NOx RECLAIM
Working Group Meeting

January 22, 2014
Agenda

• Welcome & Introductions
• Control Technology & Cost Effectiveness Analysis Approach
• Refinery Sector
  – FCCUs
• Non-Refinery Sector
  – ICEs
  – Cement Kilns
• Discussion
• Schedule/Next Meeting

1/23/2014
## Progress in Rulemaking Analysis
### Refinery Sector (September 2013)

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>FCCUs/CO Boilers</td>
<td>8</td>
<td>1.08</td>
<td>85% red</td>
<td>0.60</td>
<td>5 ppmv</td>
<td>0.45</td>
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<tr>
<td>Turbines/Duct Burners</td>
<td>21</td>
<td>1.33</td>
<td>62.27</td>
<td>2.61</td>
<td>2.5 ppmv</td>
<td>0.97</td>
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<tr>
<td>Coke Calciner</td>
<td>2</td>
<td>0.55</td>
<td>30 ppmv</td>
<td>0.25</td>
<td>5 ppmv</td>
<td>0.04</td>
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<td>Sulfur Recovery/Tail Gas Incinerators</td>
<td>17</td>
<td>0.43</td>
<td>RV</td>
<td>0.43</td>
<td>80% red</td>
<td>0.09</td>
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<td>Boilers/Heaters &gt; 110 mmbtu/hr</td>
<td>73</td>
<td>4.88</td>
<td>5 ppmv</td>
<td>0.82</td>
<td>2 ppmv</td>
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<tr>
<td>Heaters 40-110 mmbtu/hr</td>
<td>69</td>
<td>2.00</td>
<td>25 ppmv</td>
<td>0.97</td>
<td>5 ppmv</td>
<td>0.20</td>
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<tr>
<td>Heaters 20-40 mmbtu/hr</td>
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<td>0.45</td>
<td>9 ppmv</td>
<td>0.10</td>
<td>5 ppmv</td>
<td>0.06</td>
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<td>Heaters &lt;20 mmbtu/hr</td>
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<td>12 ppmv</td>
<td>0.02</td>
<td>9 ppmv</td>
<td>0.01</td>
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<td>Furnace &gt; 110 mmbtu/hr</td>
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<td>0.01</td>
<td>30 ppmv</td>
<td>0.00</td>
<td>2 ppmv</td>
<td>0.00</td>
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<tr>
<td>Others</td>
<td>4</td>
<td>0.10</td>
<td>RV</td>
<td>0.10</td>
<td>RV</td>
<td>0.10</td>
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</table>

**Total (tpd)**

<p>| | | | | | |</p>
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<thead>
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</thead>
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<tr>
<td></td>
<td>265</td>
<td>10.90</td>
<td>5.92</td>
<td></td>
<td>2.25</td>
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</tbody>
</table>

Note: The cost analysis for the 2013 BARCT standards under consideration is still on-going and therefore this assessment is subject to further analysis and refinement.
Progress in Rulemaking Analysis (cont.)
Non-refinery Sector (September 2013)

## DRAFT - NON-REFINERY SECTOR & PRELIMINARY ASSESSMENT

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>Boilers</td>
<td>16</td>
<td>0.44</td>
<td>7 ppm</td>
<td>0.68</td>
<td>2 ppm</td>
<td>0.21</td>
<td>0.24</td>
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<tr>
<td>Turbines/Duct Burners</td>
<td>21</td>
<td>0.83</td>
<td>No new level</td>
<td>1.50</td>
<td>No further control</td>
<td>1.50</td>
<td>1.72</td>
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<tr>
<td>ICEs</td>
<td>6</td>
<td>0.18</td>
<td>No new level</td>
<td>0.22</td>
<td>11 ppm</td>
<td>0.04</td>
<td>0.04</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>43</strong></td>
<td><strong>1.45</strong></td>
<td></td>
<td><strong>2.40</strong></td>
<td></td>
<td><strong>1.76</strong></td>
<td><strong>2.01</strong></td>
</tr>
</tbody>
</table>

| NON-POWER PLANTS      |            |                      |            |                                  |                                 |                                  |                                   |
| Boilers               | 16         | 0.08                 | 9-12 ppm   | 0.07                             | 5 ppm                           | 0.03                             | 0.04                              |
| Heaters               | 3          | 0.01                 | 60 ppm     | 0.01                             | No further control               | 0.01                             | 0.01                              |
| Furnaces              | 12         | 0.79                 | RV         | 0.79                             | 80% Reduction                   | 0.30                             | 0.44                              |
| Glass Melting Furnaces| 3          | 0.41                 | RV         | 0.41                             | 80% Reduction                   | 0.08                             | 0.10                              |
| Gas Turbines          | 20         | 1.93                 | No new level | 1.36                             | 2 ppm                           | 0.19                             | 0.22                              |
| ICEs                  | 31         | 0.38                 | No new level | 1.16                             | 11 ppm                          | 0.23                             | 0.29                              |
| Cement Kilns/Dryers   | 4          | 1.61                 | RV         | 1.61                             | 0.5 lb/ton                       | 0.30                             | 0.45                              |
| **TOTAL**             | **89**     | **5.21**             |            | **5.41**                         |                                 | **1.13**                         | **1.55**                          |
| **TOTAL NON-REFINERY**| **132**    | **6.67**             |            | **7.81**                         |                                 | **2.88**                         | **3.56**                          |

Note: The cost analysis for the 2013 BARCT standards under consideration is still ongoing and therefore, this assessment is subject to further analysis and refinement.

*Permit Limit emission level used for 2011 calculated emissions for Power Plant boilers and turbines. Year 2000 ending emission factor used for 2011 calculated emissions (Column b) where no new level is listed for 2005 BARCT.
<table>
<thead>
<tr>
<th>Category</th>
<th>Control Equipment Manufacturer Contacted</th>
<th>Preliminary Cost Effectiveness Analysis Completed</th>
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<tbody>
<tr>
<td>FCCU</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Cement Kilns</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Gas Turbines</td>
<td>X</td>
<td>In progress</td>
</tr>
<tr>
<td>Coke Calciner</td>
<td>X</td>
<td>In progress</td>
</tr>
<tr>
<td>Glass Furnaces</td>
<td>X</td>
<td>In progress</td>
</tr>
<tr>
<td>Metal Melting Furnaces</td>
<td>In progress</td>
<td>In progress</td>
</tr>
<tr>
<td>SRU/Tail Gas</td>
<td>In progress</td>
<td>In progress</td>
</tr>
<tr>
<td>ICEs</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Boilers/Heaters</td>
<td>X</td>
<td>In progress</td>
</tr>
</tbody>
</table>
Refinery Sector
Fluid Catalytic Cracking Units
Simplified Fluid Catalytic Cracking Process

Hydrocarbon Products to Main Fractionation Column

NO, HCN, N₂SO₂, PM2.5, and others

Stack NOx, SOx, Particulates, ROG and other air pollutants

1/23/2014

NOx RECLAIM
NOx Formation in FCCUs

- “Fuel” NOx from Coke Burned-Off in Regenerator
  - Nitric Oxide (NO), Nitrogen Dioxide (NO2)
  - Nitrous Oxide (N2O)
  - Ammonia (NH3), Hydrogen Cyanide (HCN), and Others
- Small Amount of “Thermal” and “Prompt” NOx
- NOx from Regenerator = 40 ppmv – 180 ppmv
- Parameters Affecting NOx Emissions
  - Feed Rate
  - Nitrogen in Cat-Cracker Feed
  - Oxygen in Regenerator
  - Air Pollution Control Used
Lower Emissions Even with Higher Feed Rates

Note: Refinery feed rates are from source test reports and the U.S. Energy Information Administration Website – Refinery Capacity Report [www.eia.gov](http://www.eia.gov)
Well-Designed Control Equipment Can Reduce NOx to 2 ppmv

2013 BARCT under consideration = 2 ppmv NOx (with 5 ppmv NH3 Slip) Achieved in Practice
Potential Control Technologies for FCCUs

- Selective Catalytic Reduction (SCR)
- Low Temperature Oxidation (LoTOx)
- DeNOx Catalysts
SCR Review

• Aqueous ammonia (19%-30%) with molar ratio $\text{NH}_3:\text{NO}_x = 1:1$ minimum

• Operating temperature at $600^\circ \text{F}$ or above to prevent ABS formation

• Performance confirmed by SCR manufacturers
  – It is possible to achieve $\text{NO}_x$ removal rate higher than 98% with an ammonia slip lower than 2 ppmv. \(^{(1)}\)
  – It is now possible to remove 95% of NOx \(^{(2)}\)

Scrubber with LoTOx

- **LoTOx™** = Low Temperature Oxidation
- Developed by Linde (previously BOC) and licensed to Dupont BELCO Clean Air Technologies for refinery FCCUs
- 2001 CARB’s Clean Air Innovative Technology Demonstration at RSR Quemetco
- Convert insoluble NO through ozone injection to highly soluble $\text{N}_2\text{O}_5$ and $\text{HNO}_3$

Note: 1) [www.arb.ca.gov/research/apr/past/icat99-2.pdf](http://www.arb.ca.gov/research/apr/past/icat99-2.pdf), 2) picture from [www.dupont.com](http://www.dupont.com) and [www.digitalrefining.co](http://www.digitalrefining.co)
Scrubber with LoTOx (cont.)

• Simplified Chemistry

\[
\begin{align*}
\text{NO} + \text{O}_3 & \rightarrow \text{NO}_2 + \text{O}_2 & \text{Fast} \\
2 \text{NO}_2 + \text{O}_3 & \rightarrow \text{N}_2\text{O}_5 + \text{O}_2 & \text{Fast} \\
\text{N}_2\text{O}_5 + \text{H}_2\text{O} & \rightarrow 2 \text{HNO}_3 & \text{Fast} \\
\text{HNO}_3 + \text{NaOH} & \rightarrow \text{NaNO}_3 + \text{H}_2\text{O} & \text{Fast} \\
\text{SO}_2 + \text{O}_3 & \rightarrow \text{SO}_3 + \text{O}_2 & \text{Very slow}
\end{align*}
\]

• NOx:O$_3$ = 1.75 – 2.5 for 90% - 95% reduction

• No conversion of SO$_2$ to SO$_3$. No ammonia. No ABS.

• Very low ozone slip (0-3ppmv), sulfites are ozone scavenger.

• Absorbed readily in NaOH scrubbing solution.
Scrubber with LoTOx (cont.)

• Concurrently reduce particulates and SOx (refer to SOx RECLAIM Staff Report for information on SOx scrubbers)

• 90+ scrubber installations with 30+ LoTOx in refineries worldwide. Applications in gas-fired and high sulfur coal-fired units met 95% control and/or 2-5 ppmv

• Current installations in refineries met 8-10 ppmv, and manufacturers positively confirmed that LoTOx can be designed to achieve 2 ppmv NOx

Note: “Preparing wet scrubbing system for a future with NOx emissions requirements” Dupont Belco; “Wet scrubbing-based NOx control using LoTOx technology – first commercial FCC start-up experience. Belco and Marathon Petroleum. www.digitalrefining.com, and numerous other papers by Dupont Belco.
NOx-Control Additives

• Intercat (Johnson Matthey), NOxGetterA or B \(^{(1, 2)}\)
  – 30% - 76% NOx reduction with 0.5%-5% wt% catalyst addition
  – Trial run in 20 FCCUs
  – Short 8-day trial run to establish baseline and efficiency

• Grace XNOx W \(^{(3,4)}\)
  – 65% NOx reduction
  – Trial run at Petroplus Coryton UK Refinery

• BASF CLEANOx \(^{(5)}\)
  – 72% NOx reduction with 1.4 wt% of Catalyst Addition

Cost Analysis for SCR – 2 ppmv
Approach 1 - Using Refinery 1 Information

• Used for Refinery 5, 6, 7 with similar range of flow rates
• Refinery 1’s SCR installed in 2003 achieves below 2 ppmv NOx, 5 ppmv NH₃
• Present Worth Value (PWV) of Refinery 1’s SCR assuming 4% interest rate and 25-years life for SCR

\[
PWV_{\text{Ref 1}} = \text{TIC}_{\text{Ref 1}} + (15.62 \times \text{AC}_{\text{Ref 1}}) + (2.52 \times \text{CR}_{\text{Ref 1}})
\]

where

- \( \text{TIC}_{\text{Ref 1}} \) = Total Installed Costs
- \( \text{AC}_{\text{Ref 1}} \) = Annual Operating Costs
- \( \text{CR}_{\text{Ref 1}} \) = Catalyst Replacement Costs

• Operating costs during 25-year life of SCR = 20% TIC \( \text{Ref 1} \)
• \( PWV_{\text{Ref 5, 6, 7}} = PWV_{\text{Ref 1}} \times (\text{Flow}_{\text{Ref 5, 6, 7}}/\text{Flow}_{\text{Ref 1}})^{0.7} \)
Cost Analysis for SCR – 2 ppmv (cont.)

Approach 2 - Using Manufacturer C and EPA Information

- Manufacturer’s cost data available. Manufacturer C provided equipment costs (EC) for Refinery 4 and Refinery 9 to achieve 2 ppmv NOx.

- Using EPA’s Office of Air Quality Planning and Standards (OAQPS) approach to estimate TIC

\[
TIC_{Ref\ 4,\ 9} = EC + \text{instrument} + \text{sales tax} + \text{freight} + \text{installation} = 1.86 \times EC_{Ref\ 4,\ 9}
\]

- Operating costs in 25-year life = 20% TIC_{Ref\ 4,\ 9}

- Contingency factor of 1.5 to account for cost variation

\[
PWV_{Ref\ 4,\ 9} = 1.2 \times TIC_{Ref\ 4,\ 9} = 1.2 \times 1.86 \times EC_{Ref\ 4,\ 9}
\]

- Cost Effectiveness = PWV / Emission Reduction
## Cost Analysis for SCR – 2 ppmv (cont.)

<table>
<thead>
<tr>
<th>Fac ID</th>
<th>Emission (tpd)</th>
<th>NOx (ppmv)</th>
<th>% Control</th>
<th>Emission Reduction (tpd)</th>
<th>PWV ($M)</th>
<th>CE ($/ton)</th>
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<tbody>
<tr>
<td><strong>for reference</strong></td>
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<tr>
<td>1</td>
<td>0.02</td>
<td>&lt;2</td>
<td>95%</td>
<td>-</td>
<td>41</td>
<td>(10,181)</td>
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<tr>
<td>5</td>
<td>0.16</td>
<td>15</td>
<td>87%</td>
<td>0.14</td>
<td>33</td>
<td>&lt; 25,259 *</td>
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<td>6</td>
<td>0.20</td>
<td>6</td>
<td>64%</td>
<td>0.13</td>
<td>57</td>
<td>&lt; 49,408 *</td>
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<td>7</td>
<td>0.14</td>
<td>13</td>
<td>84%</td>
<td>0.12</td>
<td>27</td>
<td>25,455</td>
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<tr>
<td>4</td>
<td>0.22</td>
<td>21 - 23</td>
<td>91%</td>
<td>0.20</td>
<td>16</td>
<td>8,961</td>
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<tr>
<td>9</td>
<td>0.34</td>
<td>34 - 52</td>
<td>95%</td>
<td>0.32</td>
<td>19</td>
<td>6,537</td>
</tr>
<tr>
<td><strong>Summary for Ref 4, 9, 5, 6, and 7</strong></td>
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</table>

**Approach 1**

<table>
<thead>
<tr>
<th>Fac ID</th>
<th>Emission (tpd)</th>
<th>NOx (ppmv)</th>
<th>% Control</th>
<th>Emission Reduction (tpd)</th>
<th>PWV ($M)</th>
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<table>
<thead>
<tr>
<th>Fac ID</th>
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<td>9</td>
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<tr>
<td><strong>Summary for Ref 4, 9, 5, 6, and 7</strong></td>
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**Approach 2**

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<th>NOx (ppmv)</th>
<th>% Control</th>
<th>Emission Reduction (tpd)</th>
<th>PWV ($M)</th>
<th>CE ($/ton)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>0.22</td>
<td>21 - 23</td>
<td>91%</td>
<td>0.20</td>
<td>16</td>
<td>8,961</td>
</tr>
<tr>
<td>9</td>
<td>0.34</td>
<td>34 - 52</td>
<td>95%</td>
<td>0.32</td>
<td>19</td>
<td>6,537</td>
</tr>
</tbody>
</table>

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**Note:** * Because of the inclusion of SCR costs that already have been installed.
Cost Analysis for SCR – 2 ppmv (cont.)

• Two approaches based on full installation cost.
• Refineries with equipment already installed may add additional layer of catalysts instead of retrofitting the entire SCR.
  – Based on Manufacturer D information, an increase of 10% catalyst volume would reduce the outlet NOx concentration from 10 ppmv to 2 ppmv at a cost of $396,000
• Manufacturer B and D: install a monitoring device for NH$_3$ slip to help monitor the mixing of NH3 and the flue gas
• Manufacturer B: investigate in the use of DeNOx catalysts to lower the inlet NOx concentrations to the SCR
• Staff will use this information to refine analysis
Cost Analysis for LoTOx - 2 ppmv
Using Manufacturer Information

• Manufacturer A provided TIC and annual operating costs for Refinery 4, 7 and 9 to meet 2 ppmv level

\[ PWV_{Ref\ 4,\ 7,\ 9} = TIC_{Ref\ 4,\ 7,\ 9} + (15.62 \times AC_{Ref\ 4,\ 7,\ 9}) \]

• A contingency factor of 2 is used to account for additional modification costs at the site if needed

• \( PWV_{Ref\ 5} = PWV_{Ref\ 4} \times (Flow_{Ref\ 5}/Flow_{Ref\ 4})^{0.7} \)

• \( PWV_{Ref\ 6} = PWV_{Ref\ 7} \times (Flow_{Ref\ 6}/Flow_{Ref\ 7})^{0.7} \)
## Cost Analysis for LoTOx – 2 ppmv (cont.)

<table>
<thead>
<tr>
<th>Fac ID</th>
<th>Emission (tpd)</th>
<th>NOx (ppmv)</th>
<th>% Control</th>
<th>Emission Reduction (tpd)</th>
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</thead>
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<td>21 - 23</td>
<td>91%</td>
<td>0.20</td>
<td>19</td>
<td>10,767</td>
</tr>
<tr>
<td>7</td>
<td>0.14</td>
<td>13</td>
<td>84%</td>
<td>0.12</td>
<td>16</td>
<td>15,199</td>
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<tr>
<td>9</td>
<td>0.34</td>
<td>34 - 52</td>
<td>95%</td>
<td>0.32</td>
<td>32</td>
<td>10,631</td>
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<tr>
<td>5</td>
<td>0.16</td>
<td>15</td>
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<td>0.14</td>
<td>24</td>
<td>18,590</td>
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<td>6</td>
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<td>6</td>
<td>64%</td>
<td>0.13</td>
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<td>29,502</td>
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**Summary for Ref 4, 7, 9, 5 and 6**

<p>| | | | | | | |</p>
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<td></td>
<td></td>
<td>0.91</td>
<td>125</td>
<td>15,124</td>
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## Incremental Cost Analysis

<table>
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<tr>
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<th>PWV ($ million)</th>
<th>Emission Reduction (tpd)</th>
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</thead>
<tbody>
<tr>
<td>SCRs for 85% Control</td>
<td>139</td>
<td>0.48</td>
</tr>
<tr>
<td>SCR for 2 ppmv</td>
<td>152</td>
<td>0.91</td>
</tr>
<tr>
<td>LoTOx for 2 ppmv</td>
<td>125</td>
<td>0.91</td>
</tr>
</tbody>
</table>

**Incremental Cost Effectiveness SCR - SCR**

\[(13/0.43/25/365) = 3,444 \$/ton\]

**Incremental Cost Effectiveness SCR - LoTOx**

\[(-14/0.43/25/365) = -3,521 \$/ton\]

1/23/2014

NOx RECLAIM
Non Refinery Sector
Preliminary Cost Effectiveness
Non Refinery ICE Emissions

ppm concentration @15% $O_2$

Proposed emission level: 11 ppm
Cost Analysis for ICEs
(Spark-Ignited, Lean Burn)

- Fueled on Natural Gas
- No new BARCT level in 2005
- Proposed BARCT level: 11 ppm @15% O$_2$ *
- Proposed control technology: Selective Catalytic Reduction (SCR)

* Amended Rule 1110.2 NOx emission level (Feb. 2008)
Cost Analysis for ICEs (Spark-Ignited, Lean Burn)

• SCR manufacturer equipment costs and achieved-in-practice installation costs used for Total Installed Costs (TIC) and includes air compression
  – Achieved-in-Practice installation is the SCR unit at Orange County Sanitation District

• Achieved-in-practice Annual Costs (AC) used for urea, catalyst replacement, power, maintenance, and testing.

• Present Worth Value (PWV) assumes a 4% interest rate and a 25-year equipment life
Cost Analysis for ICEs (Spark-Ignited, Lean Burn)

- PWV = TIC + (15.622 x AC)
- Emission Reductions (ER) for this category
  - 0.275 tons per day
- Cost Effectiveness = PWV / (ER x 25 years)
- Cost Effectiveness Range
  - $5,000 - $36,000 / ton
Cost Analysis for ICEs (Spark-Ignited, Lean Burn)

Cost Effectiveness ($/ton)
Cement Kilns - Emission Level

Proposed emission level:
0.5 lb/ton clinker
(80% reduction)
Cement Kilns

• No 2005 BARCT
• Proposed BARCT level: 80% reduction
• Proposed Control Technologies
  – Selective Catalytic Reduction
  – Ultra Cat Ceramic Filters
As described previously, NO and NO$_2$ are reduced to N$_2$ gas and water in the presence of a catalyst.

In a cement kiln, however, PM plugging becomes an issue and can mask active catalyst sites and reduce effectiveness.

SCR can be placed on the “cold side” of PM control equipment, but the temperature can be too low for catalyst operation.
Selective Catalytic Reduction

• Several installations in Europe use blowers to prevent catalyst plugging on “hot side” installations

• SCR technology can be installed before PM control equipment at a temperature that can facilitate NOx removal
Ultra Cat Ceramic Filters

- Ceramic fiber filters can provide multi-pollutant control of NOx, SOx, and PM
- NOx is controlled by urea injection and reaction with embedded catalyst on the filter tube walls
- SOx is controlled via dry sorbent injection with resultant particulates captured on outside of filter walls
- PM is captured on outside of filter walls
Ultra Cat Ceramic Filters

• Accumulated solids are removed with a pulsed jet of air through the filter and resultant solid waste is collected underneath the housing
Ultra Cat Ceramic Filters

- Ceramic fiber filters are arranged in a baghouse-like housing
- 80% NOx reductions guaranteed
Cost Analysis for Cement Kilns (SCR)

• Capital and Annual Costs supplied by SCR Vendor A with experience in cement kiln applications worldwide
• Pending costs from SCR Vendor B
• 60% contingency applied for contractor labor and construction cost for Vendor A
• PWV = TIC + (15.622 x AC)
• Assumes 4% interest rate and 25 year equipment life
Cost Analysis for Cement Kilns
(Ultra Cat Ceramic Filters)

• Capital and annual operating costs supplied by vendor with nationwide experience across various source categories

• PWV = TIC + (15.622 x AC)

• Assumes 4% interest rate and 25 year equipment life
Cost Analysis for Cement Kilns

- \( \text{PWV}_{\text{SCR}} = $26.4 \text{ M} \)
- \( \text{PWV}_{\text{Ultra Cat}} = $45.6 \text{ M} \)
- Emission Reductions (ER) for this category
  - 1.287 tons per day
- Cost Effectiveness (CE) = \( \frac{\text{PWV}}{(\text{ER} \times 25 \text{ years})} \)
- \( \text{NOx CE}_{\text{SCR}} = $2,300 / \text{ton} \)
- \( \text{NOx CE}_{\text{Ultra Cat}} = $3,900 / \text{ton} \)
Other Non Refinery Sector Emission Levels by Category

[Cost-effectiveness analysis ongoing]
Non Refinery Gas Turbines

ppm concentration @15% O₂

Proposed emission level: 2 ppm
Glass Melting Furnaces
(Container Glass)

Proposed emission level: 80% reduction

lbs NOx/ton of glass pulled

Furnace A

Furnace B

Proposed emission level: 80% reduction
Glass Melting Furnace (non-container glass)

ppm concentration @3% O₂

Proposed emission level:
80% reduction
Non-Refinery Boilers
>20 MMBTU/hr

ppm concentration @3% O₂

Proposed Emission Level: 5 ppm

2005 BARCT level: 9 ppm
Next Steps

• Complete BARCT Analysis
• Schedule next meeting February/March 2014
• Ongoing individual meetings to review BARCT
Contact

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