



## **Fire Fighter Dies after being Ejected from a Pumper in a Single Vehicle Rollover Crash - New York**

### **SUMMARY**

On July 8, 2008, a 25-year-old male volunteer fire fighter (the victim) was fatally injured after being ejected in a fire truck rollover. The crash occurred as the fire truck was returning to the station after a call for a propane gas fire. The fire truck was traveling down a winding, steep grade. The paved road had a posted speed limit of 45 mph with a curve warning sign and recommended safe speed of 20 mph through the S-curve. The driver lost control of the fire truck, swerved off the left side of the road, returned to the pavement and overturned on the right side of the road. The victim was not wearing a seat belt and was ejected out of the driver's side window. The



**Crash Scene Photo.**  
*(Courtesy of County Sheriff's Office)*

pumper's 725 gallon water tank detached from the truck body and landed on top of the victim in the street. The victim was pinned underneath the water tank and died from injuries sustained in the crash. Key contributing factors identified in this investigation include: non-use of seatbelt, inadequate driver training, driver inexperience with this specific apparatus, an older apparatus with minimal safety features, potentially incorrect installation of a replacement water tank, and difficult road conditions.

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](http://www.cdc.gov/niosh/fire) or call toll free **1-800-CDC-INFO** (1-800-232-4636).



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

- *ensure that standard operating procedures (SOPs) regarding seatbelt use are enforced*
- *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*
- *ensure that replacement water tanks are installed according to manufacturer's instructions*
- *ensure that programs are in place to provide for the inspection, maintenance, testing and retirement of automotive fire apparatus*
- *consider replacing fire apparatus over 25 years old*
- *be aware of programs that provide assistance in obtaining alternative funding such as grant funding to replace or purchase fire apparatus and equipment*

Additionally, federal and state departments of transportation should:

- *consider removing exemptions that allow fire fighters to not wear seat belts*

## **INTRODUCTION**

On July 8, 2008, a 25-year-old male volunteer fire fighter (the victim) was fatally injured after being ejected in a fire truck rollover. The fire truck was returning from a call on a winding, steep downgrade slope. The driver failed to maintain control of the fire truck and swerved off the left side of the road, then returned to the pavement, lost control and overturned the truck on the right side of the road. The fire fighter (victim) was the only truck occupant. On July 9, 2008, the U.S. Fire Administration (USFA) notified the National Institute for Occupational Safety and Health (NIOSH) of this fatality.

On July 22, 2008, two Occupational Safety and Health Specialists from the NIOSH Fire Fighter Fatality Investigation and Prevention Program traveled to New York to investigate the incident. Photographs of the incident scene as well as the fire apparatus were taken. NIOSH investigators met with representatives from the local police department, fire fighters and officers from the involved fire department, and representatives from the New York State Office of Fire Prevention and Control. Interviews were conducted with fire department officers, fire fighters and the investigating officer from the local police department. NIOSH investigators reviewed the department's standard operating procedures (SOPs), the victim's training records, and police photographs of the incident scene. NIOSH investigators were accompanied by police representatives to inspect the involved fire apparatus at a secured police impound yard, and to examine the incident scene. NIOSH investigators also contacted



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the manufacturer of the composite water tank that was installed as a replacement in 1997. Information regarding the pumper's original drive train was obtained by NIOSH investigators through the VIN (vehicle identification number) and parts identification list.

### **FIRE DEPARTMENT**

The volunteer department involved in this incident has one fire station serving a primary response geographical area of one mile, and responds to approximately 30-40 emergency incidents per year. A total of 9 volunteer members serve a population of about 600-700 residents.

The department had one pumper (the incident apparatus), two tankers (a 1994, 1,800 gallon tanker and a 1968, 1,200 gallon tanker), and one brush/rescue truck. The department had a written seatbelt policy that stated "all passengers shall be seated and passenger restraint devices used." The department's SOP for vehicles and equipment was limited to a one page notice that noted all drivers and operators will be physically able to operate the vehicle; the requirements for procedures at traffic lights and when in the vicinity of school buses; required compliance with the New York state vehicle and traffic law; and, the responsibility of the driver for the safe operation of the vehicle. The department did not have any other written SOP's or SOG's regarding the operation of vehicles and equipment or driver training.

### **APPARATUS**

The apparatus involved in the incident was a 1978 1,000 gallon per minute (GPM) pumper equipped with a 725 gallon water tank mounted on a 173" wheelbase commercial chassis. The pumper was equipped with a 427 cubic inch gasoline engine. The transmission was a 5-speed straight (no split range) manual reported to be unsynchronized<sup>a</sup> and required double clutching<sup>b</sup>. NIOSH investigators were able to determine that the original transmission was a synchronized 5-speed manual transmission through the vehicle identification number and parts identification list. The reported gear shifting problems with the transmission and clutch were possibly the result of mechanical issues. The tires were reported to be original and tread depth (23/32 inch rear x 4, 10/32 inch front x 2) was not considered a factor. The apparatus had a conventional cab with "lap-type seat belts" that appeared to function correctly per police investigators. The apparatus was reported to have less than 5,000 miles, although

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<sup>a</sup> Manual transmissions come in two basic types: non-synchronous or sliding-mesh, where gears are spinning freely and must be synchronized by the operator using engine revolutions (and double clutching) to match road speed to prevent gear clash or grinding, and synchronized systems or constant-mesh, which eliminate this necessity while changing gears.

<sup>b</sup> Double clutching is a term that describes shifting the gears of a non-synchronized transmission whereby the clutch is depressed, the gear shift is brought to neutral, the clutch is released and then depressed and the gear shift is moved to the desired gear and the clutch is released. This method allows the gears to manually mesh with the engine speed and transmission.



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the odometer was unreadable after the incident. The brakes were hydraulic drum in the front and rear, and were reported to be original from the factory. The fire chief reported that the brakes were checked regularly, but had not been replaced since the apparatus was purchased new in 1978. The fire department had utilized a local service facility to inspect the truck annually and no fire fighters had reported any problems with the brakes or steering. There were no braking assist systems installed.

All of the drivers interviewed acknowledged the difficulty of shifting the transmission in this truck which required double clutching and gear selection. Several interviewed fire fighters reported that the truck was difficult to drive. Other operators of this truck reported a need to use the transmission to help slow the vehicle down on a downgrade slope, but did not report problems with braking. The department had an un-written policy for this apparatus that required the driver to place the truck in a lower gear and leave it in gear on downgrade slopes. There were no reports of the transmission “kicking” out of gear on downhill slopes.

The pumper’s original 750 gallon steel water tank was replaced in 1997 with a 725 gallon baffled composite tank by a local fire apparatus repair facility. The tank manufacturer provided written instructions adhered to the tank (see photo 1), that required specific mounting hardware, brackets and spacing for the tank’s installation. The water tank was reported to be full at the time of the incident.

### **TRAINING/EXPERIENCE**

The department required that all new members be enrolled in a fire fighter 1 class within one year of becoming a member. The victim (driver) in this incident had approximately 6 months experience at this department, and had participated in 3 driver training sessions (number of hours unknown) with the department’s most experienced driver/operator. This consisted of hands-on driver training in the local area. No other training records were available from this department.

The victim had previously been a member of another fire department for 6 years and had driven fire apparatus at that fire department, but the apparatus all reportedly had automatic transmissions. The victim had received fire fighter 1 and 2 training as well as hazmat training before becoming a member of this department and was also employed by a private ambulance company as a full time emergency medical technician.

The fatality occurred on the victim’s first emergency call driving this truck.

### **ROAD AND WEATHER CONDITIONS**

The engine was traveling downgrade on a two-lane blacktop state highway with a posted speed limit of 45 mph. The incident occurred at an S-curve that was marked by signage indicating a recommended speed of 20 mph. The road surface was asphalt in good condition and was dry. At the time of the crash



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it was daylight, the skies were partly cloudy, visibility was 7 miles, and the temperature was 80°-85°F. Winds were 10 mph, from the west.

## **SEAT BELT LAWS**

New York state law exempts emergency vehicle operators and passengers from the use of seat belts. The Federal Motor Carrier Safety Administration also exempts the occupants of fire trucks and rescue vehicles while involved in emergency and related operations from wearing seat belts.

## **INVESTIGATION**

On July 8, 2008, a 25-year-old male volunteer fire fighter (the victim) was fatally injured after being ejected in a fire truck rollover. The crash occurred at approximately 1808 hours as the fire truck was returning from a propane gas fire. The victim had responded to the fire scene alone in the fire truck with one other volunteer fire fighter in a privately owned vehicle (POV) leading the way. On arrival at the incident scene, units from another fire department reported that the fire was under control, and it was determined that no further assistance was needed.

The victim had a brief conversation with the volunteer who had responded in his POV; the conversation centered around the difficulties in shifting the gears on this fire truck.

The victim backed the fire truck out of the driveway and proceeded back to the station while the other volunteer got into his POV and returned to the station taking the same route as the victim. The volunteer driving his own POV came upon the overturned fire apparatus and wreckage in the S-turn (see photo 2), and summoned help via a portable fire department radio. Emergency units from the neighboring fire department responded to the scene immediately and rendered aid to the victim who was lying in the roadway trapped underneath the water tank.

The fire truck had rolled over during the crash, ejecting the driver onto the roadway, with the full water tank landing on top of the victim. The water tank separated from the fire truck during the rollover and landed upright in the roadway. It is not known if the water tank separation was secondary to the crash or contributed to the inability of the driver to bring the truck back under control. Once the tank was drained of enough water, fire fighters were able to move the tank off of the victim (see photo 3). The victim was transported to a local hospital where he died from his injuries.

Police investigators determined from the tire marks on the road that the fire truck had swerved to the left side of the road on approach to the curve then returned to the pavement, went out of control in the S-turn, and overturned on the right side of the road. The truck tires left yaw marks indicating the rear of the truck was sliding sideways down the road grade and to the right, while the front tires were



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tracking to the left (see photo 2). The victim was ejected out of the driver's side window onto the roadway with the full 725 gallon water tank landing on top of him.

### **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:

- Non-use of a seat belt. Although the department had a policy of mandatory usage of seatbelts, the policy was not followed. Police investigators concluded that the victim was not wearing his seat belt and was ejected during the rollover crash.
- Inadequate driver training and driver inexperience with this specific fire apparatus. This incident was the first emergency response and the fourth time ever for the victim driving this truck. The fire truck had been returning from a fire and traveled approximately 7/10ths of a mile when the crash occurred. The victim had a brief conversation with another fire fighter before leaving the incident scene regarding difficulty in shifting gears on the way to the call. Several members of the fire department reported that the truck was difficult to drive due to its type of transmission, braking capacity and the local road conditions.
- An older apparatus with minimal safety features. This fire apparatus was purchased new in 1978 (see photo 4), and did not have safety features that are standard on newer apparatus, such as automatic transmissions, disc brakes, traction control systems, and three-point seat belts. The sheriff's office found no evidence of brake failure after the incident. The fire department had utilized a local service facility to inspect the truck annually and no fire fighters had reported any problems with the brakes or steering. There were several comments from members regarding the difficulties in shifting gears in the truck, although the transmission and clutch had not been reported for repair or replaced. During initial interviews with department members, it was not known if the manual transmission was synchronized or non-synchronized, however the practice of this fire department was to double clutch the transmission to achieve a successful gear change.
- Potentially incorrect installation of the water tank. The truck's original steel water tank was replaced in 1997 with a composite tank. Findings from the investigation suggest that the tank was not installed per the manufacturers instructions found on the tank (photo 1). No evidence was found of the required 1" x 2" rectangular brackets that were referenced to be installed on 24" centers on top of the tank. There were no mounting hardware or rectangular brackets found in the wreckage, and examination of the wreckage did not indicate markings on the top of the tank from a bracket (see photos 5 & 6), mount or brace. It is important to note that the full



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water tank was ejected during the crash and landed on top of the victim. It is not known if the 725 gallon water tank (lacking a securing mechanism on the top of the tank), shifted and caused a change in the handling of the apparatus prior to or during the incident.

- Difficult road conditions. The paved road had a speed limit of 45 mph with a curve warning sign and recommended safe speed of 20 mph through the S-curve. The road leading down to and through the curve has a steep down grade slope, limited shoulder and trees that reduced the ability to observe on-coming traffic.

## **CAUSE OF DEATH**

The cause of death was reported as multiple-trauma crush injuries to chest and abdomen.

## **RECOMMENDATIONS/DISCUSSION**

***Recommendation #1: Fire departments should ensure Standard Operating Procedures (SOPs) regarding seatbelt use are enforced.***

Discussion: The fire department involved in this incident had a standard operating procedure (SOP) requiring the use of seat belts, however the victim in this incident was not wearing a seat belt at the time of the incident. Fire departments should enforce SOPs on the use of seat belts. 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 in motion.

Vehicle crashes are the second leading cause of fire fighter line of duty deaths. The driver/operator must always assure the safety of all personnel riding on the apparatus. Drivers should not move fire apparatus until all persons on the vehicle are seated and secured with seat belts in approved riding positions.<sup>1</sup> Seat belts are not only important for protecting occupants in the event of a crash, but they may be useful in helping to avoid crashes. The U.S. Fire Administration's *Safe operation of fire tankers* states "Some crash reconstruction specialists have speculated that particular incidents may have occurred after the unrestrained driver of a truck was bounced out of an effective driving position following the initial contact with a bump in the road or another object."<sup>2</sup>

A seat belt policy that is not followed and/or enforced by fire department personnel does not 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.<sup>3</sup> The National Institute for Occupational Safety and Health, United States Fire Administration, International Association of Fire Chiefs, National Volunteer Fire Council, National Fire Protection Association, 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.<sup>4</sup> Fire fighters who take the pledge and fire



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departments who achieve 100% pledge participation show their individual and organizational commitment to fire fighter safety.<sup>5</sup>

***Recommendation #2: 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 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]*. 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.<sup>6</sup> A combination of inexperience in this class of vehicle and lack of training were factors that may have contributed to this incident.

A disadvantage of a manual transmission is that the driver cannot maintain two hands on the steering wheel at all times (true for an experienced driver as well). A manual transmission can be especially problematic for inexperienced drivers who may not adapt to changing road conditions because of their focus on shifting gears. Fire departments should be explicit with SOPs and driver training regarding driving downhill or through sharp turns, and ensure operators are trained to select a lower gear and remain in the gear at all times in these situations. The engine provides braking power when the vehicle is in gear.<sup>7</sup> In this incident, the truck was on a downhill slope on a narrow and winding road with an approaching S-curve on the grade. If the driver's focus was distracted due to inexperience with the transmission (looking down at the gear shifter, tachometer, having to double clutch with the left foot and possibly having to move the right foot from the brake pedal to the gas pedal to increase the RPM's in an attempt to synchronize the transmission), the road conditions could have caused the truck to accelerate and contributed to the in-ability of the driver to regain control. It is not known if the transmission was in gear just before the crash, but the New York State Commercial Vehicle Enforcement Unit noted that the truck transmission was in neutral after the crash.

The victim had driven the truck in 3 driver training exercises before the incident. All of the drivers interviewed noted the department's unwritten policy of having the truck in a lower gear and using the transmission to assist in braking before starting down a hill or grade.



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***Recommendation #3: Fire departments should ensure that replacement fire apparatus water tanks are installed according to manufacturer's instructions.***

Discussion: In this incident, the original metal water tank of the pumper was replaced in 1997 with a composite (fiberglass) water tank by a local fire apparatus repair facility. Evidence was found that suggest the installation was not per the manufacturer's instructions found on the tank. NIOSH investigators found no evidence of the 1" x 2" rectangular brackets that were required by the manufacturer's instructions to be installed on top of the tank. There were no mounting hardware or rectangular brackets found in the wreckage, and examination of the wreckage did not indicate markings on the top of the tank from a bracket, mount or brace. It is important to note that the full water tank was ejected during the crash and landed on top of the victim. It is not known if the 725 gallon water tank (lacking a securing mechanism on the top of the tank), shifted and caused a change in the handling of the apparatus prior to or during the crash. The water in the full water tank would have weighed approximately 6053 lbs.

***Recommendation #4: Fire departments should ensure that programs are in place to provide for the inspection, maintenance, testing and retirement of automotive fire apparatus***

Discussion: In this incident, the fire apparatus was 30 years old, and although the mileage was low, safety features normally found on more modern trucks (braking systems, braking assist devices, drive trains, steering and suspension systems, tires, and other safety systems) were not present. Newer apparatus have designs that improve the stopping power of the braking system. Anti-lock disc braking on all axles and additional braking assist devices, such as engine brakes, have made heavy fire apparatus safer for the responding fire fighters. Automatic transmissions have become the standard in most heavy apparatus, eliminating the need to change gears and allowing the driver operator to keep both hands on the steering wheel at all times, and eliminating the need to move the braking foot from the brake pedal back to the accelerator to increase engine speed to successfully synchronize a gear shift.

The fire chief reported that the brakes were checked regularly, but had not been replaced since the apparatus was purchased. Police investigators found no evidence of brake failure. All of the drivers interviewed acknowledged the difficulty of shifting the transmission in this truck because of the need for double clutching and gear selection. Many of the fire fighters reported that the truck was difficult to drive. Other operators of this truck had reported no braking problem specifically, but they did indicate a need to use the transmission to help slow the vehicle down on a downgrade slope. There were no reports of the transmission "kicking" out of gear on downhill slopes.

Fire departments should consider upgrading older fire apparatus in accordance with NFPA 1912, *Standard for Fire Apparatus Refurbishing* [latest edition],<sup>8</sup> and retire or replace older apparatus in accordance with current standards such as NFPA 1911, *Standard For The Inspection, Maintenance, Testing, And Retirement Of In-Service Automotive Fire Apparatus* [latest edition].<sup>9</sup>



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***Recommendation #5: Fire departments should consider replacing fire apparatus over 25 years old. In addition it is recommended that apparatus manufactured prior to 1991 that are less than 25 years old, that have been properly maintained, and that are still in serviceable condition should be placed in reserve status and upgraded to incorporate as many features as possible of the post-1991 fire apparatus edition.***

Discussion: In this incident, the fire apparatus was over 30 years old, and with the very low department call volume (30-40 incidents per year), the truck was reported to have very low mileage. The truck was reported to have the original tires, and brakes.

To maximize fire fighter safety as well as the safety of the traveling public, it is important that fire apparatus be equipped with the latest safety features and operating capabilities. In the last 10 to 15 years, much progress has been made in upgrading the safety features and capabilities of fire apparatus. Significant improvements involving fire fighter safety of fire apparatus have been the standard since 1991, and fire departments should consider the value (or risk) to fire fighters of keeping pre-1991 fire apparatus in first-line service. Apparatus manufactured prior to 1991 usually only included a few of the safety upgrades required by recent editions of the NFPA fire department apparatus standards.<sup>6</sup>

It is a generally accepted fact that fire apparatus, like all types of mechanical devices, have a finite life. The length of that life depends on many factors, including vehicle mileage and engine hours, quality of the preventive maintenance program, quality of the driver training program, whether the fire apparatus was used within the design parameters, whether the apparatus was manufactured on a custom or commercial chassis, quality of workmanship by the original manufacturer, quality of the components used, and the availability of replacement parts, to name a few.<sup>10</sup>

***Recommendation #6: Fire departments should be aware of programs that provide assistance in obtaining alternative funding, such as grant funding, to replace or purchase fire apparatus and equipment***

Discussion: While it is important that fire departments seek constant improvements and upgrades to their fire apparatus and equipment, some departments may not have the resources or programs to replace or upgrade their apparatus and equipment as often as they should. Alternative funding sources, such as federal grants to purchase fire apparatus and equipment are available, additionally; there are organizations that can assist fire departments in researching, requesting and writing grant applications. Useful resources include:

- Federal Emergency Management Agency (FEMA), Assistance to Firefighters Grant Program 1-866-274-0960 or [firegrants@dhs.gov](mailto:firegrants@dhs.gov) . For more information from their web site go to <http://www.firegrantsupport.com>
- Federal Emergency Management Agency (FEMA), Fire Prevention and Safety Grants (FP&S) <http://www.firegrantsupport.com/fps/>



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- Federal Emergency Management Agency (FEMA), Staffing for Adequate fire and Emergency Response Grants (SAFER) <http://www.firegrantsupport.com/safer/> and <http://www.nfpa.org/SAFERActGrant>
- National Volunteer Fire Council [http://www.nvfc.org/page/638/Grants\\_Funding.htm](http://www.nvfc.org/page/638/Grants_Funding.htm)
- Non-governmental groups such as firegrantshelp.com are also available to provide members of the first responder community with resources for grant information and assistance <http://www.firegrantshelp.com>

The primary goal of the Assistance to Fire Fighters Grants (AFG) is to provide critically needed resources such as emergency vehicles and apparatus, equipment, protective gear, training for responders and other needs to help fire departments protect the public and emergency workers from fire and related hazards. The Grant Programs Directorate of the Federal Emergency Management Agency administers the grants in cooperation with the United States Fire Administration.

***Recommendation #7: Federal and state departments of transportation should consider removing exemptions that allow fire fighters to not wear seatbelts.***

Discussion: The July/August 2007 issue of NFPA Journal, Firefighter Fatalities Studies<sup>11</sup> states, “ In 1987, the first edition of NFPA 1500, Standard on Fire Department Occupational Safety and Health program, was issued with requirements that all firefighters riding on fire apparatus be seated and belted any time the apparatus is in motion. That same year, a Tentative Interim Amendment to NFPA 1901, Standard for Automotive Fire Apparatus, required the provision of seats and seat belts for the maximum number of persons who are going to ride on the apparatus.” The journal noted that in a 30 year study of fire fighter fatalities, the second largest share of fire fighter deaths occurred from crashes. Of the 406 victims, 76% were known not to be wearing seatbelts.

In this incident, the state of New York exempts fire fighters from using seat belts. The Federal Motor Carrier Administration regulations provide exemptions for fire and emergency vehicle responders regarding seat belts use as well. Federal and state departments of transportation should consider removing the exemptions for fire fighters to be more consistent with best practices. Federal and state seat belt laws need to be in agreement with consensus standards such as NFPA 1500, Standard on fire department occupational safety and health program, which require all fire fighters to be seated and belted while the vehicle is in motion.



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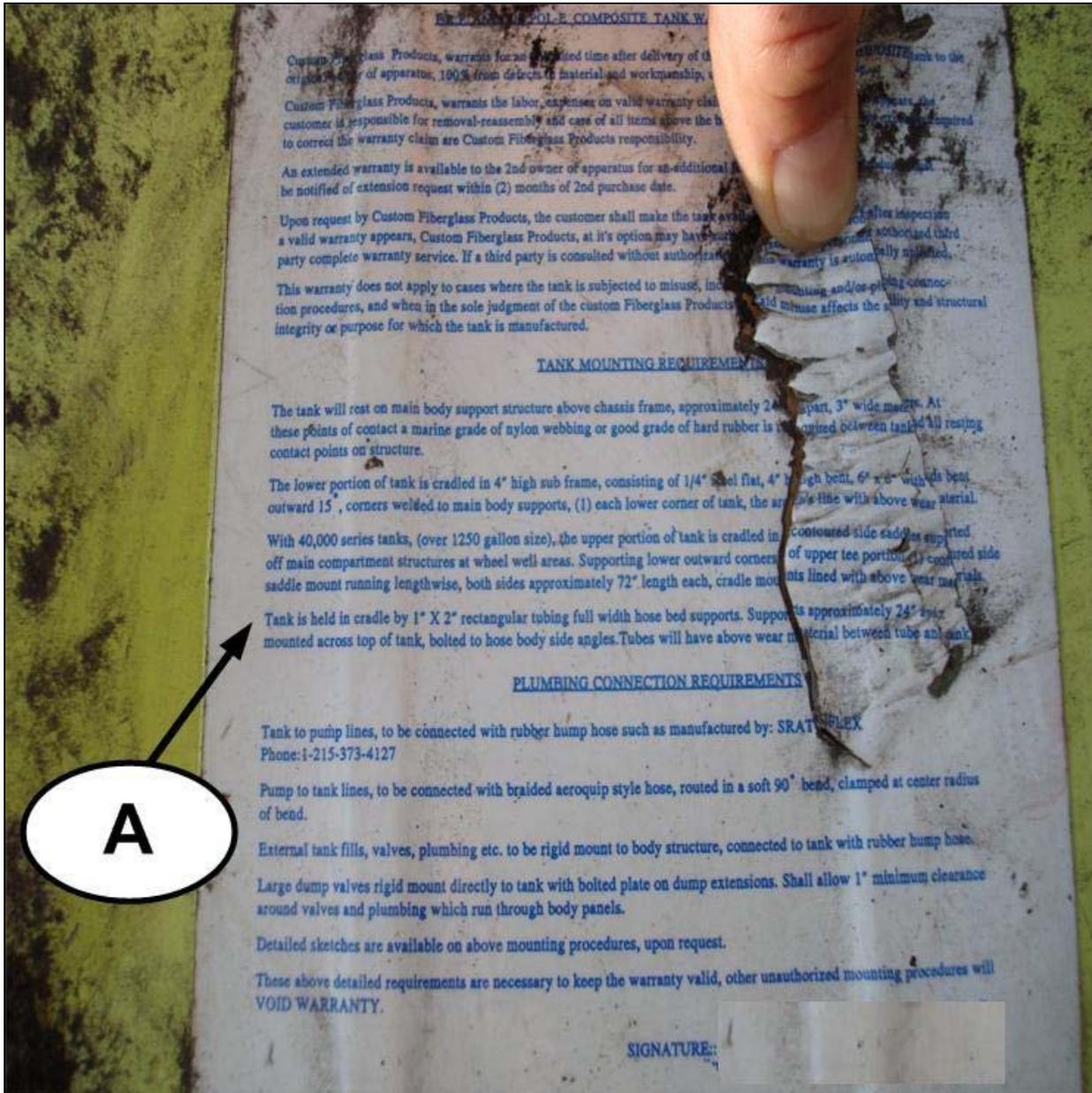
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## **INVESTIGATOR INFORMATION**

This investigation was conducted by Stephen T. Miles and Jay Tarley, Occupational Safety and Health Specialists with the Fire Fighter Fatality Investigation and Prevention Program, Surveillance and Field Investigations Branch, Division of Safety Research, NIOSH. This report was authored by Stephen T. Miles. An expert technical review was conducted by Dr. Burton A. Clark [EFO, CFO, National Fire Academy] and Kevin Roche [Assistant to the Fire Chief, Phoenix Fire Department].



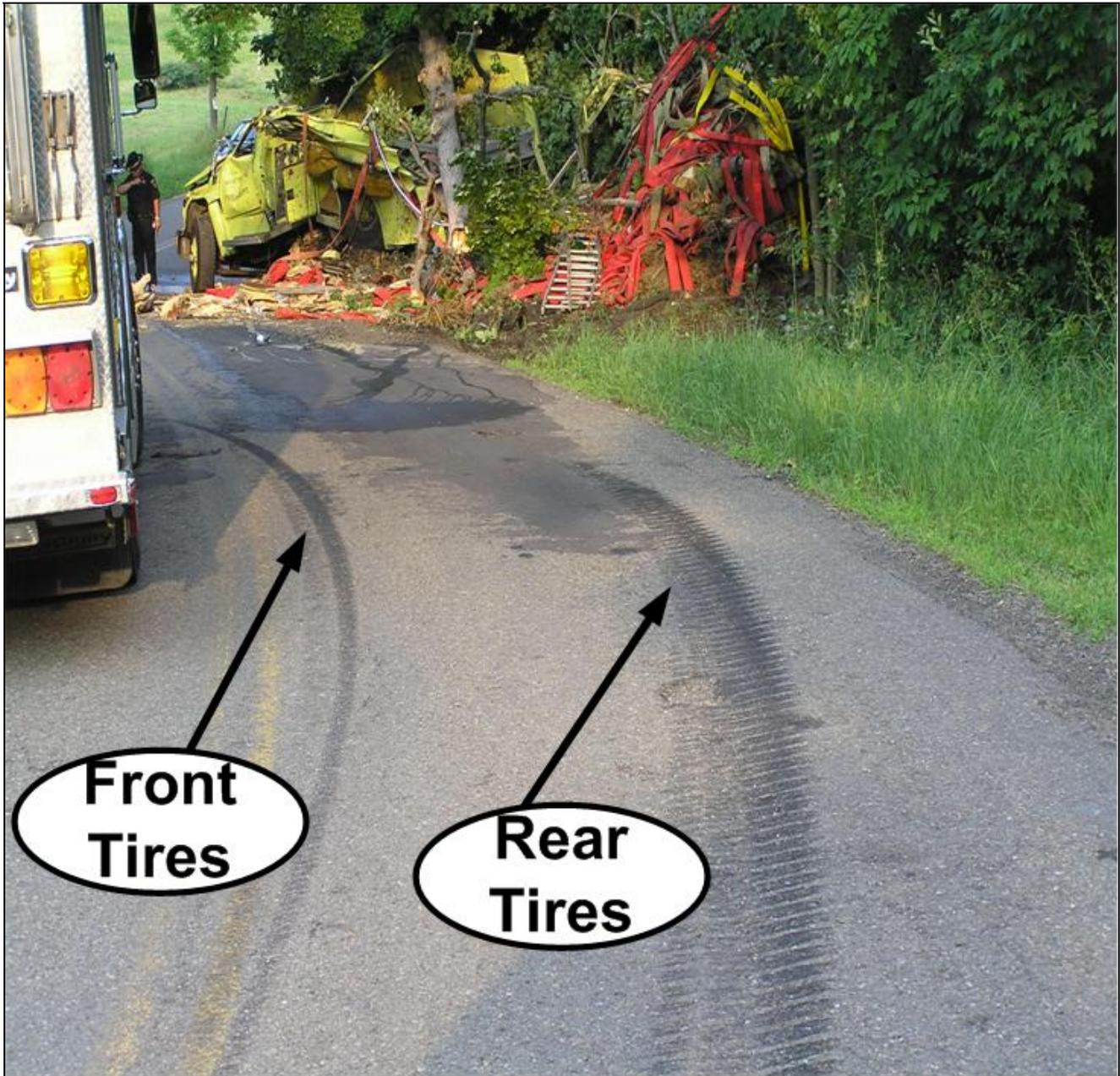
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**Photo 1. Tank Mounting Instructions (A) from manufacturer requiring tank to: be “held in cradle by 1” x 2” rectangular tubing full width hose bed supports; have supports approximately 24” apart mounted across top of tank, bolted to hose body side angles; and have wear material between tube and tank.” NIOSH investigators found no evidence of the rectangular 1” x 2” tubing, hose body side angles, bolts or brackets or wear material for tubing.**  
*(Photo by NIOSH investigators)*



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**Photo 2.** Note “yaw” marks on roadway. Marks on the right are from the rear tires and marks on the left are from the front tires just prior to the rollover. Tire yaw marks occur when a vehicle slides sideways while still moving forward. In a true yaw, where the vehicle’s rear is attempting to pass the vehicle’s front, each rear tire tracks outside the corresponding front tire.<sup>12</sup>  
*(Photo Courtesy of County Sheriff’s Office)*



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**Photo 3. Photo of the tank upside down in roadway after being flipped over to rescue fire fighter who was pinned underneath. The tank was ejected during the rollover and landed on the victim, right-side up.**

*(Photo Courtesy of County Sheriff's Office)*



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**Photo 4. Fire truck rollover.**  
*(Photo Courtesy of County Sheriff's Office)*



*Fire Fighter Dies after being Ejected from a Pumper in a Single Vehicle Rollover Crash-New York*



**Photo 5. Top of water tank, note the lack of trace markings or evidence of brackets or bracing hardware (A in photo)**  
*(Photo Courtesy of County Sheriff's Office)*



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**Photo 6. Tank main body supports. Note that the forward right support is pushed up by the right side body of the apparatus. This suggests that the tank was not in place when the bracket was bent.**

*(Photo by NIOSH investigators)*