Building Appliance Rules: Health and Equity Benefits

Stationary Source & Climate Impacts Committee Meeting
October 17, 2022

Phil Martien, PhD
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Presentation Outcome

• Brief the Committee on the results of a modeling-based evaluation quantifying the health and equity benefits that could be realized through implementation of proposed amendments to Regulation 9, Rules 4 and 6 for Nitrogen Oxides (NOx) emissions from building appliances.
Presentation Outline

- Goals of the Modeling-Based Evaluation
- Methods
- Findings
Presentation Requested Action

• None, informational only.
Provide supplemental information for proposed amendments to Air District rules to limit emissions of oxides of nitrogen (NO\textsubscript{x}) from building appliances:

- Rule 9-4 for residential and commercial natural gas-fired furnaces*
- Rule 9-6 for residential and commercial water heaters and boilers**

* Rule 9-4: Equipment with max. heat input rating under 175,000 BTU/hr
** Rule 9-6: Equipment with max. heat input rating under 2 million BTU/hr

Goals

Rule 9-4 would limit NO\textsubscript{x} from natural gas-fired furnaces. Image: energy.gov
Methods
What’s Included

• Outdoor air quality and **health benefits** from emissions reductions
  • Sources covered by proposed amendments to **building appliance rules**
  • Reduced residential exposures to outdoor fine particulate matter (PM$_{2.5}$)
    • With conversion to zero-NOx natural gas appliances (eliminates NOx)
    • With conversion to electric appliances (eliminates NOx and primary PM$_{2.5}$)

• Outdoor air quality and **health impacts** from an unlikely scenario:
  • Added load to Bay Area **fossil power plants**
  • Increased exposures to PM$_{2.5}$ from a 12% increase in power plant emissions
What’s Included (cont’d)

- Exposures by race and ethnicity to PM$_{2.5}$ from existing appliances
- Changes to peak air pollution levels
Tracking Compounds
Primary Versus Secondary Particles

**PRIMARY PM\textsubscript{2.5}**
\(CO_2\), organic compounds, \(NO_x\)

**SECONDARY PM\textsubscript{2.5}**
(ammonium nitrate)

NO\textsubscript{x} transformed in atmosphere
Bay Area Air Quality Management District

Modeling Process

- Baseline Emissions
- Scenario Emissions
- Regional Air Quality Model* ($\Delta$ concentration)
- Health Benefits Model**
- Exposure Assessment

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* The Community Multiscale Air Quality Modeling System (epa.gov/cmaq)
** Benefits Mapping and Analysis Program (epa.gov/benmap)
Bay Area total: 68,760 ton/yr

- Off-Road Mobile Sources: 37%
- On-Road Mobile Sources: 40%
- Residential Cooking, Other Natural Gas Appliances: 17%, 0.7%
- Other Stationary Sources: 5.5%

Reductions: 3,750 ton/yr

- Residential Water Heating: 1.6%
- Residential Space Heating: 3.5%
- Commercial Space Heating, 0.1%
- Commercial Water Heating, 0.2%

Baseline (Pie Chart)
- Emissions, 2018
- Of nitrogen oxides (NOx)
- From all inventoried sources in Bay Area

Reductions (Bar Chart)
- From elimination of NOx emissions from Bay Area natural gas-fired commercial & residential space/water heating*
- ~6% of total NOx eliminated

* Excluding permitted sources.
Bay Area total: 12,530 ton/yr

Baseline (Pie Chart)
- Emissions, 2018
- Of fine particles (PM$_{2.5}$)
- From all inventoried sources in Bay Area

Reductions (Bar Chart)
- From elimination of PM$_{2.5}$ emissions from Bay Area natural gas-fired commercial & residential space/water heating*
- ~4% of total PM$_{2.5}$ eliminated

* Excluding permitted sources.
**Baseline (Left Map)**
- Gridded 1-km emissions, 2018
- Of nitrogen oxides (NO\textsubscript{x})
- From all inventoried sources in Bay Area*

**Reductions (Right Map)**
- From elimination of NO\textsubscript{x} emissions from Bay Area natural gas-fired commercial & residential space/water heating**

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* Not just natural gas appliances. Includes mobile, stationary, and area sources.

** Excluding permitted sources.
Findings
Modeled Impact on Secondary PM$_{2.5}$

Baseline (Left Map)
- Annual average outdoor concentrations, 2018
- Of secondary PM$_{2.5}$
- Attributed to all sources in modeling domain*

Reductions (Right Map)
- From elimination of NO$_x$ emissions from Bay Area natural gas-fired commercial & residential space/water heating**

* Not just natural gas appliances. Includes some sources outside SF air basin.
** Excluding permitted sources.
Modeled Impact on Total PM$_{2.5}$

Baseline (Left Map)
- Annual average outdoor concentrations, 2018
- Of total (secondary and primary) PM$_{2.5}$
- Attributed to all sources in modeling domain*

Reductions (Right Map)
- From elimination of NO$_x$ and primary PM$_{2.5}$ emissions from Bay Area natural gas commercial & residential space/water heating**

* Not just natural gas appliances. Includes some sources outside SF air basin.
** Excluding permitted sources.
## Health Benefits and Valuations

### Health Impacts

<table>
<thead>
<tr>
<th>Health Impact</th>
<th>Annual Health Benefits (Incidence Avoided)</th>
<th>Annual Valuations (Million US$, 2020)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Secondary PM$_{2.5}$</td>
<td>Total PM$_{2.5}$</td>
</tr>
<tr>
<td>--------------------------------------------</td>
<td>----------------------</td>
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<tr>
<td>Premature mortality</td>
<td>25–56</td>
<td>39–89</td>
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<tr>
<td>Non-fatal heart attack</td>
<td>2.8–26</td>
<td>4.4–41</td>
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<tr>
<td>Hospital admission, neurological</td>
<td>8.3</td>
<td>13</td>
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<tr>
<td>Out of hospital cardiac arrest</td>
<td>0.48</td>
<td>0.76</td>
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<tr>
<td>Stroke</td>
<td>1.6</td>
<td>2.5</td>
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<tr>
<td>Lung cancer</td>
<td>2.1</td>
<td>3.2</td>
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<tr>
<td>Hospital admission, respiratory</td>
<td>2.6</td>
<td>4.1</td>
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<tr>
<td>Hospital admission, cardiovascular</td>
<td>3.2</td>
<td>5.2</td>
</tr>
<tr>
<td>ER visit, respiratory</td>
<td>13</td>
<td>21</td>
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<tr>
<td>ER visits, cardiovascular</td>
<td>6.7</td>
<td>11</td>
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<tr>
<td>Restricted activity days</td>
<td>26,000</td>
<td>41,000</td>
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<tr>
<td>Work loss days</td>
<td>4,400</td>
<td>7,000</td>
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<tr>
<td>Hay fever/allergic rhinitis</td>
<td>480</td>
<td>750</td>
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<tr>
<td>Asthma symptoms/albuterol use</td>
<td>9,900</td>
<td>15,000</td>
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<tr>
<td>Asthma onset</td>
<td>77</td>
<td>120</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Stationary Source &amp; Climate Impacts Committee</th>
</tr>
</thead>
<tbody>
<tr>
<td>October 17, 2022</td>
</tr>
</tbody>
</table>
## Increased Fossil Power Health Impacts and Valuations (Unlikely Scenario)

<table>
<thead>
<tr>
<th>Health Impacts</th>
<th>Annual Health Impacts (Incidence Added)</th>
<th>Annual Valuations (Million US$, 2020)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total PM$_{2.5}$</td>
<td>Total PM$_{2.5}$</td>
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<tr>
<td>Premature mortality</td>
<td>0.96–2.2</td>
<td>9.8–23</td>
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<tr>
<td>Non-fatal heart attack</td>
<td>0.11–1.0</td>
<td>0.0097–0.09</td>
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<tr>
<td>Hospital admission, neurological</td>
<td>0.33</td>
<td>0.0049</td>
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<tr>
<td>Out of hospital cardiac arrest</td>
<td>0.019</td>
<td>0.0008</td>
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<tr>
<td>Stroke</td>
<td>0.063</td>
<td>0.0025</td>
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<tr>
<td>Lung cancer</td>
<td>0.081</td>
<td>0.0024</td>
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<tr>
<td>Hospital admission, respiratory</td>
<td>0.1</td>
<td>0.0012</td>
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<tr>
<td>Hospital admission, cardiovascular</td>
<td>0.12</td>
<td>0.0023</td>
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<tr>
<td>ER visit, respiratory</td>
<td>0.57</td>
<td>0.00058</td>
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<tr>
<td>ER visits, cardiovascular</td>
<td>0.27</td>
<td>0.00036</td>
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<tr>
<td>Restricted activity days</td>
<td>1,100</td>
<td>0.086</td>
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<td>Work loss days</td>
<td>180</td>
<td>0.048</td>
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<tr>
<td>Hay fever/allergic rhinitis</td>
<td>20</td>
<td>0.014</td>
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<td>Asthma symptoms/albuterol use</td>
<td>420</td>
<td>0.00017</td>
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<tr>
<td>Asthma onset</td>
<td>3.2</td>
<td>0.17</td>
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</table>

Stationary Source & Climate Impacts Committee  
October 17, 2022
Zero-NOx natural gas appliances: benefits only from reductions in NOx emissions

High estimate: $580M
Low estimate: $270M

Electric appliances + non-fossil power: benefits from reductions in both NOx and PM$_{2.5}$ emissions

High estimate: $930M
Low estimate: $410M

Electric appliances + fossil power: small disbenefits from power plant emissions

High estimate: $907M
Low estimate: $400M
Modeled PM$_{2.5}$ Exposure

- Exposures highest in high-density areas where PM$_{2.5}$ concentrations are also high (2020 residential population)
- Exposure levels vary by county and by race/ethnicity
Equity Assessment

- The counties most affected by these sources, like Santa Clara, have a higher percentage of Asian/Pacific Islander residents. This explains most of the regional pattern (shown at right).

- Within every county, the most-impacted residents are also people of color: primarily Hispanic/Latino and African-American/Black.
Examined modeled changes at monitoring station locations when concentrations were higher

Relevant to compliance with state and federal standards

For 24-hour PM$_{2.5}$: Mean modeled reduction of about 0.7 µg/m$^3$ for peak levels (at least 30 µg/m$^3$ observed)

For 8-hour ozone: Mean modeled reduction < 0.1 ppb for peak levels (at least 65 ppb observed)
Potential premature deaths avoided: 39–89 deaths per year
Potential total benefit valuation: $410–930 million per year
About 60% of benefits accrue from eliminating NOx emissions
About 40% from eliminating PM$_{2.5}$ emissions (electric appliances)
Relatively small disbenefit from scenario of added fossil power load
People of color most impacted by PM$_{2.5}$ attributed to combustion of natural gas for residential space and water heating
Some reduction to peak air pollution levels, relevant to attainment
Building Appliance Rules Update
Regulation 9, Rules 4 and 6

Stationary Source and Climate Impacts Committee Meeting
October 17, 2022

Amy Dao
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Jennifer Elwell
Senior Air Quality Engineer
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• Update committee on proposed amendments to Regulation 9, Rules 4 and 6 for Nitrogen Oxides (NOx) emissions from building appliances, the implementation working group, and timeline moving forward.
Presentation Outline

• Background
• Path Forward
• Implementation Working Group
• Timeline Updates
Presentation Requested Action

- None, informational only.
Background

• Draft amendments include zero-NOx requirement for residential and commercial space and water heaters
  • Compliance dates 2027-2031 depending on equipment type and size

• Draft amendments released for public comment and workshop in October 2021

• Updated draft amendments and CEQA NOP/IS released for public comment in May 2022 (Scoping Meeting held June 9, 2022)

• Anticipated Timeline:
  • Proposed amendments and supporting materials to be released in Q4 2022
  • Public Hearing for Board consideration in Q1 2023
• Buildings account for > 25% of all stationary source NOx emissions in the region
• Significant NOx and secondary PM formation reductions
• Primary PM and GHG co-benefits expected
• Bay Area can continue to show leadership in health protective rules
Rule Updates and Package Contents

- Update to ultra-low NOx requirement in Rule 9-4 – now January 1, 2024 (no impact to zero-NOx requirement timeline)

- Proposed amendments package and supporting analyses, including:
  - Health analysis
  - Utility impact analysis
  - CEQA Draft Environmental Impact Report
  - Socioeconomic Analysis
Implementation Working Group

- **Purpose**: Inform periodic reporting back to the Board on rule implementation for technical readiness and equitable transition

- **Potential topics of discussion**:
  - Market availability of zero NOx technology
  - Costs of purchase, installation and operation for zero NOx technologies
  - Incentives and other funding and financing available in the Bay Area, especially to low-income residents
  - Potential challenges and opportunities for facilitating an equitable transition
Implementation Working Group (cont’d)

• Led by staff with facilitation from professional facilitator

• Invited stakeholders will represent:
  - environmental justice groups
  - community-based organizations
  - tenant and landlord groups
  - affordable housing developers
  - building management firms
  - labor and trade organizations
  - technology manufacturers
  - subject matter experts/building energy advocates
  - technology entrepreneurs focused on home electrification at scale
  - local governments
  - state agencies
  - utility and energy service providers
Implementation Working Group Structure

Implementation Working Group (IWG)

Technical Subcommittee

Community/Equity Subcommittee
Launching Implementation Working Group—Timeline and Next Steps

• **To date:** Contracted with third party facilitator, consulted with building advocates and nonprofit networks regarding structure and membership.

• **October:**
  - Finalize invitational roster
  - Determine method and need for providing stipends for working group members
  - Finalize supportive documents (Working Group charter, stipend policy)

• **November:**
  - Send formal invitations to participate in Working Group
  - Send invitations for Dec meeting

• **December:**
  - Convene first meeting to establish common baseline level of knowledge

• **February 2023:**
  - Working Group will resume meetings upon adoption of rule amendments
Feedback Requested/Prompt

• Questions and comments?
Update on Air District Permitting

Stationary Source and Climate Impacts Committee Meeting
October 17, 2022

Fred Tanaka
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Presentation Outcome

Seeking to provide the Board with Information on:

• Permitting Overview
• Current Permitting Productivity and Backlog
• Reasons for the Backlog
• Comparison with South Coast AQMD
• Possible Solutions to Backlog Issues
Presentation Outline

- New Source Review Permit Program – Overview
- Permitting Backlog
- Backlog, Staffing and Fee Comparison with South Coast AQMD
- Possible Solutions to Backlog Issues
- Next Steps
Presentation Requested Action

None, Information Only.
Common permit and approval documents:

- Authority to Construct (A/C) – New Source Review
- Permit to Operate (P/O) – New Source Review
- Certificate of Registration
- Certificate of Exemption
- Certificate for Emission Reduction Credits (ERCs)
- Major Facility Review (Title V) Permit

Note: Asbestos and open burn notifications are handled in Compliance and Enforcement.
New Source Review - Overview

New Source Review is a two-part process:

• Authority to Construct
  • Obtained prior to the commencement of construction
  • May require meeting start-up conditions

• Permit to Operate
  • Allows for the operation of a source
  • Issued after the requirements of the A/C are met
  • Renewed on an annual basis
New Source Review – Overview (cont’d)

Ensure compliance with requirements:

- Applicable rules and regulations
- Best Available Control Technology (BACT)
- Offsets
- Air Toxics Health Risk Assessment (HRA)
- California Environmental Quality Act (CEQA)
- Public Noticing requirements
- Fees
## General Statistics for FYE 2022

<table>
<thead>
<tr>
<th>Description</th>
<th>Count</th>
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</thead>
<tbody>
<tr>
<td>Applications received, All types</td>
<td>1,069</td>
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<tr>
<td><strong>New Source Review</strong></td>
<td>976</td>
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<tr>
<td>Registrations</td>
<td>6</td>
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<tr>
<td>Major Facility Review (Title V)</td>
<td>68</td>
</tr>
<tr>
<td>Other</td>
<td>19</td>
</tr>
<tr>
<td>Permitted/registered facilities</td>
<td>10,419</td>
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<tr>
<td>Sources at the above facilities</td>
<td>26,271</td>
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<tr>
<td>Renewals processed – Permits to Operate &amp; Registrations</td>
<td>9,738</td>
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<tr>
<td>Data updates processed</td>
<td>3,660</td>
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</table>
Application Metrics: Productivity

Approved New Source Review (NSR) Applications

- Approved means initial permit decision made: A/C issued, A/C waived, Registration Issued, Certificate of Exemption, Canceled, Denied.
- Excludes Title V, Synthetic Minor, Banking, emission reduction credit transfers.

980 projected
**Application Metrics: Approved Processing times**

From 2010 through August 29, 2022

<table>
<thead>
<tr>
<th>Processing times</th>
<th># Eval to Approved</th>
<th>% Eval to Approved</th>
<th># Submit to approved</th>
<th>% Submit to approved</th>
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<tbody>
<tr>
<td>&lt;90 days</td>
<td>9555</td>
<td>82%</td>
<td>5785</td>
<td>49%</td>
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<tr>
<td>90 days to &lt;180 days</td>
<td>1340</td>
<td>11%</td>
<td>3331</td>
<td>28%</td>
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<td>180 days to &lt;1 year</td>
<td>501</td>
<td>4%</td>
<td>1760</td>
<td>15%</td>
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<tr>
<td>1 to &lt;2 years</td>
<td>183</td>
<td>2%</td>
<td>612</td>
<td>5%</td>
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<td>2 to &lt;3 years</td>
<td>64</td>
<td>1%</td>
<td>159</td>
<td>1%</td>
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<tr>
<td>3 to &lt;4 years</td>
<td>12</td>
<td>0.1%</td>
<td>46</td>
<td>0.4%</td>
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<tr>
<td>4 to &lt;5 years</td>
<td>11</td>
<td>0.1%</td>
<td>30</td>
<td>0.3%</td>
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<tr>
<td>5+ years</td>
<td>16</td>
<td>0.1%</td>
<td>25</td>
<td>0.2%</td>
</tr>
</tbody>
</table>

‘Eval to Approved’ means applications completed from the time we received all information to issuance. ‘Submit to Approved’ means applications completed from receipt of the application to issuance.
Application Metrics: Processing times by Year

NSR Application Processing Times

Projected For 2022
Overdue NSR Applications

NSR applications: Overdue Trends

Stationary Source and Climate Impacts Committee
October 17, 2022

Bay Area Air Quality Management District
Overdue Applications and Staffing

- Data as of August 29, 2022

- Regulation 11-18 adopted 11/2017
- Power Safety Shutoff Program begins 6/2019
- Regulation 12-15 Implemented
Annual Application Metrics

Comparison of Applications Received and Approved

Regulation 12-15 adopted 4/2016
Regulation 11-18 adopted 11/2017
Power Safety Shutoff Program begins 6/2019
Projected For 2022

Stationary Source and Climate Impacts Committee
October 17, 2022
Evolution of Permitting

Increased complication in permitting

• More rules and regulations
• New abatement technology
• Compliance issues
• Additional toxics and lower thresholds
• Additional Public Noticing requirements
• CEQA considerations – Notice of Exemption (NOE) & Notice of Determination (NOD) filings
Evolution of Permitting (cont’d)

Other

• New permit mandates
• Permit exemptions require scrutiny and review!
• Recent changes to Regulation 2 for Overburdened Communities are expected to lengthen permit issuance timeframes.
Industries with complex permitting evaluations:

- Petroleum refinery
- Wastewater treatment facilities
- Landfill
- Material handling
- Composting operations
Issue: Engine Permitting

BAAQMD Internal Combustion Engine Permit Statistics

- 500+ engine applications received per year
- 9,700 Permitted Internal Combustion Engines
- 442 Prime Engines – 169 Diesel, 177 Natural Gas/LPG, 54 Digester gas, 34 landfill gas
- 322 Natural Gas/LPG Emergency Backup Engines
- 7928 Diesel Emergency Backup Engines
- 2035 Diesel Emergency Backup Engines that are 1000 BHP and larger
**Issue: Regulation 12-15 Program Implementation**

Regulation 12, Rule 15 Review

![43 Spreadsheets in One Workbook!](image)

Each Spreadsheet has over 8,000 rows and between 20 to 40 columns for review

Millions of cell entries in one workbook
Issue: Regulation 11-18
Program Implementation

• Implementation Timelines and Workgroup
• Litigation Settlements and their Constraints
• Limited time and priorities of Air District facility engineers
• Modeling staff time diverted to handle other high priority projects
  • Crematory expansions due to COVID-19
  • Bay View Hunters Point Applications, Public Meetings and CEQA
  • Schnitzer Steel Thermal Oxidizer and settlements
• Permit Reform Rule Amendments and Implementation (Fees)
• Public Workshop for Reg. 11-18 HRA for AB&I Foundry
### Air District Comparison

<table>
<thead>
<tr>
<th>Description</th>
<th>BAAQMD</th>
<th>SCAQMD</th>
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<tbody>
<tr>
<td>Budget – General Fund (2022)</td>
<td>$117 MM</td>
<td>$180 MM</td>
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<tr>
<td>Revenue from fees</td>
<td>$53.6 MM</td>
<td>$101 MM</td>
</tr>
<tr>
<td>Direct costs for fee-based work</td>
<td>66%</td>
<td>74%</td>
</tr>
<tr>
<td>Indirect costs for fee-based work</td>
<td>34%</td>
<td>26%</td>
</tr>
<tr>
<td>Overall cost recovery</td>
<td>83.70%</td>
<td>100%*</td>
</tr>
<tr>
<td>Budgeted positions</td>
<td>415</td>
<td>957</td>
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<tr>
<td>Vacancy rate</td>
<td>12%</td>
<td>13%</td>
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<tr>
<td>Total facilities</td>
<td>10,419</td>
<td>24,889</td>
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<tr>
<td>Total sources</td>
<td>26,271</td>
<td>66,642</td>
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</tbody>
</table>
Comparison of Active New Source Review Applications

Stationary Source and Climate Impacts Committee
October 17, 2022

**BAAQMD Active applications, 8/29/2022**
- 21% More than 2 years
- 25% Between 1 and 2 years
- 16% Between 180 days and 1 year
- 37% 180 days or less

**SCAQMD Active applications, 5/2022**
- 28% More than 2 years
- 19% Between 1 and 2 years
- 14% Between 180 days and 1 year
- 39% 180 days or less
Permit Streamlining Policy  New minimum requirements for application acceptance;

• New minimum requirements for applications to be deemed complete;
• Restrictions on the numbers and types of application revisions;
• Timeboxing for requests for project revisions;
• Timeboxing for requests to review permit conditions; and
• Restrictions on revisions to permit conditions after authority to construct issuance.

Webinar in March 2022
11-18 Program
- Dedicate staffing
- Utilize consultants for inventory and modeling preparation

Permitting Program
- Look for methods to address “bubbles” for examples: IC Engines, Soil Vapor Extraction
- Permitting Liaison – prescreen applications, assist companies
- Have dedicated staff for permit renewal activities
• Reevaluate 12-15 Inventory Program

• Require Implementation plans, staffing and fees for new rules and programs.

Example Amended Regulations 2, Rules 1 and 5.

– Permit reform rules were adopted in December 2021 identifying 8 FTEs needed for implementation.

– New fees were adopted in June 2022

– Requirement for rule in place now but staffing discussion needs to be completed
Next Steps

• Allocate Staffing Resources as part of a comprehensive staffing plan
  o Methods to address “bubbles” for examples: IC Engines, Soil Vapor Extraction

• Reevaluate 12-15 Inventory Program

• Continue to Implement Permit Streamlining Policy

• Monitor Backlog

• Adopt Regulation 3 (Fees) changes and approve staffing when new or modified rules are considered for adoption.
Feedback Requested/Prompt

None. Questions?