Static Electricity in Fuel Handling Facilities

Expertise to reduce the hazards associated with fires from an electrostatic discharge is based both on research and years of experience within the petroleum industry. Sully Curran provides advice and cautions to be taken when transferring fuels.

How to "short-circuit" the charge

Expertise to reduce the hazards associated with fires from an electrostatic discharge is based both on research and years of experience within the petroleum industry. This column focuses on precautions to take when handling motor vehicle and aviation fuels that may accumulate electrostatic charges because of their relatively high electrical conductivity (i.e., less than .50 picosiemens per meter).

Potential ignition source—Static electricity is generated by the separation of like or unlike bodies. For significant electrical charges to develop, the bodies must become and remain insulated with respect to each other.

In the petroleum industry, the static charge results from contact and separation that takes place in a flowing liquid. Also, the rate of electrostatic generation in a pipeline or hose increases as the length increases. In the aviation industry, the large surface area and small openings of micropore filters result in these filters being generators of static. Further, when the charged stream enters a container, charge separation occurs and will be induced on the tank wall.

As a result, once a means of generating an electrostatic charge exists, it will be a source of ignition under the following three conditions:

1. The accumulated electrostatic charge can produce an incendiary spark.
2. There is a spark gap.
3. There is an ignitable vapor-air mixture in the spark gap.

Common tank problem areas—Following is a discussion of common static electricity problem areas found in marketing distribution and aviation fuel handling facilities, and precautions to be taken for storage tanks, containers and vehicles.

• Underground fiberglass and steel storage tanks for motor vehicle fuels do not present a static ignition hazard provided that: the delivery hose nozzle is in metallic contact with the tank fill pipe or
tight connections are used; the outside of a buried fiberglass or steel tank is in contact with a conducting medium (i.e., soil); and any accumulated charges are dissipated.

- Underground lined-steel tanks also store motor fuel. They are required for aviation gasoline and jet fuel service by the American Air Transport Association of America and major oil standards to minimize fuel contamination from rust and scale. As is the case for all-fiberglass tanks, this internal lining does not insulate the tank from the soil and accumulated charges are dissipated.

- Aboveground steel and fiberglass storage tank, during filling, can develop a static charge between the liquid surface and tank shell or metallic fitting in a non-metallic tank (e.g., manhole). To minimize the risk: avoid splash filling; limit the velocity of the incoming stream; avoid ungrounded objects in the tank (e.g., gauge floats); don’t introduce entrained air with product flow; and allow a minimum relaxation time of 30 minutes for the charge to bleed off before opening.

The addition of grounding systems (e.g., grounding rods) will not reduce the hazard associated with electrostatic changes in the liquid.

- Portable metal drums and cans should be filled with metal spouts that are held in contact with the container throughout the filling operation to prevent static accumulation and discharge. However, plastic containers are not conductive to the metal filling spout and can accumulate a static charge on the liquid surface and discharge to the spout as the liquid level rises.

A recent survey documented 27 fires involving both metal and plastic filling when a plastic truck bed or carpeted car trunk supported the container. However, small plastic containers (e.g., one gallon) are less of a problem if the filling velocity is slow and the container is placed on the ground surface.

- Motor vehicle and aircraft fueling does not require bonding for fueling from a service station type dispenser at rates below 25 gpm. However, the faster fueling of large aircraft requires bonding the hose nozzle to the plane with a short bond wire and clip.

- Tank trucks are either top or bottom loaded and should be grounded before opening the tank covers. Top loading should be done with downspouts in contact with the tank bottom to avoid turbulence, and the initial velocity should be limited until the flow is submerged for both the top and bottom loading.

**Common pipe problem areas**—Static electricity accumulation is most likely to be a problem in pipes conveying nonpolar fluids at high velocities. Typical small diameter underground steel and fiberglass piping (e.g., 2 to 6 inches) for motor fuel refueling is not considered a discharge hazard. However, large diameter piping that is located in general industrial service, where electrical charge build-up is possible (e.g., aviation installations), is a potential hazard.

- Large diameter jet fuel piping has been the subject of U.S. Air Force studies on static electricity. Both buried steel and fiberglass piping were found to build up static electricity at about the same rate with fluid flows up to 15 ft/sec.

The study also found that the charge was conducted along the layer of fluid next to the inside pipe.
wall and was drained off non-metallic piping when the fluid came in contact with metal valves or fittings. Although test data is limited, 10- to 12 ft/sec. is considered to be the maximum velocity for non-conductive piping handling jet fuel, and metal valves or fittings should be properly grounded. Another method of discharging static electricity from non-metallic piping is by wrapping a copper wire around the pipe in a helix and attaching it to a grounding rod at approximately 500-foot intervals. In the case of double-wall pipe, static electricity is discharged from the primary pipe by wrapping a copper wire around the primary pipe in a helix and grounding it by passing it through a threaded outlet saddle on the secondary pipe.

Finally, fiberglass pipe and fittings are available with a grounding wire entrained in the resin and meet MIL-P-29206A for jet fuels and petroleum liquids.

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