Rule 1109.1 - Landing Rule for Refineries

Working Group Meeting #1
02/21/18
Agenda

• Background
• Key Topics
• Potential Universe
• Overview of equipment types and NOx emissions at crude refineries
• Next Steps
Background

• 2016 AQMP CMB-05 (Further NOx Reductions from RECLAIM Assessment)
  • Achieve 5 tpd of NOx emission reductions by 2025
  • Transition NOx RECLAIM to command-and-control (C&C) regulatory structure requiring Best Available Retrofit Control Technology (BARCT)

• Assembly Bill 617
  • Develop a schedule for implementing BARCT by January 1, 2019
  • BARCT implementation by December 31, 2023
Key Topics

• Includes most NOx equipment operated at facilities (applicability to be determined during rulemaking)

• Conduct BARCT determination for NOx equipment, including cost-effectiveness
  • Reference NOx limit in applicable source-specific rule, with considerations for fuel type, size, age of equipment, unique operating conditions, etc.
  • New BARCT analysis for other sources

• Explore implementation approaches
  • Traditional command and control
  • Alternative approaches - mass emissions, greatest reductions early, etc.

• Establish compliance schedule
• Monitoring, Reporting, and Recordkeeping
Rule Applicability Concepts

- Evaluating options for applicability
  - Crude processing refineries
  - Smaller independent refineries
  - Non-crude processing refineries - biodiesel
  - Related operations - hydrogen plant, sulfur recovery plant, etc.
Universe and Potential Applicability

9 Refinery Facilities
- Crude Oil Processing

5 Small Refineries
- Asphalt Plants
- Biodiesel Plant

17 Related Operation
- Hydrogen Plants
- Polypropylene Plant
- Sulfuric Acid Plants
- Storage and Bulk Loading Terminal
- Crude Pipeline Transportation
### Related Operations

<table>
<thead>
<tr>
<th>ID</th>
<th>Name</th>
<th>Facility Type</th>
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<tbody>
<tr>
<td>800372</td>
<td>Equilon Enter Bulk Loading Terminal</td>
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<td>800129</td>
<td>SFPP, L.P.</td>
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<td>137520</td>
<td>Plains West Coast Terminals</td>
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<td>182049</td>
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<td>148236</td>
<td>Air Liquide Large Industries</td>
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<td>Air Prod &amp; Chem</td>
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<td>101656</td>
<td>Air Products and Chemicals</td>
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<td>42630</td>
<td>Praxair</td>
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<td>124808</td>
<td>Ineos Polypropylene</td>
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<td>7416</td>
<td>Praxair</td>
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<td>178639</td>
<td>Eco Services Operations</td>
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### Small Refineries

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<th>Name</th>
<th>Facility Type</th>
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<tbody>
<tr>
<td>800037</td>
<td>Demenno/ Kerdoon Waste Oil Refinery</td>
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<td>800264</td>
<td>Edgington Oil Asphalt Refinery</td>
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<td>800080</td>
<td>Lunday-Thagard dba World Oil Refining Asphalt Refinery</td>
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<td>800393</td>
<td>Valero Wilmington Asphalt Plant Biodiesel Refinery</td>
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</tr>
<tr>
<td>800183</td>
<td>Paramount Polypropylene Industrial Gas</td>
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### Crude Oil Processing

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<th>ID</th>
<th>Name</th>
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<tr>
<td>151798</td>
<td>Andeavor - Sulfur Recovery Plant</td>
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<td>171107</td>
<td>Phillips 66 Wilmington</td>
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<td>171109</td>
<td>Phillips 66 Carson</td>
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<td>174591</td>
<td>Andeavor - Calciner</td>
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<td>174655</td>
<td>Andeavor Carson</td>
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<td>181667</td>
<td>TORC</td>
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<td>800026</td>
<td>Valero</td>
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<td>800030</td>
<td>Chevron</td>
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<td>800436</td>
<td>Andeavor Wilmington</td>
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NOx Emissions - tons per day

- Crude Oil Refineries, 10.9
- Small Refineries, 0.4
- Related Operations, 0.6
Applicability Considerations

• Include all equipment within the boundaries of the refineries?
  • Feedstock supply via pipeline
  • Sulfur recovery plant, hydrogen plant, sulfuric acid regeneration

• Also include similar operations outside a refinery?

• Include equipment within the boundaries of a refinery that is independent of the refinery?

• Larger universe includes similar equipment
  • Consistency between facilities
  • Refinery gas fueled equipment
  • Crude oil processing
Crude Oil Refineries
Evaluation of NOx Emissions

• Compared current NOx concentration levels to 2015 RECLAIM BARCT levels
• Data analysis
  • NOx concentration levels based on permit conditions, CEMS data, and source tests
  • Mass emissions based on unaudited data reported from facilities
  • Not a complete dataset, will complete in future analysis
• Used the 2015 RECLAIM BARCT levels to provide a reference point
• Basic analysis - more refined analysis in future Working Group meetings
  • Fuel type
  • Equipment size
  • Refined categories
• Staff will reanalyze BARCT levels for all equipment - further discussions in future Working Group meetings
2016 NOx Emissions By Refinery
Total NOx: 10 tons/day

Unaudited Data
### Universe of Equipment

6 broad categories of equipment at the 9 crude oil processing refineries

<table>
<thead>
<tr>
<th>Equipment Type</th>
<th>Total Number</th>
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<tr>
<td>Sulfur Recovery Unit/Tail Gas Incinerator</td>
<td>22</td>
</tr>
<tr>
<td>ICE Prime</td>
<td>4</td>
</tr>
<tr>
<td>Gas Turbine/Duct Burner</td>
<td>23</td>
</tr>
<tr>
<td>FCCU (1)</td>
<td>7</td>
</tr>
<tr>
<td>Coke Calciner (2)</td>
<td>2</td>
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<tr>
<td>Boiler/Heater</td>
<td>212</td>
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<tr>
<td><strong>Total</strong></td>
<td><strong>270</strong></td>
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</table>

(1) FCCU related devices; (2) One Coke Calciner system (2 devices)
2016 NOx Emissions (tons/year) by Equipment Type

- **Boiler/Heater**: 2449 tons/year
- **Coke Calciner**: 216 tons/year
- **FCCU**: 278 tons/year
- **Gas Turbine**: 600 tons/year
- **ICE Em**: 0.3 tons/year
- **ICE Prime**: 0.3 tons/year
- **SRU/TG Incinerator**: 129 tons/year
- **Gas Turbine**: 43 tons/year
- **FCCU**: 46 tons/year
- **ICE Prime**: 0.3 tons/year
- **SRU/TG Incinerator**: 9 tons/year

**Unaudited Data**
- **Boiler/Heater**: 15 tons/year
- **Coke Calciner**: 216 tons/year
# 2015 RECLAIM BARCT Analysis (Reference Only)

<table>
<thead>
<tr>
<th>Equipment</th>
<th>RECLAIM BARCT</th>
<th>Technologies</th>
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<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>SRU/TG Incinerator</td>
<td>2 ppmv @ 3% O2</td>
<td>SCR, LoTOx w/WGS</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>
</tbody>
</table>
Boilers/Heaters (167)

Natural Gas

Process Gas

Refinery Gas

Refinery Gas/Natural Gas

NOx Concentration (ppmv)

2015 RECLAIM BARCT
Coke Calciner (1)

NOx Concentration (ppmv)

Diesel

2015 RECLAIM BARCT
FCCU (6)

Refinery Gas/Natural Gas

Unknown

2015 RECLAIM BARCT

NOx Concentration (ppmv)
Gas Turbines/Duct Burners (14)

2015 RECLAIM BARCT

NOx Concentration (ppmv)

Natural Gas

Refinery Gas

Refinery Gas/Natural Gas

1 10 100
DIESEL ICE Prime (3)

2015 RECLAIM BARCT

NOx Concentration (ppmv)
SRU/TG Incinerator (14)

2015 RECLAIM BARCT

NOx Concentration (ppmv)

Natural Gas

Refinery Gas

Tail Gas
Next Steps

• Develop survey and/or spreadsheet for BARCT re-assessment
• Schedule next Working Group meeting
  • Meetings every 4 to 6 weeks
• Continue site visits and individual meetings
• Further refine the data
Rule Development Staff Contacts

Michael Krause
Planning & Rules Manager
mkrause@aqmd.gov
909-396-2706

Heather Farr
Program Supervisor
hfarr@aqmd.gov
909-396-3672

Jong Hoon Lee
AQ Specialist
jhlee@aqmd.gov
909-396-3903