



# Ignition and Explosion of Fuel Vapours

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In Hollywood movies, cars, fuel containers, factories etc, seem to explode very easily, often to great dramatic effect - see any Bruce Willis movie! All that seems to be required is a speeding bullet or a cigarette butt coming into contact with a container of fuel, or a car going over a cliff and *BANG!!* Fortunately, the reality is that these dangerous and dramatic outcomes are much less likely. The following is a very small introduction to fuel vapour explosions.

The most common cause of industrial explosions is when a flammable gas, vapour or dust cloud, is ignited in a confined space. The resulting rapid explosive combustion may cause the container, or parts of it, to fail due to the excessive internal pressures. (Note: it is actually the vapour and not the liquid that burns).

Assuming that the ignition source is suitable, these kinds of explosions will only occur when the proportions of fuel to air are within certain limits, referred to as the fuel gas or vapour's *flammable or explosive range*.

In the case of tanks containing

liquid fuels, the flammability of the fuel vapour in the headspace of the tank, is determined by the ambient temperatures and the fuel's inherent volatility. (Note: the term *volatility* is often misused when referring to liquid fuels, it only refers to a liquid's tendency to evaporate and does not refer to any flammability property).

To illustrate this, if a low volatility fuel is placed in a tank at room temperature and allowed to stand for some time, the concentration of fuel vapour in the headspace will always be too low to allow the propagation of combustion even if the ignition source would normally be suitable. These conditions are commonly referred to as the fuel/air mixture being too "*lean*". Examples of these kinds of fuels are Kerosene and Diesel.

If a very highly volatile fuel is similarly treated, the concentration of vapour will be too high to be ignited i.e. too "*rich*". The most common example of this kind of fuel is petrol.



*Partly confined dust/air explosion demonstration at TestSafe Australia Londonderry.*

