

Enhanced Operational Efficiency Combining Gas Lift with Flow Improver

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ALRDC Gas Lift Workshop June 20-23, 2022









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Synergistic Solution

- Hybrid lift approach using chemical flow improvers in conjunction with conventional gas lift
- Used in pre-identified and selected wells/scenarios
- Ultimate goal = improve flowing conditions to optimize existing gas lift
- ROI based on bridging the gap between theoretical VLP vs actual – Typical outcomes are an uplift of 20% gross fluid production

GAS LIFT + FLOW IMPROVER = SALES & OPEX





What is Foam?

- Object formed by trapping pockets of gas within a liquid/solid.
- Many types we interact with daily











Gas Lift Flow Improver

• A GLFI reduces the velocity required to lift fluids out of a wellbore Reduces fluid column density and slippage ("lightens" fluid load)





GLFI Assists Gas in Lifting Fluids to Surface



Gas is colloidally dispersed into a continuous liquid phase

Candidate Selection/Field Trial

- Picking the right well
- Selecting the correct chemistry/concentration
- Determining application
- Setting the right trial and monitoring plan
- Interpreting the results
- Extrapolating results to the rest of the field

Candidate Well Selection

- Modeled to be below critical rate
- Departure from expected VLP curves
- Gas lift system bottlenecks
- Irregular production/flow patterns

Selecting the Right Chemistry/Concentration

Benchtop Qualification Testing

- Bottle Test
- Waring Blender
- Sparge/Small Column •
- Large Column •
- Surface Tension •

Material Compatibilities

- Metallics
- Non-metals

Fluid Compatibilities

- Water-in-oil emulsion tendency Oil-in-water emulsion tendency

Physical Properties

- Flash Point/Gunking Tendency (application specific) Viscosity (chemical pump requirements)
- Pour Point (winterization)

• Percent Hydrocarbons

- More hydrocarbons = higher flow improver concentrations needed

- Hydrocarbon Composition
 - -Aromatic content has greatest (negative) impact
- Brine Chemistry \bullet

-TDS and TSS increase the weight of the fluid to lift and impact lamella

Velocities \bullet

- Excessive shear can impact foam stability both ways

Picking Application (Continuous)

Field Trial (Monitoring)

- Establish key surveillance metrics
 - Production parameters (P, T, Q)
 - Gas lift volumes
 - BS&W values
 - OIW values
 - Vessel levels/visual observations
- Record baselines
- Initiate flow improver injection at desired PPM
- Adjust in stepped intervals and build foamer response curve, recording data at each step
 - Response time may vary based on application method used
- Once flow improver concentration is optimized, adjust gas lift volume down until production parameters just begin to decline

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Measuring Success

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Return on Investment (ROI)

- Typical successes range from 20%+ more production
 - SPE-184217-MS
 - SPE-189201-MS
 - SPE-195452-MS
- Success will be situation and well dependent

* Actual Delaware Basin examples without gas lift optimization
* * ROI based solely off liquid production increase via GLFI

Dosage (ppm)

Production Summary

Actual Total Prod — Estimated Prod

Initial BTFD	Average Increase BTFD	Average Uplift (%)
606	254	42
550	193	35
769	200	26
810	129	16
1126	135	12
581	41	7
1279	76	6

Thank You!

We welcome your questions!

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