

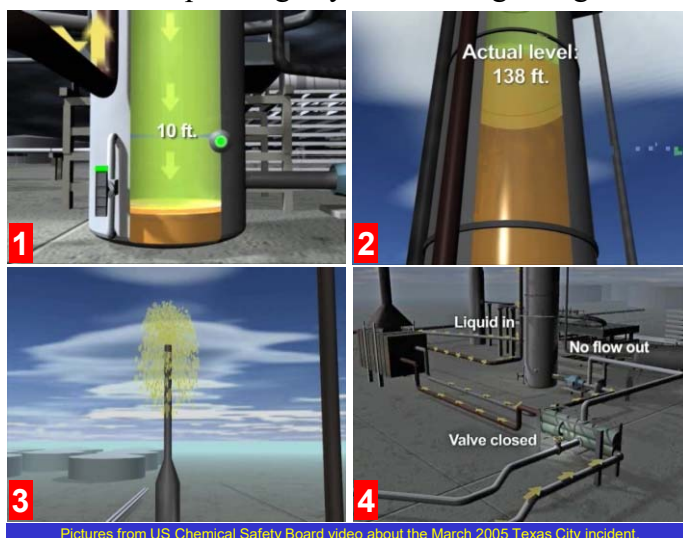
What if your process is acting differently?

September 2018

A runaway reaction incident described in the August 2018 *Beacon* occurred in a batch reactor as a result of failure to agitate during reactant addition. During normal operation, the reactor always needed cooling to maintain the required temperature. The runaway batch did not need cooling, but rather required heating! Clearly there was something different, but nobody noticed or acted upon the abnormal behavior.

The 2005 Texas City refinery explosion is another example of not responding to abnormal process conditions. In this incident, a distillation column was overfilled and over-pressurized (Pictures 1 & 2). Flammable hydrocarbons were released from a stack (Picture 3), and the vapor cloud ignited. Material was being fed to the column, while nothing was being removed (Picture 4), and the level instrument indicated a decreasing column level. The level instrument had not failed, but was operating beyond its design range. The March 2007 *Beacon* (www.sache.org) explains the incorrect level reading.

In another case, a batch specialty chemical process included a batch distillation step to remove a reaction by-product. This normally took about 10 hours, and the distillation was determined to be complete when the temperature at the top of the column reached a specified value. The temperature sensor failed during one batch. The column top temperature indication incorrectly reached the completion temperature in about 15 minutes. The process continued to the next step. Nobody questioned the unusual behavior. Fortunately there was no safety consequence, but the batch had to be discarded.



Did you know?

- When you work in a plant, you learn a lot about how it normally behaves. You get to know how long various process steps take, how long it takes to heat up a vessel, how much heating or cooling is required for a particular step, what happens to the level in various vessels when you transfer material from one place to another, what color materials are in a sight glass, what the plant normally sounds like, what it looks like, and hundreds of other things that you see and experience as you go about your daily work.
- If you observe something that appears to be different from your past experience, it is likely that there is something which has changed in your plant. It is possible that the change is hazardous.

What can you do?

- Be observant as you do your job. Learn how your plant normally behaves, and look for differences.
- If you observe any kind of unusual behavior in your plant, report it to supervision, management, and technical staff. Work with them to understand what has caused the unusual behavior. Understand if the behavior is a symptom of a hazardous condition or a change in the integrity status of your equipment.
- Read the December 2015 *Beacon* (www.sache.org) for more examples of hazardous incidents which were avoided because somebody reported an abnormal situation, and some examples of unusual things to look for as you work.

Report and investigate unusual process behavior!

Questions:

Students may find helpful the full CSB [incident report](#).

1. **(5 min)** List at least two hazards of working with hydrocarbons.
2. *****(20-30 min)** Though the article emphasizes the importance of noticing anything out of the ordinary, how can a process be changed so that it isn't dependent on people to be familiar with colors, sounds, levels, and process times? Your response should comprise 4-5 sentences. *Hint:* You may find this [resource](#) helpful.
3. **(10 min)** *What did you learn?*
What lessons have you learned from this article and how can you apply them to your chemical engineering career?