Plunger Well Vent Reduction Project

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BP
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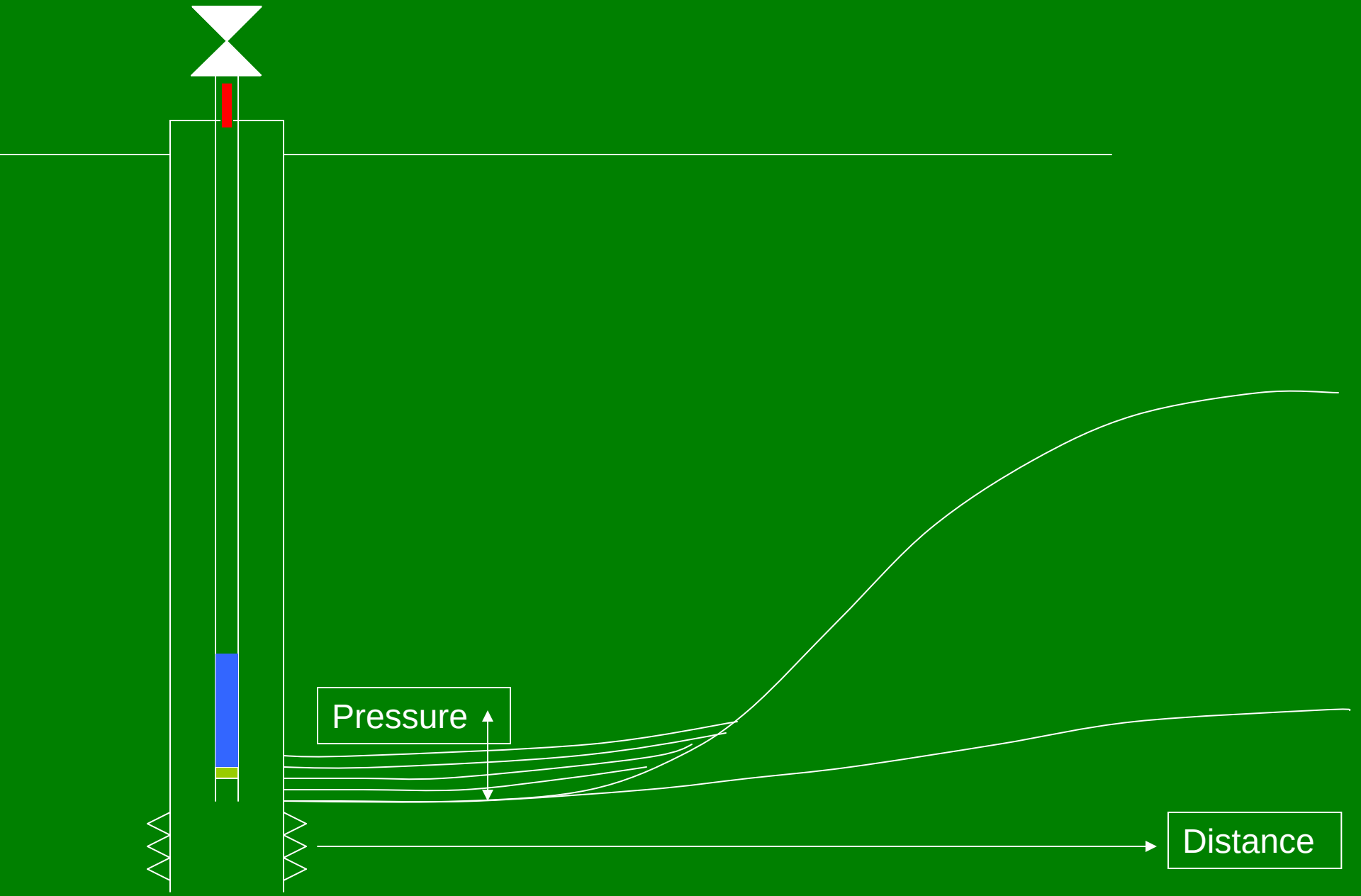
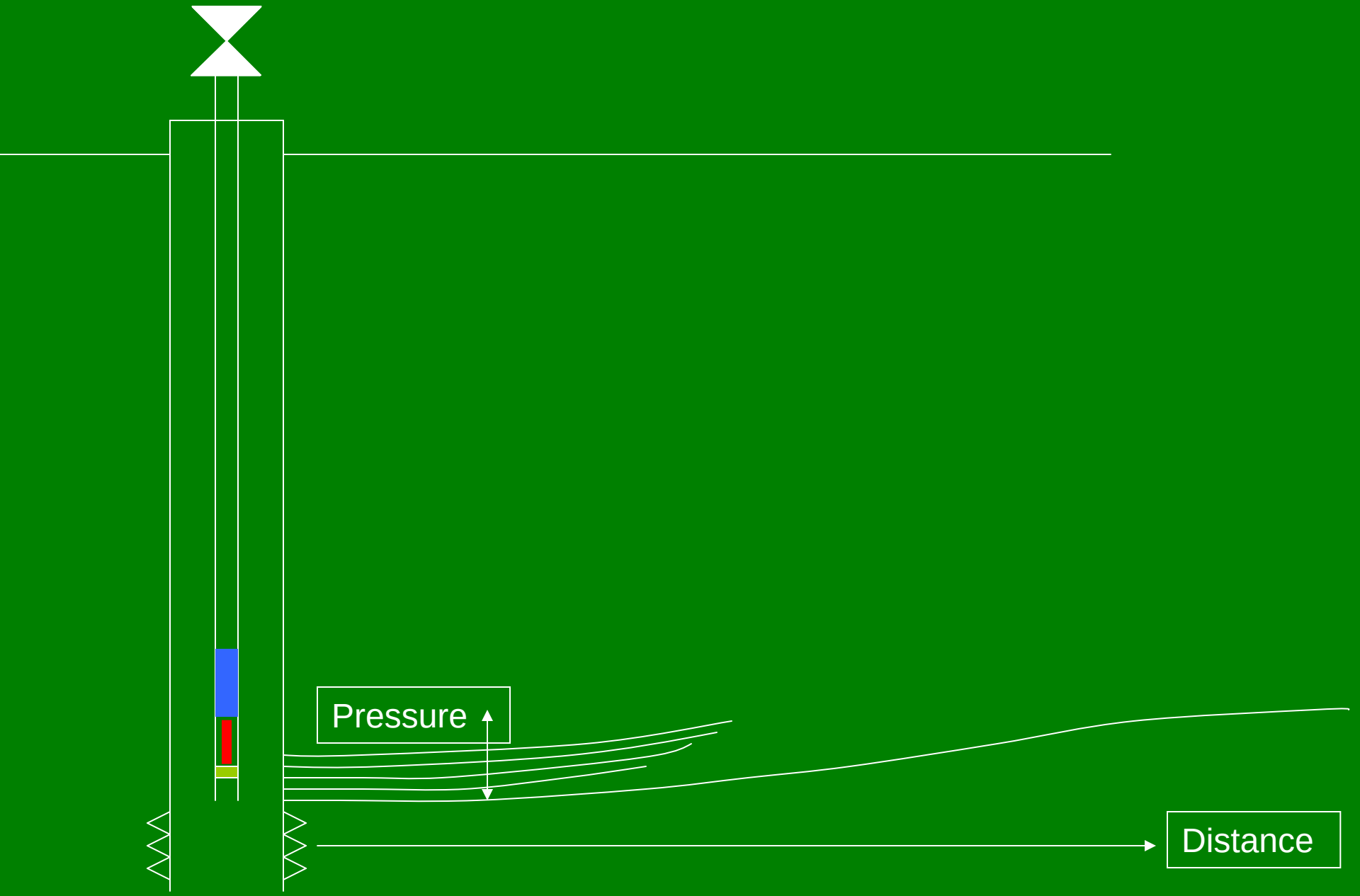
Plunger Lift

- An inexpensive method to lift fluids from gas wells using a vertical pig.
- Requires energy buildup in the casing or near wellbore reservoir to lift the plunger to surface.
- Inadequate energy or too much fluid causes well to over load and die.
- Venting to atmosphere (zero pressure) instantaneously increases differential pressure allowing well to flow.


Pressure
Distance


Pressure
Distance

Why is venting wells a bad thing?

- Vented gas is lost, never to be utilized as an energy source.
- Potential energy needed to lift liquids is depleted.
- Potential safety hazard.
  - Combustible mixture in the air.
  - High velocity plunger strikes on the wellhead.
- Global warming due to GreenHouse Gas emissions.

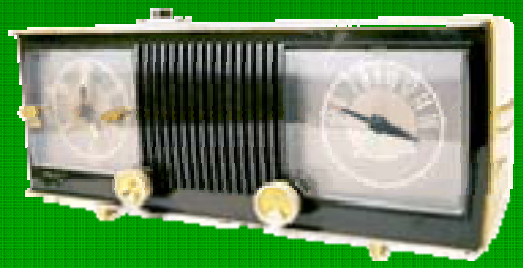
Issues

- 2300 wells with ~1000 plunger lift systems.
- Load up a well with liquids = order a swabbing unit to lift the liquids out of the well.
- Tight Gas consideration – inflow issues.

RTU Programming

LIST #2			
Index	Parameter	Signal Name	Engineering Units
1	Pipe Size	METER1.PIPE.SIZE	Inches
2	Pipe Material	METER1.PIPE.MAT	Carbon/Stainless
3	Orifice Size	METER1.ORIF.SIZE	Inches
4	Orifice Material	METER1.ORIF.MAT	Carbon/Stainless
5	Pressure Base	METER1PRESS.BASE	PSIA
6	Atmospheric Pressure	METER1.PRESS.ATM	PSIA
7	Temperature Base	METER1.TEMP.BASE	Degrees F
8	Tap Location	METER1.TAP.LOC	Up/Down Stream
9	DP Zero	METER1.DP.ZERO	“H2O
10	DP Span	METER1.DP.SPAN	“H20
11	Pressure Zero	METER1.PRESS.ZERO	PSIG
12	Pressure Span	METER1.PRESS.SPAN	PSIG

Clock



Initial Vent Reduction Project

- Automation project designed and funded in 2000.
  - Environmental project – funding justified on value of CO_2 credits and GHG mitigation commitments.
  - Upgrade existing RTUs & host system.
  - Developed new well control algorithms based on Load Factor and Turner rate.
- Pilot installations and testing in 2000.
- System sweep in 2001.
- Achieved roughly 50% reduction in venting from 2000 to 2004.

RTU & Host

- Remote Terminal Unit
  - Is the wellhead computer to do the controlling of the process as well as communicate information back and forth to the central host.
  - ~$15,000/well
- Host
  - Is the office based computer / communication system that the operators interface with in order to make setpoint changes at the wellhead.
  - $50k - $750k
    - How fast, how many sites…

But, we're still venting!!!

Recent Actions Taken

- Interviewed control room staff and worked closely with the field automation team leader.
- Developed two pilot studies in order to make changes with some scientific control.
- Established a new procedure based on plunger lift expertise and pilot well analysis.
- Incorporated new procedure into 2nd pilot.

And the solution was...

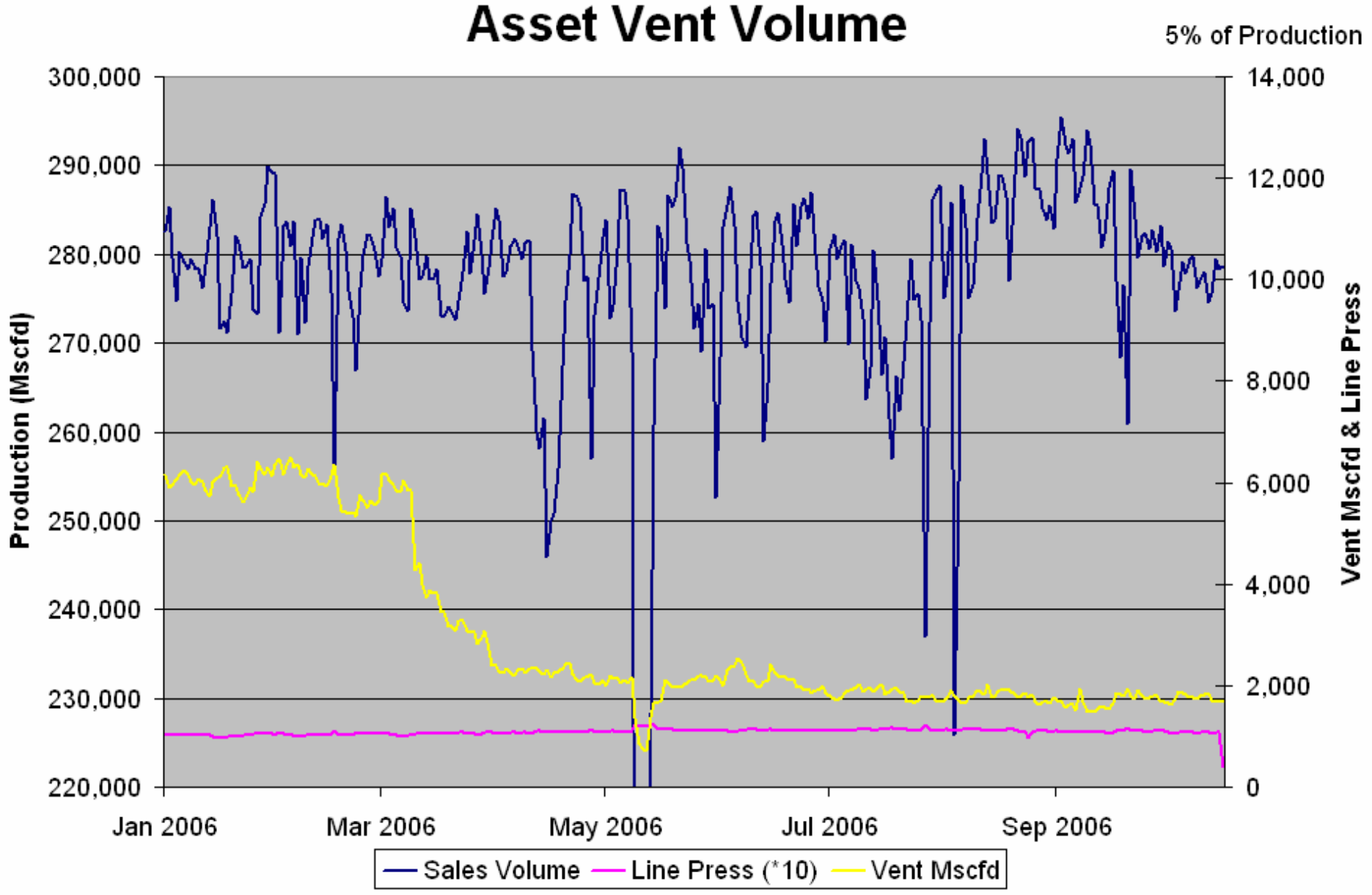
- Smarter automation (settings and code.)
- Minor maintenance changes at wellsite.
  - Leaking chokes to sales (you lose pressure and give away the gas.)
- New automation tools to help recognize problem situations.
- Making believers out of the staff and management.

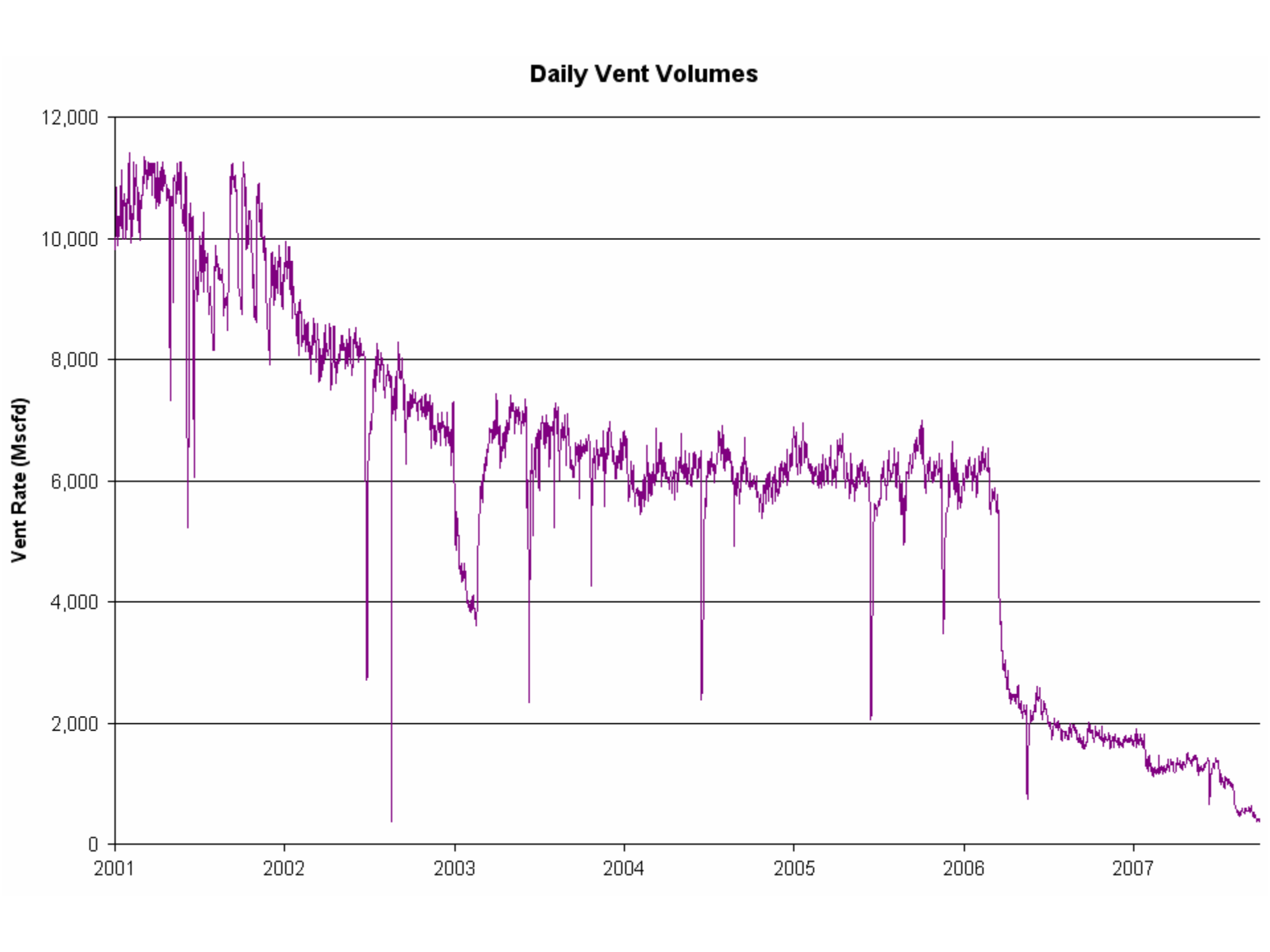
Myths

- There is always “another unique or different well”.
- After flow venting (after the plunger surfaces) is required to clean up the well.
- Increasing frequency of cycles cuts vent time.
- Tubing pressure can drop during shut-in.
- The reservoir does not have enough energy for plunger lift.

Lessons Learned

- Plunger velocities mean nothing if the well vents.
- A well can generally be run in “safe mode” (vent mode) and continue to produce.
- Load Factor is difficult to understand and evaluate.
- Need to have the option to adjust the Turner rate – critical velocity.


Asset Vent Volume
5% of Production
Production (Mscfd)
Vent Mscfd & Line Press
300,000
290,000
280,000
270,000
260,000
250,000
240,000
230,000
220,000
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
Jan 2006
Mar 2006
May 2006
Jul 2006
Sep 2006
Sales Volume
Line Press (*10)
Vent Mscfd


Daily Vent Volumes
Vent Rate (Mscfd)
12,000
10,000
8,000
6,000
4,000
2,000
0
2001
2002
2003
2004
2005
2006
2007

Summary

- Great success thus far 4 bcf/yr to 0.8 bcf/yr
- Technology is only a piece of the solution - most significant recent reductions are due to revised operational practices.
- Requires constant focus – Teams deliver on current goals.
- Operational beliefs have shifted from “We must vent to produce” to “Venting is one of our last options.”