

WORKPLACE SOLUTIONS

From the National Institute for Occupational Safety and Health

Preventing Death and Injuries of Fire Fighters Operating Modified Excess/Surplus Vehicles

Summary

Fire fighters may be at risk for crash-related injuries while operating excess and other surplus vehicles that have been modified for fire service use. The National Institute for Occupational Safety and Health (NIOSH) has summarized recommendations to prevent injuries and deaths while operating these vehicles.

Description of Exposure

Fire departments with limited financial resources often craft fire apparatus out of excess/surplus military and other vehicles as an affordable alternative to new or used apparatus designed for fire fighting. Some excess/surplus vehicles are loaned to fire departments by the Federal Excess Personal Property Program or acquired through the Department of Defense Fire Fighter Property Program, or from state agencies. Fire departments are responsible for any modifications, maintenance, and upkeep of these vehicles [US Forest Service 2009].

The U.S. Fire Administration has reported crash risks attributed to overloaded water tankers that were once used as military fuel tankers [USFA/ FEMA 2003].

The NIOSH Fire Fighter Fatality Investigation and Prevention Program investigated seven *fatal incidents* involving crashes that occurred when fire fighters were operating modified excess/surplus vehicles. These investigations identified factors that can create safety concerns for fire departments: lack and non-use of seat belts, poor maintenance, exceeding the gross vehicle weight rating (GVWR),* using fuel tankers for hauling water without proper baffling, unsafe riding locations, and inappropriate vehicle modifications. Two of the cases are described below.

Case Study 1

On June 21, 2005, a 52-year-old male volunteer chief died from injuries sustained during a tanker rollover. While driving on a gravel road at approximately

40 miles per hour, the left front tire ruptured, causing him to lose control, leave the road, and roll over several times. The chief was ejected and died on the scene from his injuries. Seat belts were not used during the incident [NIOSH 2006].

The apparatus was a 1981, 2½-ton, 6 × 6 military tanker originally designed to carry gasoline (Figure 1). The truck, primarily used off road, weighed 13,530 pounds empty and had a GVWR of 16,530 pounds cross-country.† The tank was divided into three sections and had a capacity of 1,200 gallons. The estimated fully loaded water weight was 9,960 pounds, which exceeded the cross-country weight rating by approximately 7,000 pounds. Both rear axles had dual wheels. The tanker was equipped with lap-type seat belts and still had the original split rim wheels. Eight out of ten tires were bias-ply‡ tires manufactured in 1981. The apparatus was acquired by the department in 1998 through a loan

*GVWR is the recommended weight rating by the manufacturer as the highest operational weight for a vehicle and any added cargo or equipment.

†Cross-country GVWR accounted for the severe duty the military expected during off road operations. Newer military vehicles provide only the cross-country GVWR [REC 2009a,b].

‡Bias-ply tire is a pneumatic tire having crossed layers of ply-cord set diagonally to the center line of the tread.

program. The fire department did not inspect or make any modifications to the apparatus.



Figure 1. Military surplus vehicle involved in Case Study 1.

Case Study 2

On June 26, 2003, a 46-year-old male volunteer assistant chief was fatally injured after being ejected from a water tanker as a result of a rollover crash. The victim was driving to a wildland fire on an unpaved road within a national forest. The tanker failed to negotiate a curve and rolled down into a canyon. The victim was ejected from the cab during the rollover and was found lying unresponsive on the ground. He was pronounced dead at the scene [NIOSH 2003].



Figure 2. Military surplus vehicle involved in Case Study 2.

The apparatus was reported to be a 1954, 2½-ton military fuel servicing truck acquired through a loan program with a recommended payload weight[§] (without personnel) of 7,500 pounds (Figure 2). The truck had a 1,200-gallon tank that was originally

[§]Payload is the carrying capacity of a vehicle.

used to transport diesel fuel. The estimated, fully loaded water weight was 9,960 pounds, which exceeded the recommended payload weight by more than 2,000 pounds. State police reported that the tanker probably had brake failure before the incident; the master cylinder was leaking brake fluid, and the emergency brake was inoperable. Both front shock absorbers and three tires were defective. The vehicle did not have seat belts.

Controls

NIOSH recommends that fire departments take the following precautions and actions to minimize hazards and risks to fire fighters when using modified excess/surplus vehicles for emergency response:

Guidelines and Procedures

- Ensure that all fire fighters are seated in appropriate riding positions and are secured by seat belts whenever the vehicle is in motion (NFPA 1500). Vehicles without a restraint system should have one installed that meets current standards of the Society of Automotive Engineers [SAE 1994, 1995a; 1995b].
- Develop a standard operating procedure or guideline for operating modified excess/surplus tankers, including when the vehicle should and shouldn't be used and required training for operators. Consider operating these vehicles only in nonemergency mode (i.e., no lights or siren).
- Develop procedures to declare a vehicle mechanically deficient or unsafe, and immediately remove it from service until it is repaired or replaced.

Apparatus Design and Modification

- Ensure that the weight of a fully loaded vehicle does not exceed the GVWR. This is especially important when using military fuel trucks as water tankers, since water weighs 8.33 pounds per gallon, approximately 20% more than certain fuel types. The weight of additional fire fighting equipment should also be monitored, as this added weight may increase total vehicle weight in excess of the GVWR. Since wildland fire fighting apparatus may see severe off-road use, the cross-country GVWR should be considered the maximum if specified [REC 2009b].
- Ensure that tanks are baffled for safe handling of water (NFPA 1901). Fuel tanks generally lack appropriate baffles to allow for the safe transport of water.
- Ensure the vehicle is not operated with a partially filled water tank, because the sloshing effects of water during vehicle operation may cause the vehicle to become dangerously unstable when changing lanes or negotiating curves.
- Ensure that the vehicle's center of gravity has not been raised higher than when originally manufactured. A low

center of gravity contributes to improved vehicle stability. Roscommon Equipment Center (REC), a cooperative program between the National Association of State Foresters and the Michigan Department of Natural Resources, provides calculators and guidelines to determine center of gravity and weight distribution.

Maintenance

- Implement a vehicle maintenance program following the recommendations in NFPA 1911.
- Before placing vehicles into service, ensure that the vehicles are fully inspected, repaired as needed, and road tested by a certified mechanic, or where available, a certified emergency vehicle technician (EVT) (NFPA 1911, 1500). The EVT should meet requirements found in NFPA 1071.
- Service and maintain vehicles and have them professionally inspected at least annually to keep them in safe operating condition and in compliance with federal and state motor vehicle regulations and military vehicle operation guidelines. Surplus agencies should provide fire departments with manufacturer's manuals and vehicle data when available. REC may be of assistance in obtaining manuals.
- Ensure that the vehicle maintains ample suspension, steering, and braking ability through periodic vehicle inspections and maintenance.
- Inspect tires often for uneven wear, proper inflation, and deterioration. Adequate tread depth does not necessarily mean that tires are safe. Maintain tire pressures and replace tires according to the manufacturer's recommendations (e.g., replacing tires of a certain age). Tires that show signs of dry rot or cracking should also be replaced. Consider if military grade tires are adequate for the road surfaces the vehicle may be operated on. Some military tire tread patterns may not be suitable for use on wet, hard surfaces.

Training

- Use NFPA standards such as NFPA 1002, 1451, 1500, 1901, and 1906 as a guide to assist in development of a driver training program. Consider requiring a commercial driver's license for all operators who will be driving these types of vehicles.
- Provide training before driving and operating to ensure that drivers understand the handling characteristics, capabilities, and limitations of each vehicle.

Resources

- Ensure that funds are available for routine/preventative maintenance, safety modifications, and appropriate driver/operator training. Grants are available through

the Federal Emergency Management Agency, Federal Excess Personal Property Program, and Volunteer Fire Assistance Program [USFA 2009].

- Be aware of resources provided by REC. REC develops guidelines for local, state, and federal fire agencies to safely convert these former military vehicles to wildland fire apparatus.

For information about the NFPA standards referenced in this document, visit [www.nfpa.org/aboutthecodes/list_of_codes_and_standards.asp].

For information about fire fighter fatalities listed in this document, visit [<http://www.cdc.gov/niosh/fire>] (Report Nos. F2001-06, F2002-36, F2003-23, F2004-15, F2005-27, F2006-06, F2009-08).

For more information about the U.S. Forest Service Federal Excess Personal Property Program, visit [<http://www.fs.fed.us/fire/partners/fepp/>].

Acknowledgments

The principal contributors to this publication were CDR Steve Berardinelli, Robert Koedam, Virginia Lutz, and Stacy C. Wertman. CDR Berardinelli and Mr. Koedam previously worked for NIOSH.

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For More Information

The information in this document is based on fatality investigations and expert review. More information about the Fire Fighter Fatality Investigation and Prevention Program is available at www.cdc.gov/niosh/fire.

More information about fire fighter safety is available at

www.firegrantsupport.com www.fs.fed.us/fire/partners/fepp/
www.usfa.dhs.gov www.fs.fed.us/fire/partners/vfa
www.nfpa.org

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DHHS (NIOSH) Publication No. 2011-125