Regulations to Track and Reduce Emissions from Petroleum Refineries

Board of Directors Meeting
October 15, 2014

Eric Stevenson
Director of Technical Services
Enhanced Approach

• Proceed with latest version of Regulation 12, Rule 15 (12-15), Petroleum Refining Emissions Tracking Rule

• Develop a companion rule concurrently to 12-15 to mitigate refinery emissions increases
  • Both rules to the Board for consideration by March of 2015

• Develop a Board of Directors Resolution to guide further rule development efforts to reduce emissions

• Expedite rule development
Current 12-15 Elements

• **Annual emissions inventories** of all regulated air pollutants based on upgraded methods, including emissions from cargo carriers

• **Petroleum Refinery Emissions Profile (PREP);** require that on-going inventories include comparisons with PREP

• **Crude oil composition characteristics** with annual emissions inventories (e.g. sulfur, nitrogen content, API gravity, Total Acid Number)

• **Health Risk Assessments (HRA)** with enhanced emissions inventories and revised OEHHA HRA guidelines

• **Enhance fence line monitoring systems and establish community air quality monitoring systems**
Mitigate emissions increases of criteria pollutants, Toxic Air Contaminants (TAC) and greenhouse gases (GHG) based on PREP

- Require causal analysis of any increase
- Require mitigation plan to be submitted
- Require public review of mitigation plan

- This will help ensure that crude oil composition changes do not increase emissions
- This will help identify processes that contribute to emissions increases
Approaches for Decreasing Emissions

- Investigate emission reduction opportunities
  - VOC’s at tanks, and other fugitive sources
  - PM at Fluidized Catalytic Cracking Units (FCCUs) and other combustion sources
  - Reductions to NO\textsubscript{X} sources will be limited due to recent regulatory action
  - SO\textsubscript{2} in fuel gas and coke calcining
  - Potentially reduce risk by amending Regulation 2, Rule 5

- Develop resolution directing staff to evaluate emissions reduction approaches and recommend a strategy
  - Consider reduction approaches, including those by advocates and industry
  - Provide a strategy to reduce refinery emissions with an expedited timeline
  - Resolution for Board consideration by December of 2014
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Present 12-15 for Board consideration

Air monitoring, HRA and emissions inventory provide a means to track impacts within the immediate communities and throughout the Bay Area

Development of companion rule and present to Board for consideration

Mitigate increases in refinery emissions

Develop resolution for Board consideration

Guide further rule devolvement to reduce refinery emissions
Bay Area Emissions and Air Quality: Trends & Refinery Overview

Board of Directors
October 15, 2014

Henry Hilken
Director of Planning, Rules and Research

Wayne Kino
Director of Compliance and Enforcement
Refinery Overview
Air District Refinery Regulations

REGULATION 1 - GENERAL PROVISIONS
REGULATION 2 - PERMITS
REGULATION 6 - PARTICULATE MATTER AND VISIBLE EMISSIONS
REGULATION 7 - ODOROUS SUBSTANCES
REGULATION 8 - ORGANIC COMPOUNDS:
  Rule 1 - General Provisions
  Rule 2 - Miscellaneous Operations
  Rule 5 - Storage of Organic Liquids
  Rule 6 - Terminals and Bulk Plants
  Rule 8 - Wastewater (Oil-Water) Separators
  Rule 10 - Process Vessel Depressurization
  Rule 18 - Equipment Leaks
  Rule 28 - Episodic Releases From Pressure Relief Devices
  Rule 37 - Natural Gas and Crude Oil Production Facilities
  Rule 43 - Surface Coating of Marine Vessels
  Rule 44 - Marine Vessel Loading Terminals
  Rule 46 - Marine Tank Vessel to Marine Tank Vessel Loading
REGULATION 9 - INORGANIC GASEOUS POLLUTANTS:
  Rule 1 - Sulfur Dioxide
  Rule 2 - Hydrogen Sulfide
  Rule 3 - Nitrogen Oxides from Heat Transfer Operations
  Rule 7 - Nitrogen Oxides And Carbon Monoxide from Industrial, Institutional, and Commercial Operations

Boilers, Steam Generators, And Process Heaters
Rule 8 - Nitrogen Oxides And Carbon Monoxide from Stationary Internal Combustion Engines
Rule 10 - Nitrogen oxides And Carbon Monoxide From Boilers, Steam Generators And Process Heaters in Petroleum Refineries

REGULATION 10 - STANDARDS OF PERFORMANCE FOR NEW STATIONARY SOURCES: This Regulation establishes emission and/or performance standards for new plants and other sources by reference to the provisions of Part 60, Chapter 1, Title 40, of the Code of Federal Regulations.

REGULATION 11 - HAZARDOUS POLLUTANTS
  Rule 1 - Lead
  Rule 2 - Asbestos Demolition, Renovation and Manufacturing
  Rule 7 - Benzene
  Rule 10 - Hexavalent Chromium Emissions From Cooling Towers
  Rule 11 - National Emission Standard For Benzene Emissions From Coke By-Product Recovery Plants and Benzene Storage Vessels
  Rule 12 - National Emission Standard For Benzene Emissions From Benzene Transfer Operations and Benzene Waste Operations

REGULATION 12 - MISCELLANEOUS STANDARDS OF PERFORMANCE:
  Rule 11 – Flare Monitoring
  Rule 12 – Flare Control
Refinery Sources of Emissions

- Rail cars
- Pipelines
- Barges
- Trucks
- Crude tank farm
- Crude blend tank
- Cold preheat train
- Desalter
- Hot preheat train
- Heater
- Crude unit
- Transportation
- Storage
- Processing
- Finished products

8 Regulations
18 Rules

9 Regulations
12 Rules

8 Regulations
18 Rules
Fugitive Emissions:

- 100 parts per million leak standard adopted in 1992
- First regulation to control Greenhouse Gases (methane)
- South Coast AQMD and EPA at 500 ppm
- Collaboration between Communities, Environmental Groups and Industry
**Flare Rules:** Goal to limit flaring to emergency events

- Rule 11 required state of the art monitoring in 2003
- Rule 12 required Annual Flare Management Plans in 2006
  - Causal Analysis for Each Flaring Event
  - Identify and Implement Prevention Measures
- Collaboration between Communities, Environmental Groups and Industry
Air District Compliance & Enforcement - 2013

➢ Compliance Verification Inspections
  • 10,130

➢ Complaint Investigations
  • 3,320

➢ Violations
  • 1006

➢ Incident Investigations
  • 442 Episodes, 82 Breakdowns, 2 Major Incidents

➢ Compliance Audits & Refinery Program Review
  • Tank Degas Audit
  • Regulation 8-18 Audit
  • Marine Terminals Audit
Distribution of 2013 Annual Average Emissions

- Consumer Products (ROG) / Geologic Dust (PM2.5): 21%
- On-Road (cars, trucks, etc.): 23%
- Off-Road (construction, ships, trains, etc.): 26%
- Evaporation (paints, fuels, solvents): 4%
- Refinery (processes and combustion): 5%
- Other Industrial / Commercial: 30%
- Combustion (residential): 5%
- Combustion (industrial): 53%

**ROG: 258 tpd**

- Refinery (processes and combustion): 24%
- Other Industrial / Commercial: 14%
- Combustion (residential): 11%
- Evaporation (paints, fuels, solvents): 6%
- Off-Road (construction, ships, trains, etc.): 7%
- On-Road (cars, trucks, etc.): 25%

**PM2.5: 47 tpd**

- NOx: 291 tpd
- SO2: 22 tpd
All Source

ROG (tpd)

PM$_{2.5}$ (tpd)

NOx (tpd)

SO$_2$ (tpd)
Refinery Emission Trends 1980-2015 and Main Causes of Reductions

- Reg. 8-18: Equipment Leaks
- Reg. 8-5: Storage Tanks
- Reg. 12-11: Flare Monitoring
- Reg. 12-12: Refinery Flares

- Reg. 9-10: NOx at Refinery Heaters

- Reg. 12-11: Flare Monitoring
- Reg. 12-12: Refinery Flares
- Scrubber at Valero per consent decree
Risk from Toxic Air Contaminants Declining in the Bay Area

Measurement-based Trends

- Lifetime Cancer Risk
  - 1990: 1,330 in a million
  - 2001: 625 in a million
  - 2012: 300 in a million

Legend:
- **Green**: diesel PM
- **Blue**: benzene
- **Blue**: 1,3-butadiene
- **White**: Others
Bay Area Refinery Emissions 2012 (tons/day)
Bay Area Refinery Emissions per Production Capacity, 2012

Tons per Million Barrels

Chevron  Shell  Valero  Tesoro  Phillips 66

- PM2.5
- SO2
- NOx
- ROG
Bay Area vs. South Coast Refinery Emissions per Production Capacity, 2010
## Comparing South Coast and Bay Area Refineries

<table>
<thead>
<tr>
<th>Pollutant</th>
<th>Comparison</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>NO\textsubscript{X}</td>
<td>Bay Area emissions are generally higher. With some refineries performing better than others.</td>
<td>South Coast is an extreme ozone nonattainment area. As a result, NO\textsubscript{X} requirements on all sources are more stringent in South Coast.</td>
</tr>
<tr>
<td>SO\textsubscript{X}</td>
<td>Bay Area emissions are consistently higher. However, emissions at the Valero Benicia refinery are very low.</td>
<td>South Coast PM-2.5 strategy includes aggressive SO\textsubscript{2} controls.</td>
</tr>
<tr>
<td>ROG</td>
<td>There appears to be no significant, consistent pattern. Some Bay Area refineries are high emitters and some South Coast refineries are high emitters.</td>
<td>Further investigation on this issue is required, due to differences in how ROG emissions are calculated and reported.</td>
</tr>
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<td>PM</td>
<td>Insufficient data.</td>
<td>There are significant differences between how PM is calculated and reported in each district, making it difficult to compare.</td>
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<td>Toxics</td>
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# Board Actions Requiring Emissions Reductions at Refineries 1992-2013

<table>
<thead>
<tr>
<th>Date</th>
<th>Reg.-Rule</th>
<th>Description</th>
<th>Pollutant</th>
</tr>
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<tbody>
<tr>
<td>3/92, 1/98, 11/02, 1/04</td>
<td>8-18</td>
<td>Equipment leaks at refineries</td>
<td>ROG</td>
</tr>
<tr>
<td>3/92</td>
<td>8-22, 8-25</td>
<td>Leaks from valves and flanges</td>
<td>ROG</td>
</tr>
<tr>
<td>1/93, 12/99, 10/06</td>
<td>8-5</td>
<td>Storage tanks</td>
<td>ROG</td>
</tr>
<tr>
<td>1/94, 12/10, 10/13</td>
<td>9-10</td>
<td>Boilers, steam generators, process heaters</td>
<td>NO\textsubscript{X}</td>
</tr>
<tr>
<td>12/97, 3/98, 12/05</td>
<td>8-28</td>
<td>Leaks from pressure relief valves</td>
<td>ROG</td>
</tr>
<tr>
<td>6/03</td>
<td>12-11</td>
<td>Refinery flare monitoring</td>
<td>All</td>
</tr>
<tr>
<td>1/04</td>
<td>8-10</td>
<td>Process vessel depressurization</td>
<td>ROG</td>
</tr>
<tr>
<td>9/04</td>
<td>8-8</td>
<td>Refinery wastewater separators</td>
<td>ROG</td>
</tr>
<tr>
<td>7/05, 4/06</td>
<td>12-12</td>
<td>Refinery flares</td>
<td>All</td>
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<tr>
<td>12/05</td>
<td>8-44</td>
<td>Marine loading operations</td>
<td>ROG</td>
</tr>
<tr>
<td>7/07</td>
<td>9-8</td>
<td>Stationary internal combustion engines</td>
<td>NO\textsubscript{x}, PM</td>
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<tr>
<td>4/09</td>
<td>8-33, 8-39</td>
<td>Gasoline bulk terminals</td>
<td>ROG</td>
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<td>4/12</td>
<td>8-53</td>
<td>Vacuum trucks</td>
<td>ROG</td>
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Emissions Reductions from Air District Rules 1992-2013

Stationary Source Emissions Reductions from Air District Rules 1992-2013
[tons per day]

- ROG
  - Total: 68.4 tpd
  - Refineries: 52.1
  - Other: 16.3

- NO\textsubscript{x}
  - Total: 92.6 tpd
  - Refineries: 70.0
  - Other: 22.6

- PM
  - Total: 4.7 tpd
  - Refineries: 4.5
  - Other: 0.2
## 2015 Clean Air Plan
### Preliminary Draft Control Measures & Further Study Measures for Refineries

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Significant emissions reductions have been achieved in the Bay Area, Bay Area air quality has improved

Increased focus on fine particulate
- Smaller particles (TSP > PM10 > PM2.5 > ultrafine)
- More complex sources – secondary PM and condensable PM

Continuing challenges
- Low hanging fruit is gone
- State and national AQ standards regularly revised, tightened
- Local areas with high pollution exposure, poor health outcomes
- GHGs

Each refinery is unique

Refinery emissions will continue to be focus of District rulemaking and analysis
# Summary of Ozone Seasons

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<tr>
<th>Year</th>
<th>National 8-Hour</th>
<th>State 1-Hour</th>
<th>State 8-Hour</th>
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<tbody>
<tr>
<td>2011</td>
<td>4</td>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td>2012</td>
<td>4</td>
<td>3</td>
<td>8</td>
</tr>
<tr>
<td>2013</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>2014</td>
<td>5</td>
<td>3</td>
<td>10</td>
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Spare the Air Alerts: 5/12, 5/13, 5/14, 6/8, 6/9, 7/25, 8/1, 9/11, 9/12, 10/3

Days > 0.075 ppm 8-hour NAAQS: 4/30, 5/1, 5/14, 10/4, 10/5