Coffee Break Training - Fire Protection Series

Hazardous Materials: Aboveground Flammable and Combustible Liquid Tank Emergency Venting — Part 3: Venting Requirements

No. FP-2013-REV3 January 15, 2013

Learning Objective: *The student shall be able to explain the purpose of emergency venting for aboveground flammable and combustible liquid tanks.*

The liquid contents inside an aboveground flammable or liquid storage tank emit vapors. It is vapor rather than the liquid that ignites when mixed in certain proportions with air in the presence of an ignition source.

This assembly is an example of an emergency vent. When vapor pressure increases inside a tank, the dome-shaped portion of the vent lifts from the base and allows vapors to be released.

Vapor pressure is the pressure exerted by vapor above the surface of a liquid in a closed container. It is caused by evaporation and is stabilized by confinement in a closed container to a pressure characteristic of a specific liquid. Vapor pressures of flammable liquids are an important consideration in fire prevention. They give the relative speed of evaporation: the higher the vapor pressure, the greater the evaporation rate and the more vapor escape potential. The vapor pressure of a substance depends upon the temperature: as the vapors are heated, the pressure increases.

The primary function of an emergency relief vent is to provide a controlled opening on a tank that will be large enough to prevent rupturing of the tank under severe pressure increases caused by proximity to intense fire. Dual wall tanks require two emergency vents: one for the primary tank and one for the secondary tank. The secondary emergency vent is sized to match the primary emergency vent.

During fire exposure, the tank surface that is not in contact with the stored liquid eventually will heat to the point where it may fail, but it should not be an explosive rupture if the venting device works properly. Several design and equipment options exist to provide emergency vent capacity.

Currently — and for many existing installations — National Fire Protection Association 30, *Flammable and Combustible Liquids Code*, allows the use of a weak roof-to-shell welded seam on vertical tanks in lieu of a vent opening. These weak seams are designed to fail prior to the tank shell when an overpressure condition occurs, allowing excess pressure to be relieved without a significant loss of liquid. American Petroleum Institute Standard 650, *Welded Steel Tanks for Oil Storage*, allows this design, but Underwriters Laboratories UL 142, *Steel Aboveground Tanks for Flammable and Combustible Liquids*, does not. NFPA 30 is being revised to remove the weak roof-to-shell seam design option.

Floating roof tanks are inherently capable of relieving internal pressure because the tank roof rises and falls with the liquid level. Some tanks may be fitted with a large diameter membrane that will burst under pressure and relieve excess internal pressure.

Pressure relieving devices such as weighted cover style emergency vents (as shown in the photo above), loose manhole covers, rupture or burst disks, remote-actuated relief devices, or other pressure relieving equipment may be used in place of pressure relieving tank designs. (See Coffee Break Training FP-2010-42 for one method of emergency venting using loose manhole covers.)

For additional information, refer to the following report by Jeff Shapiro, P.E. for the Steel Tank Institute, at http://www.steeltank.com/Portals/0/pubs/Venting%20Q%20and%20A.pdf and NFPA 30.