Process Optimization Review
PRO-OP
August 31, 2009

NEWFIELD EXPLORATION COMPANY

Newfield Exploration

- Offshore Malaysia
- Offshore China

INTERNATIONAL AREAS
- Gulf of Mexico
- Val Verde Basin
**Pro–Op**
Process Optimization Review

**PRO-OP Concept**

- How can we get as much product, produced at the wellhead, to the sales meter?

- **PRO-OP** – a systematic approach to increase production efficiencies and profitability through evaluating process components whereby methane emissions are reduced on a cost effective basis.

**Pro – Op……the big picture**

*Build in optimization on the front end*

- Drilling
- Completion
- Stimulation
- Production
- Work over

- Modification / Repairs
- Ongoing Facility Evaluations
Process Optimization Review

Pro–Op

Process

- Similar to a Process Hazards Review
- Follow process flow
- Identify opportunities

- Cost effectively eliminate emission source
- Cost effectively capture for sales
- Flare (destruction)

**Attention to Details... Increases Profitability**
### Optimization Techniques

#### Table 1- List of major optimization techniques for oil and gas production operations

<table>
<thead>
<tr>
<th>Process</th>
<th>Optimization Technique to Reduce Venting Emissions</th>
</tr>
</thead>
</table>
| Pneumatics                           | 1. Use low bleed pneumatics versus high bleed pneumatics  
                                          2. Use compressed air                                                                                       |
| Pressure Relief System               | 1. Repair or replace leaking relief system components                                                              |
| Production Separators                | 1. Reduce operating pressure of separators just upstream of storage tanks  
                                          2. Route flash gas to compressor for sales                                                                     |
| Glycol Dehydration Units - Still Column Vent | 1. Install condenser, flare or vapor recovery system  
                                          2. Optimize glycol circulation rates                                                                           |
| Glycol Dehydration Unit Flash Tanks  | 1. Route gas to fuel system  
                                          2. Install vapor recovery system or route compressor  
                                          3. Burn gas in flare                                                                                           |
| Flare and Vent Systems               | 1. Repair components leaking into vent system  
                                          2. Install vapor recovery to recover routine natural gas venting                                                |
| Internal Combustion Engines          | 1. Maximize fuel efficiency with controls                                                                          |
| Reciprocating Compressors            | 1. Replace worn compressor rod packing rings and rods                                                              |
| Centrifugal Compressors              | 1. Replace wet seals with dry seals in centrifugal compressors                                                     |
| Crude Oil Storage Tank               | 1. Install vapor recovery system to recover vent gases                                                             |

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### Pro - Op Process Onshore

- **High Bleed vs. Low Bleed**
- **PSV Integrity**
- **Separator Pressure?**
- **Non-Condensables**
- **Circulation Rates**
- **Fuel Efficiencies**
- **Flash Separator**
- **Seals**
- **Flash Emissions**
- **Separator Temperature?**
- **To Comp**
Non-Optimized Facility

Optimization Techniques

ATTENTION TO DETAILS EQUALS INCREASED PROFITABILITY
## Before and After Optimization

Table 3- Vent gas emissions and value before and after optimization

<table>
<thead>
<tr>
<th>Process</th>
<th>Optimization Technique</th>
<th>Gas Recovered (MMBTU/yr)</th>
<th>Optimization Costs First Year ($)</th>
<th>Recovered Product Value ($/year)</th>
<th>First Year Optimization Savings/Costs ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pneumatics</td>
<td>Low bleed natural gas pneumatics controllers</td>
<td>1,900</td>
<td>-2,200</td>
<td>9,500</td>
<td>11,700</td>
</tr>
<tr>
<td>Glycol Dehydration Unit</td>
<td>Vent gas from still column and flash tank recovered by EVRU™</td>
<td>50</td>
<td></td>
<td></td>
<td>3,850</td>
</tr>
<tr>
<td>Glycol Dehydration Unit</td>
<td>Flash tank gas routed to vapor recovery system</td>
<td>1,100</td>
<td>120,000</td>
<td>5,500</td>
<td>62,850</td>
</tr>
<tr>
<td>Heater Treater Flash</td>
<td>Vapor recovery by EVRU™</td>
<td>19,200</td>
<td></td>
<td></td>
<td>96,000</td>
</tr>
<tr>
<td>Oil Storage Tanks</td>
<td>Vapor recovery by EVRU™</td>
<td>15,500</td>
<td></td>
<td>77,500</td>
<td>74,550</td>
</tr>
<tr>
<td>Totals:</td>
<td></td>
<td>37,750</td>
<td>117,800</td>
<td>192,350</td>
<td>74,550</td>
</tr>
</tbody>
</table>

## Optimization Techniques

Table 4- Total Vent gas and methane emissions before and after optimization

<table>
<thead>
<tr>
<th>Process</th>
<th>Optimization Technique</th>
<th>Natural Gas Vented Not Optimized (MMSCF/yr)</th>
<th>Natural Gas Recovered by Optimization (MMSCF/yr)</th>
<th>Methane Only Emissions Not Optimized by Optimization (MMSCF/yr)</th>
<th>Methane Recovered by Optimization (MMSCF/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pneumatics</td>
<td>Low bleed natural gas pneumatics controllers</td>
<td>2</td>
<td>1.9</td>
<td>1.9</td>
<td>1.8</td>
</tr>
<tr>
<td>Glycol Dehydration Unit</td>
<td>Vent gas from still column and flash tank recovered by EVRU™</td>
<td>1.2</td>
<td>1.2</td>
<td>1.1</td>
<td>1.1</td>
</tr>
<tr>
<td>Heater Treater Flash Gas</td>
<td>Vapor recovery by EVRU™</td>
<td>8.4</td>
<td>8.4</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Crude Oil Storage Tanks</td>
<td>Vapor recovery by EVRU™</td>
<td>6.8</td>
<td>6.8</td>
<td>1.7</td>
<td>1.7</td>
</tr>
<tr>
<td>Totals:</td>
<td></td>
<td>18.4</td>
<td>18.3</td>
<td>9.7</td>
<td>9.6</td>
</tr>
</tbody>
</table>
Conclusion

- Use PRO-OP on new facility designs
- Prepare optimization template
- Prepare and conduct field training
- Use PRO-Op on existing facilities
- Increase Profitability and report methane reductions to EPA Natural Gas Star Program