



Revised January 8, 2009

## **Volunteer Fire Chief Dies from Injuries Received when Privately Owned Vehicle Crashes into Bay Door Pinning him Against Fire Tanker – Wisconsin**

### **SUMMARY**

On July 23, 2008, a 76-year-old male volunteer Fire Chief (the victim) was fatally injured after being pinned between a bay door and a parked fire tanker when a pickup truck, unexpectedly, crashed into the bay door. The victim and fire department members had just returned from a structure fire and were in the process of refilling tankers when the victim went inside the fire station to write the fire report. Several fire fighters noticed an Assistant Chief's pickup truck blocking the bay door for one of their tankers. After receiving permission, a fire fighter wearing his bunker pants and wet, rubber fire boots, backed the pickup truck at an angle to the adjacent bay, and was pulling forward when it accelerated suddenly. The pickup truck struck the bay door causing it to cave inward pinning the victim against a parked tanker. The victim was quickly removed from between the tanker and bay door, and taken to a local hospital where he was pronounced dead. Key contributing factors identified in this investigation include operating a vehicle while wearing wet, rubber fire boots; parking vehicles in a non-designated parking area, and lack of program oversight for privately owned vehicles used as emergency response vehicles.

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

- *consider developing and implementing a policy prohibiting the wearing of rubber fire boots while operating a vehicle*
- *consider designating parking areas for vehicles*

Additionally, fire departments and municipalities should:

- *establish program oversight and vehicle inspection procedures for privately owned vehicles used in emergency response*

The National Institute for Occupational Safety and Health (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. To request additional copies of this report (specify the case number shown in the shield above), other fatality investigation reports, or 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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**INTRODUCTION**

On July 23, 2008, a 76-year-old male volunteer Fire Chief (the victim) was fatally injured after being pinned between a bay door and a parked fire tanker when a pickup truck, unexpectedly, crashed into the bay door. On July 23, 2008, the U.S. Fire Administration (USFA) notified the National Institute for Occupational Safety and Health (NIOSH) of this incident. On August 4-7, 2008, a Safety and Occupational Health Specialist from the NIOSH Fire Fighter Fatality Investigation and Prevention Program investigated this incident. The NIOSH investigator met with the Sheriff's deputy in charge of the incident reconstruction, police department investigator, president of the municipality, fire department officers, and fire fighters. The NIOSH investigator reviewed the victim's training records, witness statements, visited the incident site and took photographs and measurements. The investigator also reviewed the 911 dispatch logs, police department report, Sheriff's Office accident reconstruction report, State police mechanical failure report, law enforcement photographs of the incident, and death certificate.

**Fire Department**

The fire department has one station with 39 volunteer members that serve a population of approximately 14,000 within an area of about 160 square miles. The department has four tankers, two engines, a ladder truck, a brush truck, and an equipment van. Although completely volunteer, the members could get paid by the hour when participating in department related activities or responding to emergency calls, but the fire department is not regularly staffed and relies heavily on member availability for responses.

**Training and Experience**

The victim had served 51 years as a volunteer with this fire department and had been the Fire Chief since 1986. The victim had received fire training equivalent to Fire Fighter I, basic first aid, and National Incident Management System (NIMS) course levels 100 and 700. The victim also attended bi-weekly training meetings on various fire topics provided by area fire districts. The victim served as the secretary of the County Fire Chiefs Association and the local newspaper named him its' 2007 Everyday Hero in the category of public service professionals.

The fire fighter operating the pickup truck had been a member of this department for three years and had never operated the pickup truck involved in the accident. He had driven various types of fire apparatus and had attended a defensive driving course provided to the fire department by the Sheriff's Office. The First Assistant Chief who owned the pick-up truck also attended the defensive driving course. There was no formal emergency vehicle operations course (EVOC) training provided.

The fire department had adopted the Wisconsin Fire Service Standard Operating Guidelines in 1991, but recently had a fire service consultant evaluate the department and make recommendations for creating and adopting their own standard operating guidelines (SOGs).<sup>1</sup> The updated SOGs had not been completed at the time of the investigation.



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**Road and Weather Conditions**

The incident occurred on a dry, level concrete apron. The weather was sunny with a temperature of 60°F.

**Personal Protective Equipment**

The fire fighter operating the pickup truck was wearing bunker pants and size 10 wide rubber firefighting boots that were wet. The boots measured 4 inches wide at the toe, 4 ½ inches wide across the arch, and 11 ½ inches in length. These boots had noticeable tread and met the requirements of the 2000 edition of NFPA 1971.<sup>2</sup> At the time of the incident, the victim was wearing slacks, a sweater, house slippers, and ball cap.

**Structure**

The fire station had five front bay doors and five rear bay doors. The incident occurred at the rear of the station. The automatic roll-up bay doors consisted of six panels made from steel with a polyurethane insulated center. Each panel measured 134 inches in length, 24 inches in height, and 1 ¾ inches thick. The third panel from the ground contained three rectangular windows with rounded corners. The windows measured 24 inches in length and 11 inches in height, with 59 inches between each window. Each bay door was separated by 24 inches of metal siding and metal studs, which were protected by two 48 inch tall, 7 inch diameter concrete pylons on the exterior. After the impact, the bottom three bay door panels had to be replaced (see Photo 1).

There was approximately 24 inches between the closed bay door and the tanker's diamond plated tailboard (see Photo 2). The tailboard was approximately 18 1/2 inches from the bay floor, and measured 102 inches in length, 18 ½ inches in width, and was 2 inches thick. The diamond plated dump chute<sup>a</sup> was approximately 48 inches from the bay floor. It measured 10 ½ inches in length, 24 inches in height, and 20 inches out (front of the chute to the rear of the truck). The tanker was moved approximately 67 inches to release the victim from between the bay door and tailboard.

**Equipment and Personnel**

The vehicle involved in this incident was a 2001 4-wheel drive pickup truck with a gross vehicle weight of 6,400 pounds (see Photo 3). The pickup truck had approximately 300,000 miles on it with a recently rebuilt automatic transmission with 4,500 miles. The pickup truck had been purchased by an Assistant Chief in 2003 from a private party. Upon titling the pickup truck in his name, he had discovered it was a rebuilt salvaged vehicle. The State Department of Motor Vehicles advised him it had passed a salvage inspection conducted by a certified state salvage title inspector prior to his purchase. Passing this inspection allowed the pickup truck to be reintroduced as a registered vehicle within the state. The pickup truck had not been state inspected since the salvage inspection, nor was an annual inspection required by the state. The First Assistant Chief stated he had experienced no operational issues since its purchase.

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<sup>a</sup> Extension of the dump piping that assists in directing the water into a portable tank.<sup>3</sup>



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The fire department had outfitted this pickup truck with an electric siren, alternating headlights, and a red optical warning device mounted on the dashboard. The state of Wisconsin has a statute allowing privately owned vehicles to be utilized as an emergency response vehicle. These vehicles are required to be outfitted with a red rotating light and siren that could be used in unison when responding to department calls. Optional alternating headlights could be used to meet the state requirements. The municipality and/or fire department chief had the authority to determine what privately owned vehicles would be used as an emergency response vehicle. The victim's department had a policy allowing privately owned vehicles of the fire chief, first assistant chief, and second assistant chief to be authorized as emergency response vehicles.

**Timeline**

The timeline for this incident listed in order of key events, includes:

- **0600 hours** Fire fighters and victim return from structure fire to refill tankers and clean equipment
- **0625 hours** Victim discussed repair of a cable on tanker dump chute with a fire fighter and an Assistant Chief
- **0632 hours** Fire fighter attempts to position pickup truck in front of bay door when it accelerates unexpectedly
- **0633 hours** Victim looking at dump chute when pickup truck crashes into bay door
- **0635 hours** 911 Dispatch Center receives a 911 call from victim's fire station for "person pinned under the back of the station...severe injuries..."
- **0636 hours** Ambulance service dispatched to fire department (no time provided for their arrival)

**INVESTIGATION**

On July 23, 2008, at 0600 hours, the victim and fire department members had just returned to the fire station to refill tankers and clean equipment following an early morning structure fire. Fire fighters were performing these tasks at the rear of the fire station.

**Activities of Victim**

The victim was inside the apparatus bay writing a fire report when he was approached by a fire fighter who handed him a broken dump chute extension. The fire fighter explained that the wire cable holding the chute extension in place had broken while on their previous fire call. The victim and fire fighter then walked over to the tanker which was parked in the forward position of the fourth bay. They could not immediately determine the length of cable needed by looking at the broken pieces on the tanker, so the victim went to an identical tanker parked in the rear position of the fourth bay to obtain a measurement. The victim walked down the driver's side of this tanker, turned left in front of the tailboard and had positioned himself on the left side of the dump chute when the pickup



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truck crashed into the closed bay door (see Diagram). The bottom two panels of the door caved inward onto the victim pinning his knees to the tailboard of the tanker. The force from the impact pushed him forward causing him to strike his chest and head against the diamond plated corner of the dump chute (see Photo 4). Fire fighters immediately moved the tanker forward to release the pressure exerted on him from the bay door. Emergency care was then given to him by trained fire fighters until EMS arrived. The victim was transported to a local hospital where he was pronounced dead.

**Activities of the Fire fighter**

A fire fighter had completed filling his tanker and needed to place it into the rear position of the third bay. He and other fire fighters noticed that an Assistant Chief's privately owned pickup truck was parked in front of this bay door. He spoke to the Assistant Chief about moving the pickup truck and the Assistant Chief told the fire fighter he could move it. The fire fighter still wearing his bunker pants and wet rubber firefighting boots, got into the driver's seat. This fire fighter had never driven the pickup truck. The fire fighter closed the driver's side door and backed the pickup truck approximately 10 feet at a 45° angle to position it in front of the rear fourth bay (see Diagram). The fire fighter noticed that the bay door was closed so he was going to drive forward and park in front of it because he knew that no apparatus needed to go in this bay. When he attempted to pull forward and park, the pickup truck unexpectedly accelerated into the bay door. The fire fighter attempted to apply the brakes with his right foot when he heard tires squealing and smoking. The eyewitnesses described it as if he was applying the brake and the accelerator at the same time.

The fire fighter attempted to shift the vehicle into park and turn the engine off, but the steering column shift lever moved freely between gears with no response. Other fire fighters who were outside on the apron witnessed what was happening and immediately ran to the pickup truck to assist the operator in turning the ignition off. Several fire fighters confirmed the free movement of the shift lever and the inability to place the lever in park. Eventually, the key was removed from the ignition, disabling the engine.

At 0635 hours, the 911 Dispatch Center received a 911 call from the victim's fire station. Fire fighters advised the 911 dispatcher of a fire fighter being pinned behind the station. The 911 dispatcher immediately dispatched law enforcement and EMS to the fire station at 0636.

**Collision Analysis and Vehicle Inspection Report**

The Sheriff's Office crash reconstruction investigator secured the bunker pants and rubber fire boots that were worn by the fire fighter during the incident. The investigator reconstructed the foot-in-boot placement on the brake and accelerator pedals of the pickup truck. The horizontal brake pedal measured 5 ¼ inches in length and 2 ½ inches in height, and the vertical accelerator pedal measured 2 ½ inches wide and 5 inches in length. The pedals were placed 2 inches apart and measured 10 inches across together. He concluded that the wet, rubber fire boot could cause a hazardous condition when operating between pedals. This hazard could involve trapping the boot under the brake pedal or





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accidental depression of both pedals at the same time (see Photo 5). This theory aligns with the unexplained and sudden acceleration of the pickup truck from the crash data retrieved from the Event Data Recorder (EDR)<sup>b</sup> from within the pickup truck's airbag control module. The airbag did not deploy, but the EDR recorded an event that appeared to be consistent with witness statements. The data showed the brake switch being applied and then releasing with the speed climbing, then the throttle going from 0-100% just before the incident.

The Wisconsin State Police performed a mechanical inspection of the pickup truck. The steering column shift lever was found to be heavily worn and could be manipulated without key or brake pedal application, or with light key turning and light brake pedal application. The shift lever had free movement from 1 to 1 ½ inches and the housing screws were missing or loose. The inspector also believed that this free movement condition had occurred over a period of time and was not due to the fire fighter pulling on the shift lever during the incident. It was also discovered that the siren cable and alternating headlamp wires had been routed through the firewall via the protective boot for the steering column. The wires and cable then ran under the steering column to a switch mounted to the left of the steering wheel. The slack was taken out of the siren cable and it was zip tied to the throttle cable. When pressure was applied downward on the siren cable, the accelerator pedal would go to the floorboard (see Photo 6). The accelerator return spring and throttle plate were also evaluated for carbon buildup, but it was clean and moved freely. Carbon buildup in these areas may cause an operator to feel no power, apply more throttle, and cause the truck to accelerate faster than expected.

The Wisconsin State Police inspector finalized his report with several other mechanical defects discovered. These items did not contribute to the incident, but would have to be corrected before the vehicle is operated again. A diagnostic test was also performed by a master technician at the local dealership with no critical findings.

### **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:

- Wearing wet, rubber fire boots while driving. The accident reconstruction report showed that the fire boots were large enough to cover the brake pedal and the accelerator pedal, and significantly touch or cover both pedals at the same time. The boots could also easily get stuck between the pedals. The boots were also wet which could have caused the boot to slip.
- Parking a vehicle in a non-designated parking spot.
- Lack of administrative program oversight and maintenance procedures. The privately owned vehicle was used as an emergency response vehicle but was not inspected and maintained by the fire department, and was found by law enforcement investigators to be in poor mechanical condition.

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<sup>b</sup> The Event Data Recorder is a device that records quantitative and objective information allowing safety researchers to identify factors which may have precipitated a collision, and to reconstruct the nature and severity of the collision itself.<sup>4</sup>



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**CAUSE OF DEATH**

According to the medical examiner, the cause of death for the victim was blunt trauma to the chest.

**RECOMMENDATIONS**

***Recommendation #1: Fire departments should consider developing and implementing a policy prohibiting the wearing of rubber fire boots while operating a vehicle***

Discussion: The use of proper footwear while driving is important for safe vehicle operation. Wearing shoes not suitable for driving, especially shoes that are thick-soled and irregularly-shaped can impact a driver's ability to safely operate vehicle braking and acceleration pedals and may lead to vehicle crashes. Shoe characteristics that should be avoided include soles thicker than 10cm, worn sole treads, and heaviness.<sup>5</sup> During the accident reconstruction study, it was determined that the wet, rubber boot likely slipped off the brake pedal and onto the accelerator pedal, then stuck underneath the brake pedal, pinning the accelerator down and causing the prolonged 100% acceleration recorded by the EDR. The pickup truck owner stated that he had previously experienced trouble negotiating the pedals in his pickup truck when wearing his rubber fire boots during operation.

***Recommendation #2: Fire departments should consider designating parking areas for privately owned vehicles***

Discussion: Fire fighters interviewed stated that there was a verbal policy prohibiting privately owned vehicles from parking on the aprons in a manner that would block the entry or exit of fire apparatus. It is not known why the pickup truck was parked on the apron before the structure fire call, or why it was repositioned in front of another bay instead of parking it in the parking lot off the apron. At the time of the investigation, there were no signs posted on the station indicating that parking was prohibited on the apron. The rear parking lot where the incident occurred had recently been resurfaced with asphalt pavement, and fire fighters interviewed stated that this area provided ample parking for private vehicles and fire apparatus (see Photo 7). The use of designated parking areas and "no parking" signs help ensure that fire apparatus and emergency response vehicles can rapidly respond to emergency incidents by negating the need to move vehicles that might block their travel routes, and eliminates injury hazards associated with moving such vehicles.

Additionally,

***Recommendation #3: Fire departments and municipalities should establish program oversight and vehicle inspection procedures for privately owned vehicles used in emergency response***



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Discussion: The Wisconsin Department of Commerce, Fire Prevention Program Division, established the Wisconsin Chief Fire Officer Guidebook. This book provides guidance for chief officers on many topics, including “Emergency Response with Private Vehicles.” This section outlines the responsibilities of the municipality and/or fire department regarding emergency response of private vehicles. These responsibilities include establishing a policy that addresses the procedure for approving emergency response of private vehicles, providing a program to assure responsibility and insure operators know the laws related to emergency vehicles and their response, verification of a valid driver’s license and adequate insurance, and giving notice under Wisconsin State Statute 347.25 (1), for a vehicle equipped with pulsating headlamps.<sup>1</sup> The policy established by the fire department included designating which chief officer positions were allowed to have privately owned emergency response vehicles and what types of equipment would be permitted.<sup>6</sup> However, there was no formal process for approving a private vehicle for emergency response or how the vehicle was to be retrofitted.

The mechanical inspection conducted after the incident discovered two serious items; poor and unsafe installation of emergency warning devices, and control and operational issues in the steering column shift lever. The crash reconstruction report stated that hand pressure applied to the siren cable was enough to cause the throttle cable to depress the accelerator pedal to the floorboard. These cables were hanging down after the incident, but were found to be above the normal foot operations for the pedals. Only a drastic foot motion could have caught these cables causing the 100% acceleration into the bay door. Although unlikely, this could not be ruled out by the crash reconstruction investigator. The crash reconstruction report also indicated the inability at times of the shift lever to successfully take the vehicle out of gear. It is reasonable to conclude that this was a mitigating factor when trying to move the pickup truck from the bay door after the initial impact. These mechanical defects were not caused by the crash, and may have been found earlier by a vehicle inspection.

## **REFERENCES**

1. Wisconsin Department of Commerce [2004]. Wisconsin chief fire officer guidebook. Madison, WI. Fire Prevention Program Division.
2. NFPA [2000]. NFPA 1971: Standard on protective ensembles for structural fire fighting and proximity fire fighting. Quincy, MA: National Fire Protection Association.
3. IFSTA [1999]. Pumping Apparatus Driver/Operator Handbook. 1<sup>st</sup> ed. Fire Protection Publications. International Fire Service Training Association.





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4. National Highway Traffic Safety Administration [2007]. Event Data Recorders: A new resource for traffic safety. [http://www.nhtsa.dot.gov/staticfiles/DOT/NHTSA/NRD/Articles/EDR/PDF/Research/Event Data Recorders-New Resource for Traffic Safety Research.pdf](http://www.nhtsa.dot.gov/staticfiles/DOT/NHTSA/NRD/Articles/EDR/PDF/Research/Event%20Data%20Recorders-New%20Resource%20for%20Traffic%20Safety%20Research.pdf) Accessed September 5, 2008.
5. Auto Tips and Advice [2007]. Proper driving footwear. <http://autotips.plentycar.com/proper-driving-footwear/> Accessed August 27, 2008.
6. Fire department [1998]. Policy.

**INVESTIGATOR INFORMATION**

This incident was investigated by Stacy C. Wertman, 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. A technical review was provided by Dr. Harry R. Carter.



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Photo 1. Damage to bay door.  
*(Photo courtesy of Sheriff's Office)*



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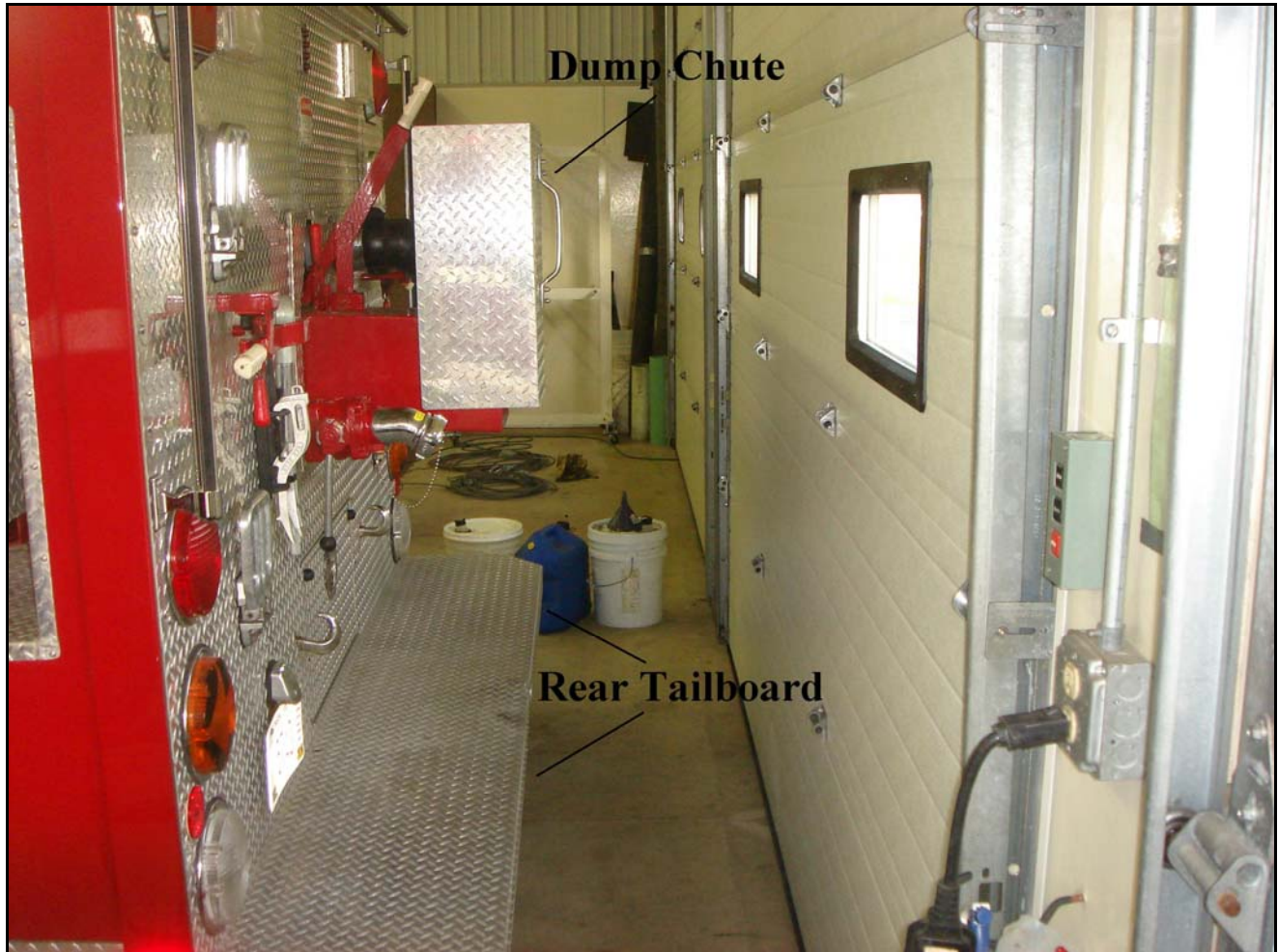


Photo 2. Tanker's position in relation to the bay door.  
(NIOSH photo)



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Photo 3. Pickup truck involved in incident.  
(Photo courtesy of Sheriff's Office)





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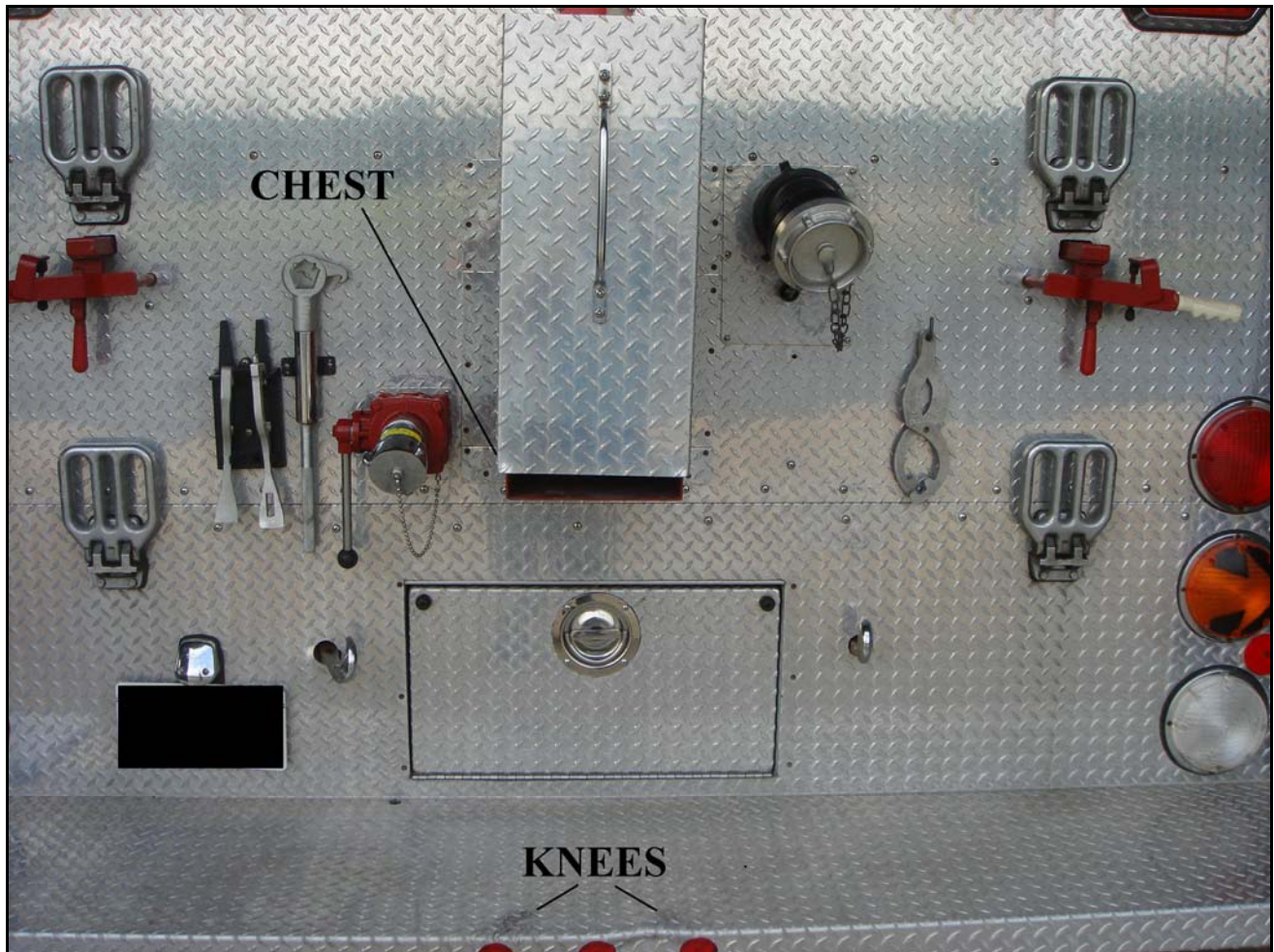


Photo 4. Victim's impact points on dump chute and tailboard.  
(NIOSH photo)





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Photo 5. Rubber fire boot caught between pedals and comparison of boot size to pickup truck's pedals.

*(Photo courtesy of Sheriff's Office)*



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Photo 6. Hand pressure being applied to exposed siren cable causing accelerator pedal to go to floor.  
*(Photo courtesy of Sheriff's Office)*



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Photo 7. Parking available at rear of station where incident occurred.  
(NIOSH Photo)





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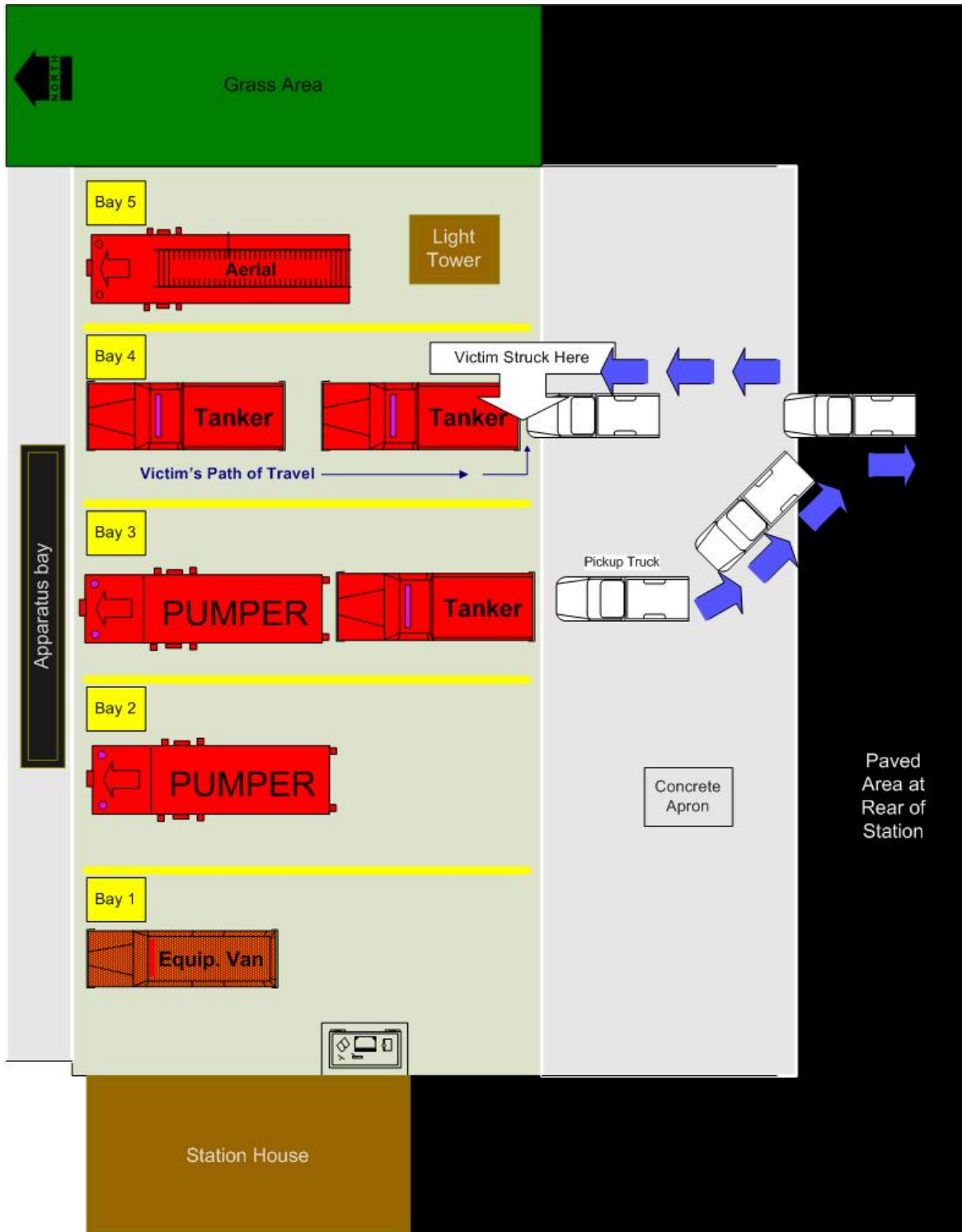


Diagram. Plan view of incident scene.