The New Normal In Air Monitoring

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In the beginning

State/Local/Tribes operated monitoring stations with many monitors with large footprints

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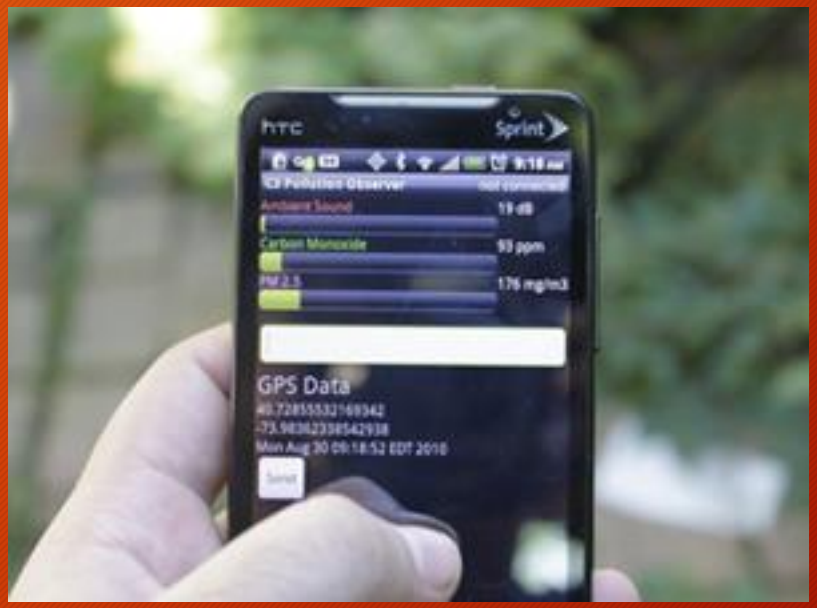
Now…

A Village Green Bench, an EPA research project totally powered by sunlight and wind turbine, with Bluetooth! The bench typically monitors for ozone and PM2.5, some also measure NO2.

Or…

To perhaps even this hand held phone app…



Looking to the future

- We’ve come a long way, baby!
- Technology has a way of driving the air monitoring discussion towards possibly a new norm
- Sensors are inexpensive, computing hardware and software are also cheaper, and there is an enormous interest in the academic, industrial, and research fields to develop a product for commercialization
- Can it work?

Regulatory vs. Non-Regulatory Monitoring

7/30/2015

Regulatory Monitoring

- The “Gold Standard”
  - Requires very sophisticated and well-established instrumentation to meet measurement accuracy requirements and an extensive set of procedures to ensure that data quality is sufficient
  - Requirements (e.g., calibration, maintenance, audits, data validation) help ensure the collection of high-quality data
  - Data collected are used for compliance with national standards
  - Monitoring methods are either Federal Reference Methods (FRM) or Federal Equivalent Methods (FEM)

Regulatory Monitoring (cont.)

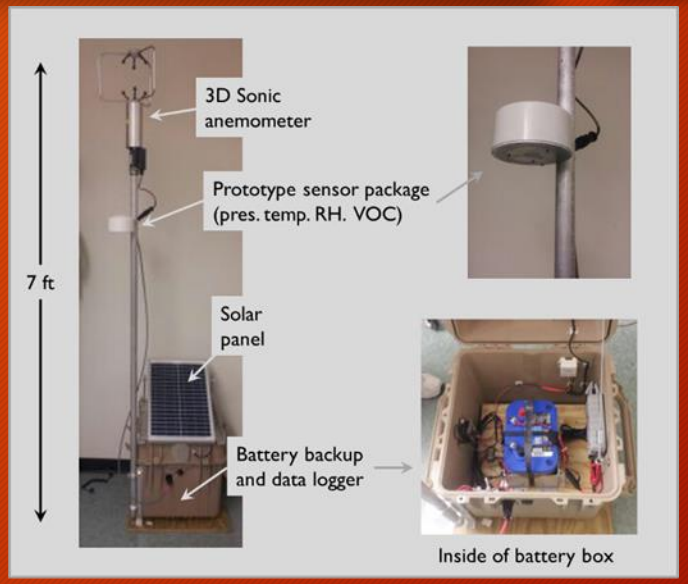
- The “Gold Standard”
  - Office of Research and Development (ORD) is responsible for developing new or revising existing monitoring methods
  - Monitoring methods must undergo extensive data analysis and testing before it is proposed/approved to be an FRM or FEM

Innovative methods on the horizon

- Region 3 has participated with ORD in developing lower cost, passive VOC samplers and air sensors around a petroleum refinery, from June 2013-March 2015
  - The resulting data would support the finalization of draft Methods 325A and 325B for fenceline monitoring at petroleum refineries

ORD Passive VOC and Air Sensors Project

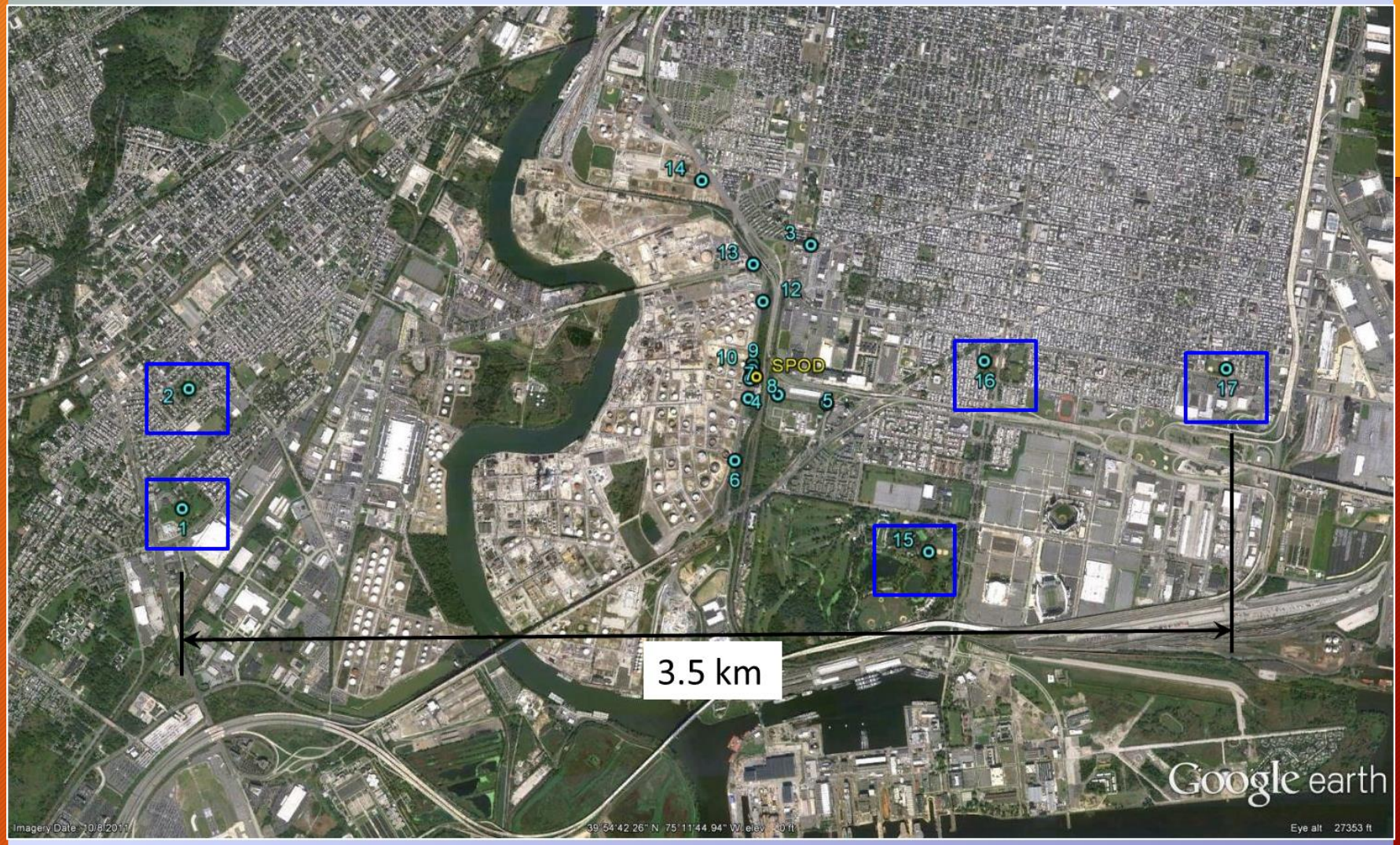
Passive VOC samplers



Air Sensors

Deployment Examples

South Philadelphia Study (started summer 2013)



17 Tier 1 PS sites with future Tier 2 sensor deployments

ORD Passive VOC and Air Sensors Project

- Data being evaluated by ORD
- Methods 325 A and B were proposed as part of EPA's fenceline monitoring rule for petroleum refineries (June 30, 2014)
- Final rule due Sept. 30, 2015

Non-Regulatory Monitoring

- Changing monitoring technology in US and internationally
  - Smaller in size (many using sensors)
  - Requires less support infrastructure
  - Capable of operating autonomously
  - Lower costs (both in purchase and operation)
- This evolution of air monitoring:
  - Has the potential to supplement regulatory air pollution monitoring networks
  - Data can fill spatial data gaps
  - Can provide information on operating processes to facility managers and inspectors
  - Promote community engagement
  - Support air pollution research

Village Green Project

- Region 3 coordinated another ORD project called Village Green with State and Local partners (Philadelphia Air Management Services and DC Dept. of Environment) that sited 2 “benches” using sensor technology operating on solar and wind power to monitor ozone and PM2.5
- Village Green benches provides real-time data for the public (http://www.airnow.gov/index.cfm?action=airnow.villagegreen)
- This 1 year research project will also assess the efficacy of operating this new technology which will compare collected ambient results with nearby air monitoring stations

R3 Village Green Projects

Independence Mall, Philadelphia

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National Zoo, District of Columbia

http://www.airnow.gov/index.cfm?action=airnow.villagegreen

Village Green Project

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Village Green Project

Select a City Philadelphia, PA Menu

Most Recent Observations
Philadelphia, PA

15 Ozone ppb

10 $PM_{2.5}$ $\mu g/m^3$

81.9 °F

83.9% humidity

1.6 mph SW

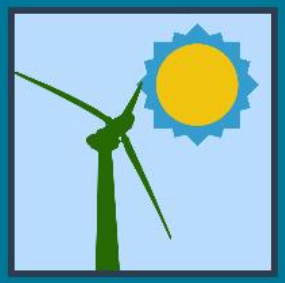
observed Tue 7:18 AM EDT

Explore Philadelphia, PA

Welcome to the Village Green Project

a research effort to discover new ways of measuring air quality and weather conditions in community environments.

Measuring and communicating on-the-spot air quality and weather conditions for research and awareness



Developing small and rugged data collection systems that can be powered by the wind and sun

Partnering with communities to pilot test the new technology in outdoor community spaces.

7/30/2015

100%

7:23 AM
7/7/2015

The Best of Times…???

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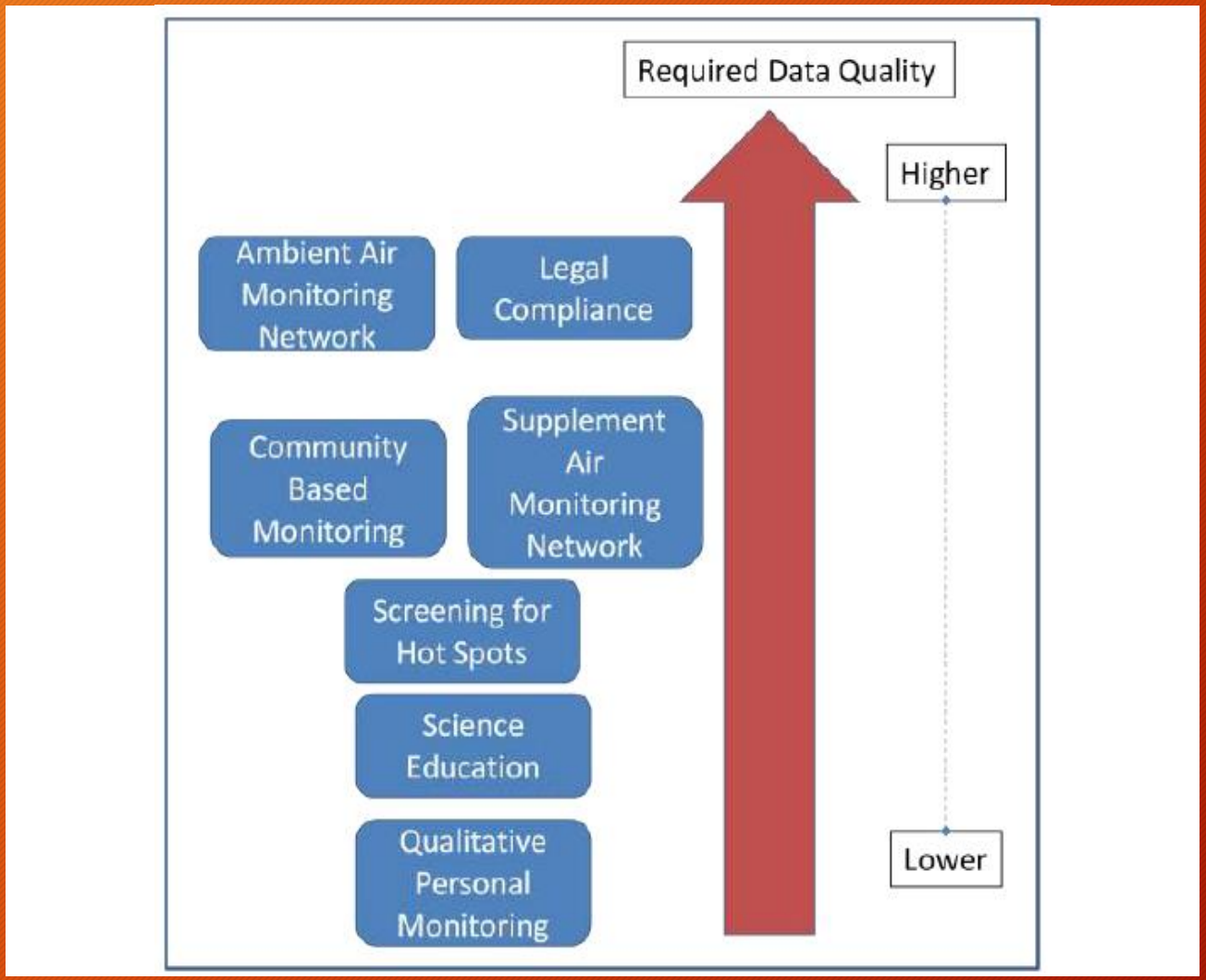
Cautionary Notes

- Communication and education are key!
- National Ambient Air Quality Standards (NAAQS) for 6 common pollutants (O3, PM, SO2, NO2, CO, and Pb) are monitored by S/L/T networks
- Each pollutant have different data handling requirements– it is very important for the user to consider the time period (daily annual or annually over 3 years) over which the pollutant level was measured
  - i.e. the daily (24 hour) PM2.5 standard is 35 ug/m3. Because the standard is based on the average of hourly monitoring measurements over a 24-hour period, it does not mean that a single PM2.5 measurement taken over a few minutes, or even hours, above 35 ug/m3 is cause for immediate concern

Regulatory vs. Non-Regulatory Monitoring have very different Data Quality Requirements



Cautionary Notes (cont.)

- Air pollution sensors are still in an early stage of technology development, and many sensors have not yet been evaluated to determine the accuracy of their measurements
- EPA has specific guidelines it must use in establishing regulatory-grade air monitors
- No lower cost sensors currently meet these strict requirements or have been formally submitted to EPA for such a determination

Cautionary Notes (Cont.)

- The actual health effects of very short term elevated levels of most pollutants are not well understood and EPA has not established health information defining such short-term pollutant exposures
- It is important for the user understand how regulatory monitoring differs from research monitoring

Cautionary Notes (cont.)

- Citizen Science
  - Lots of interest from students, communities, environmental groups
  - EPA ORD is championing the role of citizen science with webinars, conferences
  - EPA Region 2 has a citizen science website for air (http://www.epa.gov/citizenscience/air.html)
  - While it helps with research, it is important to manage overall expectations

Moving Forward

7/30/2015

What does the future bring?

- EPA is evaluating some very promising types of low cost samplers and air sensors for regulatory purposes
- Independently, interested parties are purchasing and deploying numerous equipment to gather air data with different rates of success, i.e., obtaining meaningful information
- Citizen Science data sent to State/Local air monitoring agencies stretches already limited resources

What does the future bring?

- It would be helpful for interested parties to first get informed about air monitoring and using air sensors before purchasing equipment and deploying them
- It is important to understand what you are monitoring, how you are monitoring, and what the data collected means…EPA ORD has put together resources for Citizen Scientists!

Important References

EPA Resources:

http://www2.epa.gov/air-research/next-generation-air-measuring-research

Citizen Science Toolbox

http://www.epa.gov/heasd/airsensortoolbox/

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What does the future bring?

- What's the takeaway message?
  - Regulatory monitoring requires strict protocols because the data it collects must be defensible
  - Research monitoring is informative to the user(s) and does not have to meet the rigors of legal compliance requirements
  - Results from research monitoring may help inform but not supplant regulatory monitoring results
  - Until new technologies get regulatory approval, it's important to keep these distinctions

Questions?