2025 GAS LIFT WORKSHOP

Engineering Approach in Developing and Optimizing Troubleshooting Procedures

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Agenda

Problem Statement –

- Annular gas lift wells often exhibit intermittent or declining performance that cannot be easily explained through surface diagnostics alone.

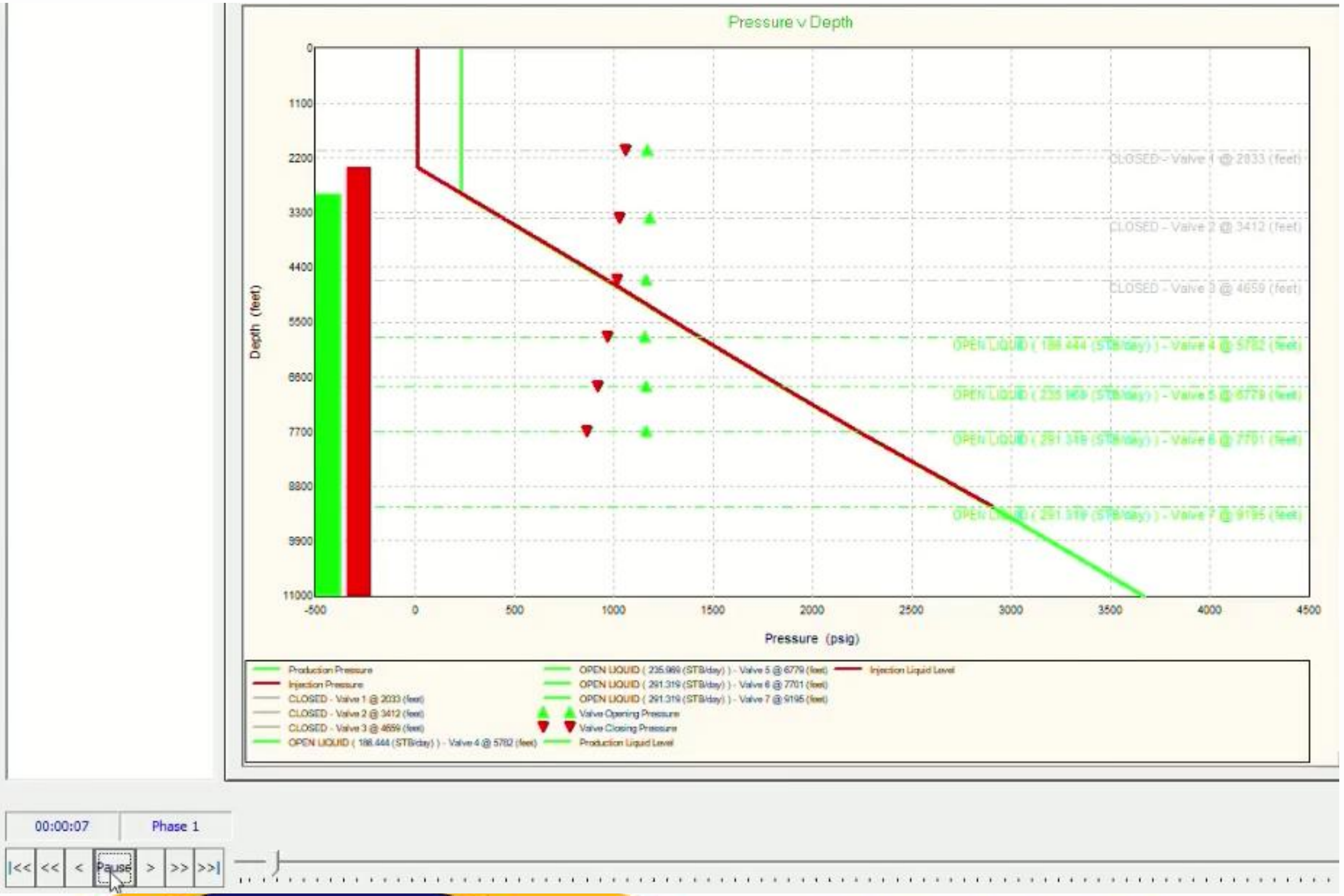
Practical solution

- Troubleshoot using dynamic simulation in Petex PROSPER.
  - Differentiate root causes of gas lift inefficiency from valve string design or mechanical issues.
  - Evaluate improvements to well performance

    Valve string design | Unloading procedure | Other

Conclusions & Recommendation

Inefficient State looks like:



Motivation

- Identify most likely root cause for well behavior

Process

- Test various Gas Lift design solutions to:
  - Kick well as fast as possible without eroding valves
  - Reach optimal depth of injection with minimum multi-pointing

- Evaluate alternatives to stabilize well
  - Adding dummies – GL pressure is preserved but can we effectively kick well
  - Changing injection device port size – will it stabilize well and close unloading valves above

- Distinguish between GL rate required to kick well and GL rate to optimally operate

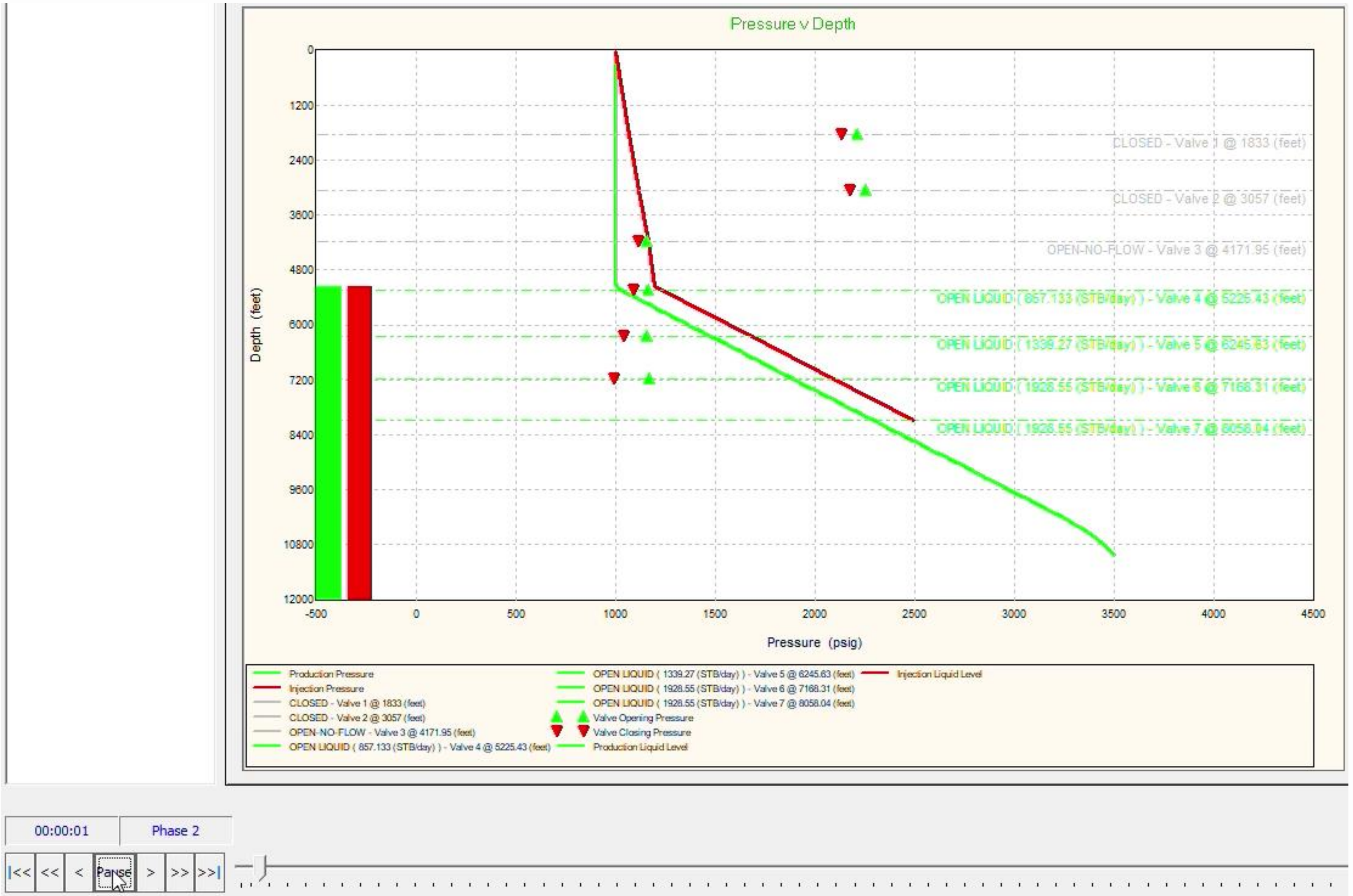
What does good look like

Objectives for optimal GL setup:

- GL design is fit for purpose within current state of reservoir depletion
- Single point of injection with sufficient dP across operating device
- Restoring full production rate fastest possible

- Apply FAST UNLOADING Start that moves deepest possible fast, and keeps only injection device open, no shallow valves passing gas

What good looks like.



Features

- 2.5 hrs to production
- Gas pressure conserved
- Valves protected during unloading
- No kicks – stable at surface

Fast Unloading at Surface

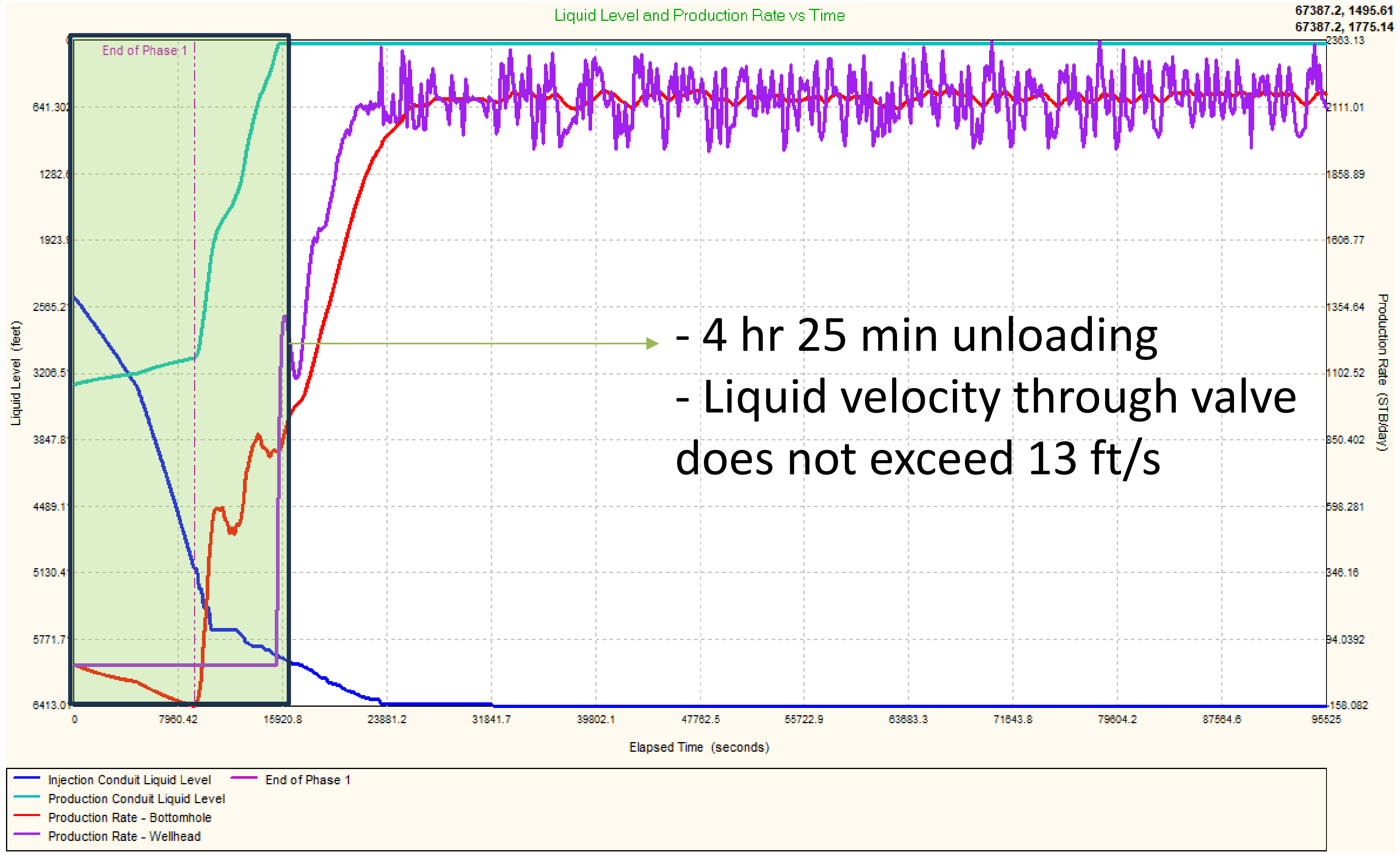
Standard unloading – 7 hours,
- pessimistic signs
- procedure not exactly followed
- patience lost

Fast unloading: 4 hours

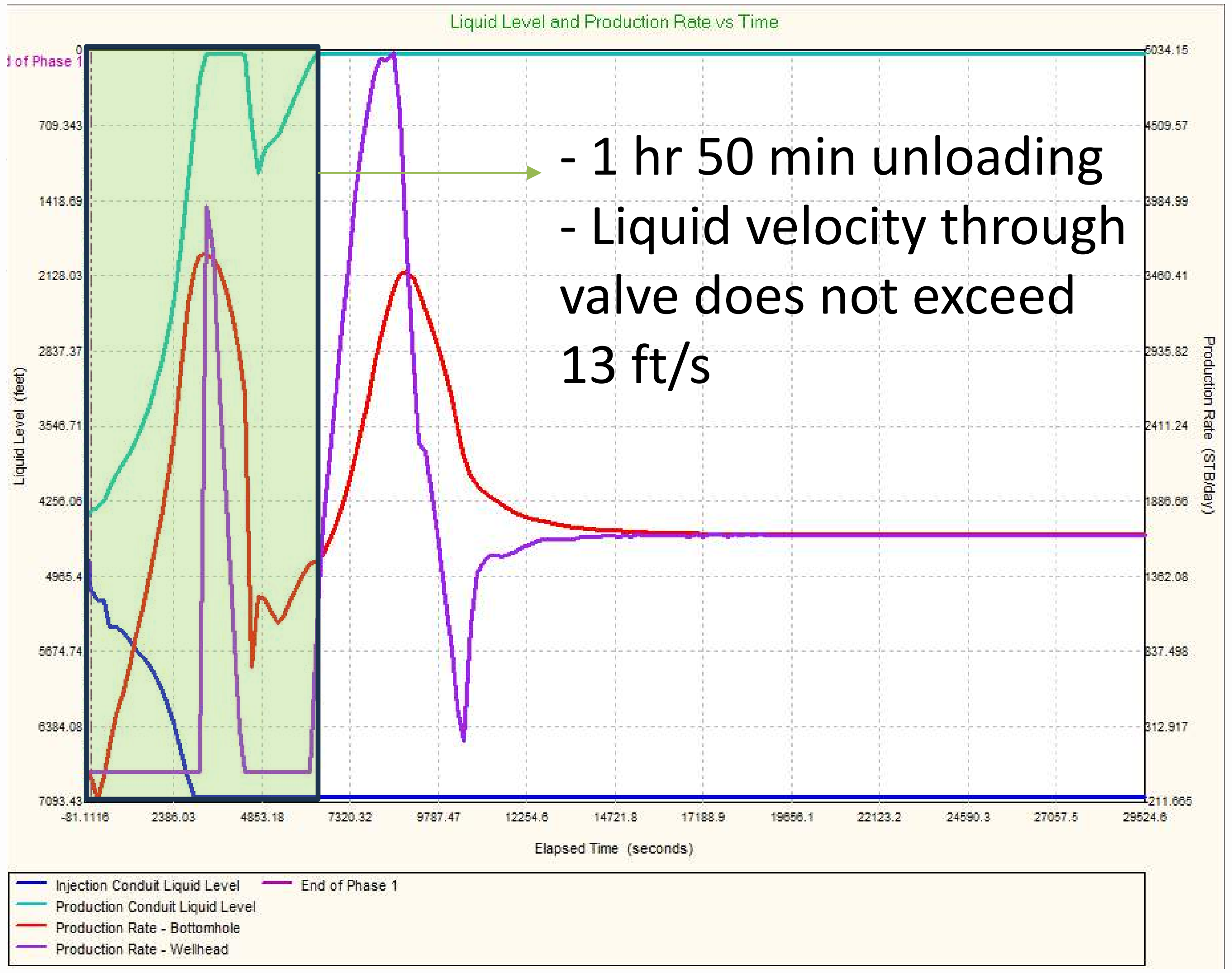
Simulator Comparison

Regular unloading

- Slow



Fast unloading – matches WHP, stable production starts sooner



Regular unloading procedure durations are 3x higher in practice.
Fast unloading durations in practice generally match simulated times.

Case 4

Situation:

Redesigning gas lift for incrementally depleted well.

Need to conserve gas, no risk of frac hit, considering installing dummy valves shallow.

Symptom:

None – this is a sensitivity use case of the simulator.

Approach:

- Run case with live valves
- Run case with dummies
- Identify the optimal

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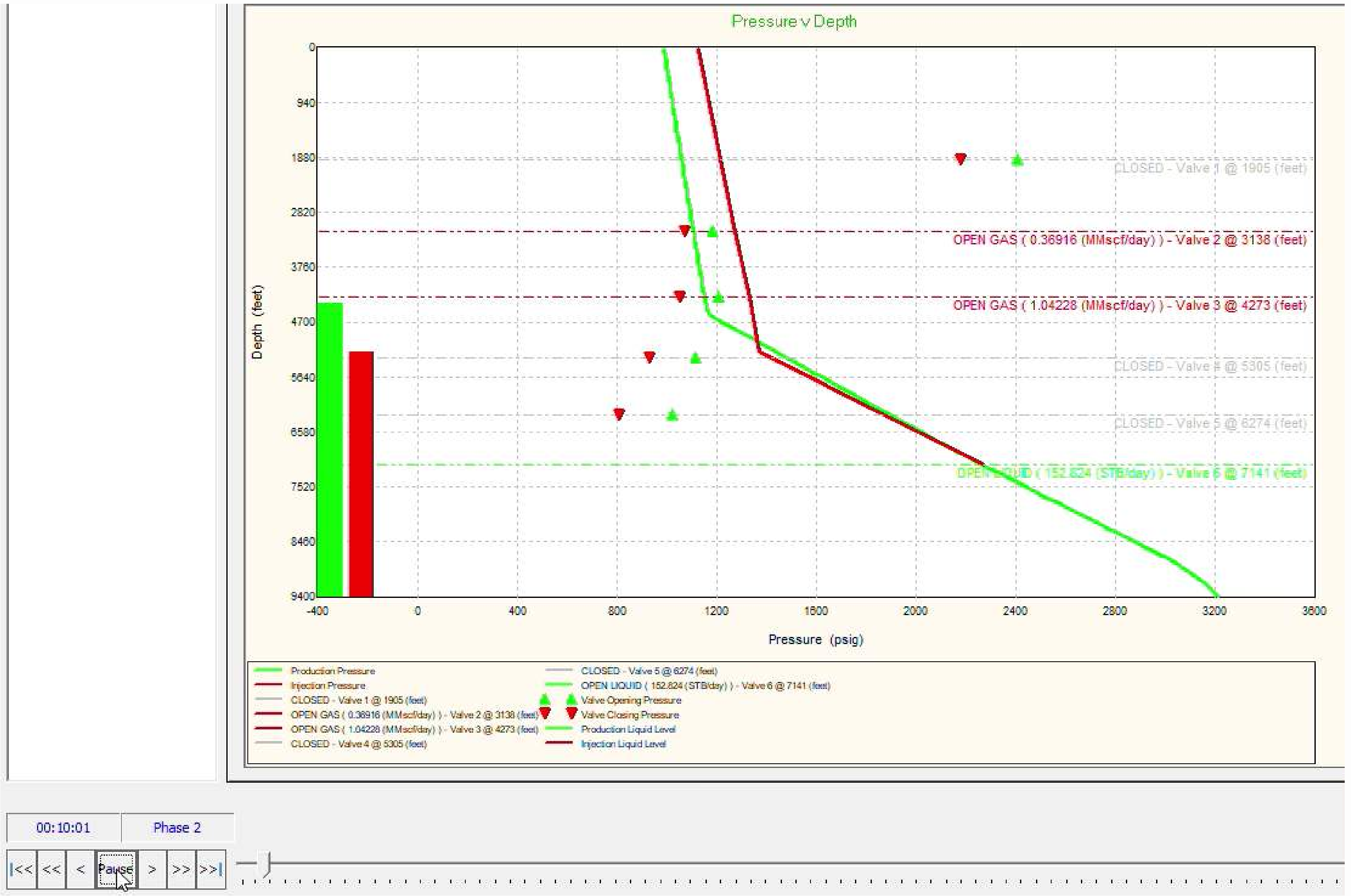
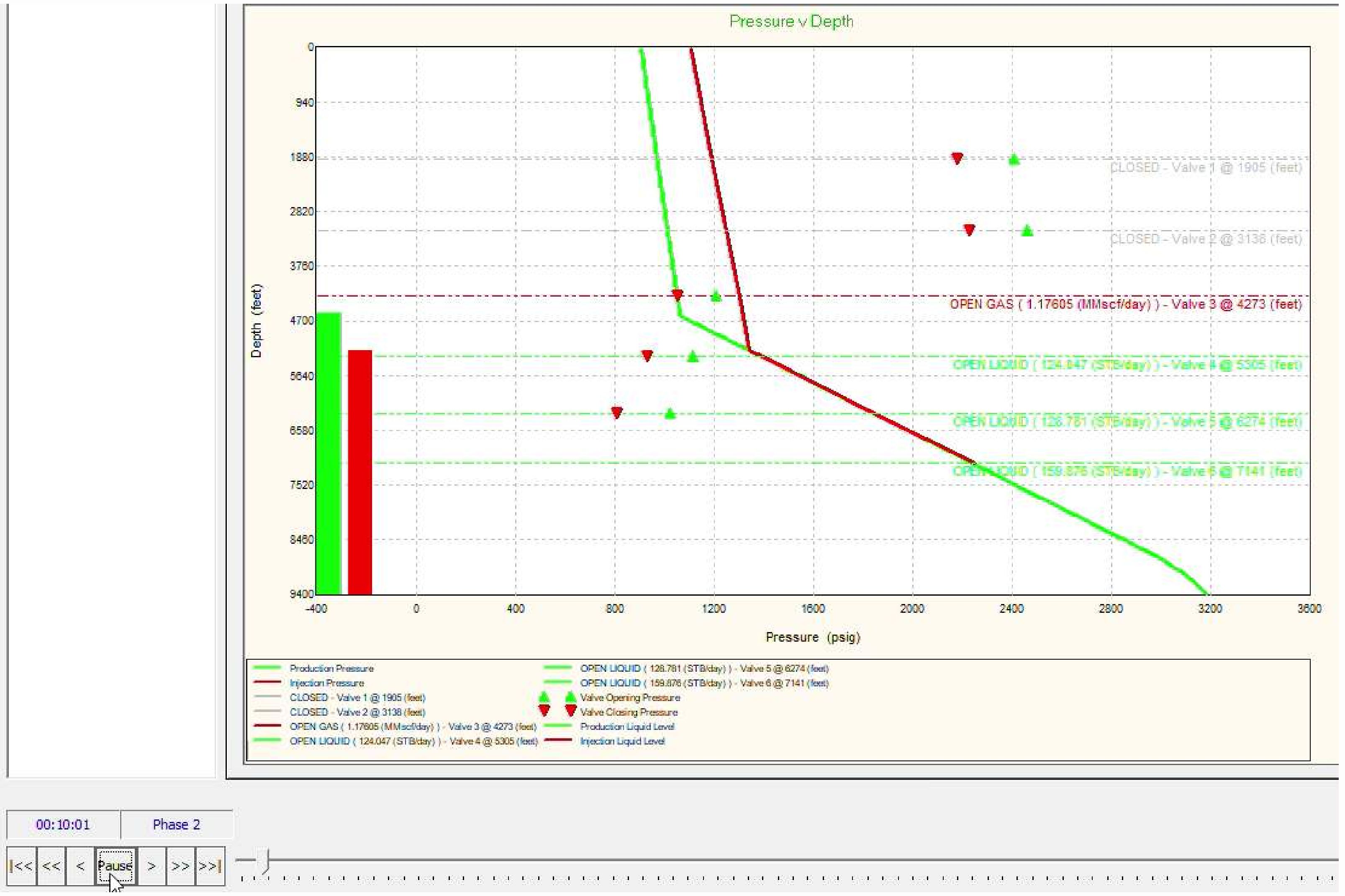
Case 4a Result

One less dummy



One more dummy



Sensitivity shows that this well prefers a shallow dummy

Case 4b Result

One less dummy

One more dummy

Sensitivity shows that this well prefers a shallow dummy

Tuning model – Utilized ROGLV for reality check

- Remotely operated valves (ROGLVs) - Each station has pressure/temperature reading inside and outside of tubing
- Real time transient effects on ROGLVs were used for models tuning and applied to standard GLVs models

Scenarios:

GLV failure (eroded stem, washed seat or failed bellows)

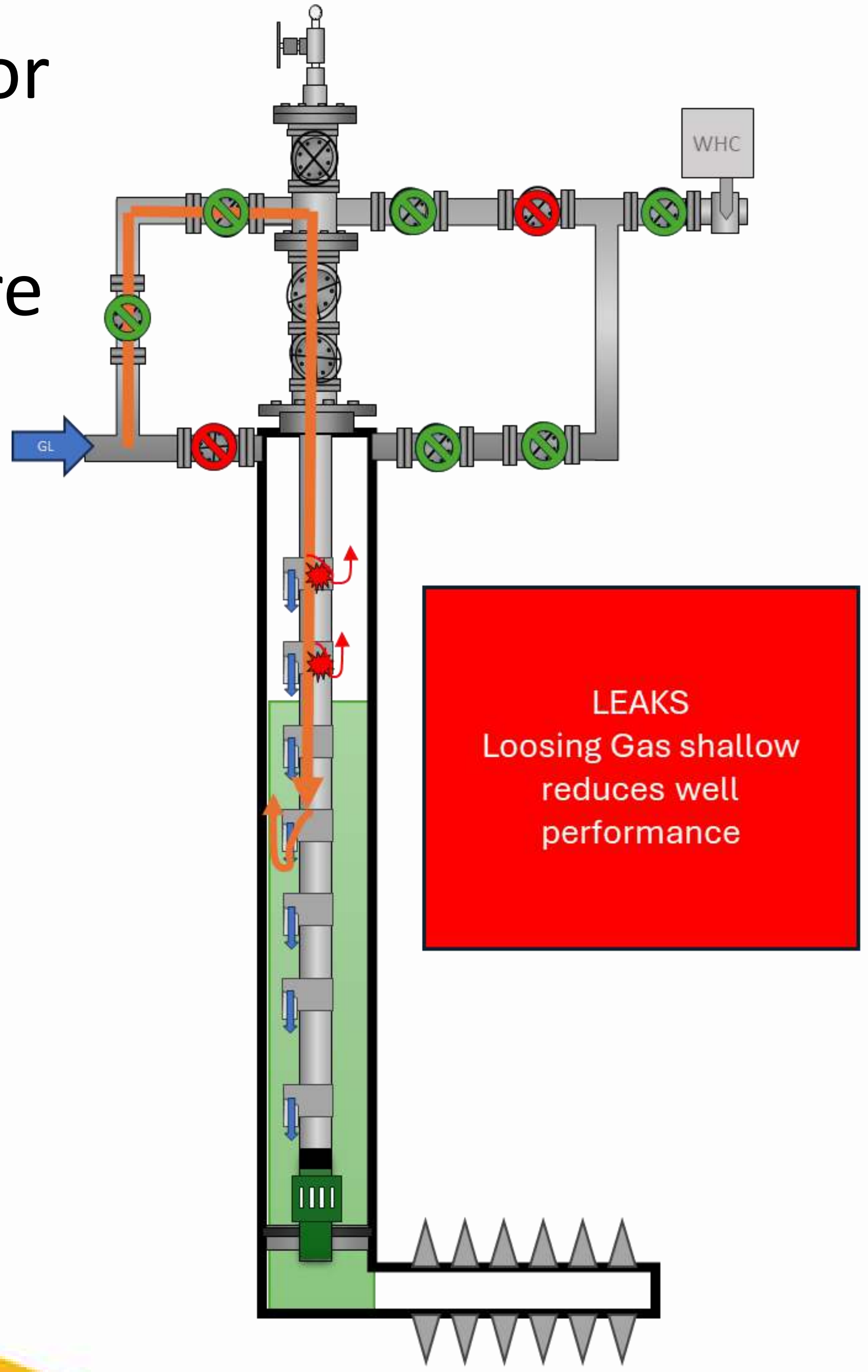
- Intentional shallow ROGLV full opening simulates hole in tubing or stuck open GLV

GL Design deficiencies

- Small percent open ROGLV used as - Too small port or too high TRO of classic GLV
  - GLV not passing enough gas to transfer deeper

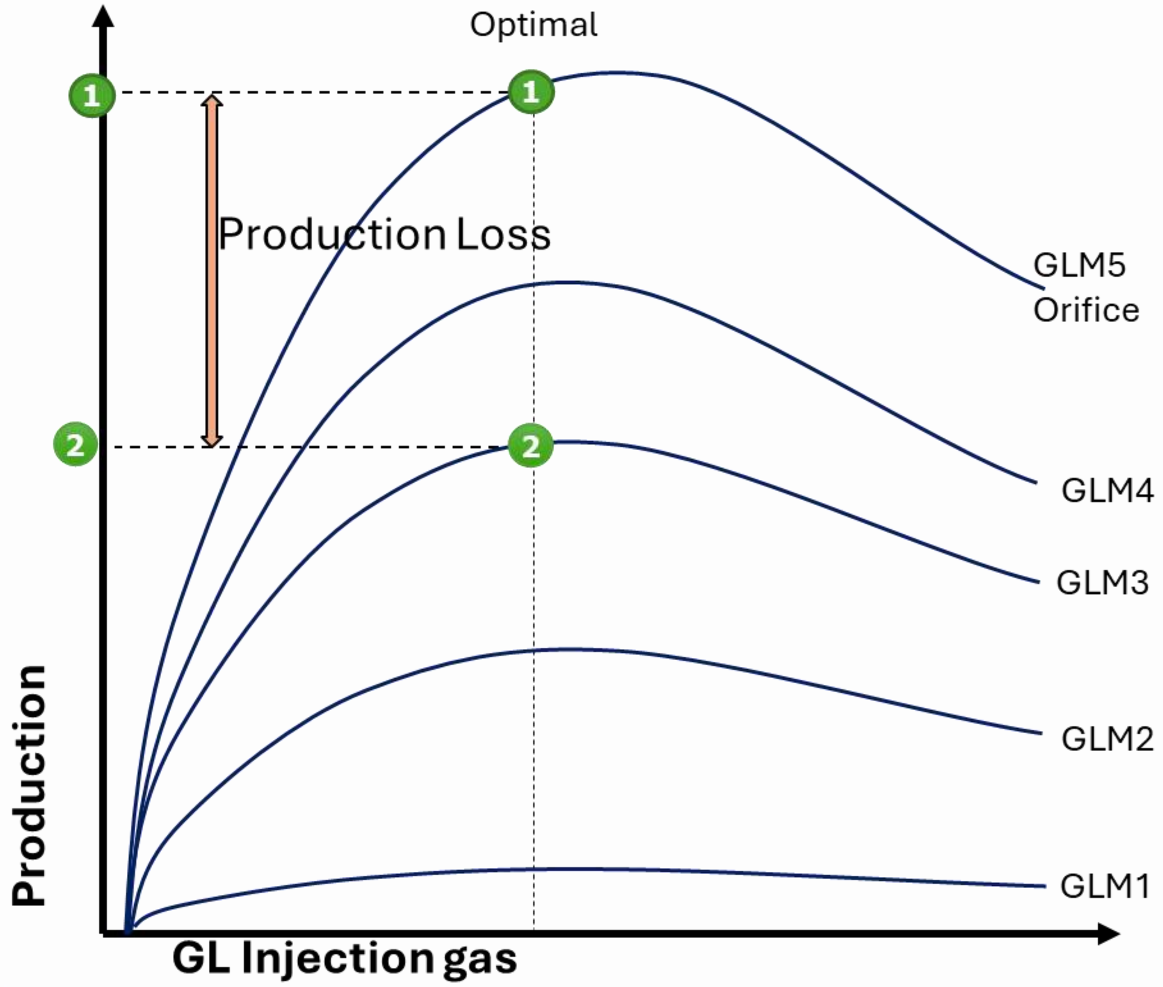
Shallow gas injection effects on production

- Shallow gas injection is a common cause for GL underperformance
- Main indication – drop in Injection Pressure



Potential causes

1. Design inappropriate for conditions,
2. Failed traditional GLV,
3. Leaking GL Mandrel issues,
4. Failed open ROGLV,
5. Hole in tubing
6. GLV packing or pocket issues



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Methods, Procedures, Processes

Model wells with annular gas lift.

Cases:

1. Valve closing pressures are too low
2. Leaking/worn-out valve
3. Hole-in-tubing
4. Gas pressure conservation using dummy
5. Well's unloading preference
6. Plugging gas lift controller

Variables:

- Valve depth/spacing
- Valve properties
- Pseudo hole-in-tubing orifice
- Wellhead pressure
- Gas injection choke diameter

Options+Input Data | PVT | Reservoir | Deviation Survey | Tubing | Casing

Initialisation	Initialise from static	
Injection Conduit Initialisation Method	Initial Injection Conduit From Equilibrium	
Initial Injection Conduit Pressure	0	psig
Limit Injection Rate in Phase 1	Based on Valve Velocity	
Valve Velocity Limit	12	ft/sec
Enter Schedule	No	
Production Type	Tubing Injection - Annular Production	
Check Valve	No	
Temperature Calculation	Yes	
Time Step Length	180	seconds
Number Of Time Steps (Phase 2)	480	
Use Fixed rate of injection at surface	Yes	
Actual Injection Rate	1.1	MMscf/day
Phase 1 WHP Limit	1126	psig
SubSea Safety Valve	No	
Casing Head Pressure	375	psig
Mid-Perforation Depth	8489.95	feet
Surface Gas Injection Temperature	78	deg F
Formation Temperature at Surface	78	deg F
Formation Temperature at Bottom-Hole	150	deg F
Holdup Correlation	Petroleum Experts 5	

Options+Input Data | PVT | Reservoir | Deviation Survey | Tubing | Casing | **Valves** | Thermal Properties | Schedule | Initialisation

Point	Valve Class	Valve Type	No. of Valves	Measured Depth (feet)	Diameter (inches)	Port Size (64ths inch)	R Value (Ap / Ab)	Dome Pressure (psig)
1	Orifice		1	1100	0.1875			
2	TUALP Untested	Casing Sensitive	1	2074	0.1875	12	0.094	907.152
3	Orifice		1	2280	0.1875			
4	TUALP Untested	Casing Sensitive	1	3261	0.21875	14	0.127	868.878
5	TUALP Untested	Casing Sensitive	1	4393	0.25	16	0.165	718.966
6	TUALP Untested	Casing Sensitive	1	5391	0.25	16	0.165	657.807
7	Orifice		1	6321	0.3125		0.313	

Conclusions & Recommendation

- Dynamic simulation offers a powerful diagnostic tool for evaluating the performance of annular gas lift systems
- It enables engineers to test mechanical failure scenarios and design improvements in a risk-free environment, identify root causes of instability, and optimize kick-off and steady-state operations
- This approach has led to improved production, reduced downtime, and better-informed decisions on interventions
- Field validation of simulation predictions further supports its use as a standard troubleshooting method for gas lift optimization.

Question Time

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