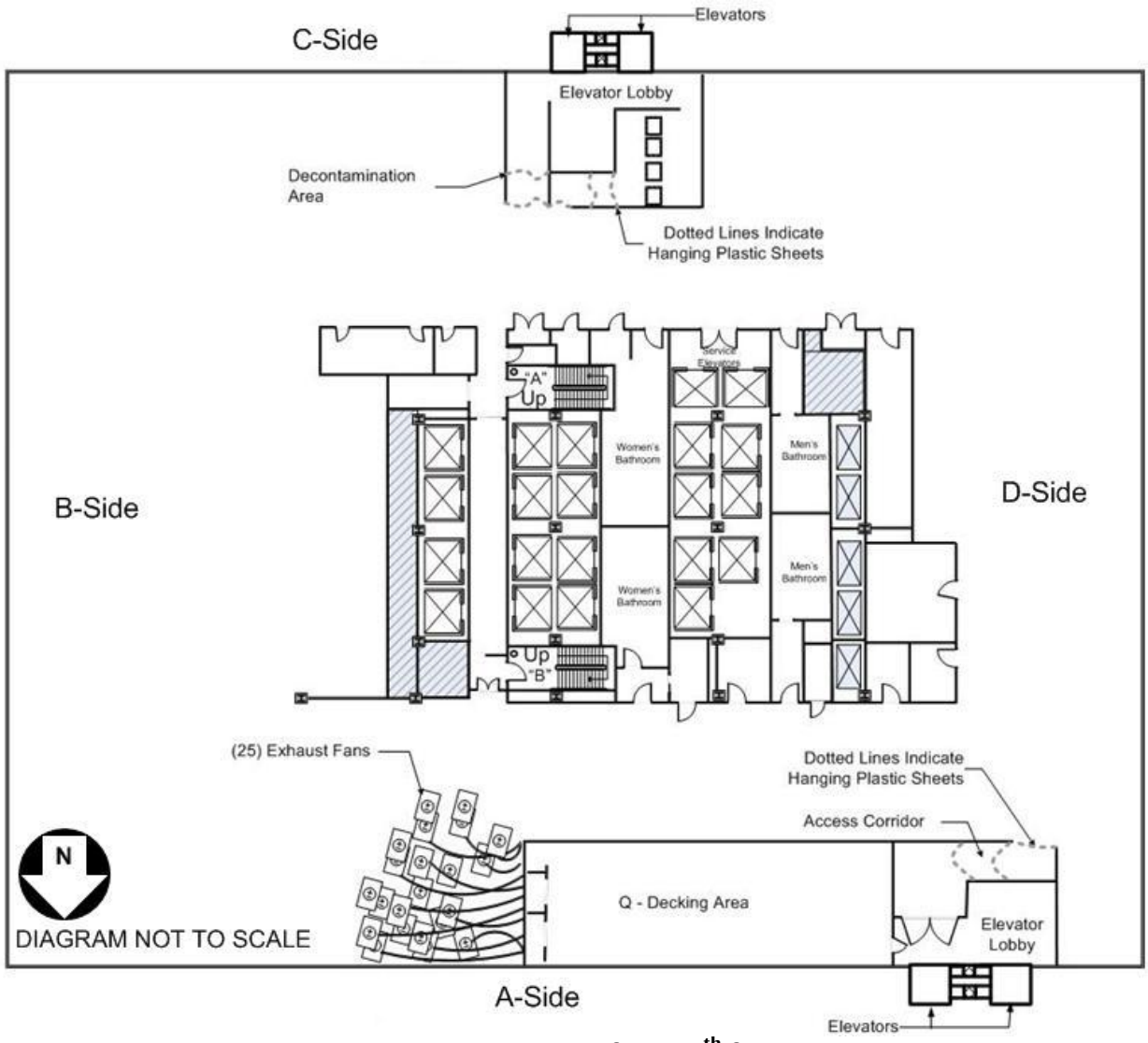

Diagram 3. Layout of the 15th floor.
(Diagram courtesy of the fire department and annotated by NIOSH.)

Appendix A

Responding Apparatus and Personnel

The following responding apparatus are listed in order of dispatch:

- 1st Alarm
  Engine 10 (officer and 4 fire fighters)
  Ladder 10 (officer and 5 fire fighters)
  Engine 4 (officer and 4 fire fighters)
  Ladder 15 (officer and 5 fire fighters)
  Battalion Chief 1 (initial Incident Commander) and battalion fire fighter
  Engine 6 (officer and 4 fire fighters)
  Engine 7 (officer and 4 fire fighters)
  Squad 18 (officer and 5 fire fighters)
  Rescue 1 (officer and 5 fire fighters)
  HazMat 1 (officer and 6 fire fighters)
  HazMat Battalion Chief 1 and battalion fire fighter
  Ladder 1 (officer and 5 fire fighters) assigned as Rapid Intervention Team (RIT)
  Battalion Chief 2 and battalion fire fighter
  Division Chief 1 and chief's aide

- 2nd Alarm
  Engine 55 (officer and 4 fire fighters)
  Engine 24 (officer and 4 fire fighters including both victims)
  Engine 15 (officer and 4 fire fighters)
  Engine 9 (officer and 4 fire fighters)
  Engine 33 (officer and 4 fire fighters)
  Squad 1 (officer and 5 fire fighters) assigned HazMat Technicians
  Ladder 8 (officer and 5 fire fighters)
  Ladder 6 (officer and 5 fire fighters)
  Battalion Chief 4 and battalion fire fighter (Incident Safety Officer)
  Battalion Chief 32 and battalion fire fighter
  Rescue Battalion Chief 1 and battalion fire fighter
  Field Communications Unit 1 (officer and 2 fire fighters)
  Recuperation and Care Unit 1 (2 fire fighters)
  Technical Support Unit 1 (officer and 3 fire fighters)
  Engine 3 (officer and 4 fire fighters)
  High-Rise Unit (officer and 4 fire fighters)
  Battalion Chief 31 and battalion fire fighter
  Division Chief 11 and chief's aide
  Car 15 Deputy Chief (Incident Commander) and chief's aide
  Mask Service Unit (2 fire fighters)

Engine 205 (officer and 4 fire fighters)
Ladder 110 (officer and 5 fire fighters)
Battalion Chief 57 and battalion fire fighter
Rescue 2 (officer and 5 fire fighters)
Engine 279 (officer and 4 fire fighters)
Ladder 101 (officer and 5 fire fighters)
Battalion Chief 41 and battalion fire fighter
Ladder 20 (officer and 5 fire fighters)
Ladder 5 (officer and 5 fire fighters)
Battalion Chief 45 and battalion fire fighter
Battalion Chief 7 and battalion fire fighter
Engine 202 (officer and 4 fire fighters)
Engine 14 (officer and 4 fire fighters)
Battalion Chief 31 and battalion fire fighter
Car 23B Deputy Chief and chief's aide
Engine 263 (officer and 4 fire fighters) assigned decon task force
Ladder 117 (officer and 5 fire fighters) assigned decon task force
Battalion Chief 49 and battalion fire fighter assigned decon task force
Battalion Chief 8 and battalion fire fighter
Car 1E Deputy Chief and chief's aide
Engine 283 (officer and 4 fire fighters) assigned decon task force

Note: Chief's aides and battalion fire fighters are assigned departmental positions that assist chief officers throughout their work shifts.

Appendix B

Incident Timeline

The following timeline is a summary of events that occurred as the incident evolved on August 18, 2007. Not all incident events are included in this timeline. *Note: Times are approximate and were obtained from review of the dispatch records, witness statements, photographs of the scene, and other available information. In some cases the times may be rounded to the nearest minute, and some events may not have been included. The timeline is not intended, nor should it be used, as a formal record of events.*

Key events

- **1536 Hours**
  911 received phone call reporting "fire on the scaffolding of a vacant building."

- **1537 Hours**
  Dispatch assigned two engine companies, two ladder companies, and a battalion chief as initial 1st alarm response to the fire.

- **1538 Hours**
  1st alarm assignment en route to scene.
  Dispatch assigned two additional engine companies, a squad unit, and a rescue company.

- **1539 Hours**
  Engine 10 arrived on scene.
  Dispatch assigned a hazardous materials company to the scene.

- **1540 Hours**
  Ladder 10 arrived on scene and requested dispatch send additional units.

- **1541 Hours**
  Dispatch assigned Division Chief 1 to the scene.
  Ladder 10 radioed Dispatch and requested a 2nd alarm.
  Engine 10 positioned apparatus near hydrant on D-side.

- **1542 Hours**
  The scaffolding surrounding the building was on fire and the fire was on multiple floors.
  Engine 10 and Ladder 10 officers conferred on whether the building's standpipe was working.
  Dispatch assigned five engine companies, a squad unit, two ladder companies, three battalion chiefs, and miscellaneous units on the 2nd alarm.

- **1543 Hours**
  Engine 7 arrived on scene and positioned the apparatus near a hydrant on the B-side.
  Engine 10 began supplying the C-side fire department connection (FDC) to building standpipe.

- **1544 Hours**
  Engine 10 crew used the construction elevator on A-side for access to the 15th floor.
  Engine 4 and Ladder 15 arrived on scene.

- **1545 Hours**
  Ladder 1 arrived on scene.

- **1546 Hours**
  Engine 10 crew was operating on the 15th floor.
  Battalion 1 arrived on scene.

- **1547 Hours**
  Engine 10 crew could not advance up building's stairwell because it was boarded over.
  Ladder 10 officer made a radio transmission for all fire fighters to use their SCBAs since the building was undergoing asbestos abatement.
  Engine 6, Rescue 1, and Squad 18 arrived on scene.
  Battalion 1 requested additional resources from dispatch for a high-rise building fire.

- **1548 Hours**
  Engine 10 requested saws and reported fire starting to drop down in the plastic on the 15th floor.
  Ladders 10 and 15 entered the construction elevator and proceeded to the 15th floor.
  Ladder 8 arrived on scene.
  Dispatch assigned another engine company, the high-rise unit, a battalion chief, a division chief, and the mask service unit for a high-rise building response.

- **1549 Hours**
  Battalion 1 ordered Ladder 8 crew to the 15th floor with saws for Engine 10.
  Ladder 10 officer informed Battalion 1 that access to the fire floor was restricted since the stairwell was boarded over.
  Engine 7, Ladder 10, and Ladder 15 crews arrived on the 15th floor.
  Engine 24 (with Victims #1 & #2) and Battalion 2 arrived on scene.
  Dispatch assigned another engine, ladder and rescue company, and battalion chief.

- **1550 Hours**
  Engine 15 and Rescue Battalion arrived on scene.
  Ladder 10 informed Battalion 1 A-side elevators should be used to access the 15th floor.
  Dispatch assigned another battalion chief, engine, and ladder company.

- **1551 Hours**
  Engine 7 and Engine 10 worked to gain stairwell access to the 16th floor.
  Engine 7 supplied FDC connection on B-side with water.
  Battalion 32 and HazMat Battalion 1 arrived on scene.

- **1552 Hours**
  Engine 7 officer conferred with demolition worker on 15th floor.
  Engine 10 was connected to a hydrant and stretching hoseline to the C-side FDC.
  Engine 55, Battalion 4, and Division 1 arrived on scene.
  Dispatch assigned two additional ladder companies.

- **1553 Hours**
  Squad 18 assisted Engine 10 with hoseline stretch to C-side FDC.
  Battalion 1 initial incident commander located on A-side.
  Ladder 6 arrived on scene.

- **1554 Hours**
  Engine 4 officer requested for a second time to bring the elevator to the ground level.
  Ladder 1 arrived on the 15th floor and staged for RIT duties.
  Engine 7 and Ladder 15 took elevator from 15th to 16th floor to assess fire conditions.
  Squad 1 arrived on scene.

- **1555 Hours**
  Ladder 10 officer reported to Battalion 1 that crews still could not access the 16th floor.
  Engines 4, 6, 10, and Squad 18 assisted in hoseline stretch to C-side FDC.

- **1556 Hours**
  Battalion 1 ordered Ladder 8 to assist Ladder 10 in gaining access to 16th floor.
  Engine 10 fire fighter vented a B-side window to access 15th floor scaffolding.
  Engine 10 supplied water to FDC on C-side.
  Dispatch assigned two additional battalion chiefs.

- **1557 Hours**
  Windows began self venting and broken glass crashed to the ground on C-side.
  E10 fire fighters began venting the 15th floor windows on C-side.
  Ladder 1 fire fighter used a saw in the A-stairwell to gain access to the 16th floor.
  Ladder 8, Rescue 1, and Battalion 2 took elevator to the 15th floor.
  Ladder 10 fire fighter brought saws to the 15th floor.
  Engine 9 and Battalion 31 arrived on scene.
  Dispatch assigned two additional engine companies and a battalion chief.

- **1558 Hours**
  Division 1 assumed incident command and set up the command board on A-side.
  Rescue 1, Ladder 8, and Battalion 2 arrived on the 15th floor.
  Ladder 10 fire fighter worked on the 15th floor B-stairwell to gain access to the 16th floor.
  Engines 33 and 279, Ladders 5 and 20, and Division 11 arrived on scene.

- **1559 Hours**
  Battalion 4 conferred with onsite building engineer about the standpipe system.
  Building engineer informed fire command that the building's standpipe system was operational and that there was water in the standpipe.
  Engine 10 fire fighter reported to Engine 10 officer confirming FDC hook up.

- **1600 Hours**
  The building engineer went to the basement of the structure to start the standpipe pumps.
  Ladder 1 fire fighter and Ladder 10 fire fighter entered onto scaffolding on the B-side 15th floor.
  Engine 24 (with Victims #1 and #2) waited at ground level for the construction elevator.
  Battalion 1 briefed Battalion 2 that both construction elevators were operational; that Ladder 8 was operating on the 15th floor; and that Squad 18, Engine 4, and Engine 6 were staging to go to the 15th floor.
  Rescue 2, HazMat 1, and the Field Communications Unit arrived on scene.

- **1601 Hours**
  Engines 3, 4, 6, and Squad 18 took elevators to 15th floor.
  5-inch large diameter hose was stretched to supply manifold.
  Engine 3 and the High-Rise Unit arrived on scene.

- **1602 Hours**
  Engine 4, Engine 6, and Squad 18 operated on the 15th floor.
  Ladder 10 fire fighter forced open a hatch in A-stairwell leading to 16th floor.
  Small fires were burning at ground level in adjacent construction sites from falling embers on the C- and D-sides; the fires were quickly extinguished by fire fighters operating in the vicinity.
  Ladder 110 arrived on scene.

- **1603 Hours**
  Rescue 1 advanced up the opened hatch in the A-stairwell to the 16th floor.
  Engine 4 and 6 teamed up and operated on the 15th floor.
  Engine 24 (with Victims #1 and #2) and Squad 1 arrived on 15th floor.
  Rescue 2 and Division 11 reported for assignments at the command post.
  Engine 205 arrived on scene.

- **1604 Hours**
  Ladder 10 officer gave report to Battalion 2: entry was gained to 16th floor, search rope was deployed, and the 17th floor was believed to be the fire floor.
  Engine 4 and 6 searched for another standpipe on the 15th floor.
  Engine 202 arrived on scene.

- **1605 Hours**
  Engine 7 reported supplying 200 psi water pressure to FDC.
  Radio transmission received from unknown fire fighter "water not reaching 15th floor" standpipe.
  Ladder 15 advanced up A-stairwell and began search of the 16th floor.
  Squad 18 operated in the B-stairwell and attempted to open the hatch blocking access to the 16th floor.
  Battalion 41 arrived on scene.

- **1606 Hours**
  Car 15 assistant chief assumed incident command.
  Squad 1 reported to Division 1 that a room was on fire on the 15th floor.
  Division 1 responded that there was a water supply problem with the standpipe.
  Dispatch advised all responding 2nd alarm units to report to the command post for assignments.

- **1607 Hours**
  Car 15 ordered Rescue Battalion 1 to assess fire conditions in the building and report back.
  Car 15 ordered Battalion 41 to assess status of building's standpipe system and report back.
  Rescue 1 officer reported to Battalion 2 that his crew was operating on the 17th floor and that they heard fire crackling and the thermal imaging camera (TIC) showed hot areas.
  Engine 10 crew hooked up to the dry standpipe on the 16th floor.
  Engine 4 officer informed Battalion 1 that Engine 10 was hooked but was having water problems and that a hoseline should be lowered down the exterior of the building.Battalion 57 arrived on scene.

- **1608 Hours**
  Fire progressing on the 15th floor
  Battalion 2 acknowledged Rescue 1's report and advised that there were still water supply problems.
  Battalion 2 reported to Division 2: heavy volume fire on the 17th floor, some fire on the 15th floor, and fire crews did not have water.
  Engines 4, 6, and 24 formulated a plan to stretch a hoseline down the exterior of the building.
  Ladder 15 descended from 16th to 15th floor in A-stairwell.
  Division 1 assigned Battalion 1 to address water supply problem.

Battalion 1 entered lower levels of the structure with a construction worker to check on the standpipe system.
Car 15 ordered Division 11 to determine if all construction workers were accounted for.

- **1609 Hours**
  Battalion 4 reported to command that, according to the building engineer, the standpipe system was operational in the B-stairwell.
  Battalion 1 and Engine 4 considered dropping a search rope for the exterior hoseline stretch.
  Battalion 41 checked the standpipe on 3rd floor.
  Ladder 15 checked standpipe for open outlets and closed section valves.

- **1610 Hours**
  Car 15 asked Battalion 2 to verify if the standpipe was working in the B-stairwell as the building engineer reported.
  Battalion 2 reported no water in the B-stairwell.
  Engine 4 officer asked Car 15 about feasibility of an external hoseline stretch.
  Fire progressed on the 15th floor; crews began to back down.
  Engines 4, 6, 24 descended from the 15th to 14th floor.
  Ladder 10 crew left the 17th floor via the A-stairwell.
  Division 11 informed by construction company representative that all workers "should be out," but was "not sure."
  Battalion 7 arrived on scene.

- **1611 Hours**
  Battalion 2 ordered Rescue 1 down from the 17th floor.
  Rescue 1 officer acknowledged, and the crew backed down to the 16th floor.
  Car 15 ordered Battalion 4 to establish water supply.
  Engine 24 was ordered to descend to the 14th floor.

- **1612 Hours**
  Heavy smoke developed on the 15th floor, forcing fire fighters to descended to the 14th floor.
  Engines 4, 6, 24 crews began connecting 2½-inch hose rolls near the construction elevator lobby on the 14th floor in preparation of lowering hose down the side of the building.
  Squad 18 officer was positioned on the 15th floor, ready to pull up lengths of hose.
  Fire fighters determined that both stairwells were blocked to the 13th floor.
  Battalion 41 checked standpipes on the 7th floor: they were dry.
  Car 15 was incorrectly informed again by building representative that the standpipe system was operational.
  Battalion 45 arrived on scene.

- **1613 Hours**
  Fire on 15th floor began to "take off."
  Conditions went from moderate to thick black smoke to no visibility on the 15th then the 14th floors.
  Fire fighters described "a black curtain of smoke" dropping on them.
  Car 15 ordered HazMat Battalion to establish a decontamination zone.
  Engine 14 arrived on scene.

- **1614 Hours**
  Heavy fire conditions on 15th floor.
  Engine 10 fire fighter on 15th floor transmitted a Mayday, "Assist us! It's banked down and starting to get hot!"
  Car 15 acknowledged the Mayday.

- **1615 Hours**
  Car 15 ordered Battalion 2 to make contact with Engine 10 fire fighter with the Mayday.
  Car 15 attempted to contact Engine 10 officer regarding the Mayday.
  Engine 10 officer transmitted a Mayday, "Engine 10, Mayday-Mayday-Mayday. We're on the 15, outside the elevators with a number of members trying to find the B-stairwell to evacuate."
  Battalion 2 ordered Squads 1 and 18 to search the 15th floor for the fire fighter who transmitted the first Mayday.
  Car 15 ordered Rescue 2 into the building in response to the Maydays.
  Car 15 ordered Division 11 into the building to coordinate operations.
  Dispatch assigned engine company, ladder company, and battalion chief as a decon task force.

- **1616 Hours**
  Radio transmissions instructed disoriented fire fighters to activate their PASS alarms.

- **1617 Hours**
  Another Engine 10 fire fighter transmitted a Mayday.
  Battalion transmitted to command, "It's getting pretty bad up here, Chief. Heavy smoke, heavy fire in the other part of the building…they're trying to locate the members."
  Two Engine 7 fire fighters and an Engine 10 fire fighter reached a plywood wall near the exhaust fans on the 15th floor.
  Ladders 1 and 15 began breaching a plywood wall.
  Engine 7 officer and fire fighter made it down the B-stairwell to the 14th floor.
  Car 23B arrived on scene.

- **1618 Hours**
  Rescue 1 found Engine 10 fire fighter who transmitted Mayday.
  Rescue 2 arrived on the 14th floor.

Engine 9 set up satellite water manifold on the A-side.
Battalion 8 arrived on scene.
Car 1E responded to scene.

- **1619 Hours**
  Ladder 10 officer reported descending to 14th floor with his crew and radioed, "I'm not sure which side I'm on, but we're blowing the windows out…we're out of air… ."
  Blocked hatch prevented fire fighters on the 14th floor from descending to the 13th floor.
  Engines 4, 6, 24 crews connected their hoselines on the 14th floor.
  Engine 24 fire fighter attached nozzle to connected hoselines making it Engine 24's line.
  Squads 1 and 18 assisted firefighters to safety on the 15th floor.

- **1620 Hours**
  Ladder 8 officer radioed, "It's starting to get bad up here on 15…we're going to force our way out…it's getting bad…we're losing visibility."
  Engine 10 fire fighter and two Engine 7 fire fighters made it through the breached plywood wall on the 15th floor.
  Victim #2 flaked out the connected hoseline over the ledge of the 14th floor to an Engine 4 fire fighter descending on the top of the construction elevator.
  Engine 24 stretched a hoseline back to the 14th floor B-stairwell.
  Car 15 ordered Division 1 to focus on fire suppression while he focused on addressing the Mayday transmissions.

- **1621 Hours**
  Fire extended to a 14th floor exterior wall.
  Several fire fighters worked to breach a plywood wall on the14th floor.
  Dispatch assigned an additional engine to decon task force.

- **1622 Hours**
  Car 15 ordered Battalion 2 to conduct a personnel accountability report (PAR).
  Battalion 2 requested the elevator be staged at the 15th floor for escaping fire fighters.
  Rescue 2 positioned to search the 15th floor.
  Victim #1 on nozzle of uncharged hoseline on the 14th floor near the B-stairwell, out of slack, could not advance line any further.

- **1623 Hours**
  Squad 18 officer transmitted a Mayday to "clear the air" to communicate with the Engine 10 officer who previously transmitted a Mayday.
  Radio transmission received that the standpipe in the B-stairwell was disconnected on the 1st floor.

- **1624 Hours**
  Squad 18 officer discussed with Engine 10 officer that Engine 10 fire fighters were no longer in danger.
  Rescue 1 crew operating on 14th floor in A-stairwell attempted to breach opening to 13th floor.

- **1625 Hours**
  Engine 7 officer transmitted a Mayday that was not acknowledged.
  Battalion 41 reported to command that all of the stairwells and landings were securely boarded over.

- **1626 Hours**
  Engine 7 officer transmitted a second Mayday that was not acknowledged.

- **1627 Hours**
  Engine 7 officer transmitted a third Mayday, "Engine 7 with a Mayday message…I'm missing two members…"
  Ladder 1 officer responded to Mayday that Engine 7 fire fighters were accounted for.
  Division 11 reported that access was blocked in both 13th floor stairwells to the 14th floor.
  Division 1 ordered the Field Communications Unit to account for all units.
  Engine 279 crew attempted to supply the 2nd floor standpipe riser in B-stairwell.

- **1628 Hours**
  Battalion 41 transmitted an urgent message requesting SCBA cylinders, more hose lengths, and manpower on the 14th floor.
  Division 1 ordered Engine 3 to bring SCBA cylinders to 14th floor.
  Rescue 1 exited the 14th floor A-stairwell.

- **1629 Hours**
  Fire on the 14th floor on C-side.
  High heat, zero visibility on the 15th floor.
  Car 15 and Rescue Battalion discussed missing fire fighters and assigning an additional rescue company.
  An urgent message was transmitted that fire fighters low on air were exiting the structure onto the scaffolding.
  Engine 9 began water supply to the satellite manifold at ground level.

- **1630 Hours**
  Car 15 transmitted for all units to stay off the primary tactical channel unless urgent and ordered immediate accountability of Engines 4, 10 and Ladders 10, 15.
  Ladder 15 officer still on 15th floor accounting for his crew.
  Dispatch assigned Rescue 3 to incident.

- **1631 Hours**
  Battalion 41 requested more hose and SCBA cylinders on the 14th floor.
  Resource Unit Leader requested a PAR from Division 11.
  Division 11 still on the 13th floor.

- **1632 Hours**
  Car 15 requested a PAR of all initial companies from Division 11 and Battalion 2.
  TAC-1 and several other fire fighters exited down the scaffolding.

- **1633 Hours**
  Engine 3 crew arrived on the 14th floor with additional SCBA cylinders.
  Car 15 advised Battalion 41 to begin pulling up the external hoseline.

- **1634 Hours**
  Engine 4 officer transmitted a Mayday that he was missing a fire fighter.
  Battalion 2 acknowledged the Mayday and attempted to contact the missing Engine 4 fire fighter.
  Battalion 41 ordered the Engine 3 officer to check hoseline stretch on the 14th floor.
  Engine 3 officer followed uncharged hoseline toward B-stairwell.

- **1635 Hours**
  Engine 24 crew operated outside the 14th floor B-stairwell.
  Victim #1 passed the nozzle to another Engine 24 fire fighter and proceeded up to the 15th floor, possibly with Victim #2.
  Battalion 2 accounted for missing Engine 4 fire fighter.
  Car 15 contacted Battalion 41 and asked if he was ready for water.
  Battalion 41 responded, "Not yet."
  Division informed Battalion 2 that command still needed the PAR.

- **1636 Hours**
  Battalion 2 performed PAR.
  Engine 9 chauffeur informed Engine 9 Officer that the static pressure at his pumper was 50 psi.
  Battalion tried to contact Engine 24 with no response.
  Engine 4 officer was told by Engine 24 fire fighter that more hose was needed.
  Engines 24 and 7 officers ascended to 15th floor from 14th floor B-stairwell.
  Victim #1 told Engine 3 officer that they needed more hose.

- **1637 Hours**
  Engine 7 officer found some hose on the 15th floor and brought it to B-stairwell.
  Car 15 asked for an update and wanted fire fighters off the 15th floor.
  Squad 1 crew left the 15th floor and took the elevator to the 14th floor.

- **1638 Hours**
  Fire was reported on the 15th through 17th floors.
  Heavy fire and smoke conditions were reported on the 15th floor.
  Battalion 41 ordered Squad 1 to take over the 14th floor hoseline.
  Car 15 followed up on the status of the PAR.

- **1639 Hours**
  Car 15 transmitted a Mayday message for fire fighters to stay off the radio until he determined if all fire fighters were accounted for.
  Ladder 10 officer and other fire fighters bailed out onto the 14th floor scaffolding after fire blew through a wall.
  Engine 279 officer on the 2nd floor connected hose to the A-stairwell standpipe outlet.

- **1640 Hours**
  Car 15 contacted Division 11 to check on accountability.
  Engines 4 and 6 readied to leave the 14th floor via the construction elevator.

- **1641 Hours**
  Car 15 transmitted, "Let's get everybody down below the fire and we'll start all over again. I want to make sure we have everybody accounted for."
  Rescue 2 completed search of 15th floor.
  Engine 24 fire fighter told Squad 1 officer they were ready for water.
  Squad 1 officer told Battalion 41 that Engine 24 was ready for water.
  Engine 9 officer told Battalion 41 that the satellite manifold was ready to supply water.
  Engine 279 officer suspected problems with the standpipe.

- **1642 Hours**
  Engine 7 and Ladder 1 fire fighters exited the 15th floor onto the scaffolding.
  Division 11 was on the 13th floor, but the blocked stairwell prevented access to the 14th floor.

- **1643 Hours**
  Heavy fire was reported on the 14th floor.
  Battalion 41 requested water in the external hoseline.
  Car 15 ordered all fire fighters off the 15th floor.

- **1644 Hours**
  Engine 24 charged a hoseline on the 14th floor from an external hoseline.

- **1645 Hours**
  Engine 24 fire fighter passed the nozzle to Victim #1 in the B-stairwell on the half landing between the 14th and 15th floors and assumed the backup position.

Rescue 2 fire fighter entered the B-stairwell from the 15th floor.

- **1646 Hours**
  Engine 24 officer passed Victim #1 at the doorway leading to the 15th floor to search for fire.
  Engine 3 officer on the 15th floor landing saw that Engine 24 was ready to operate; he went down to the 14th floor to locate his crew.
  Rescue 2 fire fighter radioed his officer that he was having trouble getting down the stairwell and needed assistance.

- **1647 Hours**
  Engine 24 officer's low-air alarm activated while searching for fire; he returned to the B-stairwell and told Victim #1 he was low on air and descended to the 14th floor.

- **1648 Hours**
  Engine 24 officer transmitted a Mayday, "I'm lost; I'm trying to exit on the charged hoseline, running out of air!"
  Engine 24 fire fighter responded "Look for the hoseline, we're in the stairs."
  Engine 24 officer found his way out by following the charged hoseline toward the elevator lobby.
  Rescue 1 began search for Rescue 2 fire fighter needing assistance in the B-stairwell.

- **1649 Hours**
  Victim #1 and Engine 24 fire fighter began backing the hoseline down the stairwell from the 15th floor.
  Engine 24 fire fighter encountered Victim #2 gasping for air on the 14th floor landing and attempted to buddy breathe, but was unable to assist Victim #2.
  Rescue 2 fire fighter made his way out of the B-stairwell and found Engine 3 officer; they proceeded to the Q-decking area.
  Car 15 continued to work on accountability.

- **1650 Hours**
  Engine 24 fire fighter transmitted a Mayday, "There are two members on the 14th floor out of air, at the stairwell."
  Division 1 attempted to contact Engine 24.
  Rescue 1 crew found Rescue 2 fire fighter and Engine 3 officer and led them to Q-decking area.

- **1651 Hours**
  Engine 24 officer reached the Q-decking area and told Rescue 1officer that Engine 24 fire fighters were still inside.
  Ladder 5 fire fighter thought he heard some Mayday transmissions from Victims #1 and #2 not received by command or dispatch.

Engine 24 fire fighter exited the 14th floor B-stairwell to get help.

- **1652 Hours**
  Car 15 requested a 3rd alarm.
  Car 15 contacted Battalion 41 and requested a suppression update.
  Battalion 41 responded that the hoseline was on the 14th floor and he wasn't sure if it was operating.
  Engine 3 officer transmitted an urgent message to locate his crew.

- **1653 Hours**
  Engine 24 fire fighter exited on Q-decking area of the 14th floor and said that there were still fire fighters inside.

- **1654 Hours**
  Car 15 asked Battalion 2 if all fire fighters above the fire were accounted for.
  Battalion 2 responded that his location was on the 13th floor scaffolding and that he heard Engine 24 fire fighters may be missing.
  Engine 3 officer began searching for two of his missing fire fighters.

- **1655 Hours**
  Battalion 2 told Car 15 that Engine 3 and 24 fire fighters may be missing because he thought he heard a Mayday from them.
  Rescue Battalion 1 contacted Division 11 about missing Engine 24 fire fighters.
  Division 11 arrived on the 14th floor.

- **1656 Hours**
  Engine 3 officer transmitted a Mayday, "Engine 3, I can't account for two men. They were with Engine 24 on the fire floor with the charged line."
  Battalion 41 responded that the two Engine 3 fire fighters were accounted for.
  Ladder 10 officer, Ladder 10 fire fighter, Ladder 1 fire fighter, TAC-1 fire fighter, and Squad 1 fire fighter were staged on the scaffolding.

- **1657 Hours**
  Car 15 attempted to radio the missing Engine 24 fire fighters.
  Battalion 2 contacted Battalion 41 to confirm that two Engine 24 fire fighters were still inside.
  Engine 24 fire fighter informed Division 11 that two Engine 24 fire fighters were still inside.
  Engine 3 officer informed Rescue Battalion 1 that two Engine 24 fire fighters were missing.

- **1658 Hours**
  Car 15 attempted to radio missing Engine 24 fire fighters.
  Rescue 1 officer and Rescue Battalion 1 searched for missing fire fighters.

Engine 24 fire fighter informed Battalion 41 that two Engine 24 fire fighters were still inside.

- **1659 Hours**
  Battalion 2 attempted to radio missing Engine 24 fire fighters.
  Rescue 1 officer heard a sounding PASS alarm.
  Division 11 entered to conduct a search.
  Engine 24 officer was at the command post.

- **1700 Hours**
  Rescue 1 crew began search for missing fire fighters.
  Car 15 radioed Battalion 2 to account for missing Engine 24 fire fighters.
  Car 15 attempted to radio missing Engine 24 fire fighters.
  E279 officer informed command that the standpipe was unserviceable.

- **1701 Hours**
  Division 11 located Victim #2.
  Division 11 radioed an urgent message to command: "I got a member down! We are trying to get him out of here on the 14th floor. His PASS alarm is going off, non response."

- **1702 Hours**
  Rescue 1 officer requested help moving Victim #2.

- **1703 Hours**
  Several fire fighters went to assist with rescue of Victim #2.
  Car 15 ordered all fire fighters below the fire.

- **1704 Hours**
  Victim #2 was removed to Q-decking area.
  Car 15 requested an immediate PAR and again ordered all fire fighters below the fire.

- **1705 Hours**
  Victim #2 received cardiopulmonary resuscitation (CPR) while taken to the elevator.
  Rescue 1 officer verified that all fire fighters operating on the 14th floor were accounted for.
  Engine 24 fire fighter said another Engine 24 fire fighter was still missing.
  Resource Unit Leader began conducting company PARs.

- **1706 Hours**
  Victim #2 was placed in elevator with CPR in progress.
  Engine 3 officer told Rescue 1 officer another fire fighter was missing.

- **1707 Hours**
  Rescue 1 officer reported hearing a second PASS alarm sounding.
  Engine 3 and Rescue 1 officers began a search for Victim #1.
  Victim #2 was removed from elevator and EMS began care.

- **1708 Hours**
  Division 11 informed command that they found an Engine 24 fire fighter and that another fire fighter may be missing on the 14th floor.

- **1709 Hours**
  Car 15 asked Battalion 2 if any fire fighters were located above the fire.
  Battalion 2 responded that Division 11, Rescue Battalion 1, and Rescue 1 were on the 14th floor.

- **1710 Hours**
  Engine 3 officer transmitted a Mayday after locating unconscious Victim #1.
  Rescue 1 officer requested assistance in moving Victim #1.

- **1712 Hours**
  Victim #2 brought to awaiting ambulance and transported to hospital.
  Rescue 1 officer attached webbing to Victim #1.
  Car 15 tried to determine which companies were missing fire fighters.
  4th alarm was transmitted.

- **1713 Hours**
  Rescue 1 crew began moving Victim #1.

- **1714 Hours**
  Victim #1 was still being moved toward the Q-decking area.
  Rescue 1 officer again requested assistance in moving Victim #1.

- **1715 Hours**
  Division 11 transmitted a Mayday that Victim #1 had been located.
  Car 15 acknowledged the Mayday and asked for the location of the downed fire fighter.
  Victim #1 was removed to the Q-decking area through the breach in the plywood wall.
  Ladder 1 and Squad 18 crews arrived on the 14th floor and assisted in moving Victim #1 to the elevator while initiating CPR.

- **1716 Hours**
  Car 15 attempted to get more crews to assist in removing Victim #1.

- **1717 Hours**
  Victim #1 was removed from the structure via the construction elevator while CPR continued.
  Physician on scene began treatment at ground level.
  Victim #1 brought to awaiting ambulance and transported to hospital.

- **1809–1810 Hours**
  Victims pronounced dead at hospital.