Other Production Emissions Sources

September 13, 2012

*This presentation contains minor corrections to slides presented at the workshop.*
Methane Potential from Natural Gas Production Sector

2010 Production Sector Emissions (2012 Inventory), MMTCO2e

- Shallow water Gas Platforms: 12.8
- Compressor Exhaust (Gas Engines): 5.6
- Pneumatic Device Vents: 5.6
- Liquids Unloading: 12.5
- Completions and Workovers with Hydraulic Fracturing: 3.8
- Others: 85.7

Total: 101.2
## Other Production Emission Sources

<table>
<thead>
<tr>
<th>Category</th>
<th>Activity 1</th>
<th>Activity 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shallow water Gas Platforms (Gulf of Mexico and Pacific)</td>
<td>Pipeline Leaks – Gathering</td>
<td>Gas Well Completions with Hydraulic Fracturing</td>
</tr>
<tr>
<td>Deepwater Gas Platforms (Gulf of Mexico and Pacific)</td>
<td>Gas Well Completions without</td>
<td>Gas Well Workovers with Hydraulic Fracturing</td>
</tr>
<tr>
<td>Non-associated Gas Wells (less fractured wells)</td>
<td>Hydraulic Fracturing</td>
<td></td>
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<tr>
<td>Gas Wells with Hydraulic Fracturing</td>
<td>Well Drilling</td>
<td>Vessel – Blowdowns</td>
</tr>
<tr>
<td>Heaters – Field Separation Equipment</td>
<td>Pneumatic Device Vents</td>
<td>Pipeline – Blowdowns</td>
</tr>
<tr>
<td>Separators – Field Separation Equipment</td>
<td>Chemical Injection Pumps</td>
<td>Compressor – Blowdowns</td>
</tr>
<tr>
<td>Dehydrators – Field Separation Equipment</td>
<td>Kimray Pumps</td>
<td>Compressor Starts – Blowdowns</td>
</tr>
<tr>
<td>Meters/Piping – Field Separation Equipment</td>
<td>Dehydrator Vents</td>
<td>Pressure Relief Valves – Upsets</td>
</tr>
<tr>
<td>Small Reciprocating Compressors – Gathering</td>
<td>Condensate Tanks without Control Devices</td>
<td>Mishaps – Upsets</td>
</tr>
<tr>
<td>Large Reciprocating Compressors – Gathering</td>
<td>Condensate Tanks with Control Devices</td>
<td>Black Warrior – CBM Produced Water</td>
</tr>
<tr>
<td>Large Reciprocating Stations – Gathering</td>
<td>Gas Engines</td>
<td>Powder River – CBM Produced Water</td>
</tr>
</tbody>
</table>

- Presentation will focus on 3 large sources not already covered
  - Pneumatic device vents
  - Shallow water offshore platforms
  - Compressor exhaust
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
Pneumatic Device Vents

Automated devices that control onsite conditions

- Gas-driven pneumatics release gas with valve movements and/or continuously from valve control pilot

Step 1. Calculate Potential Methane

- Activity data is # of pneumatic devices in each region
  - (# of non associated gas wells in each region) × (# of pneumatic devices per gas well in each region, EPA/GRI (1996))
- Emission factor is 125,925 scf per year-device, EPA/GRI (1996)

Step 2. Compile Reductions Data

- Reductions are those reported to GasStar
  - Replace high bleed pneumatics with low bleed pneumatics
- Future Inventories-NSPS impacts

Example for 2010 Emissions (2012 Inventory), MMTCO2e

<table>
<thead>
<tr>
<th>Activity data (devices)</th>
<th>Emissions Factor (scf per device)</th>
<th>Potential Methane (MMTCO2e)</th>
<th>Reductions (MMTCO2e)</th>
<th>Emissions (MMTCO2e)</th>
</tr>
</thead>
<tbody>
<tr>
<td>468,281</td>
<td>× 125,925</td>
<td>= 24.8</td>
<td>- 12.8</td>
<td>= 12.1</td>
</tr>
</tbody>
</table>
Compressor Exhaust (Gas Engines)

Emissions from the incomplete combustion of gas that fuels the compressors

Step 1. Calculate Potential Methane
- Activity data is total horsepower-hours for each region
  - Horsepower-hours per non-associated well (EPA/GRI 1996) × (# of non-associated wells in region)
- Emission factor is 0.24 scf per horsepower-hour EPA/GRI (1996)

Step 2. Compile Reductions Data
- N/A

Step 3. Calculate Net Emissions
Example for 2010 Emissions (2012 Inventory), MMTCO2e

<table>
<thead>
<tr>
<th>Activity data (horsepower-hour)</th>
<th>Emissions Factor (scf/horsepower-hour)</th>
<th>Emissions (MMTCO2e)</th>
</tr>
</thead>
<tbody>
<tr>
<td>55,368,000,000</td>
<td>× 0.24</td>
<td>= 5.6</td>
</tr>
</tbody>
</table>
Shallow Water Offshore Platforms

Offshore natural gas production wells in the Gulf of Mexico and the Pacific Ocean in water depths that do not exceed 500 feet

Step 1. Calculate Potential Methane
- Activity data: # of shallow offshore platforms in gas fields
  - ($\#$ of offshore platforms – $\#$ of deep water offshore platforms, BOEMRE) $\times$ (fraction of offshore platforms in gas fields, BOEMRE)
- Emission factor: 6,999,970 scf/year per shallow offshore gas platform (GOADS 2000)

Step 2. Compile Reductions Data
- N/A

Step 3. Calculate Net Emissions

Example for 2010 Emissions (2012 Inventory), MMTCO$_2$e

<table>
<thead>
<tr>
<th>Activity data (platforms)</th>
<th>Emissions Factor (scf/platform)</th>
<th>Emissions (MMTCO$_2$e)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1973</td>
<td>$\times$ 6,999,970</td>
<td>= 5.6</td>
</tr>
</tbody>
</table>
Questions for Stakeholders

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

• Suggestions for updates to presentation of information on these activities in the GHG Inventory?