Fine Particulate Matter Local Risk Methodology Update

Advisory Council Meeting  
September 12, 2022

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Overview

• Recap

• Provide updates responsive to Council feedback
  • Link implementation to risk framework
  • Focus on exposure window and adjustment factors

• Next Steps
<table>
<thead>
<tr>
<th>Month</th>
<th>Topic</th>
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</thead>
</table>
| February | Regulatory toolbox  
Broadly scoped whitepaper |
| April | Gaps in the regulatory framework  
Q: *simplicity vs complexity* |
| July | Focus on **maximal risk**  
Extend to multi-year exposure  
Expand to include asthma  
Q: *sensitive individuals* |
Risk Framework

\[ y = y_0(\beta \Delta x) \]

Baseline risk

Risk increment
\[ \Delta y = y - y_0 \]

Effect size

PM\(_{2.5}\) increment

Concentration

Exposure

Dose

Response

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Baseline Risk

- **Exposure window** is key parameter
  - Consistent with HRA principles and guidelines
  - Asthma rates higher for children; mortality rates higher for seniors

<table>
<thead>
<tr>
<th>Receptor Type</th>
<th>Mortality</th>
<th>Asthma</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residential</td>
<td>55–84</td>
<td>0–17</td>
</tr>
<tr>
<td>Worker</td>
<td>40–64</td>
<td>ends at adulthood</td>
</tr>
<tr>
<td>Student</td>
<td>–</td>
<td>5–13</td>
</tr>
<tr>
<td>Daycare</td>
<td>–</td>
<td>0–5</td>
</tr>
</tbody>
</table>

\[ y_o(e^{\beta \Delta x}) \]
Concentration

• Source-specific, based on modeling
  • Simulate contributions to annual-average ambient PM$_{2.5}$ on a grid
  • Match receptor types (previous slide) to grid locations
  • Identify maximum impacts

• Why is modeled ambient PM$_{2.5}$ concentration the link?
  • Follows convention and guidance for toxics assessments
  • Outdoor PM$_{2.5}$ is the independent variable in epi studies
Exposure

• Incremental average exposure intensity
  • If emissions and receptor are 100% co-present, then equal to the incremental concentration
  • If the schedules of the source and receptor differ, then less

• Follow existing HRA guidance

$$y_0(e^\beta \Delta x)$$
• **Breathing rates** are linked to exposure window

• Health-protective estimates
  - 95\textsuperscript{th} %ile moderate 8-hr for workplace, school, daycare receptors
  - 95\textsuperscript{th} %ile daily for residential

• Use ratios to adjust PM\textsubscript{2.5} increment (\(\Delta x\))
  - Denominators = mean daily rates (implicit in epi studies)
  - No separate variable for dose

\[ y_0 (e^\beta \Delta x) \]
• Senior residents
  • Studies of age 65+ report 2–3x average relative risk (RR) for seniors of color, Medicaid eligible, and/or residing in low-income neighborhoods
  • Propose factor of 3x to cover this variation

• Pediatric asthma and off-site worker mortality
  • Data deficiencies, as discussed in July
  • Propose factor of 3x
Summary

\[ y = y_0 e^{\beta \Delta x} \]

**BASELINE RATE** $y_0$
- Asthma higher for children; mortality higher for seniors

**EFFECT SIZE** $\beta$
- Adjust RR by 3x
- To cover known and unknown variation

**PM$_{2.5}$ INCREMENT** $\Delta x$
- Modeled outdoor (max)
- Source & receptor schedules
- 95$^{th}$ %ile breathing rates by age and activity level

linked to selection of exposure window
### Net Adjustments

Adjustments to relative risk and adjustments to breathing rate:

**Formula:**
\[ y = y_o \left( e^{\beta \Delta x} \right) \]

**Table:**

<table>
<thead>
<tr>
<th>Category</th>
<th>Subcategory</th>
<th>( \beta )</th>
<th>( \Delta x )</th>
<th>Combined</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mortality</td>
<td>Residential</td>
<td>3.0</td>
<td>1.6</td>
<td>5x</td>
</tr>
<tr>
<td></td>
<td>Worker</td>
<td>3.0</td>
<td>3.7</td>
<td>11x</td>
</tr>
<tr>
<td>Asthma</td>
<td>Daycare</td>
<td>2.9</td>
<td>4.2</td>
<td>12x</td>
</tr>
<tr>
<td></td>
<td>Student</td>
<td>2.9</td>
<td>3.5</td>
<td>10x</td>
</tr>
<tr>
<td></td>
<td>Residential</td>
<td>2.9</td>
<td>1.6</td>
<td>5x</td>
</tr>
</tbody>
</table>

Ratios of final results (with vs without adjustments) for a +0.1 ug/m³ incremental concentration, evaluated over the relevant exposure windows.
# Status and Next Steps

<table>
<thead>
<tr>
<th>Month</th>
<th>Activity</th>
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</thead>
<tbody>
<tr>
<td>September</td>
<td>External reviewer feedback on current draft</td>
</tr>
<tr>
<td>October</td>
<td>Release v1.0 for public review &amp; comment</td>
</tr>
<tr>
<td>November</td>
<td>Present v1.0 to Advisory Council</td>
</tr>
<tr>
<td>December</td>
<td>Present v1.0 to Stationary Source &amp; Climate Impacts Committee</td>
</tr>
<tr>
<td>Early 2023</td>
<td>Transition to considering applications</td>
</tr>
</tbody>
</table>
Questions and comments welcome
Source Prioritization Framework

Advisory Council Meeting
September 12, 2022

Elizabeth Yura
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Outline

- Why prioritize rule making efforts
- What is prioritization framework
- How modeling informs prioritization
- Work in larger context
- Prioritization implications and input needed
- Next steps
Why set priorities?

**Problem**
- Lack of clarity on board and community priorities
- Lack of transparency on which rules go first
- Reasons for rule delays are unclear
- Long and uncertain timelines

**Result**
- Rules often start and stop as priorities shift
- Community and board frustrated with lack of progress on rule making
- Community and board lose confidence in staff to fulfil agency mission
Prioritization Framework

- **Purpose:** Align work efforts to board and community priorities.
- Focus on commitments, as a first screen.
- Perform *priority screening* to guide what commitment gets done first.

### Prioritization Factors

- **Commitments**: Legal or prior commitments, such as in a community emission reduction plan.
- **Health & Equity**: Magnitude of emissions and/or exposure, relative potency of pollutant, distribution of exposure.
- **Authority**: Statutory authority or purview to regulate emissions and/or source.
- **Reduction Potential**: Availability and feasibility of controls, and/or performance levels.
- **Other Impacts**: Economic, socioeconomic, other environmental, and equity impacts.

*Modeling Informs*
The Larger Context

• **Ideal:** propose *emission reduction strategies* that align with priorities.
• Set policy via prioritization framework
• Priorities determine which sources go first
• Possible strategies: new rules, rule amendments, incentives, increased enforcement, etc.
Implications & Questions

Magnitude of existing commitments means new, non-committed rules would not be taken up for next few years.

Sources or strategies with primarily climate impact will likely be low priority, unless significant co-benefits.

Role of rules in climate efforts remain uncertain.

Considering implications, are factors the right ones?
Next Steps

• Review prioritization framework with Community Advisory Council
• Review health and equity modeling data for sources.
• Run sources through entire prioritization process
• Identify and evaluate emission reduction strategies