CENTER FOR Hydrogen SAFETY
Connecting a Global Community

Safety Culture Spotlight

Spark Finds Fuel—Risk Planning

- Failure to identify risks leads to death of two workers
- Wrong materials selected for methanol tank
- Lack of procedures to perform hot-work

BACKGROUND

A wastewater treatment plant provided a metal roof to shade a plastic methanol storage tank to reduce solar heating of the tank. After the roof was damaged in severe weather, facility management decided to remove it. Two workers in a man-lift basket cut the roof into sections, and each section was lowered to the ground by a crane. The work proceeded over several days.

WHAT HAPPENED

While cutting a section near the tank vent, a spark ignited vapors coming from the vent. The fire flashed back through the vent's malfunctioning flame arrestor, igniting vapors in the headspace. The pressure from the resulting fire separated most of the connections from the tank, including the flame arrestor, the level transmitter, a level switch, and inlet and outlet piping. The flat bottom of the tank also bulged and pulled off its foundation. Flaming methanol vapor discharged from vapor-space connections, burning the two workers and the crane operator. One burned worker fell to his death, one died from his burns, and the third was hospitalized for more than four months.

The Chemical Safety Board (CSB) investigators (Ref E.5) determined the facility's engineering contractor had selected the wrong materials of construction for the tank and the flame arrestor. Consequently, the aluminum flame arrestor had corroded to the point it no longer functioned and the plastic tank could not withstand the pressure and stresses of the internal and external fire. The investigators further discovered the facility did not have a permit-to-work system, that it was seriously overdue on equipment inspection, and that its frequency of safety training had been steadily decreasing over the prior eight years. Based on interviews, the last training involving methanol hazards had occurred twelve years earlier. In its investigation report, the CSB made recommendations to regulatory agencies, standards organizations, and the engineering company that installed the methanol system. However, it made no recommendations to the facility, which is ultimately responsible for worker and process safety. Which culture factors could CSB have explored in this investigation? Did facility management and workers understand the hazards and risks of its processes? What caused the decrease in training frequency? Was the imperative for safety weakening?

SAFETY CULTURE FOCUS

- ✓ Strong leadership must ensure safety is integrated with all design processes and maintenance activities.
- ✓ Establishing formal work systems with a questioning environment is critical to identifying risk.
- ✓ Quality control and validation of design features and materials is essential for safe operations.

****Only 63% of those surveyed indicated training was a strength in their organization.****

IMPROVING HYDROGEN SAFETY CULTURE

LEARNING OPPORTUNITIES FROM OTHER'S EXPERIENCES

"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

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