Overview of Regional Planning Activities

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Lake Michigan Air Directors Consortium

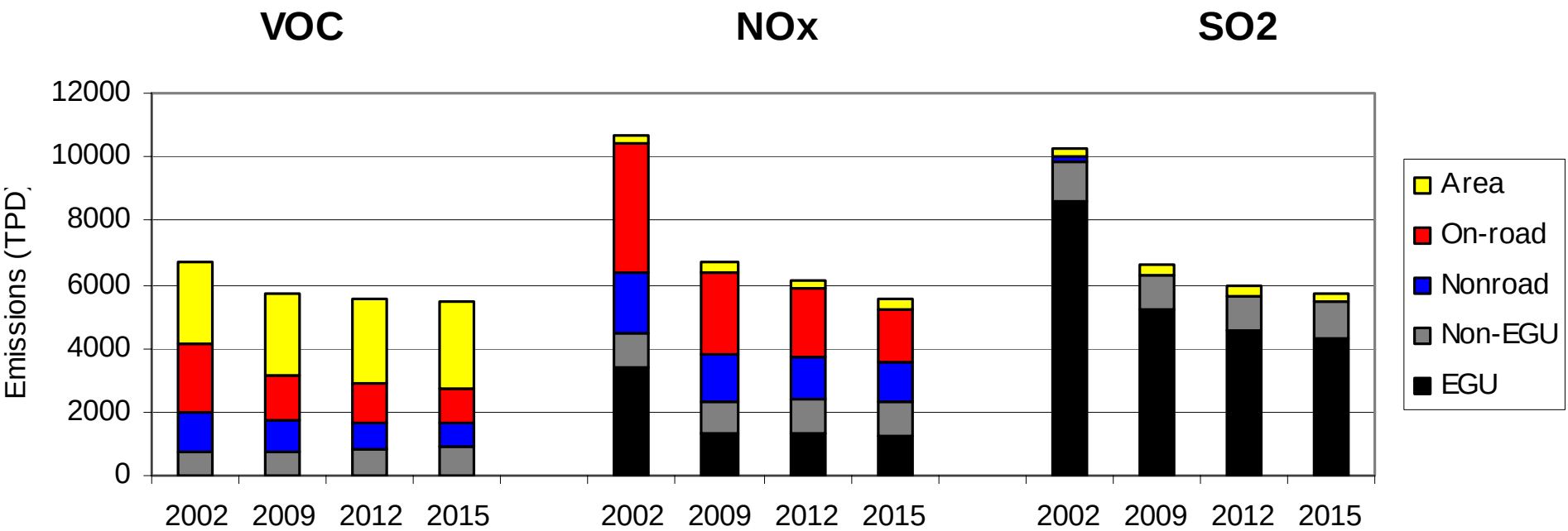
March 21, 2007

Topics

- Development of Regional Emissions Inventory
- Application of Air Quality Models
- Analysis of Monitoring Data
- Evaluation of Candidate Control Strategies

Emission Inventories

Regional Emissions



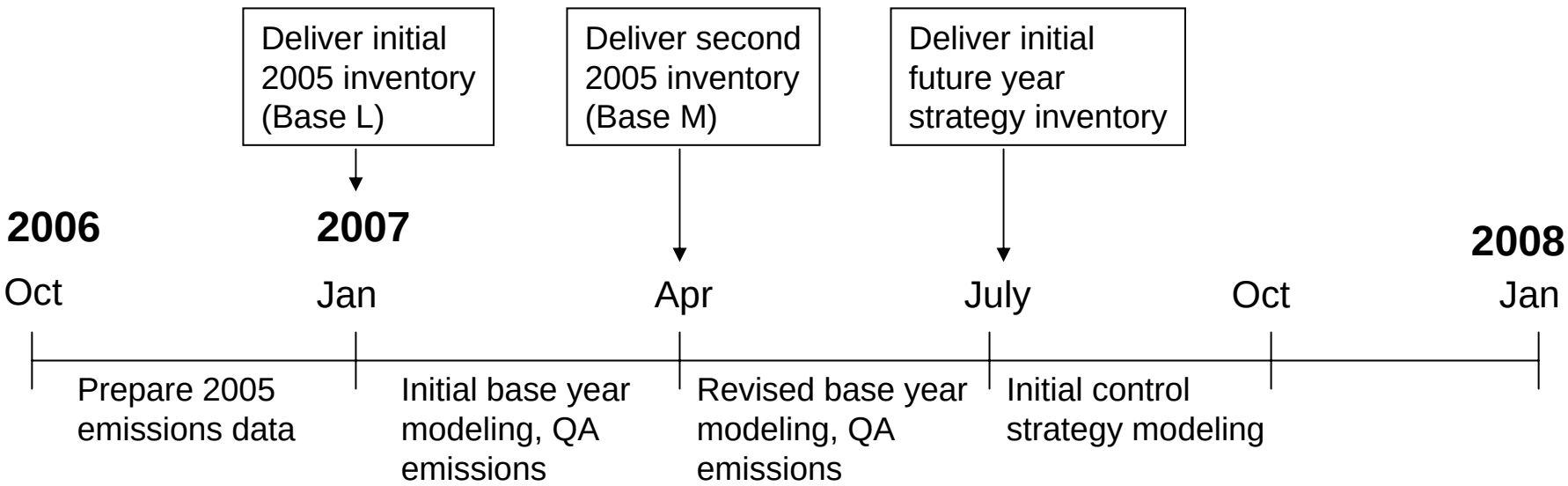
Note: Reflects 2002 base year (Base K)

Emission Inventory Improvements

(2005 Base Year)

- On-road mobile sources
  - Used data from over 20 local transportation networks
- Off-road mobile sources
  - Used latest version of NONROAD model (NMIM2005)
  - Updated commercial marine and locomotives
- Point sources
  - Updated EGU temporal profiles with latest CEM data
  - Corrected several erroneous non-EGU sources
- Area sources
  - Included new categories (outdoor wood boilers)
  - Further consistency reviews
- Other
  - Improved biogenic emissions
  - Updated emissions for other (non-LADCO) states
  - Improved growth and control factors

2005 Base Year Modeling: Schedule



Expect final modeling and TSD by fall 2007 for ozone (moderate NA areas), $PM_{2.5}$, and haze

Modeling

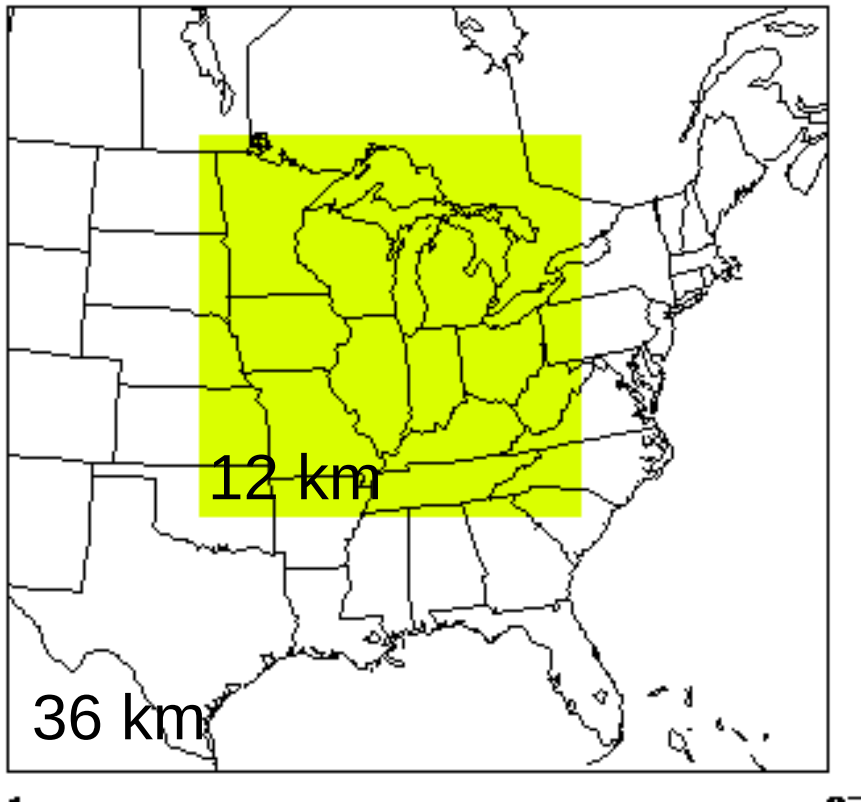
Air Quality Modeling

Model: CAMx

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

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

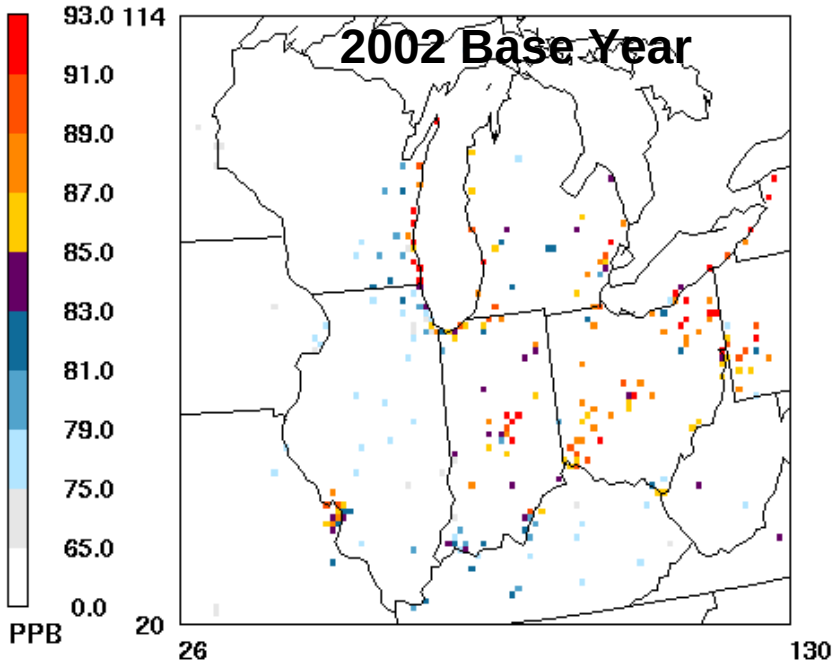
2001, 2002, 2003 (summer) – O_3, 12 km

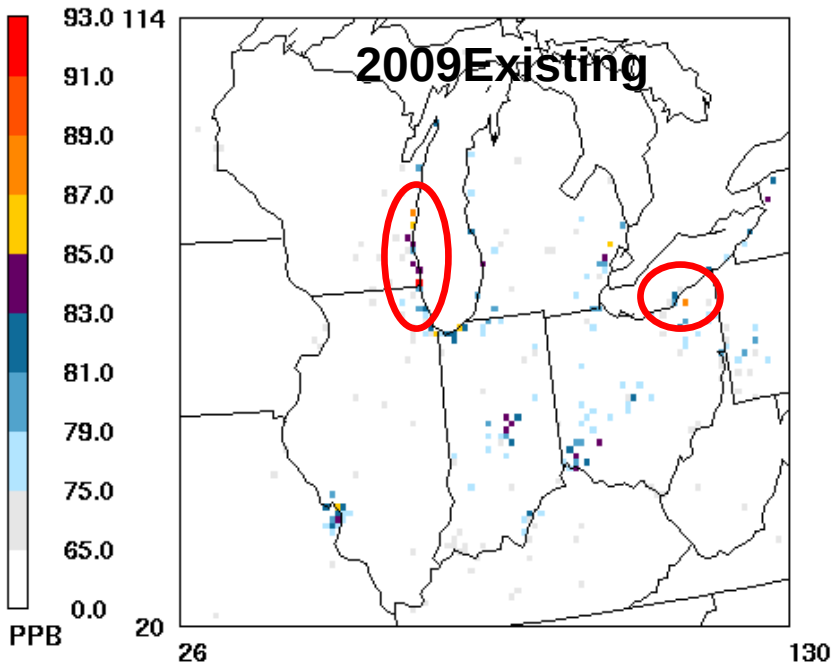


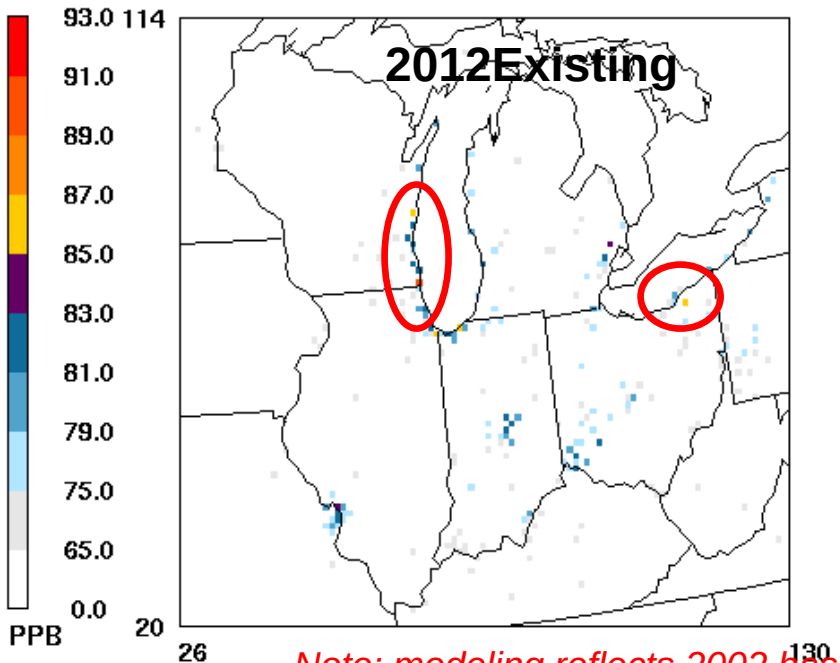
Ozone

Number of NA Monitors

	2002	2009	2012
IL	3	0	0
IN	22	2	2
MI	15	1	1
OH	40	1	1
WI	13	4	3
total	***93***	***8***	***6***





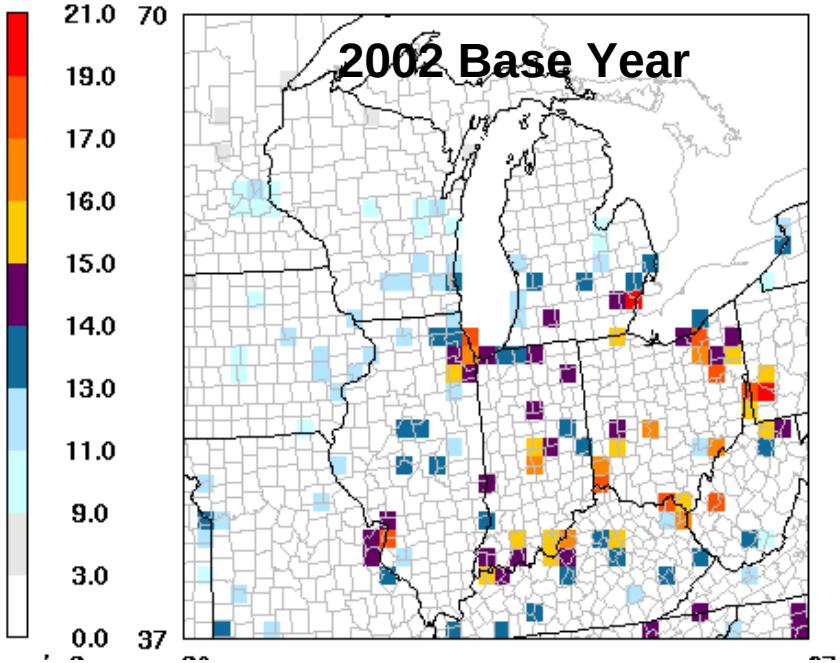


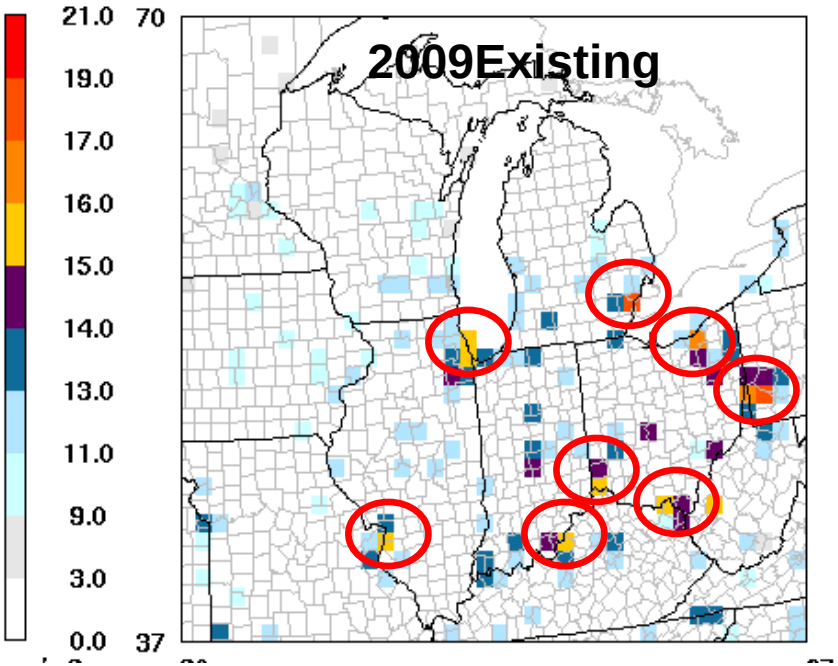
Note: modeling reflects 2002 base year

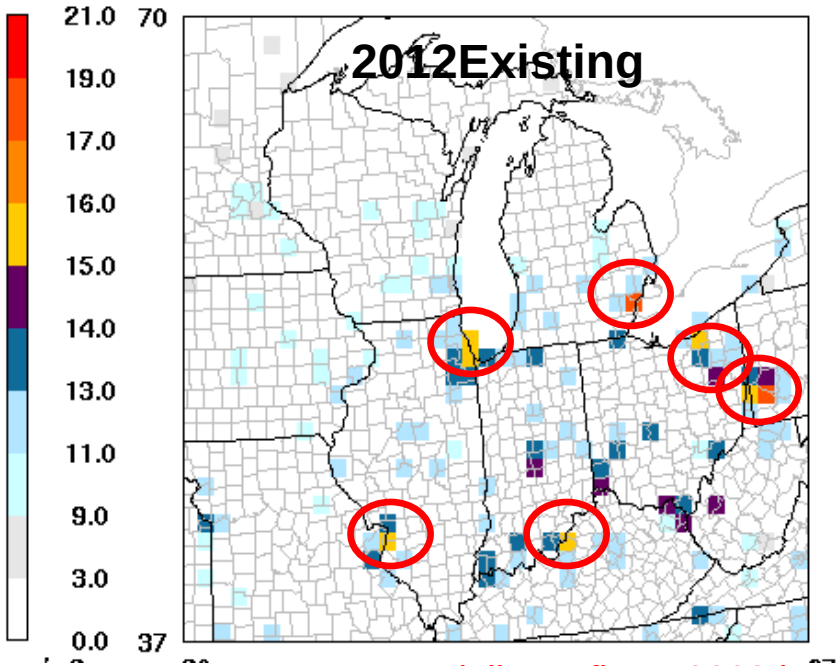
$PM_{2.5}$

Number of NA Monitors

	2002	2009	2012
IL	11	3	3
IN	10	1	1
MI	6	3	2
OH	31	7	4
WI	---	---	---
total	***58***	***14***	***10***

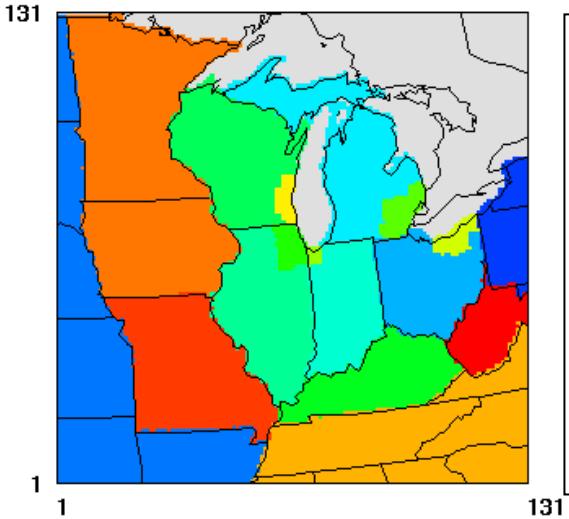






Note: modeling reflects 2002 base year

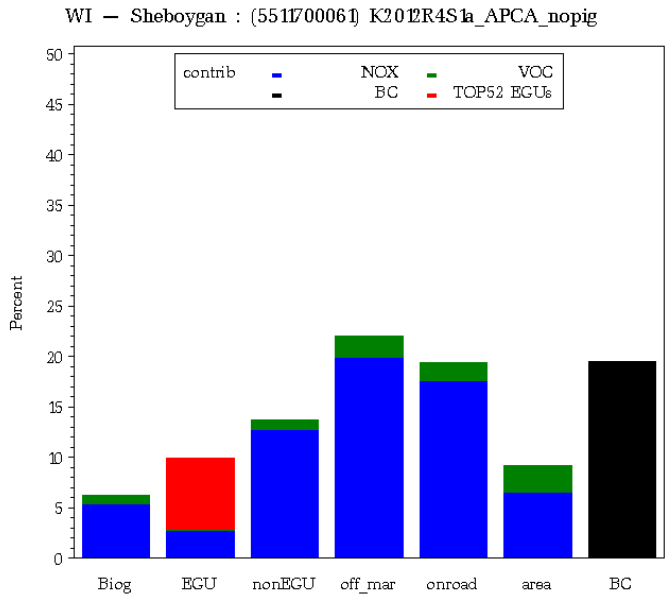
Ozone Source Apportionment

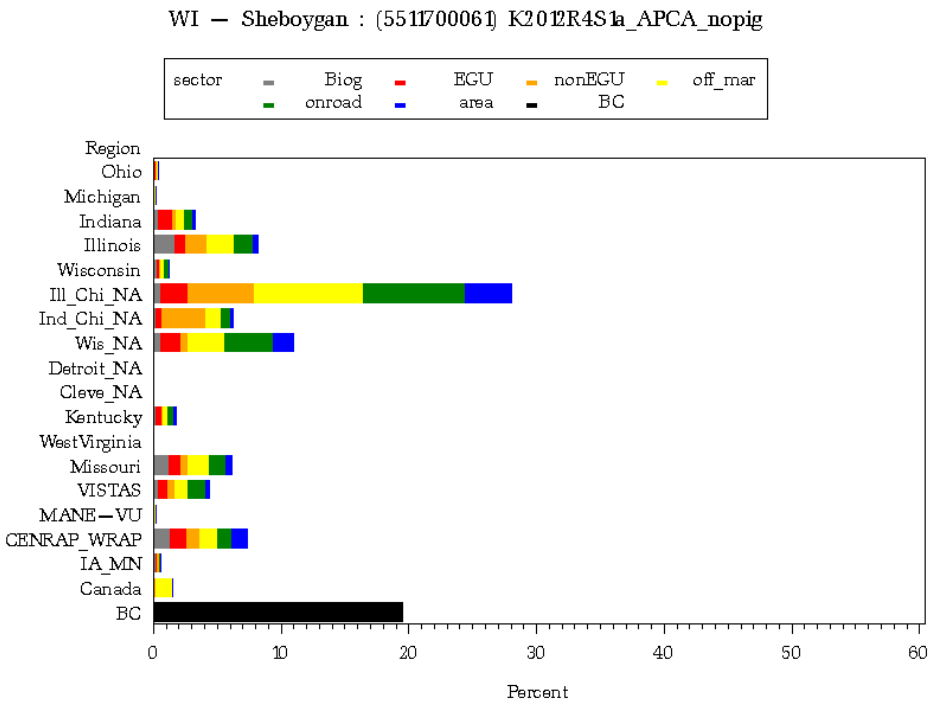


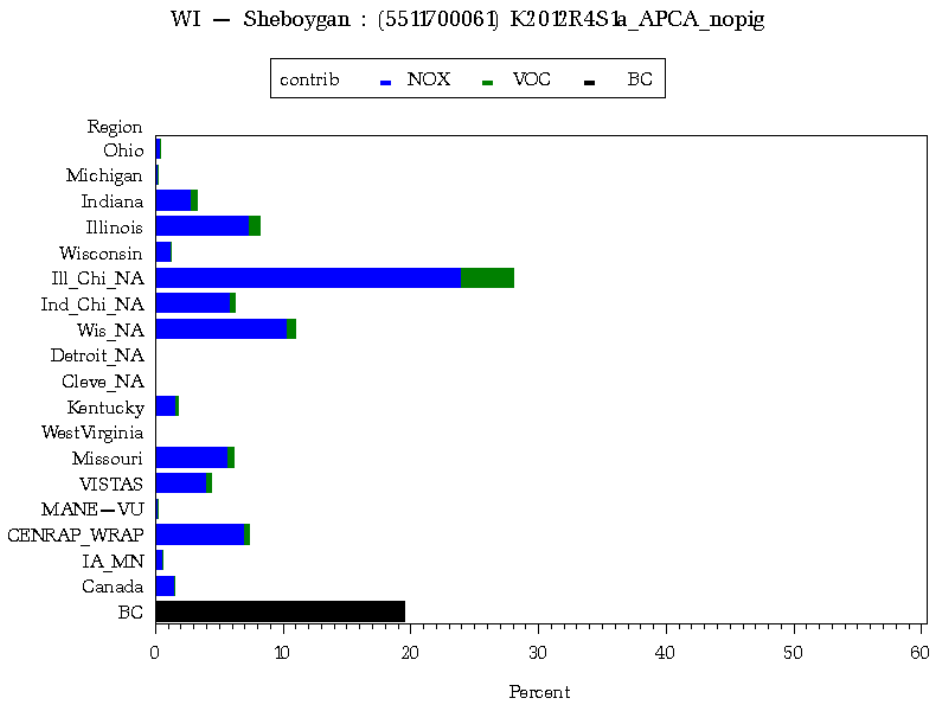
18 geographic regions

6 source groups:

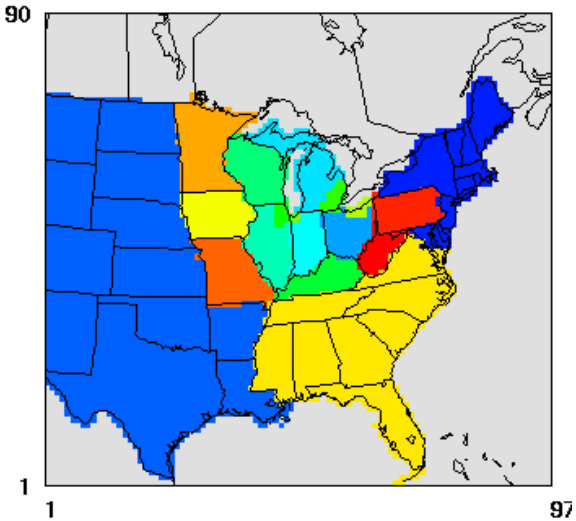
- **EGU point**
- **Non-EGU point**
- **On-road**
- **Non-road, marine, aircraft, rail**
- **Other area**
- **biogenics**







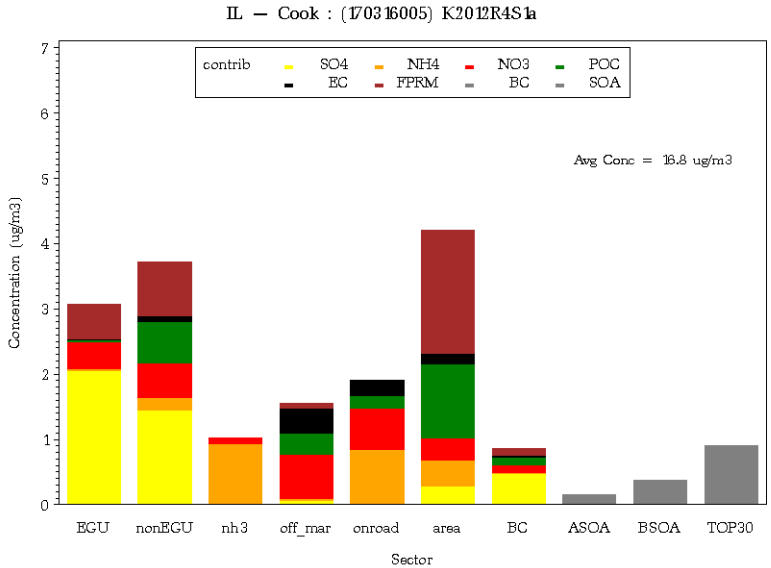
$PM_{2.5}$ Source Apportionment

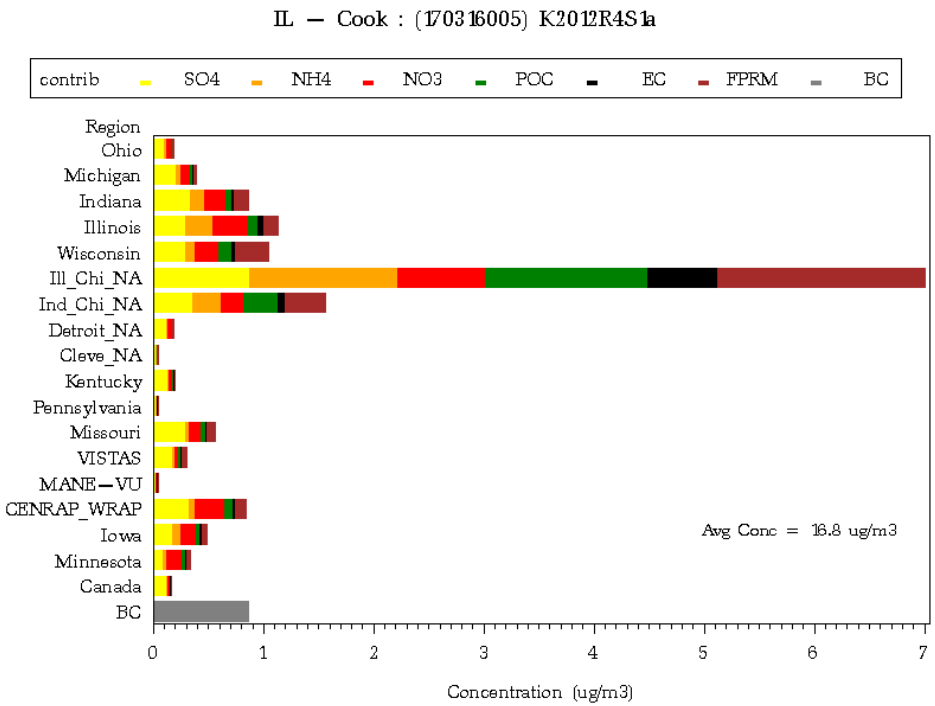


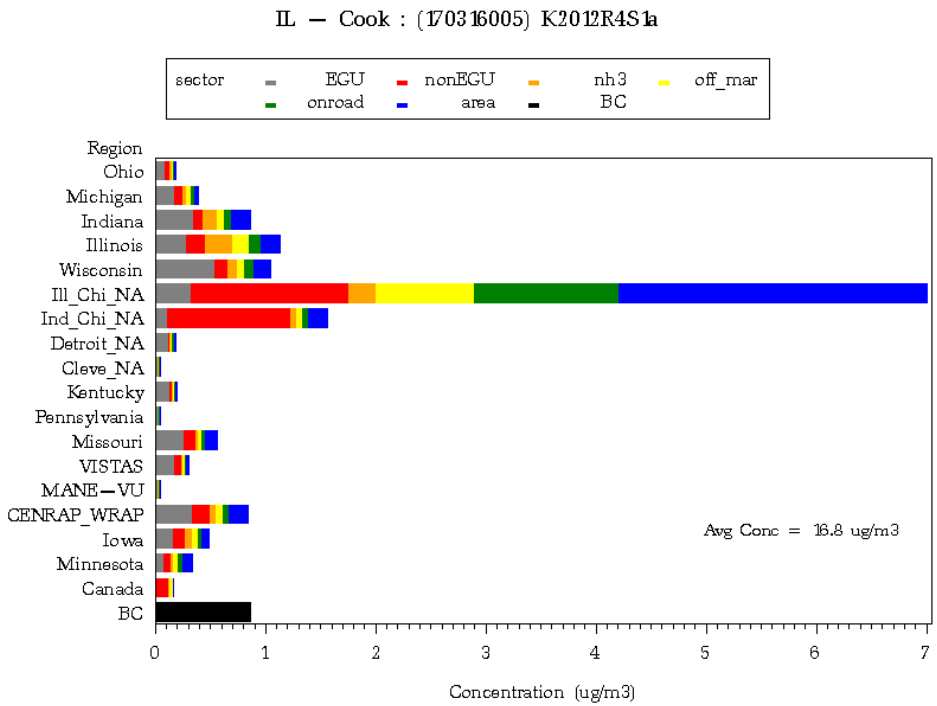
18 geographic regions

6 source groups:

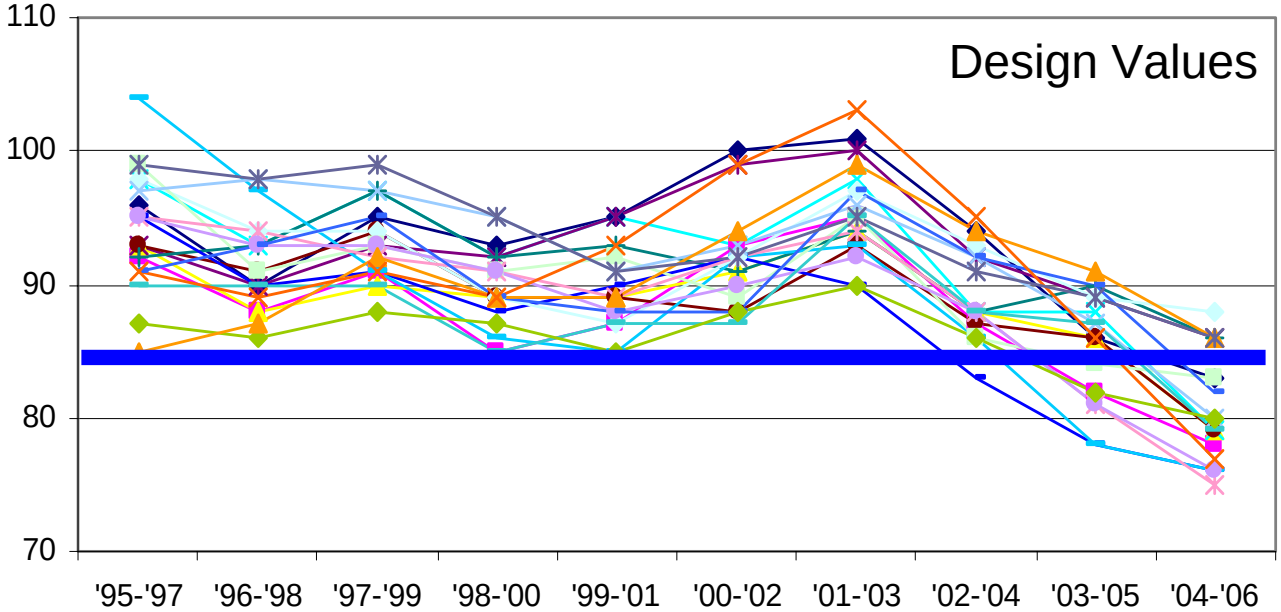
- **EGU point**
- **Non-EGU point**
- **On-road**
- **Non-road, marine, aircraft, rail**
- **Other area**
- **Ammonia**

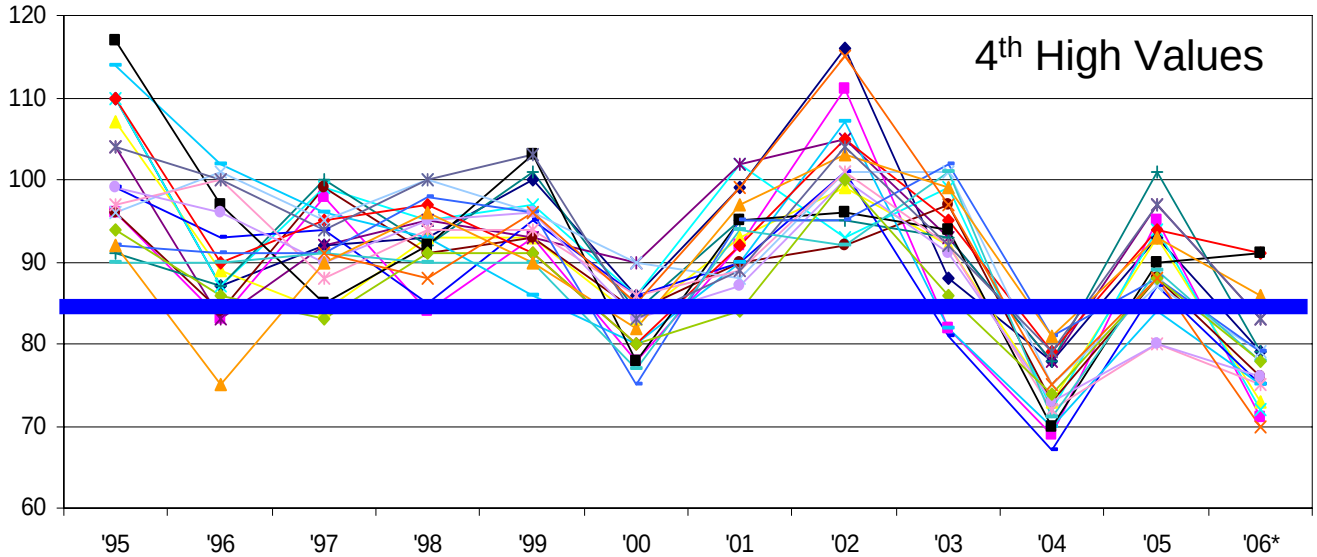




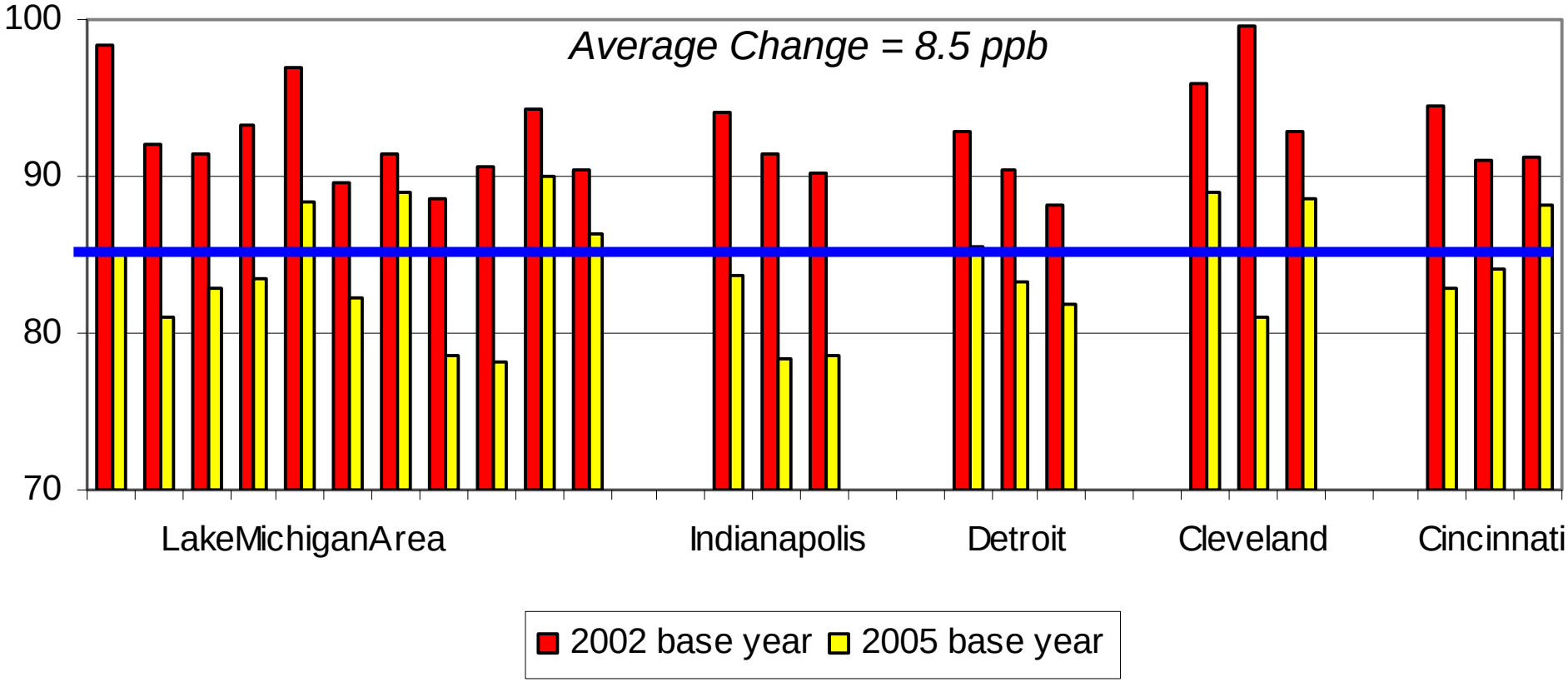


Ozone Trends





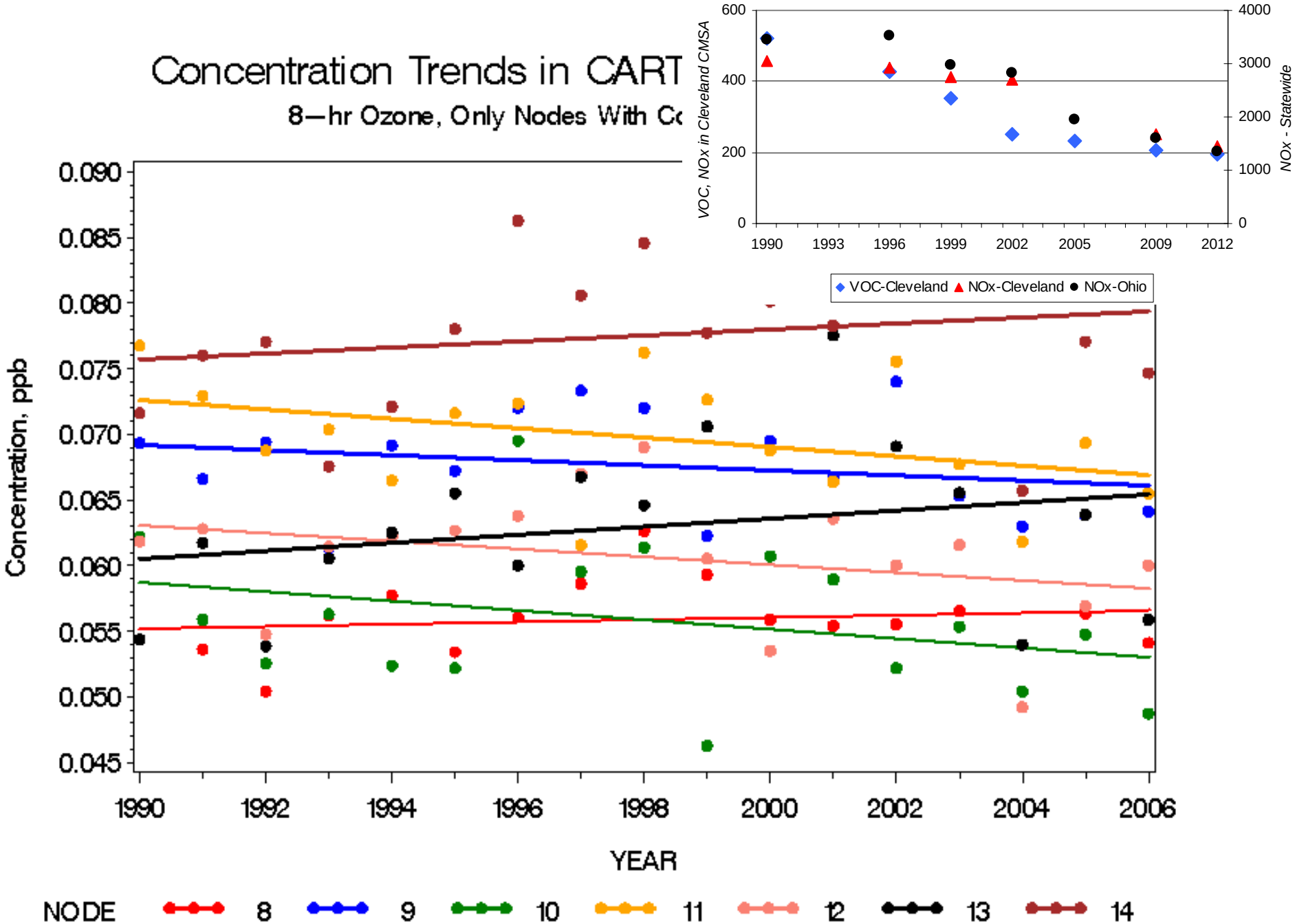
2002 v. 2005 Base Year: Ozone



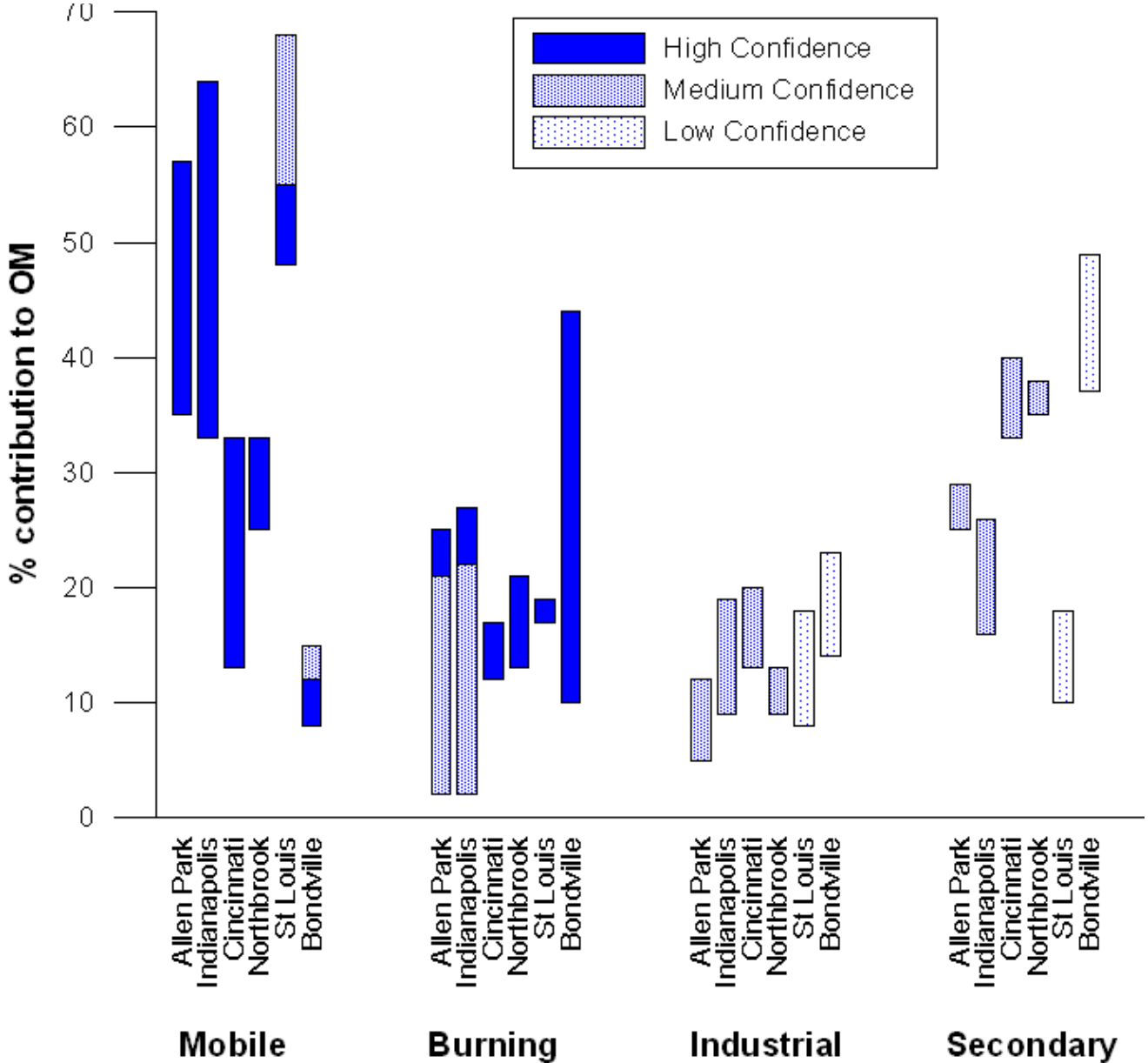
Data Analysis

Example Analyses

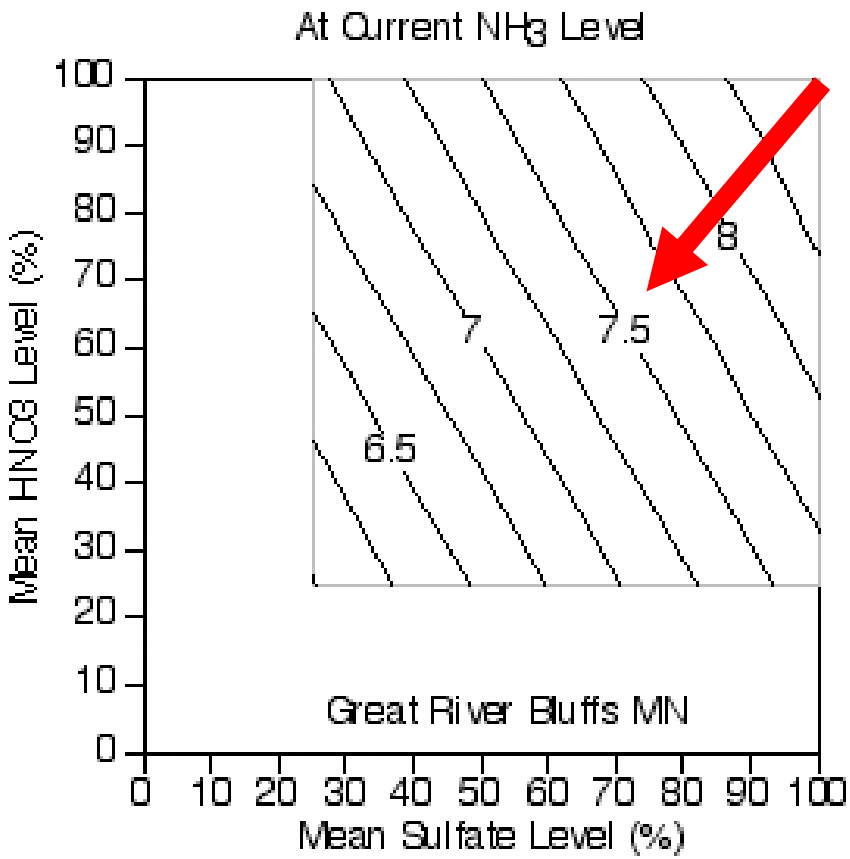
- Weight-of-evidence (Ozone)
  - Air quality modeling (based on guidance)
  - Air quality modeling (alternative assumptions)
  - Trends-based analysis (monitoring and emissions)
  - Observation-based methods
- Source apportionment ($PM_{2.5}$)
- Observation-based methods ($PM_{2.5}$)
- Trajectories (Haze)

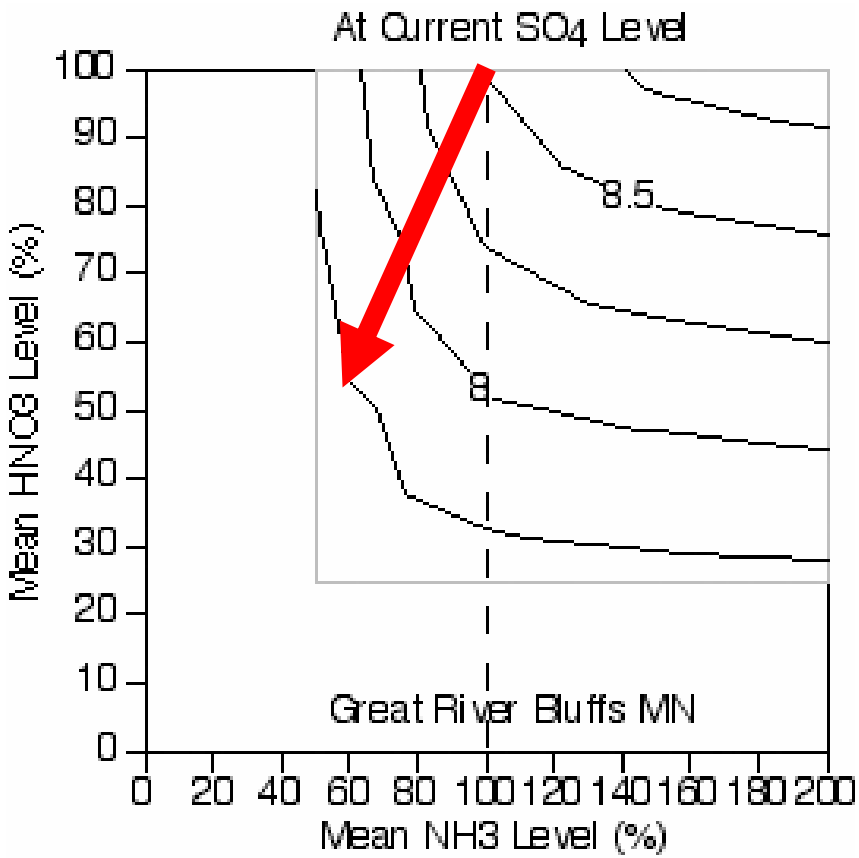

Concentration Trends in CART
8—hr Ozone, Only Nodes With Co
Concentration, ppb
0.090
0.085
0.080
0.075
0.070
0.065
0.060
0.055
0.050
0.045
1990
1992
1994
1996
1998
2000
2002
2004
2006
YEAR
NODE
8
9
10
11
12
13
14
VOC, NOx in Cleveland CMSA
NOx - Statewide
600
400
200
0
4000
3000
2000
1000
0
1990
1993
1996
1999
2002
2005
2009
2012
VOC-Cleveland
NOx-Cleveland
NOx-Ohio

Sources of Organic Carbon

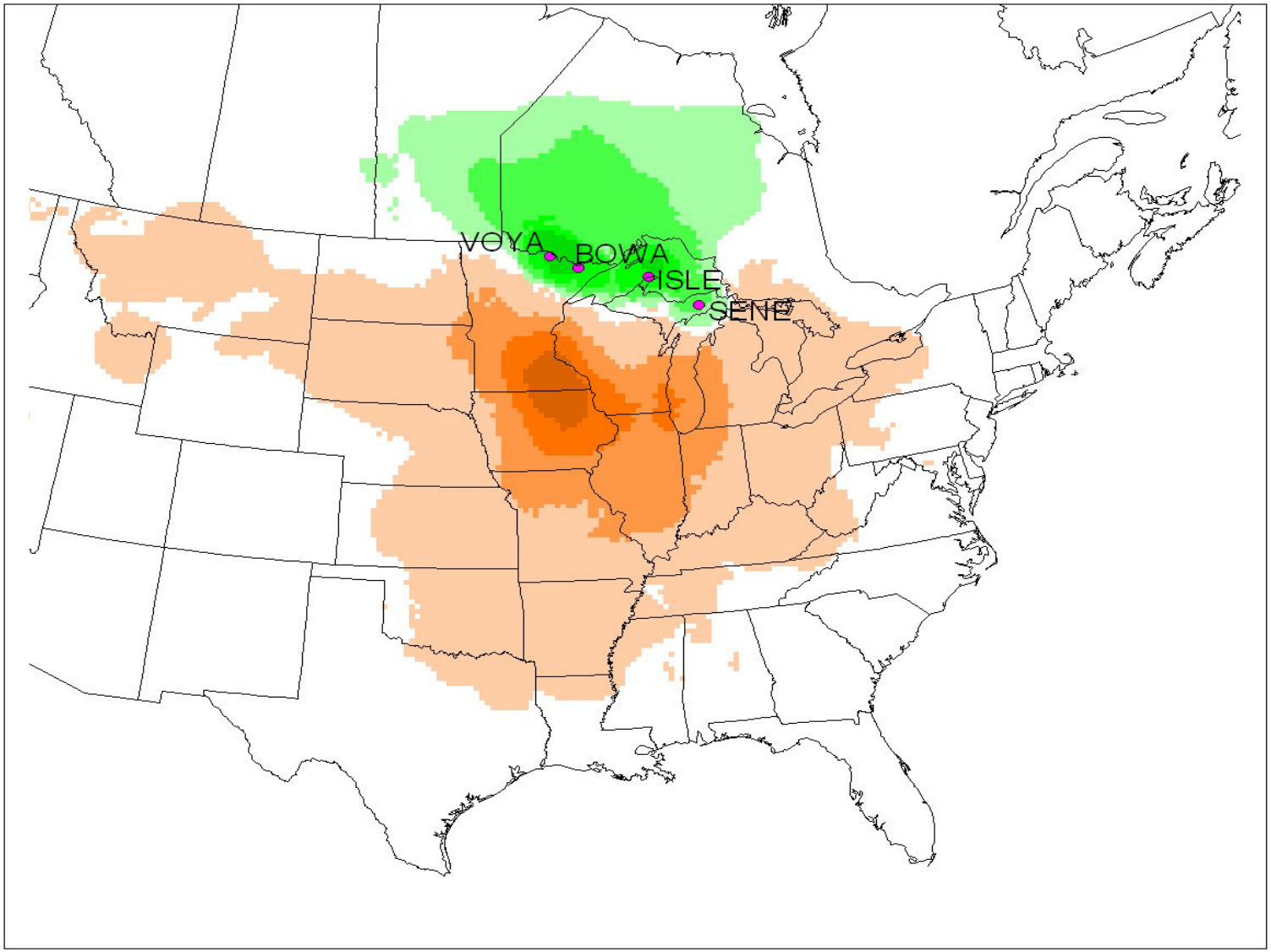


Change in $PM_{2.5}$ in response to reductions in nitric acid (or NO_x), sulfate (or SO_2), and ammonia





Composite Back Trajectory: 20% Worst Visibility Days



Control Strategies

Summary: Emission Reduction Effectiveness

	Ozone	$PM_{2.5}$	Haze
Regional NOx	x	x	x
Regional SO2		x	x
Urban OC		x (?)	
Urban VOC	x		
Local Source Control		x	

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)
  - NOx 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

Note: EPA's Midwest Clean Diesel Initiative also expected to provide NOx and $PM_{2.5}$ emission reductions from mobile sources

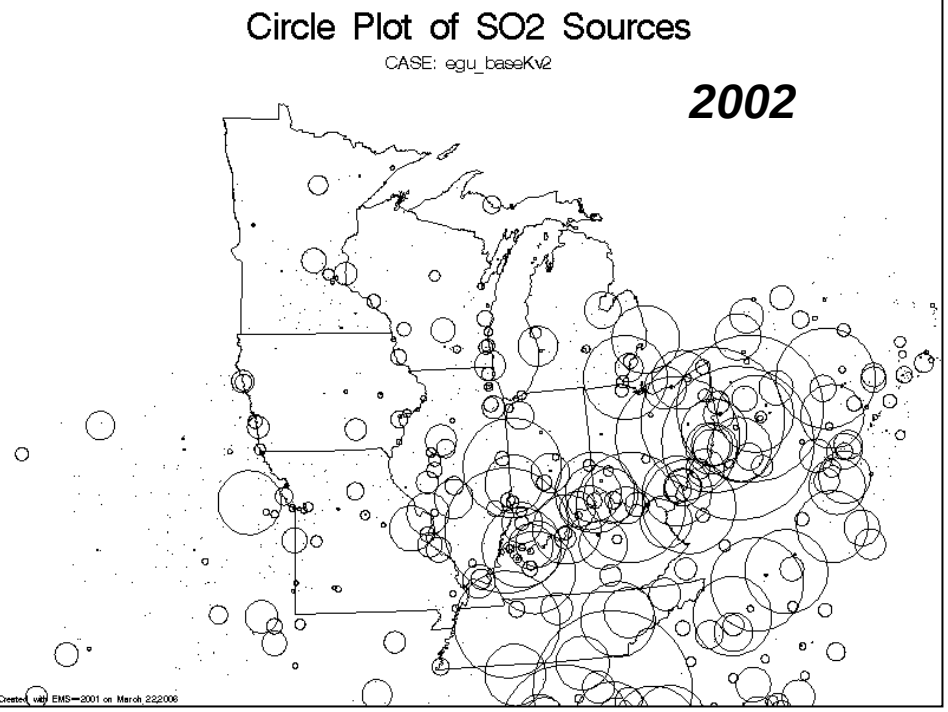
Possible Stationary and Mobile Source Control Measures

- Point Sources (SOx, NOx)
  - Electric Generating Units*
  - Industrial/Commercial/ Institutional (ICI) Boilers*
  - Cement Kilns
  - Petroleum Refineries
  - Iron & Steel Plants
  - Chemical Plants
  - Surface Coating
  - Degreasing
- Area Sources (VOC)
  - Industrial Surface Coating
  - Degreasing
  - Architectural Coatings*
  - Portable Fuel Containers*
  - Consumer Products*
  - Auto Refinishing
  - Gasoline Dispensing Facilities
- Heavy-Duty Diesel Vehicles/Diesel Equipment (PM, NOx, and VOC)
  - Retrofit programs*
  - Accelerate turnover of older vehicles with new, cleaner vehicles or alternative fuel vehicles
  - Repower older, high emitting engines with low emitting engines
  - Accelerate “reflashing” programs*
  - Use of reformulated fuels*
- Light Duty Vehicles (PM, NOx, and VOC)
  - Accelerated turnover of current vehicles with lower emitting vehicles or alternative fuel vehicles
  - High emitting vehicle control programs

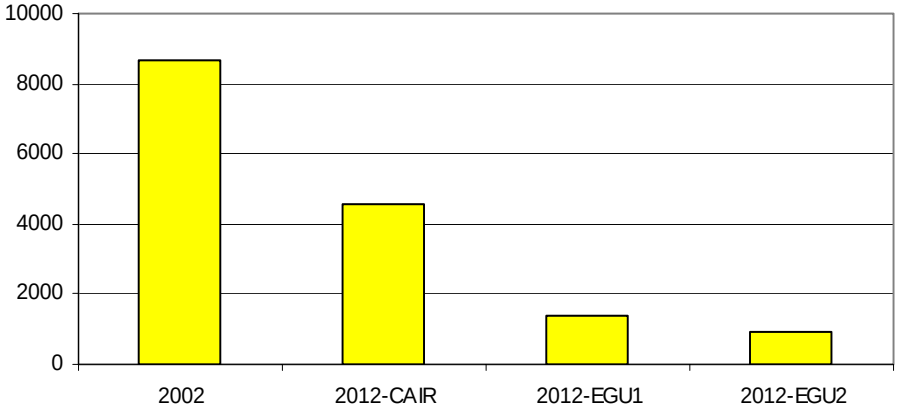
** Candidate state collaborative measure*

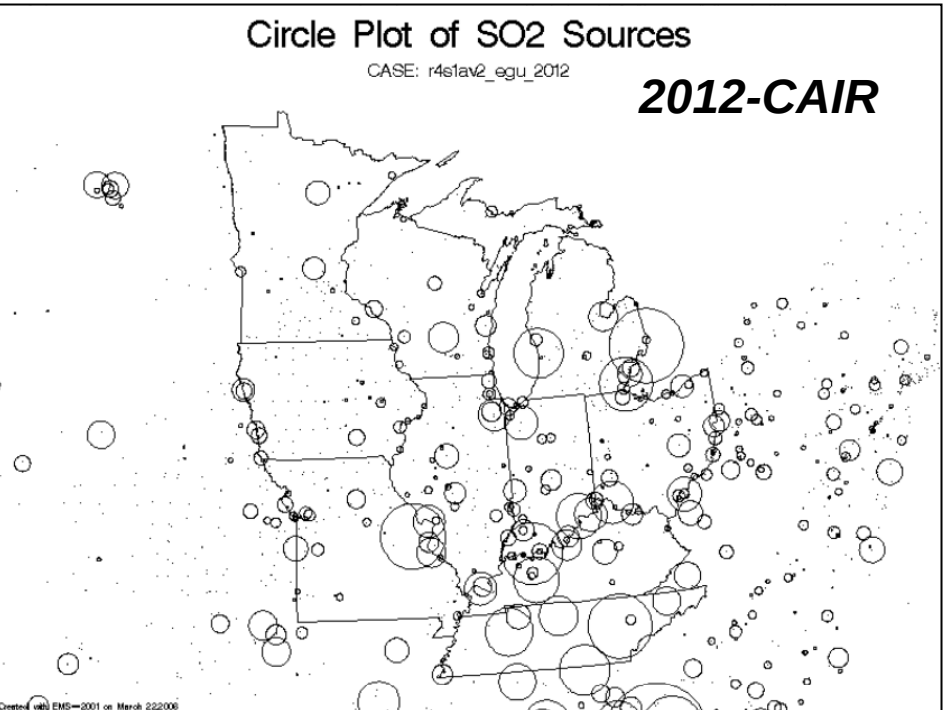
EGUs

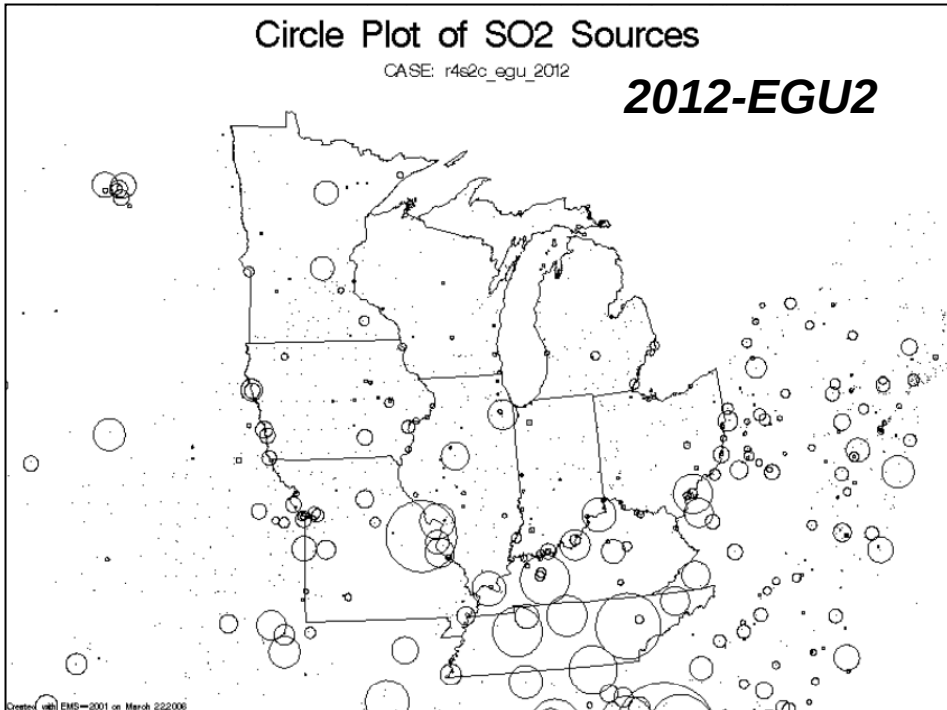
Option	SO2 (lb/MMBTU)	NOx (lb/MMBTU)
CAIR	0.52 (0.42)	0.15 (0.12)
EGU1	0.15	0.10
EGU2	0.10	0.07

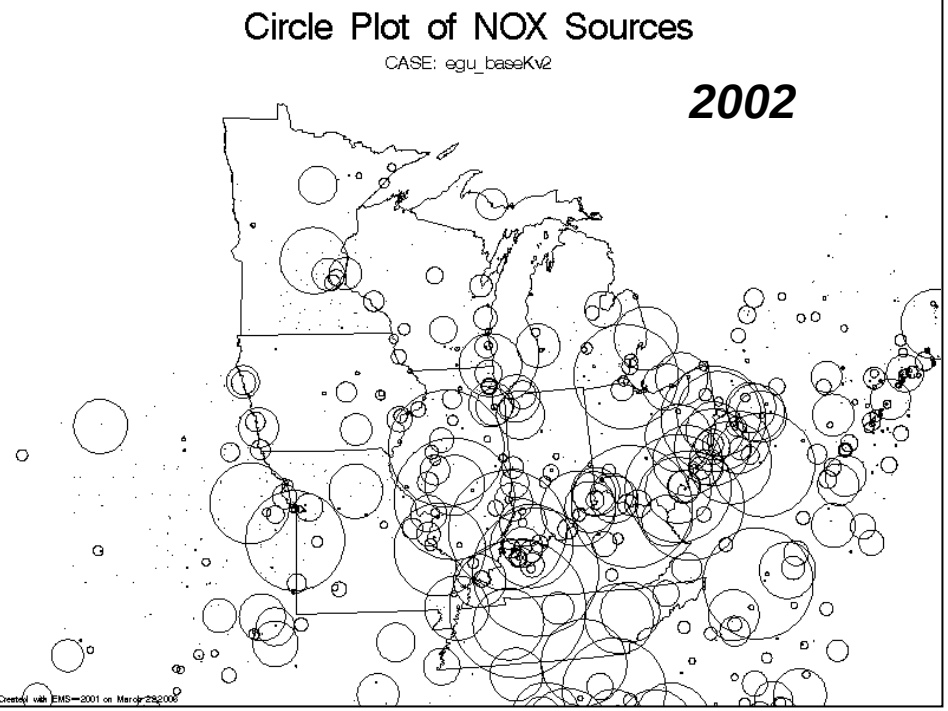

Circle Plot of SO2 Sources
CASE: egu_baseKv2
2002

SO2

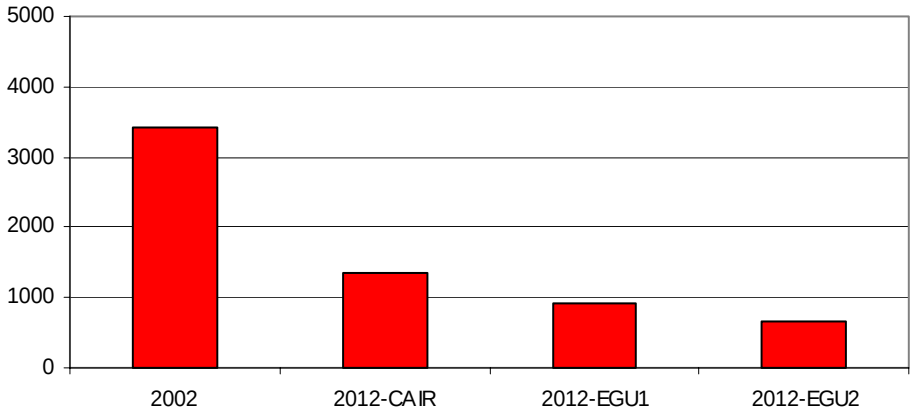

10000
8000
6000
4000
2000
0
2002
2012-CAIR
2012-EGU1
2012-EGU2

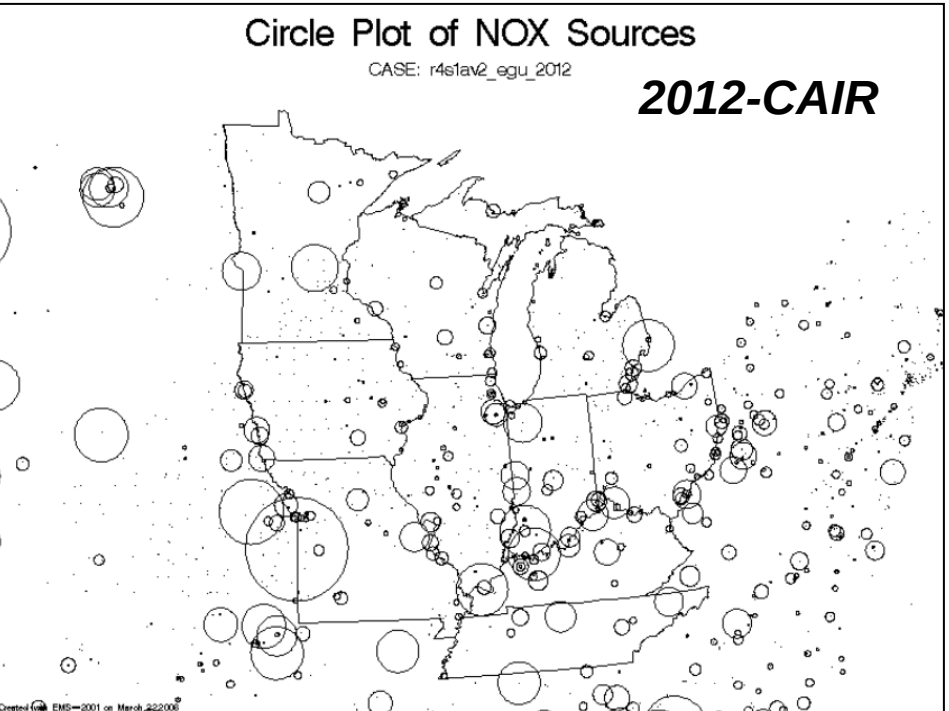

Circle Plot of SO2 Sources
CASE: r4s1av2_egu_2012
2012-CAIR

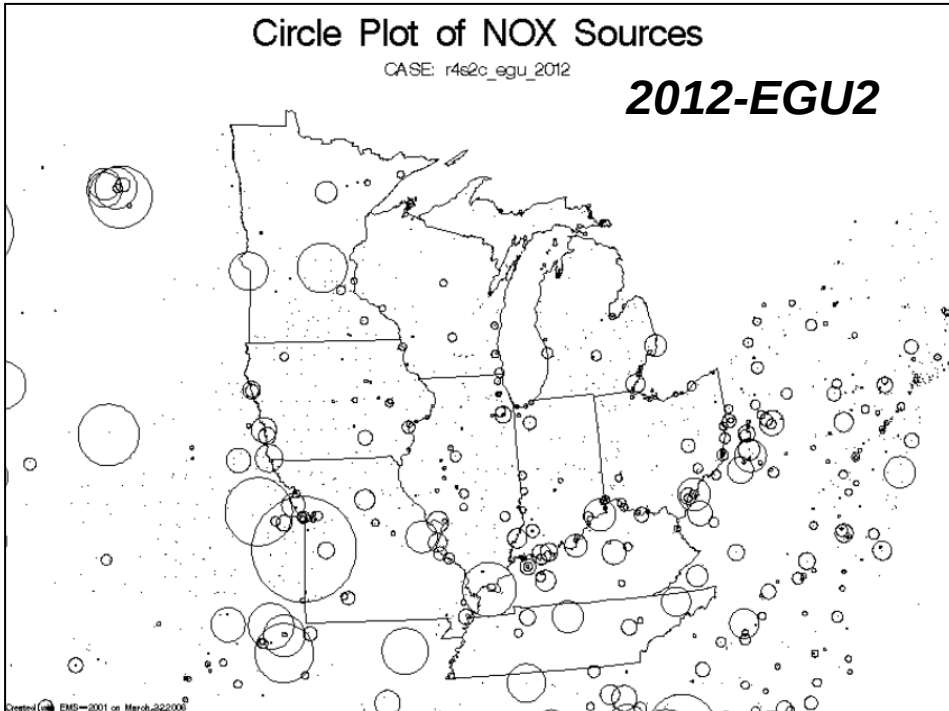

Circle Plot of SO2 Sources
CASE: r4s2c_egu_2012
2012-EGU2


Circle Plot of NOX Sources
CASE: egu_baseKv2
2002

NOx


5000
4000
3000
2000
1000
0
2002
2012-CAIR
2012-EGU1
2012-EGU2


Circle Plot of NOX Sources
CASE: r4s1av2_egu_2012
2012-CAIR


Circle Plot of NOX Sources
CASE: r4e2c_egu_2012
2012-EGU2

ICI Boilers

Option	SO2	NOx
OTB*	-18%	-2%
ICI1	-40%	-60%
ICI3	-90%	-80%

** "on the books" controls include NOx SIP call, enforcement settlements, and other controls*

ICI Boilers: Workgroup Proposal

SO2

	Boiler Size (MMBTU/Hour)			
Fuel Type	**< 50**	**50-100**	**100-250**	**> 250**
Distillate Oil (#1,#2)	0.05%S	0.05%S	0.05%S	0.05%S
Residual Oil (#4,#5,#6)	0.50%S	0.50%S	0.50%S	0.50%S
Coal (and other solid fuels)		2.0 or 30%	1.2 or 85%	0.25 or 85%

NOx

Fuel Type	**< 50**	**50-100**	**100-250**	**> 250**
Natural Gas		Comb. Tuning	0.06	0.06
Distillate Oil (#1,#2)		Comb. Tuning	0.10	0.10
Residual Oil (#4,#5,#6)		Comb. Tuning	0.20	0.20
Coal - Wall		Comb. Tuning	0.14	0.14
Coal - Tangential		Comb. Tuning	0.12	0.12
Coal - Stoker		Comb. Tuning	0.22	0.22
Coal - FBC		Comb. Tuning	0.08	0.08
Wood/Non-Fossil Solid Fuel		Comb. Tuning	0.22	0.22

Priority Area Source Measures

Category	Control Options	State Actions	Federal Actions
Consumer Products	1. OTC model rule 2. CARB 2003 SIP	IL, IN, MI, OH (OTC model rule)	Planning to amend federal rule to reflect OTC model rule
AIM Coatings	1. OTC model rule 2. SCAQMD Phase III limits	IL, IN, OH (OTC model rule)	Planning to amend federal rule to reflect OTC model rule
Portable Fuel Containers	1. OTC model rule 2. Incentive program to accelerate phase-in	OH (OTC model rule)	Mobile Source Air Toxics Rule (72FR8428, February 26, 2007)

“Evaluation of Candidate Mobile Source Control Measures – Phase II”, Environ, 2007

- Purpose: Assess possible control measures for on-road and off-road mobile sources, with focus on NOx and PM emission reductions by 2009 and 2012
- Candidate Measures: Diesel retrofits, fleet modernization, chip reflashing, anti-idling, and high emitting vehicles
- Results (example emission reduction scenarios):

	NOx (TPD)		PM (TPD)	
	2009	2012	2009	2012
On-road	- 94	-100	-5	-7
Construction equipment	-30	-40	-1	-2
Agricultural equipment	-25	-50	-2	-3

Next Steps

- Ozone
  - Complete new (2005) basecase modeling
- $PM_{2.5}$
  - Consider local source controls
  - Continue work to identify sources of organic carbon
- Haze
  - MI-MN Class I Areas: Complete 4-factor analysis for reasonable progress determination
  - Other (Downwind) Class I Areas: Begin consultation process

Air Quality Challenges Ahead

- Attain/maintain 8-hour ozone standard and, possibly, develop control plans to meet a new (tighter) standard
- Attain/maintain annual $PM_{2.5}$ standard, and develop control plans to meet new (tighter) daily standard
- Continue to make reasonable progress for regional haze
- Address mercury deposition, air toxics, and ….

For additional information….

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- www.ladco.org
  www.ladco.org/Regional_Air_Quality.html