Sponsored by CCPS Supporters

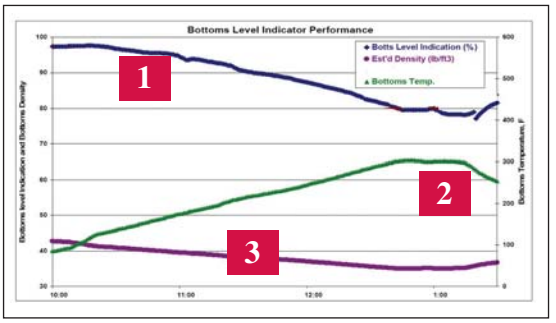
Process Safety Beacon

Messages for Manufacturing Personnel
http://www.aiche.org/CCPS/Publications/Beacon/index.aspx

CCPS CENTER FOR CHEMICAL PROCESS SAFETY 20 YEARS
An AIChE Industry Technology Alliance

March 2007

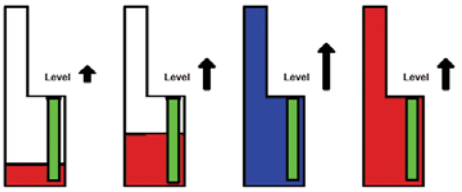
Instrumentation — Can you be fooled by it?



What happened?

A column was overfilled. However, before the incident, as shown in this instrument chart, the level ***indication*** in the bottom of the column (the dark blue line - 1) slowly decreased!

YES you can!



The level was measured with a displacement level indicator. Normally, when the displacer (green) is partially covered with liquid, it properly indicates level based on the changing force on the displacer as the liquid level changes (first and second drawings). But, on the day of the incident, the column was overfilled with cold liquid, completely submerging the displacer in cold liquid (third drawing). The level was above 100%, and the level indicator showed a high level alarm condition continuously. A high level alarm indicates an abnormal condition, and this should be an alert that something is not normal. In this incident, there was no response to the alarm condition.

With the liquid completely covering the displacer, the instrument did not indicate liquid level. Instead, the force on the displacer gave a measure of the relative density of the displacer and the liquid in which it was submerged. In other words, the instrument was not designed to function properly if the level was high enough to completely submerge the displacer. The column was heated during the startup. As the temperature of the liquid increased (the green line in the graph above - line 2), the density of the liquid decreased (the purple line - 3). The change in density of the liquid changed the force on the displacer, resulting in a decrease in the "level" indication (fourth drawing, with hot liquid), even though the column level was actually increasing. The column overflowed, flammable material was released, and there was a major explosion and fire.

What you can do

Know what can fool you. Review examples of incidents where the instrumentation provided information that did not represent the data that was wanted (for example, density of the liquid, not level). This is not always an easy concept to grasp, so consult with the engineers and technicians who know the system best.

Understand how instrumentation works, and how it will respond to conditions outside the normal operating range, including, for example, control loops, venturis, orifice plates and impulse lines, differential pressure cells, level floats. Know whether instrumentation is normally energized, and the failure mode for valves, instruments and control loops following loss of pneumatic or electrical energy.

Know what you should be observing as part of normal operations, for example, balancing transfers into and out of equipment, changes in level. And, ***NEVER*** ignore alarms — find out what caused the alarm!

Understand whether components can be tested on line or whether an "out of service" test is required to confirm that an instrument is working.

PSID members use Free Search for "Instrumentation" or "Level Control."

Understand how your equipment works — and how it can fool you!

The Beacon is usually available in Arabic, Chinese, Dutch, English, French, German, Gujarati, Hebrew, Hindi, Italian, Japanese, Korean, Portuguese, Spanish, Swedish, and Thai. For more information, circle 103 on p. 63.