Truck and Rail Loading and Unloading Systems

Truck & rail tank car loading or the unloading of flammable/combustible liquids is one of the most hazardous operations likely to be undertaken at any manufacturing or storage facility. To lessen the risk to lives and property, a quality fixed foam fire protection or a dry chemical system is often installed. Foam is the only agent that can prevent a spill of a flammable/combustible liquid from being ignited.

In this section of the manual, we focus on Foam Fire Protection Systems only. Dry Chemical Systems are the subject of a separate section. Please refer to that section for installation guidelines on Dry Chemical Systems.

Two basic methods to protect loading/unloading areas with foam:

1. Foam-water sprinklers mounted in the canopy covering the loading/unloading facility (normally a deluge system) with supplementary ground sweep directional nozzles if desired.

2. Foam-monitor nozzles positioned to discharge foam directly into the loading/ unloading area.

DESIGN INFORMATION

A truck loading rack is typically defined by a low profile dike or curb, which surrounds the loading area that will contain a spill of any flammable/ combustible liquid. If there is no low profile curb or dike surrounding the loading facility, the area under the roof or canopy including any pumps, valves or other miscellaneous equipment, would normally be considered as the hazard to be protected. It is important to remember that in some cases, the roof or canopy above the loading area may not cover the complete hazard area. The area of a truck and/or trailer parked in the loading facility must also be considered as part of the fire area. The “Authority Having Jurisdiction” should clearly define the loading area to be protected by the foam system.

A rail tank car area can be considerably longer than a truck loading facility. It may not be covered by a canopy or have a low profile dike area surrounding the hazard. The area to be covered would be the total area where the rail tank cars are parked and could be exposed to any potential fire or spill. The protected area should cover any pumps, meters or any other miscellaneous equipment that are associated with the loading or unloading of the flammable liquids.

If a foam-water sprinkler system is installed to cover a loading/unloading facility it is to be designed in accordance with NFPA 16: Installation of Foam-Water Sprinkler and Foam-Water Spray Systems shall be performed with the spacing of the sprinkler heads in accordance with NFPA 13: Installation of Sprinkler Systems

The discharge duration for any foam-water sprinkler system covering a loading/unloading facility shall be a minimum of 10 minutes at a minimum design application rate of .16 gpm per sq. ft. The "Authority Having Jurisdiction" may require higher application rates. Some water miscible/polar solvent products can also require higher application rates. In many facilities, supplementary ground sweep foam/water spray nozzles are installed. There are no current requirements per NFPA standards that require these nozzles. However, Chemguard does recommend them for installations where bottom loading of the truck takes place.

In many instances tank trucks have aluminum storage tanks and to have a spill fire start underneath could cause the aluminum tank shell to weaken. The nozzles are designed to discharge foam underneath the truck to give a rapid knock down of any fire. Normally two nozzles are used per loading/unloading bay.

One nozzle should be located near the rear wheels of the tractor and the other located at the rear wheels of the trailer. Both nozzles should be directed to discharge under the trailer area.

Example applies to hydrocarbon fuels only:

Two bay, bottom truck loading rack 50' x 85' bounded by a curb with a central island in the middle.

Total area of risk: 50 x 85 = 4,250 sq. ft.

Application rate: .16 x 4,250 = 680 gpm through the overhead sprinkler system

4 supplementary ground sweep nozzles required (Two each side of the island)

Each 7/16" orifice with a K factor of 3.9: 21.37 gpm @ 30 psi

4 x 21.37 = 85.48 gpm 680 + 85.48 = 765.48 gpm x 10 minutes = 7,654.80 gallons of foam solution

7,654.80 x .03(3% AFFF) = 229.64 (230) gallons of foam concentrate

TYPICAL EQUIPMENT LIST

1 x 250 Gallon vertical style bladder tank

1 x 4" Between flange style ratio controller

4 x Foam water spray nozzles

42 x Standard pendant sprinkler heads
(Approximate flow per head: 16.2 gpm)

250 x Gallons of 3% AFFF (230 gallons for system fill, 20 gallons for system test)

Figure 18: shows the clearly defined hazard area of a typical two bay truck loading facility with curb area.

LOADING/UNLOADING FACILITIES PROTECTED BY MONITORS

Monitor protection systems should be designed to cover the complete surface area of the hazard and can be used to protect the canopy, pumps, meters or other miscellaneous equipment associated with the operation of the loading/ unloading facility.

It is recommended that a minimum of two monitors be used to protect the hazard area. The location where the monitors are to be installed should be carefully considered. Many things affect the location such as: prevailing wind direction, traffic movement, any obstructions and the range of the selected monitors and nozzles.

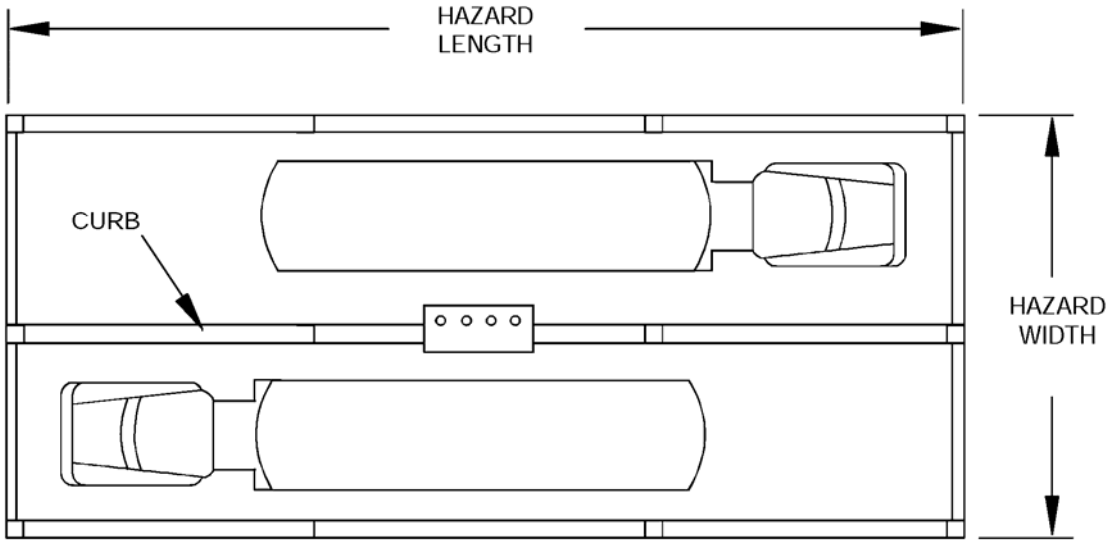
Figure 19: Is a table showing the minimum recommended application rates and discharge times to protect a loading/unloading facility.

If automatic oscillating monitors are used in lieu of non-oscillating types, the discharging foam stream range will typically be reduced by approximately 10% when the monitor is oscillating at approximately 10 degrees per second.

*With AFFF, non air-aspirating nozzles have a greater stream reach than air aspirating type nozzles.

Figures 18, 20 and 20A depicts typical examples of fire protection systems for loading/unloading facilities

CLEARLY DEFINED HAZARD AREA OF A TYPICAL TWO BAY TRUCK LOADING FACILITY WITH CURB AREA



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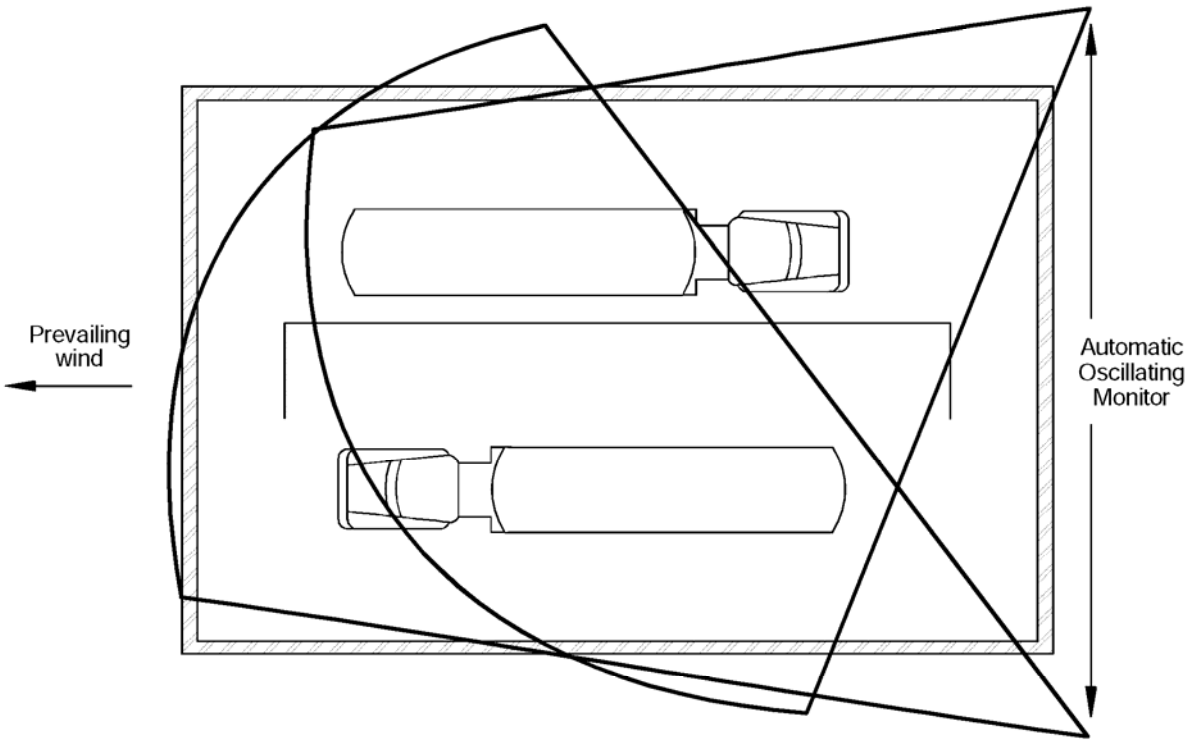
Foam Type	Minimum Application Rate gpm/ft^2.	[(L/min.)/m^2]	Minimum Discharge Time min.	Product Being Loaded
Protein Fluoroprotein	0.16	(6.5)	15	Hydrocarbons
AFFF, FFFP, & AR-AFFF	0.10*	(4.1)	15	Hydrocarbons
Alcohol resistant foam AR-AFFF	Consult Chemguard, Inc. for recommendations on specific products		15	Flammable and combustible liquids requiring alcohol resistant foam

*If a fuel dept of more than 1 in. (2.5 cm) can accumulate within the protected area, the application rate shall be increased to 0.16 gpm/ft^2 [(6.5 L/min.) m^2]

TYPICAL EXAMPLE OF TWO MONITORS COVERING A TWO BAY TRUCK LOADING RACK



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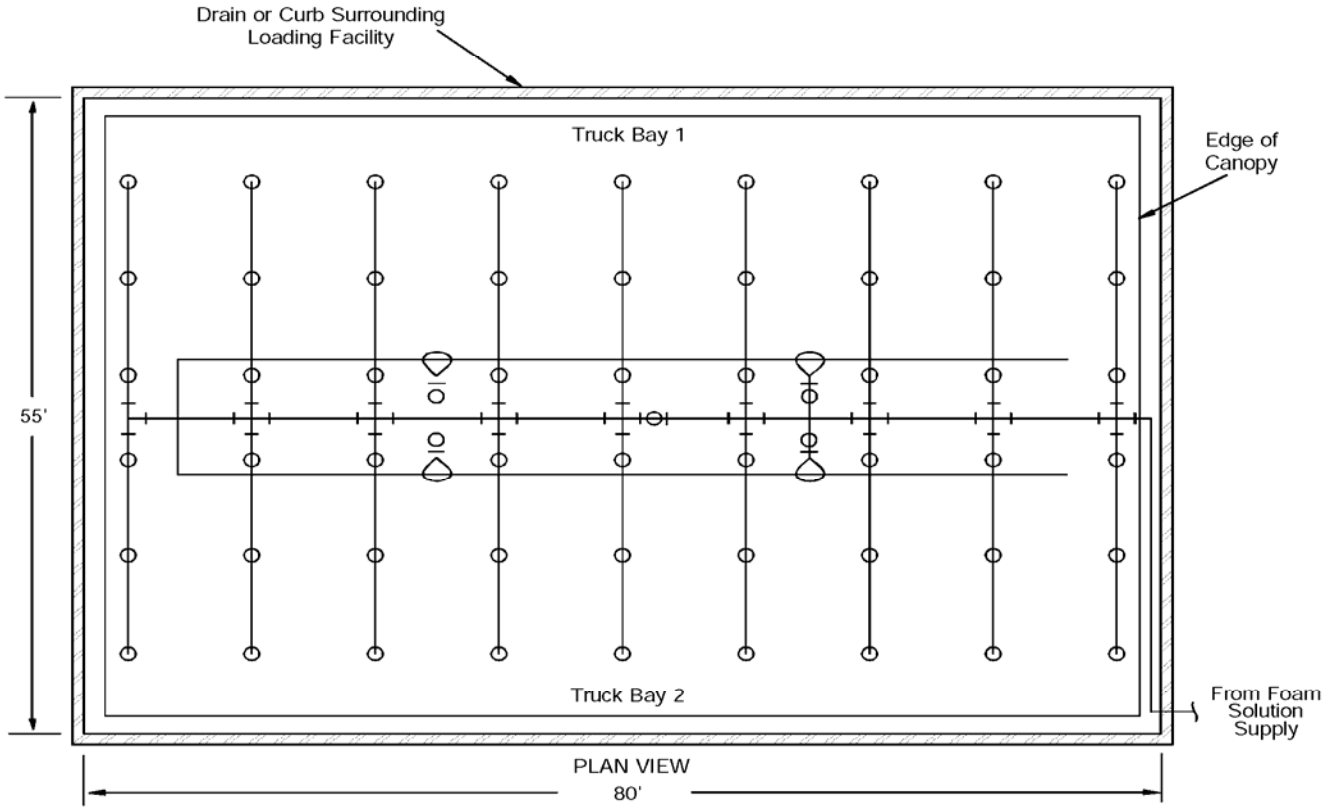
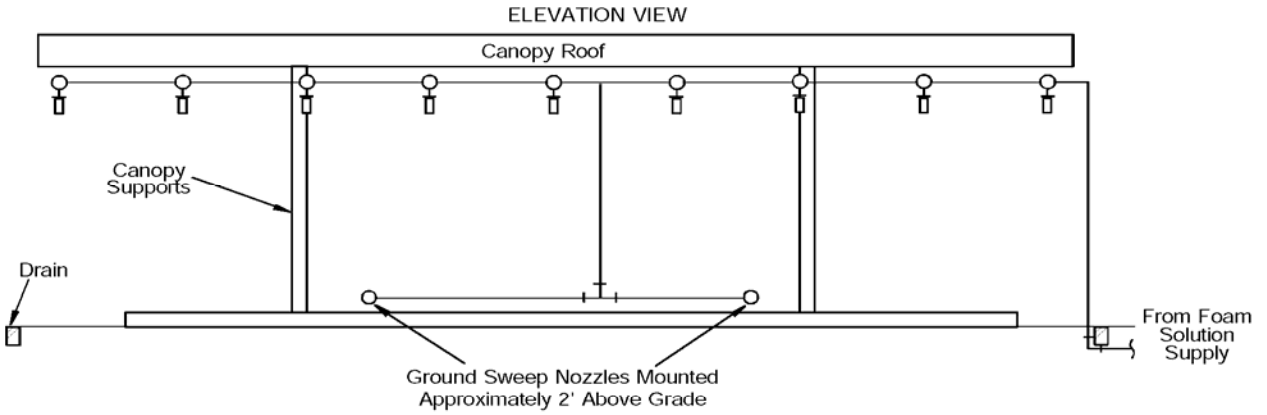
TYPICAL EXAMPLE OF FIRE PROTECTION SYSTEMS FOR LOADING/UNLOADING FACILITIES



TYPICAL DELUGE SPRINKLER LAYOUT WITH GROUND SWEEP NOZZLES FOR A TWO BAY TRUCK LOADING RACK. WILL REQUIRE A SEPARATE FIRE DETECTION SYSTEM.



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