Air Sensors – An EPA Perspective

CAAAC Meeting

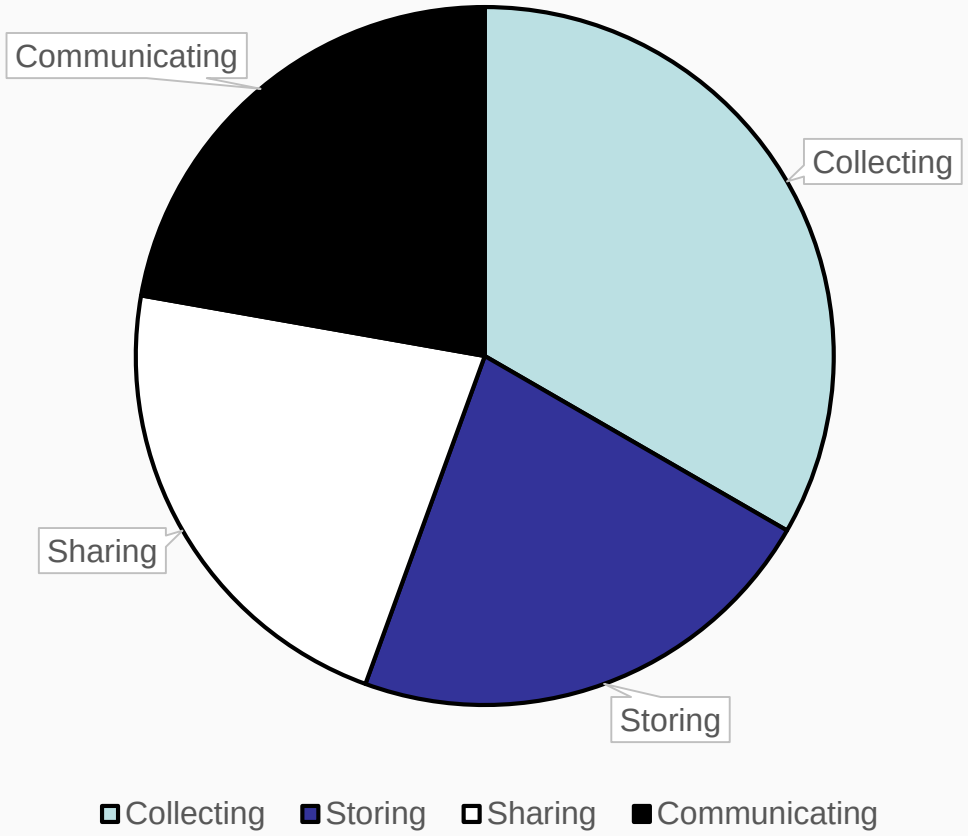
September 27, 2018

Kristen Benedict
Office of Air Quality Planning & Standards
U.S. Environmental Protection Agency

Disclaimer: Material presented is for informational purposes only. EPA does not recommend nor endorse any particular sensor product or data management platform.

Collection of Air Data

Air Quality - Traditional Government Role



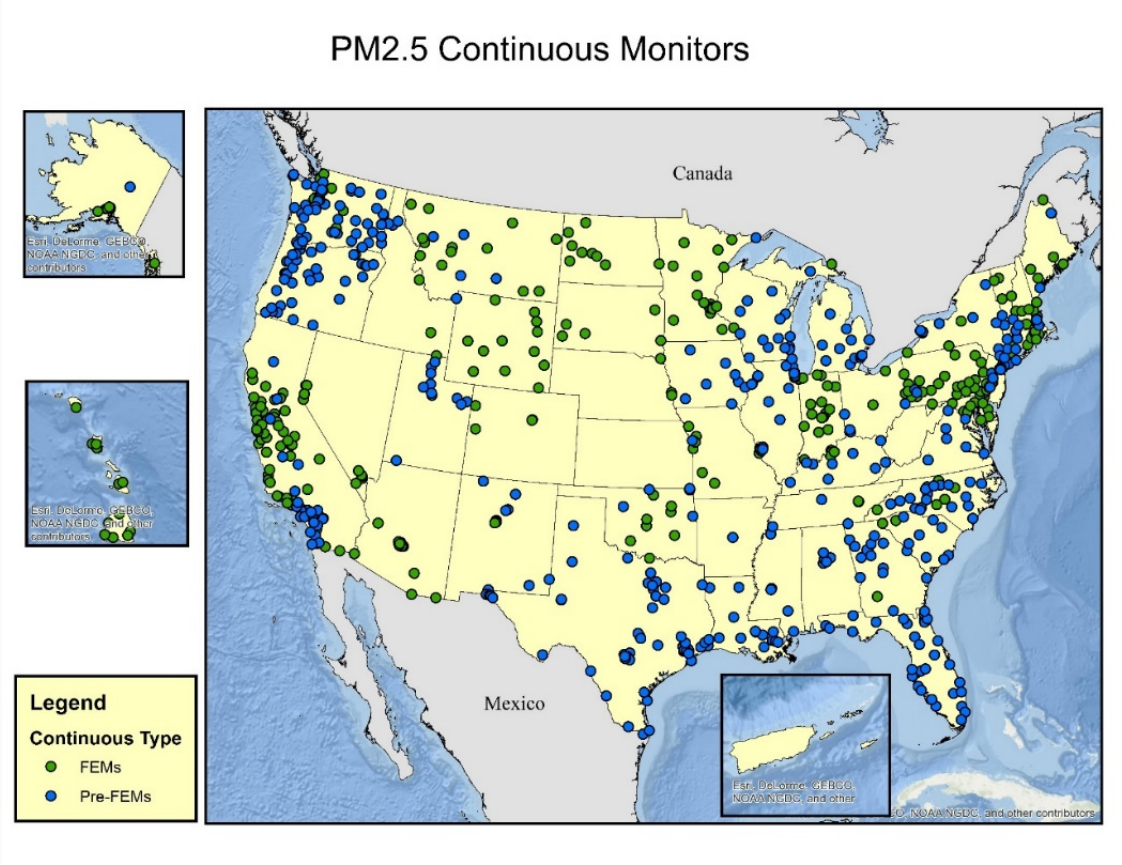
Air Quality – Complex Current State

Data Sets
Sensors
Satellites
Monitoring networks

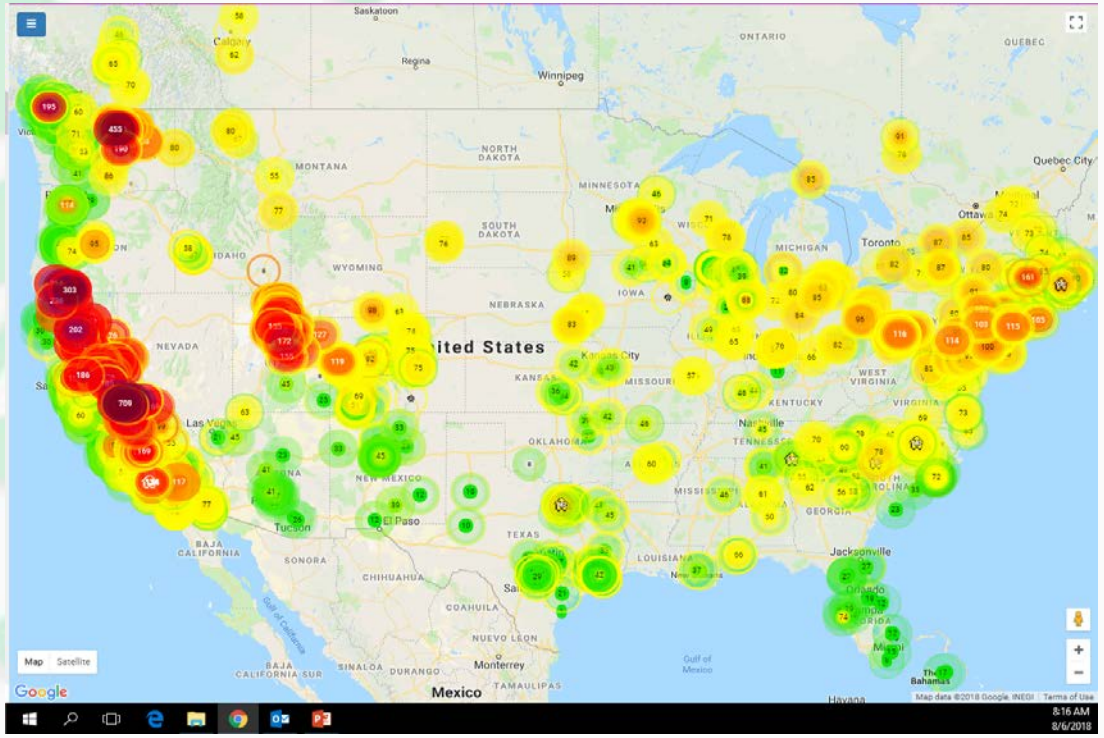
Participants
Citizens/Communities
Researchers/Academics
Nonprofits
Businesses
Governments

Information Technology
Cloud storage
Data access
Advanced analytics
Visualizations
Consumer products

Ambient $PM_{2.5}$ Monitoring October 2016

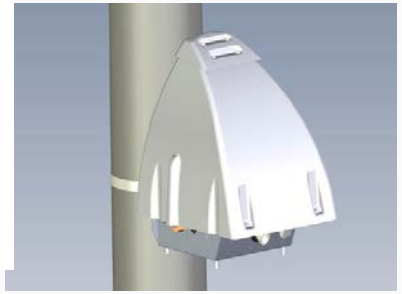


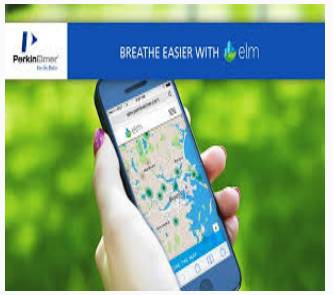
Sensor Vendor $PM_{2.5}$ Monitoring August 2018



Video: Aclima and Google Driving in California

Low Cost Sensors & Real-time Data





2018 Air Sensors International Conference

Oakland, CA September 12-14th, 2018

Conference Numbers:

518 Attendees

237 Individual Presenters

149 Podium Presentations

106 Poster Display Presentations

49 Minute Madness Presentations

45 Exhibitors

International Travelers From:

Canada
China
France
Germany
Ghana
India
Israel
New Zealand
Norway
Philippines
Taiwan
The Netherlands
The UK
Senegal

U.S. Travelers From:

California
Colorado
Georgia
Iowa
Maryland
Massachusetts
Minnesota
New York
North Carolina
Ohio
Oklahoma
Oregon
Pennsylvania
Washington
Washington D. C.
Wisconsin

https://asic.aqrc.ucdavis.edu/

Literature Review Findings - Application Categories

- Air quality forecasting
- Air quality index (AQI) reporting
- Community near-source monitoring
- Control strategy effectiveness
- Data fusion
- Emergency response
- Epidemiological studies
- Exposure reduction (personal)
- Hot-spot detection
- Model input
- Model verification
- Process study research
- Public education
- Public outreach
- Source identification
- Supplemental monitoring

Opportunities

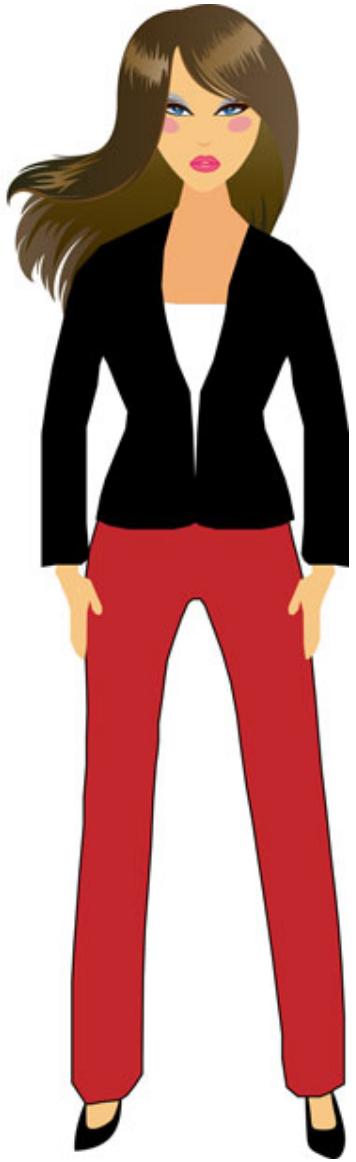
Include, but are not limited to:

- Exceptional events
- Siting regulatory monitors
- Model validation
- Identifying hot spots
- Better understanding local air quality

https://www.youtube.com/watch?v=ZRrw05wUxVI&feature=youtu.be

Advancing Sensors: Focus Areas

1. Data Quality
2. Data Interpretation
3. Data Management



“A Burning Question”

- FRM/FEMs = 7
- Temp Monitors = 10
- Sensors = 30 (3 Vendors)
- Decisions
  - Use sensor data?
  - How?
  - Risk strategy?

Deadline - 9/28/18

https://www.sacbee.com/news/state/california/fires/article216227775.html

What we heard…

- Mixed performance findings in the literature
- Desire for certification, but how and for whom?
- Binary vs. tiered
- Critical performance attributes
- International initiatives
  - Tiered approaches

Deliberating Performance Targets for Air Quality Sensors (June 25-26, 2018)		
Attendee	**Approximate % of Various Groups**	**Note**
International	8%	~700 registered participants representing dozens of countries
Private Sector/Manufacturers	26%	
Academics	22%	
State/Local/Tribal Agencies	25%	
Community Groups/Nonprofits	5%	
EPA & Other Federal Government Agencies	14%	

https://www.epa.gov/air-research/presentations-deliberating-performance-targets-air-quality-sensors-workshop

Data Quality

- Lack of systematic data quality characterization
- Disparity in how well technologies perform under various meteorological conditions
- Variations in meeting basic data quality indicators of performance (e.g. accuracy and precision)
- Uncertainty in how long the devices perform over time
- Questions in accuracy of measurements near sources

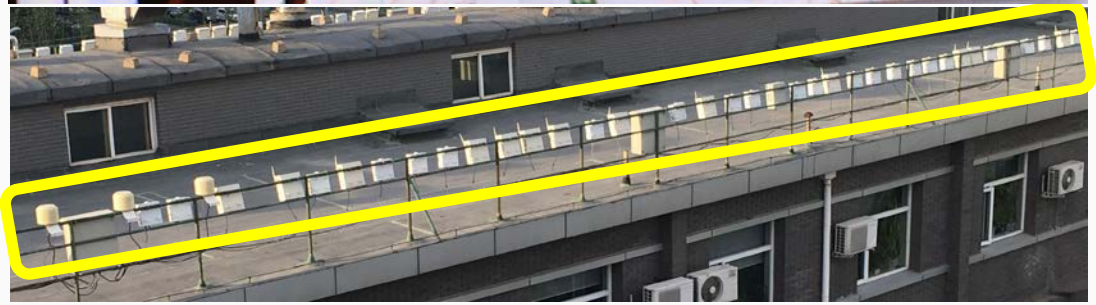
International Sensor Initiatives

Europe – Working Group 42
- Reference instrument DQOs
- Indicative measurements
- Citizen science

China
- Supplement network monitoring
- Fill in monitoring gaps
- Incorporation of sensors as part of traditional air monitoring network
- Companies putting out sensor networks

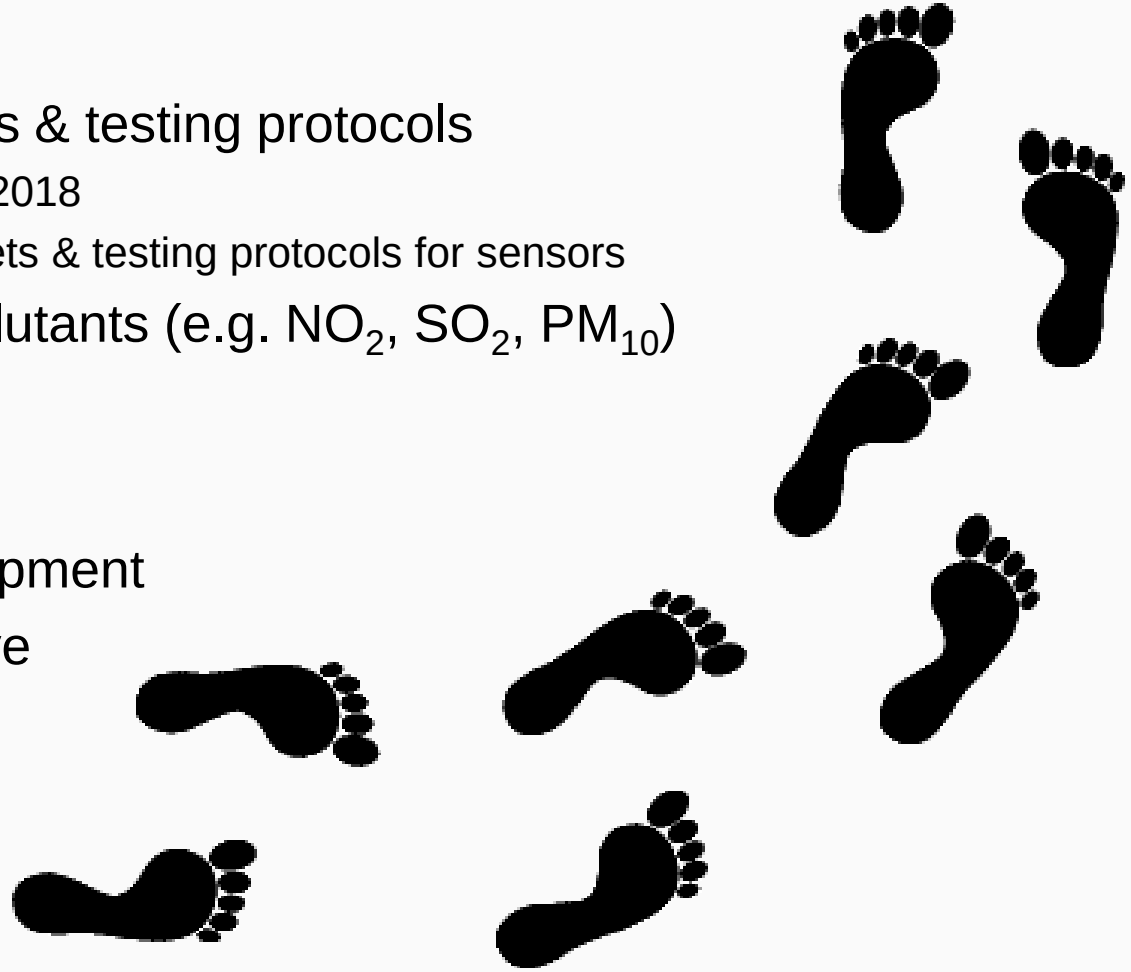
Low and Middle Income Countries
- Filling the Gaps

http://pubdocs.worldbank.org/en/425951511369561703/Filling-the-Gaps-White-Paper-Discussion-Draft-November-2017.pdf



Data Quality

- Next Steps (Ongoing)
  - Non-regulatory $PM_{2.5}$ & O_3 performance targets & testing protocols
    - » Journal publication of workshop findings – late 2018
    - » ORD EPA interim report with performance targets & testing protocols for sensors
  - 2019 Late Summer Workshop – additional pollutants (e.g. NO_2, SO_2, PM_{10})
  - Long term performance evaluations
- Intermediate Steps (1-2 years)
  - Additional lab and field testing protocol development
  - Coordinating public/private partnership initiative
    - Monitoring ASTM standard development
  - Possible VOC workshop
- Future Steps (2-3 years)
  - Evolving, TBD in agile manner



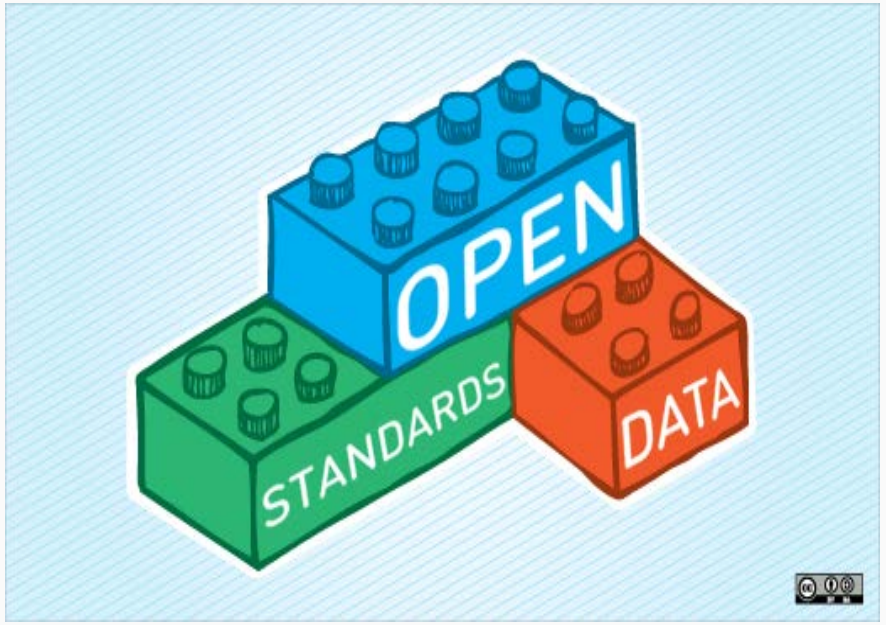
Non-Regulatory Data Management

vs

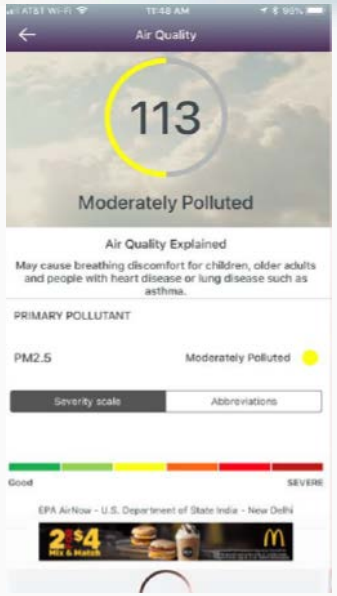
Primary Source for Storage and Dissemination

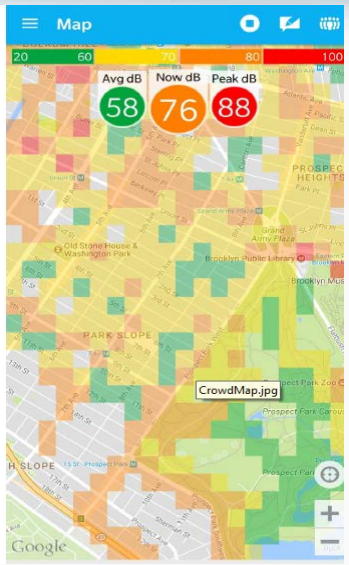
Data Management Questions

1. Ownership - Who owns the data?
2. Standardized formats and exchange
   - Facilitation of data from different devices
3. Security – FedRAMP approval?
4. Privacy – Tracking individuals
5. Fused Data Products
6. IT Considerations – New Data Streams into Existing Systems
7. Algorithms/Assumptions/Models – What adjustments are being made on raw measurements, are the corrections ‘proprietary’?



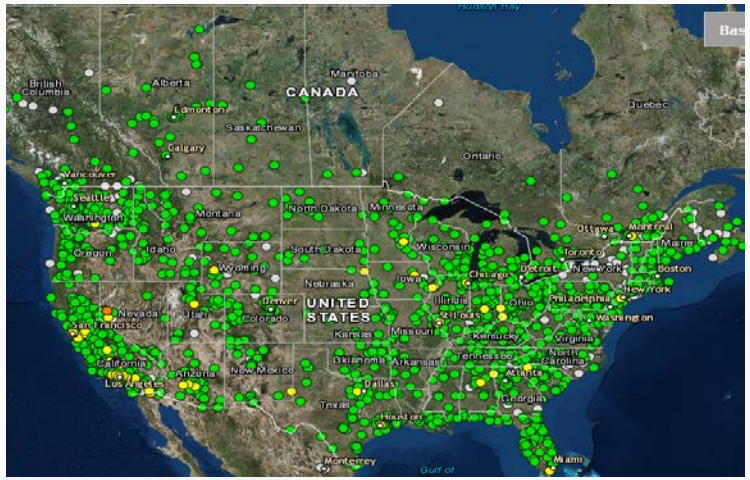
Data Interpretation

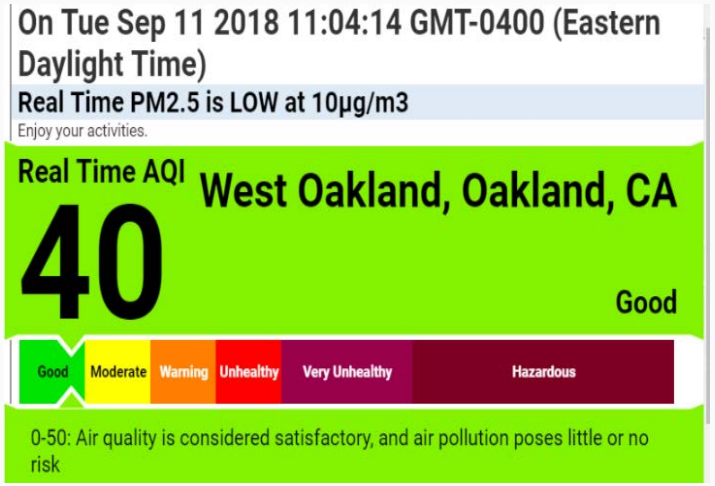


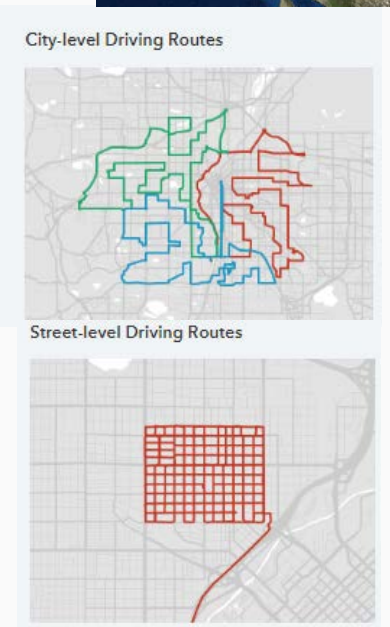


Community Air-Quality Levels (CALs)

Number range	Category	Color	Health Recommendation
0-50	Low Risk	Green	It's good time to be active outside
51-100	Moderate	Yellow	If you are unusually sensitive to particle pollution, reduce physical activity outdoors. Watch for symptoms like coughing or breathing problems.
101-150	Unhealthy for Sensitive Groups	Orange	Sensitive groups should reduce physical activity outdoors. Watch out for symptoms like coughing, breathing problems, unusual heartbeat, or unusual fatigue.
Above 150	Unhealthy	Red	Avoid physical activity outdoors.







https://asic.aqrc.ucdavis.edu/current-speakers?utm_source=newsletter&utm_medium=email&utm_content=View%20Presentations&utm_campaign=5/10%20Current%20Exhibitors%20and%20Sponsors

Data Interpretation – Path Forward

- Sensor scale pilot (~ 2 years old)
- AirNow redesign
  - https://airnow.gov/
- Outreach material
  - Integrating past, present, future lessons
- Strategic partnerships
  - For example, large data management companies

Tracking Legislation

- California Air Resources Board (ARB) Assembly Bill (AB) 617, AB 1647
- South Coast Air Quality Management District (SCAQMD) Rule 1180
- Bay Area Air Quality Management District (BAAQMD) Rule 12-15

Policy Memo

- Purpose: To address recent questions from local and state agencies regarding the use of air sensor data (e.g. National Ambient Air Quality Standards (NAAQS) compliance)
- In general, instruments - **including sensors -** should:
  - Meet the applicable requirements in the Code of Federal Regulations (CFR) - Part(s) of Title 40, Protection of Environment
  - Meet the requirements in other state environmental regulations
  - Include detailed sampling, siting, and quality assurance conditions
- Sensors not meeting the above criteria may be useful in other applications (e.g. better understanding local air quality, siting regulatory monitors, and identifying hot spots) assuming known data quality and proper interpretation
- Release of memo – Fall/Winter 2018

Charge Questions


THANK
YOU