
HAZOP CASE STUDY

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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

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.