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HAZARDS OF FLAMMABLE AND COMBUSTIBLE LIQUIDS

The fire hazard of a flammable or combustible liquid comes from its vapors, rather than from the liquid itself.

When a flammable or combustible liquid is heated, vapors are evolved from the liquid's surface; this is called evaporation. If the liquid is heated to its flashpoint, the vapors evolved will be concentrated enough to be ignited and burn. Because, by definition, most flammable liquids are stored and handled above their flashpoint temperature, vapors are continuously released by the liquid resulting in an ignitable mixture of vapor and air over its surface.

Ignitable mixtures occur when concentrations of vapors in air are within a definite percentage range, commonly referred to as the flammable range. The lower limit of the range is known as the lower flammable limit (LFL). The upper limit of the range is known as the upper flammable limit (UFL). For example, the proportions (flammable range) for carbon disulfide are from about 1 to 44 percent carbon disulfide vapors in air by volume; for ethyl alcohol, from about 4 to 19 percent by volume; and for gasoline, from about 1.4 to 7.6 percent by volume. Therefore, storing flammable and combustible liquids in the proper closed containers and minimizing the exposure of the liquid to air while in use are fundamental safety measures.

Accumulations of flammable vapor-air mixtures can occur in a confined space, such as containers, tanks, rooms, or buildings. The violence of a flammable vapor explosion is dependent on the nature of the vapors, the enclosure containing the mixture, the quantity of the mixture, and the concentration of vapor in the mixture with air. Flammable vapor-air mixtures that have vapor concentrations near the lower or upper limits of the flammable range are less intense than those that occur in a well-mixed "stochiometric" concentration.

Distinct from an explosion of a flammable vapor-air mixture inside a tank or container is over pressuring of a tank or container, which results in a rupture. As with vapor explosions, pressure ruptures vary in intensity. Any closed container may rupture violently when exposed to a severe fire.

Fire and explosion prevention measures are based on one or more of the following techniques or principles: (1) exclusion of sources of ignition, (2) exclusion of air (oxygen), (3) storage of liquids in closed containers or systems, (4) ventilation to prevent the accumulation of vapor within the flammable range, and (5) use of an atmosphere of inert gas instead of air. Extinguishing methods for flammable and combustible liquid fires involve shutting off the fuel supply, excluding air by various means, cooling the liquid to stop evaporation, or a combination thereof.

Gasoline is the most widely used flammable liquid. Gasoline generates flammable vapors at ambient temperatures. However, there are many other volatile flammable products. A comprehensive list of the more commonly used flammable or combustible liquids, including the characteristics of each, appears in NFPA's Fire Protection Guide to Hazardous Materials, 13th Edition.

Flashpoint is the most commonly used means to determine the relative hazard of flammable and combustible liquids. Other factors that influence the hazard of a liquid are ignition temperature, flammable range, rate of evaporation, reactivity when contaminated or exposed to heat, density, and rate of diffusion of the vapor. The flashpoint and other factors that determine the relative susceptibility of a flammable or combustible liquid to ignition have minimal influence on the burning characteristics of the liquid once the fire has burned for a short period of time. Although many flammable and combustible liquids are chemically stable (i.e., their primary fire hazard is that they burn), others introduce the problem of instability or reactivity.

The storage, handling, and use of unstable (reactive) flammable or combustible liquids require special attention. It may be necessary to increase the distances to property lines from storage tanks and between adjacent tanks or to provide extra fire protection. For example, it would be poor practice to locate heat-reactive and water-reactive flammable or combustible liquids tanks adjacent to each other. In the event of a ground fire, water applied to the heat-reactive tank for protection might penetrate the tank of water-reactive liquid and cause a violent reaction.

Reference:

Slye, Jr., Orville M.. Flammable and Combustible Liquids. Fire Protection Handbook 20th Edition. Massachusetts: NFPA. (2008)