


Hydrogen Safety – H₂

???

John Christensen
Account Manager – ES – DS Additives Group
November 20th, 2019

Hydrogen Safety





Hydrogen Sulfide – H₂S

Why Should We Care?

John Christensen
Account Manager – ES – DS Additives Group
November 20th, 2019

Safety Moment

Entire Presentation Focused



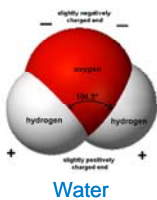
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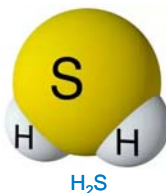


Lake Buchanan, Texas

H₂S – The Irony of One Row



6A	
8	16
O	Oxygen 15.999
16	32
S	Sulfur 32.065






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H₂S – What is It?

- Colorless Gas That is **Flammable & Explosive**
- Odor of Rotten Eggs – If Concentration is Low
- Heavier Than Air & Corrosive
- Occurs Naturally
- Toxic**


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H₂S – What Does it Do?

Concentration (ppm)	Physiological Effect
0.1 - 3	Odor Threshold
3 - 10	Offensive Odor
10 - 50 (0.001%)	Headache Nausea Throat and Eye Irritation
50 - 100	Eye Injury
100 - 300	Conjunctivitis (Pink Eye) Respiratory Tract Irritation Olfactory Paralysis
300 - 500	Pulmonary Edema (Fluid in Lungs) Imminent Threat to Life
500 - 1,000	Strong Nervous System Stimulation Apnea (Loss of Breathing)
1,000 - 2,000	Immediate Collapse with Respiratory Paralysis Risk of Death



800 ppb to 10 ppm
Odor of Rotten Eggs

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H₂S – What Does it Do?

- ▲ 1000 & Up ppm – Unconsciousness at Once
 - Immediate Collapse – Even After Inhalation of a Single Breath
 - Early Loss of Breathing
 - Death within a Few Minutes
 - Death May Occur Even if Individual is Removed to Fresh Air at Once



H₂S – Limits

- ▲ NIOSH – National Institute for Occupational Safety & Health
 - REL – Recommended Exposure Limit – 10 ppm
 - IDLH – Immediately Dangerous to Life & Health (Interferes with Ability to Escape) – 100 ppm
- ▲ OSHA – Occupational Safety and Health Administration
 - PELs – Permissible Exposure Limit (Enforceable)
 - General Industry Ceiling Limit – 20 ppm
 - General Industry Peak Limit – 50 ppm
 - Construction 8-hour Limit – 10 ppm
 - Shipyard 8-hour Limit – 10 ppm



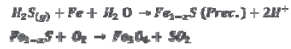
H₂S – Limits

- ▲ ACGIH – American Conference of Governmental Industrial Hygienists
 - TLV – Threshold Limit Value 8-hour – 1 ppm
 - STEL – Short Term Exposure Limit – 5 ppm
 - Canadian Provinces – Some Are Legally Bound
 - Under Review – Accurate Equipment (<10 ppm)
- ▲ General Refining and Petroleum Guideline
 - 10 ppm – Personal Monitor Level



H₂S – What Does it Do? – Corrosion

- Electrochemical – Acid or Direct Attack of Iron
 - Shallow Round Pits or FeS Film Formation
 - Aggressive in Nature
 - Tank Headspace, Within Tank & Pipes



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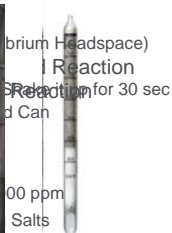
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Isla Mujeres, Quintana Roo

H₂S – How is it Measured? – Detector Tubes

- ASTM D-5705 Can
 - Measures H₂S in the Equilibrium Headspace)
 - Utilizes a 500g Asph. Reaction
 - Put in a Quart Can, Reaction for 30 sec
 - < 325°F – Open Can, Reaction in Can
 - Use Drager Tube to
- Drager Tubes
 - Increments from 0.2 to 100 ppm
 - Utilize Chemical Reaction with Salts



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Fall Creek Falls, Texas

H₂S – In Asphalt

- ▲ Sweet Crude = H₂S in your Asphalt
- ▲ Sour Crude = **More** H₂S in your Asphalt
 - H₂S Can be as High as **12,500 ppm**
- ▲ High Sulfur Crudes – More Prevalent
- ▲ < 10 ppm?
- ▲ What About PMA?
- ▲ Asphalt Testing – N = 2
 - Supplier 1 – PG 64-22, < 100 ppm; PG 76-22, 600 ppm
 - Supplier 2 – PG 64-22, ~ 150 ppm; PG 76-22, ~1000 ppm



Post Oak Creek, Texas

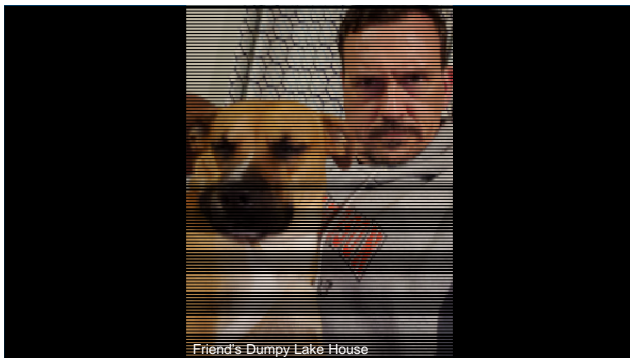
H₂S – How Do We Deal With It?

- Safe Work Practices
 - Know Where it's Expected (Tank Vapor Space)
 - Monitor Wind Direction
 - Know the Volumes & Temperatures
 - Loading & Discharging – Avoid Close Proximity
 - Wear Personal Monitors
- Engineering Controls
 - Ventilation & Carbon Canisters
 - Temperature
 - Get Upwind



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Friend's Dumpy Lake House

Questions???



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