featured columnist

Accidents happen?

What happens when your high-level indicator fails without warning? Everyone should know the answer as we have discussed it before. The unknown failure of a high level sensor used for overfill protection can result in an overfill condition resulting in lost material, clean-up and damage to equipment. But is that all? No. Results of unknown high-level detection sensor failure can include catastrophic events costing millions of dollars in damage and other expenses, and more importantly, it can cost human pain, suffering and lost lives. But, this can be prevented!

Liquid Applications

It was a calm, crisp day the morning of December 11, 2005, in southeast England. Being Sunday morning most citizens were off from their work and enjoying the remaining hour of their sleep, or perhaps beginning their ablutions in preparing to go to their local church meeting. At 6:01 a.m. local time in Hertfordshire, England, many lives were changed forever when the first explosion rocked the Buncefield oil storage depot. It was said that at least one of the initial explosions were of "massive proportion."

At the Buncefield depot area significant damage occurred to both commercial and residential property. Twenty fuel storage tanks and the majority of the site was engulfed in a massive fire which burned for several days. Forty-three people were injured, 2,000 people were evacuated from the immediate surrounding area, and it is estimated that the cost impact was nearly £1 billion ($1.6 billion). By grace, there were no fatalities.

What happened?

The Major Incident Investigation Board (MIIB) that investigated the Buncefield accident published its final report at the end of 2008. Volume 1 of the report, which is over 100 pages in length, contains the detail. Late in the afternoon of Saturday, December 10th, the day before the explosion, a fuel delivery arrived at one of the tanks at the Buncefield facility. Unfortunately, the safety systems that were in place to shut-off the supply of the fuel to prevent overfilling of the tank failed to operate. As overfilling continued, about 10 percent of the 300 tons of fuel that had overfilled the tank turned to vapor. The vapor concentration grew and became capable of supporting combustion. The vapor cloud was visible on security film and also witnesses that were nearby the facility reported seeing the vapor cloud. A severe explosion resulted and a massive fire.

Several months before the Buncefield accident in March, a massive explosion rocked the BP Texas City, Texas, facility resulting in a huge amount of damage, and in this case, the unfortunate death of 15 workers and the injury of 150 more. According to the Buncefield report, at the time the final report was being written regarding the Buncefield accident, the United States Chemical Safety Board (CSB) was examining the BP Texas City accident. Both the Buncefield and Texas City accidents were tragic. Part of that tragedy is, I believe, that they were preventable.

Referring to both the Buncefield and Texas City incidents, the Buncefield final report states that "both incidents occurred due to loss of primary containment by overfilling of a vessel resulting in the formation of a large flammable vapor cloud that subsequently ignited."

How can these accidents be prevented? Let's look at a couple of the recommendations from the Buncefield MIIB report. Recommendation #1 calls for a common methodology be developed to determine the safety integrity level (SIL) required for overfill prevention systems. This is related to IEC 61511 standard that has been in existence and use for a while. The first several recommendations actually involve overfill protection and relate to IEC 61511. Several companies currently offer level measurement transmitters and high-level detection point level sensors certified and rated as SIL2. These devices should be strongly considered for use in hazardous overfill protection applications, and even when overfilling could simply be too costly from a financial perspective.

In addition, the Buncefield report further states, in recommendation #3, that "operators of Buncefield-type sites should protect against loss of containment of highly flammable liquids by fitting a high-integrity, automatic operating overfill prevention system that is physically and electrically separate and independent from the tank gauging system." So, use an overfill prevention system with components (like the level detection sensor) suitable for the SIS (Safety Instrumented System) required with the appropriate SIL (Safety Integrity Level), and keep the overfill detection system sensor separate from the inventory tank gauging system. Sound advice, with little additional cost to save billions of dollars and, more importantly, many lives.

Powder Applications

Are accidental facility-wide explosions limited only to applications where hazardous vapors exist? No, not at all. In fact, hazardous dusts, dust fires and explosions may be a more serious problem than vapors. The reason is awareness and understanding.

Take a look at the video found at http://www.youtube.com/watch?v=3d37Ca3E4fA. This video is produced by the United State CSB (Chemical Safety Board) and it provides a good look at dust explosions and drills down into several actual accidents. I thank Mike Boudreaux of Emerson Process Measurement for calling this to my attention in a recent Tweet.

While dust explosions are very rarely caused by bin or silo overfilling, dust explosions, whatever the cause, can be just as deadly and costly as those at Texas City, Buncefield and elsewhere. Overfilling an outdoor silo full of plastic pellet will not necessarily result in an explosion, but it can be very costly in regards to clean-up, lost material and equipment damage. In addition, powder spills within bins and hoppers inside a facility (rather than outdoor silos) can add "fuel to the fire" by adding more powder dust to the environment. At the wrong time, this can be a part of the initiation process of an explosion and disaster.

The use of SIL-rated level sensors, or at least those that can provide some fail-safe and self-validation capability, should be considered for powder applications. In addition, always follow the National Electric Code and all regulatory and statutory guidelines for safety.

Conclusion

Simply put, I have two summary points:

1. Separate the inventory measurement (continuous level measurement) and high-level overfill prevention functions into two distinct devices. This has always been "good practice" and common sense. Some have avoided it simply because of cost and in an effort to further justify the expensive inventory system. But you really cannot afford not to.
2. When Safety Instrumented System guidelines require Safety Integrity Level rated devices, use them!

If you have any questions or comments, you can contact me via email at joe@cougarindustries.com or follow me on Twitter @Matt1128. In addition, I post at the Level Measurement Expert Blog on the Processing magazine Web site www.processing-magazine.com.

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