The Future of Environmental Monitoring:

Making the Invisible Visible

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U.S EPA Perspective

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Close your Eyes

Merging Monitoring Sensors with IT

- Citizen hand held sensors
- GPS
- Sensors – CO, NO2, O3
- Smartphone – App
- Data uploaded – help provide air quality info

Citizen Science

Monitoring paradigm change

- More complete, timely, accessible information
- Democratization of monitoring
- Government and industry will have less control of data collection and access

Promise of Advanced Monitoring

- Reduce pollution through:
  1. More effective regulatory monitoring
  2. Better information for sources to prevent, reduce, treat
  3. Public accountability drive improved performance
  4. More effective government inspections and enforcement actions

Advanced Monitoring Across EPA

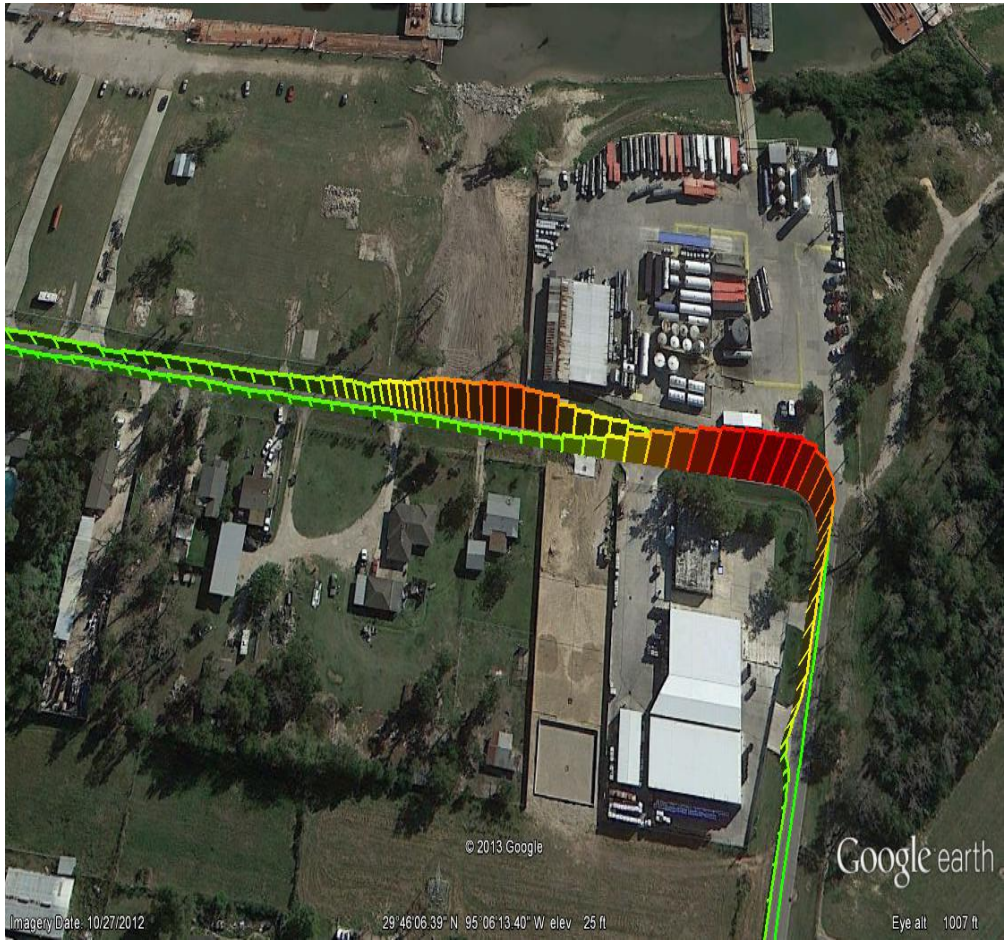
- Next Generation Compliance
- Next Generation Air Monitoring
- Citizen Science
- Water Technology Blueprint
- E-Enterprise for the Environment

Using Advanced Monitoring for Targeting/ Scouting
Example: Geospatial Monitoring for Air Pollution (GMAP)

- Real Time Analysis
- Drive-by Mapping
- Position Vehicle
  - Locate Plume
- Sensors Monitor Pollutants
  - Methane
  - BTEX
  - H2S
- Weather Conditions
- Monitoring conducted at various locations

Geospatial Monitoring for Air Pollution, cont.

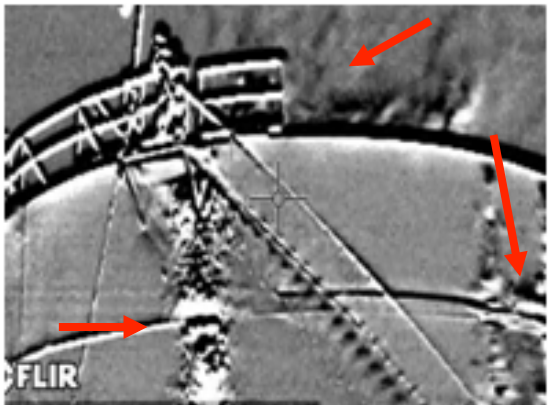
- Mapping output
  - Concentration Levels
  - Wind Direction
- Monitoring Path
  - Between facilities
  - Perimeter
  - Within
- Region 6 Facility
  - Benzene detection
  - Un-authorized emission
  - Non-reporter
  - Source was a tank
  - Leak was fixed.



Infrared Cameras

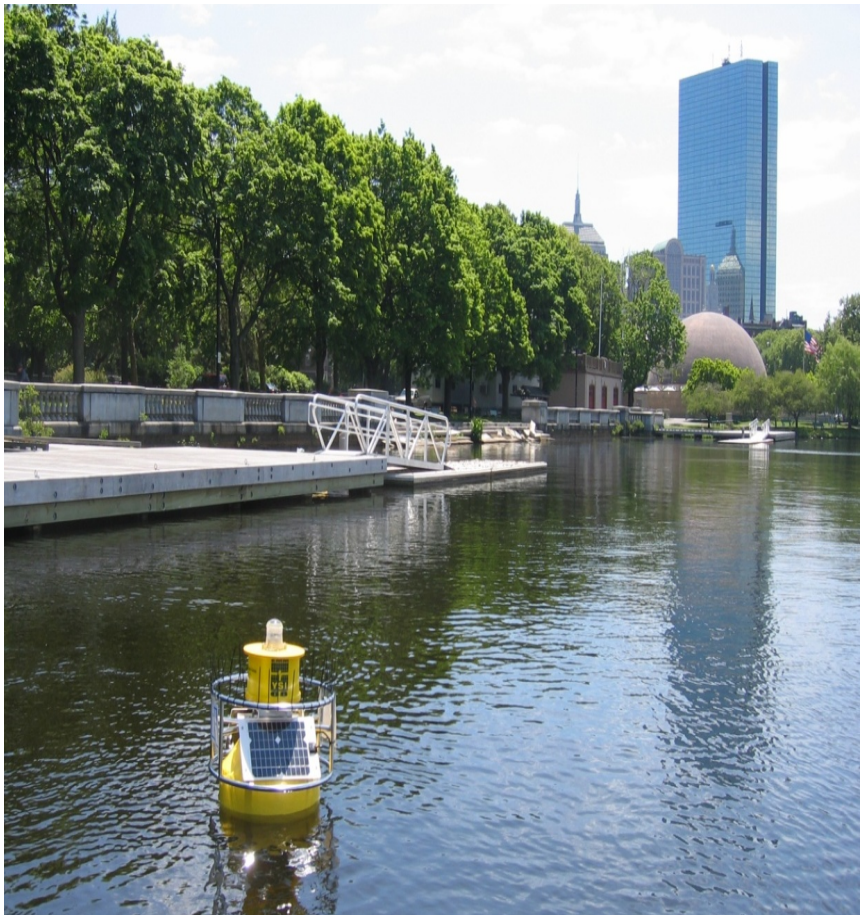
"Making the invisible visible"

- *Example:* infrared camera reveals a hazardous organic NESHAP storage tank leaking benzene and toluene from a bad seal
- Extrapolate compliance and pollution reduction outcomes facility- and nationwide



Real-Time Monitoring for Cyanobacteria in the Charles River, MA

- Water Quality Sonde mounted on Solar Powered Buoy
- 15 minute measurements
- Data uploaded to website
- Several parameters
  - Temperature
  - Conductivity
  - pH
  - Dissolved Oxygen
  - Turbidity
- Used in Rivers (Region 1)



Drop-in Place Sentinel Pod

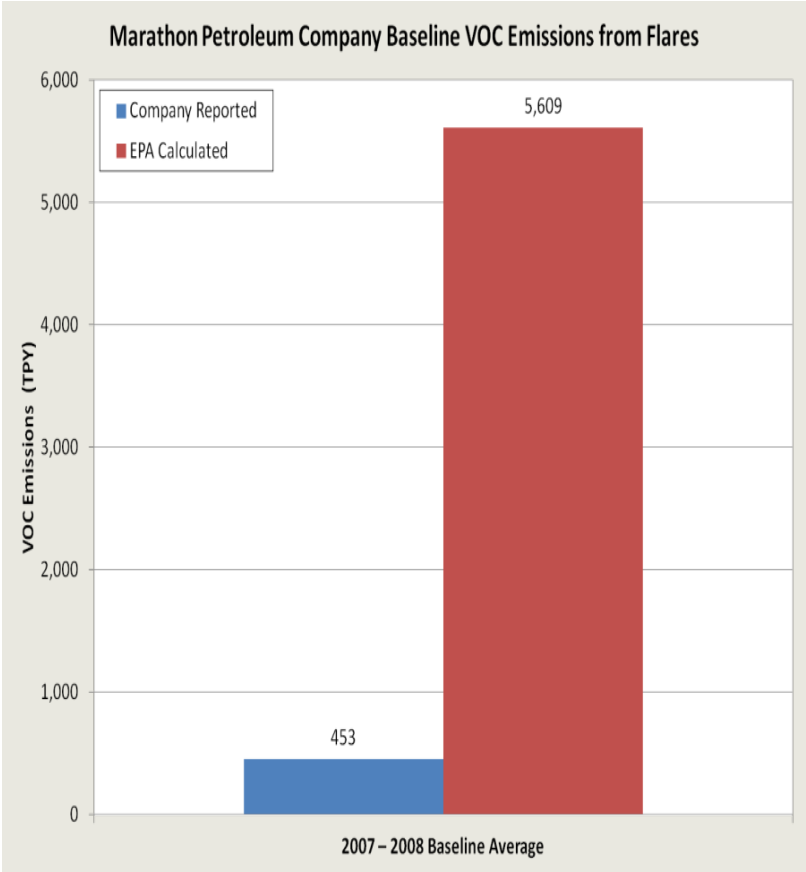
- Portable Sensor
  - VOCs
  - Temperature
  - Relative humidity

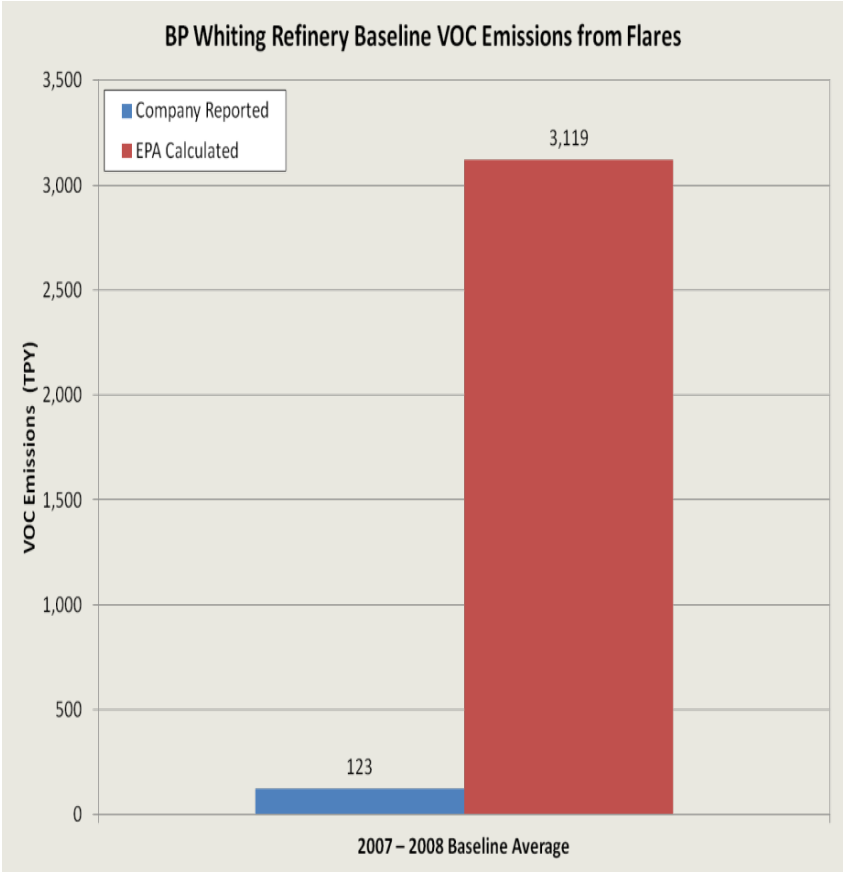
- Prototype – ORD
  - Solar Powered
  - Battery Powered
  - Data Logger
- Address community concerns
- Next step: to begin field testing

Using Advanced Monitoring To Persuade & Prove : Passive FTIR Open-Path Monitor

- Testing of flares to determine combustion efficiency
- PFTIR works by measuring flare plume gases
- We found many flares with poor combustion efficiency that emitted substantial amounts of VOCs

Advanced monitoring in flare enforcement – 'Estimating v. Knowing' -





PFTIR data showed that actual emissions (in red) at Marathon and BP were *25 times and 10 times greater*, respectively, than the companies' best engineering estimates (in blue)

Example - Incorporating Next Gen in Settlements

CAA settlement with Shell Deer Park (Texas)

- Next Gen tools included in settlement:
  - Innovative technology to reduce pollution from flairs
  - Enhanced in-plant monitoring for benzene
  - Regular tank inspections with infrared camera
  - Fence line monitoring for benzene
  - Report fence line data on public web site

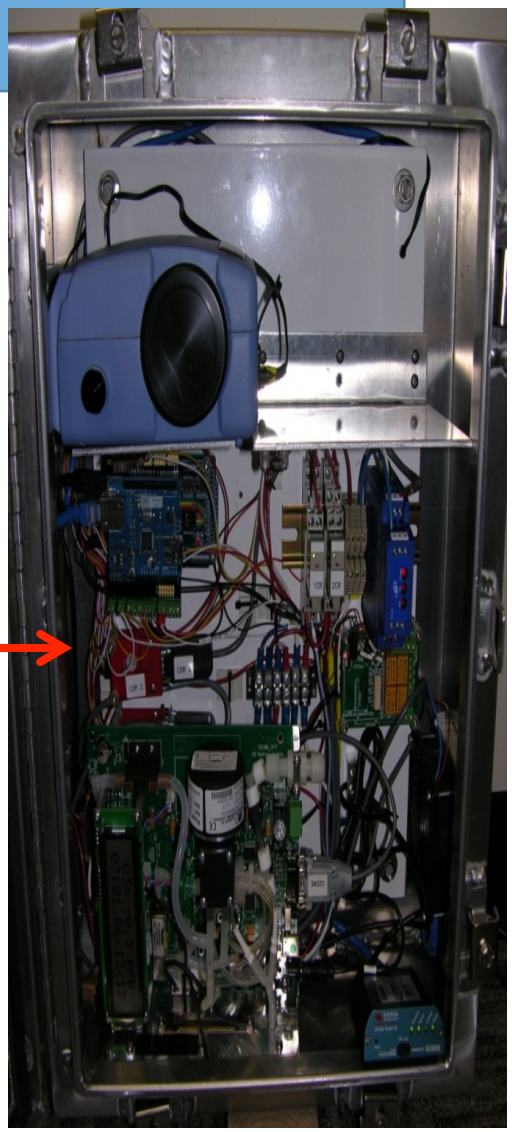
Village Green Prototype

Park Bench

- Durham, NC Library
- Meteorological Instruments
- Solar Powered

Components Stored Behind Bench

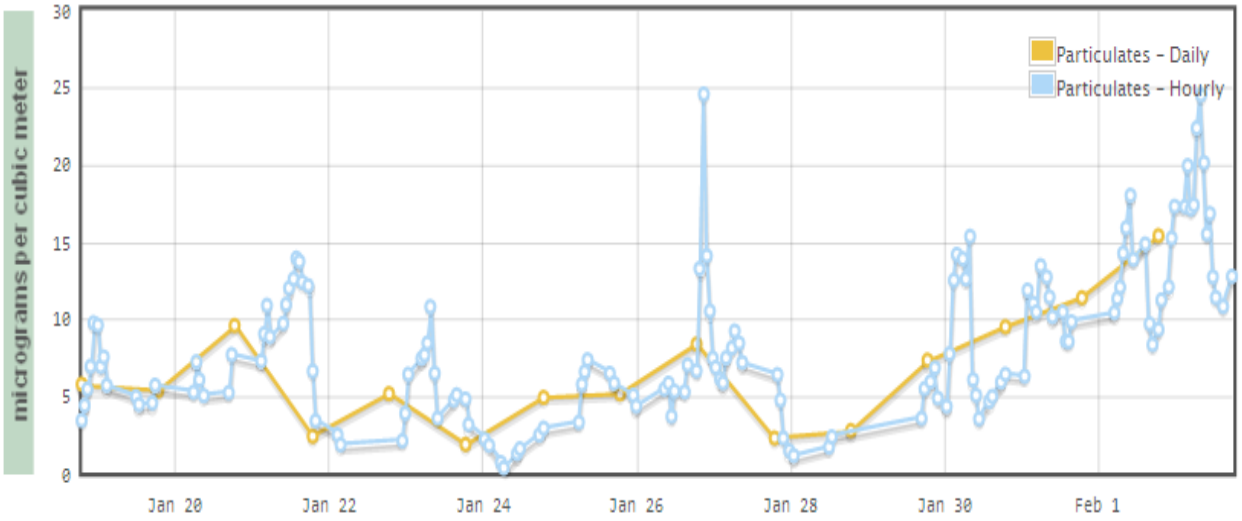
- Air Sensors (PM & Ozone)
- Communications Component
- Power System



Village Green Prototype

Public Website

- http://villagegreen.epa.gov/
- Updated Minute-by-Minute
- Weather and Air Quality Data



Emissions Data

- Daily Rate
- Hourly Rate

Citizen Scientists Win Big in upstate New York.wmv

Citizen Science Toolbox

1. Basic SOP for hand-held sensors
2. One-page, quick-start guide
3. Training materials on sensor use
4. Guidance and deployment based on pollutants and sources
5. Basic ideas for data analysis, interpretation, and communication

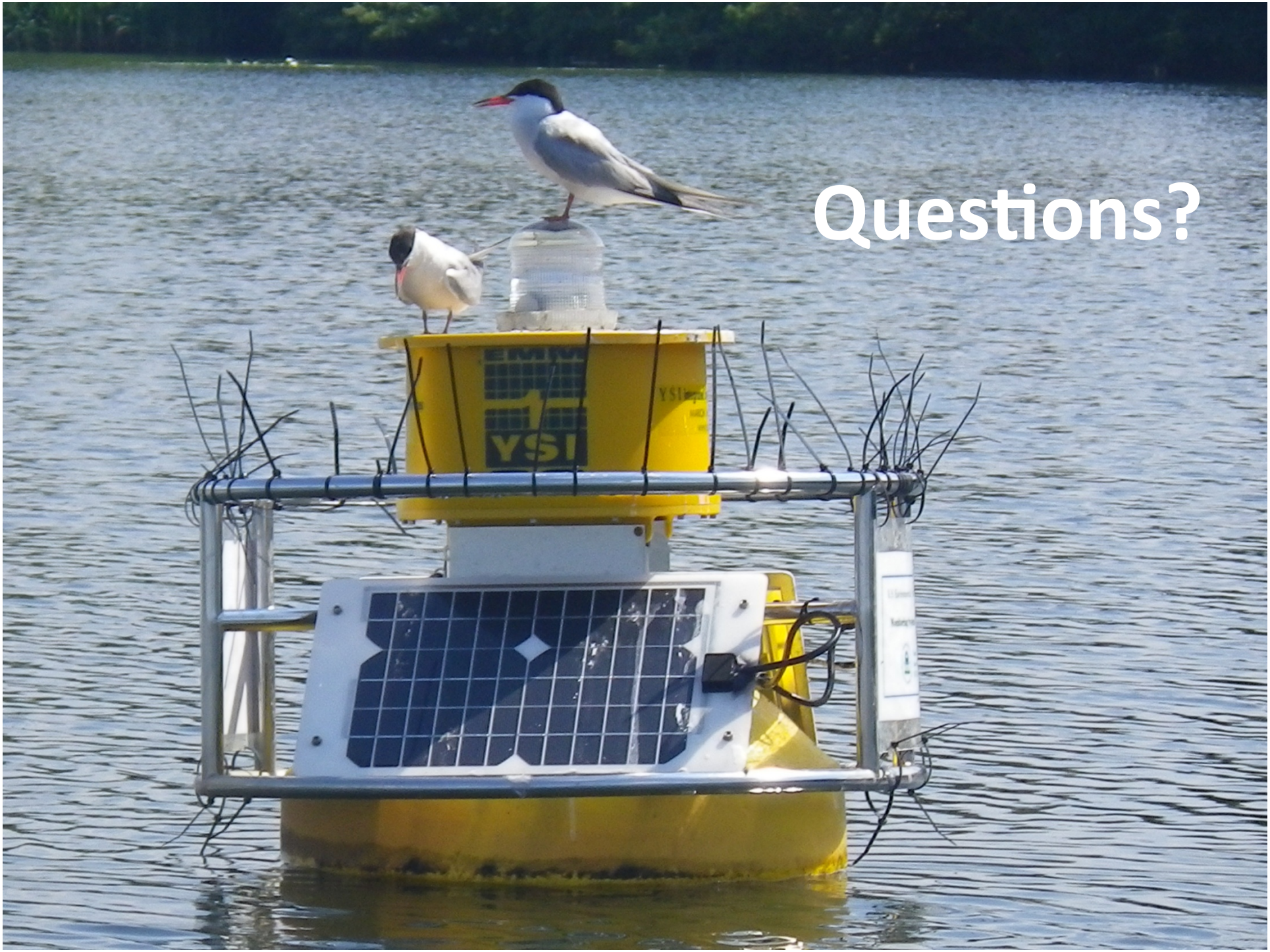
http://www.epa.gov/heasd/airsensortoolbox/

Air Pollution Monitoring In Communities

- Last month EPA announced new grant opportunity for air pollution monitoring
- Help get sensors to communities
- Increase understanding of air pollution at local level
- Evaluate the quality of the data

Challenges of Advanced Monitoring

- Democratization of monitoring and responding to citizen concerns and questions
- Will new low cost sensors have sufficient, known quality for intended purposes?
- Interpreting short-term monitoring
  - E.g., what does it mean to have a 20 second exposure that exceeds an 8 hour average?
- Large and crowd sourced data sets


Questions?
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