# Preparing Our Environmental Enterprise for Advanced Monitoring



## *Clean Air Act Advisory Committee*

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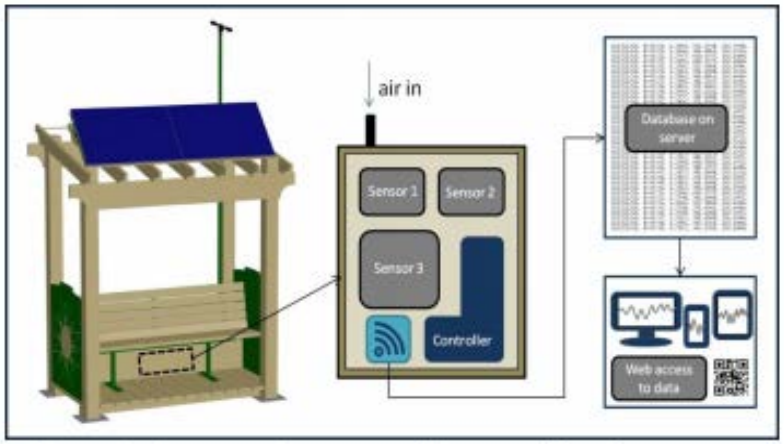
# The World is Changing




# Environmental Monitoring is Changing




*Air-monitoring system incorporated into a park bench.*

# New Technologies Will Revolutionize Environmental Monitoring



## Current Technology

- Expensive
- Big footprint to house
- May require expertise to use
- May require lab analysis
- Delays for QA

- Requires power drop
- Collected by government, industry, researchers

## New Technology

- Low cost
- Small footprint
- Easy-to-use
- Real-time
- Less or no gov't QA before release
- Mobile
- Collected by communities and individuals

# New Technologies Will Revolutionize Environmental Monitoring



## Current Paradigm

- Data collected for standards setting, compliance, research
- Data stored on gov't and university websites and on paper files

## Future Paradigm

- Data collected for community awareness, personal health, BMPs, ID'ing new "problems"
- More data, easier public access, stored on gov't and non-gov't websites

**These changes are happening outside the control or direction of EPA: they will happen to us and we will be reactive unless we prepare.**

# Working Definition of "Advanced Monitoring"



1. Not yet widespread in a sector or program;
2. Monitors real-time (or near), often without lab lag times;
3. Less expensive, easier to use, or more mobile;
4. Data quality more complete or easier to interpret for a specific need; and/or
5. Existing technology used in new way to provide better info on pollutants, pollution sources, or environmental conditions.

# Advanced Monitoring and the E-Enterprise Blueprint



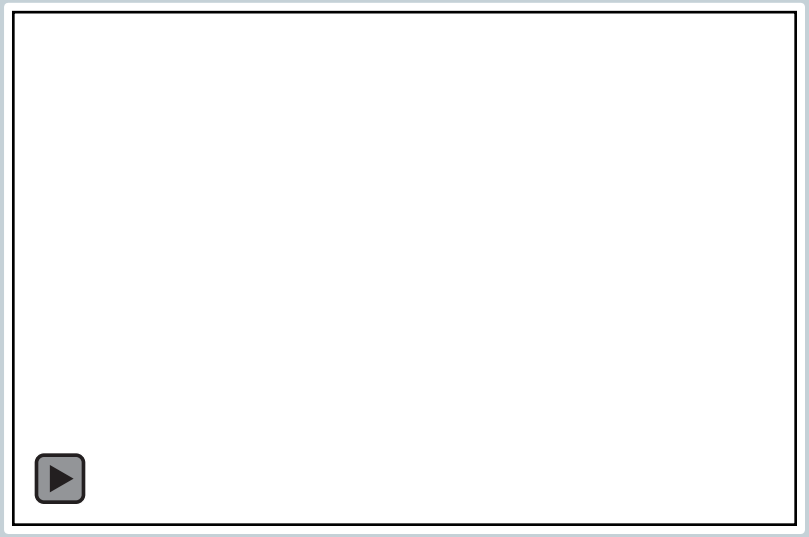
Principle #9, Component # 2: Advanced Monitoring Technologies and New Data Collection and Analysis Techniques

- Identify opportunities for business process improvement
- Practical resources
- Shared services

# Advanced Monitoring Will Improve Environmental Protection and Reduce Pollution



NPR story on industry use of advanced monitoring



Ability of individuals to make personal risk decisions

Targeted inspections and more effective enforcement

Local community awareness of environmental quality

# Democratization of Environmental Monitoring




Link to Example of Citizen Science - AirBeam

# Current and Future Uses of Advanced Monitoring Data



## Current Uses

- Targeting, research, or reconnaissance by government, academia, NGOs
- Persuading regulated sources that there is a problem
- Empowering communities and individuals with more information
- Educating students and communities about their environment
- Including in enforcement settlements

## Possible Future Uses (But Many Issues Remain)

- Substituting or supplementing regulatory monitoring in our permits, rules, enforcement actions, websites

# Piloting High Quality, Smaller, & Mobile Technologies for Monitoring



- Village Green
- GMAP
- Passive samplers for fenceline monitoring (proposed regulation)
- AirNow Pilot
- EPA National Aquatic Surveys

# Likely Challenges for EPA and States from Democratization of Monitoring: Communicating Risk



- Identified pollution may be low priority, outside statutory authority, or require expansion of regulatory monitoring network
- Poor quality or misused monitors
- Readings may not have regulatory standard or health/environmental risk data at same duration (e.g., 1 minute versus 8 hour average)

# Likely Challenges for EPA and States: Keeping Up with New Technologies



- Pressure to update existing reference methods
- Need to expand data systems to collect, display, and explain this data
- New analytical methodologies to extract useful information from larger datasets with (potentially) lower quality measurements, but greater coverage

# EPA Working to Prepare for Advanced Monitoring



- EPA Air Sensors Evaluation Report
- EPA/State Monitoring and Assessment Partnership
- Air Sensors Citizen Science Toolbox
- Air Sensors Guidebook
- ORD grant to fund research on communities use of sensors
- Interagency Nutrient Sensor Challenge

Village Greens

- Durham, NC
- Oklahoma
- Connecticut
- Philadelphia, PA
- Washington, DC
- Kansas

Infrared Cameras

- R1 - New Hampshire
- R2 - New York, New Jersey
- R3 - West Virginia
- R4 - Kentucky
- R5 – Michigan, Hamilton County, OH
- R6 - New Mexico, Louisiana
- R8 - North Dakota
- R10 - NW Clean Air Agency/Puget Sound Clean Air Agency, WA

# EPA Working to Prepare for Advanced Monitoring: Continued



- OW/interagency to develop common data elements for data sharing
- OAR, with assistance of groups within and outside of EPA, to develop guidance on interpreting sensor measurements
- The Aquatic Sensor Workgroup ensuring that water data collected by sensors are known and documented quality

# State-EPA Collaboration



**Looking at issues such as:**

- Implications for rules
- Implications for inspections
- Low cost-sensors
- Use by industry
- Use by citizens
- Transparency and risk communication

# Near-road monitoring

# Near-Road Monitoring Specifics



- Multi-pollutant near-road sites will fill a number of current data gaps:
  - Improved understanding of human exposure on and near roads
  - Improved understanding of pollutant behavior, interaction, and dispersion in the near-road environment

- Required Metrics:
  $NO_2$, CO, $PM_{2.5}$

- Optional Metrics:
  Black Carbon, Ultrafine PM, Air Toxics, Ozone, Meteorology, Traffic Count

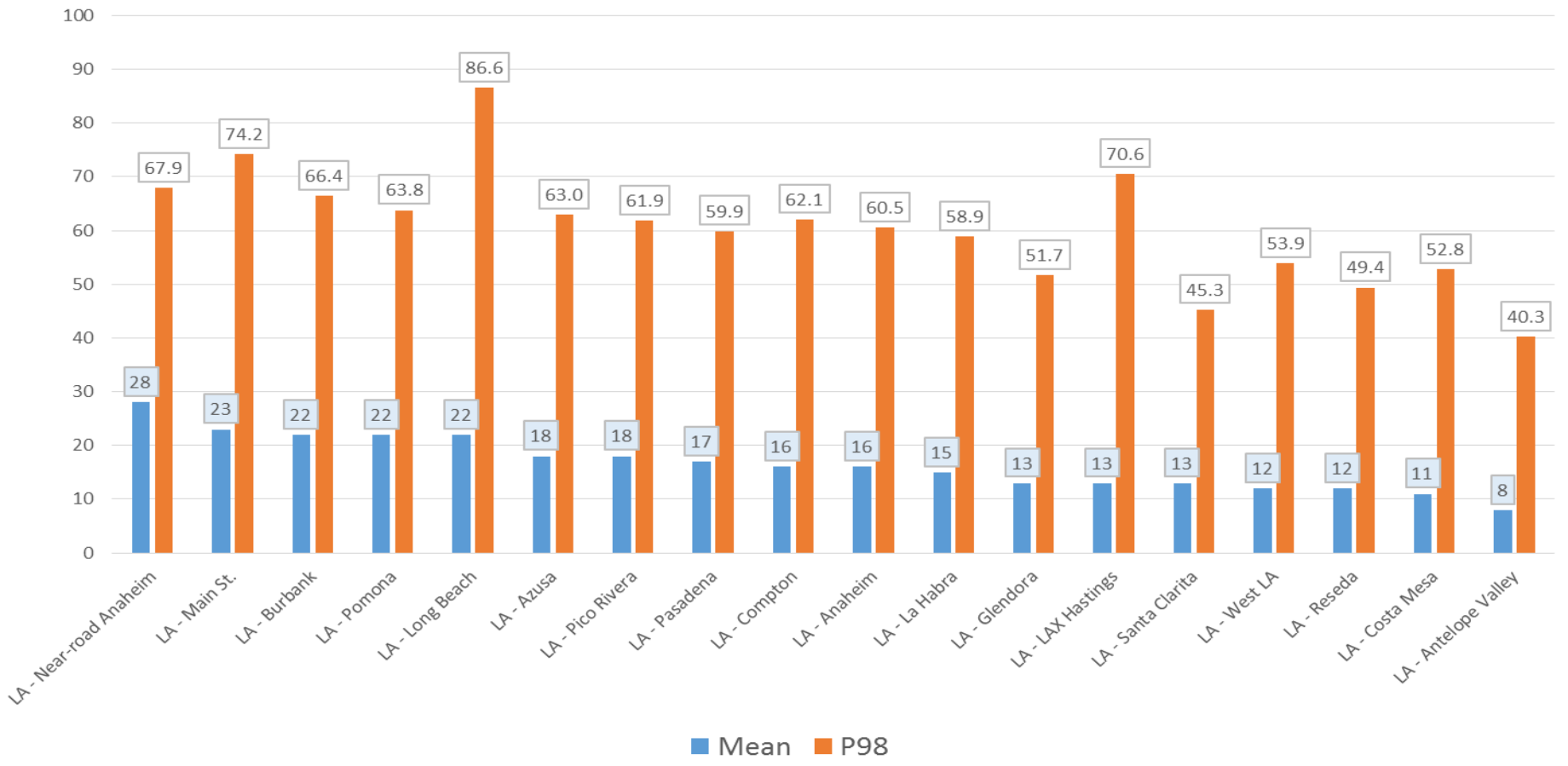
# Near-road Network Installation



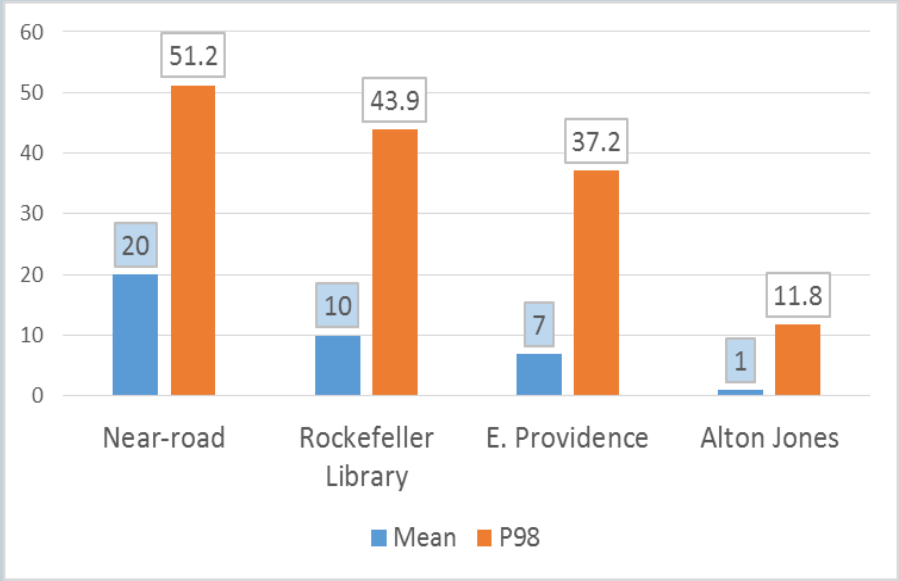
| Implementation Phase | CBSA Population | $NO_2$ | CO* | $PM_{2.5}$* |
|---|---|---|---|---|
| *Phase 1*<br>52 Sites<br>[funded] | ≥ 1 Million | Jan 1, 2014 | Jan 1, 2015 for CBSAs ≥ 2.5M<br><br>Jan. 1, 2017 for CBSAs ≥ 1M and ≤ 2.5M | Jan 1, 2015 for CBSAs ≥ 2.5M<br><br>Jan. 1, 2017 for CBSAs ≥ 1M and ≤ 2.5M |
| *Phase 2*<br>23 Sites<br>(second sites)<br>[funded] | ≥2.5 Million **OR** road segment ≥250,000 AADT ($NO_2$ only) | Jan 1, 2015<br>(second site) | | |
| *Phase 3*<br>51 Sites<br>[unfunded] | Between 500K and 1 Million | Jan 1, 2017 | | |

# Los Angeles – CBSA wide $NO_2$ (ppb)

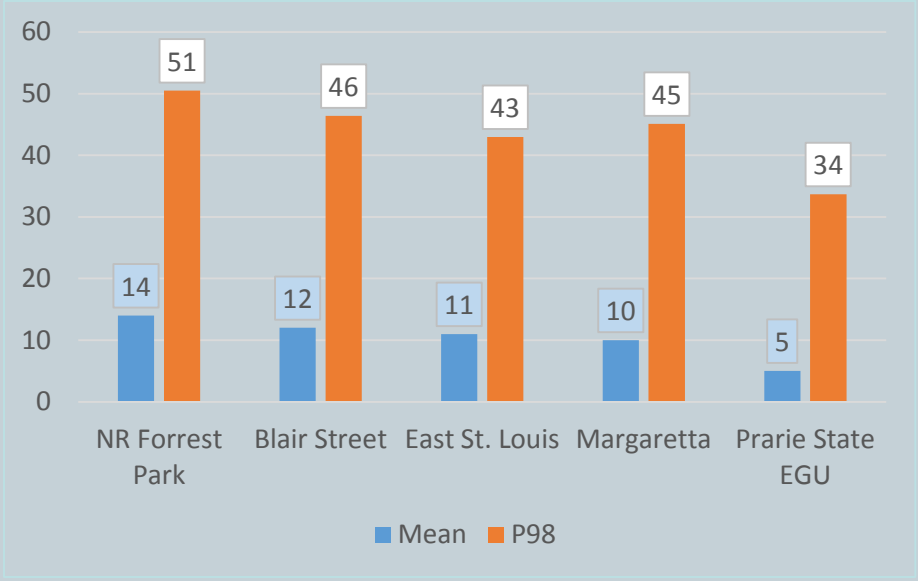




# Providence – CBSA wide $NO_2$ (ppb)




# St. Louis - CBSA wide $NO_2$ (ppb)



# Selected 2014 Near-road $NO_2$ Data Reported to AQS

| CBSA | 1-Hr Max. | Mean | ~98$^{th}$ % 1-hr daily max | Obs. (hrs) |
|---|---|---|---|---|
| Atlanta | 57.9 | 20.0 | 50.3 | 4658 |
| Austin | 56.8 | 14.0 | 48.4 | 5840 |
| Baltimore | 56.0 | 18.0 | 50.6 | 6538 |
| Birmingham | 67.3 | 14.0 | 51.1 | 8107 |
| Boise | 48.4 | 9.0 | 43.6 | 3483 |
| Boston | 64.0 | 17.0 | 53.0 | 8288 |
| Buffalo | 49.5 | 10.0 | 40.1 | 6366 |
| Charlotte | 43.6 | 11.0 | 37.6 | 4360 |
| Cincinnati | 68.0 | 23.0 | 59.0 | 8546 |
| Columbus | 53.0 | 12.0 | 47.0 | 8343 |
| Dallas | 58.2 | 10.0 | 40.0 | 6414 |
| Denver | 96.8 | 25.0 | 69.6 | 8083 |
| Des Moines | 41.1 | 9.0 | 34.9 | 8310 |
| Detroit | 62.0 | 16.0 | 51.0 | 8584 |
| Hartford | *** | 14.0 | 49.0 | 8470 |
| Houston | 55.1 | 13.0 | 48.4 | 7918 |
| Indianapolis | 64.4 | 17.0 | 58.1 | 7582 |
| Jacksonville | 70.0 | 12.0 | 44.0 | 5846 |
| Kansas City | 52.1 | 12.0 | 45.6 | 6333 |
| Los Angeles | 78.8 | 28.0 | 67.9 | 4158 |

**UNITS in PPB - PRELIMINARY DATA ANALYSIS - DO NOT CITE OR QUOTE**

***Statistics calculated from available 2014 data***

# Selected 2014 Near-road $NO_2$ Data Reported to AQS

| CBSA | 1-Hr Max. | Mean | ~98$^{th}$ % 1-hr daily max | Obs. (hrs) |
|---|---|---|---|---|
| Louisville | 69.8 | 14.0 | 47.9 | 5099 |
| Memphis | 48.4 | 12.0 | 47.5 | 1991 |
| Milwaukee | 61.7 | 16.0 | 53.2 | 8247 |
| Minneapolis | 53.0 | 16.0 | 48.0 | 8610 |
| Nashville | 57.0 | 14.0 | 56.0 | 1949 |
| New Orleans | 64.0 | 12.0 | 48.0 | 6663 |
| New York | 258.0 | 19.0 | 90.0 | 4224 |
| Philadelphia | 65.0 | 16.0 | 51.4 | 8230 |
| Phoenix | 62.0 | 21.0 | 59.0 | 7583 |
| Pittsburgh | 42.1 | 13.0 | 39.7 | 2769 |
| Portland | 48.6 | 12.0 | 38.5 | 4705 |
| Providence | 55.9 | 20.0 | 51.2 | 6328 |
| Raleigh | 41.2 | 10.0 | 36.1 | 6717 |
| Richmond | 54.1 | 14.0 | 44.7 | 6293 |
| S.F. – Oakland | 64.6 | 17.0 | 51.7 | 7558 |
| San Antonio | 51.0 | 11.0 | 45.5 | 8135 |
| San Jose | 64.9 | 20.0 | 51.6 | 2781 |
| Seattle | 90.7 | 24.0 | 69.1 | 5560 |
| St. Louis | 71.7 | 14.0 | 50.5 | 6229 |
| Tampa | 59.0 | 12.0 | 45.0 | 6252 |

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