necessity of spark or flame

Vapors and gases will spontaneously ignite at a lower temperature in oxygen than in air, and their auto-ignition temperature may be influenced by the presence of catalytic substances

• FLAMMABLE LIMITS Flammable liquids have a minimum concentration of vapor in air below which propagation of flame does not occur on contact with a source of ignition. This is known as the lower explosive limit (LEL) There is also a maximum proportion of vapor or gas in air above which propagation of flame does not occur This is known as the upper explosive limit (UEL)

For example, a gasoline vapor-air mixture with less than approximately 1 0 percent of gasoline vapor is too lean, and propagation of flame will not occur on contact with a source of ignition Similarly, if there is more than approximately 8 percent of gasoline vapor, the mixture will be too rich Other gases, such as hydrogen, acetylene, and ethylene, have a much wider range of flammable limits

• FLAMMABLE RANGE is the difference between the lower and upper flammable limits, expressed in terms of percentage of vapor or gas in air by volume It is also often referred to as the "explosive range"

For example, the limits of the flammable range of gasoline vapors are generally taken as 1 4 to 7 6 percent which is relatively narrow Thus, a mixture of 1 4 percent gasoline vapor and 98 6 percent air is flammable, as are all the intermediate mixtures up to and including 7 6 percent gasoline vapor and 92 4 percent air The range is therefore the difference between the limits, or 6 2 percent

• PROPAGATION OF FLAME is the spread of flame through the entire volume of the flammable vapor-air mixture from a single source of ignition A vapor-air mixture below the lower flammable limit may burn at the point of ignition without propagating (spreading away) from the ignition source

• RATE OF DIFFUSION indicates the tendency of one gas or vapor to disperse into or mix with another gas or vapor This rate depends on the density of the vapor or gas as compared with that of air, which is given a value of 1 Whether a vapor or gas is lighter or heavier than air determines, to a large extent, the design of the ventilation system If the vapor or gas is heavier than air, the intake duct should be slightly above floor level. Conversely, if the vapor or gas is lighter than air, the intake duct should be located just below ceiling level.

• VAPOR PRESSURE is the pressure, measured in pounds per square inch absolute (psia), which is exerted by a volatile liquid, as determined by the *Standard Method of Test for Vapor Pressure of Petroleum Products (Reid Method)*, ASTM D 323–58

• VOLATILITY is the tendency or ability of a liquid to vaporize Such liquids as alcohol and gasoline, because of their well known tendency to evaporate rapidly, are called volatile liquids

• OXYGEN DEFICIENCY designates an atmosphere having less than the percentage of oxygen found in normal air Normally, air contains about 21 percent oxygen at sea level

When the oxygen concentration in air is reduced to approximately 16 percent, many individuals become dizzy, experience a buzzing in the ears, and have a rapid heart beat

In addition to tests for toxic substances therefore, the oxygen content of the atmosphere of a tank or similarly confined space should be determined before entry is permitted, with instruments approved for the purpose by NIOSH (See discussion in Chapter 19, "Personal Protective Equipment")

No one should enter a tank or enclosed space that tests less than 16 percent oxygen, unless he wears approved respiratory protective equipment, such as a fresh-air hose mask or self-contained or self-generating breathing apparatus

Self-contained compressed air breathing apparatus, approved by OSHA-approved agencies, have proved satisfactory in oxygen deficient atmospheres They are especially useful where it is difficult to run a hose line Again, see Chapter 19

• FLAMMABLE LIQUIDS Flammable liquids are divided into three subclasses (IA, IB, and