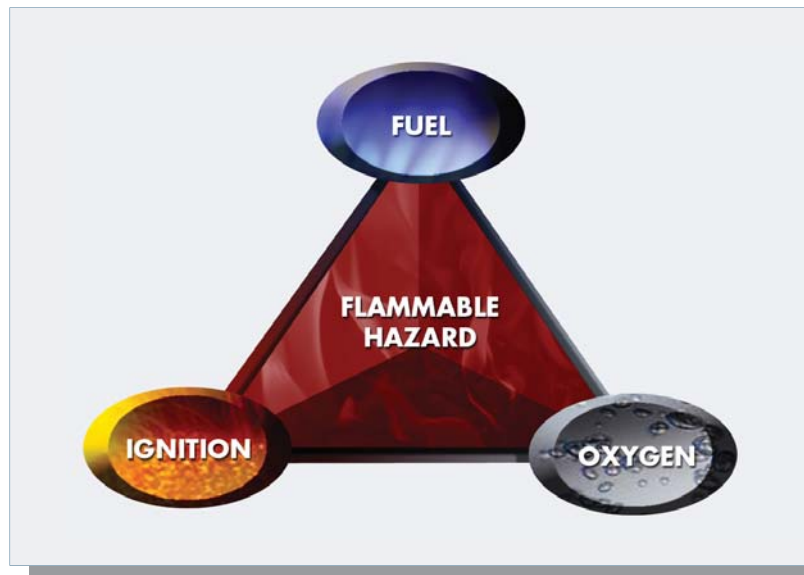


## Flammable Hazards

We will focus only on those flammable hazards involving flammable gases and vapors. The difference between a gas and a vapor is that vapors arise from liquids, whereas gases are normally in a gaseous state. Flammable vapors present additional sampling concerns (for example, we must prevent vapors from returning to the liquid state during sampling).

## The 3 Elements of Fire

Three elements must be present for a flammable hazard to exist: fuel, oxygen, and a source of ignition. If any one of these elements is lacking, it is not possible to have a fire.



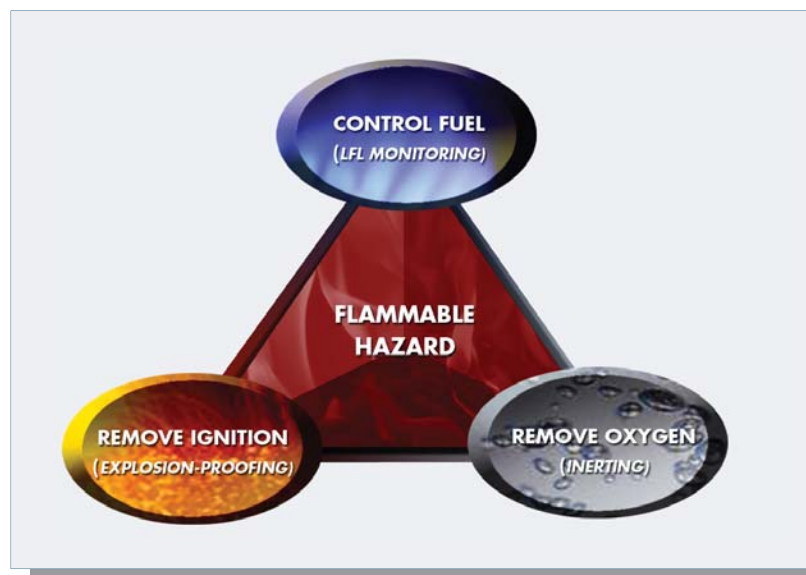
*The Elements of Fire*

## Eliminating Flammable Hazards

Understanding this, safety experts study ways to eliminate one of the three elements:

- **Removal of Oxygen Sources, Inerting:** If oxygen is removed from the atmosphere, flammable gas/vapor will be unable to burn. Typically, the oxygen is displaced by a nitrogen blanket. Inerting is only possible in enclosed spaces, and is usually only found in certain processes. Inerting is not the safest way to remove flammable hazards, because a sudden inrush of air into the enclosed space will provide the oxygen needed to have a fire or explosion. Also, the fuel level in many inert processes is very high, which means that an accident can have serious consequences. Inerting is therefore not the recommended way to reduce flammable gas/vapor hazards. You will find that most inert processes are inert not to eliminate flammable hazards, but because the process cannot have any oxygen present to be successful.

- **Removal of Sources of Ignition, Explosion-Proofing:** If all sources of ignition are removed, it is not necessary to restrict the amount of oxygen or fuel present. But eliminating all sources of ignition is so difficult that it cannot be considered a reliable means of eliminating flammable hazards. Even static electricity provides enough energy to ignite some gas/vapor hazards. Some applications (a fuel house, for example) require all components and fixtures to be explosion proof, but this is an additional measure of safety, and is not the primary means of controlling the hazard.
- **Removal of Sources of Fuel, LFL Monitoring:** The best way to control flammable gas/vapor hazards is to keep the level of fuel below the flammable level. This method accepts the fact that removal of oxygen and sources of ignition is difficult, and focuses instead on monitoring the amount of flammable gas/vapor present. This method does not require the complete removal of flammable gas/vapors, it is only necessary to keep the fuel level from reaching the flammable level. Continuous monitoring of gas and vapor levels provides the early warning needed to correct dangerous situations. This method works in the two basic types of applications: monitoring for leaks in areas where gases are not normally present; and monitoring for rising concentrations in processes where some flammable gas/vapor is always present.



*The 3 Ways to Eliminate a Flammable Hazard*

*Explosion-proofing and Inerting are difficult and unreliable. The best way to eliminate a flammable hazard is to control the amount of fuel present.*