Field Foamer Development

Jason Bell, Technical Services Rep
BJ Chemical Services
Field Foamer Development

- Global Gas Fields
- Reasons for In-field Development
- Test Methods
- Case Histories
- Conclusions
- Questions?
Global Natural Gas Reserves

- Development in more remote locations
- Laboratory settings not available
- New fields that have liquid loading wells
- Older oil fields drilling for natural gas
- Formation differences
Laboratory? Settings
Laboratory? Settings
Field Differences

- **Water**
  - Salinity
  - Total Hardness
  - Calcium Concentration

- **Condensate/Oil**
  - Specific Gravity
  - Paraffin content
  - Asphaltene content
Field Differences

- Barnett Shale
  - wells from same formation
  - less than 20 miles apart
  - same age

<table>
<thead>
<tr>
<th></th>
<th>Specific Gravity</th>
<th>TDS:</th>
<th>TDS:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1.002</td>
<td>1852</td>
<td>119448</td>
</tr>
<tr>
<td>pH:</td>
<td>5.8</td>
<td>6.3</td>
<td></td>
</tr>
<tr>
<td>Cations</td>
<td>mg/L</td>
<td>mg/L</td>
<td></td>
</tr>
<tr>
<td>Calcium:</td>
<td>173.62</td>
<td>10078.9</td>
<td></td>
</tr>
<tr>
<td>Magnesium:</td>
<td>14.69</td>
<td>1078.32</td>
<td></td>
</tr>
<tr>
<td>Sodium:</td>
<td>226</td>
<td>33337</td>
<td></td>
</tr>
<tr>
<td>Iron:</td>
<td>233.07</td>
<td>180.01</td>
<td></td>
</tr>
<tr>
<td>Barium:</td>
<td>0.3</td>
<td>8.17</td>
<td></td>
</tr>
<tr>
<td>Strontium:</td>
<td>2.72</td>
<td>517.63</td>
<td></td>
</tr>
<tr>
<td>Manganese:</td>
<td>30.46</td>
<td>2.08</td>
<td></td>
</tr>
<tr>
<td>Anions</td>
<td>mg/L</td>
<td>mg/L</td>
<td></td>
</tr>
<tr>
<td>Bicarbonate:</td>
<td>500</td>
<td>878</td>
<td></td>
</tr>
<tr>
<td>Carbonate:</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Silica:</td>
<td>21.08</td>
<td>52.04</td>
<td></td>
</tr>
<tr>
<td>Sulfate:</td>
<td>50</td>
<td>215</td>
<td></td>
</tr>
<tr>
<td>Chloride:</td>
<td>600</td>
<td>73100</td>
<td></td>
</tr>
<tr>
<td>Gases:</td>
<td>mg/L</td>
<td>mg/L</td>
<td></td>
</tr>
<tr>
<td>Carbon Dioxide:</td>
<td>650</td>
<td>370</td>
<td></td>
</tr>
<tr>
<td>Hydrogen Sulfide:</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>
Field Difference

- **East Texas**
  - Cotton Valley formation
    - Typical high gravity condensate
    - Higher paraffin content
  - Travis Peak formation
    - Lower gravity darker crude
    - Higher asphaltene content
Laboratory Development

• Benefits
  – Better testing equipment
  – Can simulate down-hole conditions
    • Temperature
    • Pressure
  – Use as confirmation tests of field developed products
Lab Development
Laboratory Development

• Drawbacks
  – Aged samples
    • Dissolved gases have escaped
    • Solids content increases (FeS, Fe$_2$O$_3$)
  – Synthetic brines
    • Similar ions
    • Often not complete
    • Lack of acid gases (CO$_2$, H$_2$S)
  – Condensate
    • Hazards and cost of shipment
Field Development

• Benefits
  – Fresh samples
    • Dissolved gases still in solution
  – Ionic content
    • Exact ionic content of what will be foamed
  – Condensate
    • Able to test with condensate from well
Field Development

• **Drawbacks**
  – Equipment
    • Often rudimentary
    • Cannot simulate down-hole conditions
  – More difficult to setup
Field Development
Field Development

- **Blender Test**
  - Determines Foam Height and Half Life of blend

  - **Half Life**
    - Example of compatibility of foamer and water
    - Stability of foam

  - **Foam Height**
    - Foam Quality
    - Performance in the produced fluids
Field Development

- Blender Test
  - Advantages
    - Accepted practice
    - Allows for quick screening of blends
    - Gives relative idea of how well water reacts to foamer
  - Disadvantages
    - Does not simulate downhole conditions
    - Not as distinct differences in performance
    - Limited amount of condensate
Field Development

Foamer Evaluation

- RFO 06271
- TF 5577
- B6

Height (mls)

Time (sec)

Height

- RFO 06271
- TF 5577
- B6

Time
Field Development

- Foam Flow Column
  - Uses inert gas (nitrogen) to lift fluids
  - Measures fluid carryover
  - More closely mimics actual liquid lift
  - Able to test higher levels of condensate
Field Development

• Foam Flow Column
  – Advantages
    • Uses gas entrained in water for reaction
    • Determines “lifting ability” of the foamer
    • More similar to downhole conditions than blender
    • Better indication of product performance
  – Disadvantages
    • Time consuming - longer set up, test interval
    • Does not take into account temp, pressure
Field Development

Grams Fluid Displaced
7,500 cc/min Flow Rate
75% Water / 25% Condensate

Weight (grams)
0 20 40 60 80 100 120 140 160
Time (min)
30 60 90 120 150 180 210 240 270 300

RFO 06271  TF 5577  B6
Grams Fluid Displaced
7,500 cc/min Flow Rate
50% Water / 50% Condensate

Weight (grams)

Time (sec)

TF 5638W  DJ 1  DJ 4  Comp Product
Conclusions

• Product Development
  – Actual production fluids: water, condensate
  – More accurate test results

• More logistically demanding
  – Equipment, personnel, products shipped to locations
  – Onsite testing presents more challenges

End Result-Better Product for Customer !!!
Questions/Discussion

Jason Bell
BJ Chemical Services

Thank You!
Copyright

Rights to this presentation are owned by the company(ies) and/or author(s) listed on the title page. By submitting this presentation to the Gas Well Deliquification Workshop, they grant to the Workshop, the Artificial Lift Research and Development Council (ALRDC), and the Southwestern Petroleum Short Course (SWPSC), rights to:

- Display the presentation at the Workshop.
- Place it on the www.alrdc.com web site, with access to the site to be as directed by the Workshop Steering Committee.
- Place it on a CD for distribution and/or sale as directed by the Workshop Steering Committee.

Other uses of this presentation are prohibited without the expressed written permission of the company(ies) and/or author(s) who own it and the Workshop Steering Committee.
Disclaimer

The following disclaimer shall be included as the last page of a Technical Presentation or Continuing Education Course. A similar disclaimer is included on the front page of the Gas Well Deliquification Web Site.

The Artificial Lift Research and Development Council and its officers and trustees, and the Gas Well Deliquification Workshop Steering Committee members, and their supporting organizations and companies (here-in-after referred to as the Sponsoring Organizations), and the author(s) of this Technical Presentation or Continuing Education Training Course and their company(ies), provide this presentation and/or training material at the Gas Well Deliquification Workshop "as is" without any warranty of any kind, express or implied, as to the accuracy of the information or the products or services referred to by any presenter (in so far as such warranties may be excluded under any relevant law) and these members and their companies will not be liable for unlawful actions and any losses or damage that may result from use of any presentation as a consequence of any inaccuracies in, or any omission from, the information which therein may be contained.

The views, opinions, and conclusions expressed in these presentations and/or training materials are those of the author and not necessarily those of the Sponsoring Organizations. The author is solely responsible for the content of the materials.

The Sponsoring Organizations cannot and do not warrant the accuracy of these documents beyond the source documents, although we do make every attempt to work from authoritative sources. The Sponsoring Organizations provide these presentations and/or training materials as a service. The Sponsoring Organizations make no representations or warranties, express or implied, with respect to the presentations and/or training materials, or any part thereof, including any warrantees of title, non-infringement of copyright or patent rights of others, merchantability, or fitness or suitability for any purpose.