Emissions Inventory Processes, Recent Research and Improvements, and The Barnett Shale Special Inventory

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The Barnett Shale Open House
at the North Central Texas Council of Governments
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Outline

- Oil and Gas Emissions Inventory (EI) Development
- Oil and Gas Emissions Inventory Improvement Projects and Activities
- Barnett Shale Special Equipment and Emissions Inventory
Oil and Gas
Emissions Inventory (EI)
Development
Types of Emissions Inventories (EIs)

- **Point sources**
  - Developed from industry-reported emissions
  - Industrial sources
- **Area sources**
  - Texas Commission on Environmental Quality (TCEQ) developed
  - Painting, gas stations, dry cleaners, etc.
- **Mobile sources**
  - TCEQ developed
  - On-road and non-road
- **Biogenic sources**
  - TCEQ developed
  - Based on estimates of vegetation type/quantity
Area Source Emissions Inventory

• If emissions sources do not meet the point source EI thresholds, their emissions are developed using area source emissions inventory methodology.

• Railroad Commission of Texas (RCT) data, variables, and information:
  – Amount of gas/condensate/etc produced
  – Number of wells, sites, etc in the state

• Emissions calculators are employed to determine the quantity and composition of emissions.

• Amounts determined from point source EI are deducted to avoid double counting.
Oil and Gas Area Source Emissions Inventory

Emissions Sources Included:

- Artificial Lifts
- Storage Tanks (crude oil & condensate)
- Heater-Treaters
- Tank Truck/Railcar Loading (Crude Oil & Condensate)
- Wellheads
- Equipment Leak Fugitives (Connectors, Flanges, Open-Ended Lines, Pumps, Valves, and Other)
- Natural Gas Fired Compressor Engines (2/4-Cycle, Rich/Lean Burn, & all HP ratings)
- Gas Well Heaters and Dehydrators
- Gas Well Venting & Completion (all Processes)
- Well Completion (all Processes)
- Pneumatic Devices
- Produced Water Storage Tanks
Oil and Gas EI Improvement Projects and Activities
256,424 - Active Oil and Gas Wells

1,000,000 – Estimated Associated Sources.
Oil and Gas EI Improvement Activities

- Oil and Gas Model Evaluation
  - Evaluate methods, models, and related data
  - Texas-specific calculator for area inventory development
  - Expect to be posted October 2010

- DFW Compressor Engine Project
  - Ambient measurements downwind of gas compressor engines
  - Develop typical compressor engine ambient signatures
  - Project schedule to be completed December 2010

- 2007 Engine Fleet DFW Nonattainment Area Survey
  - Information available upon request

- 2007 Southeast Texas Compressor and Dehydrator Survey
  - Information available upon request
Oil and Gas EI Improvement Activities

• 2005 Upstream Oil and Gas Tank Project
  – Measured emissions from oil and condensate tanks
  – Developed factor for area source emissions inventory
  – EPA approved tank testing procedure needed
  – [link](http://projects.terc.airquality.org/AQR/H051C)

• Flash Emissions Model Evaluation
  – Evaluated different methods for calculating flash emissions from oil and condensate tanks
  – Improved agency guidance
  – [link](http://www.tceq.state.tx.us/implementation/air/airmod/project/pj_report_ei.html)

• Produced Water Storage Tank Project
  – This area may need additional research
  – Limited available data
Oil and Gas EI Improvement Activities

- Drilling Rig Emissions Project
  - Activity data
  - Emissions characterization data
  - Used to develop the drilling rig emissions inventory for 2008
    - [www.tceq.state.tx.us/implementation/air/airmod/project/pj_report_ei.html](http://www.tceq.state.tx.us/implementation/air/airmod/project/pj_report_ei.html)

- Oil and Gas Platform Inventory Improvement Project
  - Oil and gas platforms in Texas water
  - Parallels federal platform inventories in Gulf of Mexico
    - [www.tceq.state.tx.us/implementation/air/airmod/project/pj_report_ei.html](http://www.tceq.state.tx.us/implementation/air/airmod/project/pj_report_ei.html)
Barnett Shale Special Equipment and Emissions Inventory
DFW Ozone Design Values and Barnett Shale Production

Dallas-Fort Worth Ozone Design Values Compared to Barnett Shale Natural Gas Production

1997 Eight-Hour Ozone Standard

<table>
<thead>
<tr>
<th>Year</th>
<th>Gas Produced (Billion Cubic Feet per Year)</th>
<th>Eight-Hour Ozone Design Value (Parts per Billion)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1993</td>
<td>11</td>
<td>120</td>
</tr>
<tr>
<td>1994</td>
<td>14</td>
<td>110</td>
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<td>1995</td>
<td>20</td>
<td>221</td>
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<td>1996</td>
<td>26</td>
<td>304</td>
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<tr>
<td>1997</td>
<td>28</td>
<td>380</td>
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<tr>
<td>1998</td>
<td>34</td>
<td>503</td>
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<td>1999</td>
<td>41</td>
<td>717</td>
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<td>2000</td>
<td>79</td>
<td>1,103</td>
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<tr>
<td>2001</td>
<td>135</td>
<td>1,610</td>
</tr>
<tr>
<td>2002</td>
<td>221</td>
<td>9,180</td>
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<tr>
<td>2003</td>
<td>304</td>
<td>86</td>
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<tr>
<td>2004</td>
<td>380</td>
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<tr>
<td>2005</td>
<td>503</td>
<td></td>
</tr>
<tr>
<td>2006</td>
<td>717</td>
<td></td>
</tr>
<tr>
<td>2007</td>
<td>1,103</td>
<td></td>
</tr>
<tr>
<td>2008</td>
<td>1,610</td>
<td></td>
</tr>
<tr>
<td>2009</td>
<td>1,773</td>
<td></td>
</tr>
</tbody>
</table>

Legend:
- **Green Bar** = Gas Produced (Billion Cubic Feet per Year)
- **Blue Line** = Eight-Hour Ozone Design Value (Parts per Billion)
Barnett Shale Special Inventory

- **Barnett Shale Formation Production***
  - 13,902 total gas and 3,333 additional permitted wells (as of May 10, 2010)
  - Accounts for 25% of the gas well production in Texas for 2009

- **The Barnett Shale includes 23 counties:**

* Railroad Commission of Texas data
Barnett Shale Special Inventory

Phase One: Equipment Counts Inventory

- Determine the location, number, and type of emissions sources located at upstream and midstream oil and gas operations associated with the Barnett Shale formation.

- Equipment count at county level and more information available at: www.tceq.state.tx.us/goto/ieas
## Barnett Shale Special Inventory

**Barnett Shale Equipment Totals for All Inventory Types:**

<table>
<thead>
<tr>
<th>Emission Source</th>
<th>Number of Sources</th>
</tr>
</thead>
<tbody>
<tr>
<td>Separators Vented to Atmosphere</td>
<td>23</td>
</tr>
<tr>
<td>Total Storage Tanks</td>
<td>20,663</td>
</tr>
<tr>
<td>Uncontrolled Glycol Dehydrators</td>
<td>111</td>
</tr>
<tr>
<td>Controlled Glycol Dehydrators</td>
<td>182</td>
</tr>
<tr>
<td>Total Stationary Engines</td>
<td>3,547</td>
</tr>
<tr>
<td>Turbines</td>
<td>37</td>
</tr>
<tr>
<td>Flares</td>
<td>78</td>
</tr>
<tr>
<td>Frac tanks</td>
<td>20</td>
</tr>
<tr>
<td>Piping Component Fugitive Areas</td>
<td>15,820</td>
</tr>
<tr>
<td>Blowdown Vents</td>
<td>7,479</td>
</tr>
<tr>
<td>Process Vents</td>
<td>1,189</td>
</tr>
<tr>
<td>Heaters/boilers</td>
<td>882</td>
</tr>
<tr>
<td>Other Stationary Equipment</td>
<td>1,770</td>
</tr>
<tr>
<td><strong>Total Emission Sources</strong></td>
<td><strong>51,801</strong></td>
</tr>
</tbody>
</table>
Sites/Leases Reported During Phase I of Barnett Shale EI
### Equipment Counts for Counties in DFW Nonattainment Area and Barnett Shale

<table>
<thead>
<tr>
<th>Emissions Source</th>
<th>Dallas</th>
<th>Denton</th>
<th>Ellis</th>
<th>Johnson</th>
<th>Parker</th>
<th>Tarrant</th>
<th>Totals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Separators Vented to Atmosphere</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>1</td>
<td>3</td>
<td>0</td>
<td>6</td>
</tr>
<tr>
<td>Total Oil Storage Tanks</td>
<td>0</td>
<td>27</td>
<td>0</td>
<td>17</td>
<td>18</td>
<td>3</td>
<td>65</td>
</tr>
<tr>
<td>Total Condensate Storage Tanks</td>
<td>5</td>
<td>709</td>
<td>1</td>
<td>210</td>
<td>591</td>
<td>132</td>
<td>1,648</td>
</tr>
<tr>
<td>Total Produced Water Storage Tanks</td>
<td>24</td>
<td>2,877</td>
<td>91</td>
<td>3,861</td>
<td>1,083</td>
<td>2,926</td>
<td>10,862</td>
</tr>
<tr>
<td>Total Slop Storage Tanks</td>
<td>0</td>
<td>10</td>
<td>7</td>
<td>22</td>
<td>40</td>
<td>10</td>
<td>89</td>
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<tr>
<td>Uncontrolled Glycol Dehydrators</td>
<td>0</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>6</td>
<td>16</td>
</tr>
<tr>
<td>Controlled Glycol Dehydrators</td>
<td>1</td>
<td>14</td>
<td>4</td>
<td>31</td>
<td>11</td>
<td>35</td>
<td>96</td>
</tr>
<tr>
<td>Total Stationary Engines</td>
<td>2</td>
<td>141</td>
<td>18</td>
<td>710</td>
<td>317</td>
<td>290</td>
<td>1,478</td>
</tr>
<tr>
<td>Turbines</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Flares</td>
<td>0</td>
<td>6</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>1</td>
<td>9</td>
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<tr>
<td>Frac Tanks</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>11</td>
<td>5</td>
<td>0</td>
<td>16</td>
</tr>
<tr>
<td>Piping Component Fugitive Areas</td>
<td>21</td>
<td>2,570</td>
<td>319</td>
<td>3,075</td>
<td>1,096</td>
<td>3,853</td>
<td>10,934</td>
</tr>
<tr>
<td>Process Vents</td>
<td>0</td>
<td>177</td>
<td>7</td>
<td>62</td>
<td>503</td>
<td>31</td>
<td>780</td>
</tr>
<tr>
<td>Blowdown Vents</td>
<td>21</td>
<td>748</td>
<td>47</td>
<td>2,576</td>
<td>677</td>
<td>867</td>
<td>4,936</td>
</tr>
<tr>
<td>Heaters/Boilers</td>
<td>0</td>
<td>104</td>
<td>5</td>
<td>52</td>
<td>37</td>
<td>59</td>
<td>257</td>
</tr>
<tr>
<td>Other Stationary Equipment</td>
<td>0</td>
<td>349</td>
<td>4</td>
<td>39</td>
<td>130</td>
<td>344</td>
<td>866</td>
</tr>
<tr>
<td>Total Emission Sources</td>
<td>74</td>
<td>7,736</td>
<td>509</td>
<td>10,669</td>
<td>4,516</td>
<td>8,557</td>
<td>32,061</td>
</tr>
</tbody>
</table>
Barnett Shale EI – Phase Two

• The inventory will collect information on:
  – equipment and production information for emission sources associated with Barnett Shale oil and gas production, transmission, processing and related activities;
  – air emissions authorizations for these sources;
  – Proximity of these sources to the nearest off-site receptor; and
  – annual 2009 emissions for NO$_x$, VOC, and HAPs.

• Due December 31, 2010

• To view a sample letter and enclosure, download the workbook, install an emissions calculator tool, and for more information, visit: http://www.tceq.state.tx.us/implementation/air/industry/psei/psei.html
How Will the Data be Used?

- **Air Quality Planning:**
  - Establishing baseline emission levels
  - Control strategy evaluation

- **Air Quality Modeling and Assessment**
  - Inputs in the photochemical modeling process

- **Trends analyses in State Implementation Plans (SIPs)**

- **Regional Offices**
  - Prioritizing for future investigations
  - Source tracking of complaints
  - Possible locations for future monitoring efforts

- **Permitting**
  - Assist in permit reviews
  - Assessing major site modifications
  - Historical emission dispersion modeling
  - Helping with rule development

- **Toxicology Reviews**
Barnett Shale EI Phase Two

Equipment Type and Activity Data to be Collected

**Equipment Type:**
- Loading/unloading emissions
- Separators vented to the atmosphere (typically oil/water separators)
- Glycol dehydrators
- Flares
- Compressor engines and turbines
- Storage tanks
- Fugitives
- Process blowdown vents
- Heaters/boilers
- Frac tanks only if onsite six months or more
Barnett Shale EI Phase Two

Equipment Type and Activity Data to be Collected

- **Activity Data:**
  - Annual throughput
  - Engine type and horsepower
  - Process temperatures
  - Control types and efficiencies
  - Liquid type and composition
  - Operating hours
  - VOC content, etc.