Monitoring, Modeling & Emissions Inventory Update

Association of Air Pollution Control Agencies
September 11, 2014

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Outline

- Chemical Speciation Network (CSN)
- Near-Road Monitoring Network
- Air Quality Sensors
- Air Quality Modeling
- National Emissions Inventory (NEIv2)

Chemical Speciation

Network Overview

- 1997 $PM_{2.5}$ NAAQS review led to the establishment of the Chemical Speciation Network (CSN)
- Initial monitoring began with 13 pilot sites in 2000
- Currently, the network consists of 189 sites:
  - 52 Speciation Trends Network (STN) sites
  - 137 supplemental sites
  - *174 sites utilize EPA's national contract and were considered in the network assessment*
- Sites collect aerosol samples of 24 hours on filters analyzed for:
  - $PM_{2.5}$ mass
  - Elements
  - Ions (sulfate, nitrate, sodium, potassium & ammonium)
  - Organic and elemental carbon (OC/EC)

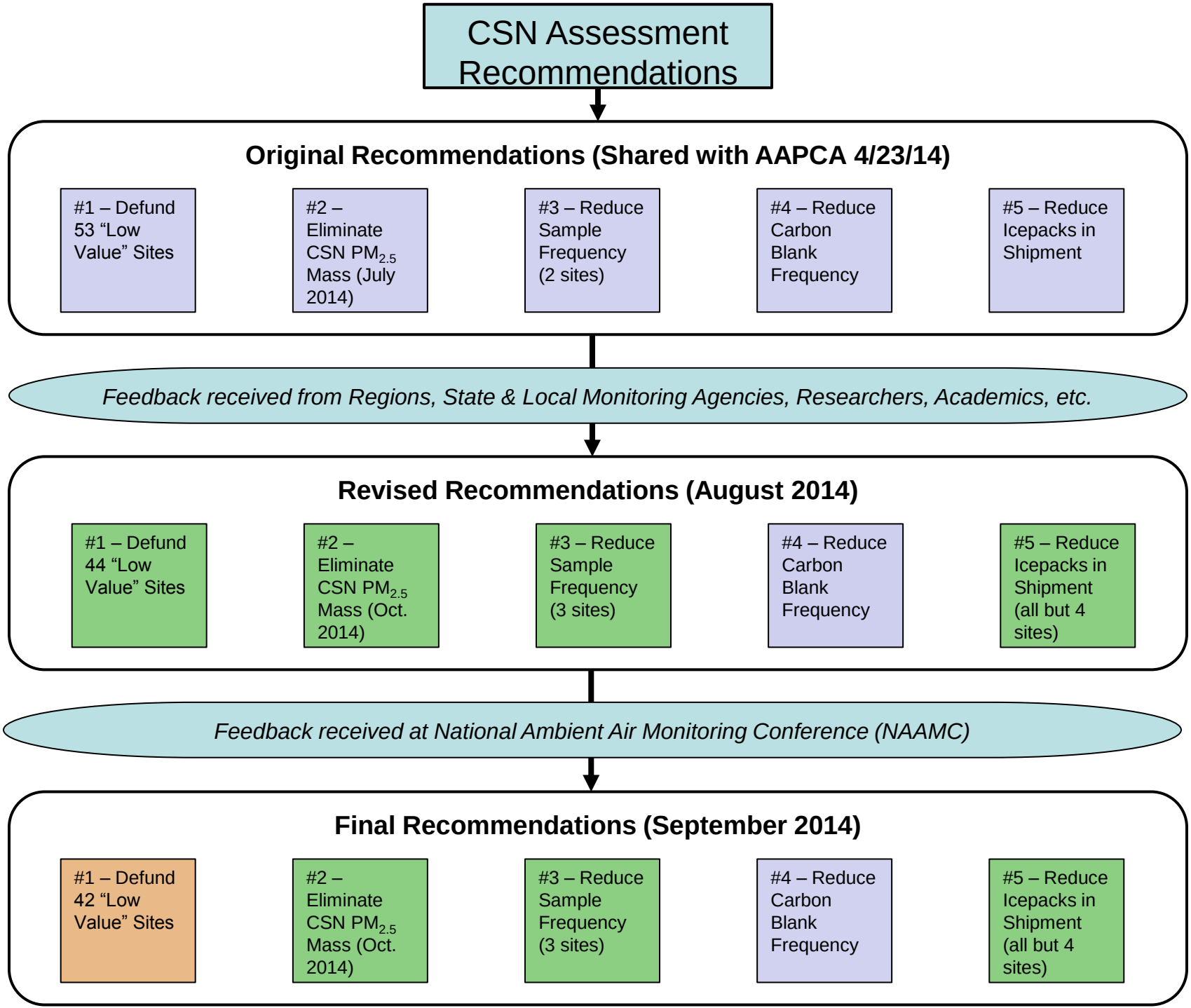
Assessment Goals & Approach

Goals

- Create a CSN network that is financially sustainable going forward
- Redistribute resources to new or high priorities from those of low-priority or low-benefit
- Extract more value from the existing network
- Fully leverage the value of other existing networks (e.g., IMPROVE)

Approach

- An objectives based approach was taken in an effort to optimize the network to support the primary objectives, which include:
  - Support of $PM_{2.5}$ Implementation (e.g., SIPs, non attainment areas, control strategies, model development, etc.)
  - Aid in interpretation of health studies
  - Detection of trends


CSN Assessment Recommendations
Original Recommendations (Shared with AAPCA 4/23/14)
#1 – Defund 53 "Low Value" Sites
#2 – Eliminate CSN PM2.5 Mass (July 2014)
#3 – Reduce Sample Frequency (2 sites)
#4 – Reduce Carbon Blank Frequency
#5 – Reduce Icepacks in Shipment
Feedback received from Regions, State & Local Monitoring Agencies, Researchers, Academics, etc.
Revised Recommendations (August 2014)
#1 – Defund 44 "Low Value" Sites
#2 – Eliminate CSN PM2.5 Mass (Oct. 2014)
#3 – Reduce Sample Frequency (3 sites)
#4 – Reduce Carbon Blank Frequency
#5 – Reduce Icepacks in Shipment (all but 4 sites)
Feedback received at National Ambient Air Monitoring Conference (NAAMC)
Final Recommendations (September 2014)
#1 – Defund 42 "Low Value" Sites
#2 – Eliminate CSN PM2.5 Mass (Oct. 2014)
#3 – Reduce Sample Frequency (3 sites)
#4 – Reduce Carbon Blank Frequency
#5 – Reduce Icepacks in Shipment (all but 4 sites)

Chemical Speciation

List of CSN Sites Scheduled for Defunding

1. Huntsville Old Airport, AL
2. MOMS, AL
3. Dover, DE
4. Skyview, FL
5. Athens, GA
6. Douglas, GA
7. Linn County, IA
8. Public Health Building, IA
9. Elkhart Prarie Street, IN
10. Ashland Health Dept, KY
11. Grayson Lake, KY
12. Lexington Health Dept, KY
13. Houghton Lake, MI
14. Sterling Park, MI
15. Port Huron, MI
16. Rochester, MN
17. Liberty, MO
18. Bonne Terre, MO
19. Hickory, NC
20. Buncombe County, NC
21. Lexington, NC
22. Rockwell, NC
23. Camden, NJ
24. Chester, NJ
25. Toledo, OH
26. Head Start, OH
27. ODOT Garage, OH
28. Columbus, OH
29. Reading Airport, PA
30. State College, PA
31. Harrisburg, PA
32. Erie, PA
33. Scranton, PA
34. York, PA
35. Chesterfield, SC
36. Greenville ESC, SC
37. Lockeland School, TN
38. Lawrence County, TN
39. UTC, TN
40. VANNEVAN, WA
41. Waukesha, WI
42. S. Charleston Library, WV

While sites recommended for defunding will no longer receive laboratory analysis funding, their speciation monitors may continue to operate if other funding sources are provided

Timeline & Key Points

- Implementation Timeline
  - October 2014
    - Eliminate CSN $PM_{2.5}$ mass measurement
  - January 2015
    - Defund 42 sites
    - Reduce sample frequency at 3 sites
    - Reduce carbon blank frequency
    - Reduce icepacks in shipment
- The CSN network assessment recommendations incorporate feedback received from regional, state & local monitoring agencies, researchers, academics and attendees at the NAAMC conference
- Sites recommended for defunding will no longer receive laboratory analysis funding, however their speciation monitors may continue to operate if other funding sources are provided

Near-Road Monitoring

Near-road NO_2 Monitoring Origination

- Near-road NO_2 monitoring requirements were promulgated in 2010 NO_2 NAAQS revision
  - Subject to CASAC review & public notice and comment
- The NAAQS revision was keyed on minimizing 1-hour NO_2 exposures that occur anywhere in an area
- Health-based evidence suggested a majority of exposures are linked to mobile sources, prompting the new near-road monitoring requirements
- Installation deadlines revised in 2013, introducing a phased implementation plan
  - Subject to public notice and comment

Near-Road Monitoring

Near-Road Monitoring Requirements

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

*Near-road CO and PM2.5 monitors are required to be co-located with an NO_2 monitor.

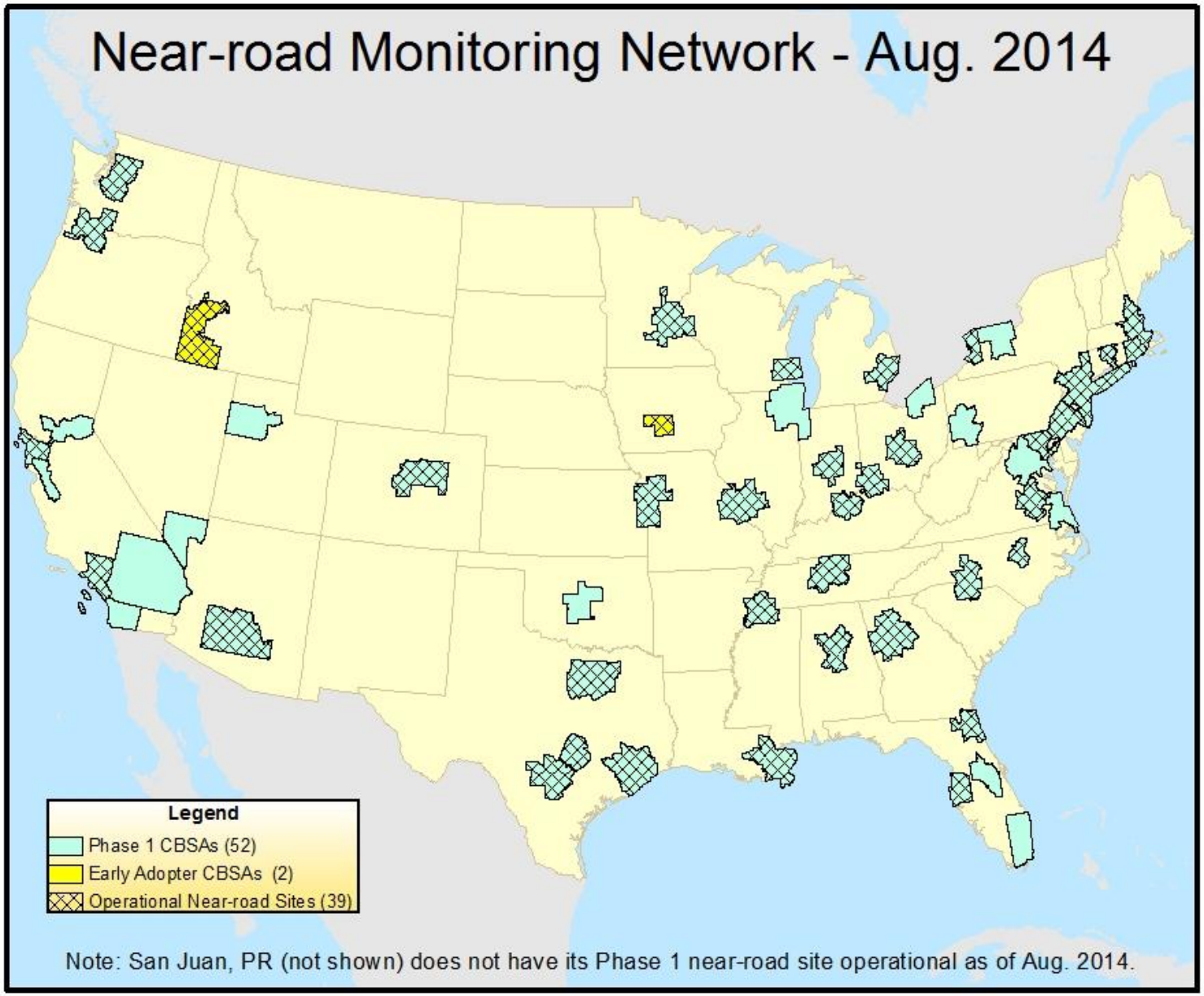
Near-Road Monitoring

Near-road Sites will be Multi-pollutant

- 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 Monitoring Network - Aug. 2014
Legend
Phase 1 CBSAs (52)
Early Adopter CBSAs (2)
Operational Near-road Sites (39)
Note: San Juan, PR (not shown) does not have its Phase 1 near-road site operational as of Aug. 2014.

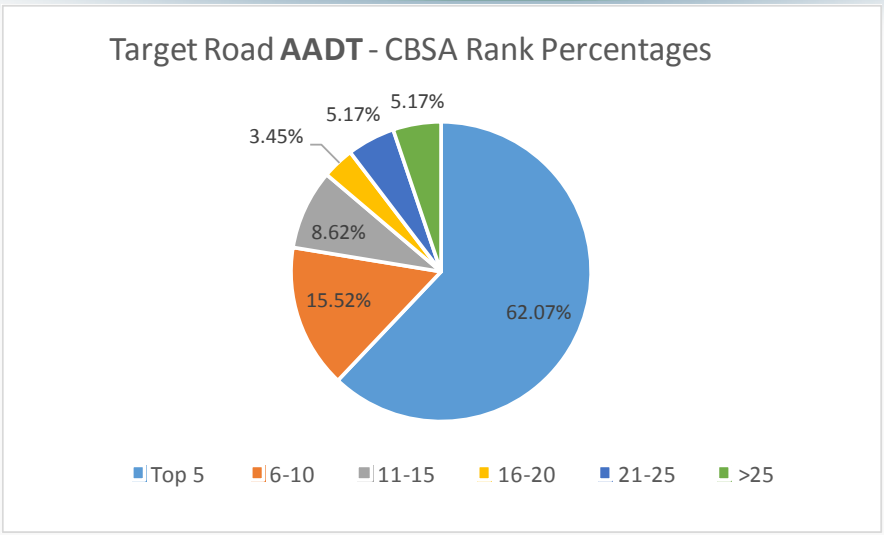
CBSA	Population	Phase	Optional Info	AADT	AADT Rank in CBSA	FE-AADT	FE-AADT Rank in CBSA	Distance to Target	Probe Height	Operational	Start Date
Detroit	4,292,060	1	Eliza How ell	140,500		188,200		8.5	5.2	YES	7/27/11
Boise	637,896	3		103,000	2	162,000	2	32	4.6	YES	4/1/12
Des Moines	588,999	3		110,000	6	150,140	14	38	3	YES	1/1/13
St. Louis	2,795,794	1		159,326	8	360,077	8	25	3	YES	1/1/13
Hartford	1,214,400	1		159,900	2	231,855	2	17.7	3.6	YES	4/1/13
Minneapolis	3,422,264	1		277,000	1	387,250	1	32.5	4.9	YES	4/1/13
Boston	4,640,802	1		193,000	1			10	4	YES	6/1/13
Denver	2,645,209	1		249,000	1	263,118	1	8.7	5	YES	6/1/13
Philadelphia	6,018,800	1		124,610	6	257,460	4	12	5	YES	8/1/13
Richmond	1,231,980	1		151,000	1	259,720	1	20	3.3	YES	10/1/13
Birmingham	1,136,650	1		141,190	4	215,527	6	23.2	5.5	YES	1/1/14
Cincinnati	2,128,603	1		163,000	1	386,380	8	8	4.7	YES	1/1/14
Columbus	1,944,002	1		142,361	10	286,050	4	32	5.3	YES	1/1/14
Jacksonville	1,377,850	1		139,000	1	304,062	1	20	4.6	YES	1/1/14
Kansas City	2,038,724	1		114,495	5	347,582	3	20	3	YES	1/1/14
Los Angeles	13,052,921	1	Anaheim	272,000	32	695,776	3	9	4.5	YES	1/1/14
Louisville	1,251,351	1		163,000	2	247,600	8	32	4.7	YES	1/1/14
Milwaukee	1,566,981	1		133,000	4	133,000	4	14	3.5	YES	1/1/14
Nashville	1,726,693	1		144,204	14	338,879	12	30	4.5	YES	1/1/14
Raleigh	1,188,564	1		141,000	3	203,280	3	20	4.3	YES	1/1/14
San Antonio	2,234,003	1		201,840	21	405,295	3	20	4	YES	1/8/14
Houston	6,177,035	1		324,119	1	496,226	1	24	4	YES	1/22/14
S.F. - Oakland	4,455,560	1	Oakland	216,000	22	424,008	2	20	6.4	YES	2/1/14
Indianapolis	1,928,982	1		189,760	1	362,110	1	24.5	4	YES	2/7/14
Phoenix	4,329,534	1	Tempe	320,138	1	624,315	1	15	5.1	YES	2/13/14
Tampa	2,842,878	1	Tampa	190,500	1	327,660	1	20	5	YES	3/1/14
New Orleans	1,227,096	1		68,015	23	129,229	23	28.5	4.22	YES	3/18/14
Buffalo	1,134,210	1		131,019	2			20	4	YES	3/24/14
Seattle	3,552,157	1		237,000	2	471,630	3	4.5	3	YES	3/24/14
Baltimore	2,753,149	1		186,750	13	452,309	1	16.15	4	YES	4/1/14
New York	19,831,858	1	Fort Lee, NJ	311,234	1	612,212	11	20	4.6	YES	4/1/14
Providence	1,601,374	1		186,300	1	416,790	1	5	3.9	YES	4/1/14
Dallas	6,700,991	1		235,790	15	431,027	7	24	4	YES	4/2/14
Austin	1,834,303	1		188,150	7	350,712	10	27	4	YES	4/16/14
Portland	2,289,800	1		156,000	5	289,052	4	25	3	YES	4/21/14
Atlanta	5,457,831	1	Ga. Tech	284,920	2	406,256	3	2	4.5	YES	6/3/14
Charlotte	2,296,569	1		153,000	11	260,830	6	30	4.5	YES	6/22/14
Pittsburgh	2,360,733	1		87,534	3	148,248	4	18	3	YES	6/29/14
Memphis	1,341,690	1		140,850	1	292,968	2	23.75	4.3	YES	7/1/14
Cleveland	2,063,535	1		153,660	1	287,580	1			NO	FALL '14
Las Vegas	2,000,759	1		260,000	1	353,825	1	15	4	NO	FALL '14
Miami	5,762,717	1	Brow ard Co.	306,000	1	622,161	1	30	4.5	NO	FALL '14
New York	19,831,858	2	Queens	166,340	115			28	4	NO	FALL '14
Oklahoma City	1,296,565	1		155,300	1	195,554	7	20		NO	FALL '14
Orlando		1		195,773	1	312,062	1	15	4.5	NO	FALL '14
Riverside	4,350,096	1	Ontario	245,300	4	657,000	3	50	4.5	NO	FALL '14
Rochester	1,082,284	1		110,990	3			20	4	NO	FALL '14
Sacramento	2,196,482	1		186,000	9	475,000	1	20	5.3	NO	FALL '14
San Diego	3,177,063	1	Rancho Carmel Dr	223,000	5	358,000	4	37	6	NO	FALL '14
S.F. - Oakland	4,455,560	2	Berkeley	265,000	3	379,246	8	20		NO	FALL '14
San Jose	1,894,388	1		191,000	8	294,140	4	35		NO	FALL '14
Virginia Beach	1,699,925	1		199,000	1	239,816	1			NO	FALL '14
Washington, D.C.	5,860,342	1	Springfield, VA	297,000	1	553,164	1	16	3.3	NO	FALL '14
Chicago	9,522,434	1								NO	Unknown
Salt Lake City	1,123,712	1								NO	Unknown
San Juan, P.R.	2,627,081	1								NO	Unknown

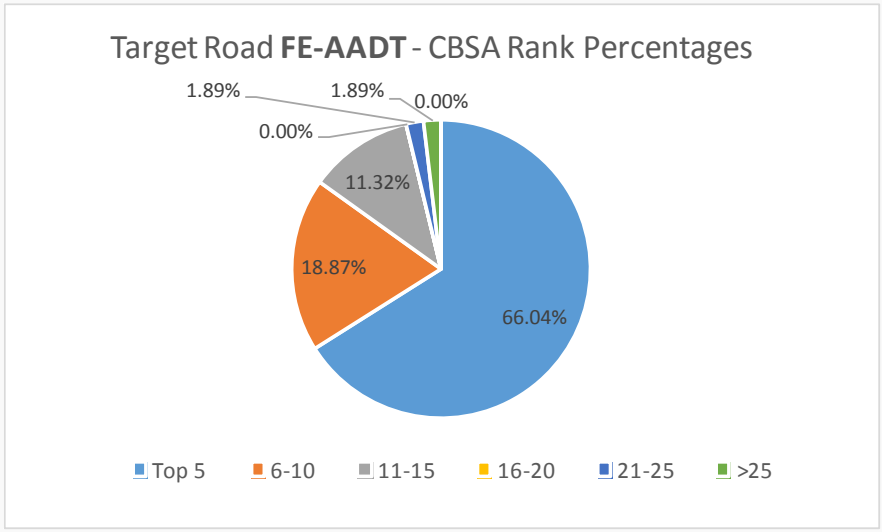
Near-road Network Status

- **39** operational sites
- Of the 52 Phase 1 CBSAs, 37 are established (71% installed)
- Two Phase 3 sites established early (Boise & Des Moines)

* As of Aug. 18, 2014

Near-Road Monitoring





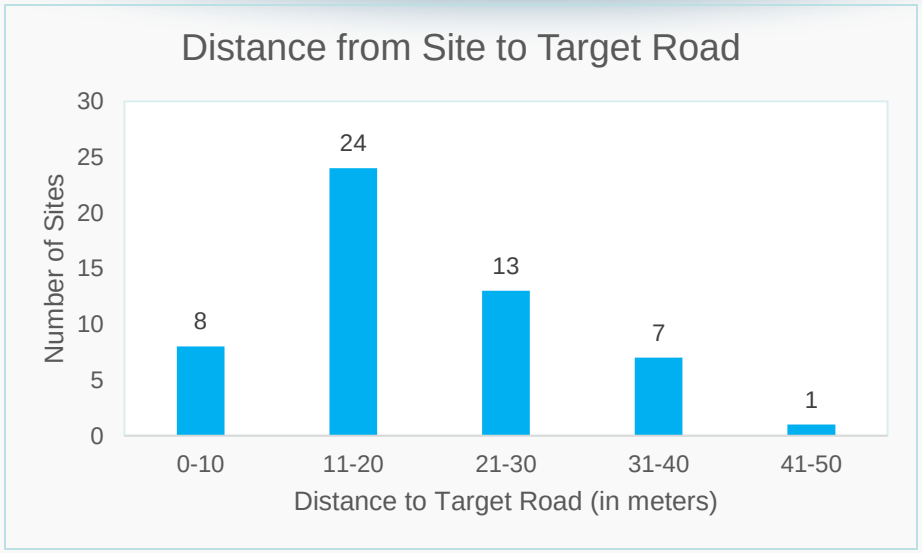
NOTE: These data are current for July 2014

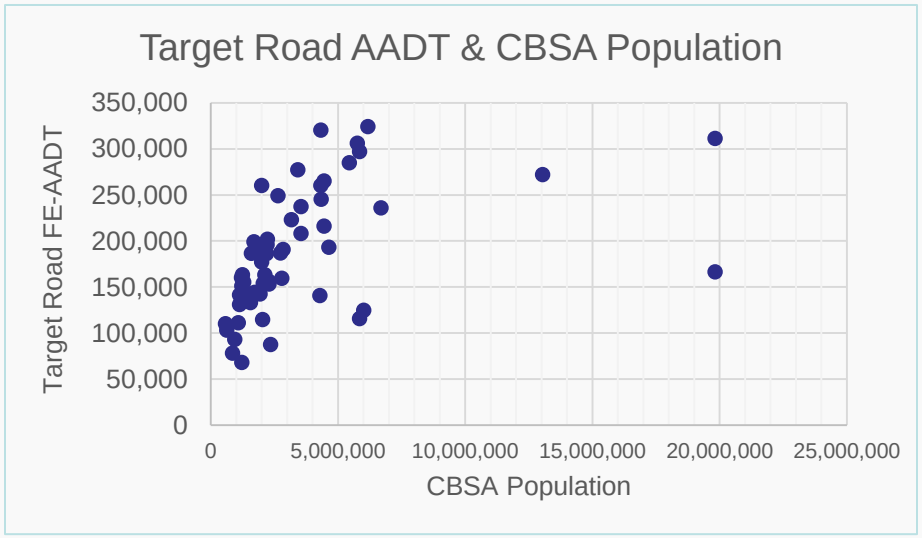
Target Roadway Rankings

- A majority of sites target a top 5 trafficked road segment in their CBSA
  - 20 sites along #1 ranked road segment for AADT
  - 16 sites along #1 ranked road segment for FE-AADT*
- Over 75% of sites along a top 10 ranked AADT road
- Over 95% of sites along a top 15 ranked road for FE-AADT

*Fleet Equivalent AADT (FE-AADT) is a single metric accounting for both traffic volume and fleet mix (diesel vs gasoline ratio)

Near-Road Monitoring

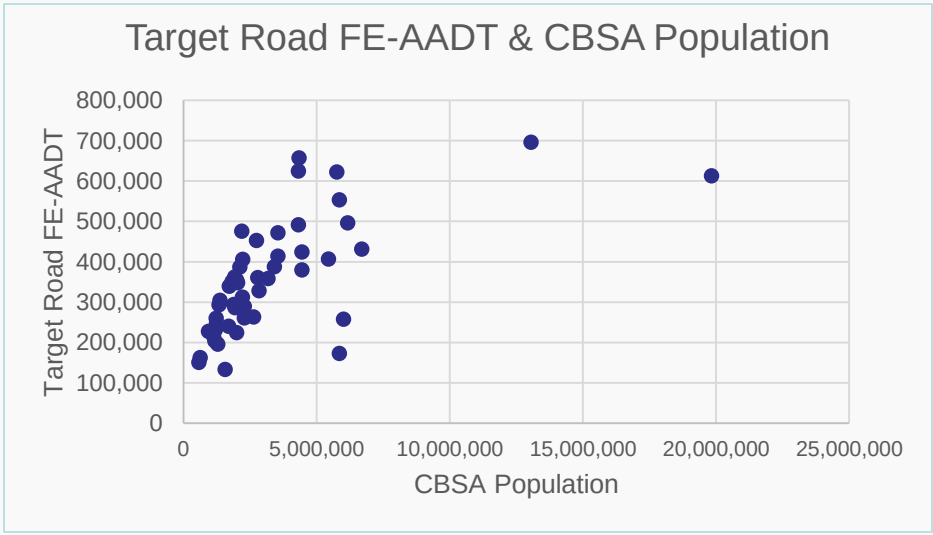




NOTE: These data are current for July 2014

Site Characteristics

- ~60% of sites within 20 meters of target roads
- ~85% of sites within 30 meters of target road
- Largest population cities tend to have monitors at higher traffic volume roads
- Many roads with monitors have large truck volumes (reflected in FE-AADT)



Near-Road Monitoring

2012 & 2013 Near-road NO_2 Data Reported to AQS					
Year	City	1-Hr Max.	98th %ile	~Annual Avg.	Notes
2012	Detroit	51.0	43.0	25.1	Complete year
	Boise	49.8	44.3*	26.5*	*Incomplete year
2013	Denver	70.8	61.7*	41.1*	*Incomplete year
	St. Louis	64.7	50.4	26.9	Complete year
	Hartford	59.0	48.0*	29.1*	*Incomplete year
	Richmond	58.3	46.0*	26.7*	*Incomplete year
	Minneapolis	54.0	45.0*	24.6*	*Incomplete year
	Boston	50.0	45.0*	27.9*	*Incomplete year
	Detroit	48.0	43.0	23.9	Complete year
	Kansas City	46.1	40.7*	26.1*	*Incomplete year
	Boise	45.9	39.3	25.1	Complete year
	Des Moines	42.2	34.1	19.0	Complete year

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

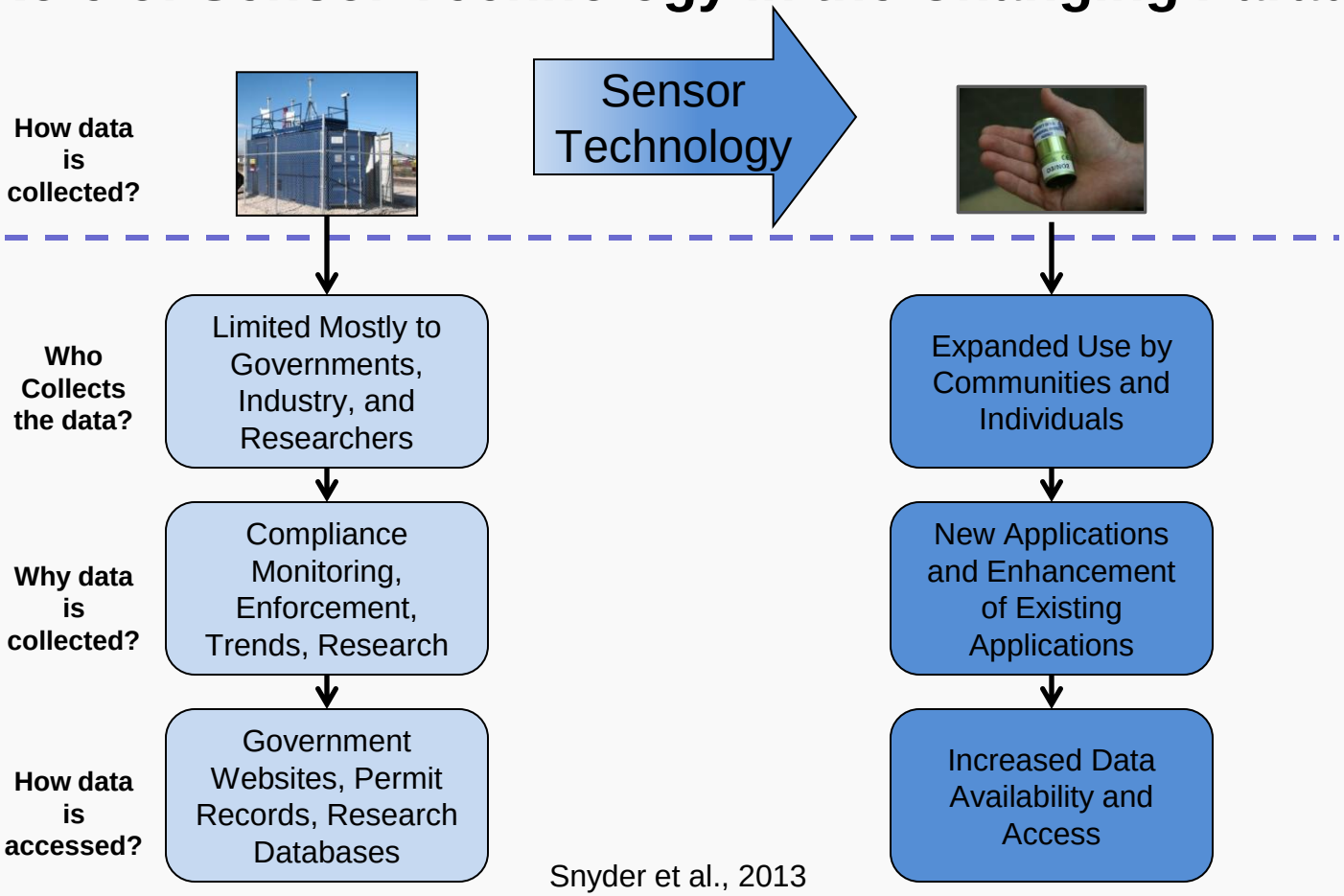
Near-Road Monitoring

Selected 1st Quarter 2014 Near-road NO_2 Data Reported to AQS			
City	1-Hr Max.	98th percentile	1st Qtr. Avg.
Denver	96.8	71.1	44.7
Hartford	80.0	63.0	34.3
St. Louis	71.2	65.7	35.3
Cincinnati	68.0	67.0	42.3
Philadelphia	65.0	59.6	36.3
Indianapolis	64.4	63.8	38.4
Boston	64.0	60.0	36.8
S.F. - Oakland	60.6	54.5	30.2
Richmond	59.4	54.9	34.6
Houston	49.1	48.4	29.2
Boise	48.1	40.7	26.7
Des Moines	41.1	37.9	20.6

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

Air Quality Sensors

Role of Sensor Technology in the Changing Paradigm



Snyder et al., 2013

Air Quality Sensors

Convergence of Technologies and Cultural Change

Miniaturized environmental sensors

e.g., CairClip

e.g., Arduino microprocessor

Introduction of low cost controls and communications

Emerging data-viewing/ communication apps

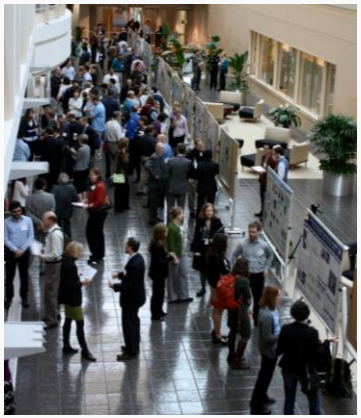
Smartphone / Tablet generation

e.g., fitbit activity tracker

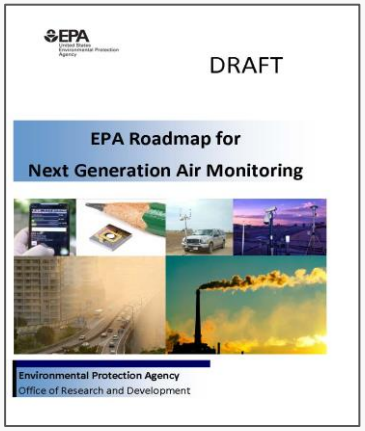
Air Quality Sensors

What is EPA doing?

- Stimulating collaboration and conversation
  - 4 NGAM Workshops since 2012
  - Government, Academia, International, DIY'ers



- Assessing emerging technology
  - Literature review of sensor technology
  - Sensor evaluation through laboratory and field analyses



- Thinking big picture about these developments and implications

http://www.epa.gov/research/airscience/docs/roadmap-20130308.pdf

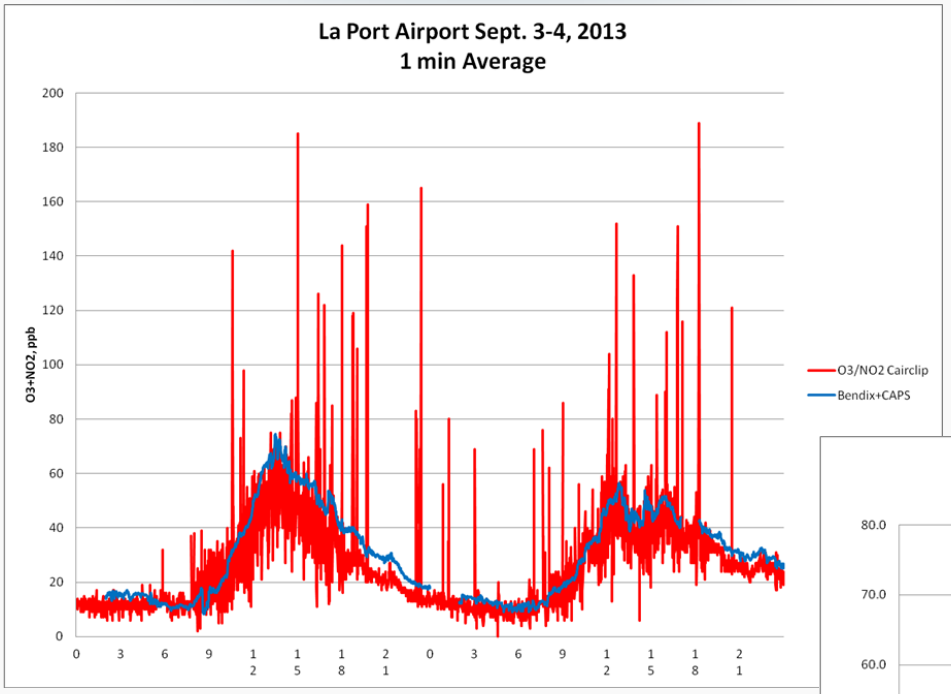
Air Quality Sensors

EPA Sensor Evaluation Activities

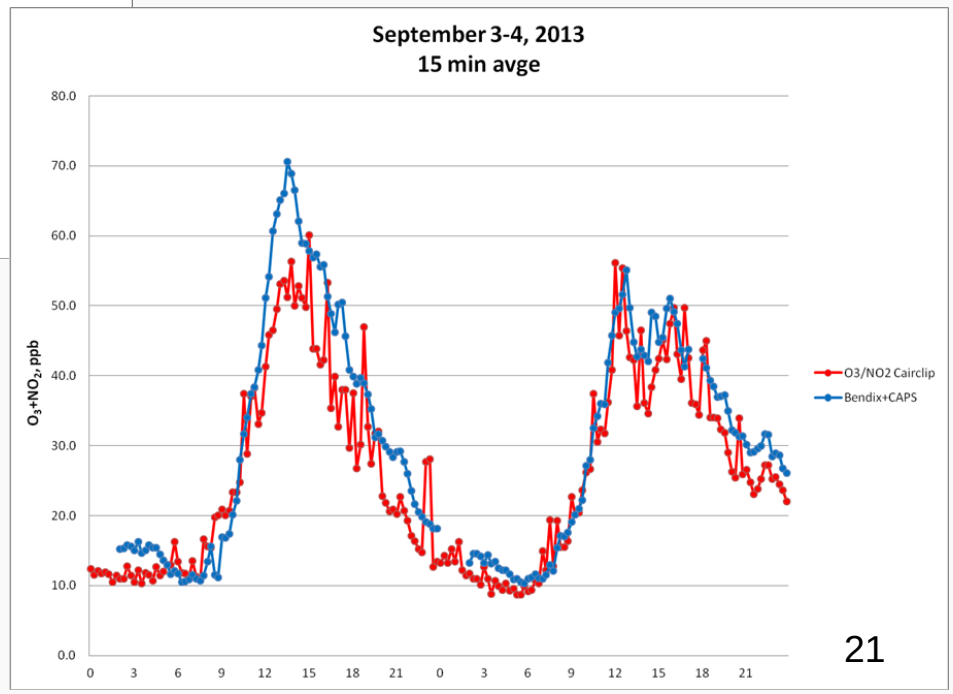
- Ozone, NO2, PM and VOC Sensor Evaluations
  - Ozone and NO2 sensors evaluated in 2012/2013*
  - A host of low cost (<$2500) PM2.5 and VOC sensors purchased or acquired for laboratory and/or field evaluation in 2013/2014
- Publications
  - Air Sensors Guidebook
  - Citizen Science Fact Sheet
  - Mobile Air Sensors & Applications for Air Pollutants
  - Sensor Evaluation Report*
- Village Green Project
- Short Term Sensor Field Projects
  - Discover AQ; AIRS; Roadside, wildfire, fenceline
- Sensor Seal and other Evaluation efforts
  - FY16 Initiative
  - South Coast AQMD project

http://www.epa.gov/research/airscience/next-generation-air-measuring.htm

Air Quality Sensors



Preliminary Results from Houston:
Integrated O_3 and NO_2



Air Quality Sensors

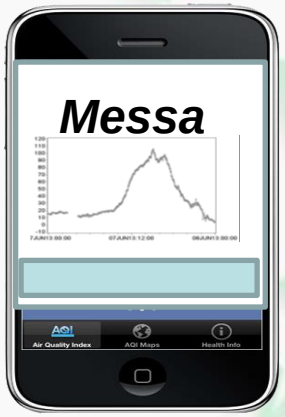
Brainstorming Sensor Messaging

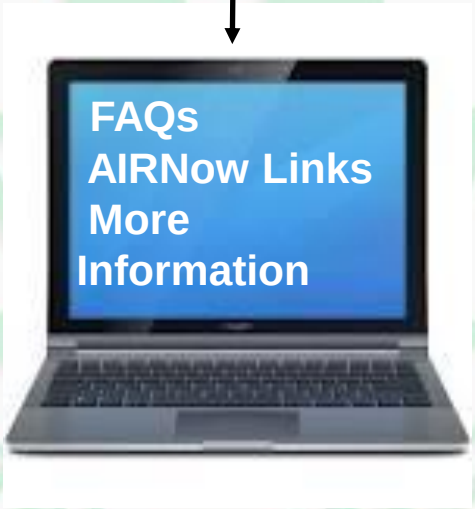
Proposed Project:

Mobile Website Development

Sensor Messaging Webpage

Focus Group Study





Air Quality Sensors

Benefits

- Enhanced capability to monitor at local levels
- Enhanced ability to understand people's exposure to air pollution as they actually experience it
- Combined with other technologies (e.g. satellites and models), improved understanding of air quality
- Improved ability for individuals to take specific actions to protect their health
- Over time, ability to improve compliance with air regulations

Challenges (Opportunities)

- Data quality & levels of detection
- Interpretation & communication of the data
- Big data

Appendix W Update: Planned Schedule

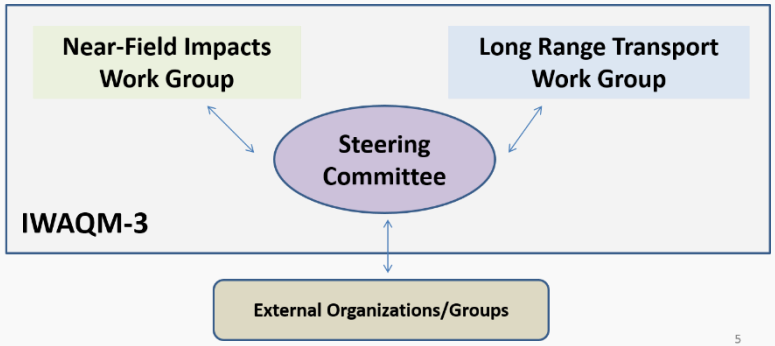
- Proposed Rulemaking, “Revision to the Guideline on Air Quality Models”, Spring 2015
- 11th Conference on Air Quality Modeling
  - Serves as public hearing for NPRM
  - 2 to 3-day conference in RTP, North Carolina
- Final Rulemaking, “Revision to the Guideline on Air Quality Models”, Spring 2016

Air Quality Modeling

- **Established formal working groups of OAQPS and Regional Office Modelers**
  - AERMOD Development & Evaluation (Roger Brode)
  - Screening Techniques (James Thurman)
  - NO2 Modeling (Chris Owen)
  - Near-road Modeling (Chris Owen)
  - Meteorological Inputs (James Thurman)
  - IWAQM Phase 3: Near field impacts & Long-range transport (EPA and FLMs)
- **Please refer to 2014 R/S/L Modelers Workshop presentations on SCRAM website for details on priorities and activities of each workgroup**
  - http://www.cleanairinfo.com/regionalstatelocalmodelingworkshop/archive/2014/agenda.htm

IWAQM Phase 3

- IWAQM (phase 3) initiated in July 2013 to provide a mechanism for updating Appendix W and related guidance documents in partnership with the Regional offices and other Federal Agencies (short term)
  - Increase knowledge regarding NSR/PSD program and single source secondary impacts
  - Understand and evaluate modeling techniques for single source secondary impacts
  - Products from the IWAQM3 process intended to inform and support regulatory revisions to Appendix W
- IWAQM3 consists of 2 working groups and a steering committee:



IWAQM3 Participants

Near-Field impacts working group
Kirk Baker, OAQPS (Chair)
Jim Kelly, OAQPS
George Bridgers, OAQPS
Andy Hawkins, Region 7
Randy Robinson, Region 5
Jaime Wagner, Region 5
Rebecca Matichuk, Region 8
Bob Kotchenruther, Region 10
Richard Monteith, Region 4
Rynda Kay, Region 9

Long range transport working group
Bret Anderson, US FS (Chair)
Tim Allen, US F&W
Mike Barna, US NPS
John Notar, US NPS
Craig Nicholls, BLM
Kirk Baker, US EPA OAQPS
Chris Owen, US EPA OAQPS
Gail Tonnesen, US EPA Region 8
Michael Feldman, US EPA Region 6
Rick Gilliam, US EPA Region 4

Steering Committee
Tyler Fox, US EPA OAQPS
Bret Anderson, US FS
Tim Allen, US F&W
Annamaria Coulter, Region 2
Erik Snyder, Region 6
Robert Elleman, Region 10
Carol Bohnenkamp, Region 9
John Vimont, US NPS
Craig Nicholls, BLM
Val Garcia, US EPA ORD
Shawn Roselle, US EPA ORD

Key Milestones

- 2011 NEIv1 completed September, 2013
  - MOVES2010b
- 2011 Modeling Platform completed December, 2013
- Open comment period on 2011 Modeling platform from November, 2013 to March, 2014
- Open comment period on 2018 modeling platform from January, 2014 to June 30, 2014
- 2011NEIv2 to be completed October, 2014
  - Addresses comments on 2011NEIv1 & 2011 Modeling platform
  - MOVES 2014 – NEI release timing uncertainty
- Updated 2011 Modeling Platform to be completed December, 2014

Key Interactions

- MOVES Workgroup thru MARAMA
- Inter-RPO modeling calls
- NEI-ERTAC cross-reference Workgroup
- Oil & Gas Workgroup
  - November 4-5 meeting in RTP with key RPO technical players
- Fire Emissions Workshop
  - November 3 meeting with USFS & other key technical players
- Upcoming workgroup formation for 2014 NEI nonpoint categories
- Emissions Inventory Conference Spring 2015

Questions?