

Vapor Cloud Explosions

January 2011



A vapor cloud explosion occurs when a sufficient amount of flammable or combustible material is released, mixes with air, and is ignited. Some causes of the release of the vapor or gas fuel include:

- Loss of process containment from failure of a pipe, reactor, storage tank, or other process vessel containing flammable or combustible liquid, or a flammable gas.
- Rapid discharge of flammable vapor to the atmosphere through a pressure relief system.
- Release of flammable liquid stored under pressure – for example, Liquefied Petroleum Gas (LPG). The discharged liquid will rapidly boil at atmospheric pressure, forming a flammable vapor cloud.

If the flammable vapor cloud is ignited, it can explode, producing a blast wave which can cause major destruction at a large distance. This is particularly true for releases in congested or confined areas, for vapor clouds that have drifted into such areas, and for reactive materials. In addition, heat from the fireball can cause significant injury or damage.

Some of the worst disasters in the history of the process industries have been vapor cloud explosions. Some examples include:

- June 1974, Flixborough, England (28 fatalities)
- October 1989, Houston, Texas (23 fatalities)
- March 2005, Texas City, Texas (15 fatalities)
- December 2005, Buncefield, England (no fatalities but 43 injuries and major damage)
- October 2009, Jaipur, India (12 fatalities)

What can you do?

- Make sure that piping and equipment inspections and preventive maintenance tasks are completed as required to ensure mechanical integrity of process equipment. Containment of fuel is the best way to prevent vapor cloud explosions. Ignition sources for flammable vapor clouds – for example, heaters, vehicles, unclassified electrical areas, hot work, static discharge – are difficult to control.
- Ensure that safe work practices are followed, including hot work procedures in areas near flammable inventories.
- If you detect any leak, no matter how small, on equipment containing flammable or combustible liquid or flammable vapor, report it immediately and know how to initiate emergency procedures.
- If your plant contains flammable or combustible materials, you should have written emergency procedures for a leak. Review and understand these procedures, participate in drills, and know what you must do to protect yourself and others in case of a leak. Know when and how to use appropriate personal protective equipment (for example, flame resistant clothing) and leak detection equipment such as portable flammable material detectors.

Keep flammable materials inside the process equipment!