CENTER FOR Hydrogen SAFETY
Connecting a Global Community

Safety Culture Spotlight

Surprised by the Unexpected—Hazards Analysis

- Exothermic reaction in filter results is fire
- Past performance overshadows future risk
- Weak management of change process

BACKGROUND

An inorganic powder used as an oxidation catalyst was being isolated for disposal. The powder had been filtered from the reaction mixture and washed with clean solvent, and the solvent was being removed by sweeping the filter with warm inert gas through a chilled water condenser. During the drying cycle, an exothermic reaction occurred in the filter that damaged it. The mix of inorganic powder and organic solvent exited the filter and found an ignition source. The resulting overpressure caused some damage, and the fire was quickly extinguished by the fire suppression system. Fortunately, no injuries resulted.

WHAT HAPPENED

The investigation team (Ref E.12) found some years earlier, reactivity testing had identified a reaction between the powder and solvent that had a 24 hour "time to maximum rate" a few degrees below the drying temperature. The drying had not always been run at a warm temperature. However, when drying was done at a cooler temperature, an unacceptable amount of solvent remained in the filtered powder. To obtain a drier cake, improving the occupational safety during pack-out, the plant increased the drying temperature. The Management Of Change (MOC) review concluded the change was necessary to improve safety in packing out the cake. However, in conducting the MOC review, the original reactivity data were not fully considered. Instead, a new set of thermal tests on solvent-free powder were conducted, which was found to be quite stable.

When the investigation team reported its findings, a manager commented, "This is the last place I thought we'd have an accident." He explained the site ran many highly energetic reactions, handled highly toxic chemicals, and distilled many volatile and flammable solvents. Surely if there was an incident on the site, he said, it would not happen in a filter. What culture questions might the investigation team have considered?

The technical team responsible for the process was unaware of the potential for reaction between powder and solvent. What barriers to open communication could have existed between the technical team and the owner of the process safety information? What other communication roadblocks might there have been?

SAFETY CULTURE FOCUS

- ✓ Strong leadership ensures safety is embedded into process hazard analysis activities.
- ✓ A questioning environment is critical to an effective management of change process.
- ✓ Effective communication between groups is essential to ensure risks are understood and mitigated.

****Only 26% of those surveyed indicated communication 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

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