Methane to Markets

Methane Savings from Natural Gas Dehydrators

Gazprom – EPA Technical Seminar on Methane Emission Mitigation

28 – 30 October, 2008
Methane Savings from Natural Gas Dehydrators: Agenda

- Methane Losses
- Opportunities for Methane Recovery
- Is Recovery Profitable?
- Industry Experience
- Discussion
Dehydrators: Methane Losses

- Produced gas is saturated with water, which must be removed for long distance gas pipelines
- Glycol dehydrators are the most common equipment used to remove water from gas
  - Most use triethylene glycol (TEG)
- Glycol dehydrators emit methane
  - Methane, Non-Methane Hydrocarbons (NMHC), Hazardous Air Pollutants (HAPs), Benzene, Toluene, Ethylbenzene, Xylene (BTEX) from reboiler vent
  - Methane from pneumatic controllers and glycol circulation pumps

Source: www.prideofthehill.com
Basic Glycol Dehydrator System Process Diagram

- **Inlet Wet Gas**
- **Dry Sales Gas**
- **Motive Gas Bypass**
- **Glycol Energy Exchange Pump**
- **Driver**
- **Lean TEG**
- **Rich TEG**
- **Glycol Reboiler/Regenerator**
- **Water/Methane/NMHC/HAPs/BTEX To Atmosphere**
- **Fuel Gas or Waste Heat**
Natural Gas Dehydrators: Options for Methane Recovery

- Optimize glycol circulation rates
- Install flash tank separator
- Install electric pump

Glycol Dehydrator Unit
Source: GasTech
Optimizing Glycol Circulation Rate

- Gas pressure and flow at gathering/booster stations vary over time
  - Glycol circulation rates are often set at a maximum circulation rate

- Glycol overcirculation results in more methane emissions without significant reduction in gas moisture content
  - Partners found circulation rates two to three times higher than necessary

- Methane emissions are directly proportional to glycol circulation rate
  - Reduction in the glycol circulation rate reduces methane emissions
  - Lessons Learned study: optimize circulation rates
Flash Tank Recovers Methane

- Methane and NMHC entrained with the rich TEG is vented to the atmosphere from the TEG regenerator
- Installation of flash tank separators enables gas and liquid separation at either the fuel gas system pressure or a compressor suction pressure
- Recovers about 90 percent of methane emissions and 10 to 90 percent of NMHC
- Must have an outlet for low pressure gas
  - Fuel
  - Compressor suction
  - Vapor recovery unit (VRU)
Flash Tank Costs

- Lessons Learned study\(^1\) provides guidelines for scoping costs, savings and economics

- Capital and installation costs:
  - Capital costs range from $3,300 to $6,700 per flash tank
  - Installation costs range from $1,600 to $3,000 per flash tank

- Negligible operational and maintenance costs

\(^1\)Source: EPA Natural Gas STAR Lessons Learned Document “Optimize Glycol Circulation and Install of Flash Tank Separators in Dehydrators”
Electric Pump Eliminates Motive Gas

Methane to Markets

Inlet Wet Gas

Glycol Contactor

Dry Sales Gas

Motive gas

Kimray Driver

Electric Motor Driven Pump

Lean TEG

Rich TEG

Glycol Reboiler/Regenerator

Water/Methane/NMHC/HAPs/BTEX To Atmosphere

Fuel Gas

Motive gas

Fuel Gas
Overall Benefits: Reducing Dehydrator Emissions

- Financial return on investment through gas savings
- Increased operational efficiency
- Reduced Operational and Maintenance costs (fuel gas, glycol make-up)
- Reduced air pollutant emissions (NMHC, HAPs, BTEX)
## Is Recovery Profitable?

### Economic Analysis of Dehydrator Options Based on Natural Gas STAR Partner Experiences

<table>
<thead>
<tr>
<th>Option</th>
<th>Cost of Implementation</th>
<th>Emissions Savings ($/year)</th>
<th>Payback Period&lt;sup&gt;1&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Optimize Circulation Rate</td>
<td>Negligible</td>
<td>$2,800 to $276,000</td>
<td>Immediate</td>
</tr>
<tr>
<td>Install Flash Tank</td>
<td>$6,500 to $18,800</td>
<td>$8,000 to $75,000</td>
<td>4 to 11 months</td>
</tr>
<tr>
<td>Install Electric Pump</td>
<td>$2,700 to $15,100</td>
<td>$2,520 to $252,000</td>
<td>&lt; 1 month to several years</td>
</tr>
</tbody>
</table>

<sup>1</sup> Based on US costs and gas prices; gas price of $250/Mcm

Source: EPA Natural Gas STAR Lessons Learned Document “Optimize Glycol Circulation and Install of Flash Tank Separators in Dehydrators” and “Replacing Gas-Assisted Glycol Pumps with Electric Pumps”
Additional Dehydration Opportunities

- **Desiccant dehydrators**
  - Use packed column of desiccant salts to remove water instead of using glycol

- **Zero emission dehydrators**
  - Combine several dehydration technologies (flash tanks, electric pumps, reroute skimmer gas, electric control valves) to virtually eliminate methane emissions

- **JATCO venturi system**
  - Use high pressure motive gas to capture still gas and reroute to facility suction to create a closed loop system
Industry Experience: EnCana Oil & Gas (USA)

- In Colorado, EnCana uses Jatco BTEX condensers and venturi valves
- Technology used to route vapors back to the suction of the facility
- All vapors post condenser are routed to the inlet via a venturi valve
- Creates a closed loop system

Source: EnCana Oil & Gas (USA) Inc.
Overview: JATCO Venturi System

- Discharge to plant inlet
- Gases in from Still Vent

Sand Vessel

- Motive Gas Supply
- Venturi Valve
  - Low pressure vent gas
  - High pressure
  - Motive Gas
  - Discharge gas to suction
EnCana Experience: JATCO Venturi Application

- Must have high pressure motive gas
- Motive gas can be from a compressor or dry gas from the dehydrator
- Must have low suction pressures, or low pressure gas stream
- EnCana’s Colorado operations are applicable because they have suctions pressures of 2.7 – 3.0 atm

\(^1\) 1 atmosphere (atm) = 0 pounds per square inch gauge (psig) and 14.7 pounds per square inch atmospheric (psia)
\(^1\) 1 atm = 1.013 bar = 101.3 kPa
EnCana Experience: Costs of Installation

- Average unit cost ~ $12,000
- Average piping cost ~ $1,300
- Average installation ~ $6,500
- Total Cost ~ $19,800
- Technology allows for large emissions savings. Quantity of methane captured is small and will vary by site.
- Eliminates the need for a BTEX combustor at the Colorado sites where the Jatco unit was installed
Methane Savings from Natural Gas Dehydrators: Discussion

- Industry experience applying these technologies and practices
- Limitations on application of these technologies and practices
- Actual costs and benefits