Goods Movement and Air Quality

Clearing the Air
UC Riverside
May 22, 2008

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Key Goods Movement Pollutants

- Nitrogen Oxides (particulate & ozone precursor)
- Sulfur Oxides (particulate precursor)
- Diesel Particulates (particulate & toxic)

Goods movement sources are primarily diesel
OZONE, 2000-2007
Number of Basin-Days Exceeding the Federal Standard**

** U.S. EPA has revised the federal ozone standard from 0.08 ppm to 0.075 ppm effective May 2008.
PM2.5, 1999-2007
Maximum Annual Average Concentration (compared to state and federal standards)
Health Impacts of PM 2.5 Particulate Pollution in South Coast Basin

5,400 Premature Deaths per year*

“Exposures to air pollution can shorten life by about 14 years for people who die prematurely”
— CARB 2007

Other annual health impacts: 980,000 lost work days, 2,400 hospitalizations 140,000 asthma & lower respiratory symptoms

* Source: California Air Resources Board, 2007; 1999-2000 Air Quality Data
USC Children’s Health Study
New England Journal of Medicine, Sept 2004

- Lower lung-function growth rate associated with PM$_{10}$, PM$_{2.5}$, NO$_2$ and acid vapor
- “By age 18, lungs of many children growing up in smoggy areas are underdeveloped and will likely never recover”
- Pollutants of harm “derive from vehicle-related emissions and combustion of fossil fuels”

“When we began the study 10 years ago, we had no idea we would find effects on the lung this serious.”
— John Peters, M.D., study senior author
Nitrogen Oxides
Regional Baseline Emissions and Federal 8-Hour Ozone Carrying Capacity
Including benefits of all regulatory agency rules adopted to date
(tons per day)
2014 NOx Top Ten Source Categories

- Heavy-Duty Diesel Trucks: 145
- Off-Road Equipment: 137
- Ships & Commercial Boats*: 87
- Light-Duty Trucks: 43
- Light-Duty Passenger Cars: 37
- RECLAIM*: 27
- Heavy-Duty Gasoline Trucks: 24
- Locomotives: 23
- Residential Fuel Combustion: 22
- Aircraft: 22

* Oceangoing vessels = 72
**RECLAIM: 320 largest stationary sources, including all refineries and power plants

Source: 2007 South Coast Air Quality Management Plan
2023 NOx Top Ten Source Categories

- Ships & Commercial Boats*: 116
- Off-Road Equipment: 81
- Heavy-Duty Diesel Trucks: 78
- Aircraft: 29
- Locomotives: 28
- RECLAIM: 27
- Light-Duty Trucks: 23
- Residential Fuel Combustion: 21
- Light-Duty Passenger Cars: 17
- Heavy-Duty Gasoline Trucks: 17

* Oceangoing vessels = 103

Source: 2007 South Coast Air Quality Management Plan
Sulfur Oxides

Regional Baseline Emissions from 2007 Air Quality Management Plan and Federal “Annual” PM 2.5 Standard Carrying Capacity

*With benefit of CARB marine auxiliary engine rule invalidated by court*

(tons per day)

Source: 2007 South Coast Air Quality Management Plan
Diesel Particulates
Regional Baseline Emissions
Including benefits of all regulatory agency rules adopted to date
With benefit of CARB marine auxiliary engine rule invalidated by court
(tons per day)
Multiple Air Toxics Exposure Study (MATES III)

• Components:
  • Monitoring of Toxics
  • Emissions Inventory
  • Cancer Risk Modeling
• Improved methodologies over MATES II (1998)
Regionwide Potency-Weighted Emissions Inventory (MATES-II vs. MATES-III)

<table>
<thead>
<tr>
<th>Source Category</th>
<th>Percent Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>On-road</td>
<td>13% decrease</td>
</tr>
<tr>
<td>Off-road</td>
<td>1% increase</td>
</tr>
<tr>
<td>Point</td>
<td>65% decrease</td>
</tr>
<tr>
<td>Area</td>
<td>43% decrease</td>
</tr>
</tbody>
</table>
MATES III Risk Contribution

(From Monitor Data)

MATES III Air Toxics Risk

- Diesel PM: 83.6%
- Benzene: 4.5%
- 1,3 Butadiene: 3.3%
- Carbonyls: 2.9%
- Other: 5.7%

Basinwide Risk: 1194 per million
Based on Average at Fixed Monitoring sites
MATES-III Modeled Risk Without Diesel
MATES-III Modeled Risk From All Sources
MATES II & III Risk Comparison

• Region-wide modeled population-weighted risk:
  – 810 in a million
  – 17% below MATES II
• Variables between MATES II & III
  – Emission inventory updates
  – Meteorology
  – Modeling methodology
  – Uncertainties of analysis
• District continuing to analyze to better define trend
• Also: Local risks trends may differ (e.g. ports)
Perspective:
SCAQMD Rule Risk Limits for Stationary Sources

- 25 in a million for existing sources
- 10 in a million for new sources
Cancer Risk From Oceangoing Vessel Emissions

- Ship pollution causes maximum cancer risk exceeding 1,200 in a million
- 4.1 million people exposed to a cancer risk over 100 in a million
- 13.7 million people exposed to a cancer risk over 25 in a million
- **Perspective:** risk over 10 in a million generally considered significant

Source: SCAQMD MATES III Study (2008)
CARB Railyard Health Risk Assessments

- BNSF San Bernardino Railyard:
  - Maximum individual cancer risk (MICR) in a residential area:
    2,030 per million
Control Measures

Being Implemented or Considered by Ports & Regulatory Agencies

- Ocean Going Vessels
  - Low-Sulfur Fuels
  - Shore Power
  - NOx Controls
- Cargo Handling Equipment
  - Replacement & Retrofit
  - Alt fuels
- Trucks
  - Replacement/Retrofit,
  - Alt fuels & electrification
- Rail
  - Multi-Engine, Hybrids, Aftertreatment & Electrification
Federal Help Is Important

- Litigation over state & local marine & rail rules
- EPA Locomotive Rule
  - 85 - 90% control not until model year 2015 and for new locomotives only
- EPA Marine Vessel Rule
  - No control of foreign flags emitting 90% of emissions
Take Away Messages:

- The health impacts are severe
- Technological solutions are available
- All levels of government must act