National-Scale Near-Road Air Quality Data Assessment: Findings from the Near-Road NO$_2$ Monitoring Program

Jennifer DeWinter$^1$, Steve Brown$^1$, Ashley Graham$^1$, Karin Landsberg$^2$, Douglas Eisinger$^1$

$^1$Sonoma Technology, Inc.
$^2$Washington State Department of Transportation

for

TRB 95th Annual Meeting, Transportation and Air Quality Committee (ADC20) Meeting
Washington, DC

January 13, 2016
Acknowledgments

This work was completed as part of the Near-Road Air Quality pooled fund, under the FHWA Transportation Pooled Fund (TPF) program. The Washington State Department of Transportation (WSDOT) is the lead agency. Other participants include the FHWA and the Arizona, California, Texas, and Virginia Departments of Transportation.

The authors would like to thank Nealson Watkins of the U.S. Environmental Protection Agency (EPA) for providing feedback on our presentation.
Background

- EPA promulgated near-road NO\textsubscript{2} monitoring in the 2010 NO\textsubscript{2} NAAQS revision
  The goal was to minimize 1-hr NO\textsubscript{2} exposures

- EPA has also encouraged near-road measurement of other pollutants and relevant data
  - Other required measurements: CO, PM\textsubscript{2.5}
  - Optional: Black carbon, ultrafine PM, O\textsubscript{3}, air toxics, meteorology, annual average daily traffic (AADT)
## Monitoring Schedule

<table>
<thead>
<tr>
<th>Population</th>
<th>NO$_2$</th>
<th>CO</th>
<th>PM$_{2.5}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>500,000 to 1 million</td>
<td>1/1/2017</td>
<td></td>
<td></td>
</tr>
<tr>
<td>≥ 1 million</td>
<td></td>
<td>1/1/2014</td>
<td></td>
</tr>
<tr>
<td>≥ 1 million to ≤ 2.5 million</td>
<td></td>
<td>1/1/2017</td>
<td>1/1/2017</td>
</tr>
<tr>
<td>≥ 2.5 million (or ≥ 250,000 AADT)</td>
<td>1/1/2015 (2$^{nd}$ site)</td>
<td>1/1/2015</td>
<td>1/1/2015</td>
</tr>
</tbody>
</table>

**Example site:**
Milwaukee, Wisconsin
I-94 NO$_2$ and CO monitoring.
Image source: WI-DNR.
TPF Near-Road Data Analysis

Objectives

– Collect and synthesize near-road program data
– Identify national-scale findings

Methods

– Acquire PM$_{2.5}$, NO$_2$, and CO data
– Characterize data and compare to NAAQS
– Identify sites (if any) with high concentrations
– Base results on program’s first full year (2014) using state-certified final data available May 2015
As of May 2015, 40 sites had reported NO$_2$ data.
Data Overview

Near-Road Site Characteristics

Distance to roadway and FE-AADT information is from the EPA's near-road monitoring meta-data spreadsheet, available from the Ambient Monitoring Technology Information Center (AMTIC) website: http://www3.epa.gov/ttnamti1/nearroad.html
FE-AADT vs. Distance to Road

Symbols indicate population
Temporal Patterns

Diurnal patterns in hourly median NO$_2$, CO, and PM$_{2.5}$ concentrations on weekdays in 2014

NO$_2$ concentrations on weekdays and weekends in 2014
In 2014, virtually all 1-hr NO₂ concentrations were below the threshold of the NO₂ NAAQS (100 ppb), with the exception of two days (August 1 and 14, accounting for 5 values out of 281,236) near the George Washington Bridge between New York and New Jersey.
In 2014, most hourly NO$_2$ concentrations were in the 0–30 ppb range.
In 2014, multiple 24-hr and annual mean PM$_{2.5}$ concentrations exceeded the PM$_{2.5}$ NAAQS thresholds.
PM$_{2.5}$ ($\mu g/m^3$) plus nonattainment and maintenance areas.

**Left**: 24-hr data. **Right**: annual average data. More sites are expected to report data from 2015.
In 2014, most hourly CO concentrations were in the 0–1 ppm range.
2014 Findings

Concentrations vs. FE-AADT

Annual average NO₂ vs. FE-AADT
Annual average PM₂.5 vs. FE-AADT
Upcoming Work

- Update findings with 2015 data
- Complete case studies
  - Selected high concentration events
  - Variation by time of day, meteorology, road distance, and other factors
  - Comparisons with NAAQS

![Hourly NO₂ for George Washington Bridge high concentration events](image)
Contact

Near-Road Data Project:
Ashley Graham, PhD
agraham@sonomatech.com
707.665.9900

Near-Road Pooled Fund:
Karin Landsberg
landsbk@wsp.dot.wa.gov
360.705.7491

Douglas Eisinger, PhD
doug@sonomatech.com
707.665.9900