AGENDA: 6

Regulation 13, Rule 1: Refinery Carbon Intensity Caps

Eric Stevenson, Director
Meteorology, Measurement, and Rules Division

Advisory Council Meeting
February 6, 2017
• Problem 1: Refinery Pollution has significant impact on nearby communities and on the climate.

• Problem 2: Production of California and Alaska North Slope crude oil is declining. Currently, refineries may retool to process more energy intensive crude oil such as Canadian tar sands.
Proposed Solution

1. Direct regulation of criteria (PM, NO\textsubscript{X}, SO\textsubscript{2}, VOC) emissions.

2. Improved measurement and reporting of refinery emissions and feedstocks.

3. Risk-based rules to reduce health risk from toxic emissions.

4. <New> Cap Refinery Carbon Intensity
Impact of Stack Height at Refineries

REGIONAL AND GLOBAL EMISSIONS

Stack Emissions
- CO$_2$
- NO$_x$
- SO$_2$
- PM

Ground-level/localized emissions
- Diesel PM
- TACs
- VOCs, TACs
- PM, VOCs, TACs, NO$_x$
Cancer Risk Drivers for Typical Large Refinery

- Diesel Engines > 90%
- Wastewater Treatment
- Storage Tanks
- Valves, Flanges, Connectors & Seals

- Benzene 74%
- DPM 17%
- Other 9%
Top Sources of GHG Emissions at Typical Large Refinery

- 89% of CO₂ emissions
- 0.45% of Benzene emissions
- 0% of DPM emissions
On track towards *Refinery Strategy* goals

- Six rules adopted in 2015 and 2016
- Criteria pollutant emissions reductions of over 15%

<table>
<thead>
<tr>
<th>Rule</th>
<th>Addresses</th>
<th>Adopted</th>
</tr>
</thead>
<tbody>
<tr>
<td>6-5</td>
<td>Reduces PM from FCCUs</td>
<td>Dec. 2015</td>
</tr>
<tr>
<td>8-18</td>
<td>Reduces VOC from equipment leaks</td>
<td></td>
</tr>
<tr>
<td>11-10</td>
<td>Reduces VOC and toxics from cooling towers</td>
<td></td>
</tr>
<tr>
<td>9-14</td>
<td>Reduces SO₂ from coke calcining operations</td>
<td>Apr. 2016</td>
</tr>
<tr>
<td>12-15</td>
<td>Tracks crude slate changes and emissions</td>
<td></td>
</tr>
<tr>
<td>9-9</td>
<td>Nitrogen Oxides from Gas Turbines</td>
<td>Q4 2017</td>
</tr>
<tr>
<td>TBD</td>
<td>Further SO₂ reductions</td>
<td>Q4 2017</td>
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</tbody>
</table>
Reduces public’s exposure to localized health risks

- Hundreds of facilities will be evaluated, including refineries
- Health Risk Assessments (HRAs) conducted by Air District staff using latest OEHHA guidelines
- Threshold for facilities to develop and execute District-approved Risk Reduction Plans reduced from 100 per million (100/M) to 10/M
- Refineries have among highest priority for HRAs (Phase 1)
- Rule 11-18 ready for Board action in May 2017
Draft Rule 13-1

First Rule of Combustion Strategy

Limits refinery GHG & criteria pollutant emissions by focusing on carbon intensity

• Carbon intensity defined on a simple barrel basis

\[
\text{Carbon Intensity} = \frac{\text{Annual GHG Emissions (MT CO}_2\text{e)}}{\text{Annual Throughput (barrels of crude oil)}}
\]

• Caps each refinery’s **carbon intensity** at a level consistent with current operation
  - Accounts for GHGs from all power and H\textsubscript{2} inputs
  - Requires execution of energy efficiency projects with simple payback of 10 years or less
Key Factors in Refinery Carbon Intensity

- **API Gravity (density)**
  - Heavier crude $\rightarrow$ more energy to convert to lighter products
  - More energy $\rightarrow$ higher emissions of GHG, PM, SO$_2$ and NO$_x$
  - GHG and PM from gaseous fuel combustion not amenable to end-of-pipe emissions controls.

- **Sulfur Content**
  - Sulfur must be removed in order to meet product regulatory and technical requirements.
  - Hydrogen is consumed in sulfur removal.
  - Hydrogen generation is a large source of GHG and other combustion emissions.

- **Energy Efficiency**
  - Thermal efficiency, steam management, heat loss, other issues
  - Most cost-effective upgrades are already implemented.
Standard Operations

Crude Unit 100% capacity

Light Ends
- SR Gasoline
- Jet Fuel
- Diesel
- Heavy Gas Oil
- Residuum

Percent Utilization
- Propane, Butane & RFG: 5%
- Catalytic Reformer: 10%
- Blending: 10%
- Desulfurizer: 15%
- FCCU: 35%
- Coker: 25%

Light Processing
- Low C°

Heavy Processing
- High C°

California Crude
Heavy / Sour Operations

Crude Unit

Light Ends
- SR Gasoline
- Jet Fuel
- Diesel
- Heavy Gas Oil
- Residuum

Light Processing
- Low C°

Heavy / Sour
- Heavy Processing
  - High C°

Percent Utilization
- Propane, Butane & RFG: 5%
- Catalytic Reformer: 10%
- Blending: 10%
- Desulfurizer: 15%
- FCCU: 35%
- Coker: 25%
Light / Sweet Operations

Light Ends
- SR Gasoline
- Jet Fuel
- Diesel
- Heavy Gas Oil
- Residua

Light / Sweet Operations:
- Catalytic Reformer: 10%
- Blending: 10%
- Desulfurizer: 15%
- FCCU: 35%
- Coker: 25%

Percent Utilization
## Crude Oil Comparison

<table>
<thead>
<tr>
<th>Crude Unit Cut</th>
<th>California (Kern River)</th>
<th>Alaska North Slope</th>
<th>Canadian Tar Sands (Albion Heavy Synthetic)</th>
<th>Fracked Crude (Eagle Ford Shale Oil)</th>
</tr>
</thead>
<tbody>
<tr>
<td>LPG</td>
<td>1%</td>
<td>4%</td>
<td>2%</td>
<td>1%</td>
</tr>
<tr>
<td>Straight Run Gasoline</td>
<td>14%</td>
<td>23%</td>
<td>14%</td>
<td>37%</td>
</tr>
<tr>
<td>Jet Fuel</td>
<td>8%</td>
<td>19%</td>
<td>5%</td>
<td>12%</td>
</tr>
<tr>
<td>Diesel</td>
<td>12%</td>
<td>13%</td>
<td>9%</td>
<td>21%</td>
</tr>
<tr>
<td>Heavy Gas Oil</td>
<td>30%</td>
<td>29%</td>
<td>11%</td>
<td>24%</td>
</tr>
<tr>
<td>Residuum</td>
<td>34%</td>
<td>12%</td>
<td>59%</td>
<td>4%</td>
</tr>
</tbody>
</table>
Impact of Rule 13-1 Carbon Intensity Limit

• Prevents refineries from re-tooling to process significantly heavier and more sulfurous crude oils like Canadian tar sands.
• Doesn’t restrict full-production with current equipment.
• Allows capital projects to increase production as long as carbon intensity does not increase.
• Aligns with draft ARB scoping plan proposal for direct regulation of the refinery sector.
Proposed by Environmental Advocacy Groups

Limits refinery GHG & criteria pollutant emissions

• Affects five refineries and three associated facilities
• Caps GHG, PM$_{10}$, PM$_{2.5}$, SO$_2$ and NO$_X$ emissions
• Limits set at 7% above each refinery’s five-year max

Has significant issues

• Conflicts with state and federal law on permitting
• Court would likely find it to be arbitrary and capricious
• May cause gasoline shortages if consumption increases
## Comparison of Rule 12-16 & Rule 13-1

<table>
<thead>
<tr>
<th>Goals / Objectives</th>
<th>Rule 12-16</th>
<th>Rule 13-1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prevents Significant Increases in PM Emissions</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Prevents Significant GHG Emission Increases</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Reduces Toxic Emissions</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Addresses Emissions Leakage</td>
<td>No</td>
<td>Yes</td>
</tr>
</tbody>
</table>

### Harmony with...

<table>
<thead>
<tr>
<th>Harmony with...</th>
<th>Rule 12-16</th>
<th>Rule 13-1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Health and Safety Code</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>AB 32 Cap-and-Trade Program</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>New Source Review</td>
<td>No</td>
<td>Yes</td>
</tr>
</tbody>
</table>
Summary

- Staff believes that draft Rule 13-1 meets the GHG-related goals of draft Rule 12-16, but more analysis and consultation with stakeholders is still required.

- Draft Rule 13-1 will be evaluated as an alternative to draft Rule 12-16 in the EIR for 12-16.

- Analysis of draft Rule 13-1 will not impact the schedule for the analysis of draft Rule 12-16.
Schedule / Next Steps

On track with 12-16/11-18 rulemaking process

- MAR 2017 – Second round of workshops / hearing package published
- MAY 17, 2017 – Board hearing

Proposed schedule for Rule 13-1

- FEB 2017 – Workshop package published
- MAR 2017 – Outreach in refinery communities
- APR 2017 – Update to Stationary Source Committee
- MAY 2017 – Hearing package published
- AUG 2017 – Board hearing
Advisory Council Deliberation on the Draft Clean Air Plan/Regional Climate Protection Strategy

Advisory Council Meeting

February 6, 2017

Henry Hilken
Director of Planning and Climate Protection
Critical Challenges

Climate Change
- The greatest common global challenge
- The biggest threat to our environment, economy, health and quality of life

Health Inequities
- Equal access to healthy air is a fundamental right that still eludes many Bay Area residents

This Plan focuses on strategies that will help us meet both of these challenges
Multi-pollutant plan to update 2010 Clean Air Plan

A comprehensive strategy of 85 measures to:

• reduce ozone and PM throughout the region
• reduce toxics in impacted communities
• reduce GHGs toward long-range targets
  → 40% below 1990 levels by 2030
  → 80% below 1990 levels by 2050

This Plan lays out a Bold Vision for a future Bay Area with a thriving economy, truly equitable access to healthy air, and a healthy, secure environment
Climate Challenge in the Bay Area

Bay Area GHG Projections to 2050 with Key State Programs

- State's 2020 AB32 target (return to 1990 level)
- State's 2030 interim target (40% below 1990 level)
- State and Air District's 2050 long-term target (80% below 1990 level)

GHG Emissions (MMT CO2e) vs. Relative to 1990
Healthy Air for All Bay Area Residents

Regionally: reduce *ozone and PM emissions* to assure long-term compliance with air quality standards

Locally: *eliminate disparities* in local exposure to air pollution
Laying out a Bold Vision for a future Bay Area

- GHG emissions have been reduced by over 80%
- Disparities in health risk from air pollution have been eliminated
- Eliminate fossil fuel combustion/keep fossil fuels in the ground
- Buildings are fossil-fuel free
- Power supply is nearly 100% renewable
- Transportation based on EVs and renewable diesel
- Half of all trips are via transit, biking or walking
- Oil companies/refineries become clean energy companies
- Organics are cut from waste stream and put to productive use
It sets us on a path to 2050 by laying out specific actions the Air District will take over the next 3-5 years

Key Priorities in the Plan:

• Reduce emissions of criteria pollutants and toxic air contaminants from all sources
• Reduce emissions of “super-GHGs” such as methane
• Reduce fossil fuel combustion
• Improve efficiency/reduce demand for fossil fuels
• Decarbonize the energy system
Priority Actions

• Develop region-wide rule-making approach to reduce risk and emissions from many sources comprehensively
  - Health risk from toxic air contaminants
  - Methane and fossil fuel combustion

• Limit GHG and criteria pollutant emissions from refineries and other large stationary sources

• Provide guidance, model ordinances, best practices and other tools to local governments for low carbon buildings, waste reduction, etc.

• Work with MTC/local governments to reduce VMT

• Implement a comprehensive approach to transition energy use in buildings from natural gas to efficiency and renewable energy

• Continue to incentivize EVs & EV infrastructure
Input Into This Plan

Outreach

• Convened stakeholder meetings in each county
• Met with subject matter experts
• Convened external working groups
• Convened open houses and workshops
• Posted draft control measures for public review and comment
• Incorporated Advisory Council recommendations

Research

• Researched state, regional and local air quality and climate plans
• Considered Plan Bay Area land-use and transportation strategies
• Considered key State documents and programs
Bay Area Leadership

We are embarking on an unprecedented journey to lead the Bay Area to a better future

• Every household, business and individual has tremendous power to make a difference

• We can do this together! The Bay Area has:
  - The brightest minds
  - A culture of innovation
  - The most committed populace
  - A blueprint for the first leg of this journey
Next Steps

• January 11 – March 9: Public comment period on Draft Plan and Draft EIR
• January 30 – February 8: Eight Open Houses
• February – March: Revisions to Draft Plan and Draft EIR per public comments
• April 19: Board Hearing on 2017 Plan and Final EIR

Implementation on many control measures has already begun and is moving forward concurrently with this plan adoption schedule.
Open House Highlights
Open House Highlights

Health Impacts

Bay Area Communities Most Impacted by Air Pollution
Exposure to air pollution depends on where people live, work, and play. Certain communities (see map) suffer from higher levels of air pollution and accompanying health impacts. The Air District seeks to eliminate these inequities over time.

How Air Pollution Affects Health

Ozone
- Damage to lungs and respiratory tract
- Irritation to nose, throat, and respiratory system
- Aggravates respiratory conditions such as asthma, bronchitis, and emphysema
- Increases susceptibility to respiratory ailments and permanent damage to lungs
- Contributes to increasing of the arthritis and heart attacks

Particulate Matter
- Aggravates asthma and bronchitis
- Contributes to heart attacks and deaths
- May increase blood pressure and damage blood vessels
- Can damage cells, tissue and DNA

Toxics
- Chronic health effects include neurological damage, hormone disruption, developmental delays, leukemias and other forms of cancer
- Nonsmoke health effects increase respiratory tract, eye and skin irritation, nausea, diarrhea, and death at high levels of exposure

Greenhouse Gases
- Increase in hotter weather may increase heat-related illness and death from heatwave
- Hotter weather will increase air pollution, which may exacerbate many of the health effects from air pollutants listed above
- Severe weather may cause injuries, fatalities and mental health impacts

Climate Impacts

Climate Change Impacts

Rising Temperatures
- The number of very hot days and severe heat waves are expected to increase significantly across the region by mid-century. Extreme heat causes heat-related illnesses such as sunstroke and heat illness, and occurs in higher course levels that also impact public health. More frequent extreme heat days threaten to roll back the gains we have made in reducing air pollution. Rising temperatures may also extend the length and severity of droughts.

Extreme Weather
- Climate change is expected to increase the frequency and severity of extreme weather events like storms, hurricanes, floods, etc. An extreme storm in the Bay Area could result in over $10 billion in damage to structures and building contents, and in transportation delays and electricity interruption.

Rising Sea Level
- Rising sea levels impact coastal flooding, erosion, shipping channels and clearance under bridges. Sea level at the Golden Gate bridge has risen 8 inches over the last 100 years. The frequency of extreme high water events has increased 35 times since 1915. The National Research Council projects an additional 3-12 inches of sea-level rise in the Bay Area by 2050 and 5-24 inches by 2060.
Open House Highlights

Transportation

By 2050: The transportation sector will be transformed.
We will bicycle, walk and take transit for the majority of our trips. When we do drive, we will travel by electric vehicles, both shared and privately-owned.

Path to 2050:

Now:
Funding, regulations, best practices, local government ordinances to support electrification of the vehicle fleet; electric vehicle readiness in buildings; low carbon freight; public transit; bicycle and pedestrian facilities; ride-, car- and bike-sharing; infill development, parking and pricing strategies

Future:
More development near transit and job centers, walkable and bike-friendly communities throughout the region, nearly 100 percent EV fleet, renewable diesel

Partners:
State, regional, and local governments, commuters, employers, commercial and residential developers, transit agencies

Buildings

By 2050: Buildings will no longer use fossil fuels.
The buildings in which we live, work, learn, shop and socialize will be more energy efficient and will be heated, cooled and powered by renewable energy.

Path to 2050:

Now:
Incentives, best practices and local government ordinances to support energy efficiency programs, cool roofs, cool parking, shade trees, rooftop solar, solar water heating, electric heat pumps and onsite renewable energy programs

Future:
Maximum energy efficiency, zero-emission buildings, zero-carbon electricity, new energy storage technologies, onsite renewable energy

Partners:
State and local governments, residential and commercial building owners