

Hydrate Hazards

As discussed in the October 2015 Beacon, water can be a hazard in process plants. When water is mixed with some materials, typically gases but also liquids, it can form a crystalline, ice-like solid. This solid is called a hydrate (Photos 1–3). When a hydrate forms, it can plug piping, instrument connections, valves, and other equipment, which causes process upsets that may be hazardous. Hydrogen sulfide, acetylene, methyl mercaptan, chlorine, vinyl fluoride, carbon dioxide, ethylene, methane, ethane, natural gas, and other hydrocarbon gases can form hydrates.

In addition to the presence of a material that can form a hydrate, three other conditions are generally required for hydrate formation:

- free, condensed water
- sufficient pressure — how much pressure depends on the material, and some materials (*e.g.*, methyl mercaptan) can form a hydrate at atmospheric pressure
- low temperature — the temperature depends on the material and the pressure, with some hydrates forming at temperatures well above the freezing point of water.

Hydrates can be stable and difficult to remove, and clearing a hydrate blockage can be hazardous if not done properly. Potential hazards include the release of flammable, combustible, corrosive, or toxic material, or the release of unexpected pockets of pressure in the blocked equipment or pipe. It may be necessary to open pipes or equipment to clear a hydrate blockage, which incurs all of the familiar hazards and complications associated with opening process equipment.

If pressure is applied to one side of a hydrate line blockage in an attempt to force it out the other end, the hydrate plug may break free and rapidly move through the pipe, causing a rupture if the solid plug impacts the pipe at a tee, an elbow, or other bend. The U.S. Chemical Safety Board recently described an incident with four fatalities that occurred when methyl mercaptan was released during attempts to clear a line blocked by a methyl mercaptan-water hydrate (www.csb.gov/dupont-laporte-facility-toxic-chemical-release-/).



What can you do?

Find out if your plant handles any materials that can form hydrates, and if it does, make sure you understand:

- what temperature and pressure conditions result in hydrate formation
- what design features and operating procedures your plant employs to prevent hydrate formation
- how to recognize hydrate formation if it occurs
- what procedures to follow to safely remove hydrates.

Remember to do a hazard evaluation before doing any nonroutine tasks, such as clearing blocked equipment.

Does your plant handle any materials that can form a hydrate?

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