HAZOP Case Study

Clint Guymon

Brigham Young University

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Keywords Spiritual Safety, Process Safety, Chemical Engineering, Risk Assessment

Learning Outcomes

- Conduct a basic HAZOP on a specific process node (e.g., a steam reformer or pump).
- Identify effective safeguards, such as relief valves or control loops, for specific process deviations.
- Formulate actionable recommendations to mitigate high-risk scenarios identified during the analysis.

Reading

- Foundations of Spiritual and Physical Safety: with Chemical Processes; Chapter 5, Sections 2.1 (Examples up to Section 2.1 Logic and Reasoning)

CSB Investigation of H2S Poisoning in a Pump House in Texas: Aghorn Operating Waterflood Station Hydrogen Sulfide Release

https://www.csb.gov/aghorn-operating-waterflood-station-hydrogen-sulfide-release-/

1:50 - 6:50 Event Summary

- Oil and water mixture sits and separates in an initial holding tank
- Water (Produced Water) is pumped out of the bottom to reintroduce into the well then pumped to the suction tank
- Waterflood station or pump house used to pressurize water
- High pressure piston pumps inject water back into the well to allow greater amounts of oil to be recovered
- Pump house occasionally occupied 2x per day
- H2S alarm and critical warning light not functional
- Alarm notification to service personal of an oil level alarm with pump malfunction of some kind
- Personal H2S monitor not brought into pump house by the operator

- Pump plunger had shattered and H2S was released with the water
- Operator was fatally injured by H2S
- Wife also fatally injured by H2S

Download lecture freeform here: https://github.com/clint-bg/safetyinjc/blob/main/physical/supportfiles/311 HAZOP Case Study.pdf

Action Items

1. Watch the CSB investigation video on the H2S release at the Aghorn Operating waterflood station and list the factors that contributed to the fatal incident.
2. Based on the video, create two rows for a HAZOP table specifically for the "Pump House" operation using guide words.
3. Generate 5 lines (or rows) of a HAZOP for the contact process of producing sulfuric acid. A simplified example process flow diagram is shown in Figure V.3 in (Guymon, 2025) page 85.

References

C. Guymon. *Foundations of Spiritual and Physical Safety: with Chemical Processes*. 2025.