Replacing High-Bleed Pneumatic Devices

Lessons Learned from Natural Gas STAR Partners

NiSource and EPA’s Natural Gas STAR Program

June 3, 2003
Pneumatic Devices

- Pneumatic devices are found in every gas production, processing, transmission and distribution facility.
- Most pneumatic devices leak gas by design.
- Losses from pneumatic devices are the largest source of methane emissions.
- Replacing, retrofitting, or maintaining high-bleed devices saves gas and money.
- These methods can be highly cost-effective.
Location of Pneumatic Devices at Compression Stations

SOV = Shut-off Valve (Unit Isolation)
LC = Level Control (Knockout, Contactor, TEG Regenerator)
TC = Temperature Control (Regenerator Fuel Gas)
FC = Flow Control (TEG Circulation, Compressor Bypass)
PC = Pressure Control (FTS Pressure, Compressor Suction/Discharge)
Sources of Methane Losses

- As part of normal operations, pneumatic devices release natural gas into the atmosphere.
- High-bleed devices bleed in excess of 6 scf per hour.
  - Equates to >50 Mcf per year.
  - Typical high-bleed pneumatic devices bleed an average of 140 Mcf per year.
- The actual bleed rate is largely dependent on the device’s design.
Magnitude of Methane Losses

- Major source of methane losses from the natural gas industry
- Pneumatic devices are used throughout the natural gas industry
  - Between 90,000 to 130,000 in the transmission sector
  - Over 250,000 in the production sector
  - In the distribution sector most pneumatic devices are non-bleeding pressure regulators
## Losses from Pneumatic Devices

<table>
<thead>
<tr>
<th></th>
<th>Gas Industry</th>
<th>Oil Industry</th>
</tr>
</thead>
<tbody>
<tr>
<td>Production</td>
<td>31 Bcf</td>
<td>22 Bcf</td>
</tr>
<tr>
<td>Processing</td>
<td>16</td>
<td>---</td>
</tr>
<tr>
<td>Transmission</td>
<td>14</td>
<td>---</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>61 Bcf</strong></td>
<td><strong>22 Bcf</strong></td>
</tr>
</tbody>
</table>

**Total Gas/Oil**: 83 Bcf/yr
Three Options for Reducing Losses

- **Option 1**: Replace high-bleed devices with low-bleed devices
- **Option 2**: Retrofit controller with bleed reduction kits
- **Option 3**: Maintenance aimed at reducing losses
Option 1: Replace High-Bleed Devices

- Most applicable to:
  - Controllers: liquid-level and pressure
  - Positioners and Transducers

- Suggested Action: Evaluate replacements
  - Replace at end of device’s useful life
  - Early replacement
Option 1: Replace High-Bleed (cont’d)

- Costs vary with size
  - Typical costs range from $700 to $3,000 per device
  - Incremental costs of low-bleed devices are modest ($150 to $250)
  - Gas savings often pay for replacement costs in short periods of time
Option 2: Retrofit with Bleed Reduction Kits

- Most applicable to:
  - High-bleed controllers

- Suggested Action: Evaluate retrofits
  - As alternative to early replacement
  - Retrofit kit costs approximately $250-$500
Option 3: Maintenance to Reduce Losses

- Applies to all pneumatic devices
- Suggested Action: Modify routine maintenance procedures
  - Field survey of installed controllers
  - Where process allows, tune controllers to minimize bleed
Option 3: Maintenance (cont’d)

Suggested Action (cont’d)

- Re-evaluate the need for pneumatic positioners
- Repair/replace airset regulators
- Reduce regulated gas supply pressure to minimum
- Routine maintenance should include repairing/replacing leaking components

Cost is low
Summary of Decision Process

1. Locate and inventory the high-bleed devices
2. Measure & record bleed rates, use vendor specifications, or use EPA defaults
3. Establish technical feasibility of alternatives
4. Evaluate economics of alternatives
5. Develop an implementation plan
### Economics of Replacement

<table>
<thead>
<tr>
<th>Implementation&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Replace at End of Life</th>
<th>Early Replacements</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost ($)&lt;sup&gt;b&lt;/sup&gt;</td>
<td>150 – 250</td>
<td>380</td>
<td>1,340</td>
</tr>
<tr>
<td>Annual Gas Savings (Mcf)</td>
<td>50 – 200</td>
<td>166</td>
<td>228</td>
</tr>
<tr>
<td>Annual Value of Saved Gas ($)&lt;sup&gt;c&lt;/sup&gt;</td>
<td>150 – 600</td>
<td>498</td>
<td>684</td>
</tr>
<tr>
<td>Payback (months)</td>
<td>5 – 12</td>
<td>9</td>
<td>23</td>
</tr>
<tr>
<td>IRR (%)</td>
<td>97 – 239</td>
<td>129</td>
<td>42</td>
</tr>
</tbody>
</table>

<sup>a</sup> All data based on Partners’ experiences. See *Lessons Learned* for more information.

<sup>b</sup> Range of incremental costs

<sup>c</sup> Gas price is assumed to be $3/Mcf.
## Economics of Retrofit

<table>
<thead>
<tr>
<th></th>
<th>Retrofit a</th>
</tr>
</thead>
<tbody>
<tr>
<td>Implementation cost b</td>
<td>$250-500</td>
</tr>
<tr>
<td>Bleed rate reduction (Mcf/device/year)</td>
<td>219</td>
</tr>
<tr>
<td>Value of gas saved ($/year) c</td>
<td>657</td>
</tr>
<tr>
<td>Payback (months)</td>
<td>9</td>
</tr>
<tr>
<td>IRR</td>
<td>129%</td>
</tr>
</tbody>
</table>

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*a* On high-bleed controllers  
*b* All data based on Partners’ experiences. See *Lessons Learned* for more information  
*c* Gas price is assumed to be $3/Mcf
## Economics of Maintenance

<table>
<thead>
<tr>
<th>Implementation Cost ($)(^a)</th>
<th>Reduce supply pressure</th>
<th>Repair &amp; retune</th>
<th>Change settings</th>
<th>Remove valve positioners</th>
</tr>
</thead>
<tbody>
<tr>
<td>153</td>
<td>23</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Gas savings (Mcf/yr)</td>
<td>175</td>
<td>44</td>
<td>88</td>
<td>158</td>
</tr>
<tr>
<td>Value of gas saved ($/yr)(^b)</td>
<td>525</td>
<td>132</td>
<td>264</td>
<td>474</td>
</tr>
<tr>
<td>Payback (months)</td>
<td>3.5</td>
<td>2</td>
<td>&lt;1</td>
<td>&lt;1</td>
</tr>
<tr>
<td>IRR</td>
<td>343%</td>
<td>574%</td>
<td>--</td>
<td>--</td>
</tr>
</tbody>
</table>

\(^a\) All data based on Partners’ experiences. See Lessons Learned for more information.

\(^b\) Gas price is assumed to be $3/Mcf
Recommendations

- Evaluate all pneumatics to identify candidates for replacement and retrofit
- Choose lower bleed models at change-out where feasible
- Identify candidates for early replacement and retrofits by doing economic analysis
- Improve maintenance
- Develop an implementation plan
Discussion Questions

- To what extent are you implementing this technology?
- How can this technology be improved upon or altered for use in your operation(s)?
- What are the barriers (technological, economic, lack of information, regulatory, etc.) that are preventing you from implementing this technology?