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MOTOR FUEL DISPENSING SAFETY

Fire! **Not an alarm anyone wants to hear, especially not when the fire is burning at a major fuel source. But that's what happened at 10:48 AM, when the general alarm sounded for a reported fire at the Department of Public Works Building where the borough gas pumps were on fire. The fire chief, first on scene, confirmed a working fire involving the pumps that dispense both gasoline and diesel fuel. The first engine stretched a foam line, while the second engine stretched another line to back up the initial fire attack crew.**

The fire was quickly knocked down and units remained on scene until the county Hazardous Materials Response Team arrived to assess fuel and foam run off. A worker had inadvertently backed a garbage truck into one of the pumps, causing the fire.

This is one of just 600 incidents involving service stations or gas stations[1] that fire departments across the U.S. responded to, on average, every day between 2003-2006. This paper will examine the hazards associated with motor fuel dispensing operations and provide property loss control guidelines to help reduce the frequency and severity of such events.

OVERVIEW

Generally speaking, the National Fire Protection Association (NFPA) classifies service stations as an occupancy where gasoline, diesel fuel or other flammable liquid is transferred to fuel tanks of self-propelled vehicles. This type of operation can be performed at traditional fuel dispensing facilities or as part of other occupancies, such as marine motor fuel dispensing facilities, fleet vehicle facilities, farms, construction sites, repair garages, public transit garages, municipal garages, car dealerships and in conjunction with convenience stores, supermarkets or discount stores. They may

range in size from one or two pumps to as many as a dozen or more and be located inside and outside of a structure.

CLASSIFICATION OF LIQUIDS

Chapter 4 of NFPA 30, *Flammable and Combustible Liquids Code*, establishes a uniform system of defining and classifying flammable and combustible liquids for the purpose of proper application of this code. The table below identifies this classification:

Gasoline is the most widely used flammable liquid, generates flammable vapors at ambient temperatures and has a closed-cup flashpoint of -45° F. Furthermore, gasoline and almost all other flammable liquids produce heavier-than-air vapors which tend to settle on the

floor in pits or in depressions. Such vapors may flow along the floor or ground for long distances, be ignited at some remote area and flash back to the original source.[2]

Fuel oil is classified 1 through 6, according to its boiling point, composition and purpose. No. 2 is the diesel fuel that trucks and some cars run on, hence the name "road diesel," and is the same product as heating oil. Although No. 2 diesel fuel has a flash point higher than 125° F, this material is flammable and, like gasoline, can be ignited by heat, sparks, flames or other ignition.

CLASS		FLASH POINT*	BOILING POINT**
I	IA	below 73° F (22.8° C)	below 100° F (37.8°C)
	IB	below 73° F (22.8° C)	at or above 100° F (37.8°C)
	IC	at or above 73° F (22.8° C)	below 100° F (37.8°C)
II		at or above 100° F (37.8°C)	below 140° F (60°C)
III		at or above 140° F (60° C)	
IIIA		at or above 140° F (60° C) but below 200° F (93° C)	
IIIB		at or above 200° F (93° C)	

**In Section 4.2.4, of NFPA 30, Flammable and Combustible Liquids Code, Flash Point is defined as the minimum temperature of a liquid at which sufficient vapor is given off to form an ignitable mixture with the air, near the surface of the liquid or within the vessel used, as determined by the appropriate test procedure.*

***In Section 4.2.1, of NFPA 30, Flammable and Combustible Liquids Code, Boiling Point is defined as the temperature at which the vapor pressure of a liquid equals the surrounding atmospheric pressure.*

COMPONENTS OF A MOTOR FUEL DISPENSING SYSTEM[3]

Fuel dispensing systems comprise a complex series of equipment that works together to deliver fuel. For example, some components are designed specifically to maintain hydraulic continuity and regulate the direction of flow and fluid pressure. Hydraulic continuity is critical to ensure that fuel and not air or fuel vapor is delivered. In order to supply fuel from the underground storage tank to the dispenser the pipelines must be essentially free of air and vapor.

In a fuel dispensing system, a check valve allows liquid fuel to flow toward the delivery nozzle and never back toward the storage tank. In addition, other automatic valves function to regulate the direction of flow or fluid pressure as fuel makes its way to the discharge hose.

Also in place is a motor-driven pump that furnishes the required pressure to move fuel from the storage tank to the dispenser, through a metering device and ultimately to the discharge hose and nozzle. Metering devices in both gasoline and diesel systems are positive displacement meters in which finite quantities of fuel are separated into compartments of known volume. Each time the meter's crankshaft makes a full revolution, an exact quantity of fuel has been metered. This shaft revolution provides the most accurate indication of the amount of fuel delivered. The amount delivered is then registered via a mechanical or electronic computer that indicates the price of the delivery, the amount delivered and the unit cost.

One of a fuel dispensing system's primary control devices is the discharge nozzle, which performs three basic functions: 1) controls fuel delivery, 2) prevents vehicle tank overfill (when the nozzle is so equipped) and 3) prevents the discharge hose from draining after completion of a delivery.

Since a fuel dispensing system consists of many integral components, the failure or malfunction of one element can affect another one and impair the correct operation of the entire system. As a result, all equipment, mechanisms and devices need continuous maintenance, inspection and testing in compliance with manufacturer's or other agency's specification to ensure proper operation.

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LOSS CONTROL GUIDELINES

NFPA 30A, *Motor Fuel Dispensing Facilities and Repair Garages* provides a list of safeguards for dispensing liquid and gaseous motor fuels into the fuel tanks of automotive vehicles and marine craft. Some guidelines contained in this document include:

1. Locate dispensing devices installed outside motor fuel dispensing stations as follows:
   - Ten feet or more from property lines
   - Ten feet or more from buildings, other than canopies, having combustible exterior wall surfaces or buildings having noncombustible exterior wall surfaces that are not part of a one-hour-fire-resistive assembly
   - The nozzle, when the hose is fully extended, will not reach within 5 ft. (1.5 m) of building openings

2. Make provisions to prevent spilled liquids from flowing into the interior of buildings. This may include grading driveways, raising door sills or other means.

3. Consider an automatic fire suppression system. A traditional wet pipe sprinkler system may not be suitable in areas where the air temperature is less than 40° F. Dry type sprinkler systems, pre-action sprinkler systems, foam or dry chemical systems may be needed.

4. Provide each motor fuel dispensing facility or repair garage with fire extinguishers. The maximum travel distance to an extinguisher is 100 ft. (30.48 m).

5. Do not use smoking materials, matches and lighters within 20 ft. (6 m) of areas used for fueling, servicing fuel systems or receiving or dispensing Class I and Class II liquids.

6. Install electrical wiring and electrical utilization equipment in accordance with NFPA 70, *National Electric Code (NEC)*. Use only electrical equipment that is specified in the NEC.

7. Provide fuel dispensing systems with one or more clearly identified emergency shutoff devices or electrical disconnects. They should be located in approved locations but not less than 20 ft. (6 m) or more than 100 ft. (30 m) from the fuel dispensing devices that they serve.

8. Strictly enforce good housekeeping practices. This includes maintaining clear aisle space to fire fighting equipment, using approved covered metal receptacles where appropriate, and keeping floors clean and free of oil and grease.

9. Use only listed hose assemblies to dispense fuel. Hose length at automotive fuel dispensing facilities should not exceed 18 ft. (5.5 m). Where hose length at marine motor fuel dispensing facilities exceeds 18 ft. (5.5 m), secure the hose to protect it from damage. Underwriters Laboratories UL 330, *Standard for Safety for Hose Assemblies for Dispensing Flammable Liquids*, covers hose and hose assemblies, including vapor recovery hose and assemblies for use on dispensing devices for flammable liquids. Hoses should be checked daily for cuts, cracks, bulges, blisters, flat spots, kinks or worn spots.

10. Storage tanks may be installed aboveground, belowground or inside buildings. Proper safeguarding is needed for openings and connections to tanks for venting, gauging, filling and withdrawing. Factors to consider when choosing the size and number of storage tanks include the characteristics of the liquid stored, the design of the tanks and their foundation and supports, the size and location of vents and the piping and its connections.

The **Petroleum Equipment Institute**, a trade association whose members manufacture, distribute and service petroleum marketing and liquid-handling equipment, publishes a 36-page document titled *Recommended Practices for Inspection and Maintenance of Motor Fuel Dispensing Equipment*. This publication provides a basic reference that consolidates published and unpublished information from equipment manufacturers, installers and end users concerning the proper inspection and maintenance of motor vehicle fuel-dispensing equipment. The recommended practice applies to fueling equipment intended to dispense gasoline, diesel and related petroleum products into motor vehicles at commercial and retail fueling facilities. Equipment covered includes all above-grade, liquid- and vapor-handling components from the base of the dispenser cabinet to the nozzle spout.

SUMMARY

While not every incident can be avoided, proactive loss-control measures are essential, especially given the inherent hazards of flammable liquids. With proper design and safeguards in place, you can greatly minimize the potential for a fire or emergency wherever motor fueling dispensing operations take place.

CONTACTS

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The objective of our publication is to provide a general overview and discussion of issues relevant to loss control. The comments and suggestions presented should not be taken as a substitute for advice about any specific situation.

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[1] Information regarding service stations/gas stations; the documentation was taken from the NFPA Report "Structure Fires in Stores and Other Mercantile Properties." If you wish to obtain the entire report, please log onto the NFPA website at www.nfpa.org; the entire report is available for NFPA members only.

[2] Arthur E. Cote, P.E., et al., *Fire Protection Handbook, Eighteenth Edition* (Quincy: National Fire Protection Association, 1997), pp. 4-59 though 4-66.

[3] National Institute of Standards and Technology, *Retail Motor-Fuel Dispensers and Consoles*, Gaithersburg, MD, 2003, pp. 3-1-3-28.