## D27 Heavy Truck Fuel-Fed Fires: Predictable Fuel Leakage, Ignition Sources, Fuel Tank Placement Hazards, and Safer Alternative Designs

*Mark C. Pozzi, MS*, Sandia Safety Sciences, Edgewood, NM 87015; David R. Bosch, PhD*, Phoenix, AZ 85028; Kenneth J. Saczalski, PhD, Newport Beach, CA 92661*

**Learning Overview:** After attending this presentation, attendees will be equipped to recognize and analyze heavy truck fuel system failures and fires, understand the survivability of such fires, and egress/escape from burning vehicles. Current designs will be analyzed and compared to safer alternative designs for fuel tank location, tank materials, tank liners and filler materials, check valves, impact guarding, etc.

**Impact on the Forensic Science Community:** This presentation will impact the forensic science community in terms of the forensic aspects of traffic accident investigation and reconstruction or fire investigation.

Some school buses and medium trucks utilize gasoline or propane-powered engines, which typically utilize fuel tanks located inside the frame rails and/or which are guarded against collision damage. A small but growing number of heavy trucks or large buses utilize compressed or liquified natural gas, with most fuel tanks mounted behind the cab, but with a few mounted outside the frame rail. Most medium and heavy trucks worldwide tend to be powered by diesel engines. The placement of diesel fuel tanks and any guarding varies widely depending on the size of the truck as well as the safety regulations in the country of operation.

In many areas of Europe and other countries, such heavy truck diesel fuel systems are guarded for impact protection. However, the heaviest Class 7 and 8 trucks and vocational vehicles operated in the United States typically utilize large-volume unguarded side-saddle type fuel tanks attached outside one or both frame rails, usually in close proximity to the cab. Many such fuel tanks incorporate steps to allow ingress and egress from driver and passenger seating areas. Many such exposed fuel tanks are adjacent to unguarded batteries and cables mounted outside the frame rails. This creates an extraordinary proximity of exposed fuel and ignition sources that are subject to collisions by other vehicles and fixed objects, which also happen to be adjacent to vehicle occupants. Failures of such exposed fuel systems and ignition sources has often occurred at low velocities, with resulting dangerous fuel leakage and fires. Egress and escape are often limited to doors or windows located directly above such vulnerable fuel tanks.

The exposed location of such heavy truck fuel tanks clearly violates many long-established principles of reasonably safe vehicle fuel system design for passenger vehicles and light trucks. Crashworthy fuel system designs have been determined by crash testing research that discovered dangerous flaws in fuel tank location and materials, and this has been published since at least the mid-1960s. One author of this study participated in the National Highway Transportation Safety Administration vehicle fuel system safety research in the 1970s and 1980s per Federal Motor Vehicle Safety Standard 301, as well as defect investigation crash tests on the Ford® Pinto®, General Motors® side-saddle tank pickups, and several other vehicles, that led to safety recalls. Another author consulted on vehicle fuel system safety, including the Ford® Pinto®, for the Department Of Transportation (DOT) and the Department of Defense. The Federal Motor Vehicle Safety Standard (FMVSS), including 301, tend to be significantly less robust or non-existent for larger vehicles with Gross Vehicle Weight Rating (GVWR) over 10,000 pounds.

Among the “justifications” for such obviously unsafe heavy truck fuel system designs is the significantly greater size and weight of medium and heavy trucks relative to passenger vehicles, as well as the supposedly lower flammability of diesel fuel compared to gasoline. The extremely dangerous sidesaddle fuel tank design of the General Motors® 1973–87 pickups was ample proof of how such placement outside the frame rail was vulnerable to failure in relatively minor collisions with other vehicles or fixed objects. Some of the “justifications” for such hazardous heavy truck fuel systems are based more on incorrect assumptions, myths, and economic/political considerations rather than any reasonable safety engineering.

**Heavy Truck Fires, Vehicle Fuel Systems, Crash Hazards**