CCPS An AIChE Technology Alliance
Center for Chemical Process Safety

Process Safety Beacon

http://www.aiche.org/CCPS/Publications/Beacon/index.aspx

Messages for Manufacturing Personnel

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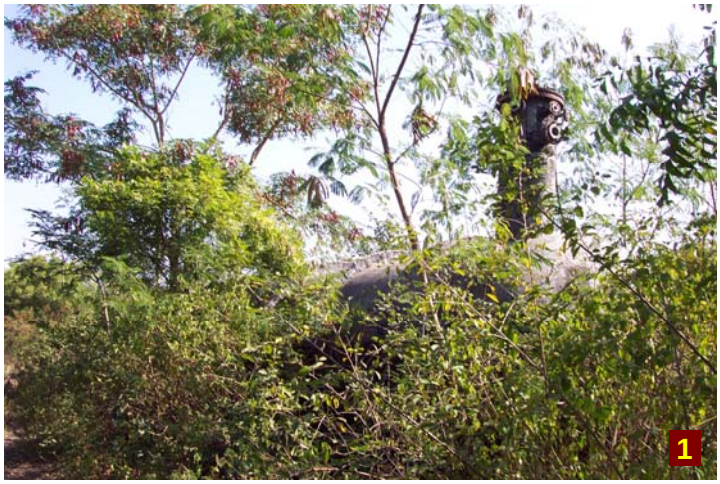
The Bhopal Tragedy – 25 Years Ago

December 2009

One of the worst tragedies in the history of the process industries occurred 25 years ago this month. A highly toxic gas, Methyl Isocyanate (MIC), was released from a pesticide plant in Bhopal, India shortly after midnight on December 3, 1984. The number of fatalities may never be known, but estimates have been in the range of 2000-4000, with estimated injuries of 100,000 or more people. The International Medical Commission on Bhopal estimated that, as of 1994, more than 50,000 people remained partially or totally disabled as a result of exposure to MIC.

Bhopal was a reactive chemistry incident. MIC reacts exothermically with water. An MIC storage tank was contaminated with water, and the reaction generated heat and pressure causing a relief valve to open. Safety systems had been taken out of service without doing a management of change evaluation, or they were unable to deal with the release. Approximately 40 tons of highly toxic MIC was released into the community, exposing tens of thousands of people.



1 – MIC storage tank (removed from underground vault)
2 – Flare stack where MIC was released
3 – Sodium hydroxide scrubber (not working during incident)
4 – Control room as it looked in 2004

Do you know?

• Reactive chemistry incidents continue to occur in the process industries. For example, on September 15, 2009, the US Chemical Safety and Hazard Investigation Board released a report on a runaway chemical reaction incident in Florida which killed 4 people and injured 32 (www.csb.gov).
• The material released from a relief valve, rupture disk, or other pressure relief device must discharge to a safe location or treatment system.
• Critical safety systems must always be properly maintained and fully operational.

What can you do?

• Learn more about what happened at Bhopal from Internet resources and the December 2004 Process Safety Beacon (a "read only" copy of that Beacon can be viewed at www.sache.org).
• Apply the lessons from Bhopal to your facility – for example, understanding all process hazards, including reactive chemistry hazards; understanding the worst case consequences of a possible accident; maintaining critical safety systems; emergency response preparation.
• Never become complacent about the hazards in your facility – remember what can go wrong!

Remember and learn from Bhopal and other tragedies!

The Beacon is usually available in Afrikaans, Arabic, Chinese, Danish, Dutch, English, French, German, Greek, Gujarati, Hebrew, Hindi, Hungarian, Indonesian, Italian, Japanese, Korean, Malay, Marathi, Norwegian, Persian, Polish, Portuguese, Russian, Spanish, Swedish, Tamil, Thai, Telugu, Turkish, Urdu, and Vietnamese.

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Process Safety Beacon

http: //www.aiche.org/ccps/safetybeacon.htm

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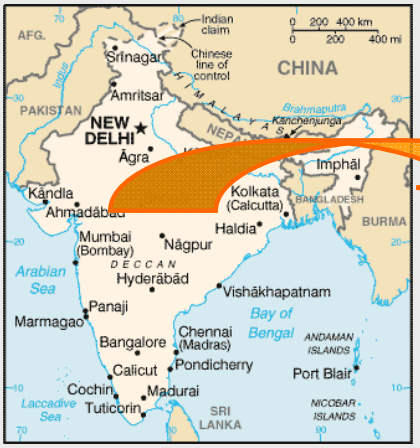
December 2004

Bhopal—A Tragic Event



Union Carbide Bhopal Plant

What Happened?

It was just after midnight, December 3, 1984 in Bhopal, India. A succession of events occurred in the Union Carbide India Limited facility that led to the release of ~40 metric tons of methyl isocyanate (MIC) gas. The consequences were tragic: according to the Indian government, more than 3800 people died shortly after the release and thousands were injured.

What You Can Do

- More than any other in the history of the chemical industry, this incident demonstrates why robust safety systems are critical when handling hazardous materials. This incident was also one of the driving forces which defined process safety management as we know it today.
- Understand the reactivity hazards of all materials in your process. Read the reactivity section of your MSDS's, fully understand all reactivity instructions in your operating procedures and be knowledgeable about why your safety systems (e.g. interlocks, relief devices, scrubbers) are there and how they work.
- If a material in your area reacts with water: 1) be cautious when washing equipment for maintenance or whenever a water hose is used, and 2) remember that compressed air may contain condensed water – be sure process air is free of water before blowing lines.
- Understand the emergency procedures you are to take if the temperature or pressure increases quickly in vessels storing hazardous materials, especially those which are reactive.
- Encourage your management and technical group to have a discussion about the "worst case" for the facility you work in and what safeguards have to be maintained to prevent that scenario from occurring.

How Did This Happen?

? The basic cause has been agreed upon by most experts who investigated this event: a significant quantity of water entered the MIC storage tank. Water reacted with MIC, temperature and pressure rose and several safety systems could not deal with the event. Eventually, the vessel's relief device lifted, releasing MIC vapor.

? 20 years later, the exact water source remains controversial. However, it is clear that installed safety systems did NOT prevent a large release of toxic gas.

Understand the "worst case scenario" & "layers of protection" for your facility!

This edition is also available in Spanish, French, Portuguese, Chinese and German. Contact CCPS at ccps_beacon@aiche.org for information.