H₂S in the Permian Basin
With the most experienced set of measurement technicians, lab analysts, and data analysts in the business, SPL delivers high value to our clients. We believe in complete transparency when it comes to helping our clients achieve their production goals and we are seen as a partner, as opposed to a vendor.

Management Owned, Partnered with Private Equity

500+ employees, including 300+ measurement techs, 100+ lab analysts, & 30+ data analysts
SPL US Locations

US Locations Map for all SPL Locations
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Industrial Hazards of Hydrogen Sulfide

• Dangerous and Deadly Gas
• PEL Limit
• Maximum Exposure Limit
Summary of Test Method – ASTM D5705

- Measurement of Hydrogen Sulfide in Vapor Space above Residual Fuel Oil
- Quart Glass Bottle is filled 50% with Oil Sample
- Vapor Space is purged with Dry Nitrogen and Capped
- Bottle and Sample is heated and agitated
- Hydrogen Sulfide in the Vapor Space is Measured by Stain Tube
H2S in the Permian Basin

ASTM D5705
H2S in the Permian Basin

ASTM D5705
H2S in the Permian Basin

Summary of UOP 163

- Measurement of Hydrogen Sulfide in Liquid Hydrocarbons by Potentiometric Titration
- Liquid Oil Sample is weighed into an Alcohol Solvent
- Solution is titrated with AgNO3 to react with H2S to create AgS
- Hydrogen Sulfide content is calculated from amount of AgNO3 required
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Picture of Typical Titration Curve

Figure
Potentiometric Titration Curves of Sulfur Species in Gasoline
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Challenges of ASTM D5705

• Method is written for Residual Fuel Oil
• Temperatures should be adjusted for differences in crude oil viscosity volatility
• Field test designed to create a 1:1 Vapor/Liquid ratio where H2S Vapor is Equilibrated
• Rapid Qualitative determination of the presence of H2S in the Vapor Space
• Results do not represent H2S Vapor Concentrations in Tanks or Transports
• Samples should be analyzed quickly, not more than once and precision is poor
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Challenges of ASTM D163

- Method is written for Liquid Petroleum Distillates
- Automatic Titration Analyzers are recommended to perform test
- Liquid Oil Sample is weighed and titrated under Atmospheric Conditions
- Operator must analyze H2S and Mercaptan separately when H2S is low
- No Precision Statement for H2S
### H2S in the Permian Basin

#### ASTM D5705 versus UOP 163

<table>
<thead>
<tr>
<th>ASTM D5705</th>
<th>UOP 163</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Field Test</td>
<td>• Lab Test</td>
</tr>
<tr>
<td>• H2S in Vapor</td>
<td>• H2S in Liquid</td>
</tr>
<tr>
<td>• Precision</td>
<td>• Precision</td>
</tr>
<tr>
<td>• Qualitative Result</td>
<td>• Quantitative Result</td>
</tr>
</tbody>
</table>
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Interpretation and Comparison of Test Results

- ASTM D5705 yields a Qualitative Result of H2S Concentration in Vapor Phase
- ASTM D5705 result are reported as ppm volume of H2S in Vapor
- UOP 163 yields a Quantitative Result of H2S Concentration in Liquid Phase
- UOP 163 result are reported as ppm weight in Liquid
- Correlation of ppm volume to ppm liquid
## H2S in the Permian Basin

Physical Properties of Hydrogen Sulfide (60°F @ 14.696 psia)

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Molecular Weight</td>
<td>34.08 (Atomic Mass)</td>
</tr>
<tr>
<td>Boiling Point</td>
<td>-76.5 °F</td>
</tr>
<tr>
<td>Vapor Pressure</td>
<td>230 psia</td>
</tr>
<tr>
<td>Liquid Specific Gravity</td>
<td>0.7989 (Water = 1.000)</td>
</tr>
<tr>
<td>Gas Specific Gravity</td>
<td>1.1767 (Air = 1)</td>
</tr>
<tr>
<td>Volumetric Ratio (Ideal Gas/Liquid)</td>
<td>554.7</td>
</tr>
</tbody>
</table>
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H2S Vapor Pressure Curve

VAPOR PRESSURE CURVE OF HYDROGEN SULFIDE

* FAHRENHEIT

PSIA

100 200 300 400 500 600

20 40 60 80 100 120 140

The Science of Sure
Recommendations for Hydrogen Sulfide Testing

• Understand the limitations of current methods
• Handle samples for H2S testing similar to other volatiles testing
• Work efforts to create or improve precision statements for current H2S tests
• Identify goals to pursue and create better analyses for H2S
Thank You!
Questions and Answers