



BR Efforts to Reduce Emissions of Criteria Pollutants

Bruce Gantner

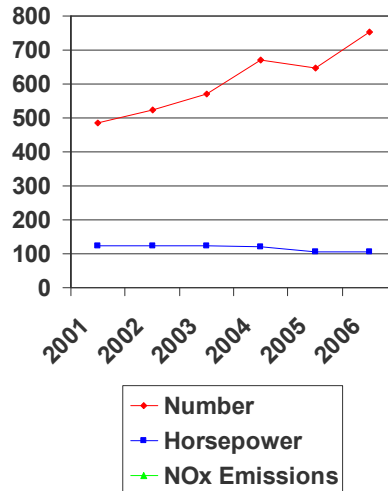
San Juan Division
Environmental, Health,
and Safety

Agenda

- Compressor Optimization (NOx and CO)
- Energy Efficiency (NOx and CO)
- Venting Efficiency (VOC)
- Vapor Recovery Units (VOC Reductions in TX and N. Dakota)

Compressor Optimization

- BR Owned Compressors
 - In 2001 BR owned approximately 485 units with a mean horsepower of 122.69 bhp.
 - As of February 2006, BR owned approximately 752 units with a mean horsepower of 106.49.



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Energy Efficiency

- Estimated Fuel Usage
 - 286 to 500 Bbl Tanks - 2.36 MMBtu/day (pilot and burner – assuming a 325,000 Btu/hr burner and 30% run time)
 - Separators - 1.8 MMBtu/day (pilot and burner – assuming a 250,000 Btu/hr burner and 30% burner run time)
- Heating is typically required 150 days out of the year during the winter for most sites.
- Some sites require heat year around to avoid solidifying of paraffin.

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Work Performed to Date

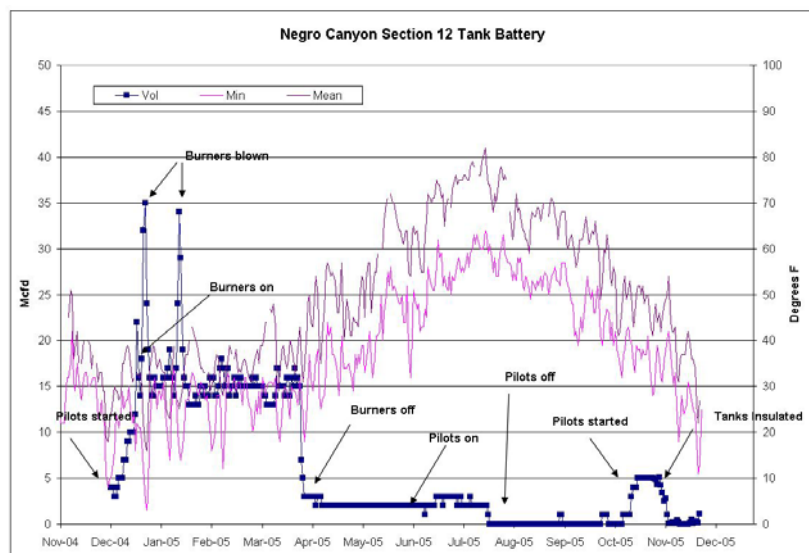
The Following sites have production equipment insulated:

- Negro Canyon #1 Tank Battery – Five Tanks
- Negro Canyon #2 Tank Battery – Three Tanks
- Cinder Gulch SWD Tank Battery – Five Tanks
- 29-7 #191 Well Location – One Separator
- Elliot Federal #22-1M Well Location – One Separator

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Energy Efficiency



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Negro Canyon #1 Tank Battery



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Negro Canyon #1 Tank Battery



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Negro Canyon #1 Tank Battery

Emissions Reductions

Fuel Saved: 2.36 MMBtu/day per tank (total fuel savings for five tanks is 11.8 MMBtu/day = 1770 MMBtu per year)

NOx Emissions REductions: 1770 MMBtu/yr x .08 lb NOx/mmBtu = 141.6 lbs NOx/year or .071 tpy

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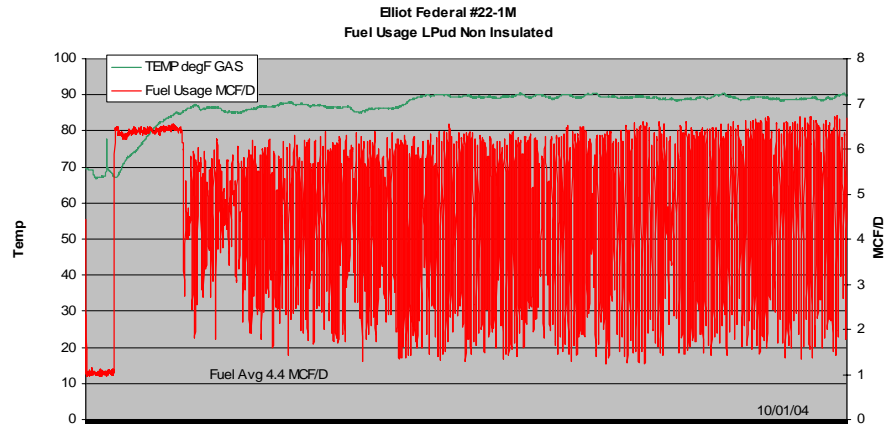
Elliot Federal #22-1M



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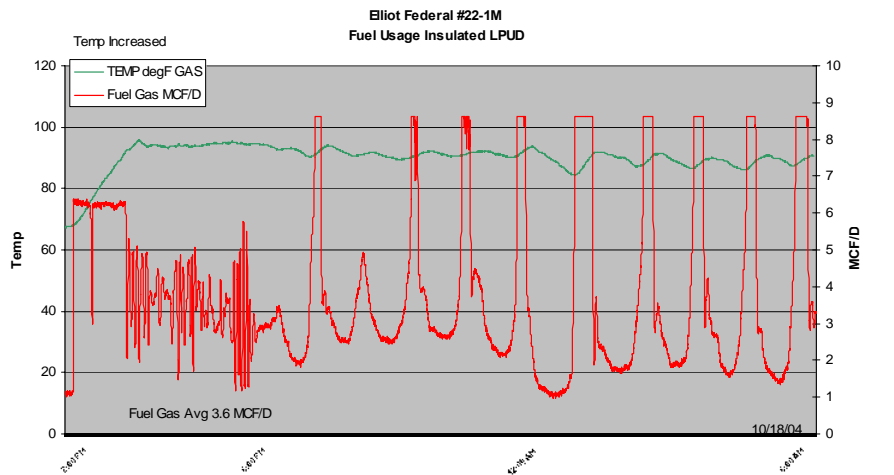
Elliot Federal #22-1M



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Elliot Federal #22-1M



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Elliot Federal #22-1M Emissions Reductions

Total Fuel Saved: 0.8 MMBtu/day (As shown on the attached graph) or 120 MMBtu/year

Emissions Reductions

$\text{NOx} = 120 \text{ MMBtu/year} \times .08 \text{ lbs NOx/MMBtu} = 9.6 \text{ lbs/year}$ or .0048 tpy.

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Typical Wellsite Emission Reductions

Assume Insulation of One Separator and One 286 Bbl Tank

Total Fuel Saved: 3.14 MMBtu/day (assuming pilots continue burning at a rate of 0.5 Mscf/day each) or 471 MMBtu/year

$\text{NOx Reduction} = 471 \text{ MMBtu/year} \times .08 \text{ lbs NOx/MMBtu} = 37.68 \text{ lbs NOx/year per wellsite}$ or .0188 tpy

Assuming like kind reductions across BR wellsites

$7000 \text{ wellsites} \times .0188 \text{ tpy} = 131.88 \text{ tpy NOx reductions}$

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Plunger Lift Operations

- Over 3000 Burlington operated wells are incapable of continuous flow (<18 hrs daily).
 - 304 MMCFD
- Venting Volumes as reported to MMS & NMOCD average last 6 months
 - 5.7 MMCFD

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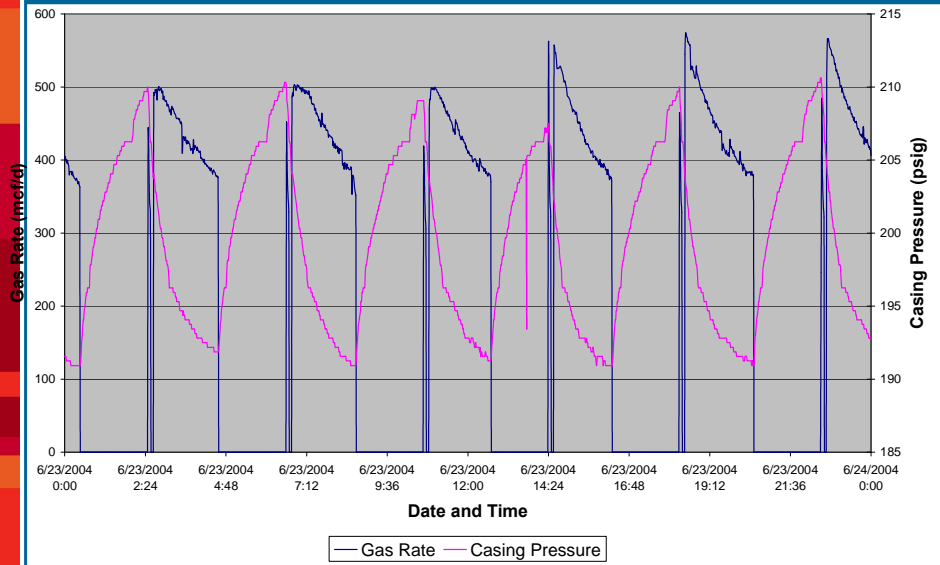
Current Status - Observations

- Opening and closing both relate to liquid load (circular logic)
 - Flowing time determines liquid load
 - Liquid load determines shut in time
- Optimum settings are difficult to translate basin wide
- Pressure builds fast and then slow

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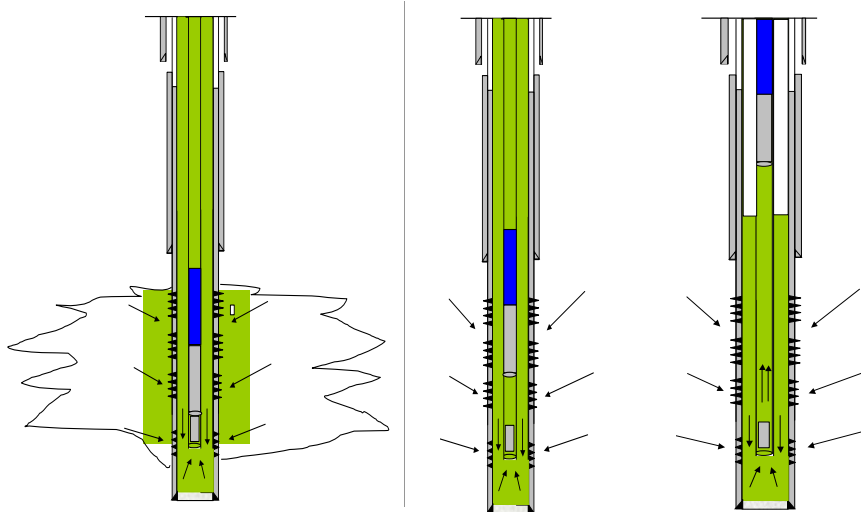
Typical Flow Cycle



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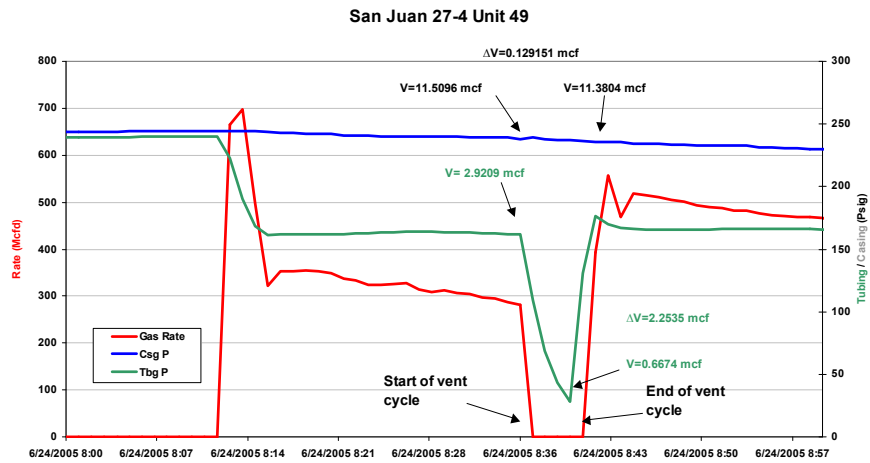
Plunger Lift Cycle Schematic



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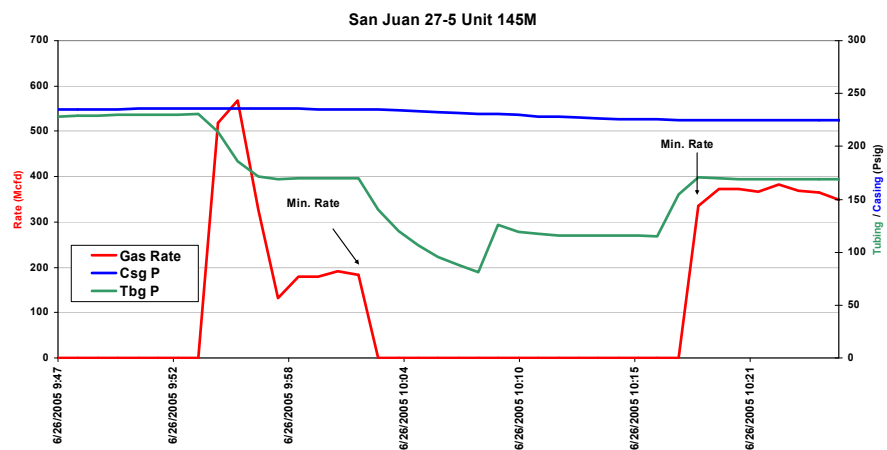
Current Status - Observations



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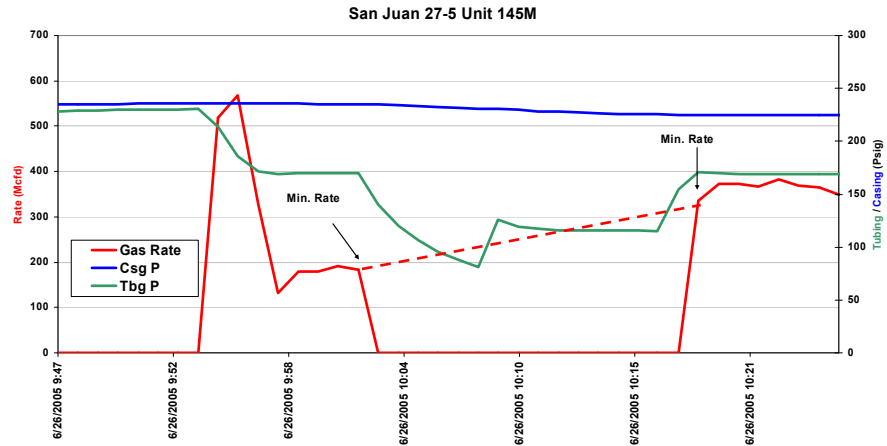
Current Status - Observations



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Current Status - Observations



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Field Measurement

- Install a connection between motor valve and backpressure regulator to accommodate Coriolis meter
- Calibration of meter was needed
- Used Coriolis meter to measure the gas rates going through the vent line
- Data Logger collected second by second data
- Collected data for about 24 hours on each well
- Pilot group consisted of 4 wells



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Test Procedure – Coriolis Meter



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San Juan 27-5 Unit 98E

	Before	After
Open Trigger	Shut-In Time Expired of 2 Hours	Casing Build of 3 psi in 30 minutes
Close Trigger	Critical Flow of 300 mcf/d	Critical Flow of 425 mcf/d
Flowing Time Per Day	16 hrs	12 hrs
Shut-In Time Per Day	8 hrs	12 hrs
Average Production	237 mcf	235 mcf
Average Line Pressure	162 psig	164 psig
Comments	Venting Every Cycle	Not Venting At All

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Coriolis Meter Data-Results

Well	Vent Cycle MCF	Vent Time Min	Cycles Per Day	~ MCFD
San Juan 27-5 145M	1.5-1.7	6	3-4	5.6
San Juan 27-5 35	4.7-4.8	15	7-8	35.6
San Juan 27-5 124M	2.6-2.7	9	4-5	11.9
San Juan 27-4 49	0.12-0.5	1.5-2.5	4	1.2

VOC emission reductions = 54.3 mcf/d x .15 x 365 days/year x 0.2 lbs/cf = 312 tpy

Methane emission reductions = 54.3 mcf/d x .80 x 365 x .0434 lbs/cf = 344 tpy

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Vapor Recovery

- Air Emission Regulations
 - State/Federal Regulations Require controls:
 - flash gas: heater-treater, tanks, dehydrators
- Avoid combustion flares
- Make economic sense at > 25MSCFD
- EPA Natural Gas Star
- API Greenhouse Gas Initiative

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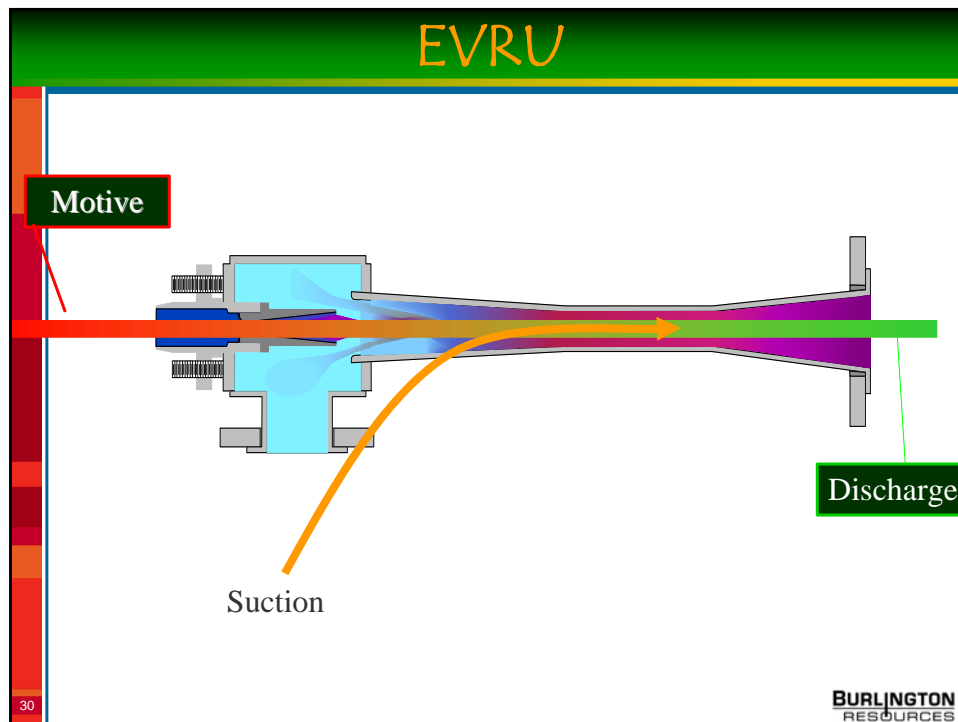
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Vapor Recovery Emissions Reductions

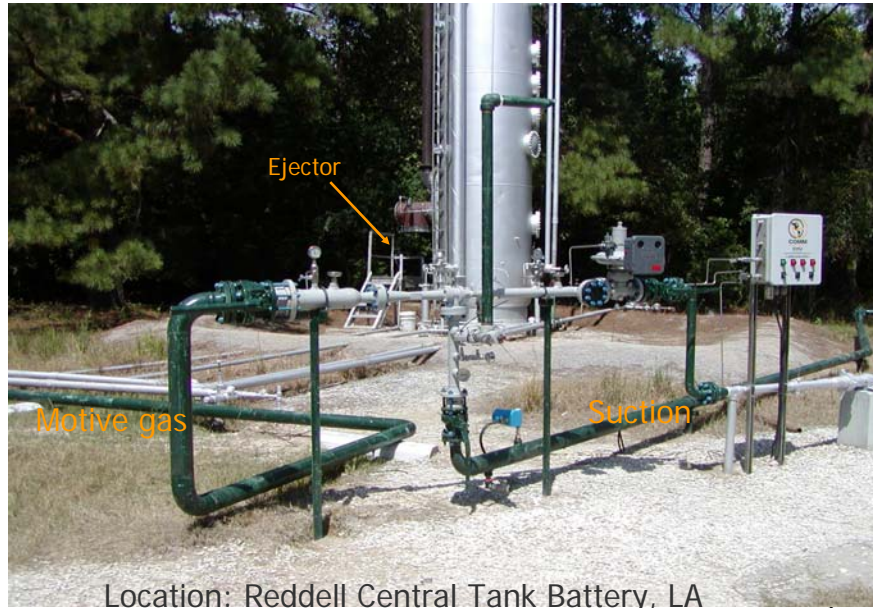
- Reddell, Louisiana: Installed 7/2004
 - Operating as planned at measured rates
 - 70MSCFD of 2475 MMBTU/SCF gas
 - VOC reductions of 383 tpy
- CHSU Nelson, North Dakota: Proposed
 - ~118 MSCFD of 2513 MMBTU/SCF gas
 - VOC reductions of 646 tpy
 - Increased unit size in 8/2005
- Several other installs followed in South LA and Cedar Creek Anticline area: 30-50 MSCFD

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Ejector-Based Vapor Recovery Unit



Location: Reddell Central Tank Battery, LA

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