



Death in the line of duty...

NIOSH
Fire Fighter Fatality Investigation
and Prevention Program

A summary of a NIOSH fire fighter fatality investigation

February 28, 2013

Volunteer Fire Fighter Dies After Being Ejected From Front Seat of Engine—Virginia

Executive Summary

On July 16, 2012, a 30-year-old male volunteer fire fighter (victim) died after being ejected from a fire engine. The victim, riding in the right front seat, was responding on Engine 6-5 with one other fire fighter (the driver) to a reported motor vehicle crash. The fire engine traveled approximately 1.3 miles from the station when the driver lost control of the engine in a curve. The engine left the paved road and crashed into trees on the right side of the roadway. The victim was ejected from the engine and landed in a wooded area (see Photo 1 and Photo 2). The driver of Engine 6-5 exited through the windshield, located the victim, and began medical treatment. Other emergency personnel responded to the scene, and the victim was pronounced dead at the scene.



Crash site.

(Photo courtesy of easternshorefire.com)

Contributing Factors

- *Narrow roadway with minimal shoulder in a curve*
- *Loss of control of the vehicle (right wheels left the paved surface)*
- *Non-use of seat belt*
- *Inadequate SOPs for seat belt usage*
- *Inadequate driver training*

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Key Recommendations

- *Fire departments should ensure that fire department drivers/operators are trained in techniques for maintaining control of their vehicles at all times.*
- *Fire departments should ensure that written standard operating procedures (SOPs) regarding seat belt use are established and enforced.*
- *Fire departments should provide and ensure all drivers successfully complete a comprehensive driver's training program, such as NFPA 1451 Standard for a Fire Service Vehicle Operations Training Program, before allowing a member to drive and operate a fire department vehicle.*
- *Fire departments should ensure that apparatus are regularly inspected and checked, recording water levels of engines, tankers, and other vehicles with water tanks.*
- *Fire departments should develop and implement fire apparatus inspection and check-off sheets and provide a systematic approach for the communicating, receiving, filing, and storage of these as well as maintenance records.*

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 1998, Congress appropriated funds to NIOSH to conduct a fire fighter initiative that resulted in the NIOSH "Fire Fighter Fatality Investigation and Prevention Program" which examines line-of-duty-deaths or on duty deaths of fire fighters to assist fire departments, fire fighters, the fire service and others to prevent similar fire fighter deaths in the future. The agency does not enforce compliance with State or Federal occupational safety and health standards and does not determine fault or assign blame. Participation of fire departments and individuals in NIOSH investigations is voluntary. Under its program, NIOSH investigators interview persons with knowledge of the incident who agree to be interviewed and review available records to develop a description of the conditions and circumstances leading to the death(s). Interviewees are not asked to sign sworn statements and interviews are not recorded. The agency's reports do not name the victim, the fire department or those interviewed. The NIOSH report's summary of the conditions and circumstances surrounding the fatality is intended to provide context to the agency's recommendations and is not intended to be definitive for purposes of determining any claim or benefit.

For further information, visit the program Web site at www.cdc.gov/niosh/fire or call toll free 1-800-CDC-INFO (1-800-232-4636).

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Introduction

On July 16, 2012, a 30-year-old male volunteer fire fighter (victim) died after being ejected from a fire engine. On July 17, 2012, the U.S. Fire Administration notified the National Institute for Occupational Safety and Health (NIOSH) of this incident. On July 25–27, 2012, a safety and occupational health specialist from the NIOSH Fire Fighter Fatality Investigation and Prevention Program in Morgantown, West Virginia, traveled to Virginia to investigate this incident. The NIOSH investigator conducted an opening meeting with the fire chief, officers, and fire fighters of the involved department, county Director of Fire and Emergency Medical Services, and members of other neighboring volunteer fire departments, as well as county EMS personnel who had responded to the fire engine crash. The NIOSH investigator met with a representative of the county medical examiner's office and the director of the county 911 commission. The NIOSH investigator also contacted the Virginia Department of Fire Programs Branch Chief of Training and Operations. The NIOSH investigator conducted interviews with the driver of the engine and with officers and fire fighters of the involved departments who responded to the apparatus crash. The NIOSH investigator visited the incident scene. On August 8–August 9, 2012, the NIOSH investigator traveled to Wisconsin to inspect the apparatus at the manufacturer's refurbishment facility. The NIOSH investigator reviewed the Virginia State Police accident report, the medical examiner's report, the county fire department's standard operating guidelines, apparatus maintenance records, the driver's and the victim's training records, and incident dispatch audio tapes.

Fire Department and Equipment

The victim's department is part of a combination county-wide fire and rescue service. The victim's station is a combination department that has 2 career fire fighters/EMS providers during the day and is staffed by volunteers during the evening hours. It has approximately 60 volunteers with 20 active as operational fire fighters. The station houses a 1999 1,250-gallon-per-minute engine with a 750-gallon tank, a 1,250-gallon-per-minute engine, a 1995 1,800-gallon tanker, a 1989 brush truck, 3 advanced life support ambulances, and 1 sedan. The victim's station serves a population of 2,000 within an area of 20–25 square miles and responds to approximately 1,000 emergency incidents per year (150–200 of the incidents are fire responses).

Engine 6-5, the engine involved in this incident, is a 1999 commercial (cab forward) chassis engine with a GVWR of 43,000 pounds, 2 axles, 6 wheels, 1,250-gallon-per-minute pump and a 750-gallon tank. The engine was purchased new by the department in 1999. The engine is diesel-powered, with an automatic transmission and air brakes. It was not equipped with assist braking devices. At the time of the incident, the engine had a current Virginia state vehicle inspection sticker and had received regular maintenance performed by a commercial heavy-duty garage. The driver of Engine 6-5 reported during interviews with the NIOSH investigator that he had experienced a steering issue (described as a slight pulling to the right when applying the brakes) with Engine 6-5. Approximately 1 year prior to the incident, when he first became a member of the department, he reported the steering issue to the department's chief engineer. The department's chief engineer reported that he had found nothing wrong with the truck. None of the other fire fighters interviewed who had driven Engine 6-5 reported

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having any issues with the braking or steering performance of Engine 6-5. There were no issues found with the truck's steering post-crash.

The fire department involved in this incident experienced a fire station fire in 2006, and many of the station and equipment maintenance records were lost in the fire. The department has very few written SOPs since the fire and is currently in the process of compiling new SOPs and SOGs. The driver of the vehicle involved in this incident joined the department after the fire; therefore his records had not been affected by the fire.

Training and Experience

The driver of Engine 6-5 had one year of fire service experience with this department and reported to the NIOSH investigator that he had 12 years of previous experience as a volunteer in Massachusetts. The driver also reported that he had driven Engine 6-5 approximately 50 times. Documents indicated that the driver had completed a Commonwealth of Virginia Emergency Vehicle Operator's Course, and ICS 100 and 200. He had begun a Fire Fighter 1 class in Virginia but had not completed the course at the time of the incident. The fire department considered the driver qualified as a driver only and not an interior fire fighter. Any training prior to the driver joining this department could not be confirmed. The driver did possess a valid Commonwealth of Virginia driver's license.

The victim had 11 years of service with the department. The victim had the following documented training: Commonwealth of Virginia Emergency Vehicle Operator's Course level 3; Vehicle Rescue Awareness and Operations level; Fire Fighter 1, 2, and 3; Hazardous Materials Awareness and Operations level; Heavy Tactical Rescue Vehicle Rescue Awareness and Operations level; Rapid Intervention Team (RIT) training course; Mayday Fire Fighter Down course; Mass Casualty Incident Management course; Liquefied Petroleum Gas Emergencies course; Geriatric and Pediatric Basic Provider course; National Incident Management System IS-700a course; and the Commonwealth of Virginia Emergency Medical Technician course.

The victim's department conducts in-house training and participates in joint training sessions with neighboring fire departments and the county department of fire and rescue. The county offers a 6-month fire academy, weekends and evenings, to all of the volunteer stations. The fire academy consists of classes that certify fire fighters to NFPA Fire Fighter 1 and Fire Fighter 2. In addition, the academy offers certification classes in fire apparatus driver/operator,* Hazardous Materials Awareness, Operations and vehicle extrication. The victim had planned to take the next county fire academy class offered by the county.

**Note: Fire Fighter 1 and 2 training meet the criteria for NFPA 1001 Standard for Fire Fighter Professional Qualifications,¹ and classes offered for driver/operator meet the criteria for NFPA 1002 Standard for Fire Apparatus Driver/Operator Professional Qualifications.²*

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Incident Timeline

- **1116 Hours**
County emergency communications center dispatches Station 7 and Station 6 fire and EMS (including Engine 6-5) for a motor vehicle incident with possible injuries.
- **1120 Hours**
Emergency communications center advises Ambulance 202 that all occupants are out of the vehicle.
- **1121 Hours**
Emergency communications center tones out Station 7 and Station 6 a second time and notes a second ambulance call.
- **1123 Hours**
Engine 6-5 (unit involved in this incident) advises emergency communications center that they are waiting for additional manpower.
- **1124 Hours**
Engine 6-5 advises emergency communications center that they are responding with two personnel.
- **1125 Hours**
Unit 610 (member from Station 6) arrives on scene of the initial motor vehicle incident and advises the emergency communications center by radio that there are no injuries and no transport will be needed. Unit 610 also advises dispatch to continue first due ambulance and Engine 6-5 and all other units can cancel.
- **1128 Hours**
Emergency communications center receives multiple calls reporting a fire engine crash. One phone call is received from a house close by, reporting a fire fighter is in the woods. *Note: SCBA PASS alarms can be heard in the background during the phone call. During interviews, many members reported hearing Engine 6-5's SCBA PASS device(s) activated. The PASS device(s) were possibly activated during the crash when the SCBA's cylinder wheel(s) were jolted and aired on.*
- **1130 Hours**
Station 7 and Station 6 fire and EMS dispatched to a crash involving a fire engine.
- **1133 Hours**
Engine 6-5 driver reports by radio to dispatcher that he is performing CPR.
- **1134 Hours**
Engine 7-2 arrives on scene and reports CPR in progress.

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- **1138 Hours**
Unit 610 arrives on scene and establishes command.
- **1140 Hours**
County-wide fire and EMS director arrives on scene. The victim was pronounced dead on scene by fire and EMS personnel.



Photo 1. Crash site.
(Photo courtesy of easternshorefire.com.)

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Photo 2. Engine 6-5's final position just off the roadway in the wooded area.
(Photo courtesy of easternshorefire.com.)

Personal Protective Equipment

The victim was wearing turnout pants and boots but no other turnout gear. The victim's helmet was found in the roadway, but it is unknown if he was wearing it at the time of the crash.

Road and Weather Conditions

Engine 6-5 was traveling on a two-lane paved asphalt state highway with a posted speed limit of 45 mph. The incident occurred as the engine entered a slight left turn after exiting a right turn. While entering the turn, the right rear wheels of Engine 6-5 left the paved surface and the engine went into the ditch. There was a narrow soft shoulder and ditch at the point where Engine 6-5 left the roadway (see Photo 3). The roadway was narrow and had a minimal shoulder in the curve (see Photo 4). The roadways in the area were reported as dry by other emergency personnel and police. At the time of the

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incident (approximately 1130 hours), the weather was clear with an approximate temperature of 88°F. The relative humidity was 57% and the wind was from the west at 10.4 mph. Visibility was reported as 10 miles.³



Photo 3. Curve where Engine 6-5 left the roadway. The ditch is visible just to the side of the pavement.
(Photo by NIOSH.)

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Investigation

On July 16, 2012, a 30-year-old male volunteer fire fighter (victim) died after being ejected from a fire engine. The victim, riding in the right front seat, was responding on Engine 6-5 with one other fire fighter (the driver) to a reported motor vehicle crash with injuries.

Engine 6-5 was traveling on a two-lane paved asphalt state highway with a posted speed limit of 45 mph. Engine 6-5 had traveled approximately 1.3 miles, and the driver told the NIOSH investigator, he was traveling approximately 35–40 miles per hour. *Note: The driver reported during interviews with the NIOSH investigator that he estimated his speed at 35–40 miles per hour. The Virginia State Police estimated his speed at 55 miles per hour.* The incident occurred as the engine entered a slight left turn after exiting a right turn. While entering the slight left turn, the right rear wheels of Engine 6-5 left the paved surface. There was a narrow soft shoulder and ditch at the point where Engine 6-5 left the roadway (see Photo 3). Engine 6-5 crashed into the ditch, impacted a utility pole and a number of trees. The victim was ejected from the right front passenger seat into the woods. The driver was belted and was not ejected during the crash. The driver self-extricated through the broken windshield on the driver's side. The driver found the victim lying in the woods unconscious. The driver then radioed the dispatcher that he was involved in a crash, that a "member was down," and he (the driver) was performing CPR.

County emergency communications center operators began receiving numerous phone calls reporting a fire truck had crashed into the woods and a fire fighter was reported to be in the woods. *Note: The NIOSH investigator reviewed the phone and radio recordings from the county emergency communications center. During some of the phone calls, SCBA PASS alarms can be heard in the background. The PASS alarms were likely activated when the SCBAs were jostled during the crash and activated by air pressure. During interviews, many witnesses on the scene recall hearing the PASS devices sounding.* The county 911 center dispatched fire and rescue units to the fire truck crash scene, and units that were responding to the original vehicle crash were diverted to the scene. Fire and rescue units arrived on the scene within minutes, and they began to administer emergency medical care to the victim. Advanced life support personnel from the responding units pronounced the victim dead on the scene.

During interviews with the NIOSH investigator, the driver of Engine 6-5 reported that he was driving approximately 35–40 miles per hour and had just come out of a right-hand curve and was entering a left-hand curve when he described the rear end as being "picked up and moved over to the right." The driver also stated that the truck had seemed sluggish and he had mentioned that to the victim. They had no other conversation during the response. The truck traveled in the ditch and struck a utility pole and several trees. The victim was ejected from the cab and landed in the woods (see Photo 4). The driver did not recall any further details of the crash except pulling the engine stop control while crawling out of the windshield and looking for the victim. He did not recall if the victim had secured his seatbelt before they left the station and they had little to no conversation en route to the call.

During interviews with fire fighters from another department that responded to the scene, one fire fighter who removed the water from Engine 6-5's tank stated that he thought the truck was only carrying approximately half a tank of water judging from how much he removed. During interviews

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with Station 6 officers, they said it was unlikely that the truck had less than a full tank of water and they would not respond to an incident with less than a full tank. Engine 6-5's water tank was the original baffled polymer tank. The NIOSH investigator traveled to the manufacturer's refurbishment facility to inspect the truck but could not verify the condition of the baffles in the water tank due to the tank's location and configuration. A spokesman for the manufacturer's refurbishment plant stated that the tank could not be re-used due to the likelihood of breakage of the baffles during the crash.



**Photo 4. Crash scene after Engine 6-5 was removed. Yaw mark from left side dual wheels. Right side dual wheels were already off the roadway.
(Photo by NIOSH.)**

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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 led to this fatality:

- Narrow roadway with minimal shoulder in a curve
- Loss of control of the vehicle (right wheels left the paved surface)
- Non-use of seat belt
- Inadequate SOPs for seat belt usage
- Inadequate driver training

Cause of Death

According to the medical examiner investigator, the cause of death was multiple impact injuries.

Recommendations

Recommendation #1: Fire departments should ensure that fire department drivers/operators are trained in techniques for maintaining control of their vehicles at all times.

Discussion: Fire apparatus driver/operators are responsible for safely transporting fire fighters, apparatus, and equipment to and from the scene of an emergency or other calls for service. Crashes are second only to cardiac events as the cause of on-duty deaths of fire fighters.⁴ Under all circumstances, the fire apparatus driver/operator must exercise care for the safety of others and must maintain complete control of the vehicle.⁵ NFPA 1500 *Standard on Fire Department Occupational Safety and Health Program*, Chapter 6.2.4, states, “Drivers of fire apparatus shall be directly responsible for the safe and prudent operation of the vehicles under all conditions.”^{6,7} The International Association of Fire Chiefs provides a *Guide to IAFC Model Policies and Procedures for Emergency Vehicle Safety*.⁸ Many human elements are involved in failing to maintain the safe control of fire apparatus while responding to an alarm. Insufficient training, excessive speed, inexperience with the apparatus, failure to recognize a dangerous situation, overconfidence in one’s driving ability, sense of urgency, and poor driving habits are some of the human elements that fire fighters and officers have a shared responsibility to understand and train to avoid.^{9,6} According to the United States Fire Administration’s *Safe Operation of Fire Tankers*⁹ a significant percentage of crashes involving fire department tankers is attributed to the vehicle being driven at a speed that is excessive for the given conditions. *Note: The fire apparatus involved in this incident was an engine and not a tanker but did have a 750-gallon water tank.* According to the United States Department of Transportation, National Highway Traffic Safety Administration, “a vehicle in transport sometimes leaves the travel lane and encroaches onto the shoulder, median, roadside, parking lane, gore or a separator and hits one or more natural or artificial objects. This event usually involves a single vehicle and is referred to as a run-off-road crash (ROR). ROR crashes account for a significant percentage (around 70%) of all fatal single-vehicle crashes.

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Curved road segments, rural roads, high-speed-limit roadways and roadways with fewer lanes are found to be more likely to be involved in fatal single vehicle ROR crashes.”¹⁰

In this incident, the driver of Engine 6-5 stated during interviews that his speed was approximately 35–40 mph and the road conditions were dry. The driver also stated that the truck had seemed sluggish and he had mentioned that to the victim (they had no other conversation during the response). After coming around the first right-hand curve, he started to enter the second left-hand curve and he described the rear end as being “picked up and moved over to the right.” The truck’s right wheels dropped off the pavement and traveled in the ditch and struck a utility pole and several trees. Engine 6-5 did have anti-lock brakes, and yaw marks on the roadway showed the point where Engine 6-5 left the pavement and entered the ditch (see Photo 4).

The state police crash report estimates the speed of Engine 6-5 to have been 55 miles per hour and notes failure to maintain proper control by the driver as a factor. The posted speed limit for the highway was 45 miles per hour. The roadway was narrow and had a minimal shoulder in the curve (see Photo 4). The state police crash reconstruction personnel examined the truck and could find no issues with the truck regarding braking or steering. There were no indications that anything was mechanically wrong with the truck. The truck was sent to the manufacturer’s refurbishment plant in Wisconsin for evaluation and possible repair.

Recommendation #2: Fire departments should ensure that written standard operating procedures (SOPs) regarding seat belt use are established and enforced.

Discussion: The fire department involved in this incident had a verbal policy that required all fire fighters to use their seat belts but did not have a written standard operating procedure (SOP) requiring the use of seat belts. The driver was wearing a seat belt, and the victim was likely not wearing his seatbelt and was ejected out of the fire engine. The driver doesn’t remember seeing the victim buckling his three-point seat belt. The state police report notes that it is not known if the victim was wearing his seat belt at the time of the crash. During interviews, fire fighters and officers reported that the unwritten rule was to use seat belts.

Fire departments should develop, train upon, and strictly enforce SOPs on the use of seat belts. Training and enforcement should include all levels of the organization, from the apparatus driver and fire fighters riding in the apparatus to the officer on the apparatus and chief officer levels. The SOPs should apply to all persons driving or riding in all emergency vehicles, and they should state that all persons should be seated and secured in an approved riding position before the vehicle is put in motion.

Vehicle crashes are the second leading cause of fire fighter line-of-duty deaths. The driver/operator must always ensure the safety of all personnel riding on the apparatus. NFPA 1500 *Standard on Fire Department Occupational Safety and Health Program*,⁶ 6.3.1, states, “all persons riding in fire apparatus shall be seated and belted securely by seat belts in approved riding positions at any time the vehicle is in motion other than as allowed in 6.3.4 and 6.3.5.” NFPA 1500, 6.2.5,⁶ also states, “drivers shall not move fire apparatus until all persons on the vehicle are seated and secured with seat belts in approved riding positions.” Seat belts are not only important for protecting occupants in the event of a

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crash, but they may be useful in helping to avoid crashes. Any person not wearing a seat belt while riding in a vehicle can become a positional projectile that can cause injury or death to others in the vehicle as demonstrated in the following video link:

<http://flashovertv.firerescue1.com/Clip.aspx?key=3F1203582FF55152>.¹¹

A seat belt policy that is followed and/or enforced by fire department personnel helps achieve the benefit of the safety device. To increase the use of seat belts by fire fighters, the National Fire Service Seat Belt Pledge Campaign was created.¹² The National Institute for Occupational Safety and Health, United States Fire Administration, International Association of Fire Chiefs, National Volunteer Fire Council, NFPA, and National Fallen Fire Fighters Foundation all support the campaign as a method of raising awareness of the importance of mandatory use of seat belts by all fire fighters. Fire fighters wearing seat belts are an essential component of efforts to ensure the safety of fire fighters in fire apparatus and vehicles.¹³ Fire fighters who take the pledge and fire departments who achieve 100% pledge participation show their individual and organizational commitment to fire fighter safety.¹⁴ The International Association of Fire Chiefs has guidance on developing SOPs for emergency vehicle safety.⁸

The state of Virginia Criminal and Traffic Laws, Chapter 10, Section 46.2-1094, requires occupants of the front seat of a motor vehicle to wear the appropriate safety belt system at all times while the vehicle is in motion on any public highway. The section does give exceptions for law enforcement officers in certain circumstances, rural mail carriers, waste collection vehicles, and utility meter reader vehicles. Fire-fighting vehicles are not exempt from these seat belt provisions.

Recommendation #3: Fire departments should provide and ensure all drivers successfully complete a comprehensive driver's training program, such as NFPA 1451 Standard for a Fire Service Vehicle Operations Training Program, before allowing a member to drive and operate a fire department vehicle.

Discussion: Fire departments should provide adequate resources and training to ensure that the safe arrival (and return from) an emergency scene is their first priority. Fire departments should develop, implement, and enforce written standard operating procedures on emergency vehicle driving and ensure fire fighters are thoroughly trained and qualified before being allowed to drive and operate emergency vehicles. The minimum requirements for a fire service vehicle operations training program are contained in NFPA 1451, *Standard for a Fire Service Vehicle Operations Training Program* [2007].⁷ The objective of the training program is to prevent crashes, injuries, and fatalities (both civilian and fire service) involving fire service vehicles. Fire departments must also ensure that fire fighters are familiar with all of the different models of fire apparatus that they may be expected to operate. The members should be trained to operate specific vehicles or classes of vehicles before being authorized to drive or operate such vehicles.^{2,6,7}

In this incident, the driver of Engine 6-5 did not have any documented driver operator training other than the emergency vehicle operators course (EVOC). The driver did begin a Fire Fighter 1 course in the Commonwealth of Virginia but did not complete it.

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Recommendation #4: Fire departments should ensure that apparatus are regularly inspected and checked, recording water levels of engines, tankers, and other vehicles with water tanks.

Discussion: Fire apparatus should be inspected and checked regularly and the results recorded in a format that allows department maintenance personnel to monitor the readiness of the department's apparatus. This regular inspection should include checking the water tank level in all apparatus that carry water. If an apparatus has a water leak in the pump, valves, or tank assembly, much of the water can leak out and might not be noticed due to drains in the apparatus bay floor. If the trucks are not moved for a number of days, the water level could have dropped and then the water tank would be partially filled. NFPA 1500 *Standard on Fire Department Occupational Safety and Health Program*,⁶ 6.4.1 states, "All fire apparatus shall be inspected, maintained, and tested in accordance with the applicable requirements of NFPA 1911, Standard for the Inspection, Maintenance, Testing, and Retirement of In-Service Automotive Fire Apparatus."¹⁴

In this incident, the driver and members of the department stated that the truck did not have any water leaks and the truck was checked off by ambulance personnel that day but the water tank level was not checked. One of the fire fighters from a neighboring department, who removed the water from the tank after the crash, told the NIOSH investigator that he estimated that he only removed a couple of hundred gallons while helping the wrecker truck remove Engine 6-5 from the ditch. He stated that there wasn't a large amount of water in the ditch area and he had hooked up hoses to the truck and discharged the tank water to the other side of the street.

Recommendation #5: Fire departments should develop and implement fire apparatus inspection and check-off sheets and provide a systematic approach for the communicating, receiving, filing, and storage of these as well as maintenance records.

Discussion: NFPA 1911 *Standard for the Inspection, Maintenance, Testing, and Retirement of In-Service Automotive Fire Apparatus*¹⁴ states, "All fire apparatus that could be placed in service for emergency response shall be inspected, maintained, tested, and retired by this standard," and daily, weekly, monthly, and yearly inspections should be conducted by qualified personnel or individuals.¹⁵ NFPA 1911 further explains that inspections, maintenance, and diagnostic testing on fire apparatus should be performed by qualified personnel meeting qualifications set forth in NFPA 1071 *Standard for Emergency Vehicle Technician Professional Qualifications*,¹⁶ or the equivalent, and those performing inspections, maintenance, diagnostic testing, or operational checks on fire apparatus should consult the appropriate operator's service and maintenance manuals before starting any work on the apparatus. It is the responsibility of the fire department to determine who is qualified to perform the daily/weekly inspections and the operational checks of fire apparatus. These types of inspections and checks should be conducted within the fire station by driver/operators of the fire apparatus. Guidelines should be established for field personnel to take an apparatus out of service if a check or inspection discovers something is wrong.

NFPA 1911 annex C¹⁴ provides example check-off sheets and sample forms for inspection, maintenance and testing that can be used by fire departments to verify the apparatus is ready for service. These records should be maintained for each piece of fire apparatus and organized and filed by date. Records shall be maintained on the results of all apparatus inspections, maintenance requests,

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preventative maintenance requests, preventative maintenance, repairs and testing. Separate files shall be established and maintained for each fire apparatus. All records shall be kept for the life of the vehicle and delivered with the vehicle upon transfer or change of ownership.¹⁴ This allows the responsible personnel to evaluate the current status of apparatus and identify potential issues before they arise.¹⁵ The daily check-off records should include checking the water level in all of the apparatus that have water tanks, and those records should be retained and stored.

In this incident, many of the station's records were destroyed in a fire in 2006, and the department is currently establishing a new record-keeping system. According to fire department personnel, the engine involved in this incident did not have any reported issues, and all of the heavy maintenance was performed at a qualified heavy-equipment garage.

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Investigator Information

This incident was investigated by Stephen Miles, Safety and Occupational Health Specialist with the Fire Fighter Fatality Investigation and Prevention Program, Surveillance and Field Investigations Branch, Division of Safety Research, NIOSH, located in Morgantown, WV. An expert technical review was provided by John Tippet, Deputy Chief of Operations for the City of Charleston Fire Department. He is a 37-year veteran of the fire service. Chief Tippet spent 34 years with the Montgomery County (MD) Fire and Rescue Service, retiring as the department's safety battalion chief in 2009. He has been involved in a number of fire fighter health and safety initiatives over the last decade including introducing crew resource management to the fire service and working closely with the IAFC's National Fire Fighter Near-Miss Reporting System. A technical review was also provided by the National Fire Protection Association, Public Fire Protection Division.

Additional Information

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2. United States Fire Administration (1999) Guide to Developing Effective Standard Operating Procedures for Fire and EMS Departments/FA-197, Emmitsburg, MD [<http://www.usfa.fema.gov/downloads/pdf/publications/fa-197.pdf>]

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3. United States Fire Administration & The National Volunteer Fire Council (2006) Emergency Vehicle Safe Operations for Volunteer & Small Combination Emergency Services Organizations, Washington, DC [http://www.nvfc.org/files/documents/EVSO_2009.pdf]
4. United States Fire Administration & The International Association of Fire Fighters (2006) Improving Apparatus Response and Roadway Operations Safety in the Career Fire Service, Washington, DC [http://www.usfa.fema.gov/fireservice/firefighter_health_safety/safety/vehicle_safety/index.shtm]
5. United States Fire Administration, Safe Operation of Fire Tankers, Emmitsburg, MD [<http://www.usfa.fema.gov/downloads/pdf/publications/fa-248.pdf>]
6. The National Fire Fighter Near-Miss Reporting System [www.firefighternearmiss.com]
7. Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health (2001) Hazard ID, Fire Fighter Deaths from Tanker Truck Rollovers[<http://www.cdc.gov/niosh/docs/2002-111/pdfs/2002-111.pdf>]

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