Chicago Air Quality Overview

Chicago Area Locomotive and Railyard Meeting
July 13, 2010

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Lake Michigan Air Directors Consortium
Outline

• What is the current urban-scale air quality in the Chicago area?
  • How has air quality changed over the past 10 years and how is it expected to change over the next 10 years?

• Who is contributing to urban-scale air quality?

• Are there local-scale “hot spots”? 
Current Air Quality
Air Monitoring Sites
# National Ambient Air Quality Standards

<table>
<thead>
<tr>
<th>Pollutant</th>
<th>Air Quality Standard</th>
<th>Attainment Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon Monoxide</td>
<td>9 ppm, 8-hour</td>
<td>ATT</td>
</tr>
<tr>
<td></td>
<td>35 ppm, 1-hour</td>
<td>ATT</td>
</tr>
<tr>
<td>Nitrogen Dioxide</td>
<td>53 ppb, annual</td>
<td>ATT</td>
</tr>
<tr>
<td></td>
<td>100 ppb, 1-hour</td>
<td>NONATT</td>
</tr>
<tr>
<td>Sulfur Dioxide</td>
<td>75 ppb, 1-hour</td>
<td>NONATT</td>
</tr>
<tr>
<td></td>
<td>500 ppb, 3-hour</td>
<td>ATT</td>
</tr>
<tr>
<td>Ozone</td>
<td>0.08 ppm, 8-hr (1997)</td>
<td>NONATT*</td>
</tr>
<tr>
<td></td>
<td>0.075 ppm, 8-hr (2008)</td>
<td>NONATT*</td>
</tr>
<tr>
<td>Particulate Matter</td>
<td>* PM10 150 ug/m³, 24-hour</td>
<td>ATT</td>
</tr>
<tr>
<td></td>
<td>* PM2.5 15.0 ug/m³, annual</td>
<td>NONATT*</td>
</tr>
<tr>
<td></td>
<td>35 ug/m³, 24-hour</td>
<td>ATT</td>
</tr>
<tr>
<td>Lead</td>
<td>0.15 ug/m³, 3-month</td>
<td>ATT</td>
</tr>
</tbody>
</table>

\* = all sites measured attainment for 2007-2009
Chicago NO\textsubscript{2} Problem

CTA bus staging area during afternoon rush hour

Monitor Inlet
Daily Air Quality Index
Cook Co, Illinois

Main Pollutant (days): + CO (1) ▼ O3 (91) ★ SO2 (1) ▲ PM2.5 (232) ▼ PM10 (11)

Source: US EPA Office of Air and Radiation, AGS Database
Chicago Air Quality Trends

Cook County – PM$_{2.5}$ annual

Cook County – 8-hr ozone
Contributing Sources
Ozone and PM$_{2.5}$ Source Contributions

**VOC**
- **MAR**: 1%
- **on-road**: 22%
- **EGU**: 0%
- **nonroad**: 21%
- **nonEGU**: 8%

**NOx**
- **area**: 48%
- **on-road**: 48%
- **MAR**: 13%
- **nonEGU**: 7%
- **nonroad**: 18%

**PM$_{2.5}$**
- **MAR**: 5%
- **EGU**: 13%
- **nonroad**: 19%
- **nonEGU**: 9%
- **area**: 49%

MAR = Marine Aircraft Rail
(note, most of the total is from rail)

2005 Annual Emissions
Cook County, IL
Ozone and PM$_{2.5}$ Source Contributions

Annual Emissions
Cook County, IL
Ozone and PM$_{2.5}$ Source Contributions

*Improved rail estimates from ERTAC process*

**LADCO 2005 Inventory:**

- **NOx:** 13,000
- **VOC:** 700
- **PM2.5:** 400

**ERTAC annual emissions for Cook County (2008)**

*Note: does not include passenger trains and commuter lines*
Air Monitoring Sites
PM$_{2.5}$ Source Contributions

**Lawndale**
- OM: 18%
- Ind. Zinc: <1%
- Sec. Nitrate: 27%
- Soil: 5%
- Diesel: 5%
- Ind. Lead: 5%
- Steel: 8%
- Sec. Sulfate: 32%

**Springfield**
- Diesel/Local Carbon: 14%
- Soil Ind. Zinc: 6%
- Sec. Sulfate: 28%
- Sec. Nitrate: 24%
- Steel: 3%
- Ind. Copper: 2%
- OM: 23%

Maps showing locations of source contributions.
Local “Hot Spots”
Why do we care about local hot-spots?

• Recent EPA movement for source-oriented monitoring
  • Pb: Monitors required in areas with sources of Pb > 1 TPY (proposed lower threshold of 0.5 TPY)
  • NO2: At least 1 monitor required near a major road in urban areas ≥ 0.5M people, and a second monitor required near a major road in urban areas with either population ≥ 2.5M or road segment with AADT ≥ 250,000 vehicles
  • SO2: Monitors required at locations which meet one or more objectives, including source-oriented or highest concentration

• Environmental justice issues
  • Over 35M people live within 100 m of a major road
Air Monitoring Sites

Sites:
- BNSF-Cicero
- BUP - Proviso
- CP - Bensenville
- BNSF-Corwith
- BNSF-UPS
- CSX-Barr Yard
BNSF – Cicero Yard

PM$_{2.5}$

NO$_2$, SO$_2$, CO, O$_3$

1.2 miles

41.8396, -87.763936
Closeness Counts!

Mean Benzene Ratio

Station 1
Station 2
Station 3
Station 4
10 m
100 m
300 m
upwind background

Cite: FHWA-EPA Las Vegas Near-Roadway Study

(*) 95th percentile daily-average concentration for impact at the Dearborn station (D), Sep-Dec 2007
(**) emissions for same day of week one year later, after all four switcher locomotives were replaced with GenSet technology
Summary

• Existing monitoring data show that Chicago meets federal air quality standards for almost all regulated pollutants
  • Chicago air quality has improved significantly over the past decade; continued improvement is expected in the future

• Major emission source categories in Cook County include area, on-road, and nonroad (80% or more)
  • Rail contribution is on the order of 5 – 10% (in Cook County)

• Modeling information suggests there are local “hot spots” (not confirmed by monitoring data)