Oil Field Microbiological Control

COQG – May, 2006
SRB Related Problems

1. Microbiologically Influenced Corrosion (MIC)

2. Sourcing of Crude Oil Production (Reservoir souring...)

3. Plugging of Equipment, Injection Wells, Flow lines
   - Microbiological Control (Biocides...)

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Microbiologically Influenced Corrosion (MIC)

- Sulfate Reducing Bacteria (SRB)
- Acid Producing Bacteria & Fungi
- Aerobic Slime Formers
- Iron Oxidizing Bacteria
- Methane Producing Bacteria
- Sulfur/Sulfide Oxidizing Bacteria
Biofilm Formation

Attachment

Colonization

Growth

Pipe Surface
MIC

- Under Deposits
- Filter Beds
- Dead Legs & Drains
- Tank Bottoms
- Water hold up in flow lines

Pitting Corrosion
Groove Corrosion
6 o’clock Corrosion
### Plugging & Injectivity Problems

- Plugging and reduced flow in filters, down hole formations and flow lines.
- Coating of the walls of heat exchangers causing efficiency reduction
- Formation of insoluble salts, slime production, and cellular debris (biomass)
- Injectivity limitations
- \( \text{H}_2\text{S} \) generation
Reservoir Sourcing

Not a question of “if”, but “when” will the reservoir sour?

- SRB the main culprit
- Injected seawater provides
  - SRB, Sulfate, lower temp, salinity...
- Formation water provides
  - Dissolved organic carbon (VFA, soluble hydrocarbon...)
- Costly consequences (increased H2S levels..)
- Proactive vs. Reactive (Deep water...)

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System & Bacterial Monitoring

Sessile v. Planktonic

Sidestreams
Corrosion Coupons
Bioprobes
Monitoring and Control

Microscopy
ATP
Luminescence (Tra-Cide)
Serial Dilutions (Cultures)
Immunoassays
Molecular Techniques (PCR)
SEM/EDS
Typical Seawater Injection System

- Lift pumps
- Hypochlorite
- Biocide
- Fine filters
- Injection pumps
- Injection wells
- Gas coolers
- Glycol coolers
- Deaerators
- Biocide/antifoam
- Course filters
- Vacuum
- Booster pumps
Oil Field Biocides

- Glutaraldehyde
- Quaternary Amine Compounds
- THPS
- Carbamates
- Isothiazolone
- Acrolein
- DBNPA
- Biguanide
Biocide Application & Fate

- **Continuous Injection** (5-50 ppm)

- **Batch/Slug** (100 – 2000 ppm, 1-6 hours X1 – X3 weekly)

- **Pulse** (500 – 2000 ppm, Minutes – Hours)

Many traditional oil field biocides follow the water and their downstream fate is influenced by:

- Dryness of crude, half-life, upstream consumption, fluid chemistry, etc.
THANK YOU