



Death in the line of duty...

A summary of a NIOSH fire fighter fatality investigation

December 14, 2009

A Career Fire Fighter Dies and a Career Engineer is Seriously Injured Investigating Smoke Resulting From a Manhole Fire - California

SUMMARY

On March 26, 2008, a 35-year-old male career fire fighter (victim) died and a 48-year-old male career engineer was seriously injured while investigating smoke in an unmarked utility closet resulting from a manhole fire. Central dispatch received a call at 1357 hours from an employee of an office supply store who reported an explosion and the smell of smoke in the store. At 1358 hours, central dispatch received a second 911 call reporting an underground explosion that shook the entire block, with smoke coming from a manhole. An engine company was dispatched to the scene to investigate the smell of smoke. At 1422 hours, a third call was placed to central dispatch with the report of smoke coming from a locked storage area in a commercial building on the corner of the same block where the manhole incident was being investigated. A full alarm was dispatched for a structure fire and assigned a different incident number and tactical channel. The victim's apparatus arrived on scene to what they believed was a structure fire and attempted to force open the unmarked utility closet door to investigate the cause of smoke. The victim began to cut the door bolt with a rotary saw when the utility closet exploded and the victim was struck by the door. Key contributing factors identified in this investigation include insufficient situational awareness, a lack of hazard identification, and dispatch not recognizing the relationship and severity of the incidents.

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

- ***ensure that members are trained to maintain situational awareness and use extreme caution when operating at sewer and underground vault incidents***

The National Institute for Occupational Safety and Health (NIOSH), an institute within the Centers for Disease Control and Prevention (CDC), is the federal agency responsible for conducting research and making recommendations for the prevention of work-related injury and illness. In fiscal year 1998, the Congress appropriated funds to NIOSH to conduct a fire fighter initiative. NIOSH initiated the Fire Fighter Fatality Investigation and Prevention Program to examine deaths of fire fighters in the line of duty so that fire departments, fire fighters, fire service organizations, safety experts and researchers could learn from these incidents. The primary goal of these investigations is for NIOSH to make recommendations to prevent similar occurrences. These NIOSH investigations are intended to reduce or prevent future fire fighter deaths and are completely separate from the rulemaking, enforcement and inspection activities of any other federal or state agency. Under its program, NIOSH investigators interview persons with knowledge of the incident and review available records to develop a description of the conditions and circumstances leading to the deaths in order to provide a context for the agency's recommendations. The NIOSH summary of these conditions and circumstances in its reports is not intended as a legal statement of facts. This summary, as well as the conclusions and recommendations made by NIOSH, should not be used for the purpose of litigation or the adjudication of any claim. For further information, visit the Program Website at www.cdc.gov/niosh/fire or call toll free **1-800-CDC-INFO** (1-800-232-4636).



A Career Fire Fighter Dies and a Career Engineer is Seriously Injured Investigating Smoke Resulting From a Manhole Fire—California

Additionally authorities having jurisdiction should:

- *ensure that entrances to electrical rooms, vaults, and similar enclosures are clearly identified and provide proper warning to unauthorized people*
- *ensure that central dispatch has the technical capability to communicate information among multiple incident responses and that dispatchers are trained to recognize when separately reported incidents are related*

INTRODUCTION

On March 26, 2008, a 35-year-old male career fire fighter died and a 48-year-old male career engineer was seriously injured while investigating smoke in an unmarked electrical utility closet resulting from a manhole fire. On March 27, 2007, the U.S. Fire Administration and the International Association of Fire Fighters (IAFF) notified the National Institute for Occupational Safety and Health (NIOSH) of this incident. On April 14–17, 2008, a Safety and Occupational Health Specialist and a Safety Engineer from the NIOSH Fire Fighter Fatality Investigation and Prevention Program traveled to California to meet with the fire department, representatives of the IAFF, and the city’s building code enforcement office and to conduct interviews with the fire fighters and officers who were directly involved with this incident. The investigators reviewed the victim’s training records, the department’s training requirements, the department’s standard operating procedures (SOPs), witness statements, dispatch logs, death certificate, and photos and sketches of the incident site. The investigators also inspected the victim’s personal protective equipment and visited the incident site.

FIRE DEPARTMENT

This career department consists of 3,586 uniformed fire fighters. The department has 106 fire stations and serves a population of about 4,000,000 in a geographic area of approximately 471 square miles. The fire department responded to 753,428 calls in 2008.

The fire department discussed having a verbal procedure for responses involving underground utilities in which the responding fire department companies were to contact the underground electrical utility provider and to stay clear of the scene until it was cleared by the electrical utility company.

PERSONAL PROTECTIVE EQUIPMENT

The victim was wearing his turnout pants, turnout coat, and his helmet. The injured engineer was wearing his turnout pants, a uniform work jacket, and his helmet. Neither fire fighter had on his self-contained breathing apparatus (SCBA).



A Career Fire Fighter Dies and a Career Engineer is Seriously Injured Investigating Smoke Resulting From a Manhole Fire—California

TRAINING and EXPERIENCE

The state requires all career fire fighters to complete training equivalent to National Fire Protection Association (NFPA) Level I. The fire department provides all new recruits with a 15-week training course conducted at the city's fire academy. The victim had more than 10 years of experience as a fire fighter. The injured engineer had more than 17 years of experience.

CENTRAL DISPATCH

The central dispatch center employs 26 call-takers/resource controllers, 3 floor captains, and 1 battalion commander during a normal 24-hour shift. The center may also staff two members each morning to assist with the phones for four hours from 0700-1100 hours if possible. On high hazard days, the center may also augment staffing by hiring additional dispatchers or recalling off-duty members to the dispatch floor during hours when the call level becomes extremely high and they cannot effectively answer the calls with normal staffing.

The dispatch system at each call-taker console consists of three monitors. There are four monitors at the resource controller's consoles and seven monitors at each of the captain's consoles. All of the monitors are able to view various screens including unit status, mapping, specific incidents, incident summary and other information which allows the user to monitor multiple incidents.

WEATHER CONDITIONS

The conditions were clear with the temperature averaging 70 degrees Fahrenheit. The wind was between 9 and 20 miles per hour with gusts up to 24 miles per hour from the south.

EQUIPMENT and PERSONNEL

Only the companies directly involved in this incident are included.

Engine 5 (E5)

officer, driver/operator, two fire fighters (hydrant person)

Engine 95 (E95)

officer, driver/operator (engineer), nozzleperson (victim), fire fighter

Light Force 5 (LF5)

officer, driver/operator, two fire fighters



Fatality Assessment and Control Evaluation Investigation Report # F2008-11

A Career Fire Fighter Dies and a Career Engineer is Seriously Injured Investigating Smoke Resulting From a Manhole Fire—California

INVESTIGATION

On March 26, 2008, at 1357 hours, central dispatch received a call from an employee of an office supply store who reported an explosion and the smell of smoke in the store. At 1358 hours, central dispatch received a second 911 call reporting an underground explosion that shook the entire block with smoke coming from a manhole.

At 1358 hours, Engine 5 (E5) was dispatched to investigate the smell of smoke. Central dispatch stated to the fire department that they would notify the department of water and power (DWP). Upon arrival, E5 was flagged down by one of the evacuated employees from the office supply store and directed to a manhole that had been blown off from an explosion stemming from an underground fire. At 1406 hours, E5 reported to central dispatch that they had a blown manhole cover and that DWP was on scene and that E5 would handle the incident. The E5 hydrant person (fire fighter) observed light, gray smoke emitting from the manhole. The E5 hydrant person inspected the manhole cover, which was designated for electric and sewer and was laying upside down approximately 5 feet away from the manhole; with a thermal imaging camera he observed that the temperature of the cover was between 93 to 95 degrees Fahrenheit and the asphalt was 105 degrees Fahrenheit. E5 contacted central dispatch to request assistance from DWP and to find out their estimated time of arrival. *Note: The DWP crew who was on scene stated that they were not assigned to the incident and that a specialized crew was on the way.* After approximately 15 minutes on scene, the E5 crew was working with the police department on traffic control and discussing their options when another explosion occurred. E5 called central dispatch to request assistance from Light Force 5 (LF5).

At 1421 hours, central dispatch added LF5 to assist E5 with the incident. At 1422 hours, central dispatch received another 911 call from a person approximately a block away from the original calls, reporting heavy smoke emitting from a storage area located at the rear of the bottom floor of a two-story, mixed-occupancy commercial building (see Photo, Diagram). Central dispatch informed the caller to evacuate the building and created another assignment for a report of smoke in a building. Central dispatch assigned Rescue 5, Engine 95, Rescue 95, Light Force 63, Engine 63, Engine 62, Light Force 94, EMS 4, and Battalion Chief 4 to respond to the second incident and assigned them a different tactical channel than the initial response. While en route to the initial incident, LF5 heard the dispatch for a possible structure fire and called central dispatch on the dispatch channel. LF5 requested to be added to the structure alarm and to be replaced on the manhole incident. Central dispatch added LF5 to the second dispatch, which was the structure incident. At 1423, E5 called central dispatch and informed them that they were on scene and believed that the two incidents were related. E5 informed central dispatch that they were confident LF5 would be sufficient to assist with securing the scene of the first incident until DWP arrived. E5 and central dispatch discussed the situation and the original responses and added LF5 to the second incident (possible structure fire).

During this time the E5 hydrant person was directed by his officer to investigate the second manhole explosion on foot. While walking, he found and inspected two additional manholes that had exploded. Both additional manholes had conditions similar to the first one. The conditions were light, gray smoke



Fatality Assessment and Control Evaluation Investigation Report # F2008-11

A Career Fire Fighter Dies and a Career Engineer is Seriously Injured Investigating Smoke Resulting From a Manhole Fire—California

emitting from the manhole with temperatures reading approximately 93 degrees Fahrenheit on the manhole cover and 105 degrees Fahrenheit on the surrounding asphalt. *Note: The E5 hydrant person attempted to communicate his findings to his officer, but the officer was switching channels to communicate with central dispatch regarding the second incident and did not receive the information.* The E5 hydrant person met a police officer in the street who informed him that smoke had been observed from a room attached to the back of a commercial building.

At 1425 hours, the E5 hydrant person found an unmarked, locked steel door under an open stairway at the end of a covered patio of the commercial building. Black smoke was leaking from the top and bottom of the unmarked door. He described the smell to the NIOSH investigators as resembling an auto fire which was identical to the smoke coming from the manholes. He felt all over the door with his bare hand and did not detect any heat. The E5 hydrant person heard sirens and walked into the parking lot to see who was responding. *Note: At this time, the E5 hydrant person was unaware of any additional incidents or apparatus being assigned to his company's incident.* He found E95 and told them he had observed smoke at a rear door area. He followed them on foot as they pulled into the parking lot just behind the stairway. The E95 nozzleperson (victim) exited the truck with a rotary saw and was followed by the E95 engineer. The E95 officer exited the cab and did not see or smell any smoke as he proceeded to the rear of the apparatus to retrieve his air pack. The E95 engineer followed the victim into the hallway leading to the door under the stairs. The door was locked and no smoke or smell of any kind was observed emitting from the door. The victim started the saw and began to make a cut on the bolt. At approximately 1428 hours, the E95 engineer, who was within an arm's length of the victim, turned to leave and retrieve a tool to assist in prying open the door when an explosion occurred. *Note: It was reported that the saw had been running approximately 3 to 4 seconds before the explosion occurred.* The force of the explosion blew the door off its hinge. The door and the saw propelled into the victim. The force of the explosion blew the E95 engineer back several feet. Crews on the scene immediately extricated the two fire fighters and initiated advanced life support. Rescue 95 transported the victim to a local hospital where he was pronounced dead. The E95 engineer was life-flighted to an area hospital where he was treated for his injuries.

CAUSE OF DEATH

The death certificate listed the cause of death for the victim as blunt force trauma.

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:

- Insufficient situational awareness



A Career Fire Fighter Dies and a Career Engineer is Seriously Injured Investigating Smoke Resulting From a Manhole Fire—California

- Lack of hazard identification
- Dispatch not recognizing the relationship and severity of the incidents

RECOMMENDATIONS/DISCUSSION

Recommendation #1: Fire departments should ensure that their members are trained to maintain situational awareness and use extreme caution when operating at sewer and underground vault incidents.

Discussion: Situational awareness is one of the most critical aspects of safety on the fireground.¹ The incident information provided from the dispatcher may not always be what is encountered on the fireground. Individual fire fighters must remain aware of their immediate surroundings and be alert for unsafe conditions before a size-up is completed, and even if a safety officer has been designated to an incident. Members should immediately report any unusual conditions to their supervisor or to command.¹

Manhole fires require that fire fighters exercise extreme caution due to the potentially volatile situation that may exist. Typically, when a fire department has been dispatched to a manhole incident an explosion has already occurred. These explosions can happen randomly and may occur after a considerable amount of time, when conditions appear to be dormant. It is imperative that everyone is made aware of the current conditions and that they remain prepared for changing conditions and the potential for what they may bring. Due to the nature of these incidents which can escalate very quickly, fire fighters should be in their full array of protective equipment, including SCBA.² There are many possible hazardous conditions involved with these types of incidents that fire departments should be aware of, such as the following:

- Carbon monoxide or other gases within their explosive limits
- Damaged gas lines from the explosion(s)
- Electrocutation hazards
- Fire and smoke extension through conduits from the manhole(s)
- Environmental hazards (polychlorinated biphenyls, asbestos, lead)
- Confined-space entry
- Oxygen deficiency inside manholes and vaults
- Flying debris and manhole covers following explosions
- Flash fires

Recommendation #2: Authorities having jurisdiction should ensure that entrances to electrical rooms, vaults, or similar enclosures are clearly identified and provide proper warning to unauthorized people.



A Career Fire Fighter Dies and a Career Engineer is Seriously Injured Investigating Smoke Resulting From a Manhole Fire—California

“Guarding” involves locating or enclosing electric equipment to make sure people do not accidentally come into contact with energized parts. Effective guarding requires equipment with exposed parts operating at 50 volts or more to be placed where it is accessible only to authorized people qualified to work with it. Recommended locations can be a room, vault, or similar enclosure.³

Conspicuous signs must be posted at the entrances to electrical rooms and similarly guarded locations to alert people to electrical and other potential hazards and to warn that entry is for authorized personnel only. Signs may contain the word "Danger," "Warning," or "Caution" along with appropriate, concise wording that alerts people to the hazards or gives an instruction, such as "Danger/High Voltage/Keep Out."⁴ This could possibly be achieved through the jurisdiction’s permitting process and code enforcement/inspections.

The room that the victim was attempting to gain entry into was unmarked and thought to be a storage room that was producing smoke from the structure fire incident. If the door had the proper marking, the fire fighters may have been prompted that the incidents were related due to the underground electrical utilities supplying the electrical storage room.

Recommendation #3: Authorities having jurisdiction should ensure that central dispatch has the technical capability to communicate information among multiple incident responses and that dispatchers are trained to recognize when separately reported incidents are related.

Discussion: Manhole fires are extremely dangerous situations that require different tactics than structure fires. The authority having jurisdiction should ensure that telecommunicators are trained to analyze the information provided by callers so that the center can determine potentially serious incidents, and if incidents are related. Telecommunicators should be trained and have knowledge of street locations of high-hazard structures or areas within their jurisdiction, such as underground utility systems.⁵ They should also be trained to extract information from the caller in order to categorize and prioritize the incident to the proper policies, procedures, and guidelines set forth by the authority having jurisdiction.⁶ Including this information with the initial dispatch description is critical for responding units to use the proper tactics.

The initial call made to central dispatch was for the smell of smoke. E5 was the first arriving crew. They found and reported a manhole fire with multiple manholes involved within the immediate area. E5 requested one additional unit for scene control until the utility company responded to assess the situation per the fire department practice. Just after the request for an additional apparatus, central dispatch received another call for smoke inside a structure within several hundred feet of the involved manholes. Central dispatch dispatched a full alarm for a structure fire with a different incident number and on a different tactical radio channel. The possibility of these incidents being related may not have been recognized by central dispatch, and therefore information was not provided to the units responding to the structure fire. The E5 officer called central dispatch to inform them that he believed the two incidents were related. Central dispatch discussed the situation with the E5 officer on his tactical channel and mentioned the possibility of the fire being in an electrical room. The units



A Career Fire Fighter Dies and a Career Engineer is Seriously Injured Investigating Smoke Resulting From a Manhole Fire—California

responding to the structure fire (including E95, the victim's unit) were on a different channel and did not hear the information that a fire was possibly in an electrical room, and that the incidents may have been related. That information was not provided to the units responding to the structure fire dispatch. The report of an explosion should have initiated a full first alarm assignment dispatch to this location. This failure resulted in the first due units mistakenly assuming that the incident was much smaller and thus not establishing the appropriate command structure to manage this kind of incident.

Though often in a location well away from the incident itself, telecommunicators (dispatchers) must be viewed as first responders as well.⁷ Their ability to understand and interpret the information from the caller sets the incident in motion and is critical to the overall success of the incident. When in doubt, the dispatching of additional resources to an incident involving potentially significant events such as explosions, collapses, and other similar incidents should trigger the dispatching of full first alarm assignments until the breadth and complexity of the incident is confirmed.



A Career Fire Fighter Dies and a Career Engineer is Seriously Injured Investigating Smoke Resulting From a Manhole Fire—California

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INVESTIGATOR INFORMATION

This incident was investigated by Jay Tarley, safety and occupational health specialist, and Timothy Merinar, Safety Engineer, Surveillance and Field Investigations Branch, Division of Safety Research, NIOSH. The primary author of this report was Jay Tarley. An expert technical review was conducted by I. David Daniels, Fire Chief / Emergency Services Administrator, Renton Washington, and member of the International Association of Fire Chiefs, Executive Board of Directors.



A Career Fire Fighter Dies and a Career Engineer is Seriously Injured Investigating Smoke Resulting From a Manhole Fire—California

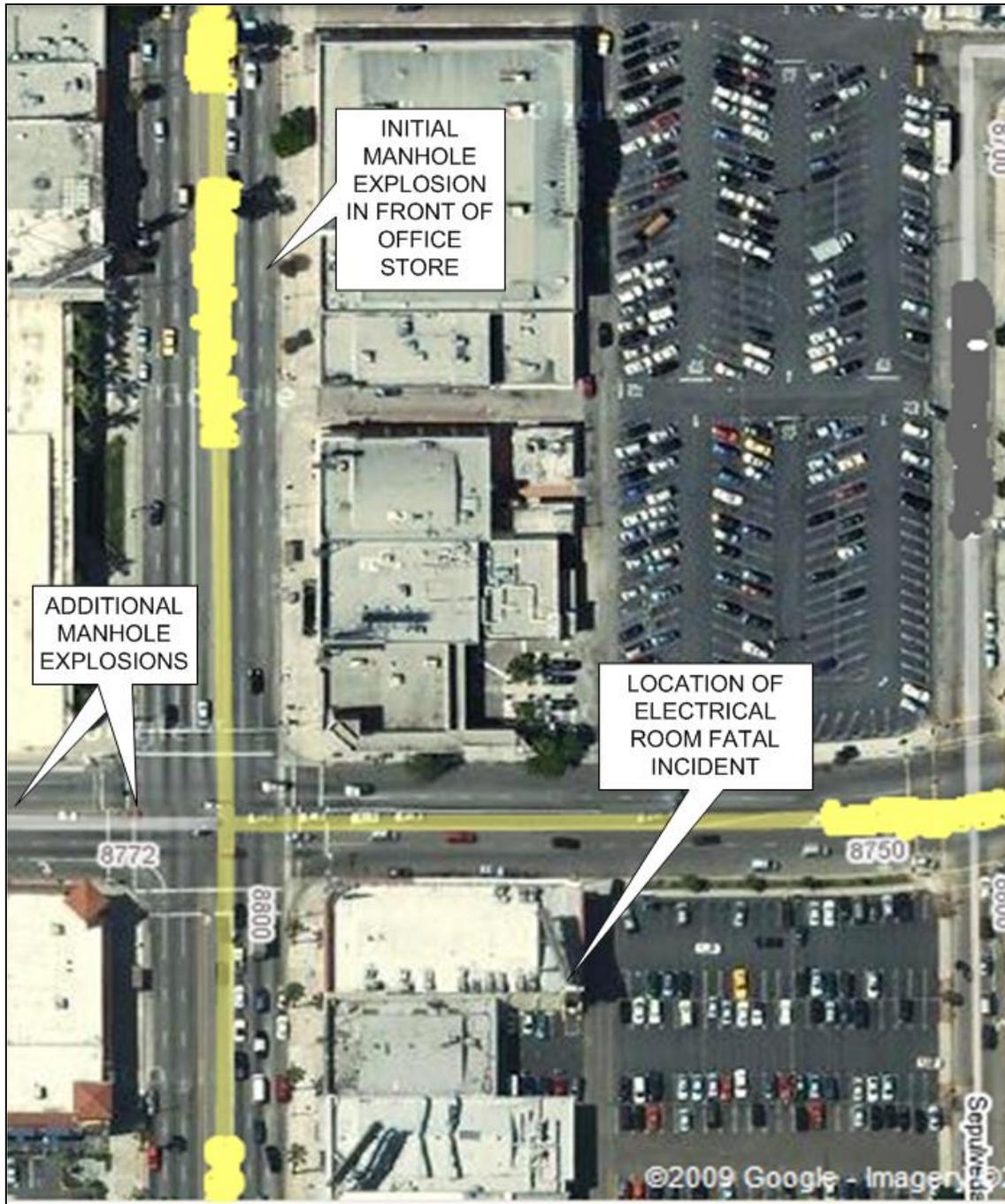


Photo. Aerial photo showing proximity of manholes.
(Source: Google Earth.)



A Career Fire Fighter Dies and a Career Engineer is Seriously Injured Investigating Smoke Resulting From a Manhole Fire—California

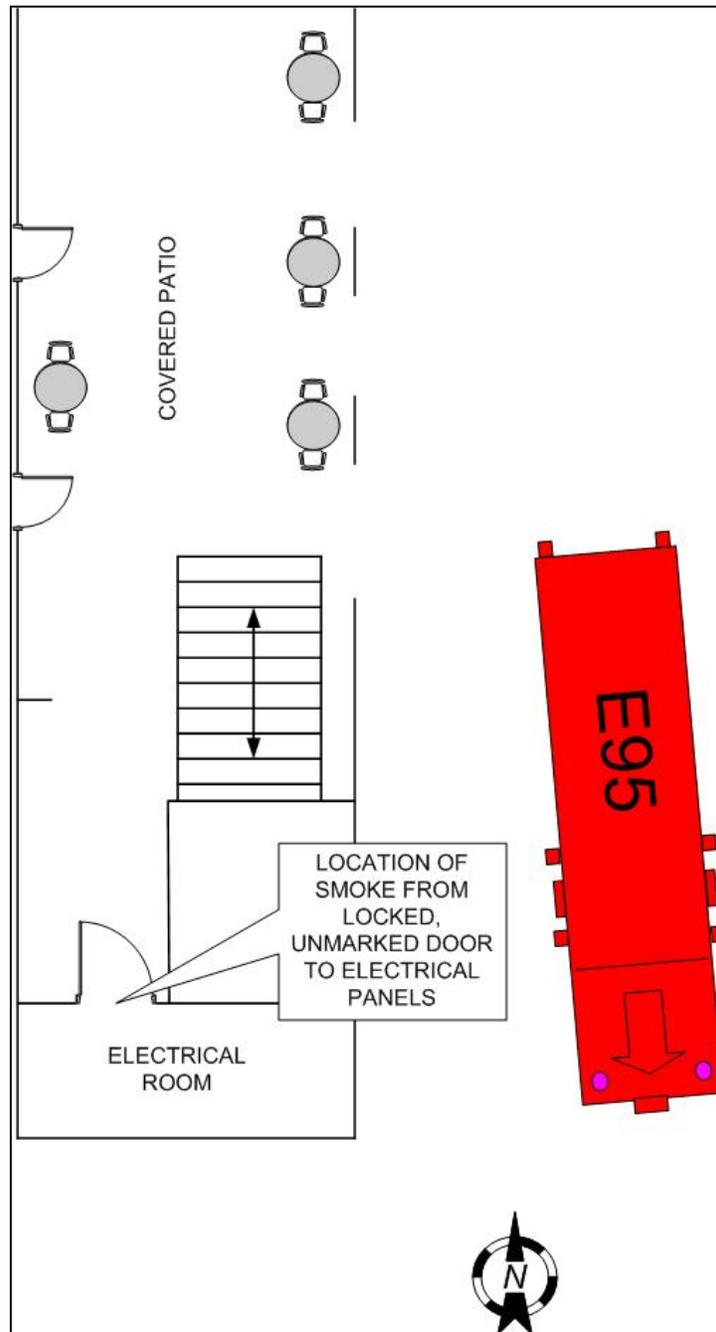


Diagram. Location of unmarked electrical utility closet.