Current and Future Year Emission Impacts on Air Quality, Health Risk, and Environmental Justice in Southeast Los Angeles County

June 25, 2014
Background

Gateway Cities Air Quality Study

• Why this study
  – Mobility and air quality/health effects are major concerns in Southern California and to the Gateway Cities Communities
  – History: MATES-I, II, and III studies & POLA, POLB

• Presentation focus
  – Overview of Methodology
  – Results and Findings

• Large public outreach, consensus building with all stakeholders, public communication – not discussed here
Gateway Cities Study Area

56 km x 56 km
~ 2 million residents
Rail line, on-road at link level
Watercraft, railyard, airports at property boundaries
I-710 Truck Traffic
Study objectives originally established in 2005 as part of I-710 major corridor study:

1. Determine existing air quality and health impacts
2. Determine future air quality and health impacts, given adopted measures and programs
3. Identify and analyze new air quality improvements strategies
4. Develop a conceptual plan to implement and measure air quality improvements for the region
5. Work with public agencies and stakeholders to develop consensus for the plan
Methodology Overview

Develop a comprehensive 2009 and 2035 emission inventory
- Obtain data from AQMD (non-road, stationary, area, etc)
- Develop link and TAZ geospatial inventory for on-road sources
- Additional measures – evaluate in terms of AQ/HRA

Develop hi-resolution (~ 1km) dataset
- Local 3-D meteorological (1-yr)
- Land-use and terrain

Apply this using 3-D Air Quality Modeling System
- CALMET/CALPUFF
- Receptor at block group census level + sensitive
Health Risk Assessment Metrics

1. Air Pollution Component of Potential Lifetime Cancer Risk

2. Air Pollution Non-Cancer Chronic Health Index
   - Respiratory Non-Cancer Chronic Health Index (e.g., increased chronic bronchitis)
   - Developmental Non-Cancer Chronic Health Index (e.g., increased stillbirths)

3. PM2.5 Potential Annual Mortality Risk (≥ 30 years old)

4. PM2.5 Potential Annual Morbidity Risk (≥ 65 years old)
Base year (2009) analysis found significant levels of air pollution and adverse health impacts.

Pollutants of greatest concern:
- Fine particulate matter (PM2.5) – contributes to premature death and unscheduled hospitalizations
- Diesel particulate matter (DPM) – contributes to cancer
- Nitrogen oxide (NOx) – major contributor to ozone (smog); also creates PM2.5
2009 Average DPM Concentration by City

Gateway City Average DPM Concentration 4.0 µg/m³

- Area and Point Sources
- On-Road Vehicles
- Watercraft
- Rail Lines
- Railyards
- Other Off-Road Mobile Sources
## Results: 2009 Air Pollution Health Risk

<table>
<thead>
<tr>
<th>Health Risk Type</th>
<th>Gateway Cities Average Risk (per million)</th>
<th>Gateway Cities Maximum Risk (per million)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cancer Risk</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Residents</td>
<td>1,328</td>
<td>5,032</td>
</tr>
<tr>
<td>Non-Resident Workers</td>
<td>259</td>
<td>983</td>
</tr>
<tr>
<td><strong>PM2.5 Health Risk</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mortality (30+)</td>
<td>503</td>
<td>1,741</td>
</tr>
<tr>
<td>Respiratory Hospitalization (65+)</td>
<td>298</td>
<td>574</td>
</tr>
<tr>
<td>Cardiovascular Hospitalization (65+)</td>
<td>192</td>
<td>368</td>
</tr>
</tbody>
</table>
PM2.5 Emissions by Source Type, 2035

- Commercial charbroiling: 26%
- Residential wood burning: 7%
- Building construction and demolition: 6%
- Other wood burning: 5%
- Residential natural gas combustion: 4%
- Other Area Sources: 9%
- Point Sources: 6%
- On-Road Vehicles: 12%
- Off-Road Mobile Sources: 12%
- Road Dust: 13%
- Other Area Sources: 9%
Findings in 2009 and 2035

Annual Average PM$_{2.5}$ Concentrations 2009 and 2035 (21% reduction)

2009
GC Average = 14.3 µg/m$^3$

2035
GC Average = 11.2 µg/m$^3$
DPM Concentration in 2009 to 2035

Annual Average DPM Concentrations 2009 and 2035 (78% reduction)

2009
Gateway Cities Average = 4.0 µg/m³

2035
Gateway Cities Average = 0.9 µg/m³
Source Contribution to DPM Concentration, 2035

- On-Road Vehicles: 54%
- Rail Lines and Rail Yards: 16%
- Other Off-Road Mobile Sources: 15%
- Watercraft: 7%
- Area Sources: 5%
- Point Sources: 3%
By 2035, average PM2.5 mortality risk (30+) will drop 57%.
Air Pollution Potential Lifetime Cancer Risk in 2009 and 2035

**2009**
Gateway Cities Average = 1,328 per million

**2035**
Gateway Cities Average = 410 per million
Air Pollution Potential Lifetime Cancer Risk, 2009 Avg. and Range

GC Average = 1343

Lakewood
La Habra Heights
Huntington Park
Hawaiian Gardens
East LA
Downey
Cudahy
Compton
Commerce
Carson
Bellflower
Bell Gardens
Bell
Artesia
Air Pollution Potential Lifetime Cancer Risk, 2035 Avg. and Range

GCCOG Average = 422

Lifetime Cancer Risk (per million)
## Results: Future Air Pollution Health Risk

<table>
<thead>
<tr>
<th>Health Risk Type</th>
<th>Gateway Cities Average</th>
<th>Gateway Cities Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Risk per Million in 2035</td>
<td>Change from 2009</td>
</tr>
<tr>
<td><strong>Cancer Risk</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Residents</td>
<td>420</td>
<td>-68%</td>
</tr>
<tr>
<td>Non-Resident Workers</td>
<td>82</td>
<td>-68%</td>
</tr>
<tr>
<td><strong>PM2.5 Health Risk</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mortality (30+)</td>
<td>208</td>
<td>-59%</td>
</tr>
<tr>
<td>Respiratory Hospitalization (65+)</td>
<td>271</td>
<td>-9%</td>
</tr>
<tr>
<td>Cardiovascular Hospitalization (65+)</td>
<td>174</td>
<td>-9%</td>
</tr>
</tbody>
</table>
Cardiovascular Hospitalization Risk Demographic Distribution from PM2.5 Exposure

2009

- 25% of Population with Highest Risk
- 25% of Population with Lowest Risk

Population Percentage

<table>
<thead>
<tr>
<th>Risk per million</th>
<th>Minority</th>
<th>No HS diploma (25+)</th>
<th>Limited or no English (5+)</th>
<th>Below poverty</th>
</tr>
</thead>
<tbody>
<tr>
<td>329-574</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>293-329</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>243-293</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>146-243</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2035

- 25% of Population with Highest Risk
- 25% of Population with Lowest Risk

Population Percentage

<table>
<thead>
<tr>
<th>Risk per million</th>
<th>Minority</th>
<th>No HS diploma (25+)</th>
<th>Limited or no English (5+)</th>
<th>Below poverty</th>
</tr>
</thead>
<tbody>
<tr>
<td>279-322</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>270-279</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>257-270</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>211-257</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Air Pollution Potential Lifetime Cancer Risk: Nationwide Comparison Average and Range

<table>
<thead>
<tr>
<th>AQAP Analysis of GC Region</th>
<th>Gateway Cities: 2035</th>
<th>Gateway Cities: 2009</th>
</tr>
</thead>
<tbody>
<tr>
<td>South Coast AQMD’s MATES III Analysis (2005)</td>
<td>Los Angeles (Los Angeles Co)</td>
<td>South Coast Air Basin</td>
</tr>
<tr>
<td>US EPA’s National Air Toxics Assessment (2005)*</td>
<td>Los Angeles (Los Angeles Co)</td>
<td>Oakland (Alameda Co)</td>
</tr>
</tbody>
</table>

* Values based on NATA estimated concentrations of diesel particulate matter, chromium-6, arsenic, benzene, 1,3-butadiene, and formaldehyde (primary and secondary), combined with OEHHA cancer risk factors
## Result Highlights

### Air Quality Modeling & Health Risk Analysis

#### Summary

- DPM emissions decrease between 2009 to 2035 by 70% despite 12% VMT growth
- Largest decrease in DPM is from changes in off-road vehicles
- Charbroiling is the biggest contributor to primary PM2.5 concentrations
- 2035 cancer risk fairly uniform across GC, but highest in Commerce, East LA, Maywood, and Santa Fe Springs. Little evidence of disproportionate impacts on disadvantaged populations
- 2035 chronic and acute non-cancer developmental health risks vary substantially across GC
  - Evidence of disproportionate impacts on low education and limited English populations
- 2035 PM2.5 mortality fairly uniform across GC: highest risk in Bellflower, Norwalk, and Paramount.
  - Risk below the level associated with NAAQS for all but 2% of population. Little evidence of disproportionate impacts.

#### Key Lessons Learned

- There are significant variation in emissions across the GC – air quality impacts strongly dependent on location—particularly for point source dominated emissions
- One strategy will not work equally everywhere – significant variations in emission across the GC.
- Tailored strategies to individual communities and pollutants may be more effective
- Measures targeting secondary PM2.5 precursor emissions maybe helpful (particularly for Long Beach)
Summary of Key Findings

• With only a 21% reduction in PM2.5 the mortality risk decreased 59%
• 79% reduction in DPM – large reductions in non-road vehicles and equip
• Transportation direct emissions only one-fourth of PM2.5 in 2035
  – Range from 1 to 50% across the region
• Transportation still responsible for 92% of DPM in 2035
  – On-road is 54% across the region, ranges from 28-74%
• Targeted measures need to include location and source type to evaluate cost effectiveness
• Study approach transferable to other large metropolitans
To achieve further improvements in air quality and reduction of health risk in 2035, new control measures should focus on the following five goals:

1. Reduce PM Emissions from Charbroiling and Wood Burning
2. Control Road Dust Emissions
3. Accelerate Deployment of Low- and Zero-Emission Medium to Heavy-duty Trucks
5. Further Reduce Ocean-Going Vessel Emissions
Significant emission reductions in 2035 if all new measure are implemented to maximum extent.

- 13% reduction in PM2.5 emissions
- 53% reduction in DPM emissions
- 23% reduction in NO\textsubscript{x} emissions

These reductions are on top of the reductions already projected to occur as required by the state and South Coast AQMD.
References


- Air Quality and Health Risk Assessment

- Air Quality Action Plan

- Early Action Plan

Webinars and Workshops also available at same web-site
Additional Slides
**GHG Emissions**

### Summary

- Overall reduction in GHG emissions within the GC by 20% (2009 to 2035) decrease 7.9 MMT CO2e/yr
- Largest reductions in light-duty cars, electric utilities, petro refining (decrease 11.1 MMT CO2e/yr)
  - Includes reductions for Pavely, LCFS, Fed CAFE stds, AB32 Cap & Trade; governor EO S-03-05
  - Not included - effects of SB375 (sustainable communities) which targets 13% per capita reduction in GHG emissions from reduced VMT by 2035 based on a baseline year of 2005
  - Overall net increases from aircraft & rail operations, & heavy-duty trucks (net increase 1.8 MMT CO2e/yr)
    - Due to overall increase in activity despite per engine emission reduction

### Key Lessons

- Light duty remains largest contributor at one-third in 2035
  - Continue efforts to shift from gasoline to natural gas and electric vehicles
- Electric power generate 2nd highest category at 15%
  - Reduce residential and commercial demand – renewables (solar, wind)
- Heavy-duty vehicle category represent 13% of GHG in 2035
  - Increase efficiencies via improved logistics and supply chain management; shift fleet to the extent possible to natural gas and electric
### #3. New Air Quality Improvement Strategies

#### Options for reducing PM2.5 emissions

<table>
<thead>
<tr>
<th>Goal</th>
<th>Possible New Control Measures</th>
</tr>
</thead>
</table>
| **#1. Reduce PM from Charbroiling and Wood Burning**      | **Adopt New Rule for Restaurant Under-Fire Charbroiling**  
  • Charbroiling responsible for 26% of all PM2.5 in 2035  
  **Require Low-Emission Fireplaces and Woodstoves in Residences**  
  • Residential wood burning responsible for 12% of all PM2.5 in 2035 |
| **#2. Control Dust Emissions**                            | **Expand Municipal and Highway Street Sweeping to Reduce Road Dust**  
  • Road dust responsible for 12% of all PM2.5 in 2035  
  **Expand Rules and Best Management Practices to Reduce Dust from Building Construction and Demolition**  
  • Bldg construction and demo. responsible for 6% of PM2.5 in 2035 |
#3. New Air Quality Improvement Strategies

Options for reducing arsenic, DPM, and NOx emissions

<table>
<thead>
<tr>
<th>Goal</th>
<th>Possible New Control Measures</th>
</tr>
</thead>
</table>
| #3. Reduce Arsenic Emissions | Adopt New Rules for Glass Manufacturing  
  • Glass manufacturing responsible for most arsenic emissions  
  • Requires further investigation into current activities |
  • Heavy trucks account for 54% of GCCOG air pollution cancer risk in 2035 |
|      | Encourage Low-Emission Trucks in the Gateway Cities Communities  
  • Heavy trucks account for 54% of GCCOG air pollution cancer risk in 2035 |
|      | Provide Alternative Fuel Infrastructure for Trucks  
  • Natural gas fueling stations  
  • EV charging stations (once HD truck technology becomes clear) |
### #3. New Air Quality Improvement Strategies

Options for reducing DPM and NOx emissions

<table>
<thead>
<tr>
<th>Goal</th>
<th>Possible New Control Measures</th>
</tr>
</thead>
</table>
| #5. Accelerate Deployment of Zero-Emission Cargo Handling Equipment | Replace Diesel Yard Hostlers at Ports with Hybrid and Electric Alternatives  
• Small contributor overall, but significant around ports  
Electrify Rubber Tire Gantry Cranes at Ports  
• Small contributor overall, but significant around ports  
Promote Zero-Emission Transport Refrigeration Units (TRUs)  
• Small contributor to emissions, but measure is highly cost effective |
| #6. Further Reduce Ocean-Going Vessel Emissions | Expand Control of At-Berth Ship Emissions  
• Ships will contribute 14% of DPM and 21% of NOx in 2035  
Develop and Deploy Clean Ship Engine Technologies  
• Ships will contribute 14% of DPM and 21% of NOx in 2035 |