2025 GAS LIFT WORKSHOP

Utilizing Dissolvable Barriers to Pilot Life of Well Gas Lift

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Acknowledgements

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Agenda

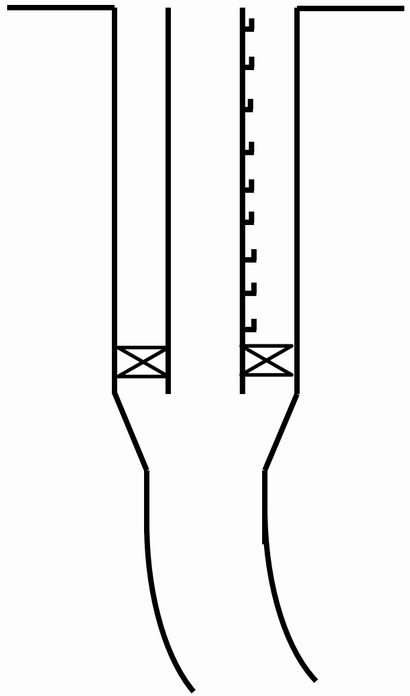
- Problem Statement
- Review of Current First Lift Gas Lift Practices
- Trial Well Information
- IPR/VLP Design Review for Trial Well
- Evaluation of Conventionally Available Options
- Planning Dissolvable Barrier System on the Trial Well
- Dissolvable Gas Lift Valve Protection
- Trial Well Implementation and Results
- Forward Plan/Conclusion
- Questions?

Problem Statement

- After Reviewing Past Gas Lift Artificial Lift Installations in Target Bench, Operator Sought to:
  - Reduce Initial Capex Expenditure on Gas Lift Initial Installs
  - Reduce Emissions and Electrical Usage Associated With Gas Lift Gas Compression
  - Maximize Initial Drawdown Potential
  - Maintain Current TTM Efficiencies
  - Prevent need for planned tubing downsize

Standard First Lift Gas Lift Installation

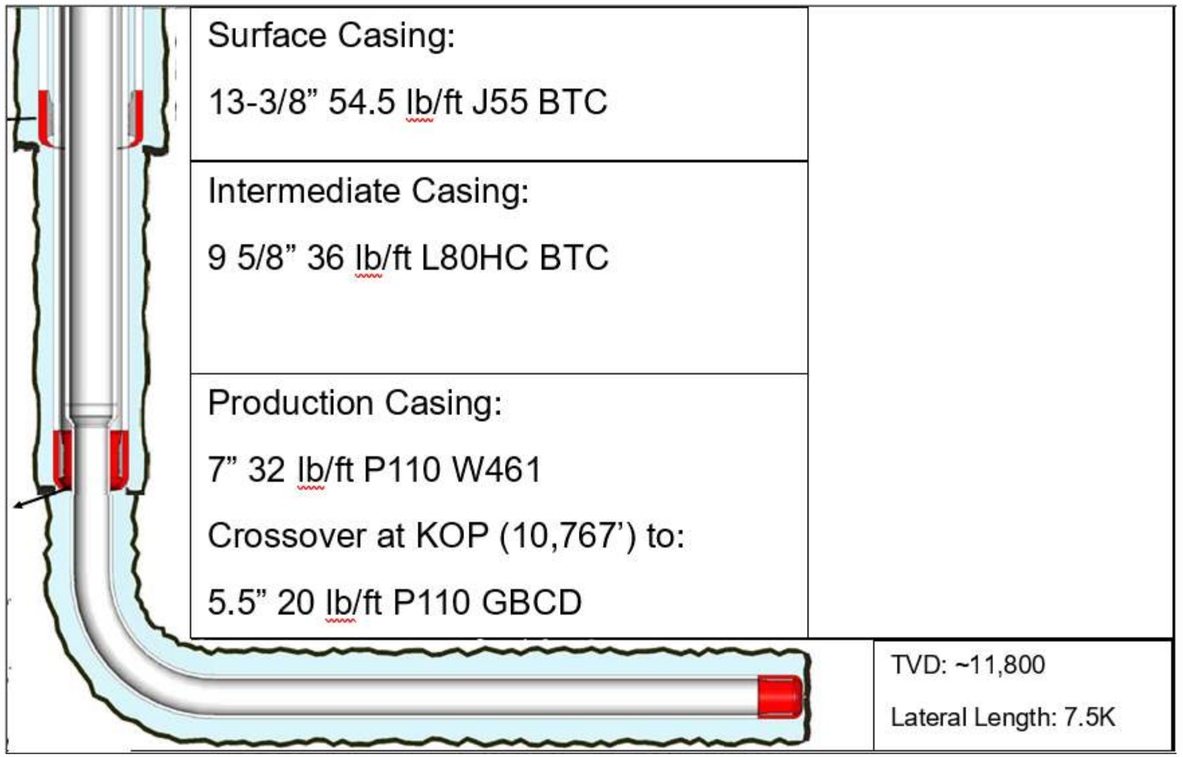
- 3.5” Tubing, Conventional Gas Lift (GL), and Packer Installed Prior to Flowback:
  - Advantages:
    - Net Time to Market (TTM) Improvement
      - Utilization of SIMOPs to allow for installation simultaneous to cleanout on adjacent pad
      - 1 day needed for swap to GL from flowing instead of 4 days for gas lift install
    - Flow Stability
    - Capstring and Downhole Gauge Present Day One when Desired
  - Disadvantages:
    - Increased Compression Requirements until Tubing is Downsized
      - Increased Electricity Usage and Emissions
    - Higher Capex Requirement Initially
      - Increased in Tubing Cost from 2-7/8” to 3.5”
    - Differential Pressure Effects Choking Back Well if it Overperforms Expectation



Prospective Trial Well Information

- Basin: Midland Basin
- Production Casing: 7” x 5.5”
- TVD: 11,800’
- Expected Total Fluid (1st Month): 2700 BFPD
- Expected GLR: 2300 scf/bbl

- Due to available annular capacity, evaluated options to flow well annularly prior to installing 2-7/8” Conventional Gas Lift



IPR/VLP Evaluation of 2-7/8” Annular Flow

Early Life: Fit Inflow Performance and Vertical Lift Performance Curve using Type Curve and Prospective Well Date

- 2700 BFPD, 900 GLR, 1.5 WOR
- Tuned using offset well with downhole gauge

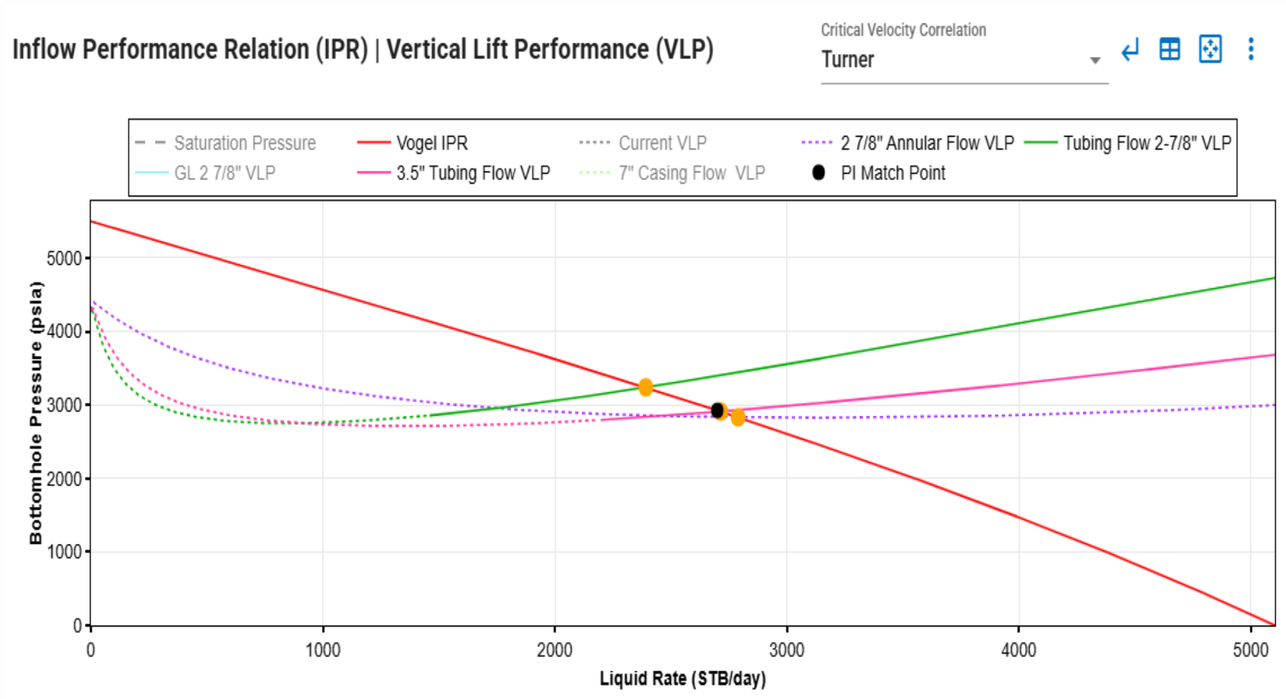
Comparison to 2-7/8” Annular flow

- 2-7/8” tubing flow chokes back 325 BFPD

Mid Life: Comparison at Conversion from 2-7/8” Annular flow to 2 7/8” Gas Lift:

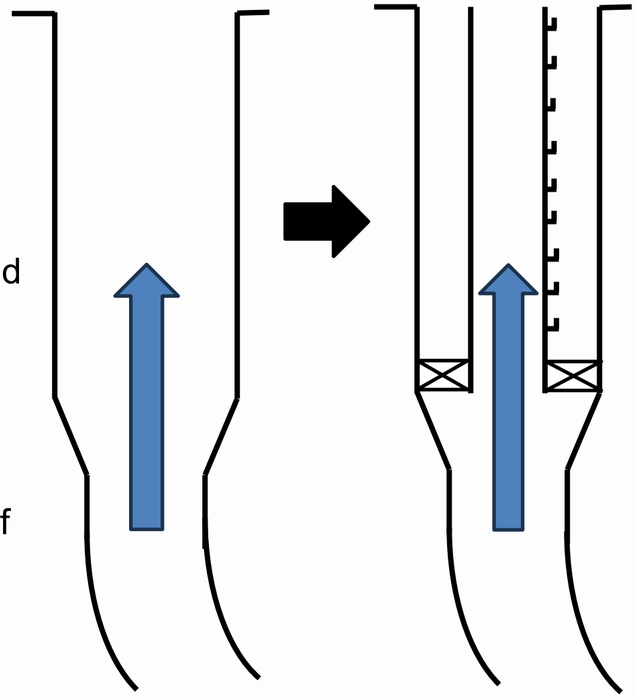
- Modeled the Optimal Rate to swap to 2-7/8” GL: 1000 BFPD
  - At 1000 BFPD, 3.5” Gas Lift models at 50-125 psi lower FBHP until 400 BFPD, but does require 33% more lift gas as the well declines
    - Production Delta at 1000 BFPD: 120 BFPD

30 Day IPR/VLP Curve

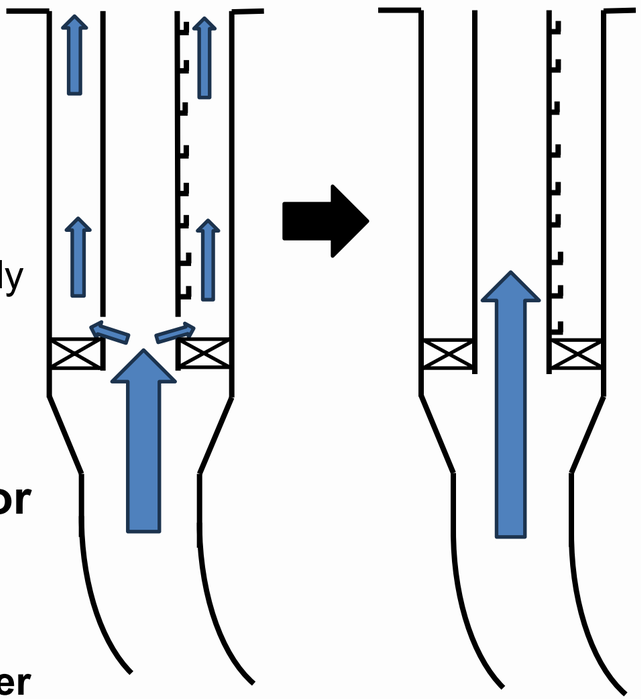


Initially Discussed Options to Downsize to 2 7/8” Tubing

- Free Flow to 2-7/8” GL
  - Process:
    - Free flow well up casing
    - Once within the range of liquid loading, install GL
  - Disadvantages:
    - Loss of TTM advantage from current methodology
    - Potential to choke back well if well loads up early due to facility shut-in

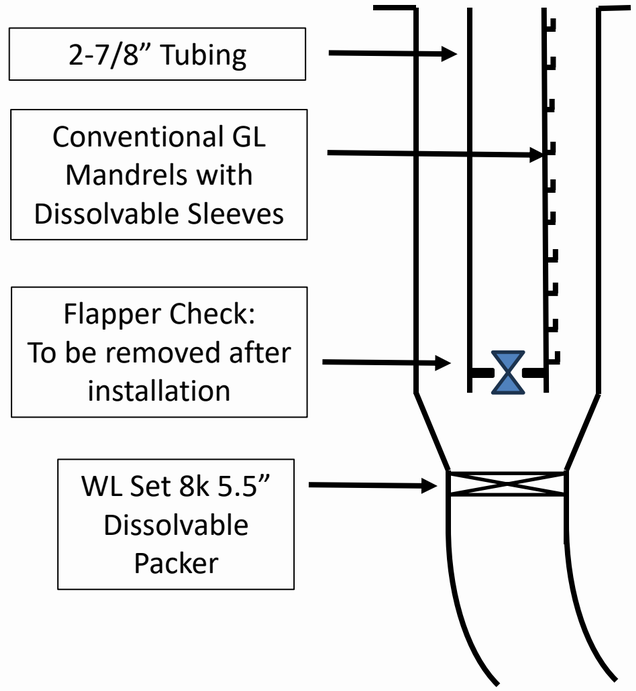


- 2 7/8” GL Day One
  - Process
    - Unlatch from packer initially and flow annularly
    - Latch onto packer once ready for gas lift
  - **Packer needed for lift install pre-flowback for well control**
  - Disadvantages:
    - **Sand Buildup on Packer**
    - **Potential Valve Damage**



Revised First Lift Plan Utilizing Dissolvable Barriers

- Worked with vendor and gas lift provider to address concerns with unprotected conventional valves by utilizing external dissolvable gas lift mandrel sleeves timed to dissolve over the course of 45 days
- To allow for pre-gas lift annular flow, a dissolvable packer was planned with a pump out plug pinned for 1725 psi, designed to dissolve over 3 days
  - To mitigate risk, planned to have kill-weight fluid on location and had a flapper check installed in the seat nipple of the tubing to allow for one way flow down tubing in the event of loss of pressure control
- Due to long term nature of installation, included DH equipment needed to eventually convert well to PAGL



Dissolvable Valve Barrier

Concept

- **Dissolvable Barrier Sleeve:** Attaches to valve body to cover and protect inlet ports.
- **Functionality:** Exposed to annular production fluid, the sleeve dissolves after a pre-determined period, enabling normal injection.

Trial Requirements

- Ensure 45 days of protection during annular flow.

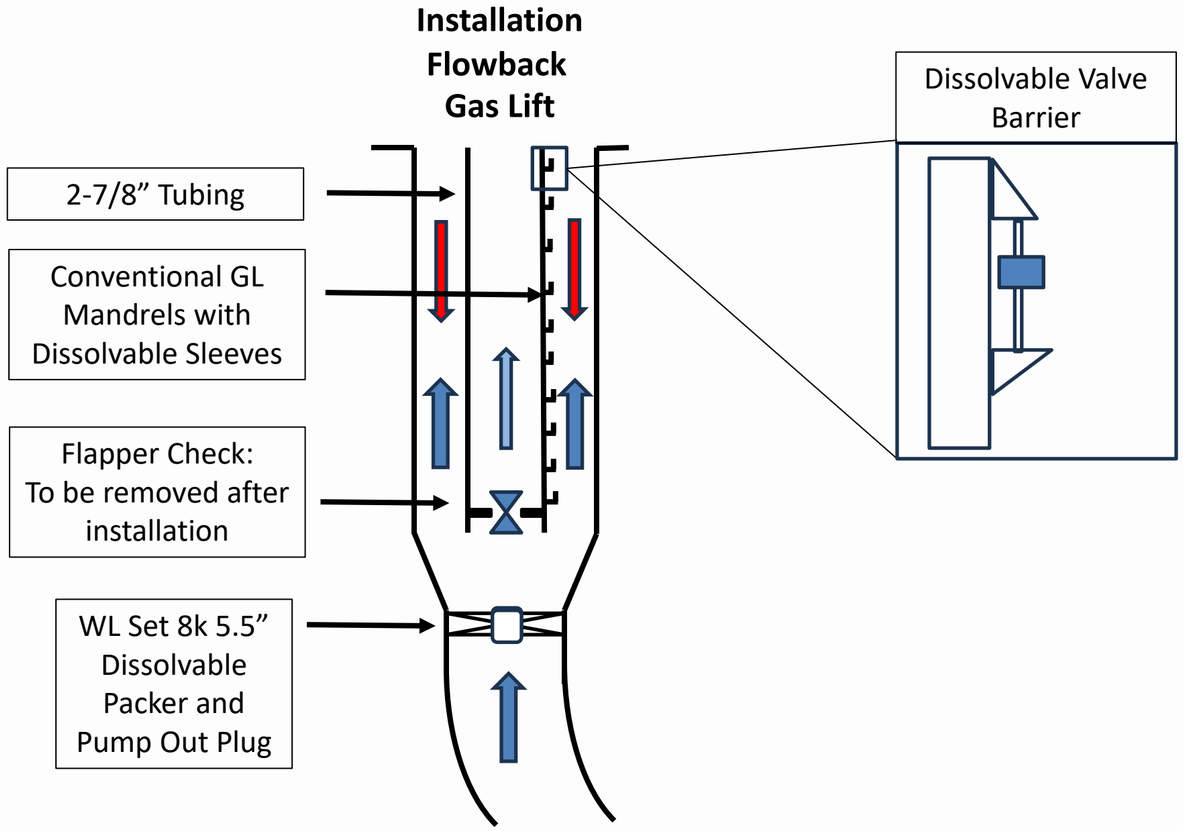
Trial Design

- **Specifications:** 1” gas lift valve, 1 ½” mandrel.
- **Material Selection:** A slow-dissolving alloy was selected after testing the dissolution of several alloys in sample production fluid.

Trial Logistics

- **Assembly:** Valves fitted with barrier sleeve and installed by Flowco, per their design.

Installation and Flow Diagram



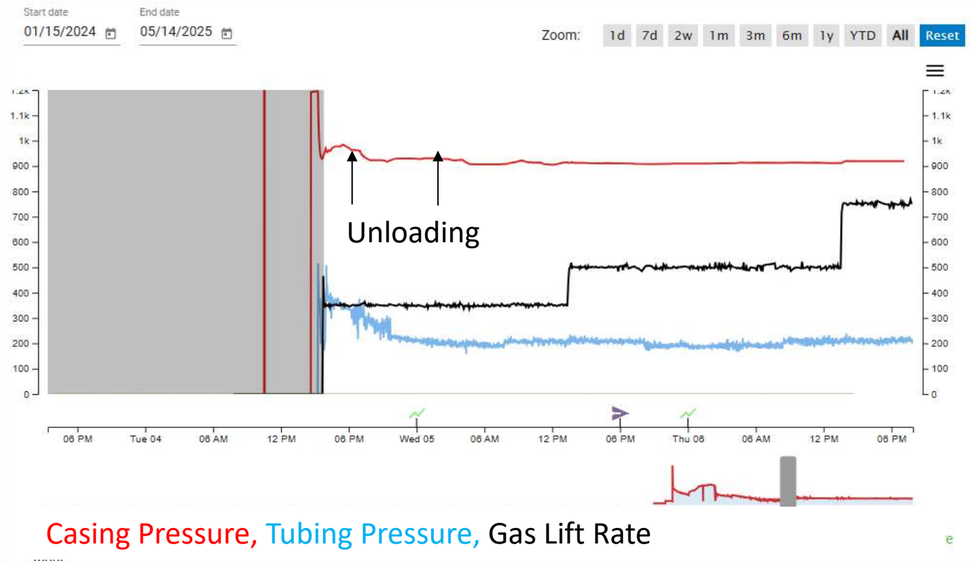
Installation & First Production

Date and Time	Activity
Dec. 20, 10:00 PM	Rigged up wireline to run packer and dissolvable pump out plug
Dec. 21, 3:00 AM	Landed packer and performed successful positive and negative pressure tests
Dec. 21, 8:00 AM	Began running in hole with tubing, gas lift mandrels, and capstring
Dec. 21, 8:30 PM	Successfully landed the tubing, began nippling down BOP and nippling up WH.
Dec. 22, 5:20 AM	Pumped out the dissolvable plug set in the packer at a differential pressure of 1700 psi.
Dec. 30	Commenced flowing back the trial well without any issues.

Flowback & Conversion to Gas Lift (CTGL)

Timeline of Flowback and Conversion to Gas Lift

- Initial Flowback: 12/30-1/8/25
- Shut-in for offset Frac Hit: 1/8/25-1/23/25
  - Saw Increased Sand Production Post-Frac Hit
- Continued Flowback: 1/23/25-3/3/25
- Conversion to Gas Lift: 3/3/25
  - Total of 60 days in hole and 45 days actively flowing before the CTGL
  - Conversion to gas lift was accelerated slightly from the BFPD target due to accelerated fluid rate decline
  - After unloading, began lifting from valve 9 based on modeling and gas lift design
  - Casing Pressure trends then indicated 2 further transfers quickly thereafter, indicating that the gas lift valves were behaving normally

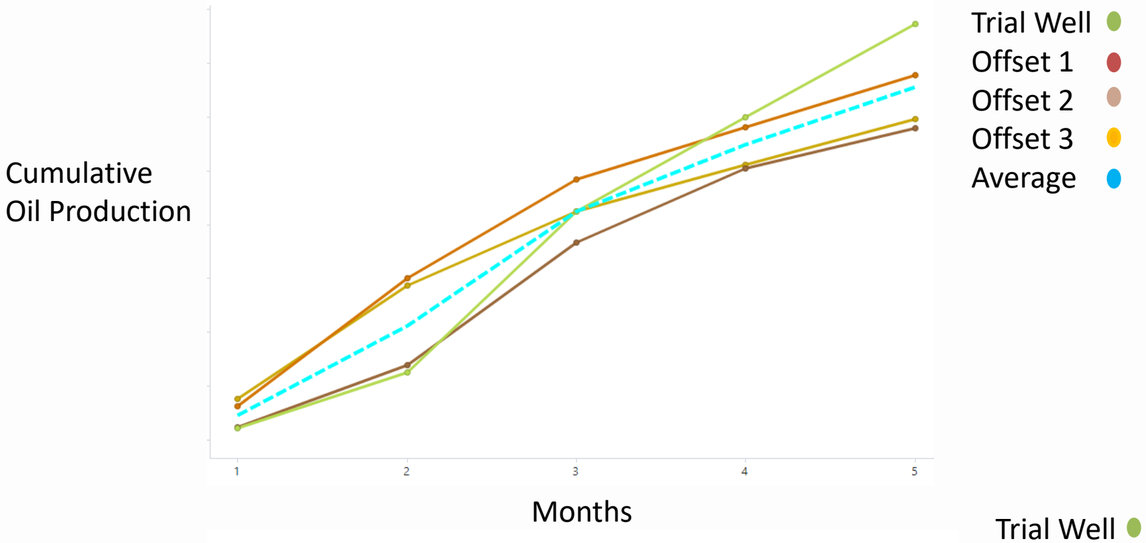


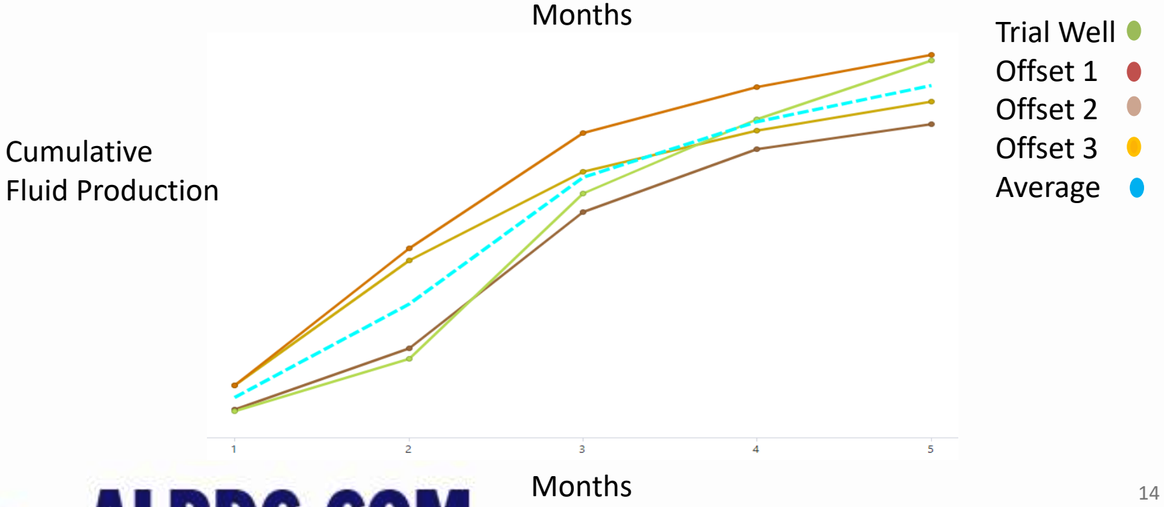
Casing Pressure, Tubing Pressure, Gas Lift Rate

Performance Results

Performance vs Same Pad Offsets

- Wells included in the comparison are of comparable length and frac design
- Offset 1, 2, and 3 utilized 3.5” GL from day one installs
- Water Cut and Gas Oil Ratio differences between wells, but trial well’s total fluid and oil cumulatives are outperforming





Forward Plan and Conclusions

Conclusions:

- Reduced Tubing Expense on Trial Well by 52%
- Reduce Emissions and Electrical Usage by 33% when well declines
- Maximized Early Life Cumulative Production as compared to pad average
- Maintained Current TTM Efficiencies
- Prevented need for planned tubing downsize and associated workover
  - Opex and NPT Savings

Forward Plan:

- Further trialing of this system in upcoming 5.5” casing wells
- When applicable continuing to trial this design on wells with 7” casing
- Implement conversion to plunger when production rates diminish sufficiently

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Question Time

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