Agenda

- Summary of Working Group Meeting #1
- Stakeholder meetings and comments
- Survey questionnaire
- Revised universe and equipment
- Best Available Retrofit Control Technology (BARCT) Assessment
- Emissions data
- Next Steps
Progress of Rule Development

• Summary of Working Group #1 held 2/21/18
  • Presented initial concepts for Proposed Rule 1109.1
  • Discussed applicability/universe
  • Presented equipment types at major crude oil processing facilities

• Since working group meeting
  • Met with stakeholders
  • Populated and distributed survey questionnaire
  • Revised universe
  • Conducted site visits with Andeavor Carson and Phillips 66 Wilmington
  • Held stakeholder meetings with WSPA, Eco-Services, Phillips 66
Stakeholder Comments

• Proposed Rule 1109.1 needs to consider:
  • Space limitations
  • Ability to meet 2015 BARCT levels
  • Considerations for current planned projects to satisfy RECLAIM shave
  • Applicability of currently controlled equipment (i.e., incremental cost-effectiveness)
  • Low-volume and low-use equipment exemptions
  • Consideration for age of the control equipment
  • Refinery turnaround schedule
  • “Small heater” applicability(<40 MMBTU)
  • Startup and shutdown allowances
  • Monitoring, reporting, and recordkeeping
Progress of Rule Development - Survey Questionnaire

- Staff developed a comprehensive survey questionnaire
- Survey included:
  - All permitted equipment, permit limits, specific information on the control equipment, fuel characteristics, age of equipment and controls, emissions, source test information, potential retrofit challenges, etc.
- Survey will provide essential equipment information for:
  - Reassessing the 2015 BARCT limits
  - Determining cost effectiveness and incremental cost effectiveness
Status of Survey Questionnaire

- Distributed draft survey in March
- Met with stakeholders in April
- Revised survey to address comments and concerns
- Populated survey with equipment, permit limits, source test data, fuel type, and throughput
- Released finalized survey late May
- Completed survey due August 10, 2018
  - Seeking as much information as possible, recognize not all data is available
  - Default values can be used where appropriate
Revised Universe and Equipment
Facility Universe

- Initially proposed including 31 refineries and refinery associated facilities
  - 9 crude oil refineries
  - 5 small refineries
  - 17 related operations
- Criteria for revised universe
  - Within the boundaries of crude oil refineries
  - Support facilities that primarily serve refineries
  - Similar operations
  - Facilities with equipment fueled by refinery gas
Revised Universe and Applicability

9 Major Refineries
- Crude Oil Processing

4 Small Refineries
- Asphalt Plants
- Biodiesel Plant

4 Related Operations
- Hydrogen Plants
- Sulfuric Acid Plants
## Revised Universe of Facilities

### Crude Oil Processing

<table>
<thead>
<tr>
<th>ID</th>
<th>Name</th>
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<tbody>
<tr>
<td>151798</td>
<td>Andeavor - Sulfur Recovery Plant</td>
</tr>
<tr>
<td>171107</td>
<td>Phillips 66 Wilmington</td>
</tr>
<tr>
<td>171109</td>
<td>Phillips 66 Carson</td>
</tr>
<tr>
<td>174591</td>
<td>Andeavor - Calciner</td>
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<tr>
<td>174655</td>
<td>Andeavor Carson</td>
</tr>
<tr>
<td>181667</td>
<td>TORC</td>
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<tr>
<td>800026</td>
<td>Valero</td>
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<td>800030</td>
<td>Chevron</td>
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<tr>
<td>800436</td>
<td>Andeavor Wilmington</td>
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### Small Refineries

<table>
<thead>
<tr>
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<th>Name</th>
<th>Facility Type</th>
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<tbody>
<tr>
<td>800264</td>
<td>Edgington Oil</td>
<td>Asphalt Refinery</td>
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<tr>
<td>800080</td>
<td>Lunday-Thagard DBA World Oil Refining</td>
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<tr>
<td>800393</td>
<td>Valero Wilmington Asphalt Plant</td>
<td>Biodiesel Refinery</td>
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<tr>
<td>800183</td>
<td>Paramount</td>
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### Related Operations

<table>
<thead>
<tr>
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<th>Facility Type</th>
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<tbody>
<tr>
<td>148236</td>
<td>Air Liquide Large Industries</td>
<td>Hydrogen Plant</td>
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<tr>
<td>3417</td>
<td>Air Prod &amp; Chem</td>
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<tr>
<td>101656</td>
<td>Air Products and Chemicals</td>
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</tr>
<tr>
<td>178639</td>
<td>Eco Services Operations</td>
<td>Sulfuric Acid</td>
</tr>
<tr>
<td>Equipment Type</td>
<td>Total Number</td>
<td></td>
</tr>
<tr>
<td>----------------------------------------------------</td>
<td>--------------</td>
<td></td>
</tr>
<tr>
<td>Boiler/Heater</td>
<td>276</td>
<td></td>
</tr>
<tr>
<td>Coke Calciner (2)</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>FCCU (1)</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Gas Turbine/Duct Burner</td>
<td>23</td>
<td></td>
</tr>
<tr>
<td>ICE Prime</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Sulfur Recovery Unit/Tail Gas Incinerator</td>
<td>28</td>
<td></td>
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<tr>
<td><strong>Total</strong></td>
<td><strong>341</strong></td>
<td></td>
</tr>
</tbody>
</table>

(1) FCCU related devices; (2) One coke calciner system (2 devices)
**Equipment Categories**

<table>
<thead>
<tr>
<th>Category</th>
<th>Equipment</th>
</tr>
</thead>
</table>
| **Boiler/Heater** | • Boiler
                   • Furnace
                   • Heater |
| **Coke Calciner** | • Coke Kiln
                   • Coke Afterburner |
| **FCCU**          | • Reactor
                   • Regenerator |
| **Gas Turbine**   | • Gas Turbine/Turbine
                   • Duct Burner |
| **ICE Prime**     | • ICE Prime |
| **SRU/TG Incinerator** | • Oxidizer
                   • Thermal Oxidizer
                   • Incinerator
                   • SRU Incinerator
                   • Thermal Incinerator |

*ICE Emergency will not be included
BARCT Assessment
• California Health and Safety Code Section 40406 defines BARCT as
  “...an emission limitation that is based on the maximum degree of reduction achievable, taking into account environmental, energy, and economic impacts by each class or category of source.”

• Health and Safety Code Section 40920.6:
  Requires evaluation of BARCT prior to adopting rules or regulations
BARCT Assessment Guiding Principles

• BARCT assessment includes a technology assessment
  • Equipment specific
  • Fuel specific
  • Equipment size specific - Range of equipment sizes depending on control strategies
  • Application and use of unit - capacity, types of uses, heat input, etc.
  • Possibly other considerations

• Overall cost-effectiveness will also consider:
  • Incremental cost-effectiveness
  • Stranded assets
  • Outliers
  • Recent installation to meet previous NOx reduction commitments
Overview of Technology Assessment

- Assessment of SCAQMD Regulatory Requirements
- Assessment of Emission Limits for Existing Units
- Other Regulatory Requirements
- Assessment of Pollution Control Technologies
Assessment of SCAQMD Regulatory Requirements

**Objective:** Identify existing SCAQMD regulatory requirements for that particular source category

- Applicable SCAQMD rule
  - Current requirements
  - Other rules regulating the source category
  - Existing exemptions
- Potential issues identified during previous rulemakings
Assessment of Emission Limits for Existing Units

Objective: Evaluate existing units to understand what emission levels can be achieved based on permitted and actual levels

- Permitted emission limits
- Actual emission rate
  - Source test
  - Continuous Emissions Monitoring Systems (CEMS)
  - Relative Accuracy Test Audit (RATA)
- Pollution control technology
Information Needed for Evaluating Existing Units

Analysis of Permitted Emission Levels
- Emission limit
- Pollution control technology
- Equipment type
- Fuel type
- Equipment size
- Air pollution control technology
- When permitted
- Age of equipment
- Retrofit or replacement

Analysis of Actual Emissions Data
- Emission limit
- Throughput data
  - Annual Emission Reports (AER)
  - Source test or CEMS data
Other Regulatory Requirements

**Objective:** Evaluate other air districts and states with more stringent limits for same source categories

- Assess other rules and regulations outside of SCAQMD’s jurisdiction that regulate same sources
- Consider
  - Implementation date
  - Applicability
  - Alternative compliance approach
Assessment of Pollution Control Technologies

Objective: Identify pollution control technologies, approaches and potential emission reductions.

- Technology assessment should be all encompassing
- Identify known controls
- Consider emerging technology
2015 RECLAIM BARCT Analysis

- 2015 NOx RECLAIM amendment
  - Included BARCT assessment
  - SCAQMD assessed BARCT for refinery equipment
  - Norton Engineering conducted a third party review
- RECLAIM amendment approved December 2015
  - NOx shave of 12 tons per day
  - 56% of the shave would affect 9 major refineries
- Status:
  - 2016 - 2 tpd NOx reduction*
  - 2018 - 1 tpd NOx reduction*

* Overall RECLAIM cap
## 2015 RECLAIM BARCT Analysis (Reference Only)

<table>
<thead>
<tr>
<th>Equipment</th>
<th>RECLAIM BARCT</th>
<th>Technologies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boiler/Heater</td>
<td>2 ppmv</td>
<td>LNB, ULNB, SCR (more common); LoTOx w/WGS, SNCR, Flameless Heaters, Clear Sign (less common)</td>
</tr>
<tr>
<td>Coke Calciner</td>
<td>10 ppmv @ 3% O2</td>
<td>LoTOx, UltraCat</td>
</tr>
<tr>
<td>FCCU</td>
<td>2 ppmv @ 3% O2</td>
<td>SCR, SCR w/ASC, LoTOx w/WGS, NOx Reduction Additives</td>
</tr>
<tr>
<td>Gas Turbine</td>
<td>2 ppmv @ 15% O2</td>
<td>Water/steam injection, SCR, SCR w/ASC, DLE/DLN, CLN</td>
</tr>
<tr>
<td>ICE Prime</td>
<td>11 ppmv @ 15% O2</td>
<td>SCR for lean burn, NSCR (3-way catalyst) for rich burn</td>
</tr>
<tr>
<td>SRU/TG Incinerator</td>
<td>2 ppmv @ 3% O2</td>
<td>SCR, LoTOx w/WGS</td>
</tr>
</tbody>
</table>
Emissions Data
Emissions Data Evaluation

• Evaluate equipment by:
  • Fuel type (e.g., natural gas, refinery gas, process gas, diesel)
  • Equipment type (e.g., turbine, boiler, etc.)
  • NOx emissions from AER data

• Focus on low NOx units

• Evaluate permit conditions for each piece of equipment
  • Use permit limit first, if not available rely on CEMS (RATA) data
  • Future evaluation will compare permit limits to CEMS

• Preliminary evaluation based on available data

• Additional information from survey
  • Control technology, age, etc.
### Emissions Data - Boiler/Heaters

#### Boiler/Heater

<table>
<thead>
<tr>
<th>Size (MMBTU/Hr)</th>
<th>Fuel Type</th>
<th>NOx Limit (ppm)</th>
<th>Data Source</th>
<th>2016 NOx Emissions (tons/year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>60</td>
<td>Refinery Gas</td>
<td>3</td>
<td>CEMS (RATA)</td>
<td>0.42</td>
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<tr>
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<td>CEMS (RATA)</td>
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<td>78</td>
<td>Refinery Gas</td>
<td>5</td>
<td>Permit Condition</td>
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<tr>
<td>199</td>
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<td>Permit Condition</td>
<td>1.2</td>
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<tr>
<td>88</td>
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<td>Permit Condition</td>
<td>0.31</td>
</tr>
<tr>
<td>123</td>
<td>Refinery Gas</td>
<td>5</td>
<td>Permit Condition</td>
<td>0.59</td>
</tr>
<tr>
<td>177</td>
<td>Refinery Gas</td>
<td>5</td>
<td>Permit Condition</td>
<td>0.62</td>
</tr>
<tr>
<td>315</td>
<td>Refinery Gas</td>
<td>5</td>
<td>CEMS (RATA)</td>
<td>6.6</td>
</tr>
<tr>
<td>653</td>
<td>Refinery Gas</td>
<td>5</td>
<td>Permit Condition</td>
<td>9.5</td>
</tr>
<tr>
<td>764</td>
<td>Refinery Gas</td>
<td>5</td>
<td>Permit Condition</td>
<td>1.7</td>
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<td>780</td>
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<td>Permit Condition</td>
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<td>304</td>
<td>Refinery Gas</td>
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<td>CEMS (RATA)</td>
<td>9.3</td>
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<tr>
<td>460</td>
<td>Refinery Gas</td>
<td>7</td>
<td>Permit Condition</td>
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<td>245</td>
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<td>30</td>
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<td>CEMS (RATA)</td>
<td>1.2</td>
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<td>650</td>
<td>Refinery Gas</td>
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<td>CEMS (RATA)</td>
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<td>785</td>
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<td>Permit Condition</td>
<td>31.6</td>
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<td>300</td>
<td>Natural Gas</td>
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<td>CEMS (RATA)</td>
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<tr>
<td>40</td>
<td>Natural Gas</td>
<td>9</td>
<td>Permit Condition</td>
<td>0.63</td>
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</table>
Summary of Initial Analysis of Boiler/Heaters

• Total units: 276
• Permit Limits
  • Natural gas - as low as 5 ppm
  • Refinery gas - as low as 5 ppm
• Source test/CEMS (RATA) data
  • Natural gas - as low as 3 ppm
  • Refinery gas - as low as 3 ppm
• No permit limit for 48 units
• 2015 RECLAIM BARCT at 2 ppm
# Emissions Data - Coke Calciner

<table>
<thead>
<tr>
<th>Size (MMBTU/Hr)</th>
<th>Fuel Type</th>
<th>NOx Limit (ppm)</th>
<th>Data Source</th>
<th>2016 NOx Emissions (tons/year)</th>
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</thead>
<tbody>
<tr>
<td>120</td>
<td>Natural Gas</td>
<td>66</td>
<td>CEMS (RATA)</td>
<td>216</td>
</tr>
</tbody>
</table>
Summary of Initial Analysis of Coke Calciner

- Total units: 1 unit with 2 devices
- CEMS (RATA) data: 66 ppm
- 2015 RECLAIM BARCT at 10 ppm
## Emissions Data - FCCU

<table>
<thead>
<tr>
<th>NOx Limit (ppm)</th>
<th>Data Source</th>
<th>2016 NOx Emissions (tons/year)</th>
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<tbody>
<tr>
<td>5</td>
<td>CEMS (RATA)</td>
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<tr>
<td>21</td>
<td>CEMS (RATA)</td>
<td>14.5</td>
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<td>41</td>
<td>Permit Condition</td>
<td>112.3</td>
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<td>20</td>
<td>Permit Condition</td>
<td>60.6</td>
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<td>20</td>
<td>Permit Condition</td>
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</tr>
<tr>
<td>20</td>
<td>Permit Condition</td>
<td>76.3</td>
</tr>
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</table>
Summary of Initial Analysis of FCCU

• Total units: 6
• Permit limits:
  • As low as 5 ppm
• No missing permit limit
• 2015 RECLAIM BARCT at 2 ppm
## Combined Cycle Gas Turbines

<table>
<thead>
<tr>
<th>Size (MMBTU/Hr)</th>
<th>Fuel Type</th>
<th>NOx Limit (ppm)</th>
<th>Data Source</th>
<th>2016 NOx Emissions (tons/year)</th>
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<tbody>
<tr>
<td>341.6</td>
<td>Natural Gas</td>
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<td>Permit Condition</td>
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<tr>
<td>508.6</td>
<td>Natural Gas</td>
<td>2</td>
<td>Permit Condition</td>
<td>9.3</td>
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<tr>
<td>506</td>
<td>Natural Gas</td>
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<td>Permit Condition</td>
<td>48.6</td>
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<td>560</td>
<td>Natural Gas</td>
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<td>Permit Condition</td>
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<td>560</td>
<td>Natural Gas</td>
<td>9</td>
<td>Permit Condition</td>
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<td>985.5</td>
<td>Refinery Gas</td>
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<td>Permit Condition</td>
<td>78.1</td>
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<td>985.5</td>
<td>Refinery Gas</td>
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<td>Permit Condition</td>
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<tr>
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<td>Refinery Gas</td>
<td>8</td>
<td>Permit Condition</td>
<td>86.6</td>
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<tr>
<td>985.5</td>
<td>Refinery Gas</td>
<td>8</td>
<td>Permit Condition</td>
<td>71.6</td>
</tr>
<tr>
<td>646.3</td>
<td>Refinery Gas</td>
<td>9</td>
<td>Permit Condition</td>
<td>50.3</td>
</tr>
</tbody>
</table>
## Simple Cycle Gas Turbines

<table>
<thead>
<tr>
<th>Size (MMBTU/Hr)</th>
<th>Fuel Type</th>
<th>NOx Limit (ppm)</th>
<th>Data Source</th>
<th>2016 NOx Emissions (tons/year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>316</td>
<td>Natural Gas</td>
<td>n/a</td>
<td>Permit Condition</td>
<td>1.7</td>
</tr>
<tr>
<td>392</td>
<td>Refinery Gas</td>
<td>96</td>
<td>Permit Condition</td>
<td>50.6</td>
</tr>
<tr>
<td>392</td>
<td>Refinery Gas</td>
<td>96</td>
<td>Permit Condition</td>
<td>41.5</td>
</tr>
</tbody>
</table>
Summary of Initial Analysis of Gas Turbines

- Total units: 23
  - 10 combined cycle turbines
  - 3 simple cycle turbines
- Permit limits:
  - Combined cycle
    - Natural gas - as low as 2 ppm
    - Refinery gas - as low as 8 ppm
  - Simple cycle
    - 2 refinery gas units at 96 ppm
    - No permit limit for 1 unit
- 2015 RECLAIM BARCT at 2 ppm
## Emissions Data - ICE Prime

<table>
<thead>
<tr>
<th>Size</th>
<th>Fuel Type</th>
<th>NOx Limit (ppm)</th>
<th>Data Source</th>
<th>2016 NOx Emissions (tons/year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>18 HP</td>
<td>Diesel</td>
<td>n/a</td>
<td>Permit Condition</td>
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<tr>
<td>700 BHP</td>
<td>Diesel</td>
<td>880</td>
<td>Permit Condition</td>
<td>0.1</td>
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<tr>
<td>700 BHP</td>
<td>Diesel</td>
<td>880</td>
<td>Permit Condition</td>
<td>0.03</td>
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<td>1095 HP</td>
<td>Diesel</td>
<td>882</td>
<td>Permit Condition</td>
<td>0.4</td>
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<tr>
<td>60 HP</td>
<td>Gasoline</td>
<td>191</td>
<td>Permit Condition</td>
<td>0</td>
</tr>
<tr>
<td>880 HP</td>
<td>Natural Gas</td>
<td>878</td>
<td>Permit Condition</td>
<td>0</td>
</tr>
</tbody>
</table>
Summary of Initial Analysis of ICE Prime

• Total units: 6
• Permit limits:
  • Diesel - 880 to 882 ppm
  • Gasoline - 191 ppm
  • Natural gas - 878 ppm
• No permit limit for 1 unit
• High NOx concentration permit limits but low NOx emissions (e.g., low use)
• 2015 RECLAIM BARCT at 11 ppm*

* Command and control limit, i.e., Rule 1110.2
## SRU/TG Incinerator

<table>
<thead>
<tr>
<th>Size (MMBTU/Hr)</th>
<th>Fuel Type</th>
<th>NOx Limit (ppm)</th>
<th>Data Source</th>
<th>2016 NOx Emissions (tons/year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>Refinery Gas</td>
<td>38</td>
<td>Source Test (3% O2)</td>
<td>3.6</td>
</tr>
<tr>
<td>44.5</td>
<td>Refinery Gas</td>
<td>22</td>
<td>CEMS (RATA)</td>
<td>20.3</td>
</tr>
<tr>
<td>14</td>
<td>Natural Gas</td>
<td>45</td>
<td>Permit Condition</td>
<td>11.2</td>
</tr>
<tr>
<td>35.8</td>
<td>Natural Gas</td>
<td>35</td>
<td>CEMS (RATA)</td>
<td>3.7</td>
</tr>
<tr>
<td>50</td>
<td>Natural Gas</td>
<td>41</td>
<td>Permit Condition</td>
<td>8.3</td>
</tr>
<tr>
<td>52</td>
<td>Natural Gas</td>
<td>11</td>
<td>CEMS (RATA)</td>
<td>6.8</td>
</tr>
</tbody>
</table>
Summary of Initial Analysis of SRU/TG Incinerators

- Total units: 28
- Permit Limits
  - Natural gas - as low as 41 ppm
  - Refinery gas - as low as 45 ppm
- Source test/CEMS (RATA) data
  - Source test (3% O2) - as low as 38 ppm
  - Refinery gas - as low as 11 ppm
- No permit limit for 11 units
- 2015 RECLAIM BARCT at 2 ppm
Initial Consideration for Emission Limits

- Achieved in practice limits will be one of several factors
- Limits to allow for retrofit or replacement of equipment
- Cost-effectiveness and incremental cost-effectiveness incorporated into BARCT assessment
- Include an ammonia emission limit
- Seeking third party for BARCT assessment
  - Request for proposal (RFP) to select consultant
- Effective date still under consideration
  - 2016 AQMP goal of 5 tons per day of NOx reductions by 2025
  - AB 617 requirement of BARCT implementation by 2023
Next Steps

- Continue stakeholder site visits and meetings
- RFP for BARCT validation
- Evaluate current SCAQMD source specific rules
- Evaluate other air districts and states
- Analyze/refine data from survey spreadsheet
- Develop rule concepts
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