COP Efforts to Reduce Greenhouse Gas Emissions

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Health, Safety, and Environment
Agenda

- Compressor Optimization (CO₂)
- Energy Efficiency (CO₂)
- Venting Efficiency (CH₄)
Compressor Optimization

- COP-Owned Compressors
  - In 2000 a COP subsidiary owned approximately 485 units with a mean horsepower of 122.69 bhp.
  - As of February 2006, that same COP subsidiary owned approximately 1087 units with a mean horsepower of 124.37.

![Graph showing the increase in number and average horsepower from 2000 to 2006.](image)
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
Negro Canyon #1 Tank Battery
Negro Canyon #1 Tank Battery
Field Measurement

- Install a connection between motor valve and back-pressure 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
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

CO₂ Emissions Reductions: 1770 MMBtu/yr x 120 lb CO₂ /mmBtu = 212400 lbs CO₂/yr or 106 tpy
Elliot Federal #22-1M

Fuel Usage LPud Non Insulated

Fuel Avg 4.4 MCF/D

Temp degF GAS

ConocoPhillips
Elliot Federal #22-1M

Fuel Usage Insulated LPUD

Temp increased

Fuel Gas Avg 3.6 MCF/D

10/18/04
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

$\text{CO}_2 = 120 \text{ MMBtu/year} \quad 120 \text{ lbs CO}_2 /\text{MMBtu} = 14400 \text{ lbs/year} \text{ or 7.2 tpy.}$
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

CO₂ Reduction = 471 MMBtu/year  x 120 lbs CO₂ /MMBtu = 56520 lbs CO₂ /year per wellsite or 28.26 tpy

Assuming like-kind reductions across COP wellsites

10000 wellsites x 28.26 tpy = 282,600 tpy NOx reductions
Plunger Lift Operations

- Over 3000 ConocoPhillips operated wells are incapable of continuous flow (<18 hrs daily).
  - 304 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 (mcf/d)

Gas Rate
Casing Pressure
Plunger Lift Cycle Schematic
Current Status - Observations

San Juan 27-4 Unit 49

- Start of vent cycle
- End of vent cycle
- \( V = 11.5096 \) mcf
- \( V = 11.3804 \) mcf
- \( V = 2.9209 \) mcf
- \( \Delta V = 2.2535 \) mcf
- \( \Delta V = 0.129151 \) mcf
- \( V = 0.6674 \) mcf
## San Juan 27-5 Unit 98E

<table>
<thead>
<tr>
<th></th>
<th>Before</th>
<th>After</th>
</tr>
</thead>
<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>
</tr>
<tr>
<td>Close Trigger</td>
<td>Critical Flow of 300 mcf/d</td>
<td>Critical Flow of 425 mcf/d</td>
</tr>
<tr>
<td>Flowing Time Per Day</td>
<td>16 hrs</td>
<td>12 hrs</td>
</tr>
<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>
</tr>
</tbody>
</table>
## Coriolis Meter Data - Results

<table>
<thead>
<tr>
<th>Well</th>
<th>San Juan 27-5 #145M</th>
<th>San Juan 27-5 #35</th>
<th>San Juan 27-5 #124M</th>
<th>San Juan 27-4 #49</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Csg Depth</strong></td>
<td>7769</td>
<td>5535</td>
<td>7644</td>
<td>8023</td>
</tr>
<tr>
<td><strong>Tbg Depth</strong></td>
<td>7649</td>
<td>5455</td>
<td>7518</td>
<td>7960</td>
</tr>
<tr>
<td><strong>Avg. LP</strong></td>
<td>177-179 psia</td>
<td>184-187 psia</td>
<td>182-184 psia</td>
<td>164-174 psia</td>
</tr>
<tr>
<td><strong>D/P</strong></td>
<td>(-5) to (-7) psig</td>
<td>68-69 psig</td>
<td>18-22 psig</td>
<td>(-1) to (-2) psig</td>
</tr>
</tbody>
</table>

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

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