Implementing a Chemical EOR Project

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Casper, Wyoming
Implementing a Chemical EOR Project

Surface Facilities
A Key to Field Success
Presentation Overview

– The Goals of Facility Performance
– Facilities Design Parameters
– Process Flow Schematics
– Scope of Equipment & Services
– Fabricators
– Conclusions
Performance Requirements

- Define Facility Goals
  - Scale – pilot or full-field?
# EOR Chemical Injection Plant Design Parameters

<table>
<thead>
<tr>
<th>Parameter Description</th>
<th>Design Data</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Field Injection</td>
<td>5,000 to 7,000 BPD</td>
<td></td>
</tr>
<tr>
<td>Max. Inj. Pressure</td>
<td>1500 PSI</td>
<td></td>
</tr>
<tr>
<td>No. of Injection Wells (IW’s)</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>IW injection range, per well</td>
<td>500 to 2500 BPD</td>
<td></td>
</tr>
<tr>
<td>Does ea. IW require separate Injection control?</td>
<td>Yes, must be able to adjust Polymer concentration to ea. IW</td>
<td></td>
</tr>
</tbody>
</table>

## Chemical Design Data

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Polymer concentration injected</td>
<td>1800 ppm</td>
</tr>
<tr>
<td>Alkaline</td>
<td></td>
</tr>
<tr>
<td>NaOH (state % active)</td>
<td>No</td>
</tr>
<tr>
<td>Na₂CO₃</td>
<td>1.0 percent active</td>
</tr>
<tr>
<td>Surfactant No. 1</td>
<td>0.5 percent active</td>
</tr>
<tr>
<td>% active</td>
<td>50</td>
</tr>
<tr>
<td>Surfactant No. 2 or Solvent</td>
<td>% active</td>
</tr>
</tbody>
</table>

## Injection Water Data

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td>Total hardness</td>
<td>450 ppm</td>
</tr>
<tr>
<td>Surface temperature range</td>
<td>20 - 25°C</td>
</tr>
</tbody>
</table>

## Environmental Data

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td>Geographical location</td>
<td>Texas</td>
</tr>
<tr>
<td>Ambient temperature range</td>
<td>0 - 33°C</td>
</tr>
<tr>
<td>Humidity range</td>
<td>10 to 100 R.H.</td>
</tr>
<tr>
<td>Elevation</td>
<td>500 Ft. MSL</td>
</tr>
</tbody>
</table>

## Facility Type

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td>Modular skid building</td>
<td>Yes</td>
</tr>
<tr>
<td>Max. module width / length (for transportation issues)</td>
<td>16’ W X 60’ L</td>
</tr>
<tr>
<td>Permanent building w/ concrete floor</td>
<td>No</td>
</tr>
</tbody>
</table>

## Other:

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
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<tbody>
<tr>
<td>Seismic Zone 2</td>
<td></td>
</tr>
</tbody>
</table>

Performance Requirements

- Define Facility Goals
  - Scale – pilot or full-field?
    - Modular & Mobile
    - Expandable
    - Non-mobile & Permanent
Design Requirements...

- Operating Logistics
- Raw Chemical Receiving & Handling
Design Requirements...

- Operating Logistics
  - Raw Chemical Receiving & Handling
  - Operator Oversight
    - Full-Time
    - Part-Time
Site Infrastructure Inspection

- Water Source
  - Required water treatment
- Facilities Location
  - Chemical & Process facility
  - Supply tanks
  - Delivery truck access
- Electrical Power
- Flow Line & Injection Header
Talk It Through

• **Design Meetings are a must-have**
  • Decide what is necessary
  • Define expectations
    • Scope of Equipment Supply
      • Primary Equipment & System
      • Spare Parts
  • Services
    • Pre-Fabrication Design Drawings
    • Factory Testing
    • Installation, Start-up & Operator Training
    • Warranty Support
Talking It Through...

• Know your limitations
  • Local service providers
    • Contractors, pipe-fitting, electrical
    • Cranes & rigging
  • The selected fabricator
    • EOR Experience
    • Design & Engineering
    • Codes & Standards
    • Field Support
Process Flow Diagrams
Typical Polymer Flood – Process Flow Diagram

Multi-Well Distribution Header

Low Pressure Suction Header, concentrate polymer solution and dilution co-
mixed and dispersed w/ in-line mixer prior to final filtration.

Magnetic Flow Meter, may be installed on suction of individual
injection pump

From Polymer PD
Metering Pump, variable rate as required, pressure as required

For clarity, not all manual valves, pressure gauges and fittings are shown.

Typical for Multi-
Injection Wells
To I.W.

Proportional Loop
Control – polymer concentration to well is automatically
controlled by PLC
Typical Facilities

- Raw chemical storage & handling
Typical Facilities

• Raw chemical storage & handling
• Chemical processing
Typical Facilities

- Raw chemical storage & handling
- Chemical processing
- High Pressure Injection
Typical Facilities

• Raw chemical storage & handling
• Chemical processing
• High Pressure Injection
• Automation & Data Management
Typical Facilities

- Raw chemical storage & handling
- Chemical processing
- High Pressure Injection
- Automation & Data Management
- Facility Start-Up & Commissioning
Typical Facilities

- Raw chemical storage & handling
- Chemical processing
- High Pressure Injection
- Automation & Data Management
- Facility Start-Up & Commissioning
- Operator Training
Conclusions

- Purpose designed & built
  - Pre-design communications
  - Stake holder collaboration
- Operator training
  - Understanding the process
    - Lab to Field
    - Quality fluids down hole
    - Meaningful data = accurate interpretation