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NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.

ISSUED: November 8, 1974

Forwarded to:
Honorable Norbert T. Tiemann
Administrator
Federal Highway Administration
and
Honorable John H. Stender
Assistant Secretary of Labor for
Occupational Safety and Health

SAFETY RECOMMENDATION(S)

H-74-35

On August 6, 1974, an O'Boyle Tank Lines, Inc., tank-semitrailer exploded while preparing to bottom-load a cargo of gasoline at the Exxon Company, USA, Fairfax Terminal, at Newington, Virginia. Fire ensued, but was quickly extinguished. The tank-semitrailer and its tractor were destroyed. The loading bay structure and its equipment were damaged; no one was injured.

The National Transportation Safety Board and the Bureau of Motor Carrier Safety have investigated the explosion. The investigation revealed that the explosion was caused by an overvoltage application to a cargo overflow prevention system (Scully High Level Sensing System) installed in the O'Boyle tank-semitrailer.

The sensing system used four Dynaprobe sensors. Each sensor incorporates a thermistor and a housing assembly which are installed inside the tank where they can be in direct contact with either the cargo or vapors remaining from previous cargoes.

The Scully High Level Sensing System Dynaprobe sensors are designed to operate on an electrical signal for which amplitude is limited to 15 volts at zero amps or zero volts at 0.150 amps.

The Exxon Company loading bay was equipped with an electrical circuitry designed to actuate the DeLaval "gems" liquid level magnetic float switch (installed in many Exxon tank-semitrailers) which has a switch contact rating of 0.5 amp. Resistive or inductive (L/R=.026) at 6-32 VDC or 10 watts at 110-220 VAC.

When the Dynaprobe sensors in the O'Boyle tank-semitrailer were subjected to an electrical current in excess of their design limitations, a high thermal blowout took place in one of the thermistors, and ignited the JP-4 jet fuel

vapors which remained in the tank from a previous cargo. The excess voltage resulted from fire-safe incompatibility of the tank's sensor system and the loading bay's electrical actuating system.

When the liquid cargo contacts the Dynaprobe sensor, the resistance of the entire system is altered, the current flow is thereby changed, and the loading process is stopped.

Recent regulations by the Environmental Protection Agency (EPA) require the discontinuance of the practice of venting the tanks to the atmosphere while loading. Vapor which is displaced from inside the cargo tank during loading is now captured and returned to a storage tank, and thus does not escape into and pollute the atmosphere.

Preliminary data indicate that there may be six or more companies manufacturing liquid level sensor systems. Some of these companies manufacture complete systems, while others purchase components from other manufacturers and assemble systems. Although there are no industry standards to insure compatibility of loading rack and cargo tank electrical sensing systems, both the Truck Trailer Manufacturers Association (TTMA) and American Petroleum Institute (API) have recommended practices which are applicable. TTMA's Recommended Practice (RP) No. 46-74, dated June 19, 1974, suggests electric circuitry for liquid level indicating systems but does not include specific sensing device recommendations. API's Recommended Practice No. 1004 addresses the dimensional specifications of bottom loading hardware and goes no further than the TTMA's RP 46-74 with regard to electric circuitry. Both recommended practices name only one type of connector without regard to circuitry, a feature which permits mismatch of circuitry, such as occurred in the explosion at Fairfax Terminal.

Of the approximately 250 MC306 cargo tanks being manufactured each month, 35 to 50 percent are designed for bottom loading. A substantial number of cargo tanks originally constructed for top loading are being retrofitted to accommodate bottom loading and are being equipped with liquid level sensing systems. Unless prompt and specific regulatory action is taken, this type of accident may recur and with possible injury and loss of life.

The Occupational Safety and Health Administration (OSHA) has jurisdiction over the safety aspects of equipment, electrical circuitry, and procedures used by loading facilities during the loading of flammable liquids.

The Bureau of Motor Carrier Safety has authority to formulate and enforce regulations relating to the design and construction of cargo tanks used to transport hazardous materials and the safe loading of flammable liquids (18 USC 34(a) and (c) and 49 CFR 177.837(c)).

The Tank Truck Technical Council (TTTC), is composed of representatives of those industries that have an interest in the manufacture and use of tank

trucks. The TTTC can assist in making available technical expertise and industry support to the regulatory agencies concerning the devices and techniques including liquid level sensing systems used in bottom loading of flammable liquids.

Liquid level sensor systems and the electrical circuitry used in conjunction with the bottom loading of cargo tanks must be standardized to assure the complete fire-safe compatibility of all liquid level sensor systems or to provide for automatic controls to prevent the transfer of electrical current between systems not fire-safe compatible.

Therefore, the National Transportation Safety Board recommends that the Federal Highway Administration and the Occupational Safety and Health Administration in cooperation with the Tank Truck Technical Council:

> Promulgate regulations to (1) eliminate the possibility that a liquid level sensor system can become a potential ignition source, and (2) ensure that product loading facilities equipped to energize cargo tank sensor systems have electric circuitry which is intrinsically safe. 1/

REED, Chairman, McADAMS, THAYER, BURGESS, and HALEY, Members concurred in the above recommendation.

By: John H. Reed
Chairman

1/ National Fire Protection Association 493-1969 Intrinsically Safe Equipment and Wiring--Equipment and wiring that are incapable of releasing sufficient electrical or thermal energy under normal or abnormal conditions to cause ignition of a specific hazardous atmospheric mixture in its most easily ignited concentration.