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Taking Charge of Flowing Tubing and Injection Pressures to Optimize Gas Lift Wells

Larry Harms and Tom Nations

ALRDC Gas Lift Workshop

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Optimization Harmsway LLC

NC LLC
Nations Consulting LLC

Why should I take charge of surface pressures?

- If You Don't, Pressures Will be Set and Controlled Without Proper Regard for Well Performance/ Economics
- Surface Pressures Make a Difference and Are NOT "Fixed"
- Taking Charge Requires Upfront Work with the "Natural Work Team"

Suboptimization

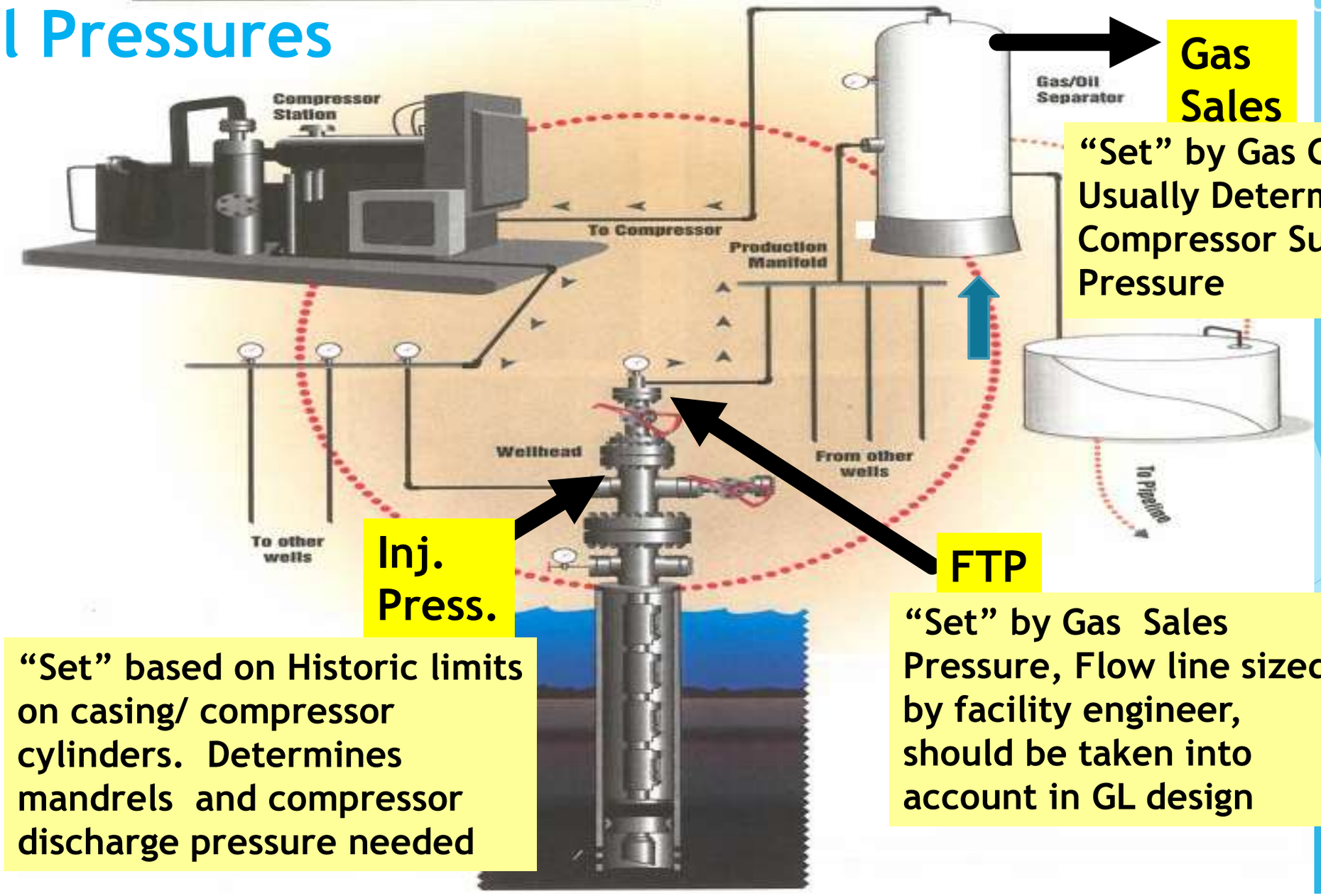
Definition of *suboptimization (Merriam Webster)*

- **:** inadequate or flawed optimization

- ***especially*** **: optimization of a part of a system or an organization rather than of the system or organization as a whole**

Critical Pressures

Onshore Unconventional



"Set" by Gas Gatherer, Usually Determines Compressor Suction Pressure

"Set" based on Historic limits on casing/ compressor cylinders. Determines mandrels and compressor discharge pressure needed

"Set" by Gas Sales Pressure, Flow line sized by facility engineer, should be taken into account in GL design

The well is the asset and the only creator of revenue

- All decisions should be based on Economics
- Costs are important, in general the revenue side dominates economics
- Involving all of the stakeholders can optimize value

Stakeholders in GL Installation/Operations Who should know how surface pressure affects well performance?

- Operations/Maintenance
- Compressor Vendor
- Gas Lift Vend
- Reserv eer
- / Production Engineer
- Facility Engineer
- Project Manager
- Systems/Automation
- Gas Gatherer

Ideally Everyone

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Optimizing Gas Lift Pressures to Increase Production and Lower Costs

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GL Valves Required at Different Surface Injection Pressures (Eagle Ford Well from SPE 187443)

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Gas Lift Supply Pressure, psig	Gas Lift Valves Required
1000	10
1200	6
1500	4
1700	3
2200	2
3700	Only Orifice

- **5-1/2” Casing with 2 7/8” Tubing;**
- **Formation TVD 10998; Formation Temp 280F**
- **10% Water; Oil Gravity 45 API – 125 psig Surface Press.**

GL Valves Required at Different Surface Injection Pressures (Permian Well Basis)

Inj. Press., psig	Mandrels
1000	14
1500	7
2000	3
3000	2
4000	1

- **2 3/8” Tubing; 625’ Bracket Spacing**
- **TVD = 10,000**
- **200 psig FTP**

Advantages of Higher Inj. Press.

- Fewer Gas Lift Mandrels (potential leak points, PL efficiency)
- Inject deeper, earlier (more production)
- Flexibility/Safety factor if conditions different than design (workover, frac hit, GLR, WC)

Disadvantage – Compressor and facility design must be different than “normal” and must be worked up front

Examples of Using Higher Pressures

- Dubai – 1700 psig gas lift manifold pressure
- Prudhoe Bay 2000 psig, 8500’ tvd, typical design uses 1800 psig
- Kuparuk 1400 psig in the core area, 6250 tvd
- Alpine 1800 psig, also around 6000-7000’ tvd. Typically design for 1600 psig to avoid setting valves high
- WHY??? Used Centrifugal Compressors, more design work, pressure maintenance

FTP Pressure Affects Initial Flow Rate

Case	Flowpath	BLPD	Drawdown,	Psurf, psig
Match Peak Flow	5 1/2" Casing	2400	820	310
Open Choke On Well	5 1/2" Casing	4030	1370	115

Example of Surface Pressure Importance on High Rate HP/SPGL Well

BLPD	Psurf, psig	GL Rate, MCFD	Pdisch. Psig	Horsepower	Fuel Gas, MCFD
5180	310	2000	2000	240	44
5180	100	700	2000	135	25
5180	50	480	2000	109	20

Nodal Analysis for Unconventional Well with Annular Flow, 5 ½" casing, 2 7/8" tubing, 8000' TVD

Example of Surface Pressure Importance on Mature GL Well

BLPD	Psurf, psig	GL Rate, MCFD	Pdisch. Psig	Horsepower	Fuel, MCFD
104	115	600	390	45	8
330	20	240	460	42	8

w,

Is Lower Surface Pressure Always Better??? (Permian Well Basis)

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Case	Fl	BLPD	PBHP, psia
200 psig FTP	Tubing	1500	3300
50 psig FTP	2 3/8" Tubing	1500	3700

Not when Friction Dominated

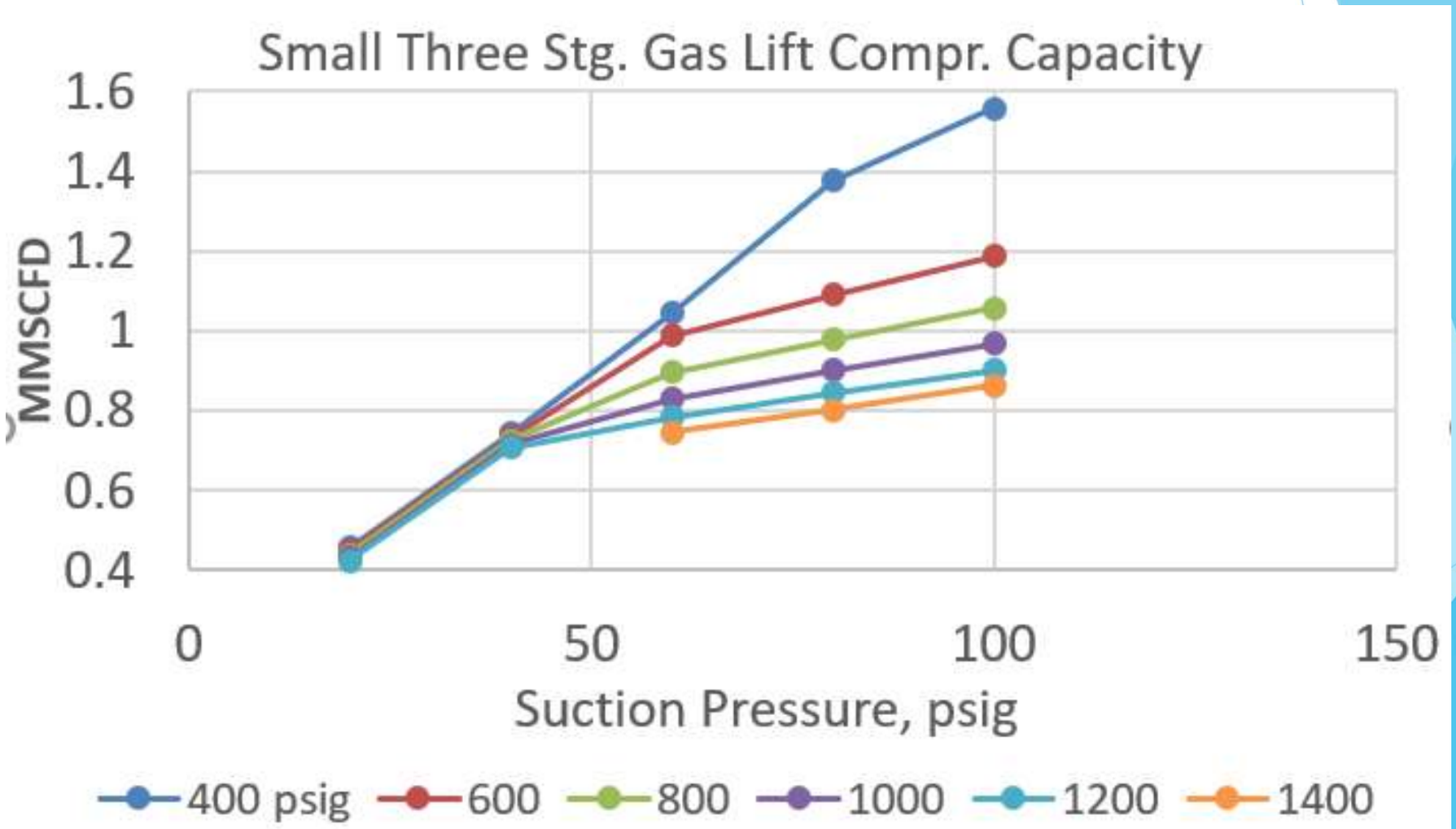
- 2 3/8” Tubing; 625’ Bracket Spacing
- TVD = 10,000
- 200 psig FTP

Since Gas Sales Pipeline Pressure is so important, what should we ask for?

Start “low” and go lower over time

- Producers must be willing to ask for and pay for what has value to them
  - Analysis of what is optimum must be done by the producer
- Cost for horsepower and fuel gas is split between producer and gatherer
  - Higher gathering pressures mean less production in general and more vapor recovery
- Gatherer profits on a “margin” basis while producer profits most from the production with gathering cost being a minor factor
- Contract should be a “win/win”, not a “we win”

Example of Compressor Flexibility/Options



As wells mature, disparate injection pressures/ failure to change compressor operations can result in added costs and operational problems

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If injection pressure is maintained at 1000 psig when only 500 psig is needed:

- 30-40% of horsepower is wasted (higher compressor costs)
- 30-40% extra fuel gas is used
- Additional methanol use
- More well downtime

“Natural Work Team” (NWT) in GL Installation/Operations

- Operations/Maintenance
- Compressor Vendor
- Gas Lift Vendor
- Reservoir Engineer
- Gas Lift/Production Engineer
- Facility Engineer
- Project Manager
- Systems/Automation
- Gas Gatherer

Utilize NWT to take charge of pressures and prevent suboptimization

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- NWT meetings that discuss optimizing pressures/well performance should start in planning phase before first well is drilled
- As the people most knowledgeable about the effect of pressures AL/Prod Engineer/Gas Lift vendors should take the lead
  - Education of the NWT is Imperative!
- Discussions need to cover life of well and continue over well's life!

Gas Gathering may be the most difficult

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- Includes commercial people and involves other producers across the system
- Gas gatherers/commercial personnel have very different outlooks/objectives
- Pressure over time discussions are needed
- Operator may need to put in own LP compression

Summary

- Taking Charge of Surface Pressures is important in optimizing well performance/economics

- The people who understand this the best should take the lead before the first well is drilled and throughout the life

Questions

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