

DEALING WITH H₂S

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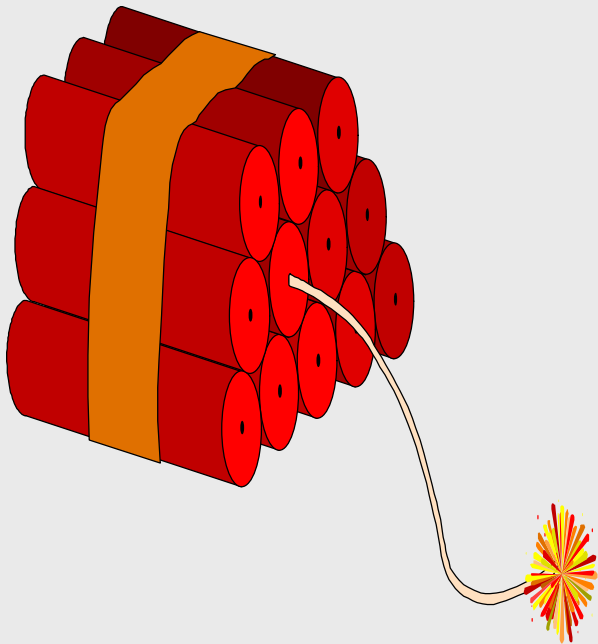
Tomball, TX

Origins of H₂S

- Sulfate reducing bacteria
- Petroleum formation process
- Volcanism



Properties of H₂S



- Very Toxic
- Flammable
- Odor-- Yes/no
- Heavier than air

How Toxic ?

- 10 ppm; okay for 8 hour periods
- 15 ppm; okay for short term
- 50-150 ppm; smell deadened
- 500 ppm; unconscious, comma, death



Engineering Consequences

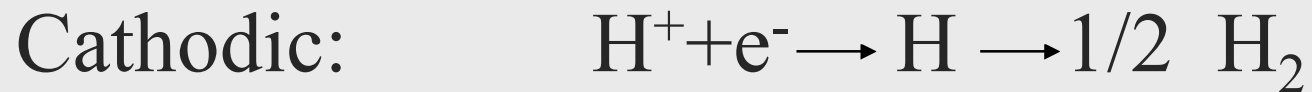
- Gas Quality
- Weight loss corrosion
- Steel Cracking



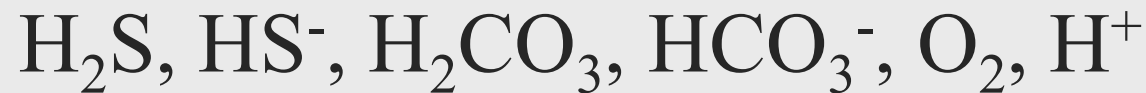
Corrosion Control

- Carbon steel plus corrosion inhibitor
- Nonmetallics
- Corrosion resistant alloys

Oilfield Corrosion



In Oilfield Brine:



Uninhibited Corrosion Rate Approximation

*** All Measured in Fresh Sample**

For temperature below 150 degrees F, no oxygen:

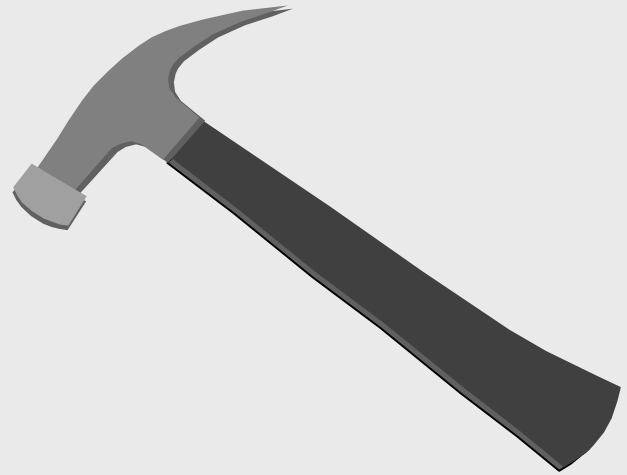
$$mpy = \frac{(ppm CO_2 + ppm H_2S/2) + 1/10 (ppm HCO_3^- + 1/2 ppm H_2S)}{K}$$

- For fresh water $k = 50$
- For oilwell brine $k = 25$

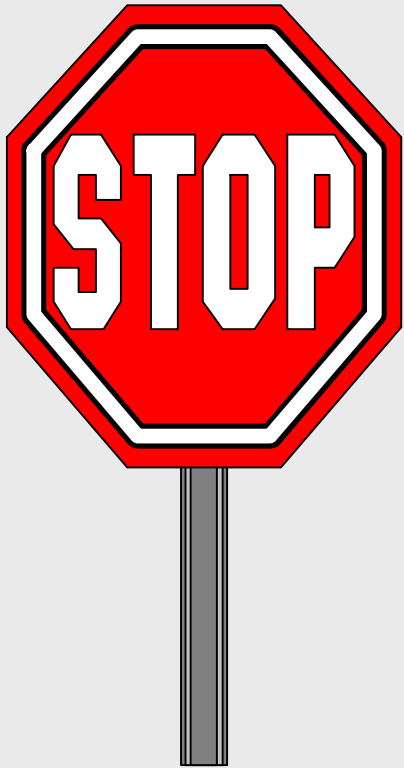
**Pits typically grow 10-50 times the above rate;
the average oilfield ratio is 20 times**

Corrosion Cracking of Steels

- Hydrogen Embrittlement
- Stepwise Cracking
- Corrosion Fatigue



Remedies for Corrosion Cracking



- Lower corrosion rate with special inhibitors
- Use less susceptible metals
- Lower stress

Removal of H₂S

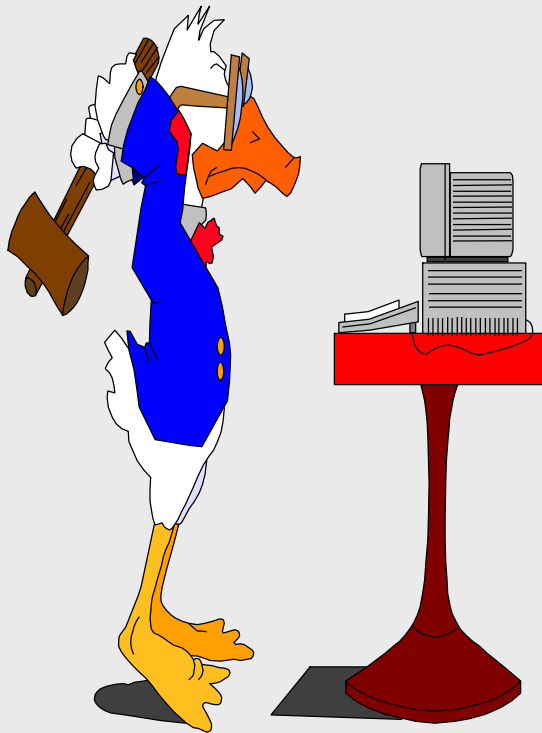
- How much ?
- Source ?
- Form/phase ?



Remedies for H₂S

- Source is SRB
- Amount is small
- Amount is medium
- Amount is large
- Use bactericide
- Use scavengers
- Use scrubber tower
- Use amine unit

Biocide Application



- Culture bottles
- Sessile/planktonic
- EPA registered process
- Usually Batch Application
- Need good contact
- Periodically alternate types

H₂S Scavengers

- In liquid or gas phase
- Good contact required
- Spray or tower for gas
- Disposal of spent into well

Sponge Towers

- For medium amounts
- For gas phase
- Disposal of spent sometimes difficult

Amine Units

- Expensive
- Requires energy
- For large amounts
- Disposal of H_2S gas
 - Acid gas well
 - Claus unit

Conclusions

- Sources of H₂S
- Consequences (all bad)
- Prevention
- Removal

