H₂S in Steam
Technical Presentation
H₂S in Steam Systems - Introduction

- Measuring H₂S in steam lines or high humidity environments is not the same as measuring in a dry gas line. The field methods to determine H₂S onsite were designed to measure H₂S in dry gas.

- The heat and moisture act as an interference. The conventional methods repeatability and reproducibility would have been calculated in the normal natural gas operating conditions.
Typical Sites and Applications

- Casing Vents
- Production Lines / Streams
H$_2$S in Steam Systems – Considerations

Considerations to make when choosing a test method:

- Flow Rate
- H$_2$S Concentration (expected)
- Steam or Moisture Content of Stream
- Is this a solvent assisted SAGD site
Conventional H₂S Sampling and Analysis (Dry Gas)

- H₂S is typically analysed in the field using one of two methods:
  - Length of Stain Tube - low accuracy (+/- 25%), detects down to 1ppm
  - Tutweiler Titration – higher accuracy, only applicable down to 1500ppm

- Limitations in SAGD Systems
  - Length of stain tube only viable from 0°C – 40°C and 0 - 90% humidity
  - Tutweiler method is only applicable from >1500 PPM.
  - Titration measurement may be diluted by steam content
H₂S in Steam Systems – Thimm Method

Thimm Method

- Uses a capture and stabilize method to measure the H₂S value offsite in the lab.

- Based on forming a stable metal sulfide salt.

  \[ \text{Cu}^{+2} + \text{S}^{-2} \rightarrow \text{CuS} \]

H₂S in Steam Systems – Thimm Method

- The Thimm method uses a system that cools, dries, and captures the H₂S in the steam leaving a sweet dry gas to be measured and characterized.
H₂S in Steam Systems – Thimm Method

How it works:

H₂S reacts with Copper

Gas is now sweet

Gas is now dry

Flow rate is measured and dry gas is captured
**H$_2$S in Steam Systems – Thimm Method**

<table>
<thead>
<tr>
<th>H$_2$S Concentration by Sampling Train, ppm</th>
<th>H$_2$S Concentration by Stain Tube, ppm</th>
<th>Difference, ppm</th>
</tr>
</thead>
<tbody>
<tr>
<td>777</td>
<td>500</td>
<td>277</td>
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<tr>
<td>555</td>
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<td>480</td>
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<td>-954</td>
</tr>
<tr>
<td>264</td>
<td>800</td>
<td>-536</td>
</tr>
</tbody>
</table>

Thimm Method Limitations

- Based on a water solution system so has a freeze potential on very cold days.

- Requires analysis back in the lab with no onsite results.

- Requires time weighted sampling over the course of roughly an hour for best results.

- Requires significant prep work prior to sampling.
Thimm Method Modifications

- Increased number of receiving containers to increase capacity to allow for longer sampling durations of high flow, high H₂S sample lines.

- Added flow and pressure regulation to better control production line sampling.
H$_2$S in Steam Systems – Modifications

System Schematic
Next Steps?

- Are other methods available that we haven’t reviewed?

- Are current methods sufficient?

- Does a completely novel and unique approach need to be considered?
Thank You!