CENTER FOR Hydrogen SAFETY
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Safety Culture Spotlight

Integration of Process—Safety Procedures

- Deflagration results in fatalities
- Failure to integrate process sampling procedures
- Inconsistent tank sampling methods results in hazardous condition

BACKGROUND

A fire and deflagration explosion happened at a liquid waste injection well site when basic sediment and water (BS&W) from two natural gas wells arrived contaminated with hydrocarbons. While the BS&W was being unloaded, the hydrocarbons ignited, causing a deflagration and subsequent pool fire. Two workers were killed, and three others were injured. The liquid waste injection site was owned by one company, the natural gas well by a second company, and the waste was being transported by a third company that was responsible to extract the BS&W from the storage tank using a vacuum truck.

The gas well owner was to notify the waste hauler which tank to extract from and the volume to extract, expressed either in inches of outage or barrels as appropriate. The waste hauler was then to extract that quantity from the bottom of the tank, checking to ensure that little or no hydrocarbon, which floated on the BS&W, was removed.

WHAT HAPPENED

Each driver had a different method for measuring the amount removed during the vacuum operation and or detecting the BS&W to hydrocarbon interface. The official amount transported was determined only by the owner by level difference after the hauler departed the well site. The hauling company and owner both clearly understood that no hydrocarbon should be removed from the tank during the extraction operation, but no check of the extracted material was made to confirm this before transporting.

On the day of the incident, investigators concluded a significant amount of hydrocarbon was unintentionally extracted. When the truck was being unloaded at the liquid waste injection site, hydrocarbon vapors from the tank were ignited, most likely from the idling truck engine. In the ensuing fire, the truck valve opened, draining additional BS&W and hydrocarbon to the unloading pad. This hydrocarbon formed a pool fire that took nearly an hour to extinguish.

The investigators (ref E.8) noted several management system failures as well as regulatory gaps that contributed to the incident. The investigator further noted the industry generally recognized BS&W as non-hazardous, and while some in the industry recognized hydrocarbon present in extracted BS&W could be flammable, the majority did not. This difference could simply be one of terminology: "flammability" is defined as having a flashpoint below 100 oF while liquids with flashpoints not too far above that temperature can burn and still ignite readily, especially if warmed. Relying on regulatory definitions when they are not accurate, and denial of hazards are clear signs of a weak sense of vulnerability and a weak imperative for safety. What other culture issues might have existed in this situation?

The well owner clearly empowered the hauler to verify the absence of hydrocarbon in the extracted BS&W, and this would seem to be a culture positive. Likewise, the waste injector empowered the hauler and the well owner to make this verification. However, where does empowerment end and become abdication of responsibility, a culture negative? Did that happen in this case?

SAFETY CULTURE FOCUS

- ✓ Strong leaders must ensure integration of safety in processes and among support contractors
- ✓ Effective communication through procedures is essential to safe operations and risk mitigation.
- ✓ Mutual trust is strengthened through a questioning environment.

****Only 51% of those surveyed indicated procedures were a strength in their organization.****

IMPROVING HYDROGEN SAFETY CULTURE

LEARNING OPPORTUNITIES FROM OTHER'S EXPERIENCES

This record is taken from "Essential Practices for Creating, Strengthening, and Sustaining Process Safety Culture," CCPS, ©2018, AIChE and John Wiley & Sons, Ltd.

"Safety culture is how the organization behaves…
…when no one is watching."

Safety Culture Framework

- Safety is everyone's responsibility
- Strong leadership support
- Integrated into all activities
- Open, timely, effective communications
- Questioning/learning environment
- Mutual trust
- Continuous improvement

What are the benefits?

- ✓ Eliminates common weaknesses identified as contributing factors to catastrophic events.
- ✓ Promotes trust in the hydrogen energy industry's ability to deliver safe, reliable, quality products and services.
- ✓ Supports a sustainable legacy for companies and the hydrogen industry.
- ✓ Fosters efficiency and productivity in the workplace.

Resources

- ✓ For further information and resources on safety culture, see: https://www.aiche.org/ccps/safety-culture-what-stake
- ✓ For further case studies on safety culture, see: https://h2tools.org

Keywords: weak, poor, minimum, regulations, flammable, chemical, checklists, compliance