

Polymer Injection Project in an Unconsolidated Sandstone in Neuquén Basin, Argentina*

Federico Hochenfellner¹

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¹Pluspetrol (fhochenfellner@pluspetrol.net)

Abstract

El Corcobo Norte Field (Neuquén Basin, Argentina) was selected for a polymer injection pilot that started early in 2012. Being an unconsolidated sandstone, medium-heavy oil reservoir, the field was developed through cold production with sand (CHOPS) and with waterflooding as a main drive. After EOR technologies screening, two processes were selected to improve oil recovery in El Corcobo Norte Field: ASP and Polymer flood. Polymer injection pilot has been running for five years and remains under evaluation. However, information already obtained from the project is considered reliable enough to propose an expansion phase for this project. The current presentation will focus on the design, execution and evaluation of a polymer injection pilot, as well as an overview of the field expansion.



AAPG

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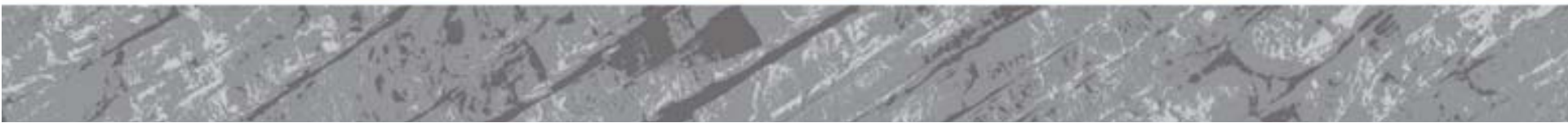
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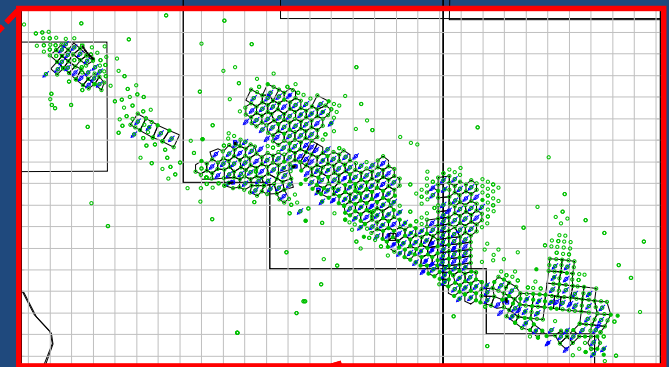




Agenda

- **Introduction: El Corcobo Norte Field**
 - **Polymer Pilot Design**
 - **Pilot Operation**
 - **Pilot Results**
 - **Summary**
 - **Next Steps**
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El Corcobo Norte Field



Reservoir Characteristics

- Basin Edge
- Coastal plain fluvial sandstones
- Stratigraphic Trap
- Low angle truncation
- Lateral facies changes

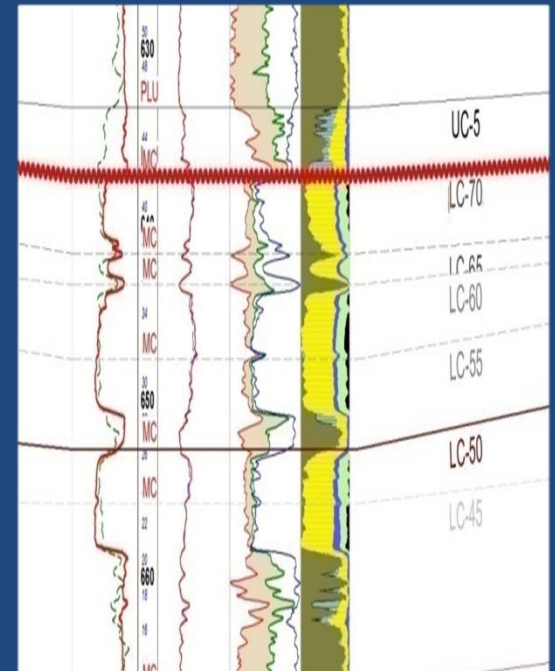
El Corcobo Norte Field

Reservoir Characteristics

- Shallow reservoir (2150ft)
- Unconsolidated sandstone
- Good lateral continuity - Up to 60ft of net pay
- High porosity (30%) and permeability (0.5 - 4.0D)
- Strongly water-wet rock
- Low reservoir temperature (38°C / 100°F)

Fluid Characteristics

- Medium-heavy oil (160 – 300 cP live Oil; 18 °API)
- Pb: 330 psi / Rsi: 7 m³/m³
- High Total Acid Number (TAN > 4mg KOH/gr oil)
- Moderate formation water salinity (46,000 ppm TDS)






El Corcobo Norte Field

Development & Field Operation

- Production started in 2005
 - Waterflooded from early beginning (2007)
 - Inverted seven spot patterns (20 acres well spacing)
 - Sand production/management
 - Wormhole generation
 - Injector – Producer “Short Circuit” – Main challenge
 - 650 Producers Wells
 - 350 Injector Wells
 - Production:
 - Liquid rate: 200000 bbl/d
 - Oil rate: 28000 bbl/d
 - Injection rate: 195000 bbl/d
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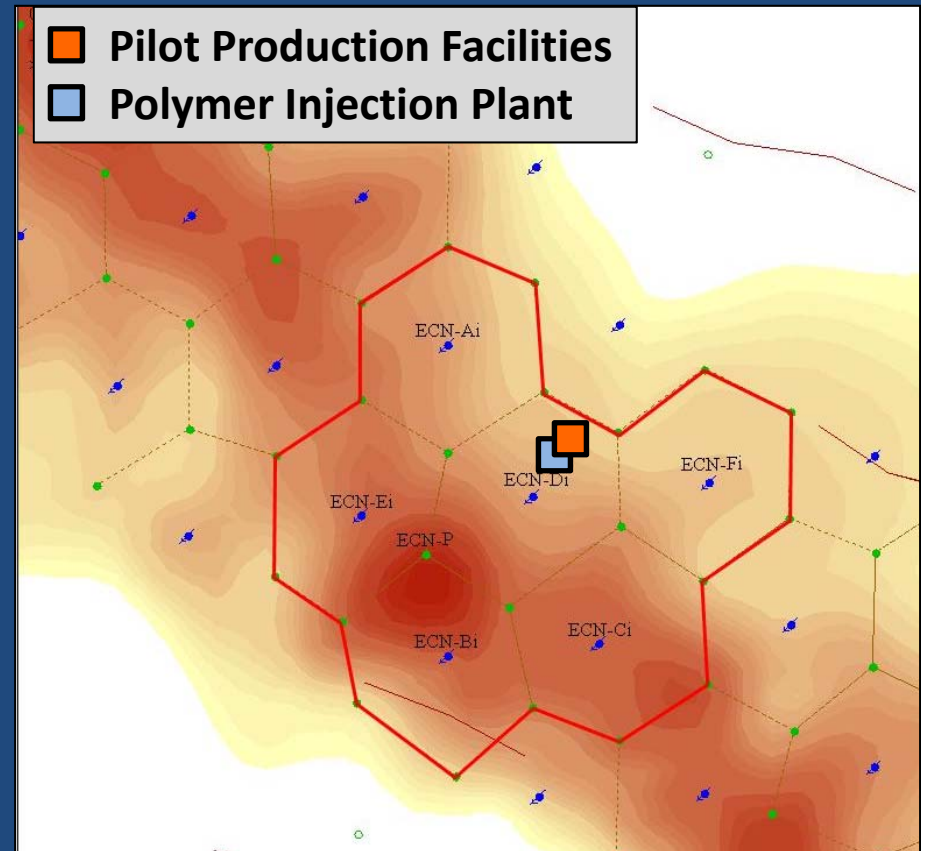
Polymer Pilot Design

➤ 6 Inverted Seven Spot Patterns

- 6 Injector Wells
- 22 Producer Wells
- 20 acres well spacing
(950ft between wells)

➤ Initial Production Conditions

- Liquid Rate: 8,500 bbl/d
- Oil Rate: 1,400 bbl/d
- Water Cut: 84%
- Dedicated Production Facilities



Polymer Pilot Design

Pilot Production Facilities

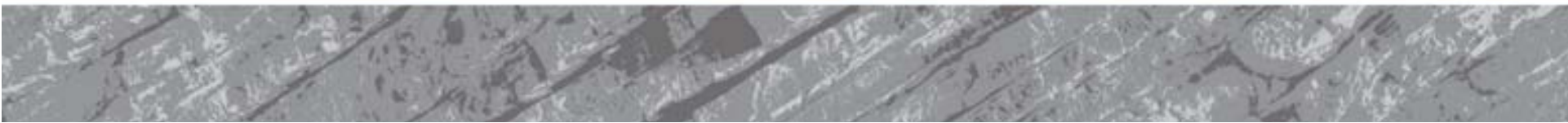
Polymer injection plant



- **Polymer:**
 - **Standard HPAM**
 - **High molecular weight (~20MMDa)**
- **Water: Softened Fresh Water**
- **Polymer concentration: 550ppm**
- **Viscosity Target : ~20 cp (@ 7 1/S, 38°C)**
- **Total injection Rate: 5200 bbl/d:**
- **Operational capabilities:**
 - **Injection rate adjusted well by well (Automatic control)**
 - **Polymer concentration selected well by well**



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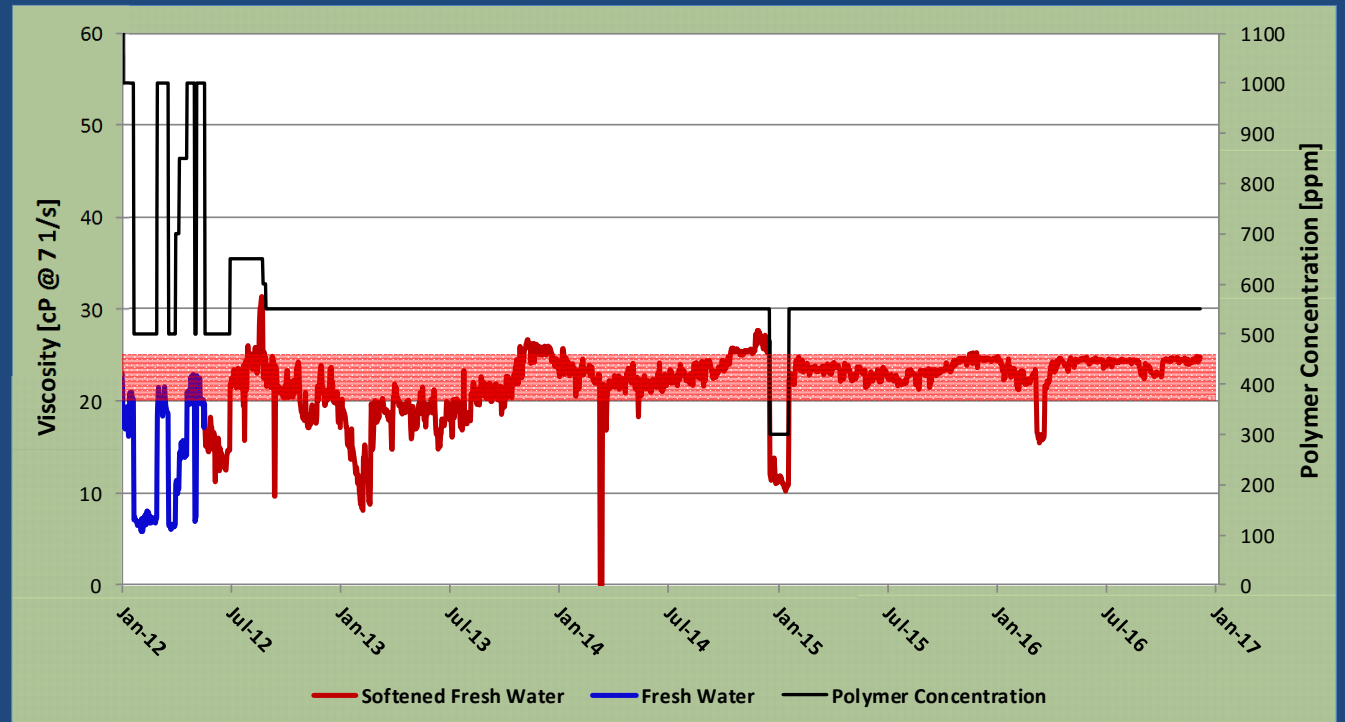
- **Pilot Operation**

Polymer Viscosity

Polymer Injection Rate

Pilot Operation

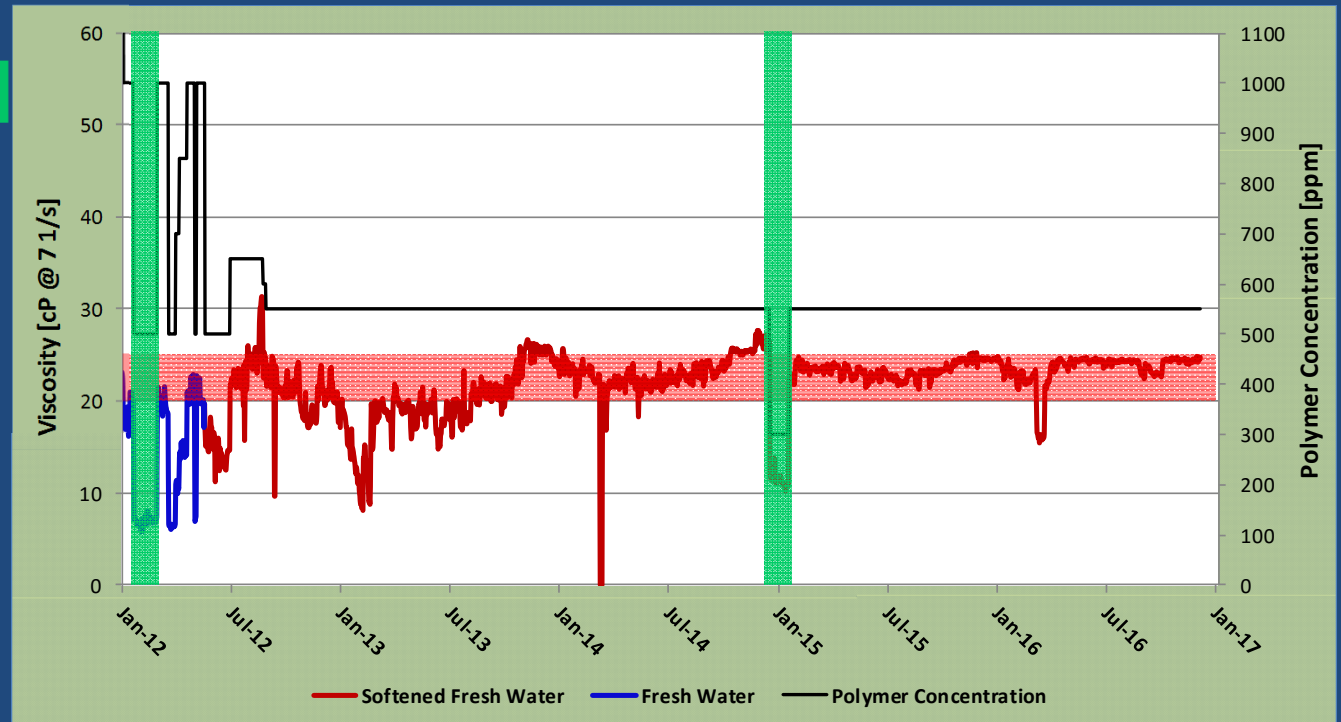
➤ Polymer viscosity
Target: 20-25 cP



Pilot Operation

➤ Water viscosity
Target: 20-25 cP

Polymer supply issues

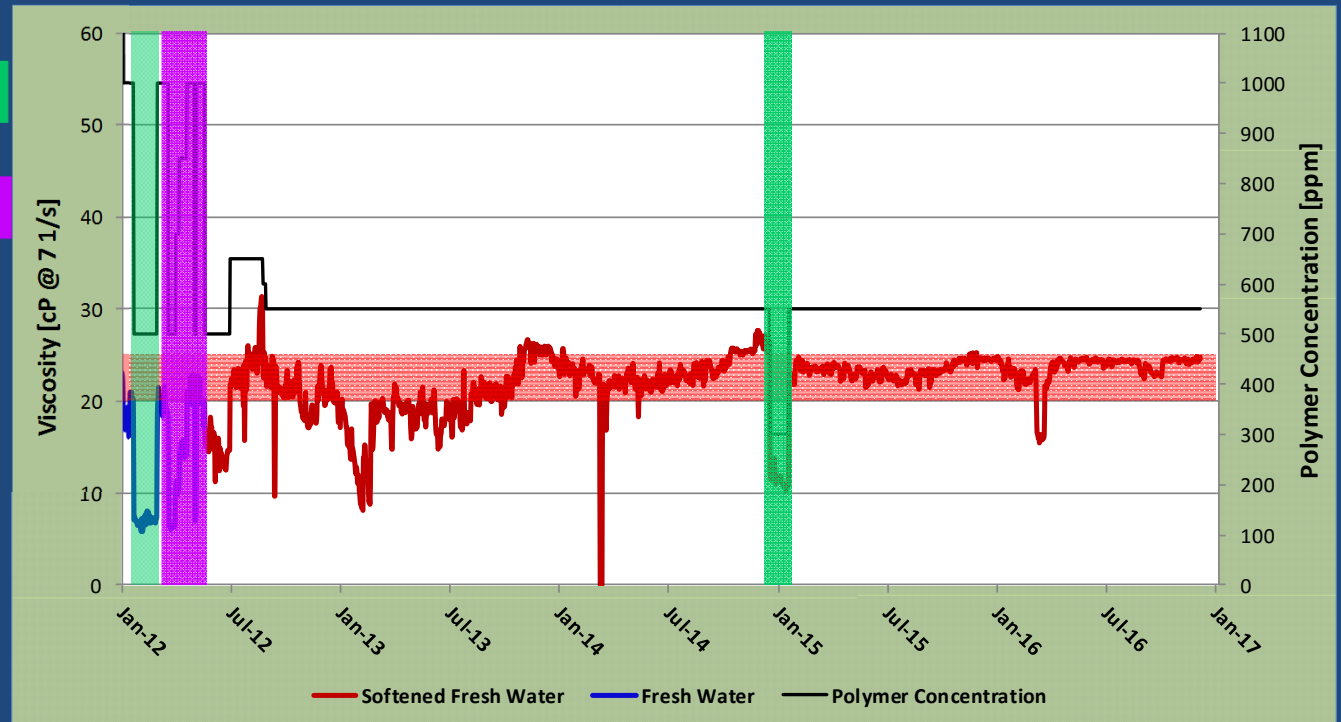


Pilot Operation

➤ Water viscosity
Target: 20-25 cP

Polymer supply issues

Softening plant start up



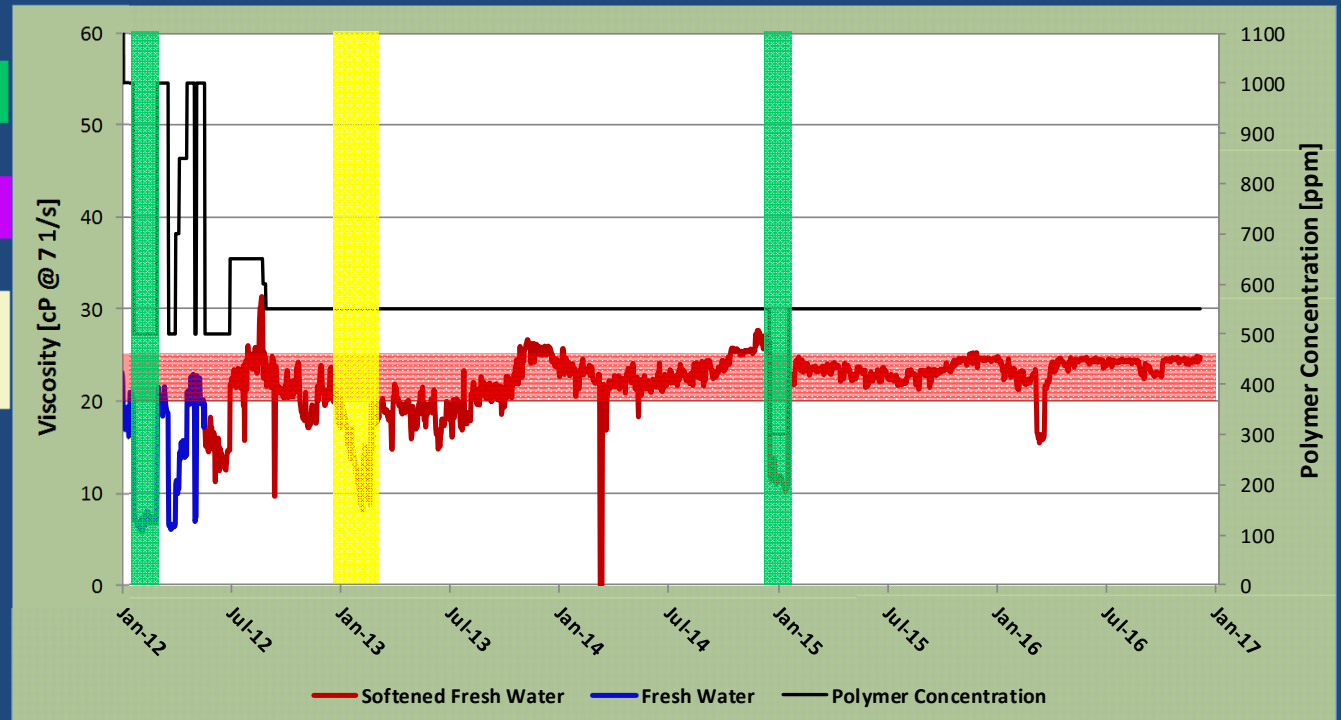
Pilot Operation

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Target: 20-25 cP

Polymer supply issues

Softening plant start up

Polymer degradation
(H₂S in blanketing gas)



Pilot Operation

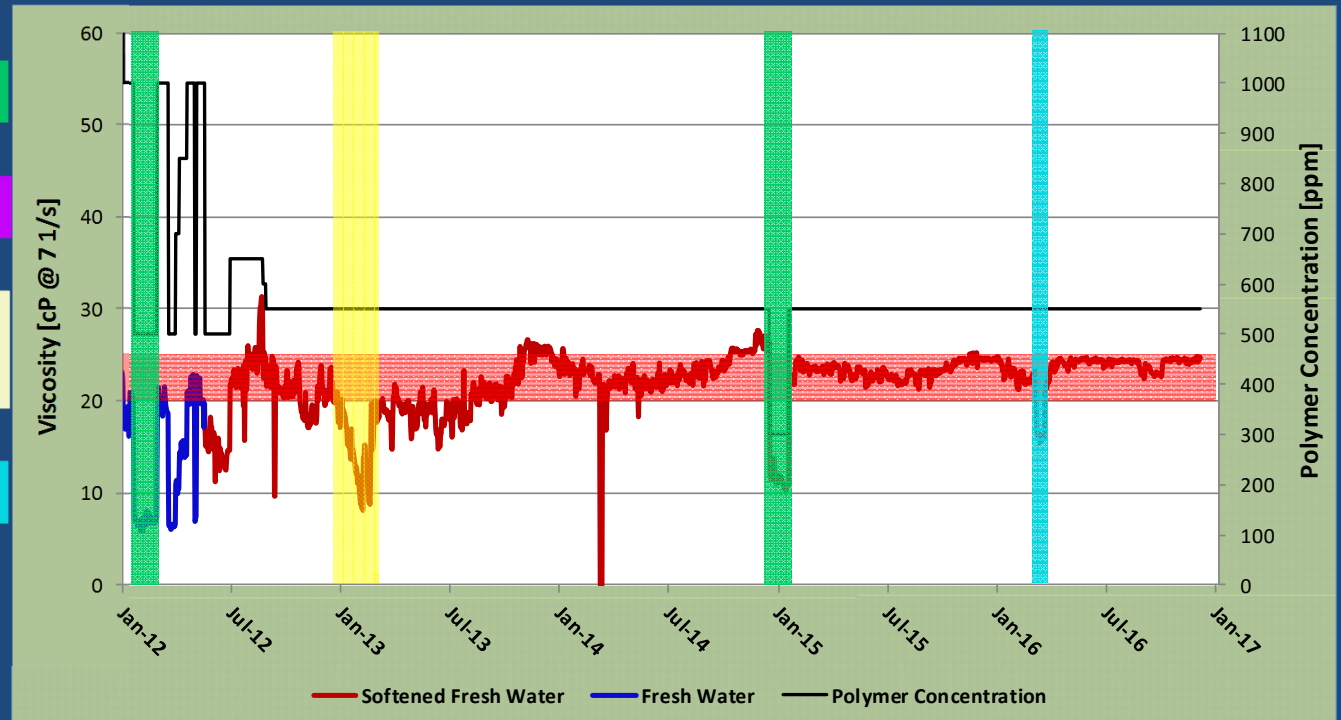
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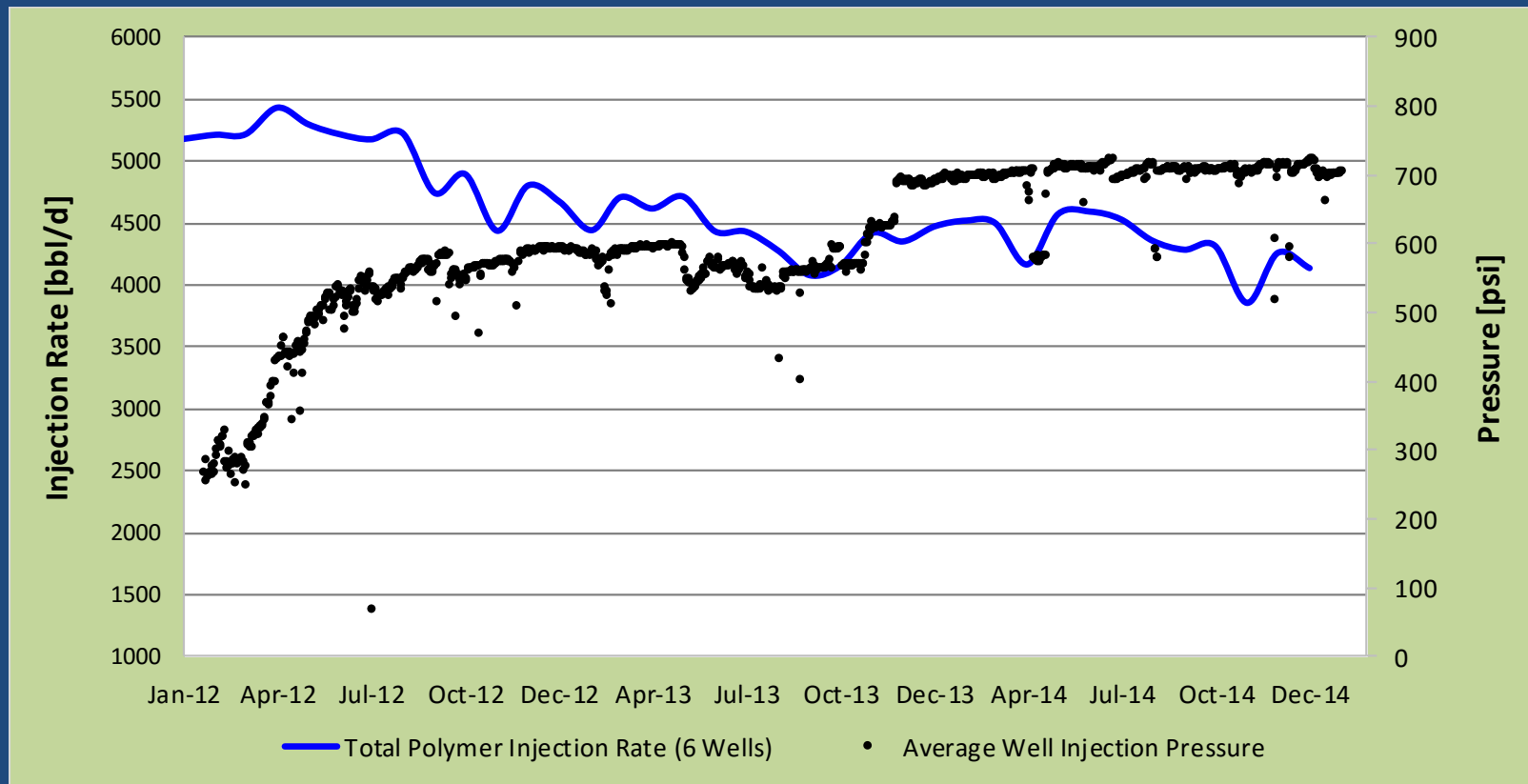
Polymer degradation
(H₂S in blanketing gas)

Alternative polymer test

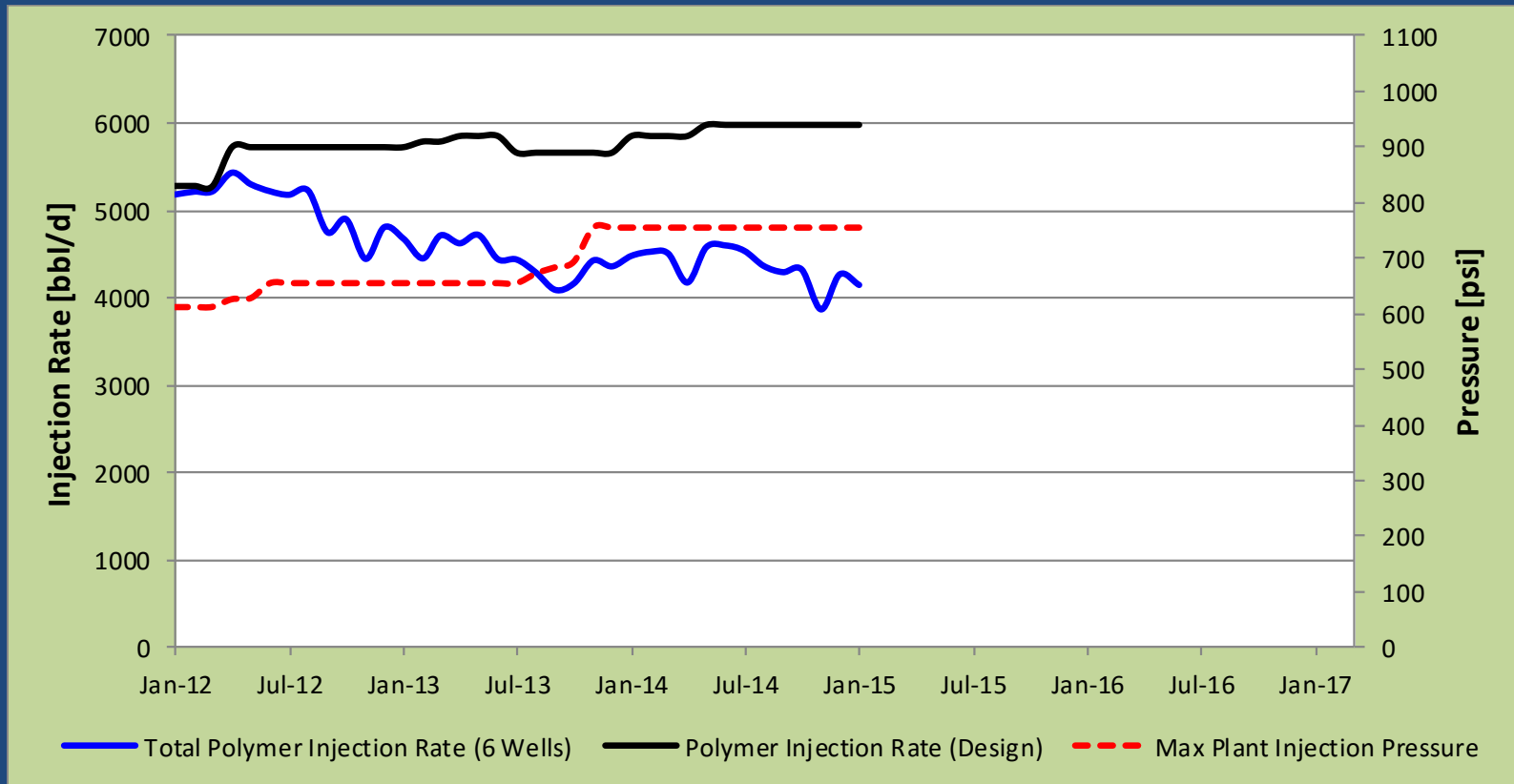


Pilot Operation

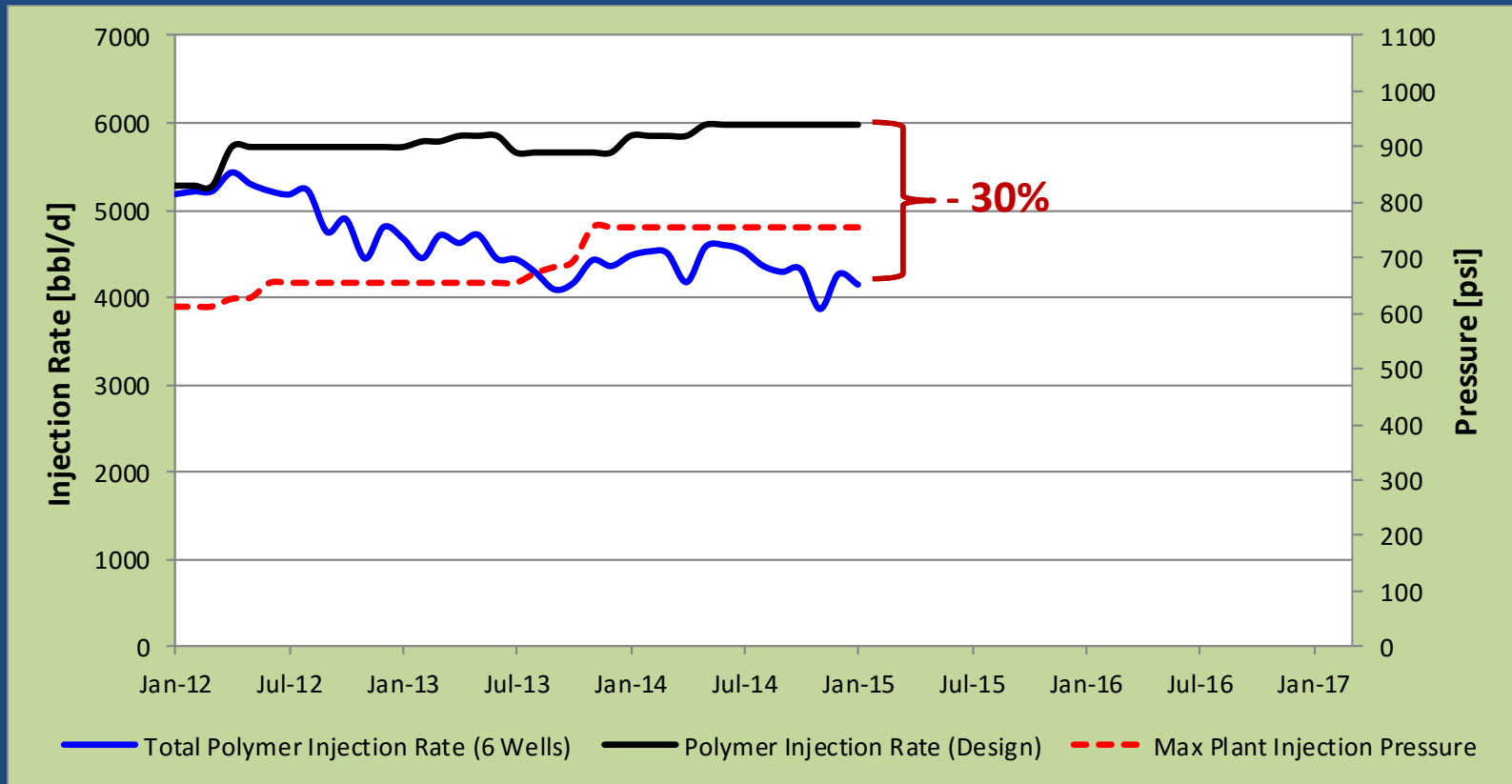
Polymer Injection Rate



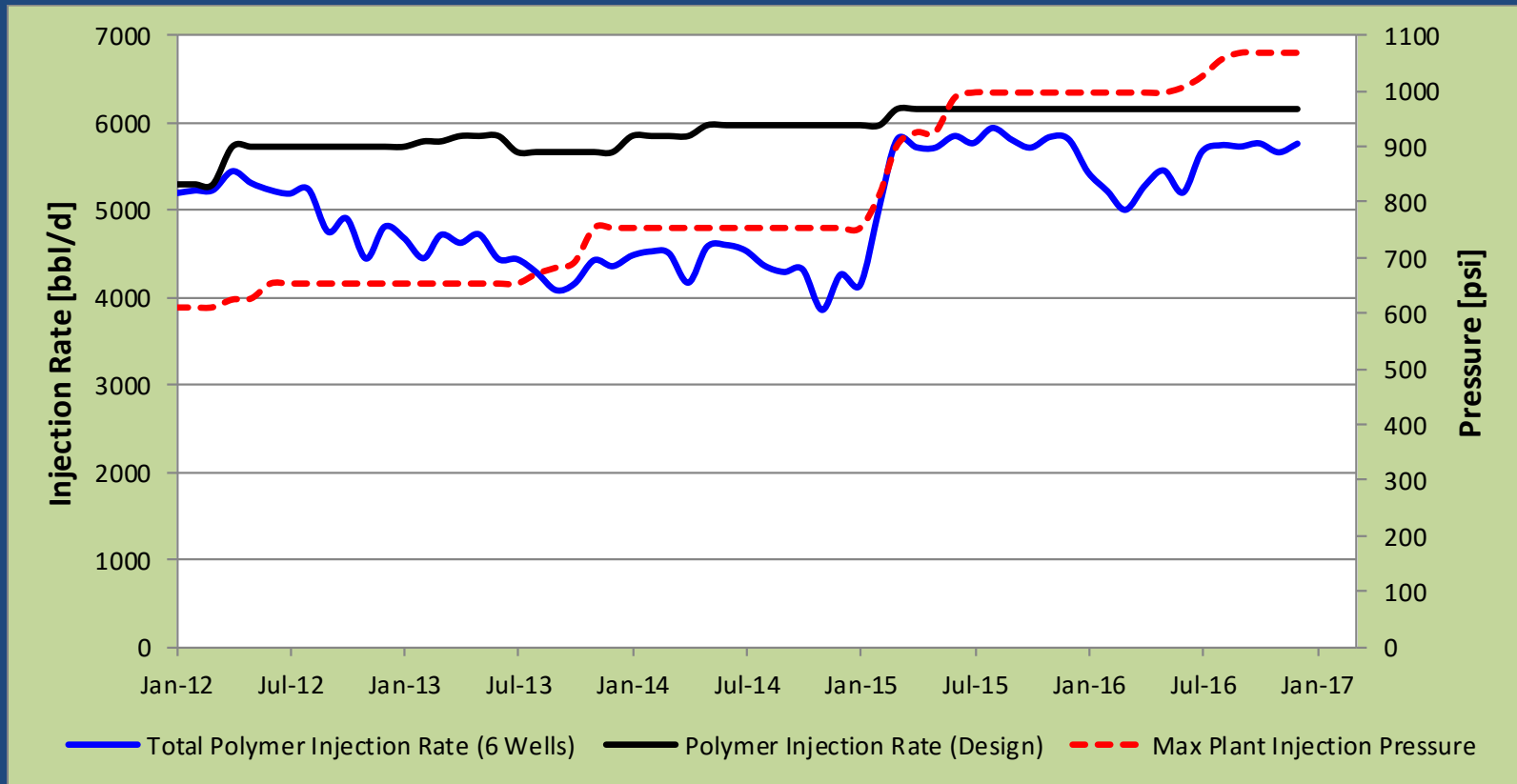
Pilot Operation



Pilot Operation

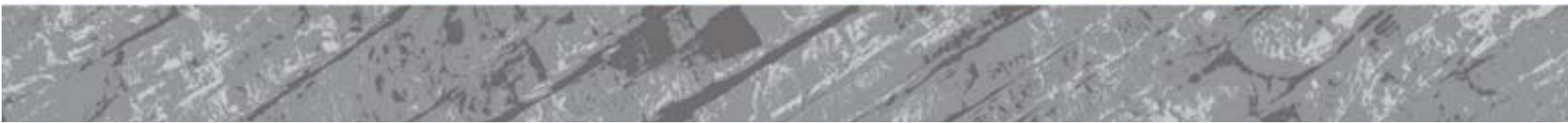


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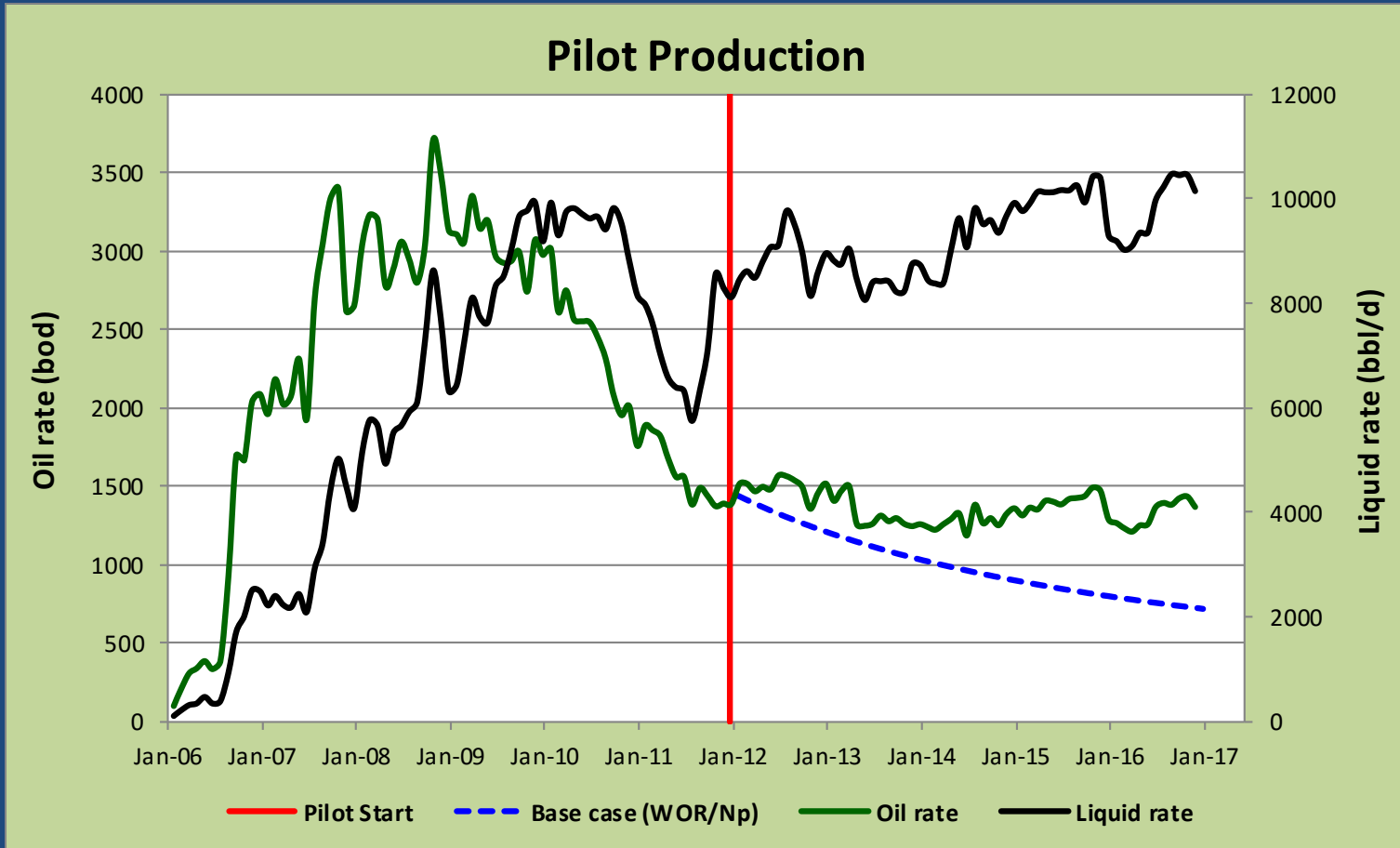




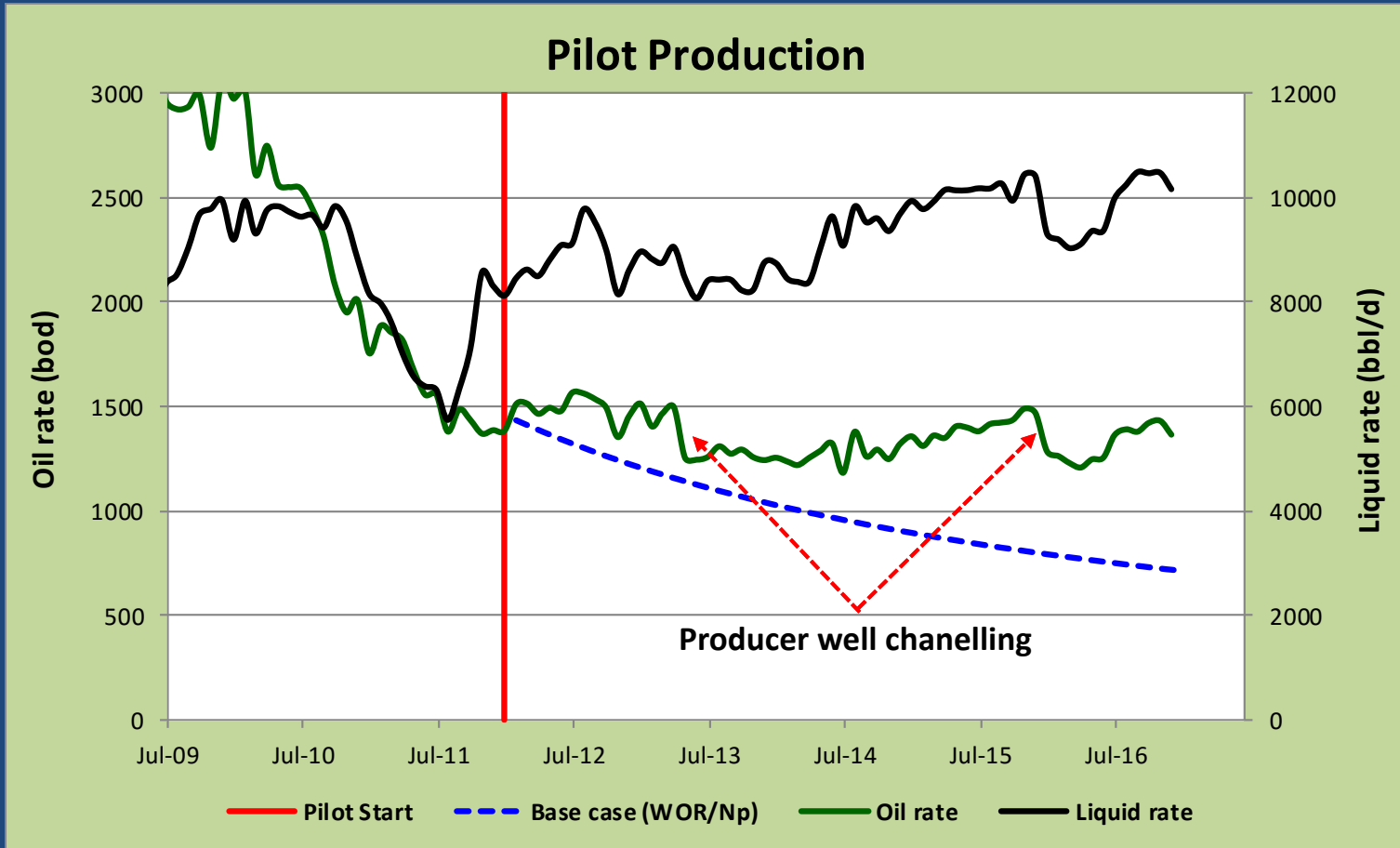
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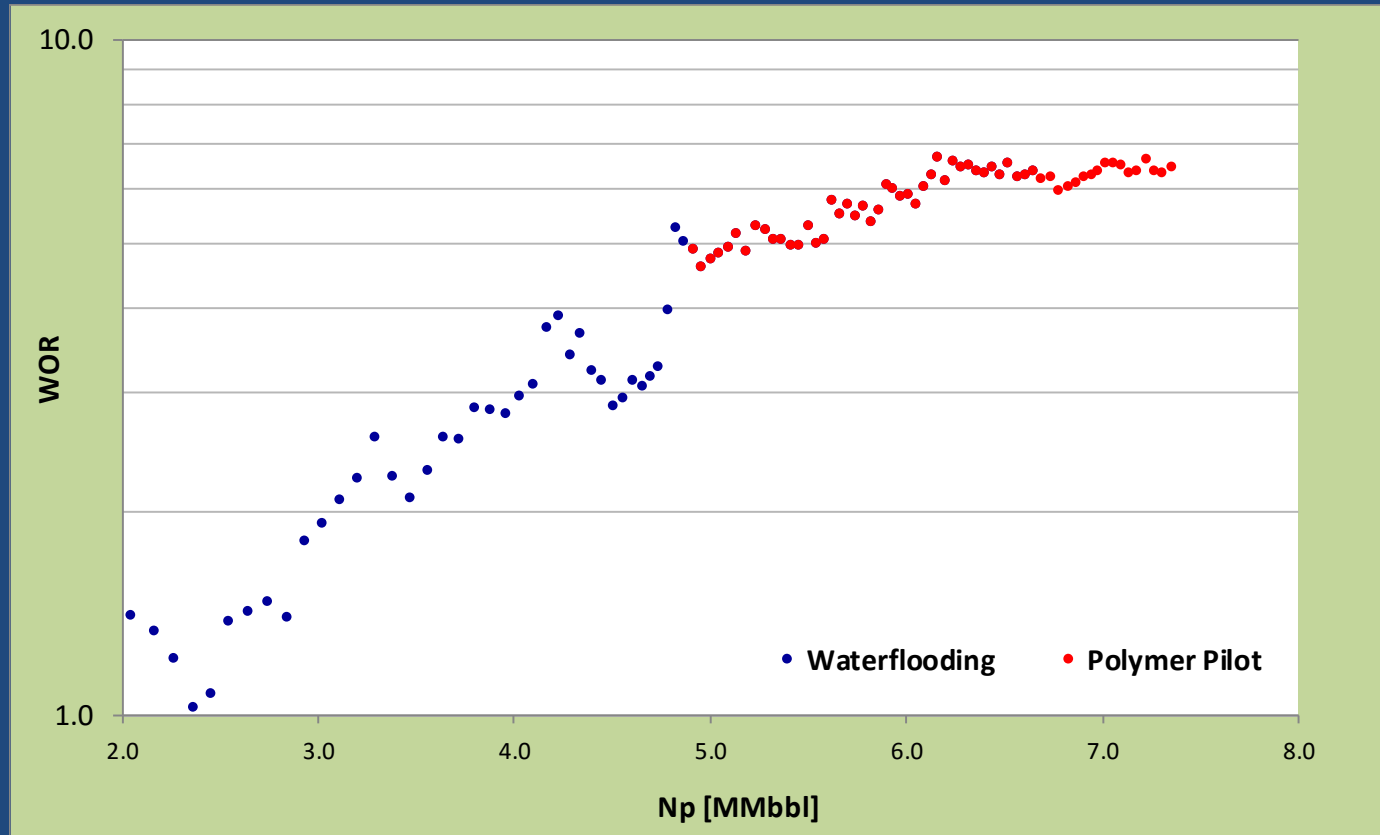
Pilot Results



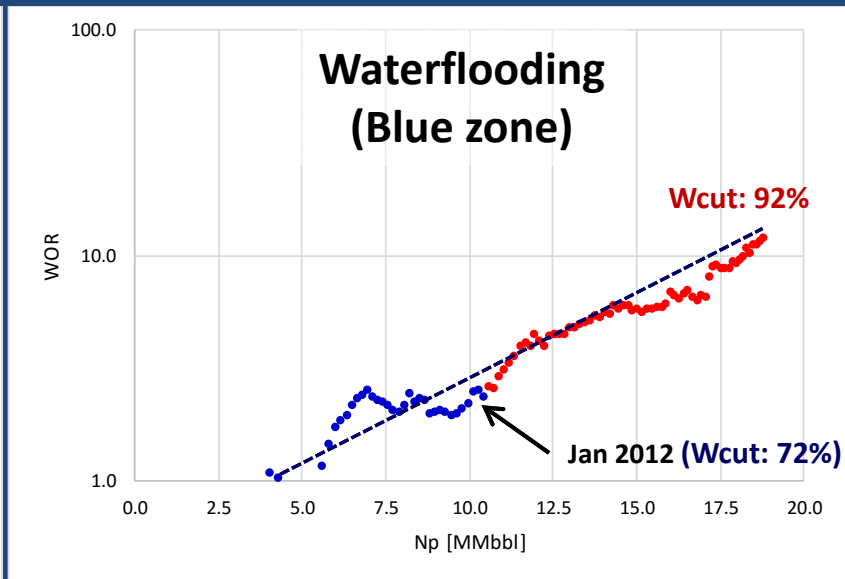
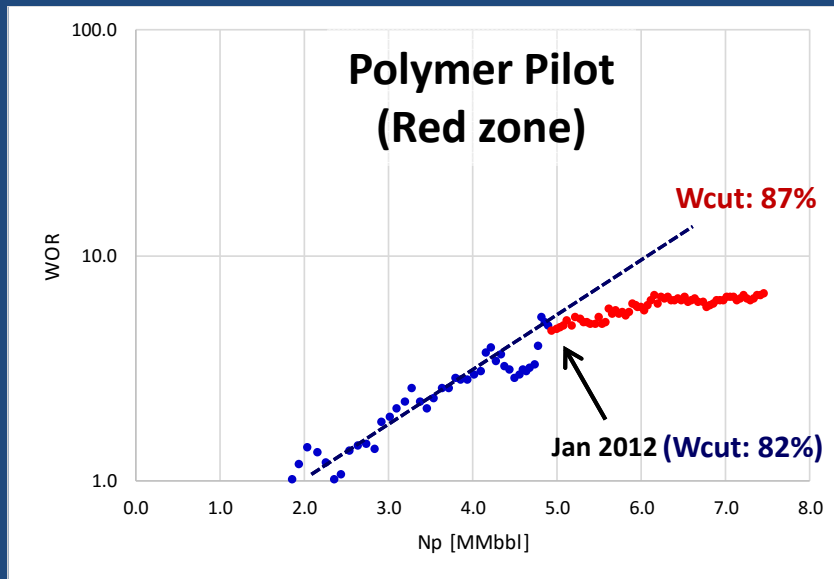
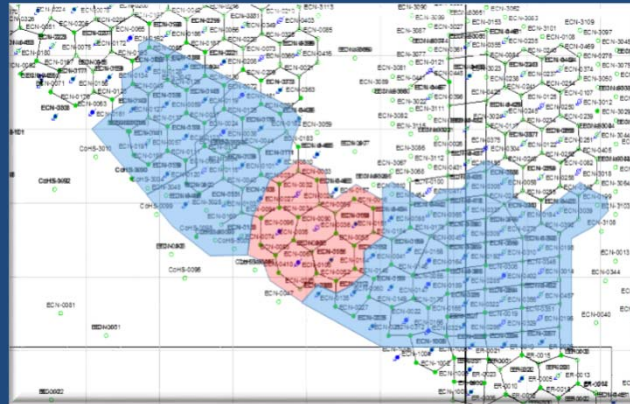
Pilot Results



Pilot Results




Pilot Results






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Summary

Pilot Operation:

- Viscosity target has been achieved from the beginning
 - Injection rate target could be reached through the increase of the injection pressure
 - Production treatment did not present any problem
- 



Summary

Pilot Operation:


- Viscosity target has been achieved from the beginning
- Injection rate target could be reached through the increase of the injection pressure
- Production treatment did not present any problem

Pilot Results:

- Positive production results have been proved
- 



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Next Steps

- Polymer pilot will continue until the project has been fully evaluated
 - An expansion project is currently under consideration
(Increasing the injection rate up to 44000 bbl/d)





Next Steps

- Polymer pilot will continue until the project has been fully evaluated
 - An expansion project is currently under consideration
(Increasing the injection rate up to 44000 bbl/d)
- ASP injection is being studied to further increase recovery factor
 - ASP pilot would be evaluated after polymer injection

