

Types of fire protection for storage tanks

By Ahmed J Al-Subiei, fire supervisor, Saudi Aramco Jubail Oil Refinery (SASREF)

The three main fire protection systems used on tanks containing flammable or combustible liquids are foam sub-surface injection, top-injection (foam chamber) and foam pourer (foam maker).

All three systems can either be fully fixed systems meaning that foam vessels and pumping systems are located within the protected area or semi-fixed meaning that foam is transported via foam trucks to the protected area.

A sub-surface injection system is used on fixed roof tanks where foam is injected at the bottom of the tank, above the water level to avoid the deterioration of the foam. Since this system is a closed system, then a high back pressure generator must be used to inject air to the foam solution entering the tank; finished fire fighting foam consist of foam+water+air. Such a system is not recommended for tanks containing liquids having high viscosity or liquids that are water miscible. This type of system most likely will not be affected by any explosion that may occur at the tank roof.

A top injection (foam chamber) system is also used on fixed roof tanks where foam is injected in the tank on top of the liquid surface. Such a system is generally not recommended due to its vulnerability against tank explosions and open tank fires. However, it may be used when high viscosity or water miscible liquids are stored.

Foam pourer (foam maker) system is used on floating roof tanks, specifically protecting the rim seal area, the area between the roof and tank shell. This system has the facility

to mix foam with air before pouring it gently into the dammed area between the tank shell and tank roof.

It is worth mentioning that fixed roof tanks generally contain combustible liquids (flashpoint above 37,8 degrees Celsius) and floating roof tank generally contain flammable liquids (flashpoint below 37,8 C degrees Celsius).

Knowing the type of liquid is essential for the system design, NFPA 11 requires foam discharge times based on the liquid flashpoint, which is one of the factors for calculating the amount of foam concentrate required.

To calculate the quantity of foam required for tank protection you need to know:

1. The type of fuel (flammable/

“Knowing the type of liquid is essential for the system design, NFPA 11 requires foam discharge times based on the liquid flashpoint, which is one of the factors for calculating the amount of foam concentrate required.”

- combustible) (55min/30min).
- 2. Surface area. Circle area = $3.14 \times (r \times r)$.
- 3. Application rate fixed system=4.1L/min/m² or portable= 6.5L/min/m².
- 4. Foam concentrate percentage (3%, 6% or 9%).

References: NFPA11 and NFPA30 ▲

