

Fire Loss Control

difficult and dangerous, but there are exceptions. Flammable liquid storage tanks can be arranged so their contents can be pumped to an isolated empty tank in case of fire. When flammable gases catch fire as they are flowing from a pipe, the fire will go out if the fuel supply can be shut off. Also, in any mixture of fuel gases or vapors in air, adding an excess of air has the effect of diluting the fuel concentration below the minimum combustible concentration point. Therefore, an air blast may extinguish a fire if the vapor-air mixture is diluted below the lower flammable limit or if the flame is moved away from the fuel source at a velocity greater than the flame propagation rate.

Limiting oxygen

Extinguishment by separation of oxygen from fire can be accomplished through smothering by covering the burning area with a wet blanket (make sure the blanket isn't made of highly flammable fibers), throwing dirt or sand on the fire, or covering it with a chemical or mechanical foam. Extinguishment by diluting the reactants—oxygen and fuel vapors—below the concentration necessary to support combustion is accomplished in blanketing the fire area with carbon dioxide or noncombustible vaporizing liquids. The fire will remain out if the blanket is maintained long enough for the combustible material to cool below its ignition temperature and if no ignition sources are present.

Carbon dioxide and vaporizing liquid are of limited value on fires involving wood, rags, or paper, because the blanket usually cannot be maintained long enough for all smoldering ignition sources to be extinguished. Moreover, smothering is ineffective on materials that contain their own oxygen supply, such as ammonium nitrate or nitrocellulose.

In the field of fire prevention, the principle of separating oxygen from the fuel supply is applied when an inert gas is used to purge operations involving flammable vapors, dusts, and other combustible materials under confined conditions when a source of ignition may exist.

Interrupting the reaction

Recent studies in fire chemistry have resulted in certain revisions and expansions in the theories of fire extinguishment. In

analyzing the anatomy of a fire, the original fuel molecules appear to combine with oxygen in a series of successive intermediate stages, called branched-chain reactions, in arriving at the final end products of combustion. It is these intermediate stages which

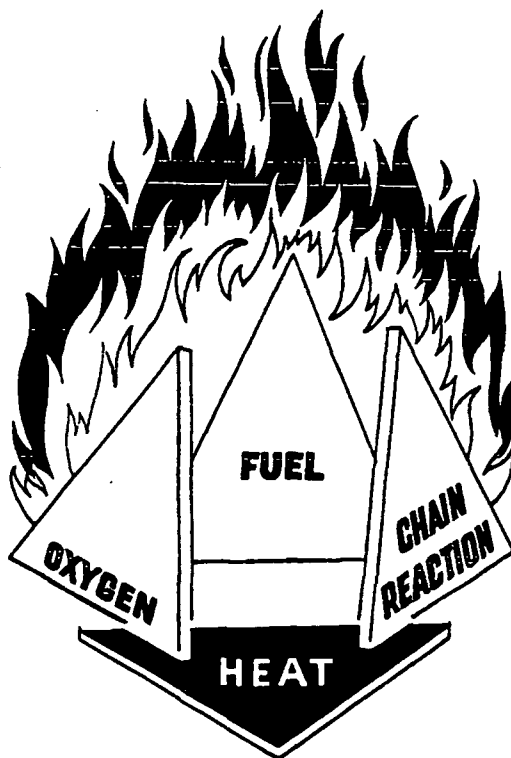


FIG 35-9 — "The fire pyramid" Oxygen, heat, fuel, and chain reactions are necessary components of a fire. Speed up the process and an explosion results.

are responsible for the evolution of flames.

As molecules fragmentize in these branched chain reactions, unstable intermediate products called free radicals are formed. The concentration of free radicals, such as hydrogen ($H\cdot$) and hydroxyl groups ($OH\cdot$), are the determining factors of flame speed. The life of the hydroxyl radical is very short, being in the order of 0.001 second, but long enough to be of vital importance in the combustion of fuel gases. The almost simultaneous formation and consumption of free