Coffee Break Training - Hazardous Materials

Vapor Pressure, Boiling Point and Vapor Density

No. HM-2012-3 November 5, 2012

Learning Objective: *The student shall be able to explain vapor pressure, boiling point and vapor density.*

Approximately 90 percent of hazardous materials (hazmat) injuries are due to inhalation. In general, although some solids are very hazardous (on physical contact with skin or if ingested into the body), gases and liquids with high vapor pressures pose the highest risks to responders. These chemicals are more dangerous because they have the capability to become airborne, to disperse and travel through the atmosphere and to be inhaled.

Vapor pressure (Vp), **boiling point** (BP) and **vapor density** (Vd) are three physical properties that are significant in determining risk.

The product inside these liquefied petroleum gas (LPG) containers has a vapor pressure (Vp) and vapor density (Vd) greater than air.

All liquids give off some vapor at their surface. The amount of vapor given off by a liquid at a given temperature and pressure is measured as that chemical's **Vp.** Vp is the force exerted by a vapor against the sides of a container or against atmospheric pressure. Chemicals that have high Vps have a greater tendency to vaporize than those with lower Vps. A chemical is said to be more volatile if it has a greater tendency of a chemical to vaporize.

The following are some important facts about Vp:

— The higher the temperature, the higher the Vp.
— The higher the Vp, the faster a liquid evaporates.
— The faster the evaporation, the more vapor in the air.
— The higher the Vp, the higher the pressure inside a container.

The BP is the temperature at which Vp equals atmospheric pressure. As temperature increases, Vp increases. Physical state change occurs as temperature and Vp increase. Liquids at normal atmospheric pressure that have high Vps also will have low BPs.

Vd is a comparison of the weight of a vapor to the weight of dry air. It is determined by computing the sum of the atomic weights of the atoms in a molecule and is measured in atomic mass units (AMUs). Dry air has a molecular weight of 29 AMUs. Vapors with a molecular weight above 29 are heavier than air, and vapors with a molecular weight less than 29 are lighter than air.