Near-road Monitoring

Nealson Watkins
US EPA – OAR – OAQPS
Ambient Air Monitoring Group

MARAMA – April 2011
Objectives

• Review CFR requirements
• Discuss forthcoming Technical Assistance Document
• Discuss Near-road NO2 pilot
• Provide an example version of the draft site selection process in action
• Wrap-up and take questions
Reviewing what's in the rule…

- 40 CFR Part 58 Appendix D and E have network design requirements and siting criteria, respectively (http://ecfr.gpoaccess.gov).

- Requirements based on CBSA populations (available from US Census Bureau [www.census.gov])

- Objectives are to monitor maximum NO2 concentrations in an area – with a component of the network design specifically focusing on mobile source impacts due to related exposure risks.

- Required near-road (NR) monitoring stations:
  - 1 NR site in CBSAs with populations ≥ 500,000
  - 2 NR sites in CBSAs with populations ≥ 2.5 million
  - 2 NR sites in CBSAs with one or more road segments having >250,000 Annual Average Daily Traffic (AADT)

- Estimated to require 127 sites in 103 CBSAs.
Monitor Location & Siting

• Key passage from Appendix D: The near-road NO$_2$ monitoring stations shall be selected by ranking all road segments within a CBSA by AADT and then identifying a location or locations adjacent to those highest ranked road segments, considering fleet mix, roadway design, congestion patterns, terrain, and meteorology, where maximum hourly NO$_2$ concentrations are expected to occur…”

• Key passage from Appendix E: “In siting near-road NO$_2$ monitors as required in paragraph 4.3.2 of appendix D of this part, the monitor probe shall be as near as practicable to the outside nearest edge of the traffic lanes of the target road segment; but shall not be located at a distance greater than 50 meters, in the horizontal, from the outside nearest edge of the traffic lanes of the target road segment.
Near-road Monitoring Technical Assistance Document (TAD)

• In response to public response to the rule for further guidance on implementing the near-road NO$_2$ network, EPA committed to creating the near-road monitoring TAD.

• The TAD will provide a ‘cookbook’ suggesting concepts for use by State and Locals to implement the network in a way that meets the intentions and physical requirements of the NO$_2$ rulemaking.

• The TAD will also discuss the merits, methods, and approaches for making near-road NO$_2$ stations multi-pollutant monitoring stations.

• Draft version due May/June – specifically for review by CASAC-Ambient Air Monitoring and Methods Subcommittee.

• Final version expected Fall of 2011

• In addition to the TAD, some State and local agencies are conducting a near-road NO$_2$ pilot, collaborating with EPA…
From the draft TAD: Creating a List of Ranked Candidate Road Segments – “The Process”

1. Total Traffic Count
2. Fleet Mix
3. Fleet-Equivalent AADT
4. Congestion

AADT Counts

Rank Segments by AADT

Do multiple segments have the same AADT?

Y

N

AADT Counts

Assign same rank to segments with same AADT counts

Proceed with ranked segment list

Rank Segments

Rank Segments by AADT

Y

N

AADT Counts

Are Truck / HD Counts available?

Y

N

Proceed with ranked AADT Segments / Counts

Are Truck / HD Counts available?

Match Heavy Duty counts with AADT by segment

Y

N

Proceed with ranked AADT Segments / Counts

Calculate Fleet-Equivalent AADT for all segments; use to rank

Is a congestion indicator available for each segment?

Y

N

Determine congestion level for each segment; use to differentiate comparably ranked segments

Ranked Candidate Segments

Proceed with ranked AADT Segments / Counts
Near-road NO$_2$ Pilot Study

The pilot is intended to:

1) Allow state and local air monitoring stakeholders to evaluate, improve, and document (with EPA) the near-road monitor siting process, and

2) Provide first-hand experience in the full installation of a near-road monitoring station to share with the air monitoring community.

- 5 Pilot CBSAs: Albuquerque, Baltimore, Boise, Miami, and Tampa
  - Pilot partners plan to conduct some passive monitoring at select roadside locations
  - Boise and Miami (Broward Co.) will install permanent near-road monitoring stations to further meet our second pilot objective
  - EPA plans to model select road segments
Near-road NO₂ Pilot Study (cont.)

- In the TAD we intend to discuss different approaches and methods for evaluating candidate near-road sites including: passive monitoring, periodic continuous (or saturation type) monitoring, mobile (on-road) monitoring, and modeling.

- EPA plans to utilize any information and experience gained in the pilot study to bolster TAD development.
  - In particular, we hope that information from the pilot can be used to compare the traffic data based selection “process” against passive NO₂ monitoring data and some AERMOD modeling results of individual road segments.
Case Study - Tampa

- The Tampa CBSA is comprised of 4 counties wrapped around the East, North, and Western sides of Tampa Bay, which includes the cities of Tampa and St. Petersburg.

- The Tampa CBSA has a population of approximately 2.7 million persons, and therefore will be required to operate 2 near-road NO₂ monitoring stations.

- There are three major interstates in the area:
  - I-75 running North-South (on the eastern fringes of Tampa)
  - I-4 running roughly East-West
  - I-275 which runs N-S through Tampa, across the bay to St. Pete, and continues south and east to rejoin I-75

- We were able to compare HPMS data versus local FL DOT data in the following slides.
For this example (Tampa CBSA), we are providing a list of the top ranked road segments (using available data) based on:

- AADT (total traffic volume)
- Heavy Duty (HD) vehicle counts (e.g. trucks/buses)
- Estimate of congestion by calculating total AADT/# lanes on each road segment (akin to Level of Service [LOS] provided by DOTs)
- Fleet Equivalent (FE) AADT – which accounts for AADT and fleet mix when data are available
  - FE AADT = (AADT – HD counts) + (HD counts * 10)
  - The “10” value in the equation is the Heavy Duty to Light Duty vehicle NOx emission ratio. This is based on an interpretation of NOx emission factors from EPA’s regulatory MOVES (MOtor Vehicle Emissions Simulator) model using national defaults.
<table>
<thead>
<tr>
<th>Source</th>
<th>HPMS</th>
<th>Florida DOT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year</td>
<td>2008</td>
<td>2011</td>
</tr>
<tr>
<td>Highest AADT (Roadway)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1&lt;sup&gt;st&lt;/sup&gt;</td>
<td>204,000 (I-275)</td>
<td>192,000 (I-275)</td>
</tr>
<tr>
<td>2&lt;sup&gt;nd&lt;/sup&gt;</td>
<td>201,000 (I-275 &amp; ramp to I-4)</td>
<td>176,500 (I-275)</td>
</tr>
<tr>
<td>3&lt;sup&gt;rd&lt;/sup&gt;</td>
<td>187,000 (I-275)</td>
<td>170,500 (I-275)</td>
</tr>
<tr>
<td>4&lt;sup&gt;th&lt;/sup&gt;</td>
<td>175,500 (I-275)</td>
<td>169,000 (I-275 &amp; ramp to I-4)</td>
</tr>
<tr>
<td>5&lt;sup&gt;th&lt;/sup&gt;</td>
<td>172,500 (I-275)</td>
<td>167,000 (I-275)</td>
</tr>
</tbody>
</table>
Example of Differences Between HPMS and Local Counts

Count Sources:
HPMS
Local
<table>
<thead>
<tr>
<th>COSITE</th>
<th>Route</th>
<th>From</th>
<th>To</th>
<th>AADT Rank</th>
<th>AADT</th>
<th>Truck Rank</th>
<th>Truck AADT</th>
<th>AADT/Lane</th>
<th>FE AADT</th>
<th>FE AADT Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>102028</td>
<td>I-4</td>
<td>10320000/10320001</td>
<td>Bridge No-100658</td>
<td>6</td>
<td>164,000</td>
<td>10</td>
<td>12,251</td>
<td>16,400</td>
<td>274,259</td>
<td>1</td>
</tr>
<tr>
<td>102016</td>
<td>I-275</td>
<td>Bridge No-100128</td>
<td>Bridge No-100110</td>
<td>1</td>
<td>192,000</td>
<td>27</td>
<td>8,467</td>
<td>19,200</td>
<td>268,203</td>
<td>2</td>
</tr>
<tr>
<td>100091</td>
<td>I-4</td>
<td>US 301 / SR 43</td>
<td>I-75/SR 93A</td>
<td>15</td>
<td>136,500</td>
<td>5</td>
<td>14,073</td>
<td>17,063</td>
<td>263,157</td>
<td>3</td>
</tr>
<tr>
<td>102026</td>
<td>I-4</td>
<td>Bridge No-100658</td>
<td>US 41/SR 599/50th St</td>
<td>13</td>
<td>151,000</td>
<td>11</td>
<td>12,050</td>
<td>18,875</td>
<td>259,450</td>
<td>4</td>
</tr>
<tr>
<td>105353</td>
<td>I-4</td>
<td>SR 93A/I-75</td>
<td>Mango Rd</td>
<td>15</td>
<td>136,500</td>
<td>6</td>
<td>13,172</td>
<td>22,750</td>
<td>255,048</td>
<td>5</td>
</tr>
<tr>
<td>105609</td>
<td>I-275</td>
<td>S600/U92/Dale Mabry</td>
<td>Bridge No-100128</td>
<td>3</td>
<td>170,500</td>
<td>25</td>
<td>8,713</td>
<td>21,313</td>
<td>248,917</td>
<td>6</td>
</tr>
<tr>
<td>100087</td>
<td>I-4</td>
<td>Bridge No-100599</td>
<td>S566/Thonotosassa Rd</td>
<td>25</td>
<td>110,000</td>
<td>3</td>
<td>15,279</td>
<td>13,750</td>
<td>247,511</td>
<td>7</td>
</tr>
<tr>
<td>100084</td>
<td>I-4</td>
<td>Bridge No-100607</td>
<td>Hills/Polk Co Line</td>
<td>28</td>
<td>105,000</td>
<td>1</td>
<td>15,719</td>
<td>17,750</td>
<td>246,471</td>
<td>8</td>
</tr>
<tr>
<td>102006</td>
<td>I-275</td>
<td>Sligh Ave</td>
<td>Bridge No-100219</td>
<td>5</td>
<td>167,000</td>
<td>26</td>
<td>8,684</td>
<td>27,833</td>
<td>245,156</td>
<td>9</td>
</tr>
<tr>
<td>102015</td>
<td>I-275</td>
<td>Bridge No-100138</td>
<td>10320000/10320001</td>
<td>4</td>
<td>169,000</td>
<td>29</td>
<td>8,298</td>
<td>12,071</td>
<td>243,682</td>
<td>10</td>
</tr>
<tr>
<td>102015</td>
<td>I-275</td>
<td>Bridge No-100110</td>
<td>Bridge No-100138</td>
<td>4</td>
<td>169,000</td>
<td>29</td>
<td>8,298</td>
<td>16,900</td>
<td>243,682</td>
<td>10</td>
</tr>
<tr>
<td>102009</td>
<td>I-275</td>
<td>Floribraska Ave</td>
<td>Bridge No-100203</td>
<td>8</td>
<td>160,500</td>
<td>21</td>
<td>9,229</td>
<td>20,063</td>
<td>243,561</td>
<td>11</td>
</tr>
<tr>
<td>102019</td>
<td>I-275</td>
<td>CR587/Westshore Blvd</td>
<td>Bridge No-100120</td>
<td>2</td>
<td>176,500</td>
<td>36</td>
<td>7,413</td>
<td>29,417</td>
<td>243,217</td>
<td>12</td>
</tr>
<tr>
<td>100112</td>
<td>I-4</td>
<td>Bridge No-100605</td>
<td>Bridge No-100607</td>
<td>29</td>
<td>103,000</td>
<td>3</td>
<td>15,388</td>
<td>17,167</td>
<td>241,492</td>
<td>13</td>
</tr>
<tr>
<td>102018</td>
<td>I-275</td>
<td>Bridge No-100120</td>
<td>S600/U92/Dale Mabry</td>
<td>7</td>
<td>163,000</td>
<td>32</td>
<td>7,824</td>
<td>20,375</td>
<td>233,416</td>
<td>14</td>
</tr>
<tr>
<td>100106</td>
<td>I-4</td>
<td>McIntosh Rd</td>
<td>Bridge No-100599</td>
<td>22</td>
<td>117,932</td>
<td>8</td>
<td>12,595</td>
<td>19,655</td>
<td>231,287</td>
<td>15</td>
</tr>
<tr>
<td>150062</td>
<td>I-275</td>
<td>East End Br 150107</td>
<td>Bridge No-100115</td>
<td>14</td>
<td>147,000</td>
<td>22</td>
<td>9,026</td>
<td>18,375</td>
<td>228,234</td>
<td>16</td>
</tr>
<tr>
<td>150062</td>
<td>I-275</td>
<td>4th St N</td>
<td>End Bridge 150107</td>
<td>14</td>
<td>147,000</td>
<td>22</td>
<td>9,026</td>
<td>14,700</td>
<td>228,234</td>
<td>16</td>
</tr>
<tr>
<td>100086</td>
<td>I-4</td>
<td>S566/Thonotosassa Rd</td>
<td>Bridge No-100605</td>
<td>30</td>
<td>98,000</td>
<td>4</td>
<td>14,396</td>
<td>16,333</td>
<td>227,564</td>
<td>17</td>
</tr>
<tr>
<td>102007</td>
<td>I-275</td>
<td>SR 600 / Hills Ave</td>
<td>Sligh Ave</td>
<td>10</td>
<td>156,500</td>
<td>34</td>
<td>7,669</td>
<td>26,083</td>
<td>225,521</td>
<td>18</td>
</tr>
<tr>
<td>100146</td>
<td>I-75</td>
<td>Gibsonton Dr</td>
<td>SR 43 / US 301</td>
<td>24</td>
<td>111,500</td>
<td>9</td>
<td>12,577</td>
<td>11,150</td>
<td>224,693</td>
<td>19</td>
</tr>
<tr>
<td>102023</td>
<td>I-4</td>
<td>SR 574/ML King Blvd</td>
<td>Orient Rd</td>
<td>20</td>
<td>122,000</td>
<td>13</td>
<td>11,236</td>
<td>20,333</td>
<td>223,124</td>
<td>20</td>
</tr>
<tr>
<td>102008</td>
<td>I-275</td>
<td>Bridge No-100203</td>
<td>SR 600 / Hills Ave</td>
<td>11</td>
<td>153,500</td>
<td>33</td>
<td>7,736</td>
<td>25,583</td>
<td>223,124</td>
<td>20</td>
</tr>
</tbody>
</table>
National Counts vs. Local Counts

Local Counts vs. Local FE AADT Counts
After ranking traffic data...

• Using the road segment lists generated by traffic data analysis, the next steps would be for a State or Local agency to begin road segment evaluation through reconnaissance.

• Reconnaissance objectives would relate to:
  – Roadway design (from the rule)
  – Terrain (from the rule)
  – Meteorology (from the rule)

Plus:
  – Logistical (site placement) feasibility
  – Population exposure (as a secondary factor)
For a given road segment under consideration as a near-road NO₂ site, EPA expects state and locals should characterize or assess the following:

- What kind of road is it? Specifically, is it a controlled access highway such as an interstate, freeway, toll-way, etc or an arterial type road.
- Is there an interchange as part of or on the end of the segment?
- Does the road have noise barriers along part or all of either side of the road?
- What type of vegetation exists along side of the road? Would any existing vegetation inhibit siting for monitoring?
- Is the target road segment at-grade, below or above grade, or lie in terrain that has a variety in relative elevations?
- What type of roadway safety features are along side the target road? Examples would be guard rails, fencing, berms, etc.
- How close are surrounding buildings, or other such non-road features, estimated to be from the edge of the target road?
- Characterize the surrounding land use. Examples are residential, commercial, industrial, etc.
- Population exposure – related to surrounding land use; how much near-road exposure is there along a segment, also, is this an Environmental Justice area?
- Characterize the local meteorology that would be representative of a given road segment
- Assess power availability in the area
- Construction – Ongoing? In a DOT’s (which they all typically have) near- and long-term plans, would a site be affected?
- Intangibles – notes on a given road segment’s candidacy to a permanent monitoring station.
Site Selection

• After any reconnaissance, EPA envisions states would have sufficient information to begin identifying viable near-road site locations, having considered all the factors in the rule.

• EPA also envisions that record-keeping of “the list” of road segments and subsequent reconnaissance would go a long way in providing rationale to Regions on why certain sites may or may not be chosen.
Wrap-up

• We hope the TAD will aid in streamlining the near-road implementation process, and facilitate network implementation in a similar fashion across the entire country.

• Look for your State and Local counterparts participating in the pilot study to present their experiences in various forums and media.
Questions?