Natural Gas Processing

- 17.1 MMT CO$_2$e
- 7.9% of total natural gas systems emissions
Background

Natural Gas Processing – Sources at processing plants, including fugitives, reciprocating compressors, centrifugal compressors, vented and combusted emissions (e.g., compressor exhaust, etc.) and maintenance venting.

### 2012 Inventory Natural Gas Processing Emissions (MMT CO$_2$e)

<table>
<thead>
<tr>
<th></th>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Calculated Potential</td>
<td>17.9</td>
<td>18.3</td>
<td>18.4</td>
<td>17.3</td>
<td>20.1</td>
</tr>
<tr>
<td>Voluntary Reductions</td>
<td>+</td>
<td>-0.1</td>
<td>-0.3</td>
<td>-2.4</td>
<td>-2.7</td>
</tr>
<tr>
<td>Regulatory Reductions</td>
<td>+</td>
<td>+</td>
<td>-0.3</td>
<td>-0.3</td>
<td>-0.3</td>
</tr>
<tr>
<td>Net Emissions</td>
<td>18.0</td>
<td>18.1</td>
<td>17.8</td>
<td>14.6</td>
<td>17.1</td>
</tr>
</tbody>
</table>

+ = Does not exceed 0.05 MMT CO$_2$e
Natural Gas Processing Emission Sources

• 3 sources represent over 97% of natural gas processing emissions
  – Reciprocating compressors
  – Centrifugal compressors (wet seals)
  – Gas engines

• Other sources
  – Plant fugitives
  – Centrifugal compressors (dry seals)
  – Gas turbines
  – Acid gas removal (AGR) vents
  – Kimray pumps
  – Dehydrator vents
  – Pneumatic devices
  – Blowdowns/venting
Natural Gas Processing Emissions

2010 Methane Emissions (2012 Inventory), MMT CO$_2$e

- Reciprocating compressors: 3.5
- Centrifugal compressors (wet seals): 8.3
- Gas engines: 4.9
- Other sources: 0.3
General Methodology
Overview

Step 1. Calculate potential methane
• 1a – Activity Data
• 1b – Emission Factor

Step 2. Compile reductions data
• 2a – Voluntary Reductions Reported to GasStar
• 2b – Regulatory Reductions

Step 3. Calculate Net Emissions
Reciprocating Compressors

*Includes methane emissions from reciprocating compressor blowdown open-ended lines, pressure relief valves, starter open-ended lines, and rod packing seals*

**Step 1. Calculate Potential Methane**
- Activity Data is number of reciprocating compressors for given year – 1992 value (EPA/GRI 1996) scaled linearly from 1992 to 2010 with dry gas production

\[
AD_{2010} = \# \text{ of Recip Comp}_{1992} \times \frac{\text{Gas Prod}_{2010}}{\text{Gas Prod}_{1992}}
\]

- Emission factor is 11,196 scfd/year-compressor from EPA/GRI (1996)

**Step 2. Compile Reductions Data**
- Future Inventories--NSPS

**Step 3. Calculate Net Emissions**

2010 Emissions (2012 Inventory), MMT CO₂e

<table>
<thead>
<tr>
<th>Activity data (Compressors)</th>
<th>Emissions Factor (scf per compressor)</th>
<th>Emissions (MMT CO₂e)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5,028</td>
<td>× 11,196</td>
<td>= 8.3</td>
</tr>
</tbody>
</table>
Centrifugal Compressors (Wet Seal)

Wet seals use oil seals around the rotating shaft to prevent natural gas from escaping where the compressor shaft exits the compressor casing.

**Step 1. Calculate Potential Methane**

- Activity Data is number of centrifugal compressors with wet seals for given year – 1992 value (EPA/GRI 1996) scaled linearly from 1992 to 2010 with dry gas production minus # of centrifugal compressors with dry seals

\[
AD_{2010} = \# \text{ of CentCompWS}_{1992} \times \left(\frac{\text{Gas Prod}_{2010}}{\text{Gas Prod}_{1992}}\right) - \# \text{ of CentCompDS}_{2010}
\]

- Emission factor is 51,369 scfd/year-compressor

**Step 2. Compile Reductions Data**

- Future Inventories—NSPS

**Step 3. Calculate Net Emissions**

2010 Emissions (2012 Inventory), MMT CO₂e

<table>
<thead>
<tr>
<th>Activity data (Compressors)</th>
<th>Emissions Factor (scf per compressor)</th>
<th>Emissions (MMT CO₂e)</th>
</tr>
</thead>
<tbody>
<tr>
<td>672</td>
<td>× 51,369</td>
<td>= 4.9</td>
</tr>
</tbody>
</table>
Gas Engines

*Internal combustion engines fueled by natural gas which serve as the driving force for reciprocating compressors*

**Step 1. Calculate Potential Methane**
- Activity Data is number of horsepower-hours for given year – scaled linearly from 1992 to 2010 with dry gas production
  \[ AD_{2010} = \text{MMHPhr}_{1992} \times \left( \frac{\text{Gas Prod}_{2010}}{\text{Gas Prod}_{1992}} \right) \]
- Emission factor is 0.24 scf/horsepower-hour from EPA/GRI (1996)

**Step 2. Compile Reductions Data**
- N/A

**Step 3. Calculate Net Emissions**
- 2010 Emissions (2012 Inventory), MMT CO₂e

<table>
<thead>
<tr>
<th>Activity data (MMHP-hr)</th>
<th>Emissions Factor (scf per HP-hour)</th>
<th>Emissions (MMT CO₂e)</th>
</tr>
</thead>
<tbody>
<tr>
<td>36,124</td>
<td>× 0.24</td>
<td>= 3.5</td>
</tr>
</tbody>
</table>
Calculating Net Emissions Processing

• Voluntary reduction activities include:
  – Directed inspection and maintenance at processing plants
  – Improve measurement systems to track gas loss
  – DI&M aerial leak detection using laser and/or infrared technology
  – Install flash tank separators on glycol dehydrators
  – Eliminate unnecessary equipment and/or systems
  – Optimize nitrogen rejection unit to reduce methane in N\textsubscript{2} reject stream

• Regulatory reduction activities include:
  – NESHAP in dehydrating vents
  – Future Inventories--NSPS

2010 Emissions from Processing (2012 Inventory), MMT CO\textsubscript{2}e

<table>
<thead>
<tr>
<th>Calculated Potential</th>
<th>Voluntary Reductions</th>
<th>Regulatory Reductions</th>
<th>Emissions (MMT CO\textsubscript{2}e)</th>
</tr>
</thead>
<tbody>
<tr>
<td>20.1</td>
<td>-2.7</td>
<td>-0.3</td>
<td>= 17.1</td>
</tr>
</tbody>
</table>
Questions for Stakeholders

• Are more recent data sources available?
  – Activity data
  – Emission factors
  – Drivers

• Suggestions for updates to presentation of processing sector information in the GHG Inventory?