BEFORE THE ILLINOIS POLLUTION CONTROL BOARD

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MAY 1 1 2007

STATE OF ILLINOIS
Pollution Control Board

IN THE MATTER OF:	)	
	)	
STATIONARY RECIPROCATING	)	**R07-18**
INTERNAL COMBUSTION	)	**(Rulemaking - Air)**
ENGINES AND TURBINES:	)	
AMENDMENTS TO 35 ILL.	)	
ADM. CODE SECTION 201.146,	)	
AND PARTS 211 AND 217	)	

NOTICE

TO:

Dorothy Gunn, Clerk
Illinois Pollution Control Board
State of Illinois Center
100 West Randolph, Suite 11-500
Chicago, Illinois 60601

SEE ATTACHED SERVICE LIST

PLEASE TAKE NOTICE that I have today filed with the Office of the Pollution Control Board the attached TESTIMONY OF ROBERT KALEEL, YOGINDER MAHAJAN, SCOTT LEOPOLD, AND MICHAEL KOERBER of the Illinois Environmental Protection Agency a copy of which is herewith served upon you.

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

By: [signature]
Rachel L. Doctors
Assistant Counsel
Division of Legal Counsel

DATED: May 10, 2007

P.O. Box 19276
Springfield, Illinois 62794-9276
217/782-5544

BEFORE THE ILLINOIS POLLUTION CONTROL BOARD

IN THE MATTER OF:	)	
	)	
STATIONARY RECIPROCATING INTERNAL COMBUSTION ENGINES AND TURBINES: AMENDMENTS TO 35 ILL. ADM. CODE SECTION 201.146, AND PARTS 211 AND 217	))))))	**R07-18** **(Rulemaking - Air)**

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TESTIMONY OF ROBERT KALEEL

My name is Robert Kaleel. I am the Manager of the Air Quality Planning Section, Division of Air Pollution Control, Bureau of Air at the Illinois Environmental Protection Agency ("Illinois EPA"), Springfield, Illinois. I have a Bachelor of Science degree in meteorology from Northern Illinois University. I have worked at the Illinois EPA for more than twenty-six years, and have been in my present position since 2004. Prior to that, I was the Manager of the Air Quality Modeling Unit in the Air Quality Planning Section, a position that I held for more than fifteen years. I have also worked as a private consultant as a specialist in air quality modeling. As Manager of the Air Quality Planning Section, my responsibilities include oversight of staff that provides technical support for regulatory initiatives needed to address air quality issues in Illinois, including the regulatory proposal before the Board at this hearing. The Air Quality Planning Section also provides technical support to the Bureau of Air's permitting and enforcement functions, and is responsible for maintaining the Bureau's emission inventory system, including Annual Emission Reports. I have been closely involved with the development of Illinois' State Implementation Plans to address the $PM_{2.5}$ and ozone nonattainment areas in Illinois.

The purpose of my testimony is to explain the purpose of this proposal, and to describe the components of the proposed rule. Included in this proposal are amendments to 35 Ill. Adm. Code Parts 201, 211 and 217. Adoption of the proposed rules will reduce emissions of nitrogen oxides ("NO_x") from stationary reciprocating internal combustion engines and turbines. This proposal is intended to satisfy Illinois' obligations under the United States Environmental Protection Agency's ("USEPA") NO_x State Implementation Plan ("SIP") Call Phase II. The proposal is also intended to address, in part, Illinois' obligation to meet certain requirements under the federal Clean Air Act ("CAA"), specifically the requirements for reasonable further progress ("RFP"), reasonably available control technology ("RACT") for these source categories, and attainment demonstrations for the 8-hour ozone and $PM_{2.5}$ National Ambient Air Quality Standards ("NAAQS").

On July 18, 1997, USEPA promulgated revised primary and secondary ozone NAAQS that increased the averaging period for the ozone standard from 1-hour to 8-hour and lowered the concentration for violations from 0.12 to 0.08 parts per million ("ppm"). It has long been recognized that volatile organic compounds ("VOC") and NO_x are the primary precursors responsible for the formation of ground level ozone. Illinois has two areas (greater Chicago and Metro East/St. Louis), consisting of 12 counties or partial counties, that were designated as nonattainment areas for the 8-hour ozone standard. The designations were effective on June 15, 2004. The two areas in Illinois are classified as moderate nonattainment areas. Moderate nonattainment areas are required to submit attainment demonstrations by June 15, 2007, addressing how the State will achieve the 8-hour ozone standard by the attainment date of June

15, 2009, which is six years from the effective date of the nonattainment designations.

On July 18, 1997, USEPA also added a new 24-hour and a new annual NAAQS for fine particles, using as the indicator particles with aerodynamic diameters smaller than a nominal 2.5 micrometers, termed $PM_{2.5}$. USEPA has determined that, in addition to direct particulate matter, that NO_x, SO_2, VOCs, and ammonia are precursors to the formation of $PM_{2.5}$. States are required to address NO_x, sulfur dioxide ("SO_2"), and direct emissions of $PM_{2.5}$ in their attainment plans. USEPA has designated two areas in Illinois (greater Chicago and Metro East/St. Louis), consisting of 12 counties or partial counties within Illinois, as not attaining the $PM_{2.5}$ standard. The designations became effective on April 5, 2005. The attainment demonstration is due April 5, 2008, and the attainment date for most areas is April 5, 2010. States may be granted up to a five-year extension of the attainment date with a demonstration showing that it is impractical for the state to attain within five years and that the state is making generally linear progress toward attainment.

As part of Illinois' effort to develop a comprehensive attainment strategy for ozone and $PM_{2.5}$, Illinois EPA plans to propose reasonable and cost effective NO_x control on all major source sectors statewide, because NO_x is a primary precursor to both ozone and particulate matter. This statewide approach to NO_x control is consistent with the rulemaking now pending with the Board addressing the requirements for the Clean Air Interstate Rule ("CAIR"), which addresses NO_x emissions from utility boilers. However, based upon USEPA's modeling, reductions from CAIR are not sufficient to insure attainment in Illinois of the ozone and $PM_{2.5}$ NAAQS.

The Illinois EPA has been working with its counterparts in nearby states to develop attainment demonstrations for both of its nonattainment areas. In the Lake Michigan region, the modeling demonstrations are being performed under the direction of the Lake Michigan Air Directors Consortium ("LADCO"). For the Metro-East/St.Louis area, the Illinois EPA has been working with the State of Missouri. The LADCO modeling, while it is not yet complete, has also shown that the reductions from the implementation of CAIR are not enough for Illinois' two nonattainment areas to reach attainment of the $PM_{2.5}$ NAAQS, and may not be sufficient to allow the Chicago nonattainment area to reach attainment of the 8-hour ozone NAAQS. LADCO's modeling does show, however, that controlling NO_x emissions on a regional, and not just a local basis, results in improved ozone and $PM_{2.5}$ air quality. LADCO has prepared a summary of recent modeling that describes the role of NO_x emissions in causing ozone, $PM_{2.5}$ and regional haze problems in the Midwest and has identified a number of candidate control measures. Mike Koerber, Executive Director of LADCO, will provide testimony to the Board as part of this rulemaking describing the summary document.

Control of engines and turbines, as well as other sources of NO_x, is an important and necessary part of Illinois' attainment strategy for ozone and $PM_{2.5}$. Hence, the Illinois EPA has proposed in this rulemaking that NO_x emission reductions be required at the same level as that required by the NO_x Call Phase II for turbines and engines that are not subject to Phase II. In addition, the Illinois EPA is planning on proposing that NO_x RACT emission controls be implemented statewide on other major stationary source categories. These NO_x reductions are needed for $PM_{2.5}$ and possibly ozone attainment, which are regional pollutants affected not just by NO_x emissions within a local (nonattainment) area, but emissions from upwind areas as well. Illinois EPA is also developing and will propose SO_2 RACT level of emissions control statewide. For all these reasons, the statewide approach to NO_x control is appropriate.

The geographic region subject to "Subpart Q: Stationary Reciprocating Internal

Combustion Engines and Turbines" is the entire State of Illinois. Emissions of NO_x from stationary internal combustion engines are not currently regulated in the State of Illinois. The proposed regulations are expected to affect existing and new units. There are 28 existing engines that were identified by the NO_x SIP Call that will be subject to this rule. The Illinois EPA estimates that there are more than 1,300 stationary engines, and more than 200 turbines, currently operating in the state. The estimated reduction of NOx emissions from the 28 engines identified by the NO_x SIP Call is 5,422 tons per ozone season. The proposed regulations will, when fully implemented, reduce NO_x emissions statewide by approximately 7,540 tons per ozone control season. The NOx SIP Call does not require any emission reductions on an annual basis. The proposed regulations will, when fully implemented, reduce NO_x emissions statewide by approximately 17,869 tons annually. This equates to a 65 percent NO_x reduction annually, and a 55 percent NO_x emission reduction in the ozone season, from this source category.

The Illinois EPA's staff has determined that affected engines and turbines can meet the requirements of proposed Subpart Q through a combination of control techniques such that compliance is both technically feasible and economically reasonable. Based on USEPA's Alternative Control Techniques ("ACT") document there are a number of control options available which achieve the control levels proposed in this rulemaking in the range of unit sizes affected. In addition, the Illinois EPA's staff found that the levels proposed in this rule were consistent with rules promulgated in other states. The Illinois EPA considers the control requirements of this proposal to be technically feasible and economically reasonable.

The proposal being considered today is the result of an extensive stakeholder process. Throughout the development of the rule, the Illinois EPA has sought and received comments from interested parties. The Illinois EPA held three general meetings (August 25, 2005, October

5, 2005, and November 14, 2005) to which owners and operators of affected units and environmental groups were invited. At least three additional meetings were held at the request of particular groups or companies affected by this proposal. The Illinois EPA's proposal was amended several times in response to comments provided by stakeholders. It is my understanding that the areas in which the parties have reached agreement are the applicability levels for engines and turbines, the control levels for engines and turbines, use of an emissions averaging plan as a method of compliance, the exemptions, the frequency of testing, treatment of low usage units, the compliance dates, and the use of NO_x allowances to address unexpected noncompliance issues. The areas where the parties did not reached agreement include the statewide applicability of the rule. However, the Illinois EPA is proceeding with the proposal because the overall benefit of the rule outweighs the detriment of further delay. The Illinois EPA has presented and discussed with the stakeholders the need for statewide reductions of NO_x emissions from sources located in both attainment and nonattainment areas in order to achieve the 8-hour ozone and $PM_{2.5}$ NAAQS.

The Illinois EPA is proposing a new Subpart Q: Stationary Reciprocating Internal Combustion Engines and Turbines to Part 217. The rule is intended to apply to stationary reciprocating internal combustion engines rated 500 brakehorsepower and above, and turbines rated 3.5 MW and above. Illinois EPA is proposing separate concentration limits for different types of engines and turbines, and based on the kind of fuel used.

The Illinois EPA recognizes that many of the engines and turbines in use in Illinois operate only intermittently and may not be cost-effective to control. To reduce compliance costs, the proposal provides a number of exemptions and compliance options. Proposed exemptions are offered for emergency and standby units, units used for research or performance verification, units that are used primarily to control gas from landfills, units used for agricultural purposes, and portable units. The Illinois EPA is also proposing special requirements for low usage units where the potential to emit ("PTE") from all engines and turbines at a source is below 100 ton per year of NO_x emissions. Low usage units may also be exempt from the requirements to meet the emission limits if the aggregate usage of the units is below specified thresholds.

The proposal includes alternate compliance options which provide companies with flexibility in reducing their compliance costs. The proposal allows owners and operators the option to comply with an emissions averaging plan in lieu of meeting the specified concentration limit for each affected unit. Unit located in Illinois that commenced operation before January 1, 2002, and are owned by the same company or parent company, can in most cases be included in an averaging plan. An averaging plan must insure that the total mass of actual NO_x emissions from all affected units included in the emissions averaging plan must be less than the total mass of allowable NO_x emissions for the same units. The proposal contains specific formulas for making the calculations needed to demonstrate compliance. This option will allow owners to control units that are most cost effective to control, and reduce or avoid control costs for units that are more expensive to control.

Another compliance option proposed in the rule allows owners and operators to use NO_x SIP Call allowances to meet the compliance requirements if they meet certain criteria. This option is intended to provide flexibility to owners and operators when noncompliance is due to unforeseen circumstances. An owner or operator can use this option up to two times in any five-year rolling period. The correct type of NO_x allowances must be used, that is, annual allowances must be used for exceedances of an annual limit and ozone season allowances must be used for exceedances of a seasonal limit. This option is included in the proposal at the suggestion of stakeholders and will again provide increased operating flexibility and will reduce compliance costs.

The Illinois EPA is proposing four different compliance dates. Engines subject to the NO_x SIP Call, as listed in Appendix G, must comply by May 1, 2007. Emission units that are located in either of the 8-hour ozone or $PM_{2.5}$ nonattainment areas comply by January 1, 2009. For units located outside of the two nonattainment areas, later compliance dates are proposed because of concerns expressed by stakeholders about the availability of equipment and contractors needed to install the controls. Accordingly, the Illinois EPA is proposing that the larger engines and turbines, engines rated at 1,500 bhp or more, or turbines rated at five MW or more, that are located outside of the two nonattainment areas comply by January 1, 2011, and that the smaller engines and turbines located outside of the two nonattainment areas comply by January 1, 2012. Again, this extended compliance schedule was added at the request of stakeholders who believed that there would be insufficient contractors to install the necessary equipment if the Illinois EPA's initial compliance schedule was implemented.

The Illinois EPA's proposal provides a flexible approach for meeting the requirements for testing and monitoring. In general, affected units must conduct a compliance test by the applicable compliance date. Engines listed in Appendix G, for example, must be tested by May 1, 2007. Affected units that operate intermittently do not need to be tested until after they have operated at least 876 hours in a year. Units that operate less than 876 hours per calendar year can be tested at the owner's or operator's choosing any time within the first five years after the applicable compliance date.

Units listed in Appendix G and units included in an emissions averaging plan must subsequently be tested once every five years. In years in which a compliance test is not performed, the proposal requires that an inexpensive portable NOx monitor be used annually to verify continued compliance. For units that operate less than 876 hours per calendar year monitoring is required only once every five years.

BEFORE THE ILLINOIS POLLUTION CONTROL BOARD

IN THE MATTER OF:	)	
	)	
PROPOSED STATIONARY RECIPROCATING INTERNAL COMBUSTION ENGINES AND TURBINES: AMENDMENTS TO 35 ILL. ADM. CODE SECTION 201.146, AND PARTS 211 AND 217	)	**R07-18 (Rulemaking - Air)**

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TESTIMONY OF YOGINDER MAHAJAN

Good Morning. My name is Yoginder Mahajan. I am employed as an Environmental Protection Engineer in the Air Quality Planning Section in the Bureau of Air of the Illinois Environmental Protection Agency (Illinois EPA). I have been employed in this capacity since March 1992. Prior to my employment with the Illinois EPA I worked for various metal fabrication industries for nine (9) years. My educational background includes a Bachelor of Engineering Degree in Mechanical Engineering from Bhopal University at Bhopal, India.

As part of my regular duties in the Air Quality Planning Section, I have been involved with preparing emission estimates for various source categories used in the development of the 1990 ozone season weekday emissions inventories; evaluating control technologies applicable to volatile organic material (VOM) emissions sources utilized in the preparation of the Rate-of-Progress plans for the Chicago and St. Louis ozone nonattainment areas; and assisting in the development of regulations for the control of VOM emissions from source categories included in the Rate-of-Progress plans. Regarding the proposal before you today, I have been involved in the development of the regulations to control nitrogen oxides (NOx) from stationary reciprocating internal combustion engines (RICE) and turbines. I provided the list of affected sources for the proposal and technical feasibility of NOx controls for the Technical Support Document (TSD) for the proposal.

RICE and turbines are used throughout the United States to drive compressors, pumps, electric generators and other equipment. In Illinois, a prominent use of large engines is to drive natural gas pipeline compressors. Emissions of NOx are the result of combustion of fuel at high temperatures and pressures in the RICE and turbines, which cause the nitrogen and oxygen in the air that sustains the combustion to unite and form the various oxides of nitrogen that constitute NOx.

Today's proposal is to control NOx emissions from sources that have a potential to emit 100 tons or more per year of NOx aggregated from all the affected units at the source. The proposed regulation applies to RICE of 500 brake horse power (bhp) capacities and above, and to stationary turbines of capacities equal to or greater than 3.5 megawatt (MW).

As part of evaluation of the control of NOx from RICE and turbines, the Illinois EPA identified several sources of guidance. The United States Environmental Protection Agency (U.S. EPA) published two Alternative Control Techniques (ACT) documents - NOx Emissions from Stationary Reciprocating Internal Combustion engines, and NOx Emissions from Stationary Gas Turbines. Also, U.S. EPA published Regulatory Impact Analysis for the NOx SIP Call, and Stationary Reciprocating Internal Combustion Engines Technical Support documents for the NOx SIP Call. Controlling Nitrogen Oxides Under the Clean Air Act: A Menu of Option document was published by State and Territorial Air Pollution Program Administrators/Association of Local Air Pollution

Control Official. These documents contain detailed information on description of sources of NOx emissions, various techniques of controlling NOx and the costs of various controls. The Illinois EPA relied upon the information contained in these documents for the costs and economic impacts for this proposal.

For reciprocating engines and turbines both combustion controls and post-combustion catalytic reduction have been developed. For reciprocating engines, air/fuel ratio adjustments, low emission combustion, and prestratified charge all function by modifying the combustion zone air/fuel ratio, thus influencing oxygen availability and peak flame temperature. Ignition timing retard lowers the peak flame temperature by delaying the onset of combustion. For turbines water/steam injection and dry low NOx combustors are the combustion control techniques to control NOx emissions. Selective catalytic reduction and non-selective catalytic reduction are the two post-combustion control strategies that destroy NOx once it has been formed for reciprocating internal combustion engines and turbines.

After reviewing the U.S. EPA's guidance documents, the Illinois EPA determined that there are cost effective NOx control techniques available to reduce NOx emissions from RICE and turbines. Lean burn spark-ignited RICE may install low emission combustion (LEC), rich burn spark-ignited RICE may use non-selective catalytic reduction, and compression ignited diesel RICE may use electronic injection techniques to cost-effectively comply with this proposal. For turbines, water/steam injection for oil/gas-fired turbines, and low NOx combustors for gas-fired turbines are available to cost-effectively comply with the proposal.

Illinois EPA's inventory contains 1,200 RICE engines greater than 1,500 bhp capacities and 205 non-EGU turbines greater than 3.5 MW capacities. Also, the Illinois EPA estimated that there are 175 RICE engines greater than 500 bhp but less than 1,500 bhp capacities. Out of 1,200 RICE engines, 202 RICE engines will be impacted by this proposal. Twenty-eight RICE engines, out of 202 RICE engines that are greater than 1,500 bhp capacities, are impacted by the NOx SIP Call Phase II requirements. This proposal will impact 36 turbines out of 205 turbines and estimated 44 engines out of 175 estimated engines of less than 1,500 bhp capacities.

The proposed regulations will reduce NOx emissions by 5,422 tons per ozone season in 2007 ozone control season and satisfy the U.S. EPA's NOx SIP Call Phase II requirements for RICE engines. When fully implemented, the statewide NOx emissions from RICE engines will be reduced by approximately 17,082 tons per year (including 2,670 tons from RICE less than 1,500 bhp) and 7,206 tons per ozone control season (including 1,113 tons from RICE less than 1,500 bhp) at a cost effectiveness of $496 to $2,436 per ton of NOx (in 2004 dollars) depending on the type and size of the engine. Emissions from gas turbines will be reduced by approximately 787 tons per year and 334 tons per ozone season at a cost effectiveness of $712 to $2,189 per ton of NOx (in 2004 dollars) depending on the type and size of the turbine.

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TESTIMONY OF SCOTT LEOPOLD

My name is Scott Leopold. I work in the Air Quality Planning Section, Division of Air Pollution Control, Bureau of Air at the Illinois Environmental Protection Agency (Illinois EPA). I have a Bachelor of Science degree in meteorology from Northern Illinois University and a Master's Degree in Geography, emphasis Meteorology, also from Northern Illinois University. I have worked at the Illinois EPA for more than eighteen years. Prior to that, I was a Research Meteorologist with the US Army at the Atmospheric Sciences Laboratory, White Sands Missile Range, New Mexico. As an air quality modeler, my responsibilities include photochemical modeling, including the modeling that will be contained in Illinois' attainment demonstrations for ozone and $PM_{2.5}$ for both the Chicago and Metro-East nonattainment areas.

The purpose of my testimony is to summarize the results of a sensitivity modeling analysis that I performed to show the air quality benefit from reducing NOx emissions on a regional basis. My testimony is based on the information provided to the Board by the Illinois EPA in the "Technical Support Document" (TSD) which accompanied the regulatory proposal. It is important to note that a sensitivity analysis does not show the effect of a particular strategy. Rather, a *sensitivity* analysis is used to show how the model responds to an across-the-board change in emissions, in this case a 30% reduction of NOx emissions from all sources.

The Illinois EPA performed the sensitivity modeling analysis to determine the extent to which NOx emission reductions would result in ozone and $PM_{2.5}$ air quality improvements in Illinois and downwind states. This modeling used the 2009 base case developed by the Lake Michigan Air Directors Consortium (LADCO) as the starting point to determine the sensitivity of predicted ozone and $PM_{2.5}$ concentrations to an assumed 30% reduction of NOx emissions within the modeling domain. As I mentioned before, the modeled 30% NOx emission reduction level is arbitrary and does not represent the reductions expected from a particular control strategy. LADCO's 2009 "base case" scenario reflects expected emissions due to economic and demographic growth by 2009 and also implementation of control measures that are "on-the-books" (OTB). "On-the-books" controls are those measures that have already been promulgated and will be implemented by 2009, including such measures as Reformulated Gasoline, Illinois' Vehicle Inspection and Maintenance program, etc. All other model inputs were developed by LADCO.

Modeling results for $PM_{2.5}$ are shown in Figure 2-3 of the TSD for each of four quarters: January – March; April – June; July – September; and October – December. The results are depicted graphically as difference plots, showing the difference between the 2009 "base case" and the 30% NOx reduction scenario. The results indicate that a 30% NOx reduction, if achieved domain-wide from all NOx sources, will improve $PM_{2.5}$ concentrations regionally by 0.5 ug/m^3 to 1.8 ug/m^3. Improvements are shown for all four calendar quarters. The greatest benefits (spatially) are predicted to occur in the fourth quarter (October through December), and the smallest benefits (spatially) are predicted to occur in the first quarter (January through March). Improvements are also shown for all four quarters in Illinois, with predicted $PM_{2.5}$ reductions in the range of 0.5 ug/m^3 to 1.5 ug/m^3. The NAAQS for $PM_{2.5}$ is 15 ug/m^3 on an annual basis, and the current 2004-2006 annual design value for Chicago is 15.6 ug/m3, so a reduction of NOx emissions of the magnitude modeled here would certainly help the area achieve attainment.

Photochemical modeling for ozone was performed in a similar manner comparing the 2009 LADCO "base case" to the 30% NOx reduction scenario. For ozone, only the summertime period of June, July, and August was modeled. The results are again depicted as difference plots, which show the difference in 8-hour ozone concentrations between the two scenarios. Figure 2-4 of the TSD shows the 8-hour ozone concentration differences for two days in the June 2002 regional ozone episode. Results are shown for two selected days from the three month period modeled. These days are considered representative of the results during periods of elevated ozone concentrations in the region. The results indicated that widespread improvements in 8-hour ozone concentrations are predicted to occur from the assumed 30% NOx emission reduction from all NOx sources in the modeling domain. Ozone improvements in Illinois range from 2.5 parts per billion (ppb) to about 10 ppb. The NAAQS for ozone is 0.08 parts per million, or 84 ppb. Illinois currently attains the 8-hour ozone standard at all monitoring locations, but downwind locations in Wisconsin and Michigan do not. The highest 8-hour ozone monitored design value in the Lake Michigan region for 2004-2006 is 88 ppb in Holland, Michigan. Again, a reduction of NOx emissions of the magnitude modeled here would help the region achieve attainment.

The sensitivity analysis I described demonstrates that regional NOx emission reductions will improve ozone and $PM_{2.5}$ air quality in Illinois.

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R07-18
(Rulemaking - Air)

TESTIMONY OF MICHAEL KOERBER, DIRECTOR
LAKE MICHIGAN AIR DIRECTORS CONSORTIUM

I have been the Executive Director for the Lake Michigan Air Directors Consortium (LADCO) for ten years and have worked there for 16. I have a Bachelor of Science degree in Environmental Engineering from the University of Illinois at Chicago, and a Master of Science degree in Meteorology from the Pennsylvania State University. As Executive Director for LADCO, my responsibilities include preparing documentation and reporting on LADCO's technical work. This documentation consists of reports and memoranda, journal articles, presentations at public meetings, and general newsletters. I have also managed the identification and evaluation of emissions control strategies to address:

- 1-hour ozone nonattainment in the Lake Michigan region, in conjunction with the four Lake Michigan States, as part of the Lake Michigan Ozone Study (LMOS),

- ozone transport problems in the eastern half of the U.S., in conjunction with over 30 states, as part of the Ozone Transport Assessment Group (OTAG),

- visibility impairment in Class I areas across the country, in conjunction other states and tribes, as part of the Regional Planning Organization (RPO) process, and

- 8-hour ozone nonattainment, PM2.5 nonattainment, and visibility impairment throughout the upper Midwest, in conjunction with five Midwest States.

Previously, I worked as the Regional Meteorologist at USEPA, Region V. In that capacity, I was responsible for reviewing, overseeing, and conducting air quality studies, for new source permits, state implementation plans, and other purposes.

The Consortium was established in 1989 by the States of Illinois, Indiana, Michigan, and Wisconsin to address regional air quality problems. Initially, LADCO's focus was ozone nonattainment around Lake Michigan. In 2000, the State of Ohio joined LADCO, and LADCO began to work on other air pollution problems. LADCO is currently helping these five Midwestern states develop implementation plans for ozone, particle matter, and regional haze.

The purpose of my testimony is to summarize the results of air quality analyses for NOx emissions performed by LADCO. NOx emissions are a precursor to ozone and PM2.5/haze (particulate nitrate) concentrations. The testimony will review NOx emissions in the upper Midwest (including, Illinois), and the effect of NOx emissions on ozone, PM2.5, and regional haze levels. In particular, information will be presented which shows that reductions in NOx emissions will help attain the current 8-hour ozone and annual PM2.5 standards, and will help meet the reasonable progress goals for haze.

My presentation today will review NOx emissions in the 5-state LADCO region, and the results of air quality modeling for ozone, PM2.5, and regional haze.

NOx emissions come from mobile and stationary point sources. On-road and off-road mobile sources make up about 60% of NOx emissions in the region. Stationary point sources (both electrical generating units (EGUs) and non-EGUs) make up about 35% of NOx emissions in the region, with non-EGUs contributing about 15%. NOx emissions are projected to decrease from our base years (2002 and 2005) to future planning years (2009, 2012, and 2015) due to existing ("on the books") control programs.

Special modeling analyses were performed to provide information on the contribution from source regions and source sectors. For ozone, the modeling results show that mobile and stationary point source NOx emissions are important contributors to ozone concentrations in urban areas. Also, nearby emissions have the highest impacts (e.g., the Chicago nonattainment area contributes about 35% to monitoring sites in and downwind of Chicago).

PM2.5 is comprised of several chemical species, including sulfates, nitrates, and organic and elemental carbon. NOx emissions contribute to the formation of nitrates. For PM2.5, the modeling shows that mobile and stationary point source NOx emissions are important contributors to nitrate concentrations in urban areas. Also, nearby emissions have the highest impacts (e.g., the Chicago nonattainment area contributes about 40% to monitoring sites in Chicago). Additional modeling (i.e., sensitivity analyses) confirms the effectiveness of reductions in NOx emissions (i.e., a 10% cut in regional NOx emissions produces air quality benefits for PM2.5 and ozone).

For regional haze, the modeling shows that mobile and stationary point source NOx emissions are important contributors to nitrate concentrations in federal Class I areas. Unlike urban air quality, which is heavily impacted by nearby emissions, we see that air quality in rural areas, such as these federal Class I areas, is impacted by many upwind states (e.g., in the Seney Wilderness Area, Illinois, Indiana, Michigan, Wisconsin, and several western states are all important contributor).

In conclusion, LADCO's emissions inventories and modeling analyses show that:

- Mobile sources are a major source of NOx emissions (about 60%) and are the important contributors to ozone, PM2.5, and regional haze concentrations. Mobile source NOx emissions are expected to decrease in the future due to existing federal control programs. Examination by LADCO's contractors of additional possible control programs for mobile sources indicates relatively small reductions and uncertain effectiveness.

- Stationary point sources are also a major source of NOx emissions (about 35%), and are also important contributors to ozone, PM2.5, and regional haze concentrations. EGU point source NOx emissions have and will continue to decrease in the future due to existing control programs. Examination by LADCO's contractors indicates that additional NOx emission reductions from EGUs and non-EGUs are possible (e.g., application of known control technologies).

I shall now review and discuss the slides in my presentation.

Assessment of Regional NOx Emissions in the Upper Midwest

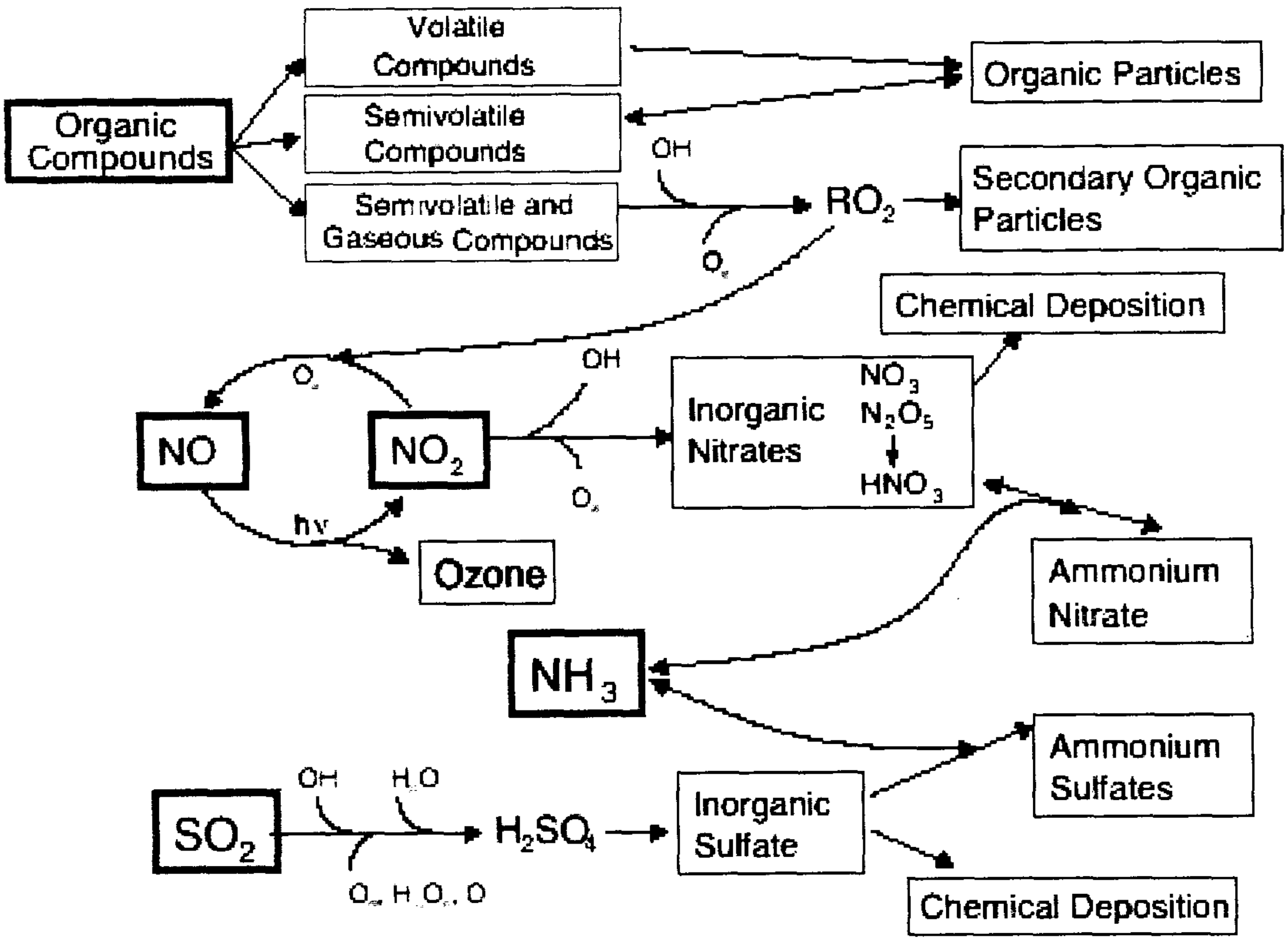
Michael Koerber
Lake Michigan Air Directors Consortium

May 21, 2007

Overview

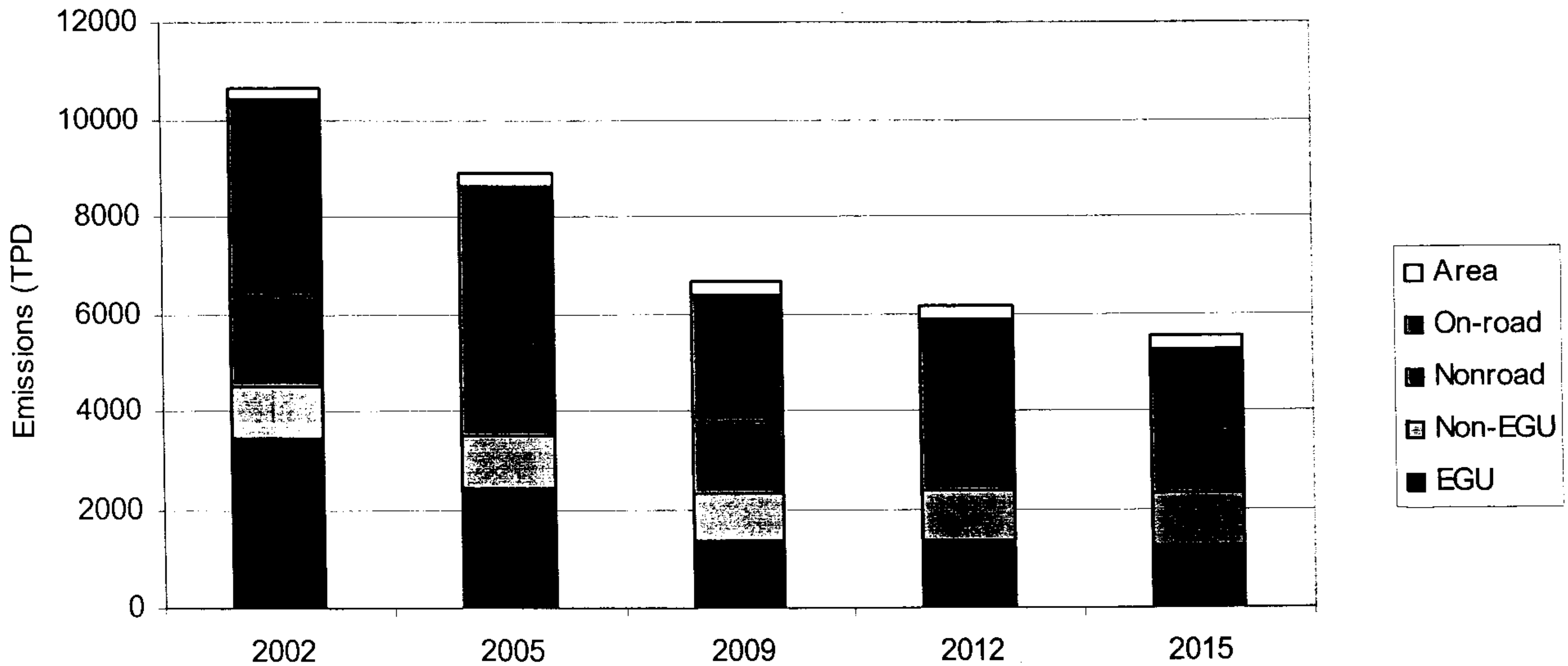
- Background
- Summary of Regional NOx Emissions
- Effect of NOx Emissions on Ozone, $PM_{2.5}$, and Regional Haze
- Summary

"One Atmosphere"

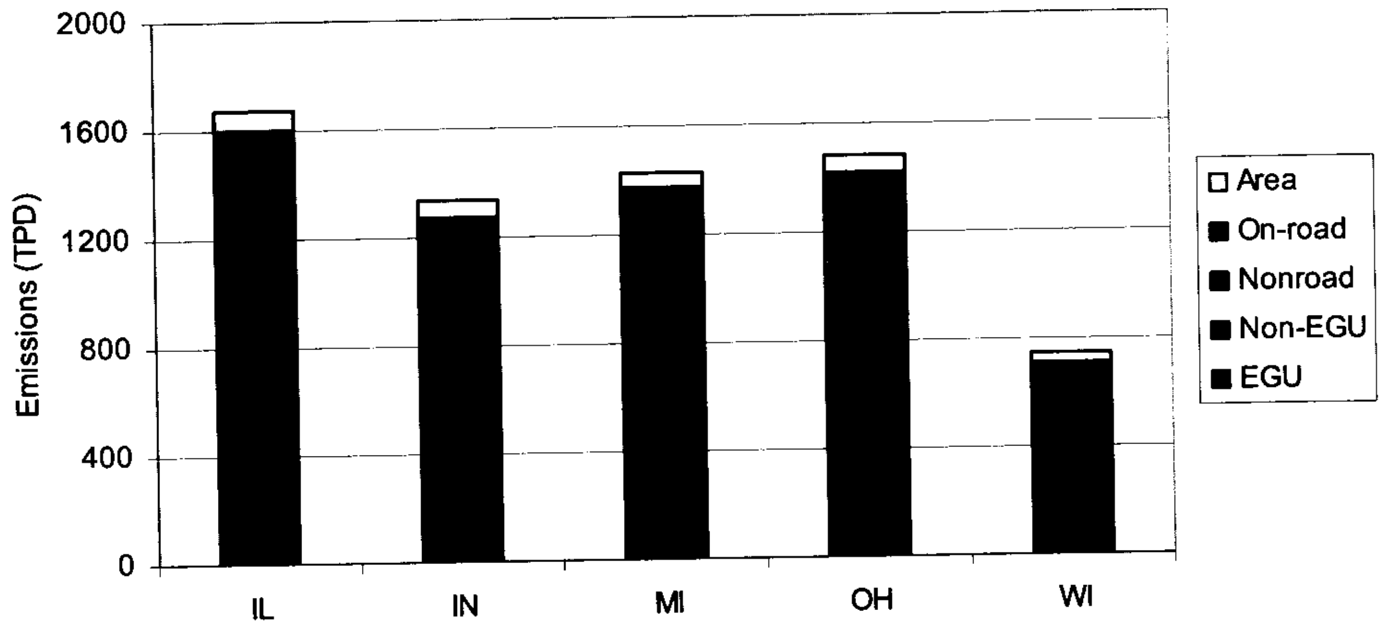


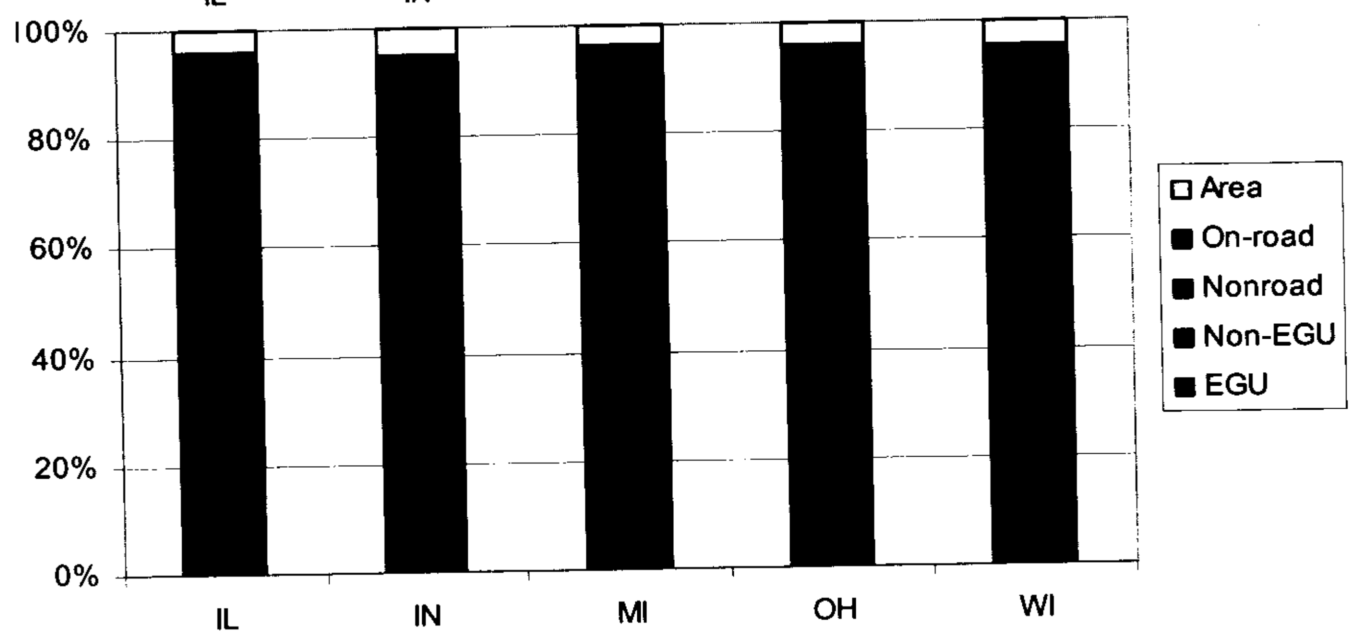
Cite: Particulate Matter Science for Policy Makers, NARSTO, February 2003

Regional NOx Emissions (TPD)



Regional NOx Emissions - 2009





NOx Emissions: Summary

- Emissions expected to decrease over time due to “on the books” controls
- Mobile sources make-up largest source sector (60%)
- Point sources make-up next largest source sector (35%)
  - Non-EGU point sources contribute 15%

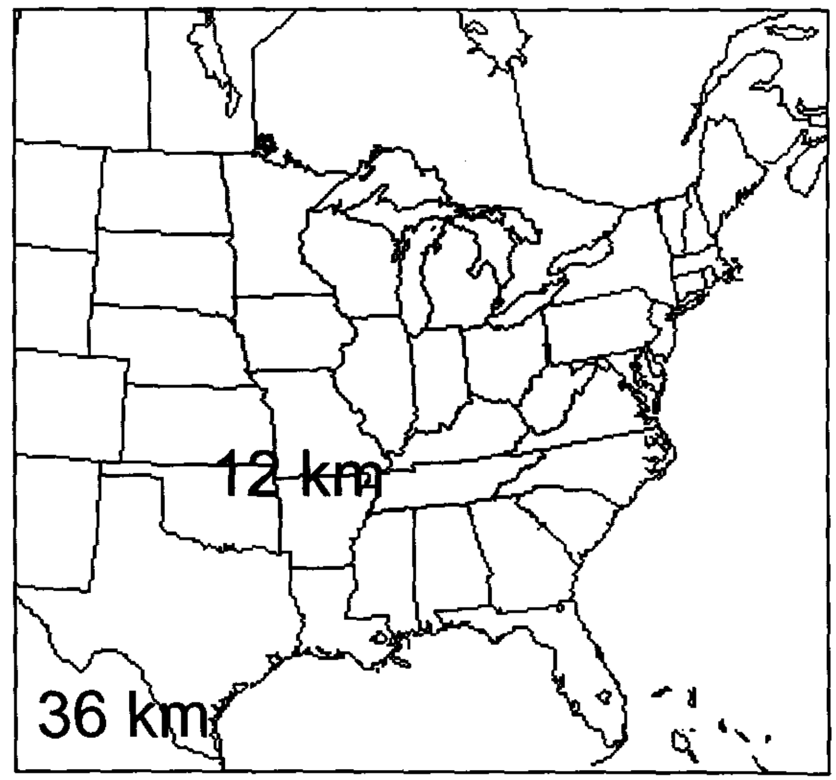
Air Quality Modeling

Model: CAMx

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

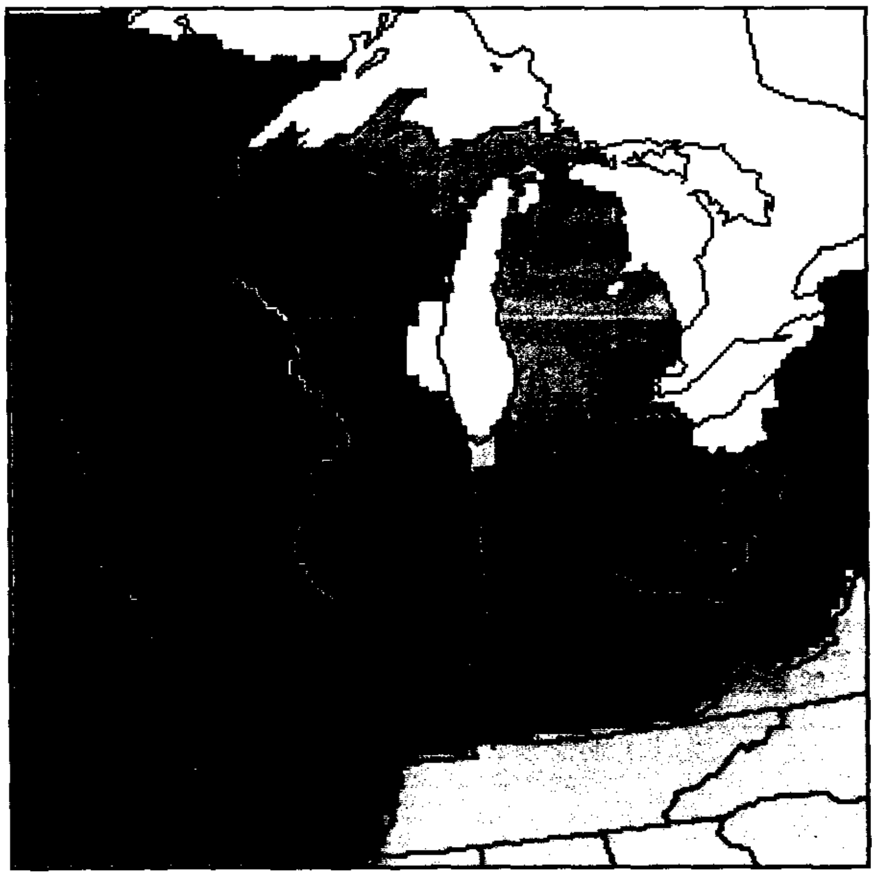
Year: 2002 (full year)
- PM/haze, 36 km

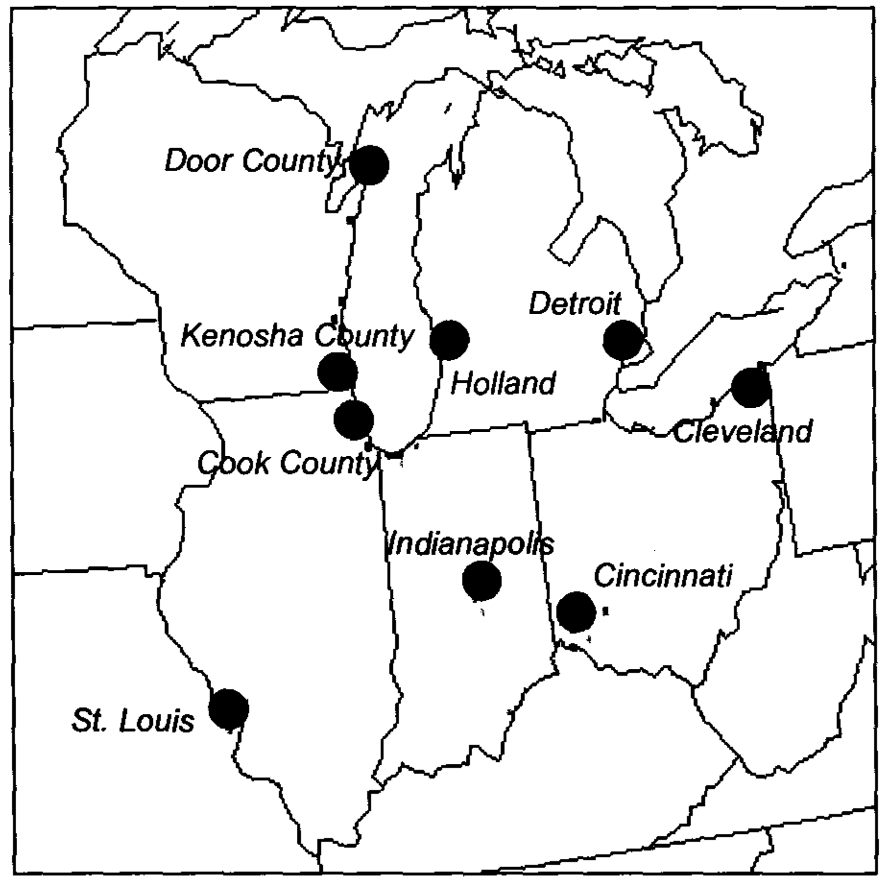
2001, 2002, 2003 (summer) – O_3, 12 km



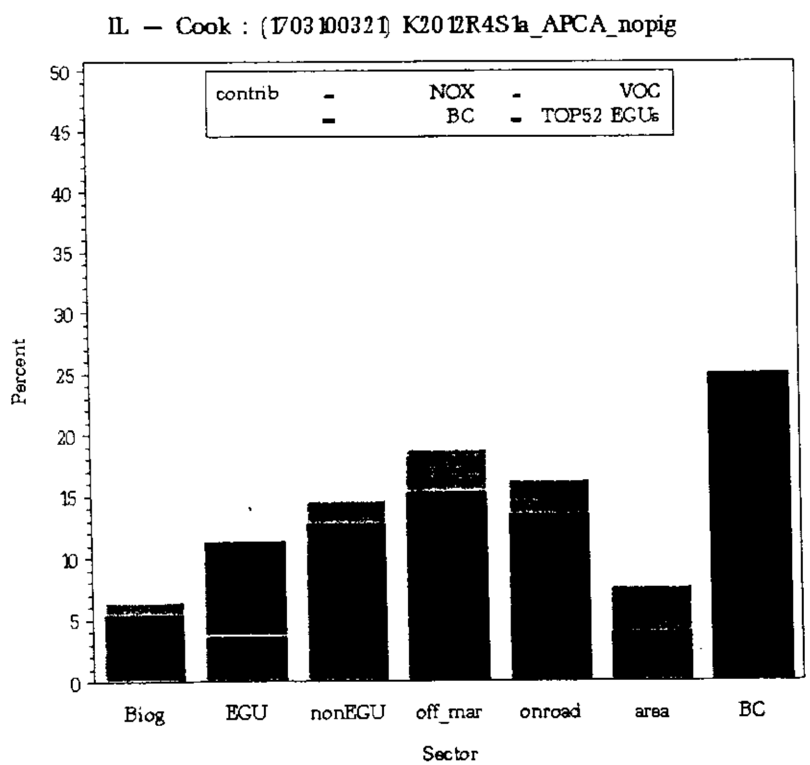
Ozone

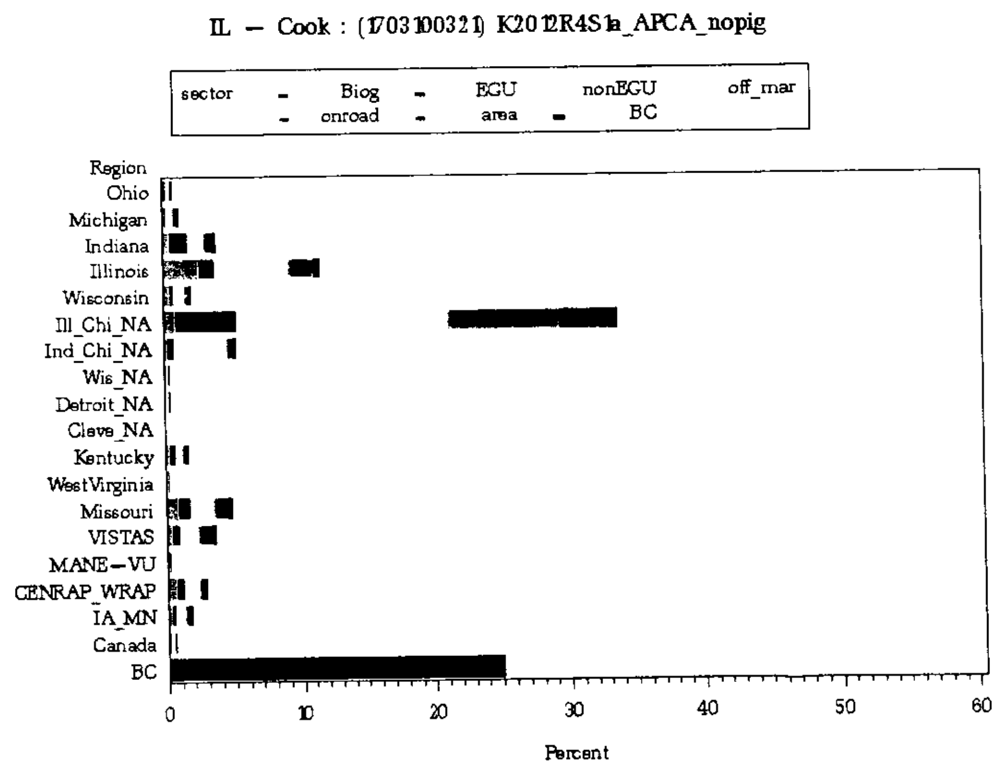
Ozone Source Apportionment



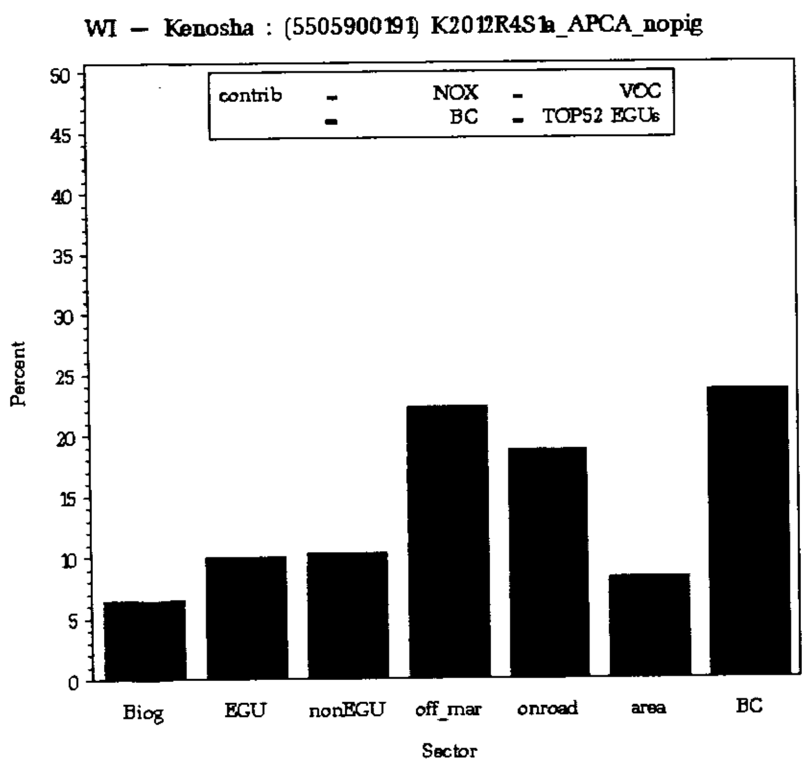


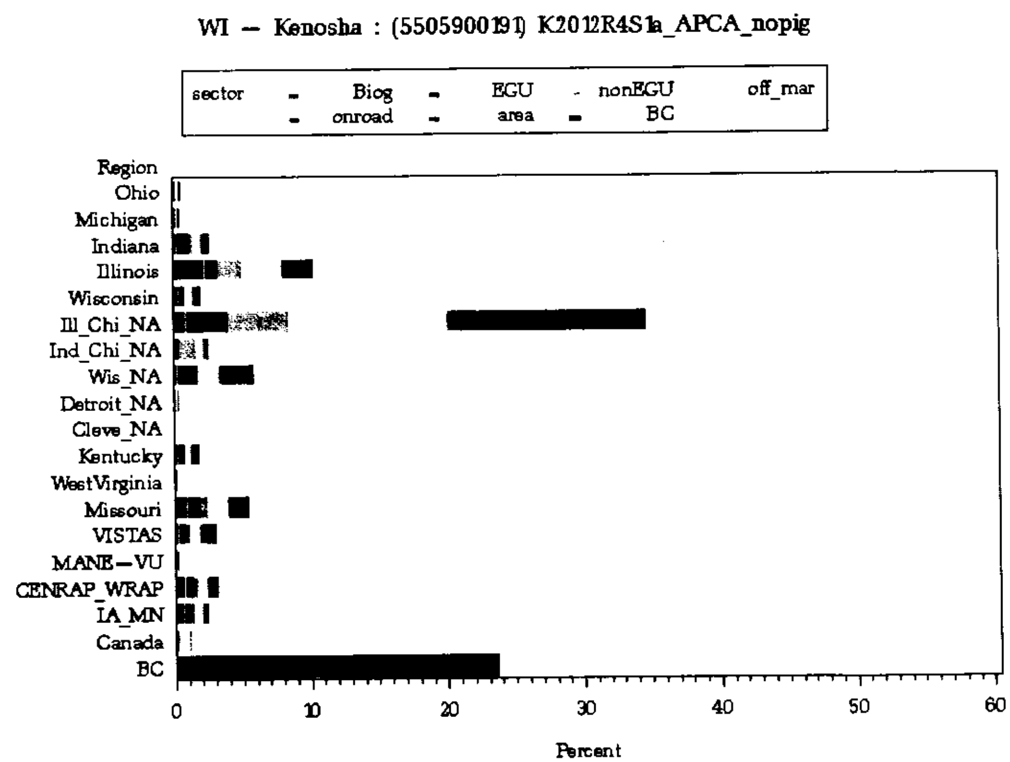
Ozone Results: Chicago, IL



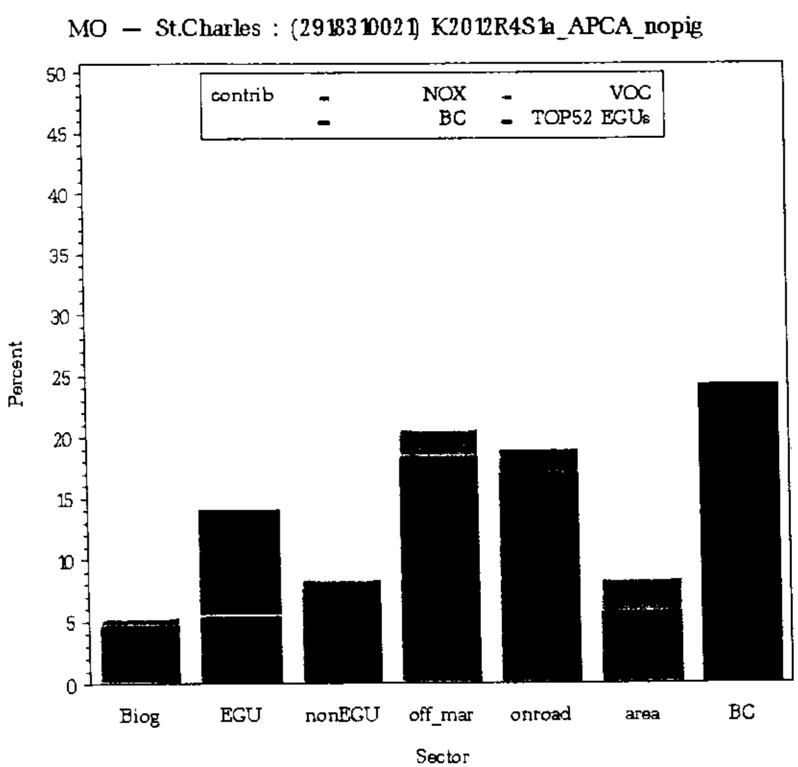


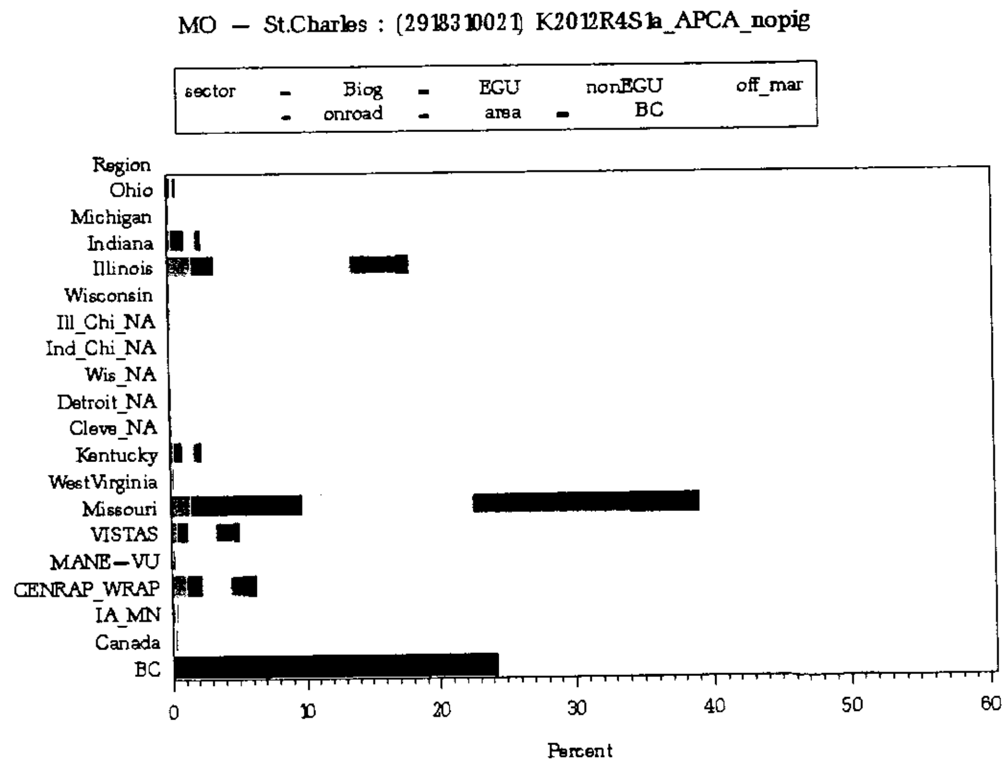
Ozone Results: Kenosha, WI





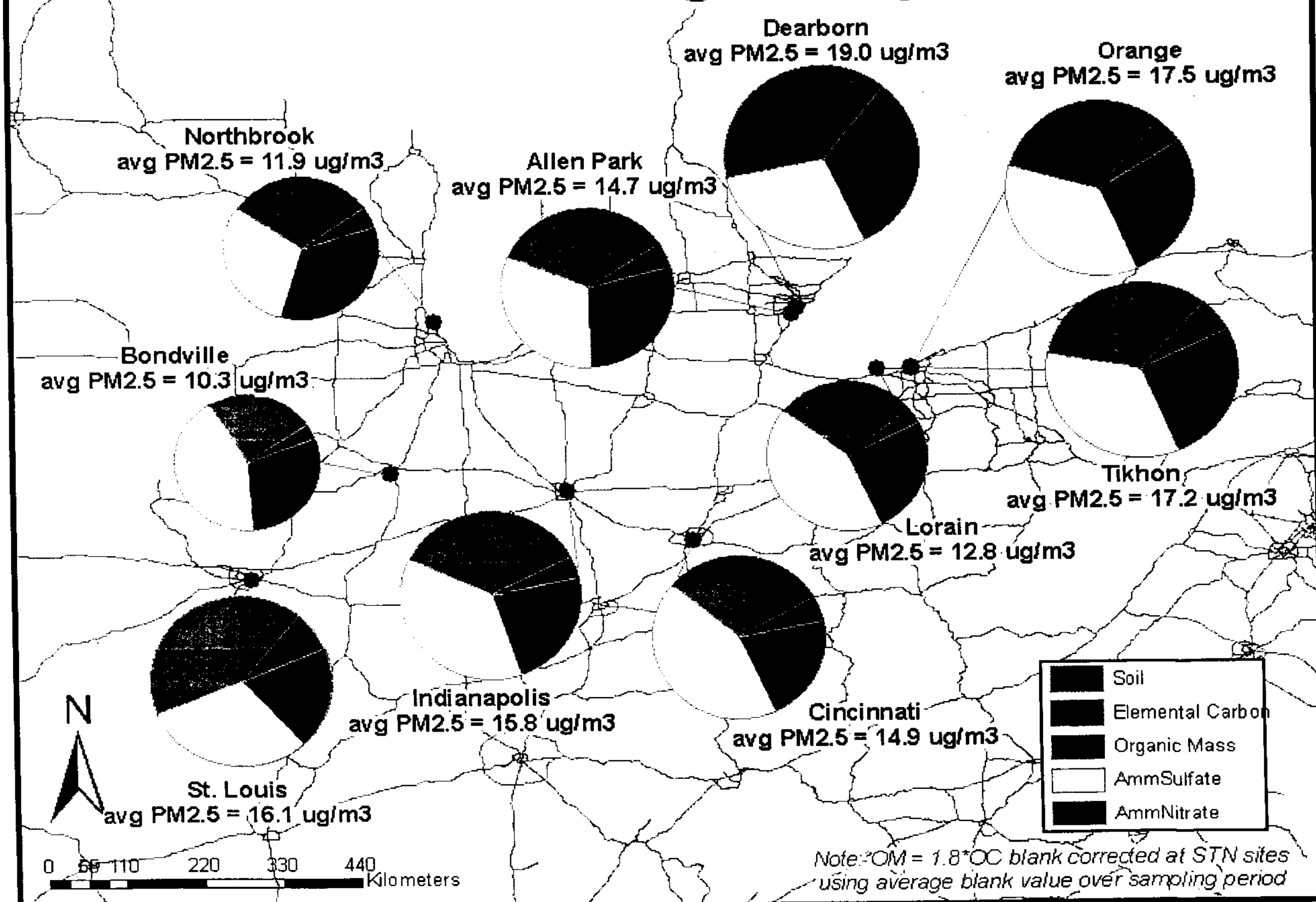
Ozone Results: St. Louis, MO



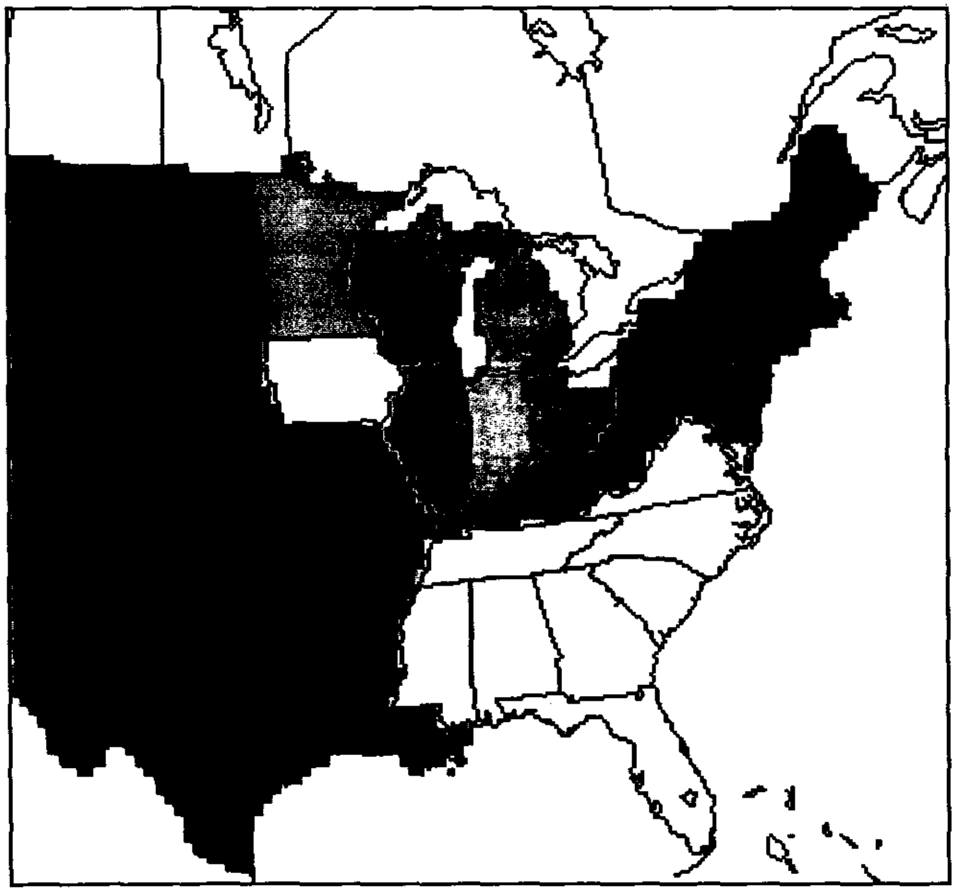


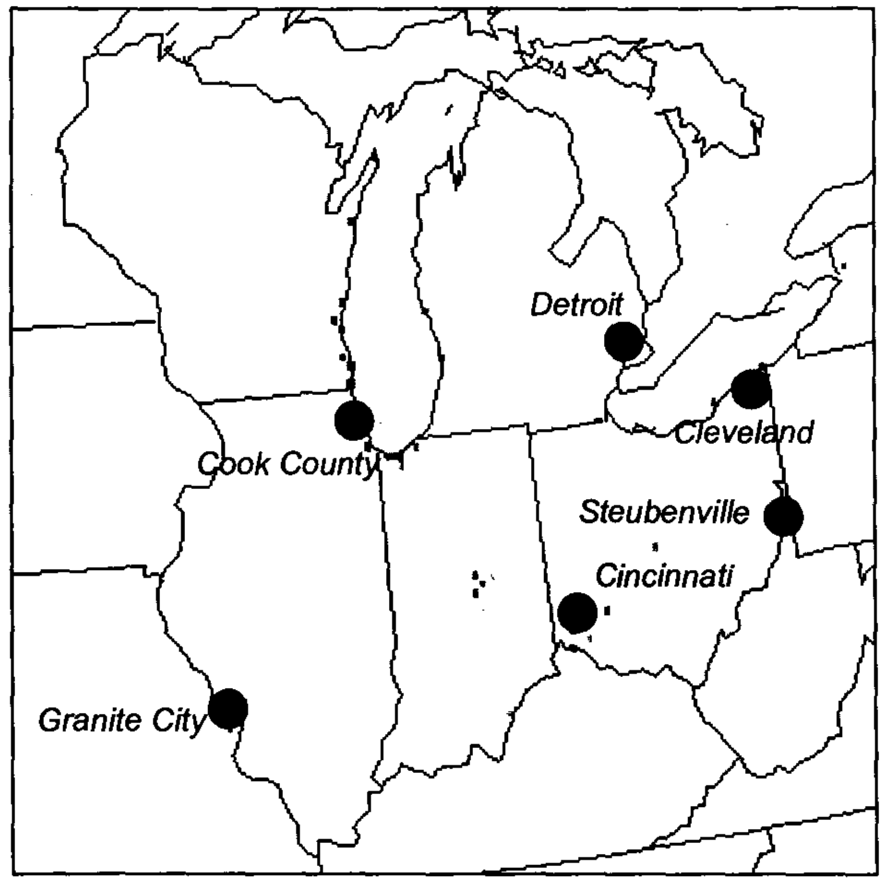
$PM_{2.5}$

2004 PM2.5 Average Composition

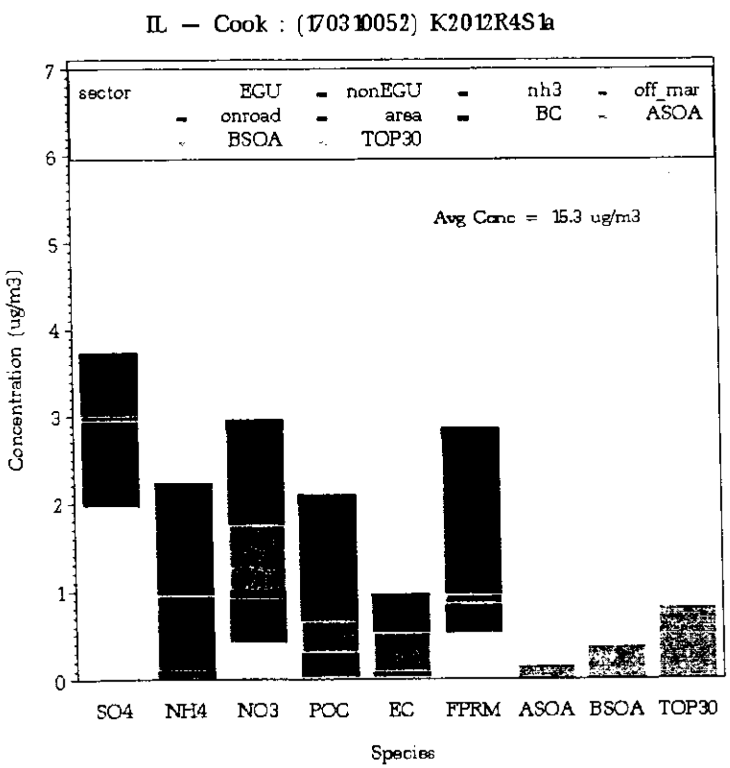


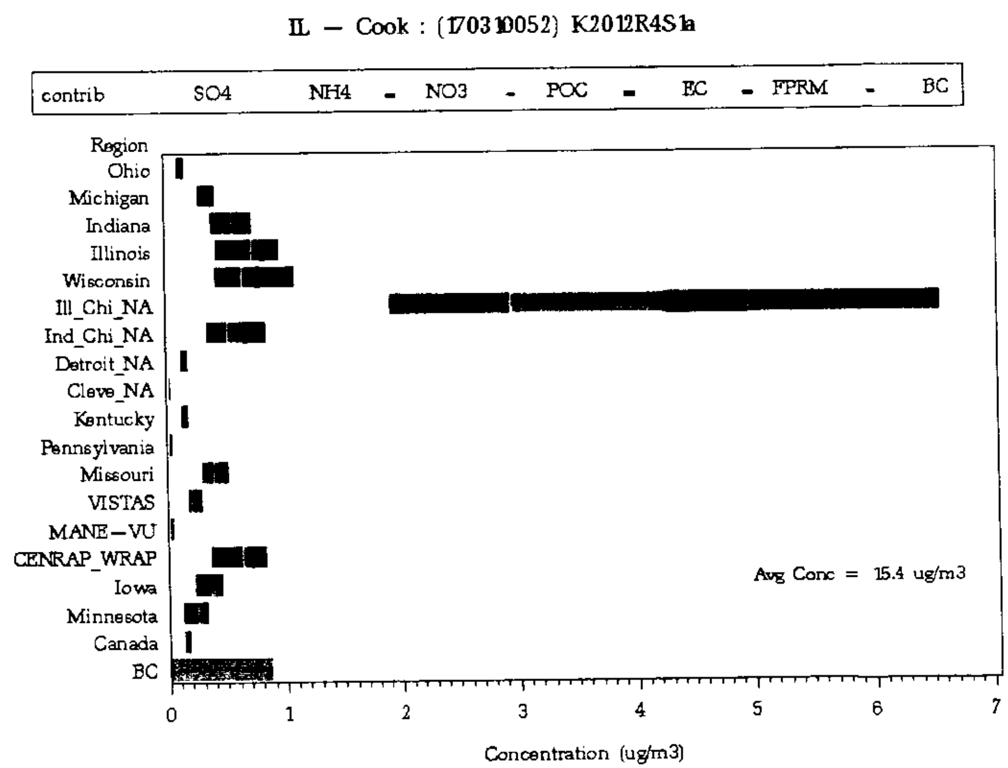
$PM_{2.5}$ Source Apportionment



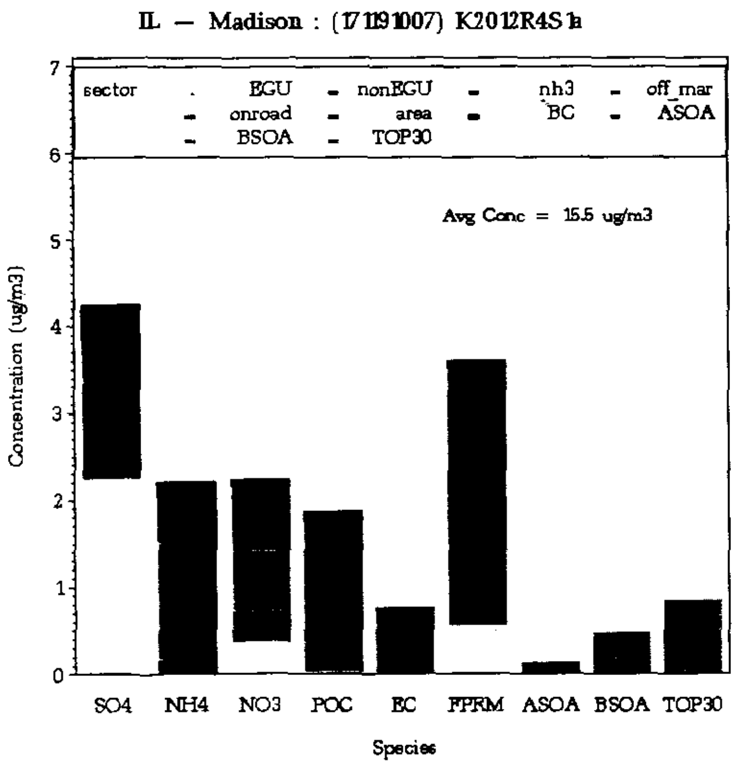


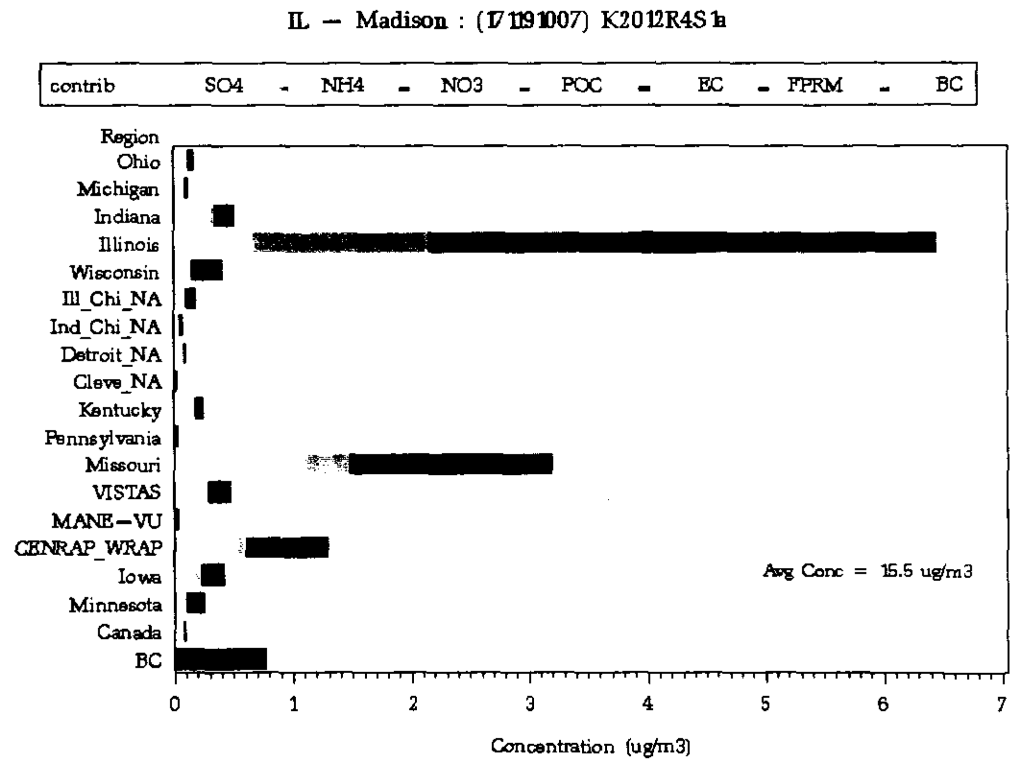
PM$_{2.5}$ Results: Chicago, IL





PM$_{2.5}$ Results: Granite City, IL

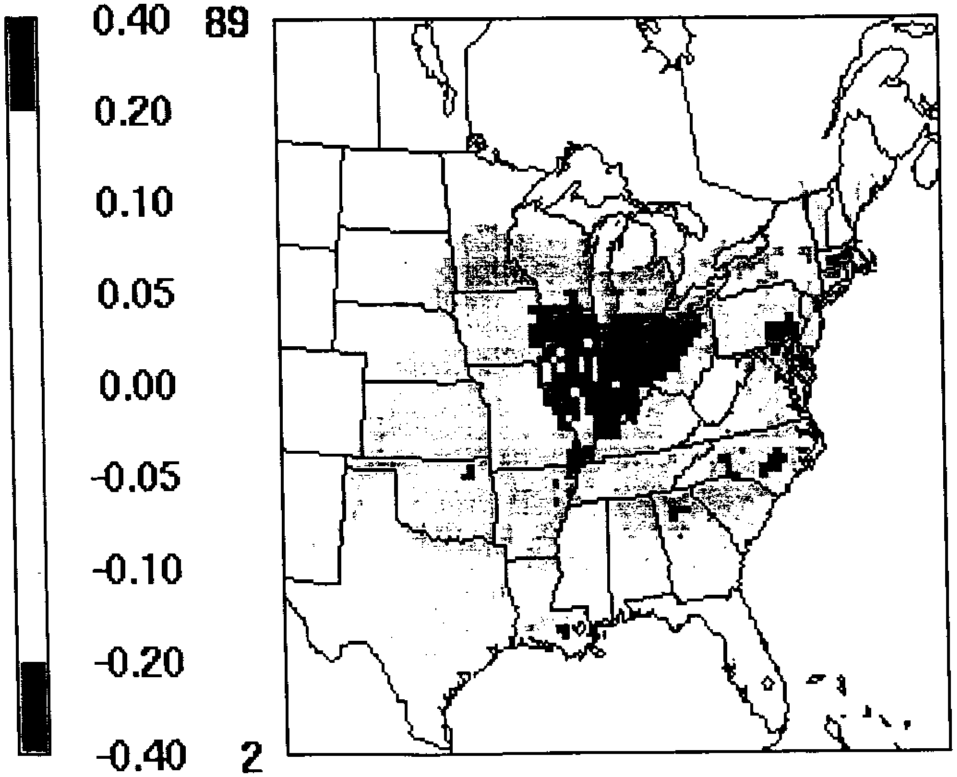




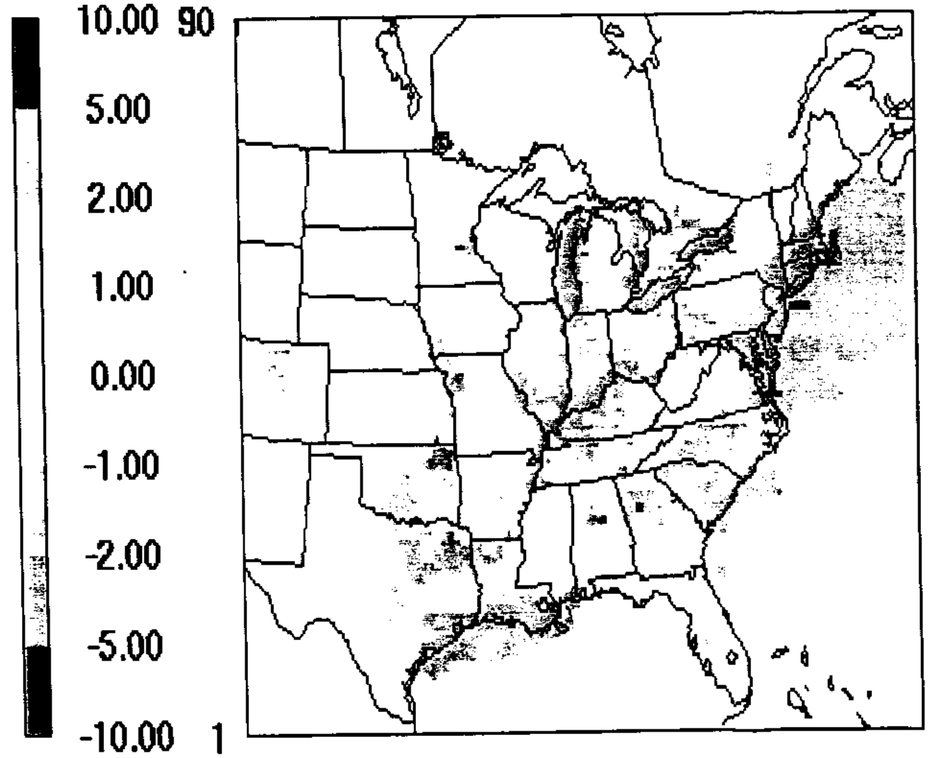
Model Sensitivity Runs:

-10% NOx Reduction

$PM_{2.5}$

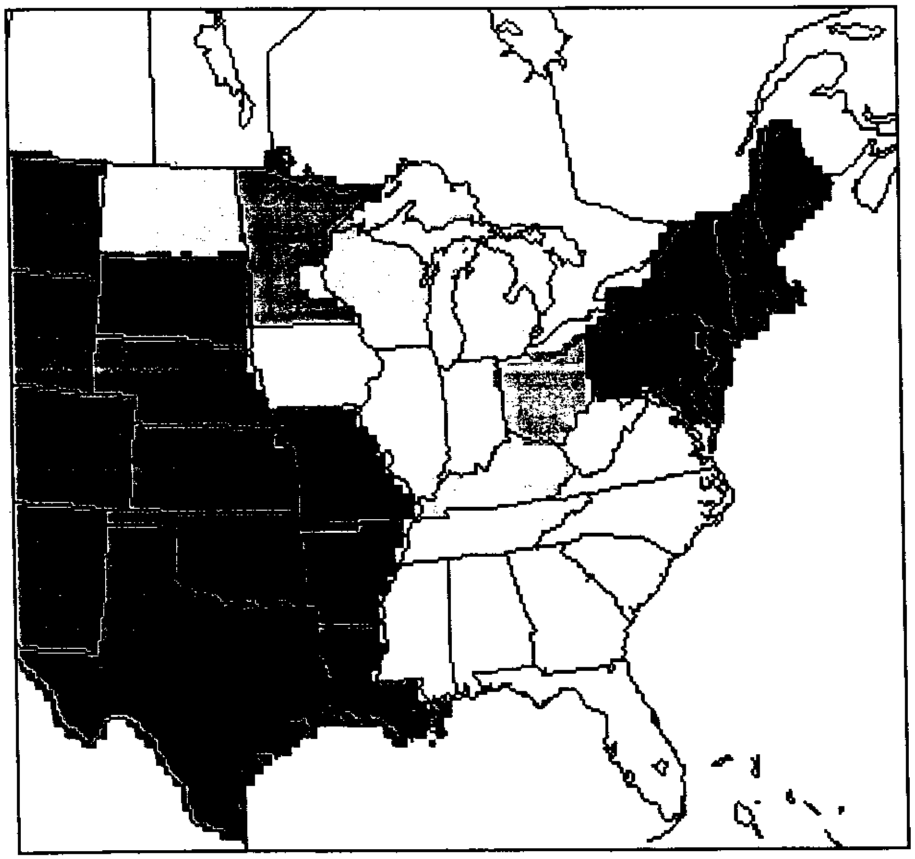


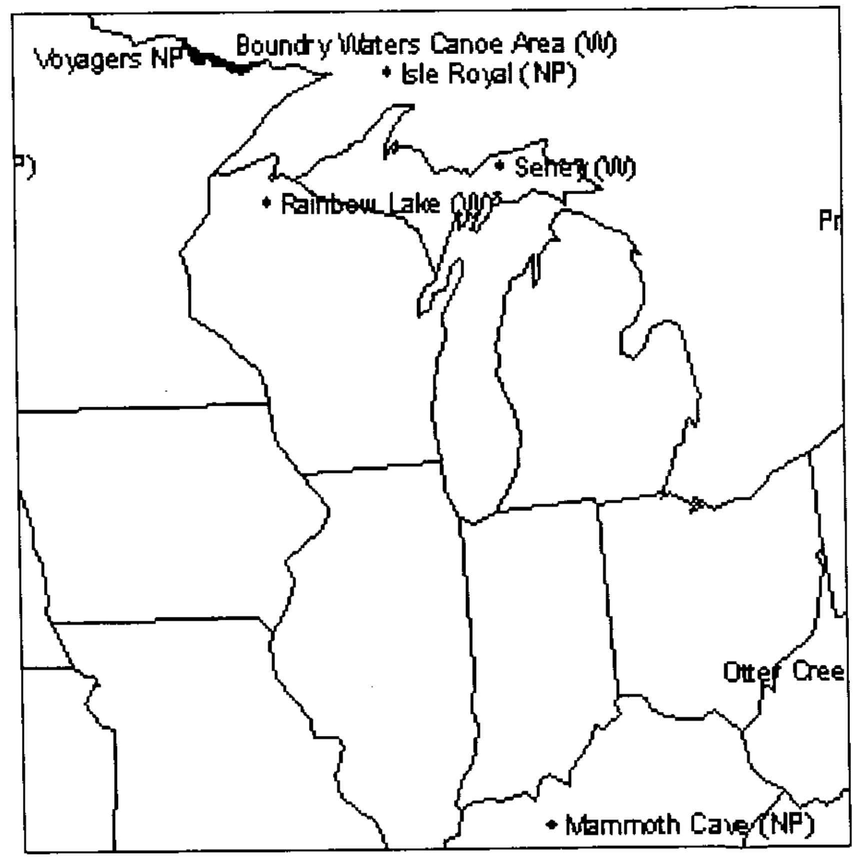
Ozone



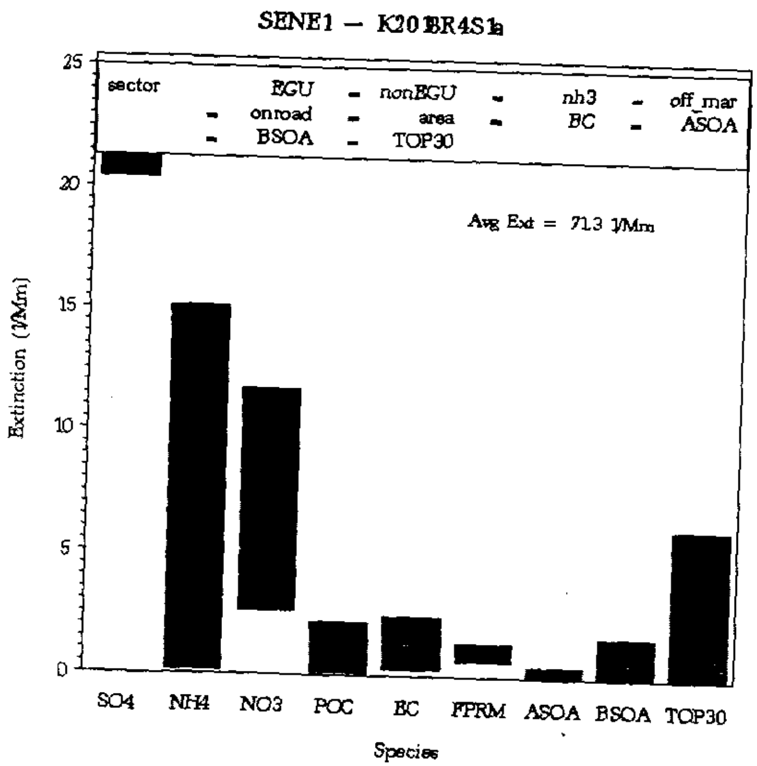
Regional Haze

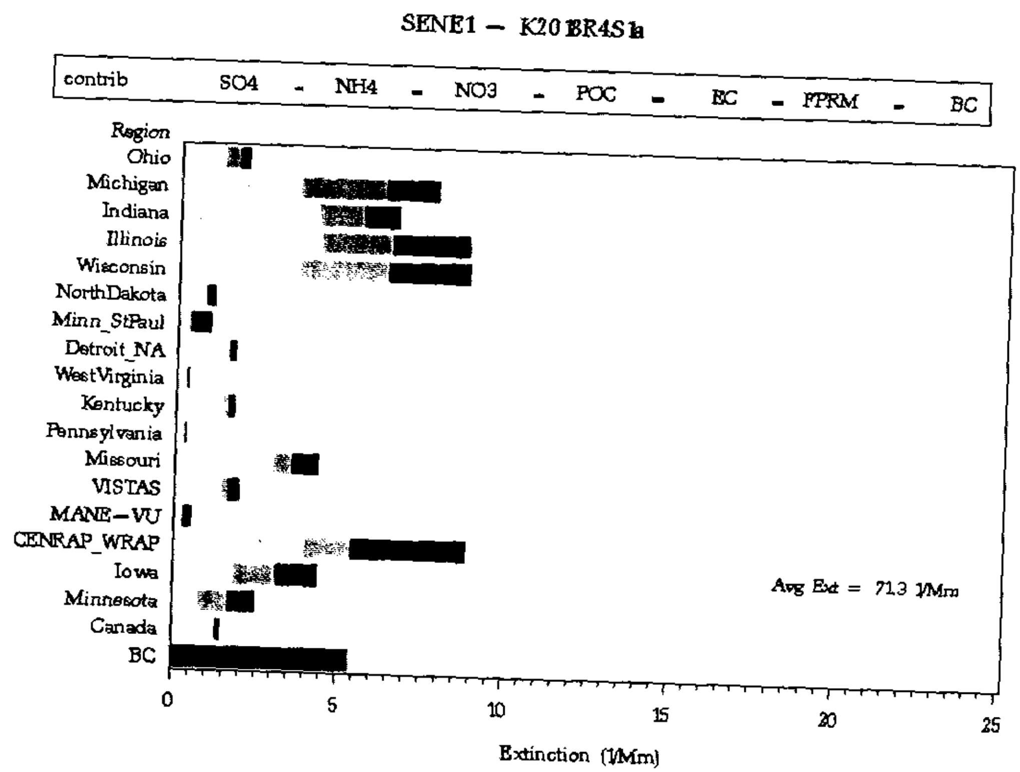
Regional Haze Source Apportionment



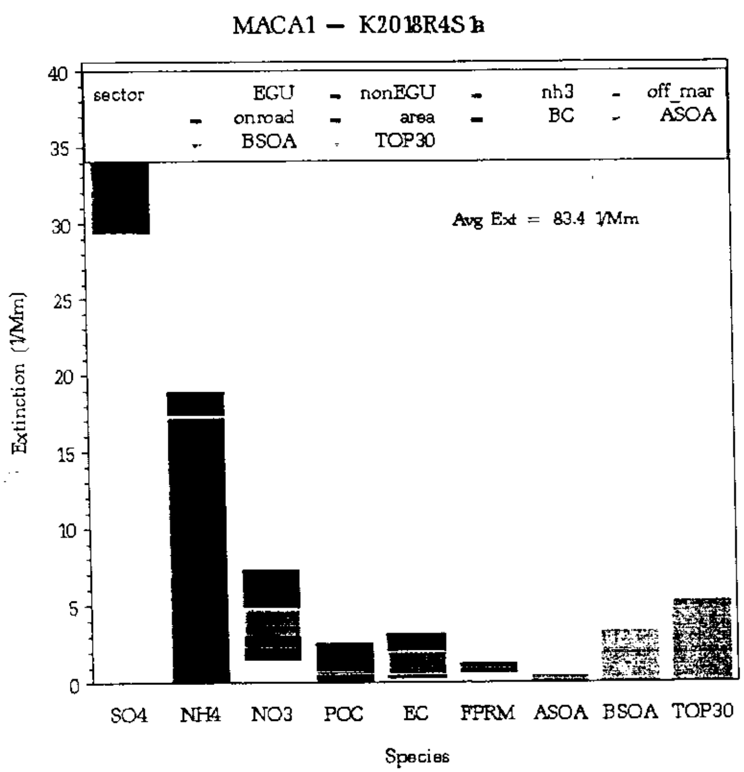


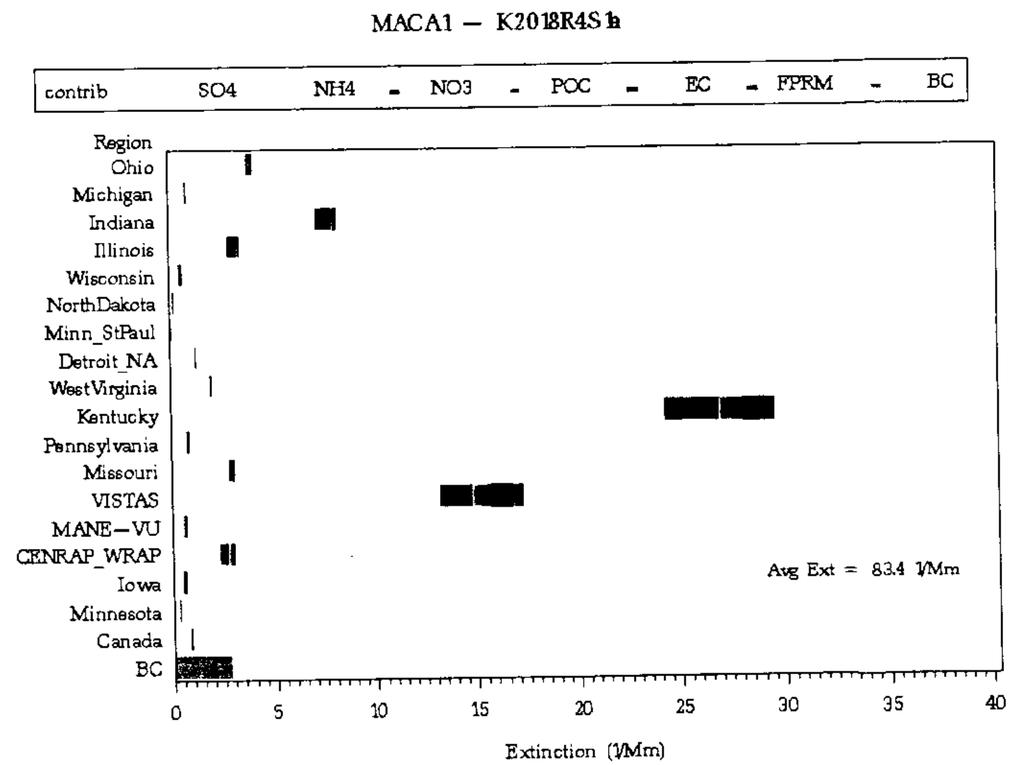
Regional Haze Results: Seney, MI





Regional Haze Results: Mammoth Cave, KY





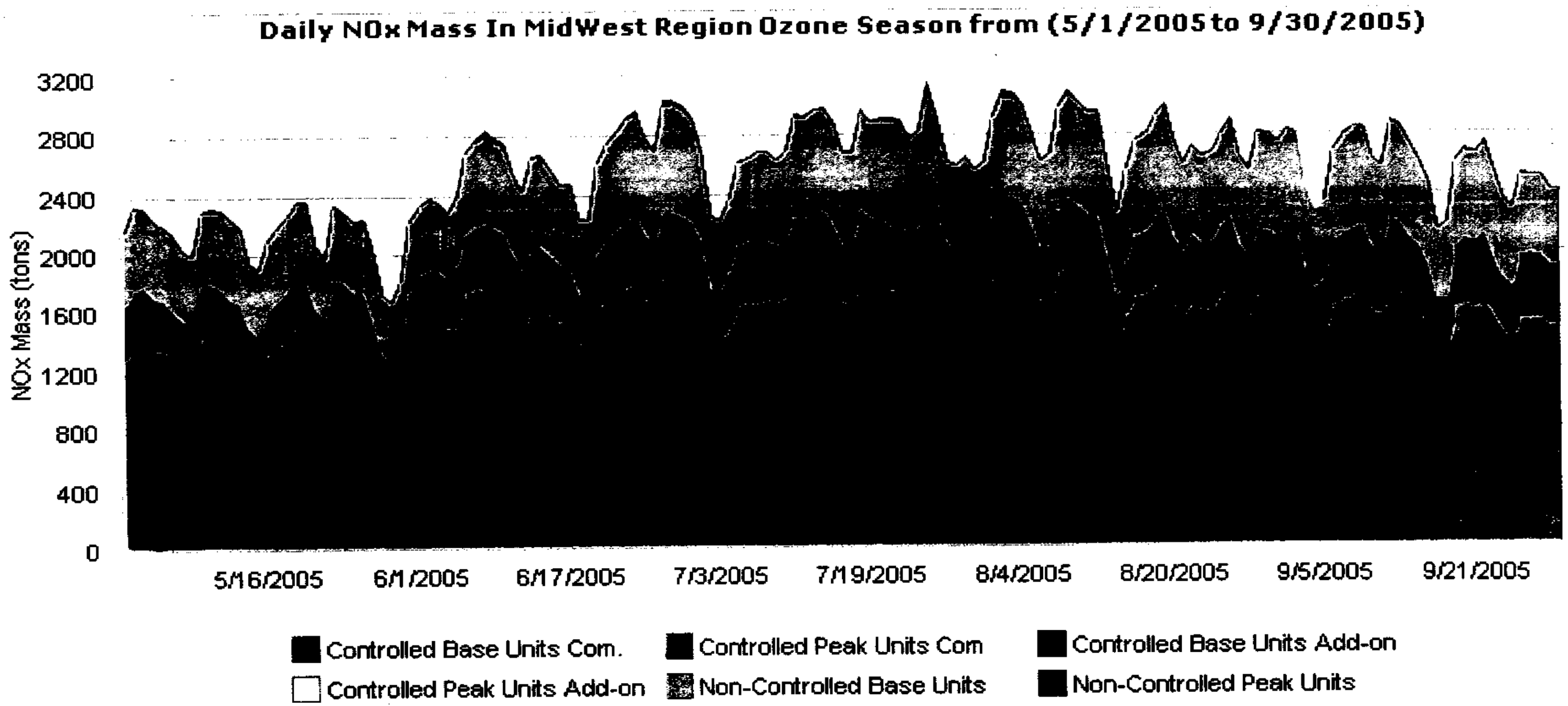
Air Quality Analyses: Summary

- On-road and nonroad NOx emissions are largest contributors
- EGU and non-EGU NOx emissions are also significant contributors
- Emissions from nearby areas have the greatest impact

In conclusion....

- Mobile sources make-up 60% of regional NOx emissions, and are largest contributor to air quality concentrations
  - Examination of candidate control measures for mobile sources indicates relatively small reductions and uncertain effectiveness
- Point sources make-up 35% of regional NOx emissions, and are also significant contributors to air quality concentrations
  - EGU point sources covered by NOx SIP Call and Clean Air Interstate Rule, but additional emission reductions possible (i.e., many facilities only have limited (combustion) controls)
  - Additional emission reductions possible for non-EGU point sources

Midwest EGU NOx Emissions (2005)



BEFORE THE ILLINOIS POLLUTION CONTROL BOARD

STATE OF ILLINOIS	)	
	)	**SS**
COUNTY OF SANGAMON	)	
	)	

CERTIFICATE OF SERVICE

I, the undersigned, an attorney, state that I have served by overnight mail the attached TESTIMONY OF ROBERT KALEEL, YOGINDER MAHAJAN, SCOTT LEOPOLD, AND MICHAEL KOERBER of the Illinois Environmental Protection Agency upon the following persons:

Dorothy Gunn, Clerk
Illinois Pollution Control Board
State of Illinois Center
100 West Randolph, Suite 11-500
Chicago, Illinois 60601

SEE ATTACHED SERVICE LIST

and mailing it by overnight mail from Springfield, Illinois on May 10, 2007, with sufficient postage affixed.

ILLINOIS ENVIRONMENTAL
PROTECTION AGENCY

Rachel L. Doctors
Assistant Counsel
Air Regulatory Unit
Division of Legal Counsel

Dated: May 10, 2007

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