

## What is BLEVE?

**Boiling Liquid Expanding Vapour Explosion (BLEVE)** is a sudden, explosive release of energy that occurs when a pressurised vessel containing liquid above its normal boiling point ruptures and releases all of its contents to the atmosphere. BLEVE results in the generation of a pressure wave due to the sudden vapour expansion and liquid flashing. Often, the vessel also shatters and shoots out shrapnel that can potentially damage equipment and harm personnel in the vicinity. If the substance stored is flammable and ignited, a fireball can result and pose heat radiation hazard.



Source: CCPS, “BLEVE!”, Process Safety Beacon, November 2009

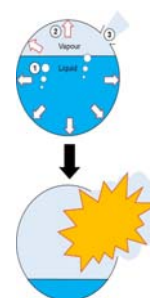
## Selective historical incidents

- 1966 – Elf Refinery, Feyzin, France
- 1984 – PEMEX LPG terminal, Mexico City, Mexico
- 1988 – Procter & Gamble GmbH CO<sub>2</sub> vessel failure, Worms, Germany

## How it happens

There are three elements which contribute to the occurrence of BLEVE:

1. A liquid that is above its boiling point;
  - The liquid does not need to be flammable. Cases involving non-flammable BLEVE have also been recorded, such as from liquid nitrogen storage in Japan (1992).
2. A closed containment; and
3. Containment failure leading to sudden loss of containment, reducing the pressure on the liquid.
  - The containment failure could initiate from mechanical impact, fatigue due to external fire impingement, etc. The loss of containment must be sudden and significant in size (total loss of containment) to escalate into BLEVE.



## What to do?

Some preventive and mitigative approaches include:

### Prevent fire and radiation exposure damage

- Keeping a safe distance between pressurized vessel with possible fire source
- Fireproofing
- Ensure water deluge or fixed water spray fire protection system is available and working

### Maintain mechanical integrity

- Perform periodic inspections and tests on the vessels

### Mitigation

- Prepare an emergency response plan to evacuate personnel and public (if necessary) from BLEVE applicable vessels, and ensure that the relevant personnel are aware of it.

## Further Reading

- T. Abbasi and S. Abbasi, “The boiling liquid expanding vapour explosion (BLEVE): Mechanism, consequence assessment, management,” *Journal of Hazardous Materials*, vol. 141, no. 3, pp. 489–519, 2007.
- Center for Chemical Process Safety, *Guidelines for Vapor Cloud Explosion, Pressure Vessel Burst, BLEVE and Flash Fire Hazards*. New York: Wiley, 2011.
- W. E. Clayton and M. L. Griffin, “Catastrophic failure of a liquid carbon dioxide storage vessel,” *Process Safety Progress*, vol. 13, no. 4, pp. 202–209, 1994.

**Process Safety is Everybody’s Responsibility!**

An initiative of the Process & Engineering Committee

**SINGAPORE CHEMICAL INDUSTRY COUNCIL LIMITED (SCIC)**  
8 Jurong Town Hall Road, #25-04, The JTC Summit, Singapore 609434  
Tel : 6267 8891 Fax : 6267 8893