Overview of EPA-R5 network assessment conducted in 2000

Motria Caudill
R5 Air Monitoring & Analysis Section
Participants & roles

- **USEPA-R5** – coordinated efforts, did data analysis
- **Lake Michigan Air Directors Consortium (LADCO)** – organized State input, drafted documents
- **Region 5 states** – evaluate local issues & priorities, review analyses and documents, suggest network changes
  - Illinois, Indiana, Michigan, Minnesota, Ohio, Wisconsin
Monitoring strategy core principles

- State-by-state recommendations to improve (decrease, increase, relocate, revise) existing criteria pollutant networks based on consideration of:
  - public information
  - public health/compliance with NAAQS
  - strategy development (i.e., support modeling)
  - trends/strategy evaluation
  - multi-pollutant sites (supersites)
  - regional-scale (O3, PM$_{2.5}$) v. local-scale (CO, SO$_2$, Pb, PM$_{10}$) pollution problems
  - over-monitoring (redundancy) and under-monitoring
  - low concentrations
  - state rules
  - population growth
Core principles, cont’d

- Not bound by Federal regs and policies; need to change NAMS/SLAMS regulations and nonattainment policies
- Evaluate new technology
- State/local flexibility (special needs – e.g., TSP in WI)
- Need to address administrative issues, incl. public outreach, reinvesting savings, preserve funding and jobs
EPA’s data analysis

• Focus on ozone and PM\textsubscript{2.5}
• Identify “high value” and “low value” monitors based on
  – Are concentrations near the NAAQS or well below?
  – Are results redundant, i.e. highly correlated with another site?
  – Does the site provide useful spatial coverage or is it near other sites?
Tribal sites considered

- Several Tribes operate PM$_{2.5}$ and ozone sites
- Valuable spatial coverage for modeling and AQI
PM$_{2.5}$ assessment

• ~200 sites in the Region
• Wrote SAS program to determine correlation ($R$) between each pair of monitors
  – “$R$” describes the degree of association between groups of variables
  – Example: if $R^2$ is 0.90, then 90% of variability in site A can be explained by variability in site B

• Other metrics
  – Distance (km) to nearest monitor
  – Average PM$_{2.5}$ concentration
  – County population change
Example of highly correlated sites in SE WI

Sites in Milwaukee and Waukesha, WI (21 km apart); R=0.980
Two sites further apart

PM2.5 Sites in Chicago, IL and Milwaukee, WI (108 km);
R=0.96

Y-Axis

03/07/00 05/03/00 06/23/00
PM$_{2.5}$ correlogram

Correlogram for CHICAGO, IL

Data taken from AIMS: July 12, 2000
Ozone Correlation Map for a Monitor in METROPOLITAN CHICAGO

Site ID = 170310064442011
Results provided to States

- Spreadsheets with data outputs
- GIS maps to display concentration, correlation, and site proximity
- States weighed these purely technical findings against real-world considerations, e.g. some monitors grow “roots” in the community and cannot be moved
### High-value sites in RED

<table>
<thead>
<tr>
<th>State</th>
<th>County</th>
<th>Metropolitan Statistical Area (MSA)</th>
<th>AIRS ID</th>
<th>Mean (ng/m³)</th>
<th>Distance to Next Site (km)</th>
<th>Correlation, Highest (R)</th>
<th>County Population Growth, Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>IL</td>
<td>Adams</td>
<td>Not in an MSA</td>
<td>1703100061</td>
<td>NA</td>
<td>60.3</td>
<td>NA</td>
<td>0 to 5 %</td>
</tr>
<tr>
<td>IL</td>
<td>Champaign</td>
<td>Champaign-Urbana, IL</td>
<td>1701900041</td>
<td>NA</td>
<td>14.6</td>
<td>NA</td>
<td>-15 to 0 %</td>
</tr>
<tr>
<td>IL</td>
<td>Champaign</td>
<td>Champaign-Urbana, IL</td>
<td>1701900111</td>
<td>14.34</td>
<td>14.0</td>
<td>0.926</td>
<td>-15 to 0 %</td>
</tr>
<tr>
<td>IL</td>
<td>Cook</td>
<td>Chicago, IL</td>
<td>17031000114</td>
<td>16.40</td>
<td>11.1</td>
<td>0.953</td>
<td>0 to 5 %</td>
</tr>
<tr>
<td>IL</td>
<td>Cook</td>
<td>Chicago, IL</td>
<td>17031000221</td>
<td>17.76</td>
<td>2.7</td>
<td>0.940</td>
<td>0 to 5 %</td>
</tr>
<tr>
<td>IL</td>
<td>Cook</td>
<td>Chicago, IL</td>
<td>17031000501</td>
<td>17.03</td>
<td>3.3</td>
<td>0.966</td>
<td>0 to 5 %</td>
</tr>
<tr>
<td>IL</td>
<td>Cook</td>
<td>Chicago, IL</td>
<td>1703100521</td>
<td>18.36</td>
<td>6.0</td>
<td>0.943</td>
<td>0 to 5 %</td>
</tr>
<tr>
<td>IL</td>
<td>Cook</td>
<td>Chicago, IL</td>
<td>1703100571</td>
<td>17.32</td>
<td>6.0</td>
<td>0.966</td>
<td>0 to 5 %</td>
</tr>
<tr>
<td>IL</td>
<td>Cook</td>
<td>Chicago, IL</td>
<td>1703100761</td>
<td>16.57</td>
<td>8.2</td>
<td>0.968</td>
<td>0 to 5 %</td>
</tr>
<tr>
<td>IL</td>
<td>Cook</td>
<td>Chicago, IL</td>
<td>1703110161</td>
<td>20.82</td>
<td>2.0</td>
<td>0.943</td>
<td>0 to 5 %</td>
</tr>
<tr>
<td>IL</td>
<td>Cook</td>
<td>Chicago, IL</td>
<td>1703117011</td>
<td>NA</td>
<td>2.0</td>
<td>NA</td>
<td>0 to 5 %</td>
</tr>
<tr>
<td>IL</td>
<td>Cook</td>
<td>Chicago, IL</td>
<td>1703120011</td>
<td>17.01</td>
<td>10.5</td>
<td>0.968</td>
<td>0 to 5 %</td>
</tr>
<tr>
<td>IL</td>
<td>Cook</td>
<td>Chicago, IL</td>
<td>1703130011</td>
<td>17.98</td>
<td>3.1</td>
<td>0.962</td>
<td>0 to 5 %</td>
</tr>
<tr>
<td>IL</td>
<td>Cook</td>
<td>Chicago, IL</td>
<td>1703140061</td>
<td>15.25</td>
<td>14.8</td>
<td>0.881</td>
<td>0 to 5 %</td>
</tr>
<tr>
<td>IL</td>
<td>Cook</td>
<td>Chicago, IL</td>
<td>1703142011</td>
<td>14.47</td>
<td>15.4</td>
<td>0.957</td>
<td>0 to 5 %</td>
</tr>
<tr>
<td>IL</td>
<td>Cook</td>
<td>Chicago, IL</td>
<td>1703160051</td>
<td>16.43</td>
<td>6.0</td>
<td>0.962</td>
<td>0 to 5 %</td>
</tr>
<tr>
<td>IL</td>
<td>Du Page</td>
<td>Chicago, IL</td>
<td>1704340021</td>
<td>15.27</td>
<td>26.5</td>
<td>0.961</td>
<td>5 to 15 %</td>
</tr>
<tr>
<td>IL</td>
<td>Kane</td>
<td>Chicago, IL</td>
<td>1708900031</td>
<td>14.51</td>
<td>19.3</td>
<td>0.959</td>
<td>15 to 30 %</td>
</tr>
<tr>
<td>IL</td>
<td>Lake</td>
<td>Chicago, IL</td>
<td>1709710071</td>
<td>12.21</td>
<td>4.2</td>
<td>0.978</td>
<td>15 to 30 %</td>
</tr>
<tr>
<td>IL</td>
<td>La Salle</td>
<td>Not in an MSA</td>
<td>1709900071</td>
<td>15.25</td>
<td>72.2</td>
<td>0.937</td>
<td>0 to 5 %</td>
</tr>
<tr>
<td>IL</td>
<td>Mc Henry</td>
<td>Chicago, IL</td>
<td>1711100011</td>
<td>14.76</td>
<td>19.4</td>
<td>0.959</td>
<td>20 - 60 %</td>
</tr>
<tr>
<td>IL</td>
<td>Mc Lean</td>
<td>Bloomington-Normal, IL</td>
<td>1711320021</td>
<td>NA</td>
<td>53.6</td>
<td>NA</td>
<td>5 to 15 %</td>
</tr>
<tr>
<td>IL</td>
<td>Macon</td>
<td>Decatur, IL</td>
<td>1711500131</td>
<td>15.48</td>
<td>51.2</td>
<td>0.926</td>
<td>-15 to 0 %</td>
</tr>
</tbody>
</table>
PM2.5 Maximum Site Correlations, Milwaukee, WI

Maximum Correlation Coefficient (R)
- NA
- 0.750 - 0.902
- 0.903 - 0.936
- 0.937 - 0.953
- 0.954 - 0.986
- 0.988 - 0.999
Proposed network changes

• Based on core principles, each state reviewed their networks and identified proposed changes to be phased-in over 2-3 years.

• In general, changes reflect elimination of several existing monitors, establishment of a few new monitors, and a movement toward multi-pollutant sites.
## Number of sites in each state before/after changes

<table>
<thead>
<tr>
<th></th>
<th>O3</th>
<th>PM$_{2.5}$ Mass</th>
<th>PM$_{2.5}$ Cont</th>
<th>PM$_{2.5}$ Spec</th>
<th>PM10</th>
<th>TSP</th>
<th>Pb</th>
<th>CO</th>
<th>SO2</th>
<th>NO2</th>
</tr>
</thead>
<tbody>
<tr>
<td>IL</td>
<td>42/35</td>
<td>36/29</td>
<td>4/14</td>
<td>6/6</td>
<td>17/12</td>
<td>15/6</td>
<td>9/7</td>
<td>23/14</td>
<td>10/8</td>
<td></td>
</tr>
<tr>
<td>IN</td>
<td>48/41</td>
<td>40/22</td>
<td>7/16</td>
<td>5/7</td>
<td>25/20</td>
<td>6/6</td>
<td>5/5</td>
<td>8/7</td>
<td>4/4</td>
<td></td>
</tr>
<tr>
<td>IN-ind.</td>
<td>1/1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MI</td>
<td>27/28</td>
<td>27/27</td>
<td>8/12</td>
<td>10/10</td>
<td>8/6</td>
<td>8/8</td>
<td>7/7</td>
<td>8/8</td>
<td>3/3</td>
<td></td>
</tr>
<tr>
<td>MN</td>
<td>7/17</td>
<td>17/15</td>
<td>1/12</td>
<td>1/8</td>
<td>19/9</td>
<td>2/2</td>
<td>10/7</td>
<td>8/6</td>
<td>4/4</td>
<td></td>
</tr>
<tr>
<td>OH</td>
<td>50/39</td>
<td>49/43</td>
<td>2/13</td>
<td>11/11</td>
<td>64/33</td>
<td>14/6</td>
<td>16/9</td>
<td>34/19</td>
<td>4/2</td>
<td></td>
</tr>
<tr>
<td>WI</td>
<td>38/32</td>
<td>28/19</td>
<td>3/9</td>
<td>6/7</td>
<td>6/5</td>
<td>19/5</td>
<td>16/16</td>
<td>0/0</td>
<td>5/2</td>
<td>5/4</td>
</tr>
<tr>
<td>WI-ind.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>212/192</td>
<td>197/155</td>
<td>25/76</td>
<td>39/49</td>
<td>139/85</td>
<td>19/5</td>
<td>427/22</td>
<td>52/37</td>
<td>86/58</td>
<td>29/25</td>
</tr>
</tbody>
</table>
Count by pollutant
VII. SUMMARY OF RECOMMENDATIONS
The regional monitoring strategy recommends the following:

Increase data collection
- more complete sampling (e.g., multi-pollutant sampling sites);
- more timely information (e.g., regional PM$_{2.5}$ continuous network); and
- more air pollutants (e.g., regional air toxics network)

Decrease (plus relocate and modify) existing state criteria pollutant monitoring networks (Note: the resource savings will not be sufficient to pay for some of the increased data collection, such as the regional air toxics monitoring network. Additional funding will be needed.)

Encourage additional tribal monitoring, especially in the vicinity of the Class I areas in northern Minnesota and Michigan

Promote new technology, especially for PM$_{2.5}$ and air toxics

Conduct public outreach effort to explain and seek “buy-in” for the proposed changes to the criteria pollutant monitoring networks

Revise the existing NAMS/SLAMS regulations to relieve the states of certain monitoring requirements and to allow some of the proposed network changes

Conduct periodic assessments
So what happened?

- FRM network is the same size today, but “tweaked” in many areas
- Work with air toxics and new technologies continues
- Reduction in PM$_{10}$, CO, NO$_2$, SO$_2$
Next steps

• Assembling workgroup with States and LADCO to start the process over again
• Much more data to work with now
• Consider regulatory changes
• Consider funding structure for PM$_{2.5}$