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
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.

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.
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

Energy Efficiency
**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

**Elliot Federal #22-1M**
Elliot Federal #22-1M

**Graph: Elliot Federal #22-1M Fuel Usage LPud Non Insulated**

- Graph shows data for Temp and Fuel Usage in MCF/D.
- Legend includes lines for TEMP(degF), GAS, and Fuel Usage MCF/D.
- Data appears to trend between 60-80 degrees Fahrenheit with fluctuations in Fuel Usage.

**Graph: Elliot Federal #22-1M Fuel Usage Insulated LPUD**

- Similar to the above graph, but with an additional line indicating Temp Increased.
- Data shows Temp Increased spikes in the 110-120 degree range with Fuel Gas MCF/D remaining consistent.

Date labels on both graphs show 10/31/04.
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

NOx = 120 MMBtu/year x .08 lbs NOx/MBtum = 9.6 lbs/year or .0048 tpy.

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

NOx Reduction = 471 MMBtu/year x .08 lbs NOx/MBtum = 37.68 lbs NOx/year per wellsite or .0188 tpy

Assuming like kind reductions across BR wellsites

7000 wellsites x .0188 tpy = 131.88 tpy NOx reductions
**Plunger Lift Operations**

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

**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
Typical Flow Cycle

Date and Time

- Gas Rate
- Casing Pressure

Plunger Lift Cycle Schematic

BURLINGTON RESOURCES
Current Status - Observations

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
Test Procedure – Coriolis Meter

San Juan 27-5 Unit 98E

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

<table>
<thead>
<tr>
<th>Well</th>
<th>Vent Cycle MCF</th>
<th>Vent Time Min</th>
<th>Cycles Per Day</th>
<th>~ MCFD</th>
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<tbody>
<tr>
<td>San Juan 27-5 145M</td>
<td>1.5-1.7</td>
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<td>3-4</td>
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<td>San Juan 27-5 35</td>
<td>4.7-4.8</td>
<td>15</td>
<td>7-8</td>
<td>35.6</td>
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<tr>
<td>San Juan 27-5 124M</td>
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<td>9</td>
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<td>11.9</td>
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<td>San Juan 27-4 49</td>
<td>0.12-0.5</td>
<td>1.5-2.5</td>
<td>4</td>
<td>1.2</td>
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</tbody>
</table>

VOC emission reductions = 54.3 mcfd $\times$ 0.15 $\times$ 365 days/year $\times$ 0.2 lbs/cf = 312 tpy

Methane emission reductions = 54.3 mcfd $\times$ 0.80 $\times$ 365 $\times$ 0.0434 lbs/cf = 344 tpy

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
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
Ejector-Based Vapor Recovery Unit

Location: Reddell Central Tank Battery, LA