

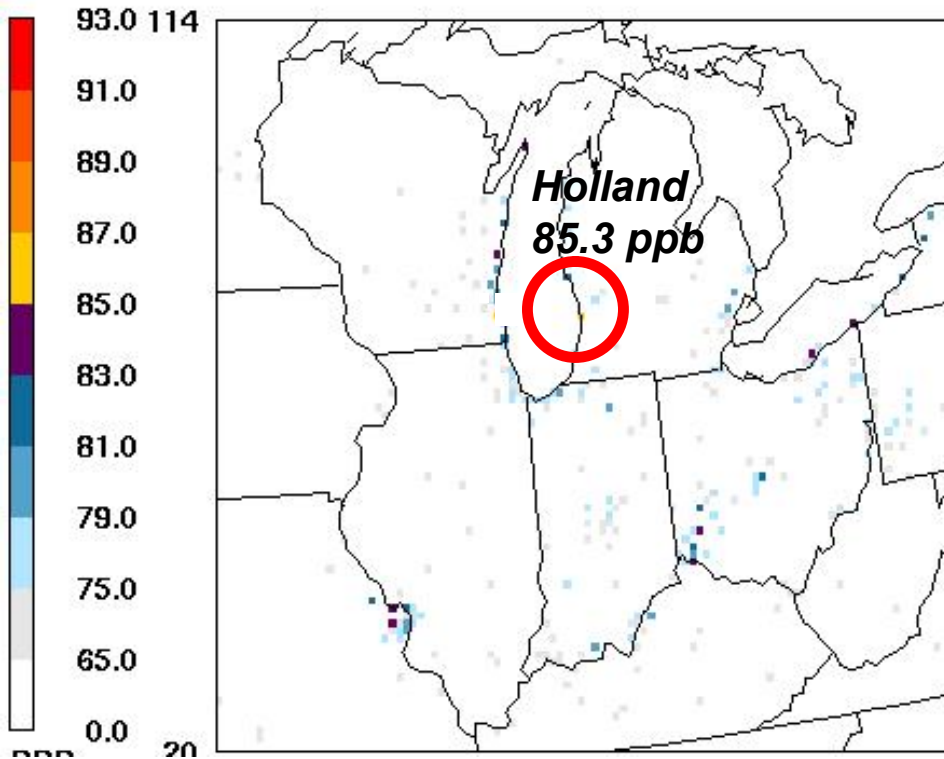
New Regional Modeling Results

Michael Koerber
Lake Michigan Air Directors Consortium

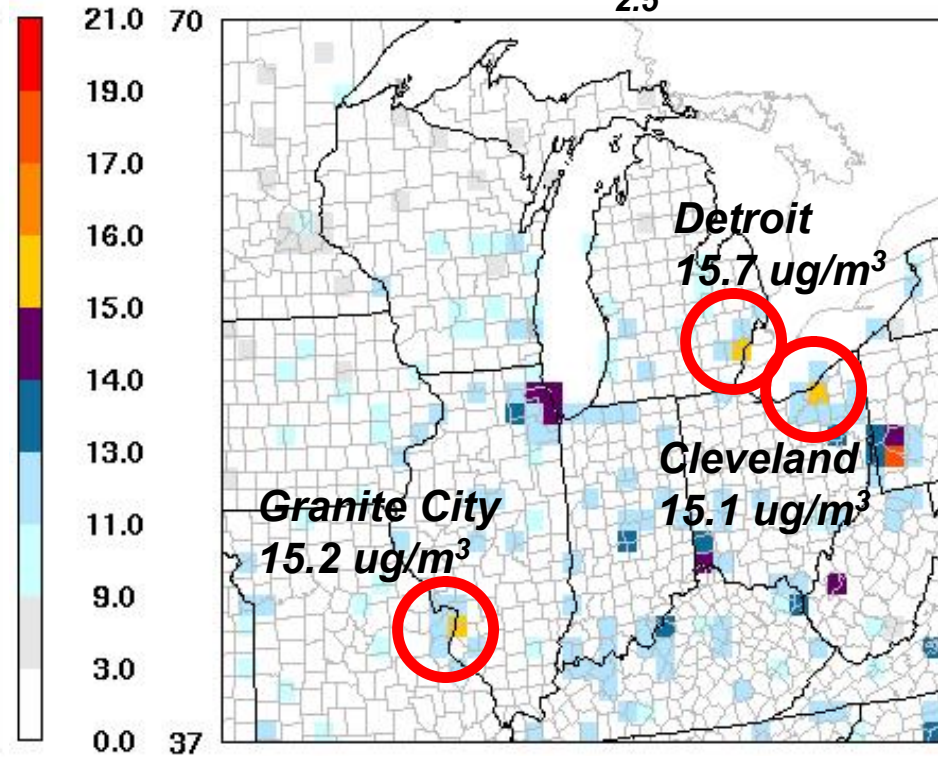
October 10, 2007

Modeling Results: 2009

Ozone



PM_{2.5}



New Modeling: Key Findings

- 2009: Regional modeling shows attainment, except:
 - Ozone: Holland, MI
 - PM_{2.5}: Granite City, IL; Cleveland, OH; and Detroit, MI
- 2012: Regional modeling shows attainment, except:
 - PM_{2.5}: Granite City, IL; and Detroit, MI
- 2018: Regional modeling shows visibility levels worse than uniform rate of visibility improvement for some Class I areas (e.g., Michigan and Northeast)
- New modeling results look better than previous modeling results, due to lower base year design values
- Attainment demonstration should reflect “weight of evidence”, with consideration of 2002 and 2005 base year modeling, and monitoring-based analyses
- Regional modeling also shows that the new PM_{2.5} (and ozone?) NAAQS will not be met, even by 2018

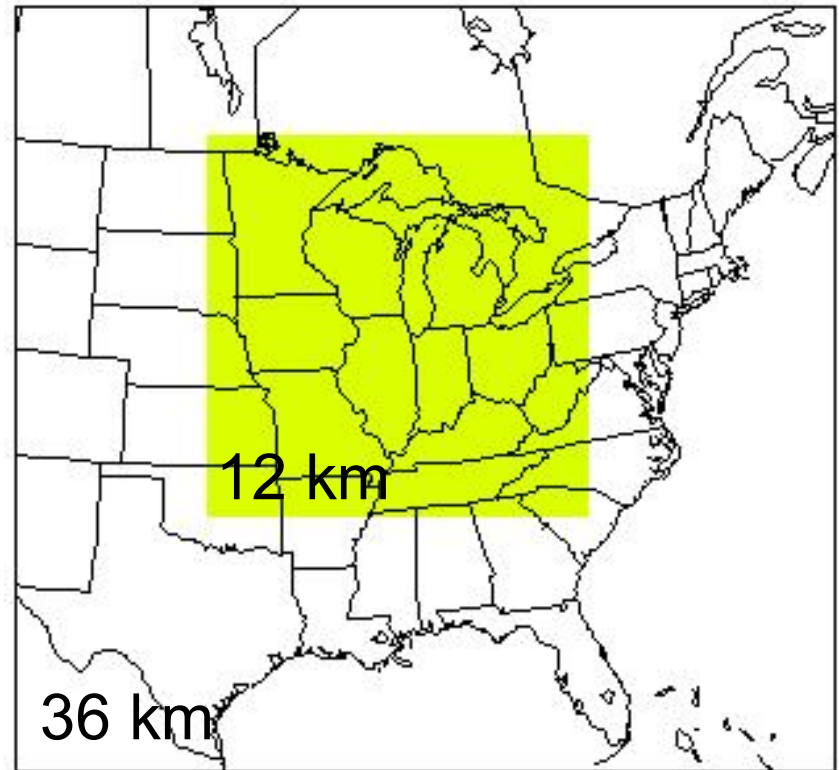
Air Quality Modeling

Model: CAMx

Domain/Grid: Eastern U.S.
(36 km), Midwest (12 km)

Year: 2002, **2005** (full year)
- PM/haze, 36 km

2002, **2005** (summer)
- O₃, 12 km



Caveats

- Model performance is generally okay, but there are a few concerns (e.g., underprediction for ozone and key PM_{2.5} species, like organic carbon)
 - Use relative, not absolute, model results
- Emissions projections are somewhat uncertain
 - EGU projections reflect 2010, not 2009
 - Growth factors are dynamic
- Results reflect REGIONAL-scale modeling. For PM_{2.5}, need to factor in LOCAL-scale analyses.

Existing Control Programs

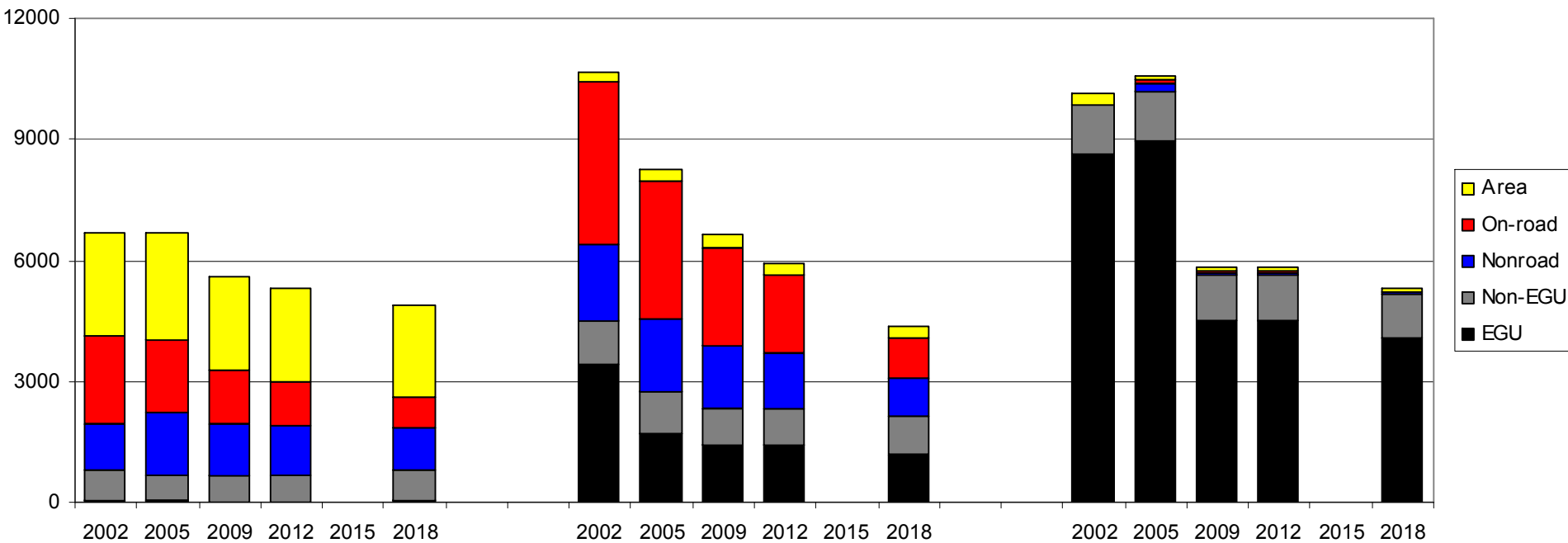
- **On-Highway Mobile Sources**
 - Tier II/Low sulfur fuel
 - Inspection/Maintenance programs (nonattainment areas)
 - Reformulated gasoline (nonattainment areas)
- **Off-Highway Mobile Sources**
 - Federal control programs incorporated into NONROAD model (e.g., nonroad diesel rule), plus the evaporative Large Spark Ignition and Recreational Vehicle standards
 - Heavy-duty diesel (2007) engine standard/Low sulfur fuel
 - Federal railroad/locomotive standards
 - Federal commercial marine vessel engine standards
- **Power Plants**
 - Title IV (Phases I and II)
 - NO_x SIP Call
 - Clean Air Interstate Rule
- **Other Point Sources**
 - VOC 2-, 4-, 7-, and 10-year MACT standards
 - Combustion turbine MACT
 - Industrial boiler/process heater/RICE MACT
 - Miscellaneous consent decrees and settlement agreements
- **Area Sources**
 - Aerosol coatings (new rule)
 - Architectural and industrial maintenance (AIM) coatings (amendments)
 - Household and institutional consumer products (amendments)
 - Portable fuel containers (Mobile Source Air Toxics rule)

Regional Emissions (TPD)

VOC

NOx

SO2



Attainment Test

$$\text{FY D.V.} = \text{BY D.V.} \times \text{RRF}$$

*Future Year
Design Value*

*Base Year
Design Value
(Average of three 3-yr
periods centered on BY)*

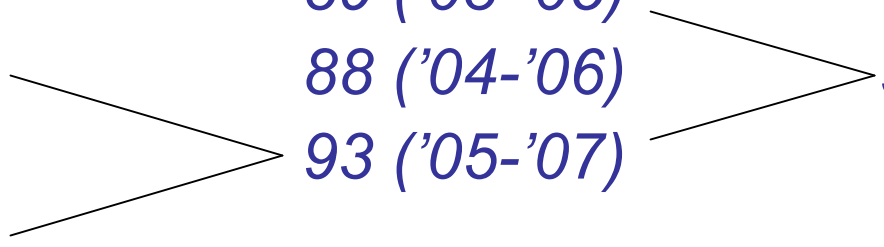
*Relative Reduction
Factor
(Change in modeled
concentrations)*

If FY D.V. \geq NAAQS, then **nonattainment**

If FY D.V. $<$ NAAQS, then **attainment**

Base Year D.V. (Holland)

Year	4th High	Design Value	Base Year D.V. (Ave of 3 3-yr periods)
2003	95 <i>ppb</i>		
2004	79	89 ('03-'05)	
2005	94	88 ('04-'06)	90.0 <i>ppb</i>
2006	91	93 ('05-'07)	
2007	95		

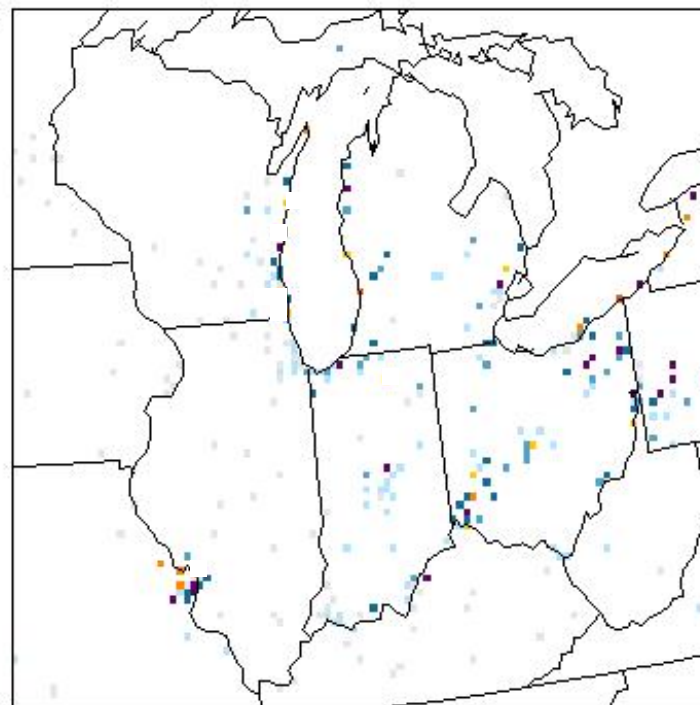
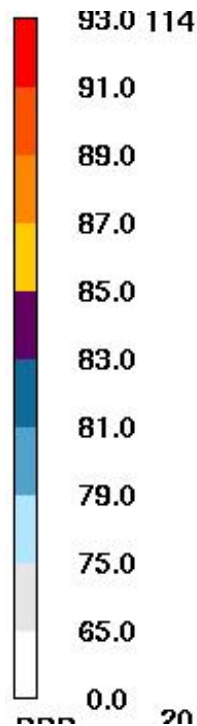
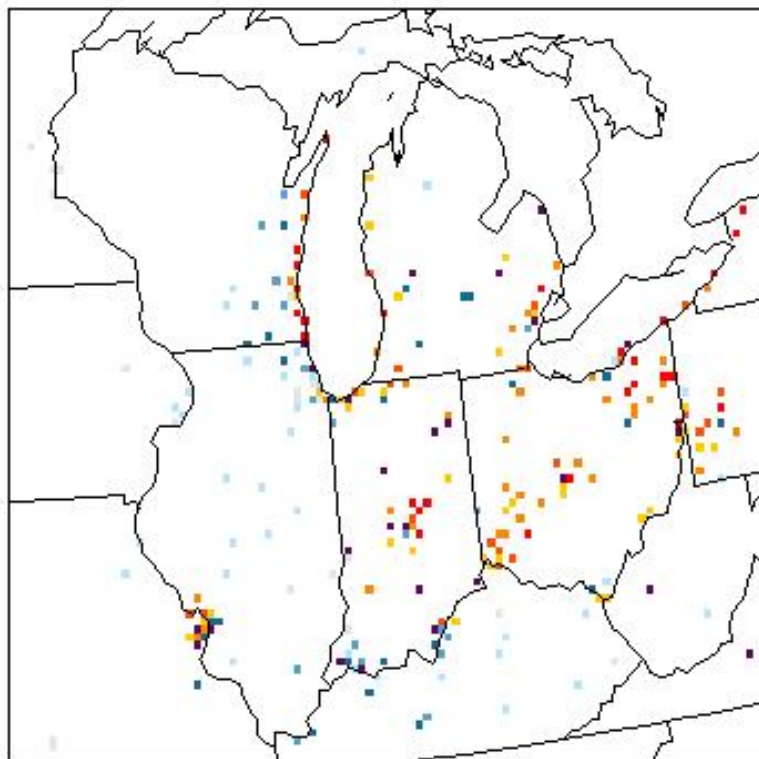


Ozone

Base Year Comparison: Ozone

2002*

2005*



Statistical Summary

# Sites > NAAQS	93	9
Peak Value	99.0 ppb	90.0 ppb
Ave Exceedance Amount	7 ppb	2 ppb

** Average of three 3-year periods centered on this year*

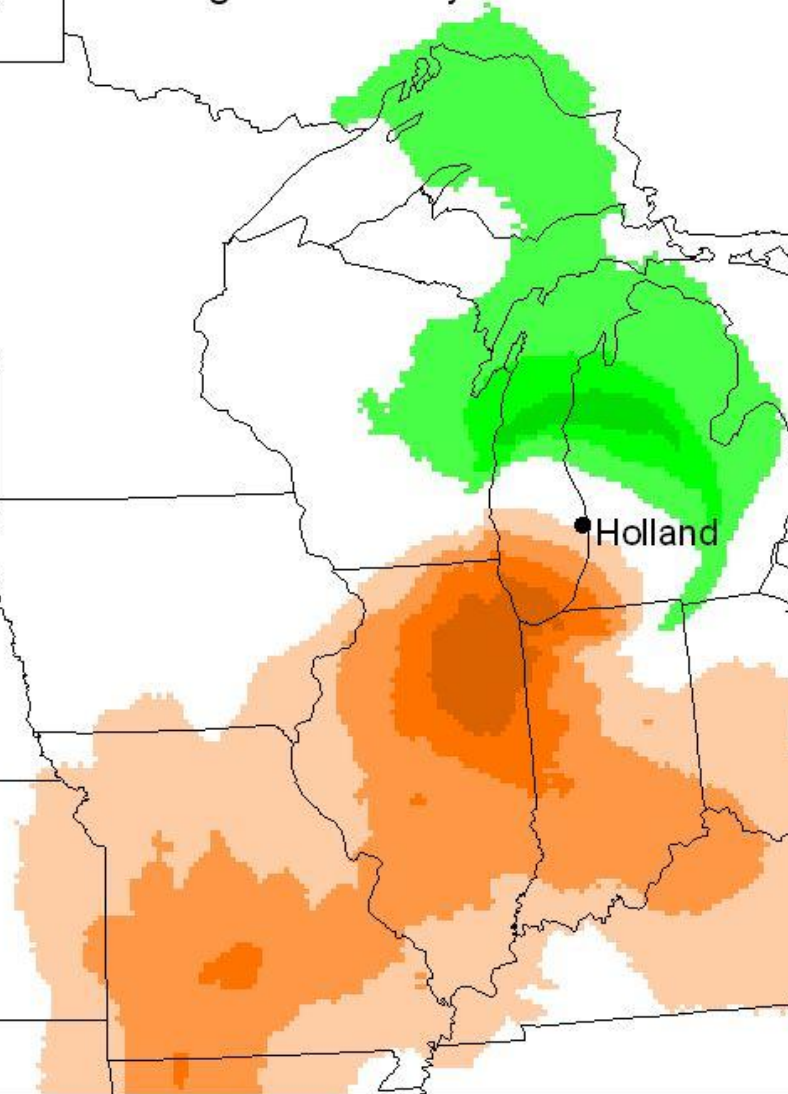
Ozone Modeling Results

Key Site	BY D.V.	2009/2010	2012	2018
<i>Lake Michigan Area</i>				
Chiwaukee (WI)	84.7	82.3	80.9	76.2
Sheboygan (WI)	88.0	84.0	81.9	75.4
Door County (WI)	88.7	83.9	81.6	74.7
Holland (MI)	90.0	85.3	82.9	76.1
Muskegon (MI)	85.3	80.8	78.6	72.2
<i>St. Louis Area</i>				
Orchard (MO)	87.0	82.0	80.4	76.2
Maryland Heights (MO)	87.3	83.4	81.9	78.1
<i>Detroit Area</i>				
New Haven	86.0	81.4	80.2	76.1
<i>Cleveland Area</i>				
Ashtabula	89.0	83.4	81.0	75.1
Eastlake	86.3	81.9	80.5	76.2
<i>Cincinnati Area</i>				
Lebanon	87.7	83.0	80.8	74.2
<i>Columbus Area</i>				
New Albany	86.3	81.8	79.6	73.0

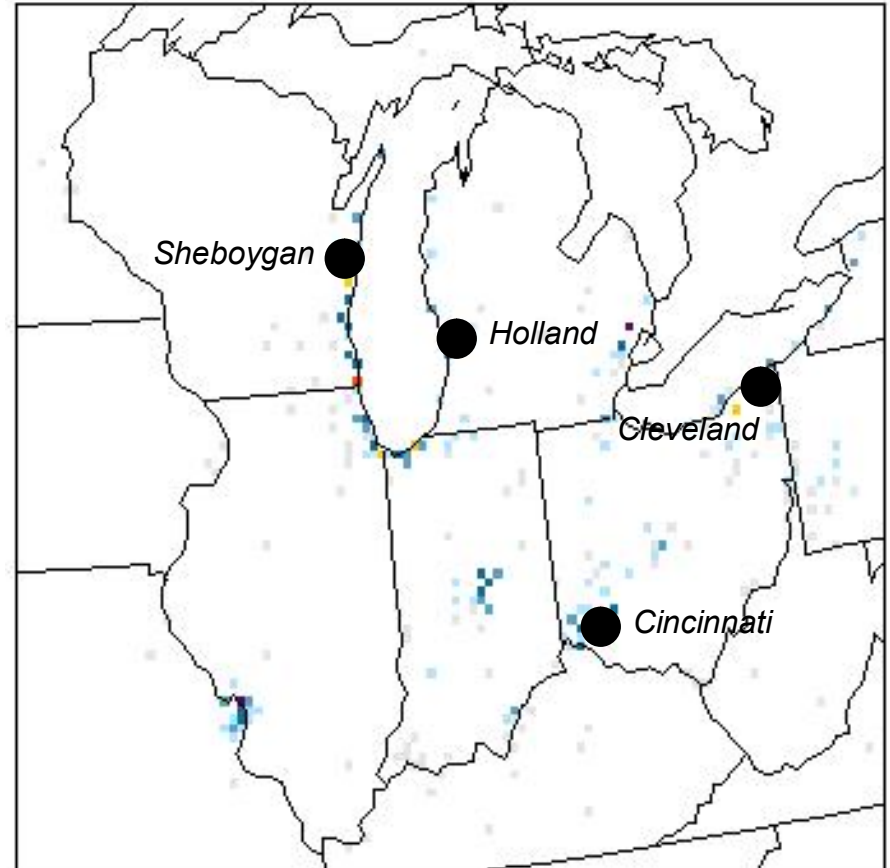
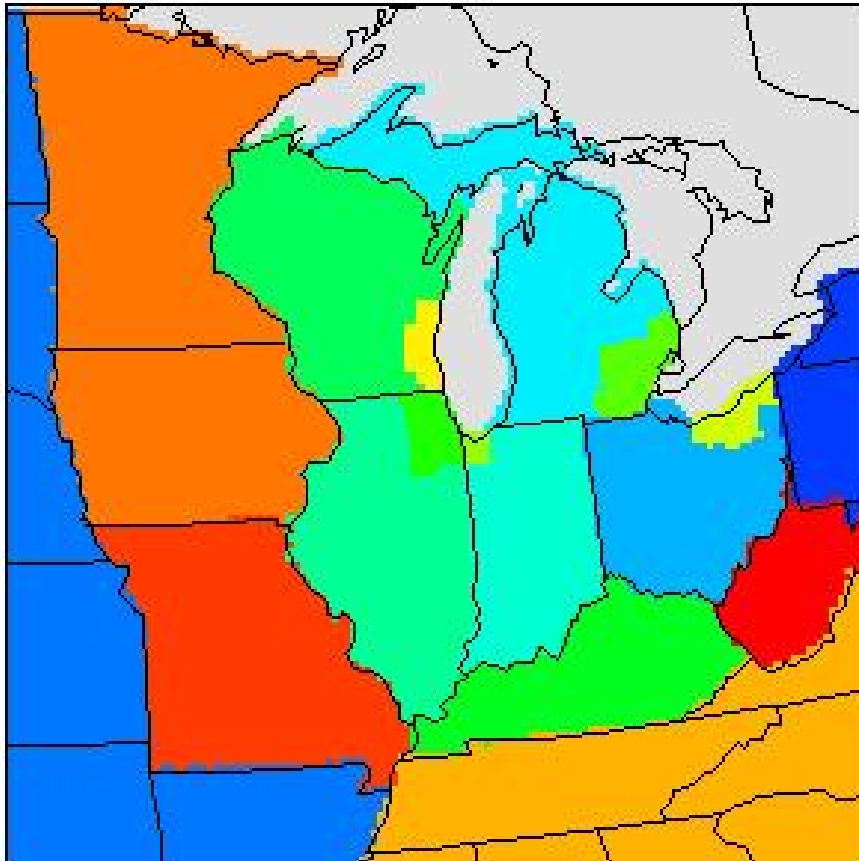
Source Regions for High Ozone Days in Holland Michigan

Orange = areas most likely upwind on high ozone days

Green = areas least likely upwind on high ozone days

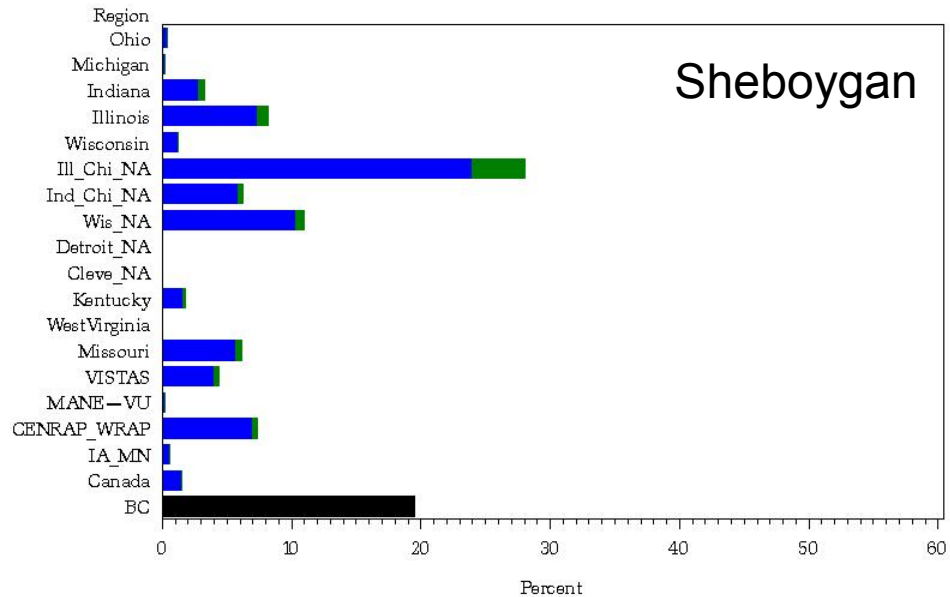


Ozone Source Apportionment



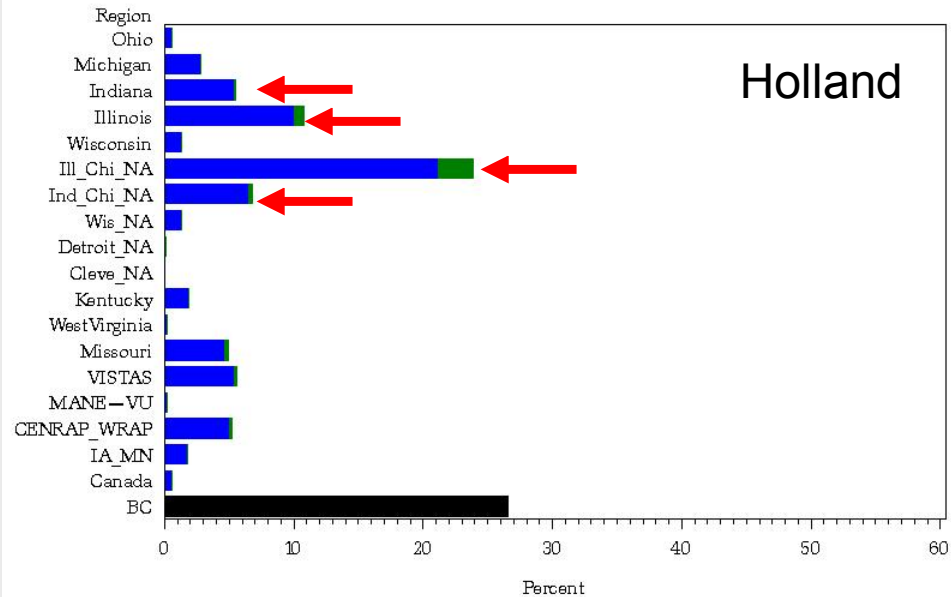
contrib NOX VOC BC

Sheboygan



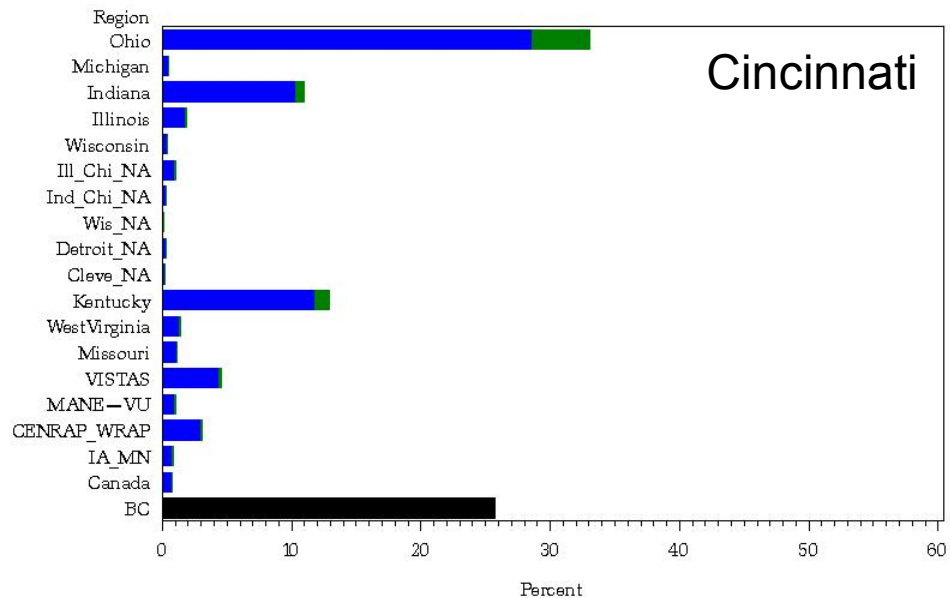
contrib NOX VOC BC

Holland



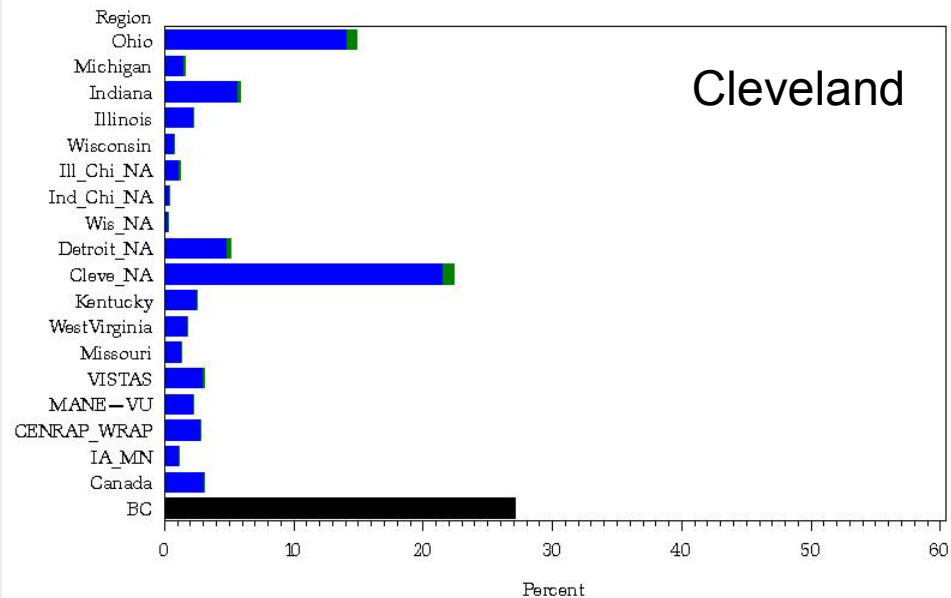
contrib NOX VOC BC

Cincinnati



contrib NOX VOC BC

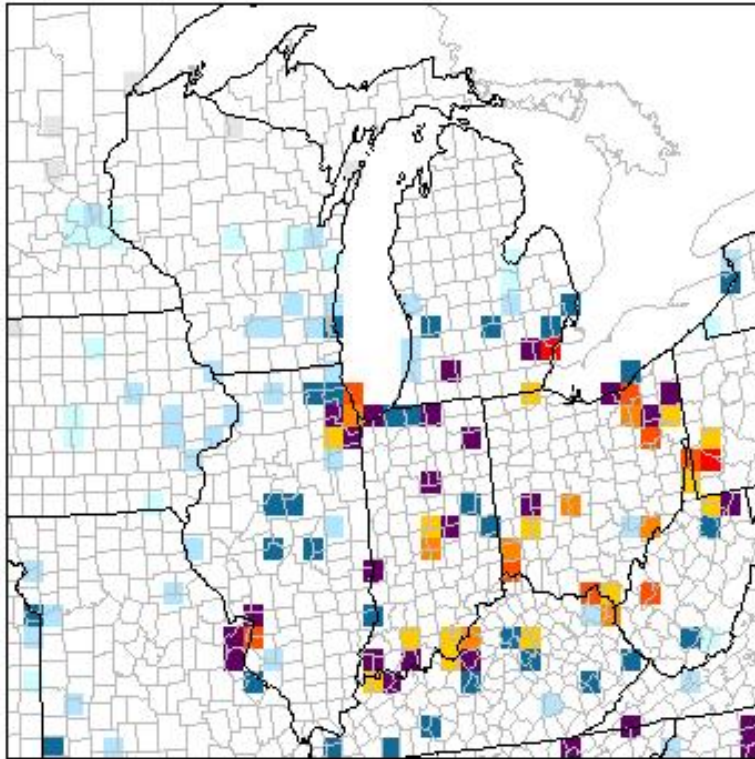
Cleveland



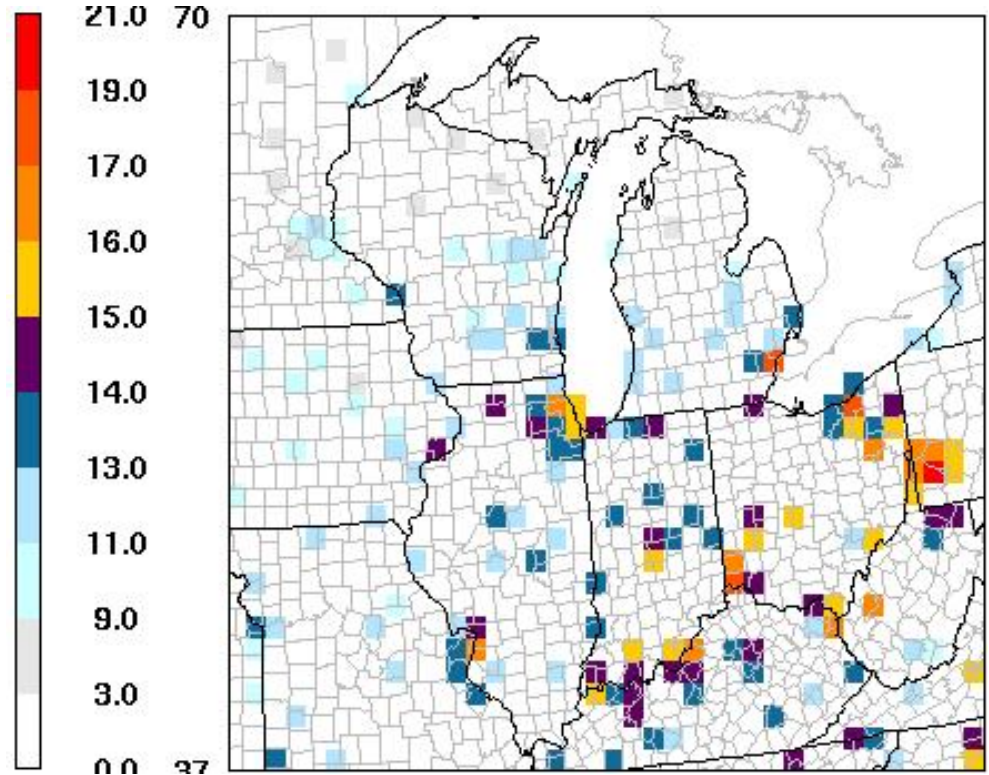
PM_{2.5}

Base Year Comparison: PM_{2.5}

2002*



2005*



Statistical Summary

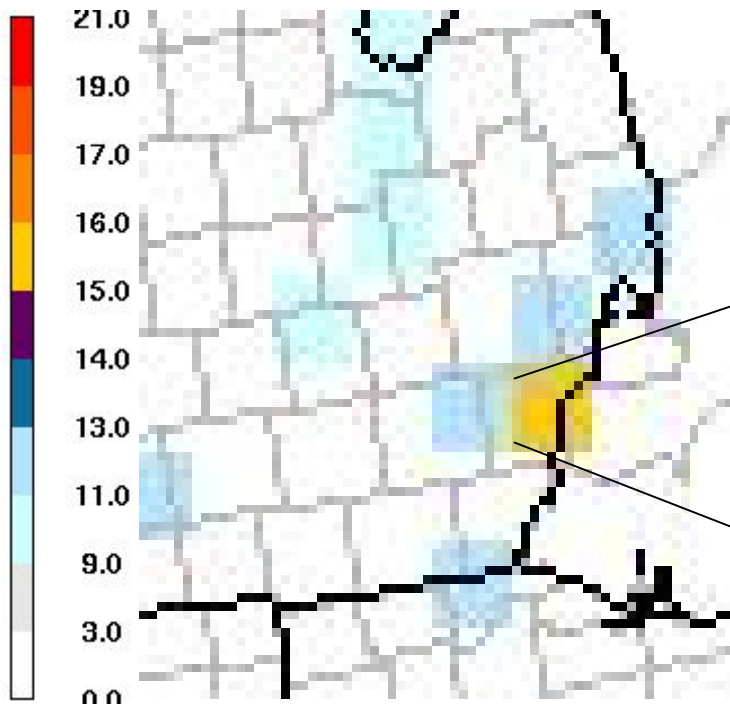
# Sites > NAAQS	58	43
Peak Value	19.3 ug/m ³	17.7 ug/m ³
Ave Exceedance Amount	1.2 ug/m ³	0.9 ug/m ³

** Average of three 3-year periods centered on this year*

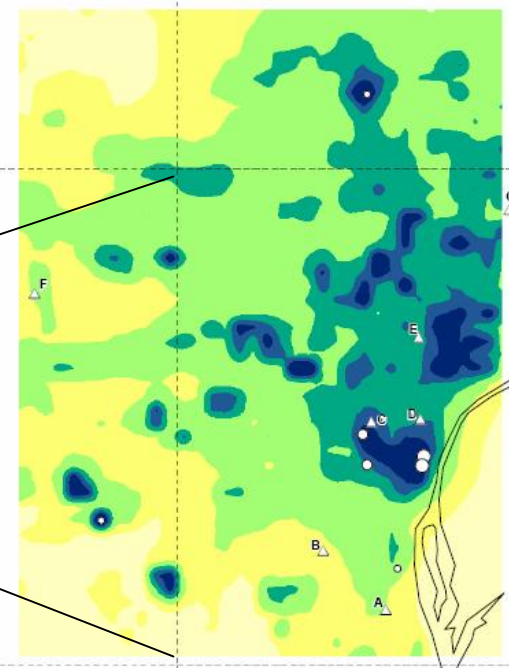
PM_{2.5} Modeling Results

Key Site	BY D.V.	2009/2010	2012	2018
<i>Chicago Area</i>				
Chicago - Mayfair	15.8	14.2	14.2	13.8
Chicago - Washington HS	15.1	13.9	13.8	13.6
Maywood	15.6	14.4	14.3	14.1
<i>St. Louis Area</i>				
Granite City	17.0	15.2	15.1	14.5
E. St. Louis	15.6	14.0	13.8	13.2
<i>Detroit Area</i>				
Southwest High School	16.0	14.2	14.0	13.5
Dearborn	17.6	15.7	15.5	15.0
<i>Cleveland Area</i>				
Cleveland - St. Tikhon	17.5	15.1	14.8	14.2
Cleveland - E14 & Orange	17.3	14.8	14.6	14.0
<i>Cincinnati Area</i>				
St. Bernard	17.8	14.6	14.5	13.9
Seymour	17.4	14.4	14.3	13.7
<i>Louisville Area</i>				
Jeffersonville	16.5	13.6	13.6	13.2

Addressing Local Source Impacts: Combining Regional Modeling with “Hot-Spot” Modeling



CAMx Regional Modeling
= 15.7 ug/m³ (Detroit)



Cite: USEPA, 2006 NAAQS for Particle Pollution:
Regulatory Impact Analysis, Appendix B

AERMOD Local Modeling
= -??? ug/m³ (Detroit)

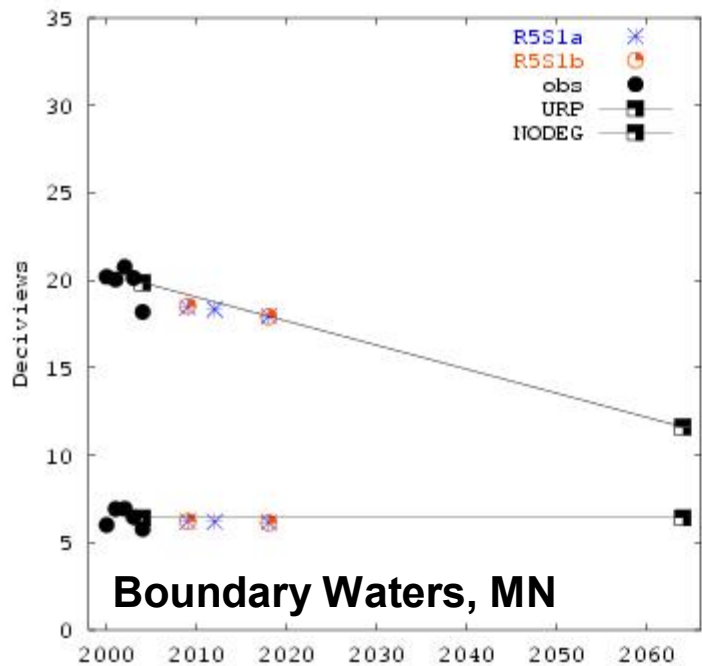
Net (adjusted) concentration = 15.7 - ??? ug/m³

Regional Haze

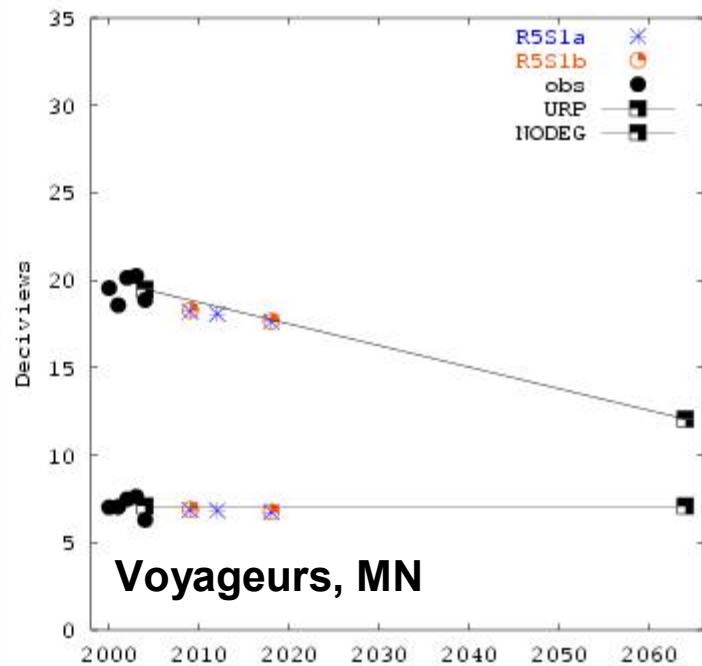
Regional Haze Requirements

- Section 169A sets as a national goal “the prevention of any future and the remedying of any existing, impairment of visibility in mandatory class I Federal areas which impairment results from manmade air pollution”
- States are required to “make reasonable progress toward meeting the national goal”
 - Improvement in visibility for most impaired days (20% worst)
 - No degradation in visibility for least impaired days (20% best)
- In determining reasonable progress, states shall consider:
 - costs of compliance,
 - time necessary for compliance,
 - energy and non-air quality environmental impacts of compliance,
 - remaining useful life of existing sources subject to such requirements
- Also, states must consider (EPA’s 1999 visibility rule):
 - uniform rate of visibility improvement (needed to attain natural visibility conditions by 2064) – i.e., “glide path”

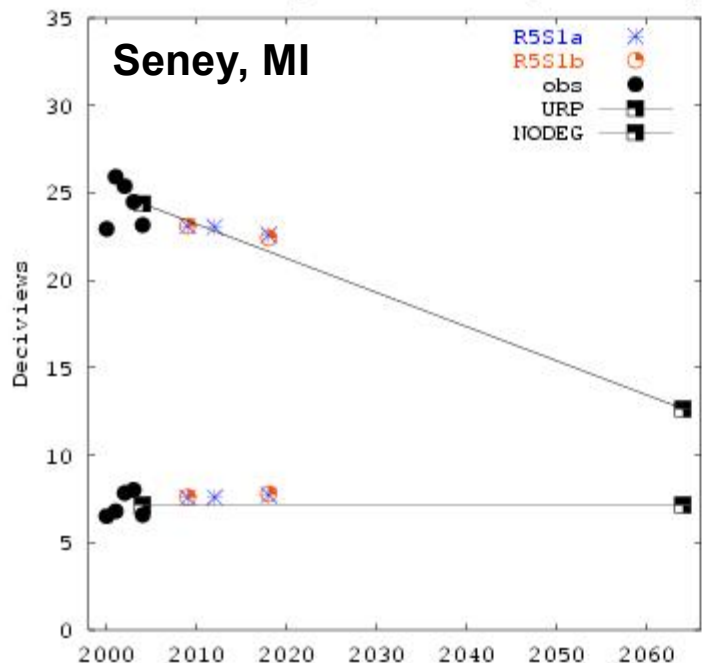
Reasonable Progress - BOWA1 - [MRPO/LADCO]



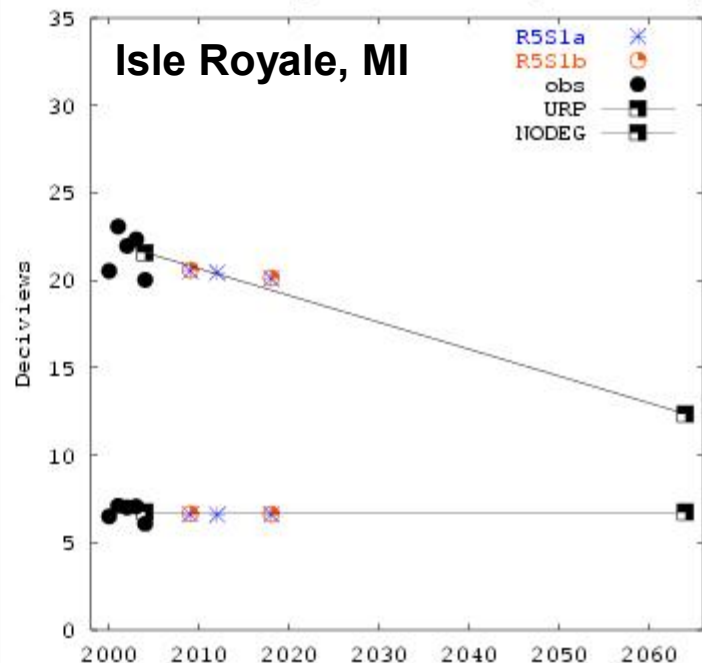
Reasonable Progress - VOYA2 - [MRPO/LADCO]



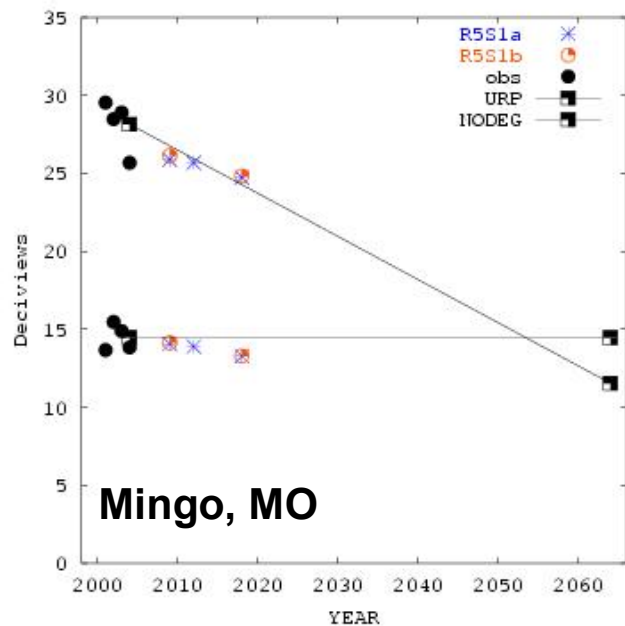
Reasonable Progress - SEI1 - [MRPO/LADCO]



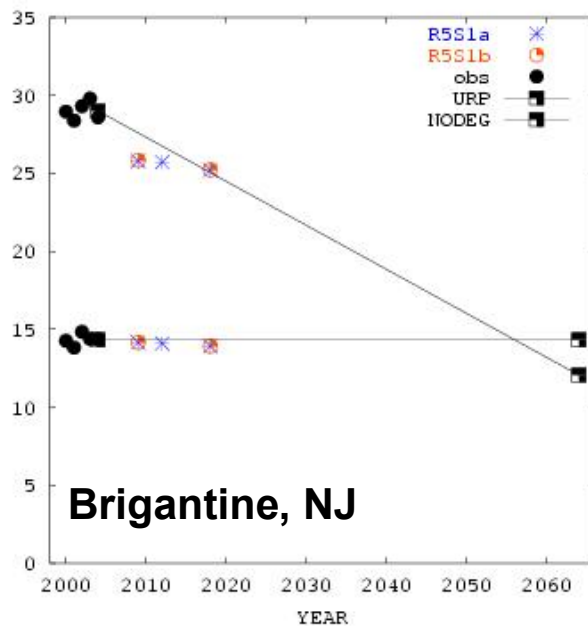
Reasonable Progress - ISLE1 - [MRPO/LADCO]



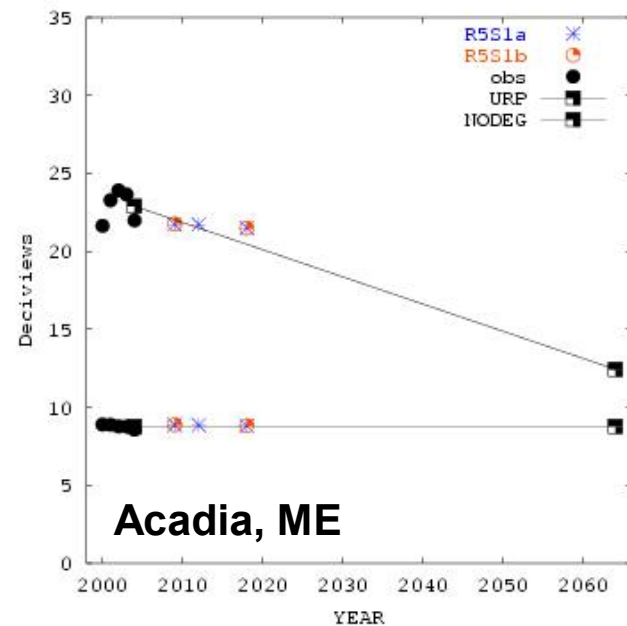
Reasonable Progress - MING1 - [MRPO/LADCO]



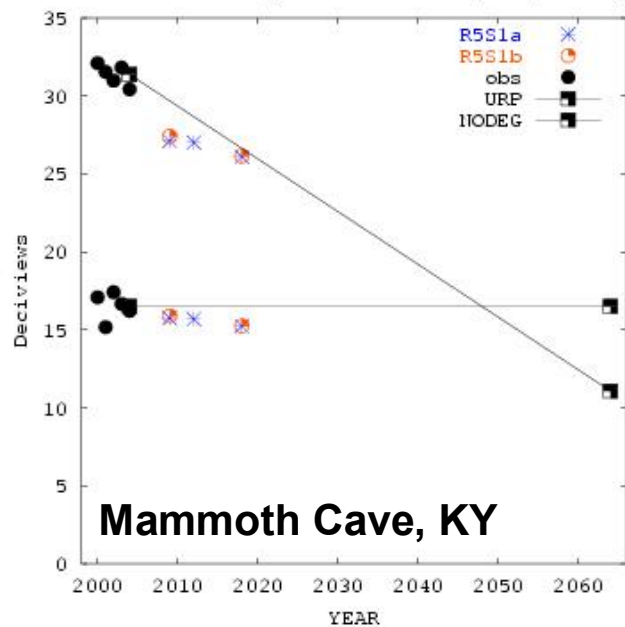
Reasonable Progress - BRIG1 - [MRPO/LADCO]



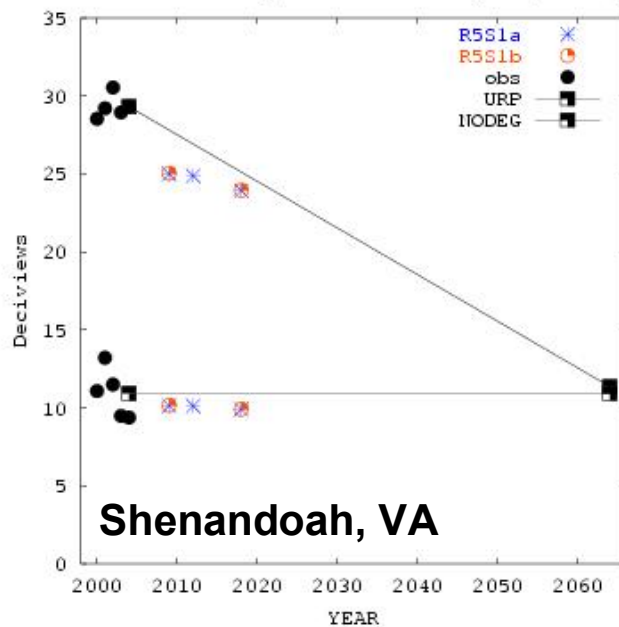
Reasonable Progress - ACAD1 - [MRPO/LADCO]



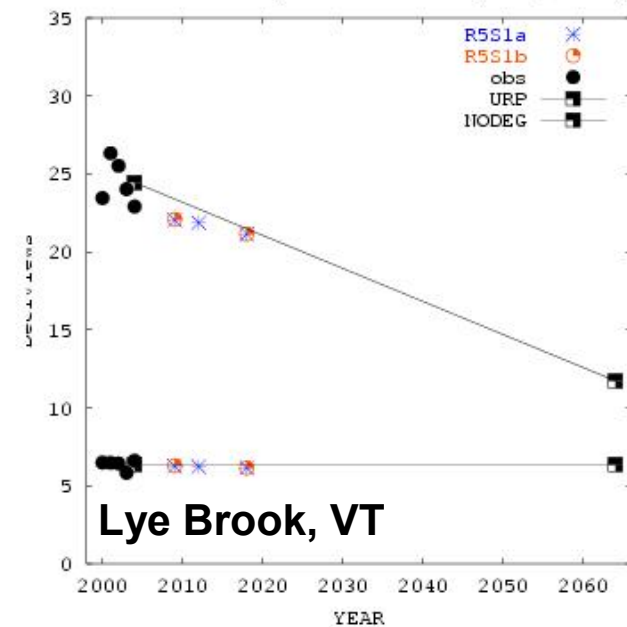
Reasonable Progress - MACA1 - [MRPO/LADCO]



Reasonable Progress - SHEN1 - [MRPO/LADCO]



Reasonable Progress - LYBRI - [MRPO/LADCO]



Reasonable Progress for Class I Areas in the Northern Midwest – Factor Analysis

July 18, 2007

Draft Final Technical Memorandum

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St. Paul, Minnesota 55155-4194

Statutory Factors

- Cost of compliance
- Time required for compliance
- Energy and non-air quality environmental impacts
- Remaining useful life

Strategies of Interest

- “On the books” measures
- Possible additional controls (sector-level)
- Possible additional controls (individual facilities)

Geographic Areas of Interest

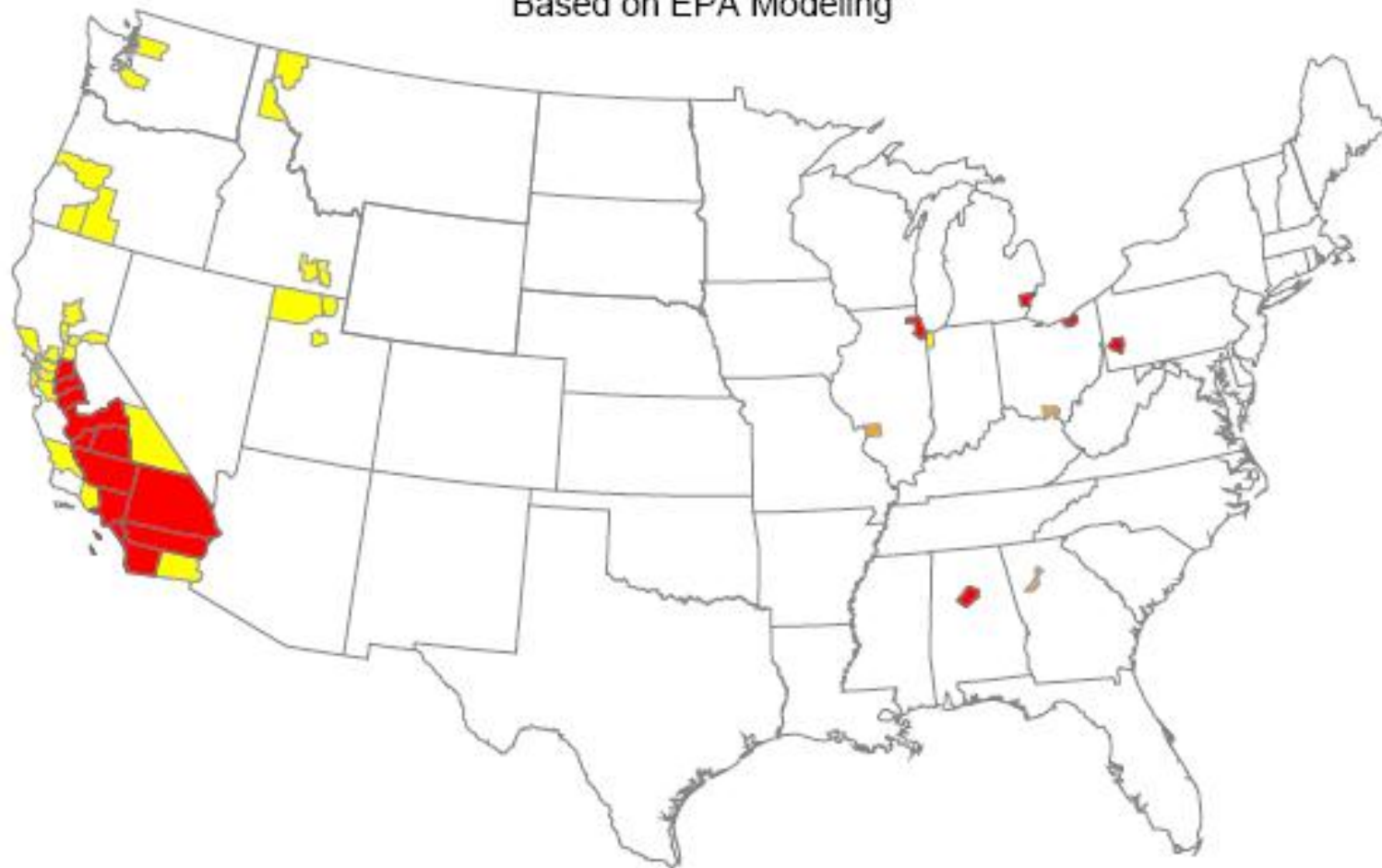
- 3-state region: MI, MN, WI
- 9-state region: MI, MN, WI, plus IA, IL, IN, MO, ND, SD

Looking Ahead: NAAQS-Haze Timeline

Milestone	2006 PM_{2.5} Primary NAAQS	2008 O₃ Primary NAAQS	Regional Haze (Progress Report)
Promulgation of Standard	September 2006	March 2008 (effective June 2008)	July 1999 rule
State Recommendations to EPA	Dec. 2007 (based on 2004-2006 monitoring data)	June 2009 (Based on 2006-2008 monitoring data)	
Final Designations Signature	December 2009	June 2010 (Approx.)	
Effective Date of Designations	April 2010	2010 (Approx.)	
SIPs Due	April 2013	2013 (Approx.)	December 2012
Attainment Date	April 2015 (based on 2012-2014 monitoring data)	2013 – 2030	2018 (1 st milestone)
Attainment Date with Extension	April 2020		

Counties Projected to Exceed the Revised PM_{2.5} Standards in 2020

Based on EPA Modeling*



Legend

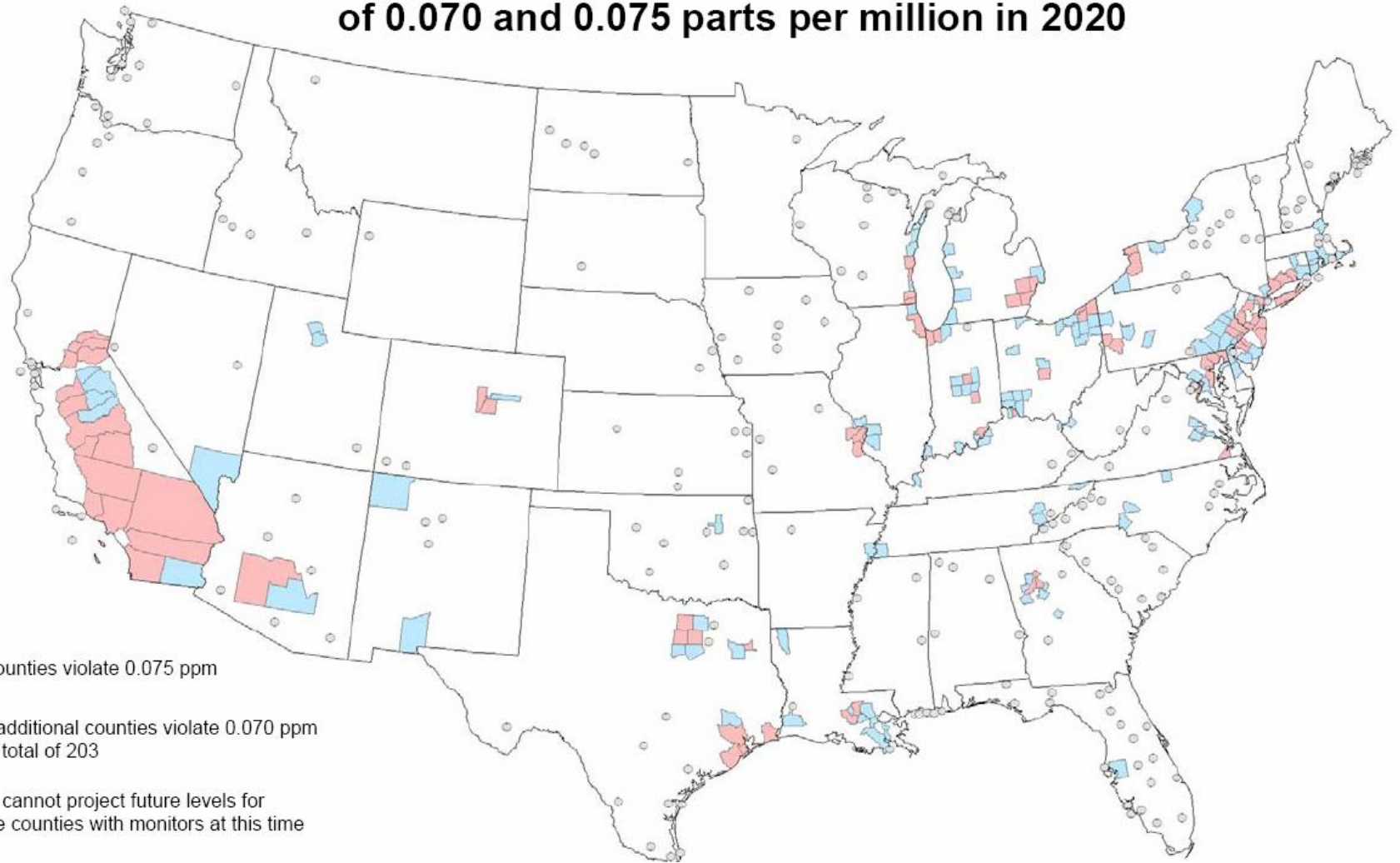
County with monitor exceeding:

- both annual (15 $\mu\text{g}/\text{m}^3$) and 24-hour (35 $\mu\text{g}/\text{m}^3$) PM_{2.5} standards
- ONLY the 24-hour PM_{2.5} standard (35 $\mu\text{g}/\text{m}^3$)
- ONLY the annual PM_{2.5} standard (15 $\mu\text{g}/\text{m}^3$)

Number of Counties

	17
	28
	3
Total Counties Projected to Exceed	48

Counties With Monitors Projected to Violate Alternate 8-hour Ozone Standards of 0.070 and 0.075 parts per million in 2020



Air Quality Challenges Ahead for Midwest States

- Attain/maintain current (1997) ozone and PM_{2.5} standards
- Develop control plans to meet new (tighter) PM_{2.5} and, possibly, new (tighter) ozone standard
- Continue to make reasonable progress for regional haze
- Address mercury deposition, air toxics, greenhouse gases, and