



# Remotely Operated Gas Lift Valves in Permian Basin Unconventional Wells

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## ALRDC Gas Lift Workshop

### June 7<sup>th</sup>-11<sup>th</sup> 2021

# Content

- ▶ Unconventional developments and their challenges
- ▶ Parameters that affect gas lift performance
- ▶ Remotely operated valves versus conventional valves
- ▶ Best Practices & Utilization opportunities
- ▶ Conclusion



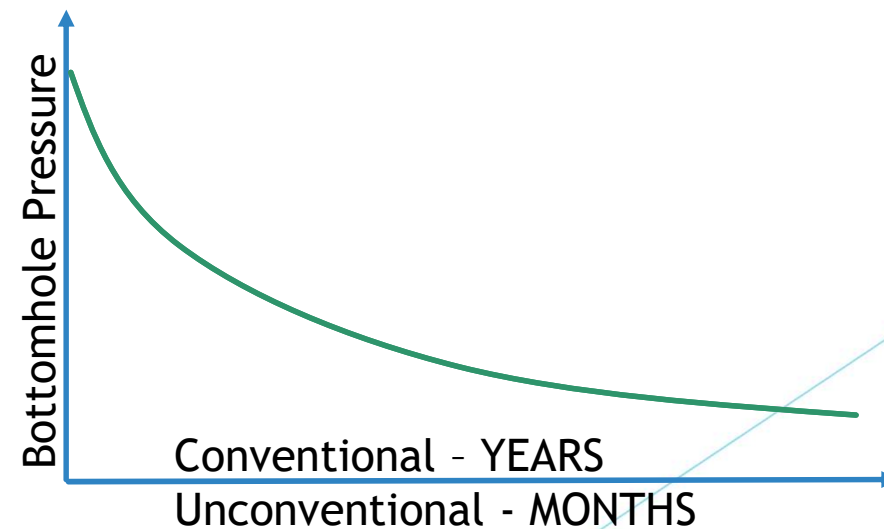
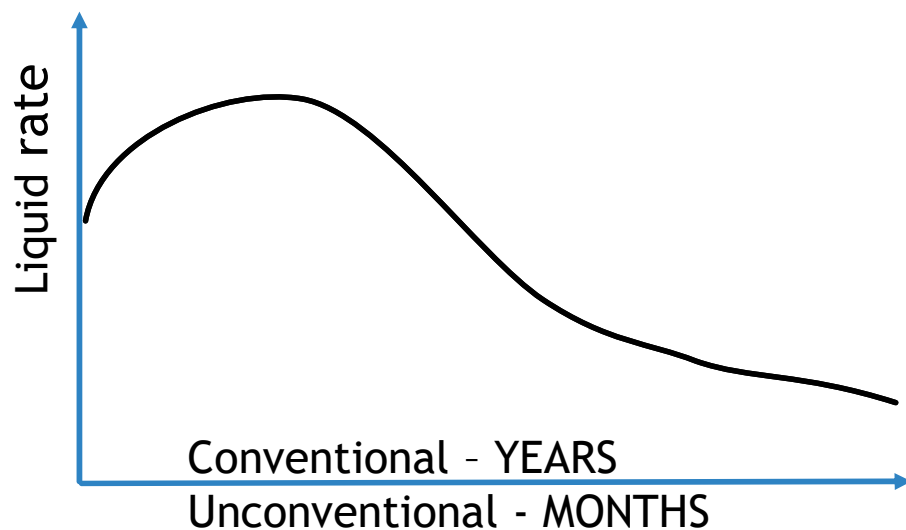


# Unconventional Developments - Gas Lift Challenges

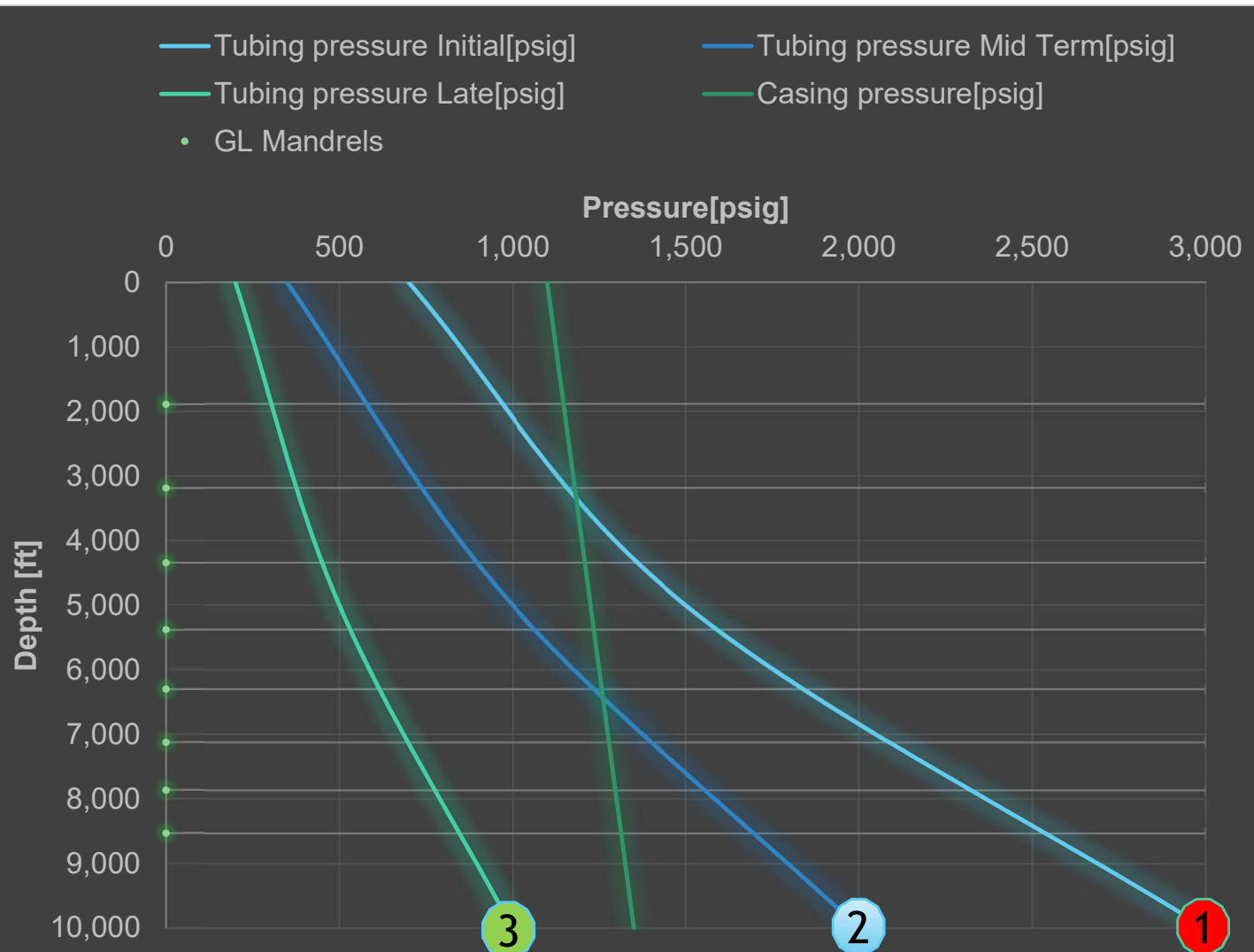
- ▶ Reservoir depletion is much faster than in conventional world
- ▶ Downhole pressures operating envelope is huge
- ▶ Gas Lift Surface facilities are set to standard 1250 psig
- ▶ Medium to High water cuts
- ▶ Lift gas contains NGLs resulting in non-ideal gas behavior
- ▶ Slugging inflow of reservoir fluids from Long horizontal wells

# Reservoir Depletion

- ▶ Gas lift setup must accommodate very high to very low rates
- ▶ Higher rates could accommodate bigger casing and bigger tubing sizes
- ▶ When reservoir depletes, tubing becomes too big causing excessive liquid holdup
- ▶ If smaller tubing is used, initial frictional pressure loss is extreme
  - ▶ Sand production makes risk of eroding equipment even higher



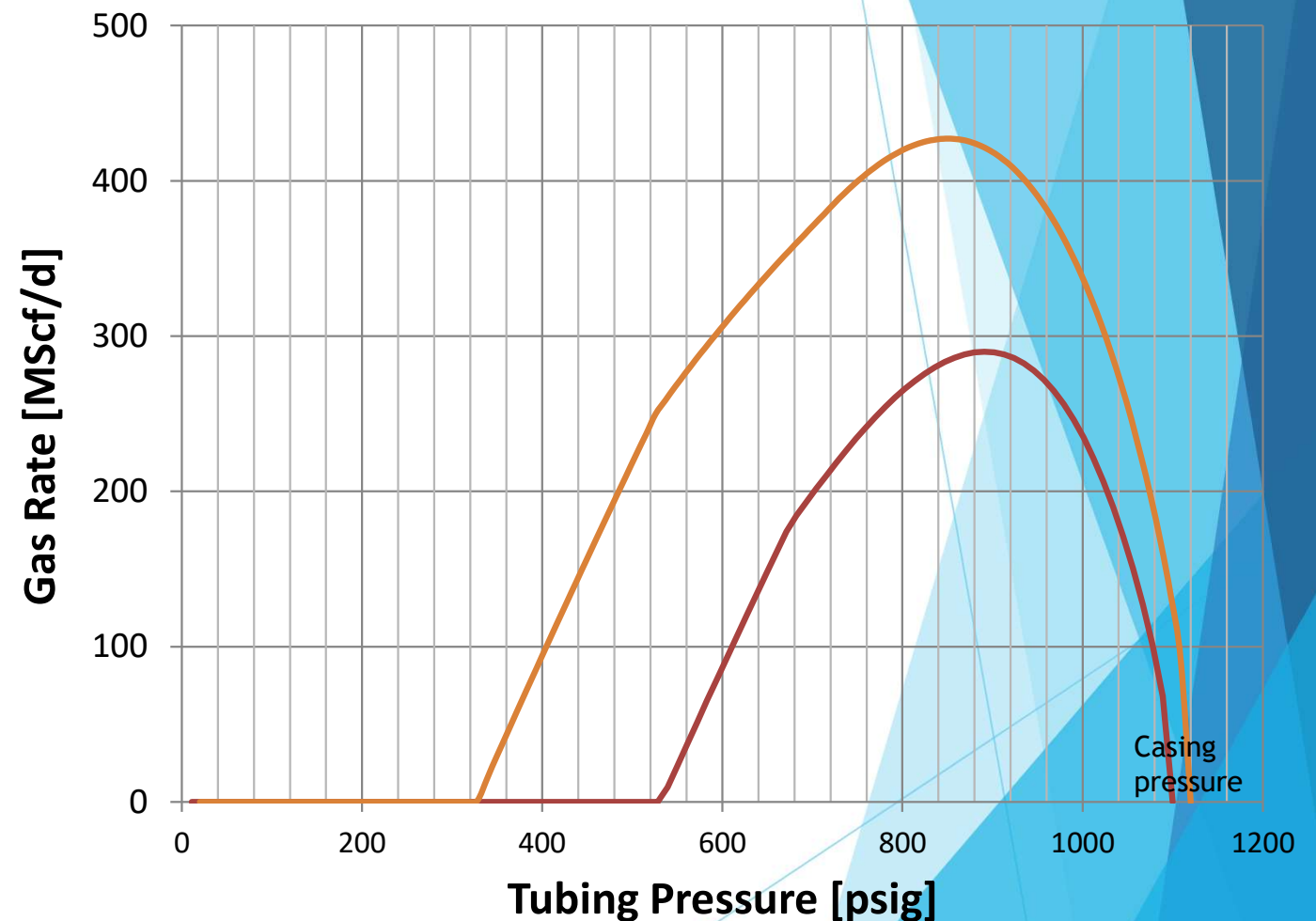
# Parameters affecting gas lift



- ▶ Depth of injection is dictated by tubing pressure
- ▶ Gas Lift valve geometry and setup pressure define gas passage
  - ▶ Flowing Temperature affects valve force balance
- ▶ Unloading valves have to operate as injection devices
- ▶ Unloading valves need to close for transfer
- ▶ Multipointing reduce flow efficiency and create instability
- ▶ Wide range of operating pressures

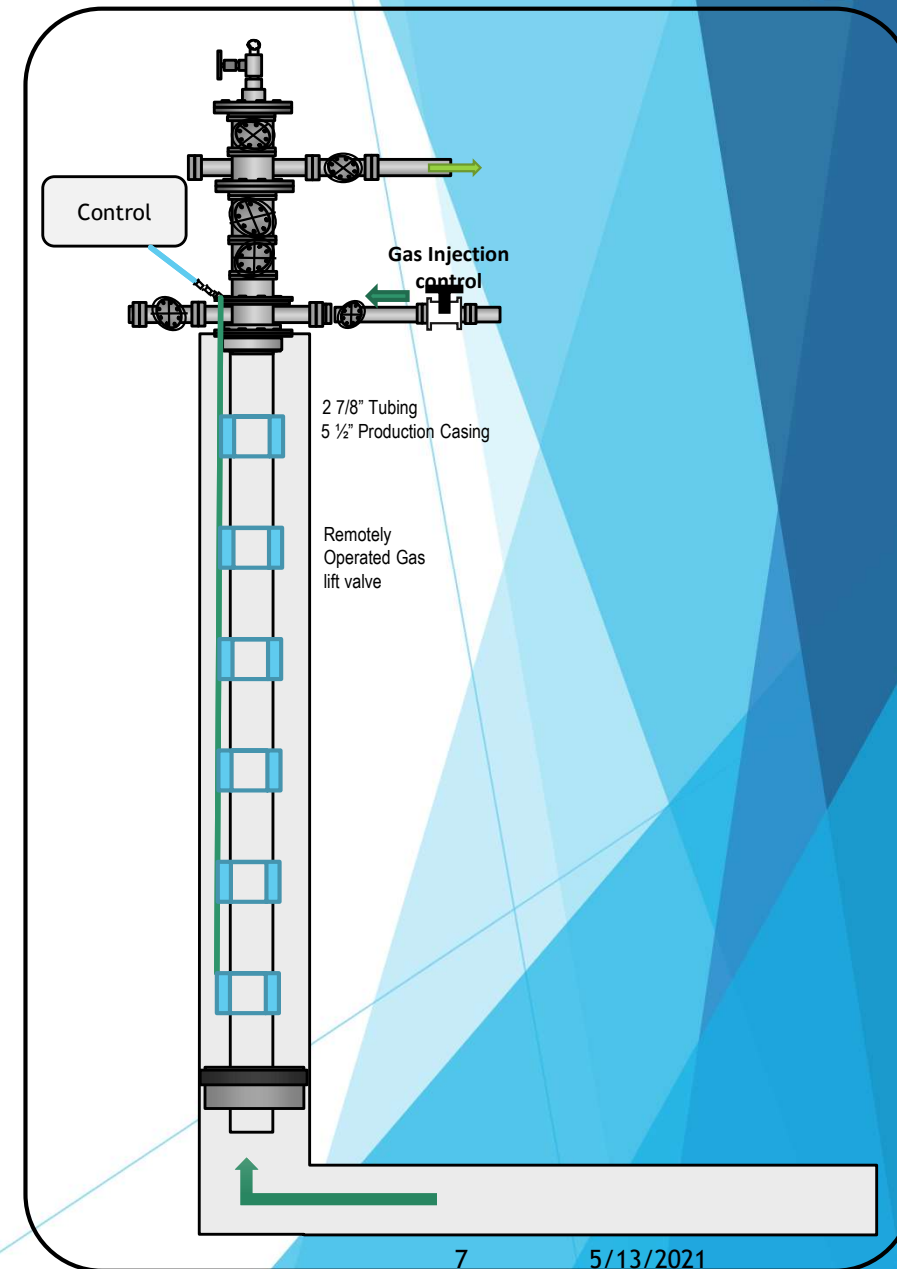
# Gas Lift injection rates

- ▶ Produced fluid velocity needs to be high enough to avoid liquid holdup
  - ▶ Turner critical rate
- ▶ Rapid water cut changes affect optimal Gas injection
- ▶ Gas Lift valve gas passage depends on tubing pressure
- ▶ Small change in casing pressure highly influence gas throughput



# Remotely operated Gas Lift injection

- ▶ Remotely operated adjustable size orifices
- ▶ Each station has pressure and temperature readings
  - ▶ Inside and outside of tubing
- ▶ Device state remotely controlled
- ▶ Gas passage regulated remotely
  - ▶ Piloted Technology has multiple ports of various sizes
  - ▶ Each port can be open closed independently







# Remotely operated Gas Lift vs. Conventional - advantages

	Conventional GL Valves	Adjustable remote
Injection depth	Not utilizing full injection pressure	Maximum usage of injection pressure
Optimal gas injection	Limited with constant setting, highly dependent on operator	Always achievable, independent of shallow stations
Multipointing	Very often	During unloading, controllable by operator
Surveillance	Doable with additional downhole gauges, typically at one depth only	Real time production and injection profile
Injection control	Surface flow control	Control downhole, surface full open





# Remotely operated Gas Lift trade offs

	Conventional GL Valves	Adjustable remote
Completion pricing	Wide range of suppliers Competitive pricing	High cost Lack of competition in the market
Instrumentation	Low instrumentation demand	Requires electricity and additional surface equipment
Communications - Scada	Can run with chart recorders	Requires radio comms Software setup at client side Skilled automation personnel
Field Competencies	Traditional Gas Lift training	Additional PE oversight and coaching*
Gas Lift Design and PE skillset	Existing methodologies	For full utilization requires high PE skills
Surface Maintenance	Low - Standard ORD	Low maintenance for Remote equipment Fully dependent on Scada reliability

*\*AI can help maintain unloading and keep system optimal at all time*

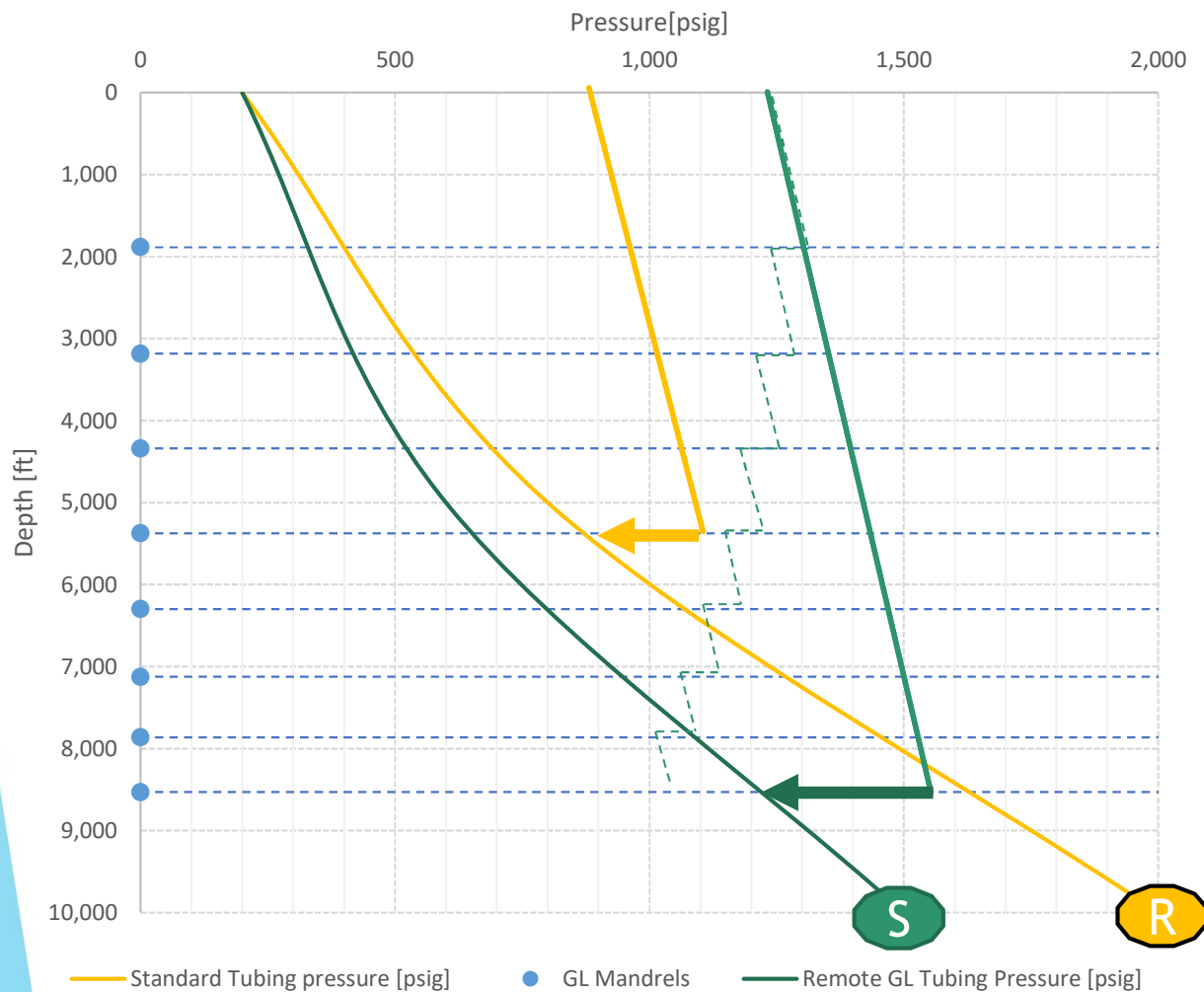


# Advanced diagnostics and well performance analysis

- ▶ Unconventional fluids vary from nice 35deg black oil to volatile and retrograde condensate
- ▶ Multiple pressure and temperature gauges enable tuning multiphase flow correlations used across the field
- ▶ Gas Lift gas contains NGL and has increased sp. gravity
  - ▶ Annular pressure sensors provide vital data for field wide GL modelling and optimization efforts

# Optimization

## Establishing maximum depth of injection



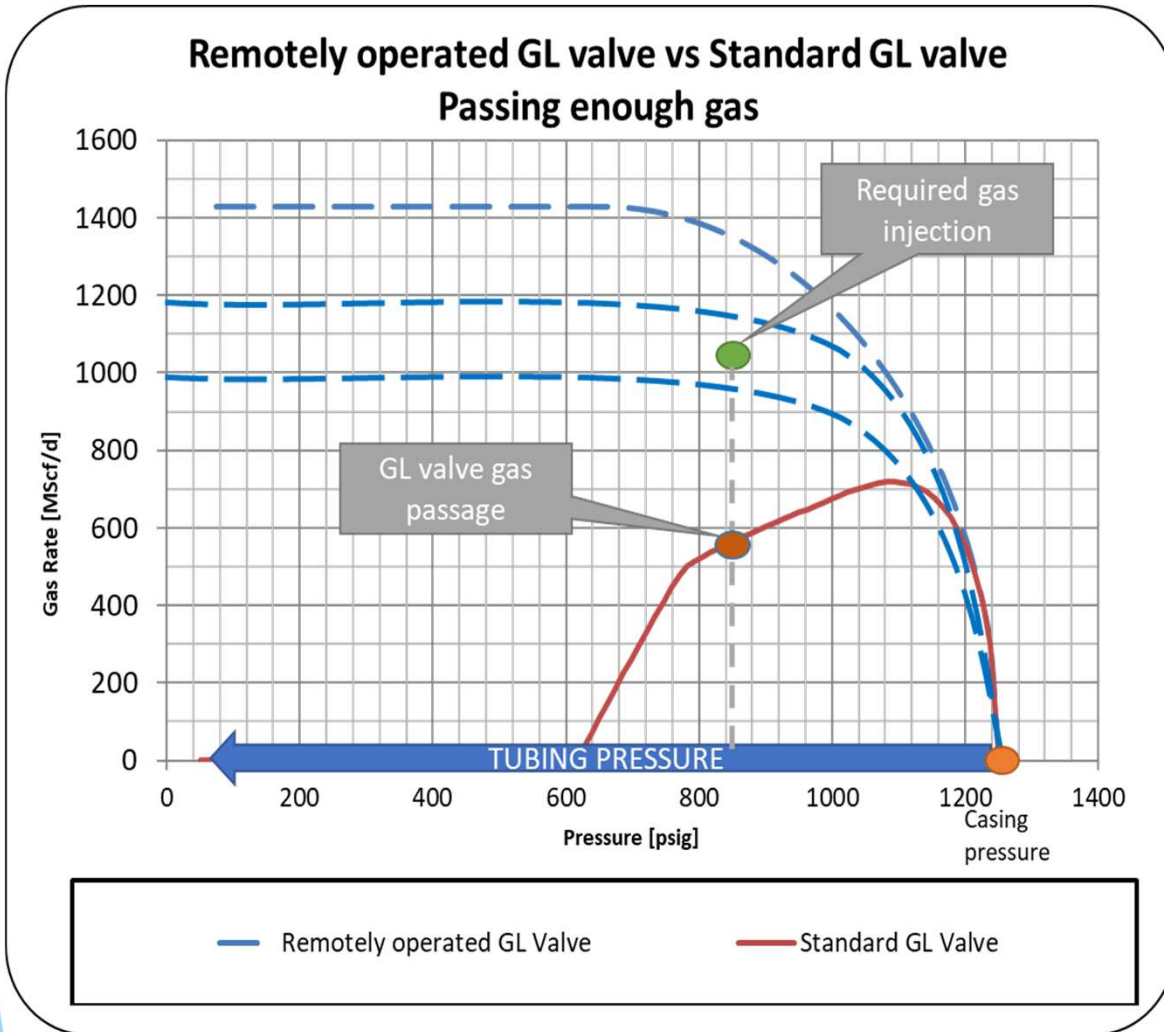
- ▶ Standard GL establishes less drawdown
- ▶ Remote GL utilizes more of available Gas Lift pressure



# Unloading

- ▶ About 30-50psi pressure differential is required for valve to inject
- ▶ Unloading process is highly controlled
- ▶ As soon as there is 50-80 psi dP across valve, close previous one
- ▶ Wells will be unstable - pending on information speed, it's important to be patient
  - ▶ It takes time for remote changes to affect conditions across the wellbore

# Inject optimal gas rate



- ▶ Standard valves gas throughput changes with tubing and casing pressure
- ▶ Remote can adjust to inject optimal rates
  - ▶ Valves act like adjustable orifices



# Frac hit recovery acceleration

- ▶ When well gets frac hit, downhole pressure and watercut get dramatically changed
- ▶ Remote GL enables fast Frac hit identification
  - ▶ Pressure gauges at each station
- ▶ Remote Gas Lift enables much faster recovery than Standard
- ▶ Maximum depth of injection is shifted shallower
  - ▶ Remote GL enables meeting much higher injection gas demand due to increased water cut
- ▶ Standard Gas Lift setup may be optimal for injection at certain inflow conditions, while more than likely it will struggle with Frac hit





# Booster compressors or high GL pressure application

- ▶ Standard Gas Lift completion is designed for available compressor discharge pressure
- ▶ Higher injection pressure on standard GL valves does not move injection deeper
  - ▶ If Booster compressors are installed, all completions have to be pulled out and GL redesigned
- ▶ Remotely operated GL valves do not have setting pressures
- ▶ Remote GL does not require any adjustment for higher GL pressure availability





# Digital transition - Automation of gas lift optimization

- ▶ All data is available to enable automated unloading of wells
- ▶ Full system optimization possible with data integrated into SCADA
- ▶ Options for data analytics and Machine Learning



# Conclusion

- ▶ Benefits of remotely operated gas lift valves in unconventional are:
  - ▶ Connectivity to the valves and data availability enables remote and autonomous operations
  - ▶ Production optimization opportunities increase with the technology due to higher level of flexibility
  - ▶ Allows for more uncertainty in well deliverability due to wider operating range (not temperature and pressure dependent)

# Thank You & Questions

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