Challenges to Interpretation of New Air Sensor Data: What Does it Mean?

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My Air Quality: Using Sensors to Know What’s in Your Air
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Challenges to Interpretation of New Air Sensor Data: What Does it Mean?

Data itself is not “information”: Interpretation required

• For an individual:
  • What does a reading mean for me, my family?
  • Is my home safe? Where should I exercise?

• For a community:
  • What neighborhoods are impacted the most?

• For State and Local officials:
  • How do I respond to citizen inquiries?
Air Sensors Health Group (ASHG) formed to support data interpretation

• Includes EPA Program offices and Regional representatives
  • Office of Research and Development (several programs)
  • Office of Air and Radiation
  • EPA Regional Offices

• Includes other Federal Agencies:
  • National Institute for Environmental Health Sciences
  • National Institute for Occupational Safety and Health
  • Centers for Disease Control
  • National Library of Medicine
ASHG Goals

• To help the state/local agencies and regions on the front lines of answering phone calls from concerned citizens
• To help consumers understand how to interpret the readings from their sensors
• To help guide sensor developers to produce instruments with meaningful information or translation
Initial ASHG Approaches

- Consider available reference values
- Consider what is “normal” air quality
Values vary due to assumptions that depend on target population and intended exposure scenario

Occupational values:
- 8-hour work shift TWA or 15-minute STEL
- Healthy workers
- 40-year exposure duration
- Safety factors

Emergency response values:
- Degrees of severity – all include some level of effect
- Aid in evacuation/Take-shelter decisions
- Assume “once in a lifetime” exposure scenario, not routine excursions

Extrapolation factors may not account for general population, sensitive subpopulations, or dosimetry
Graphical Arrays of Chemical-Specific Health Effect Reference Values for Inhalation Exposures
Figure 2.1. Comparison of Available Health Effect Reference Values for Inhalation Exposure to Acrolein
<table>
<thead>
<tr>
<th></th>
<th>Emergency Response</th>
<th>Occupational</th>
<th>General Public</th>
<th>WHO Air Quality Guideline</th>
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<tr>
<td></td>
<td>AEGL</td>
<td>ERPG</td>
<td>TEEL</td>
<td>IDLH</td>
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<td>Acrolein</td>
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<td>Ammonia</td>
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<tr>
<td>Arsine (SA)*</td>
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<tr>
<td>Chlorine*</td>
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<tr>
<td>Chromium VI</td>
<td></td>
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<tr>
<td>Cyanogen Chloride*</td>
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<tr>
<td>Ethylene Glycol Methyl Ether</td>
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<td>Ethylene Oxide</td>
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* indicates a chemical warfare agent
Reference Values?

• Consider available reference values
• Consider what is “normal” air quality

• National Ambient Air Quality Standards: 4 components
  • Indicator (e.g., ozone)
  • Level (e.g., 75 ppb)
  • Averaging time (8 hour daily maximum) **
  • Form (4th highest average across 3 years) **

** = short-term exposure data (minutes, hour) does not match up with standard
e.g., a one minute reading of 85 ppb does not mean the standard has been exceeded
What is “Normal” Air Quality?

• Examine one year of data (2013) at two contrasting sites near San Francisco, California (“higher concentration” vs. “lower concentration”)
  • Results should not be generalized. Relationships and patterns likely vary for other geographic locations, monitoring equipment, etc.
  • 1-minute data provided by Mark Stoelting, Bay Area Air Quality Management District
Santa Rosa
(lower concentration)

Livermore
(higher concentration)

Daily Max 8-hour Ozone Concentrations from 01/01/13 to 12/31/13
Parameter: Ozone (Applicable standard is 0.075 ppm)
CBSA: San Francisco-Oakland-Fremont, CA
Count: Alameda
State: California
AQS Site ID: 06-001-0007, poc 1

May 2

Source: U.S. EPA AirData <http://www.epa.gov/airdata>
Generated: April 8, 2014
May 2: 1-minute value > 75 ppb but the daily max 8-hour is not
An Advantage to the initial ASGH focus on gaseous criteria pollutants is the large network of monitors.

Messaging for PM$_{2.5}$ is also under development.
Monitoring data is limited for most Hazardous Air Pollutants, i.e. what is “normal” more difficult to evaluate
Conclusions

• Lack of short-term health reference values for general population exposure

• Lack of short-term health effects studies

• Short-term new sensor data does NOT compare to National Ambient Air Quality Standards

• Short-term (minute-by-minute) air monitoring available for some criteria air pollutants, which can be used to communicate what is “normal”

• Major challenge is effective and appropriate communication

• ASHG is working to develop information to support interpretation of new air sensor data