Static Electricity and Refueling Fires

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Examining the situation

In the past months, I read with interest of the increase in reported fires in the United States that occurred at gas stations during the refueling process. To try and see if this increase has any statistical meaning, PEI recently carried out a survey to collate statistics. The oil industry is concerned that a relatively safe operation formerly carried out safely by billions of people all over the world is starting to cause some concern. After all, the last thing you want to do is harm your customer.

I felt that I should share some of the experiences we have had in Europe with fires at gas stations during the refueling process. In my many years as a Fire Marshall, it was always convenient to blame static electricity when a fire occurred with no other obvious explanation. Static electricity is still seen by many as a “black art,” a phenomenon that occasionally just seems to happen. This is not really the case. The generation of static electricity can be foreseen and steps can be taken to reduce the risk of static generation. Static electricity occurs all the time in industry and there are many experts who can advise on this.

In 1996, German officials asked me if we had any experience in the UK with fires occurring while refueling. I was unable to report any widespread problem. In Germany, they had 42 fires reported between 1992 and 1995 and Physikalisch Technische Bundesanstalt laboratory experts carried out some research which indicated that the majority of these fires had been caused by ignition of gasoline vapor by static electricity.

In 1997, a “mini epidemic” swept France, with some 100 incidents reported in the month of March, including five completely burnt out cars. The majority of the incidents occurred on a relatively small number of sites—with an uncanny irregularity at some sites—during an exceptionally dry spell. Dry conditions are ideal for generating static electricity. There were no incidents reported the next month of April, a rainy month.

To obtain answers to your problems, I believe you should examine each possible influence: vehicles, dispensing equipment, service station operations and fuel. Research into the European incidents pointed to a number of things that have changed over the years to increase the potential to generate static electricity.

Areas of influence

Today, more parts of vehicles are constructed using non-conductive plastics including fuel fillers and tanks. Car tires are made of non-conductive material (silica) to reduce wear. The seats are often made of nylon or other synthetic material, which helps generate a charge on the driver when leaving the vehicle.

Due to environmental concerns, vehicle refueling surfaces are more often sealed to prevent spillage entering the groundwater. The conductivity of fuel changes considerably according to grade and supplier. The provision of Stage II vapor recovery can affect fire risk. Dispensers, nozzles and hoses have changed.

In the UK, there are 13,000 gas stations with 112,000 nozzles. Gasoline sales total 6.6 billion gallons per year. About 87 sites have Stage II-vapor recovery. About 75 percent of these sites are self service and have the highest proportion of sales (over 90 percent of the total). By comparison, Germany has 16,000 gas stations with 150,000 nozzles, and sales of 8 billion gallons. Abut 2,000 stations have operational Stage II vapor recovery. A very high percentage of the stations are self-service. These countries are very similar with the exception of the number of Stage II installations.

There is one vital difference between Germany and the UK: the self-service dispensing nozzles. In the UK, the delivery nozzle is not allowed to be latched open. Therefore, the driver has to hold the delivery lever open during the whole refueling process and effectively provides an earth path for any charge generated.

In Germany, research has shown the greatest influence to be the customer who goes back to the vehicle and sits in his car seat during the delivery process. He then returns once the filling is completed and his charged body causes a discharge when he touches the nozzle to remove it, causing a spark.

Safeguards

Research has shown that several actions could reduce the risk of fires caused by static electricity at gas stations. The conductivity of the fuel should be examined and considered. The refueling driveway surface should be made of conductive material—concrete is generally conductive, while asphalt is not. Dispensers, hoses and nozzles should also be made of conductive materials, as specified in the values given in standards. Car seats should be made of anti-static material; tires should be made of conductive materials. Metal parts in the vehicle fueling area, where the nozzle is inserted, should be bonded. And the method of refueling operations needs to be examined to see if changes, such as going to a no-latch-open dispenser, can reduce risk.

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European Standards committee (CEN TC 393) dealing with equipment for service stations, which has produced 23 European standards relating to filling stations. He also chairs CEN TC 265 WG8 on underground and above ground storage tanks, and sits as a European contributor to the Underwriter Laboratory standards for fuel tanks and fuel lines in the USA. He was Editor of the APEA Technical Journal "The Bulletin" for 23 years and as Chairman of the technical committee of the APEA he is involved in the publication of the APEA/EI Guidance on design and construction of filling stations known as the Blue Book.