DRAFT

ATTAINMENT DEMONSTRATION FOR THE 2008 OZONE NATIONAL AMBIENT AIR QUALITY STANDARD FOR THE CHICAGO NONATTAINMENT AREA

AQPSTR 17-06

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April 2017

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A Modeling Demonstration for the 2008 Ozone National Ambient Air Quality Standard for the Lake Michigan Region: Technical Support Document, prepared by the Lake Michigan Air Directors Consortium, December 7, 2016.

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List of Acronyms

AIM	Architectural and Industrial Maintenance
CAA	Clean Air Act of 1990
CAIR	Clean Air Interstate Rule
CFR	Code of Federal Regulations
CMAP	Chicago Metropolitan Agency for Planning
CPS	Combined Pollutant Standards
CSAPR	Cross-State Air Pollution Rule
CTG	Control Techniques Guideline
EGU	Electric Generating Unit
EPA	Environmental Protection Agency
GVWR	Gross Vehicle Weight Rating
IDOT	Illinois Department of Transportation
I/M	Inspection/Maintenance
LADCO	Lake Michigan Air Directors Consortium
MACT	Maximum Achievable Control Technology
MATS	Mercury and Air Toxics Standard
MOVES	Motor Vehicle Emissions Simulator
MPH	Miles Per Hour
MPS	Multi-Pollutant Strategy
NAA	Nonattainment Area
NAAQS	National Ambient Air Quality Standard
NESHAP	National Emission Standards for Hazardous Air Pollutants
NODA	Notice of Data Availability
NOx	Oxides of Nitrogen
NSPS	New Source Performance Standards
NSR	New Source Review
OBD	On-Board Diagnostics
OTC	Ozone Transport Commission
ppb	Parts per billion
ppm	Parts per million
RACM	Reasonably Available Control Measures
RACT	Reasonably Available Control Technology
RICE	Reciprocating Internal Combustion Engine
RFG	Reformulated Gasoline
RFP	Reasonable Further Progress
ROP	Rate of Progress
RVP	Reid Vapor Pressure
SIC	Standard Industrial Classification
SCC	Source Classification Code
SIP	State Implementation Plan
TSD	Technical Support Document
USEPA	United States Environmental Protection Agency
VMT	Vehicle Miles Traveled
VOM	Volatile Organic Material

Executive Summary

On June 11, 2012, the USEPA designated portions of the Chicago metropolitan area as marginal nonattainment for the 2008 ozone National Ambient Air Quality Standard (NAAQS). The Chicago nonattainment (NAA) area includes Cook, DuPage, Kane, Lake, McHenry, and Will Counties as well as Aux Sable and Goose Lake Townships in Grundy County and Oswego Township in Kendall County. The deadline to attain the standard was July 20, 2015. On April 11, 2016, the United States Environmental Protection Agency (USEPA) determined that the Chicago NAA failed to attain the 2008 ozone NAAQS by the applicable date, forcing the reclassification of the area to moderate ozone nonattainment. Due to the designation of these counties to moderate nonattainment, the State of Illinois was required by the Clean Air Act (CAA) to develop a plan to attain the NAAQS by January 1, 2017, with attainment of the NAAQS to be achieved by July 20, 2018.

As adjacent portions of neighboring states have also been designated as nonattainment, Illinois has worked closely with the USEPA and the states of Wisconsin and Indiana, through the Lake Michigan Air Directors Consortium (LADCO), to coordinate each state's attainment demonstration. Under the direction of LADCO, the states have developed photochemical modeling inputs to drive a model that simulates the formation and transport of ozone in the Midwest. After an extensive performance evaluation, the modeling system was used to evaluate whether the identified emissions reduction strategy was adequate to demonstrate attainment of the 2008 ozone NAAQS by the attainment deadline.

The modeling indicates that the selected strategy should provide sufficient emission reductions to achieve attainment of the ozone standard at all locations in the Chicago NAA. The modeling indicates that the states' emission reduction strategy is sufficient to demonstrate attainment for the 2008 ozone standard by July 20, 2018 (except in Sheboygan, Wisconsin).

The CAA and USEPA's implementation rule for ozone specify other requirements for states to address in preparing attainment demonstrations. These include a demonstration of Reasonable Further Progress (RFP), Reasonably Available Control Technology (RACT), contingency measures that must be implemented if the NAA area fails to achieve the RFP reductions or fails to attain the NAAQS within the specified timeframe, motor vehicle emissions budgets to address transportation conformity, and a demonstration that Illinois has the legal authority and is committing the resources needed to implement this attainment plan. These requirements are addressed in this document.

1.0 Attainment Demonstration

On June 11, 2012, the United States Environmental Protection Agency (USEPA) designated portions of the lower Lake Michigan region, including the Chicago metropolitan area, as nonattainment for the 2008 ozone National Ambient Air Quality Standard (NAAQS). These designations became effective on July 20, 2012. Six counties and three townships in northeastern Illinois were designated as a marginal nonattainment area (NAA) for ozone. This area includes Cook, DuPage, Kane, Lake, McHenry, and Will counties as well as Aux Sable and Goose Lake townships in Grundy County and Oswego Township in Kendall County.

The Illinois EPA and the air quality agencies from the states of Indiana and Wisconsin worked cooperatively with the Lake Michigan Air Directors Consortium (LADCO) to develop a photochemical modeling platform to simulate the formation and transport of ozone in the Midwest. The modeling system is used to evaluate emissions reduction strategies for inclusion in the states' attainment plans. A complete description of the modeling methodologies and results are contained in the document "Modeling Demonstration for the 2008 Ozone National Ambient Air Quality Standard for the Lake Michigan Region: Technical Support Document" (December 7, 2016), which was prepared by LADCO and is included here as Appendix A.

As described in Section 3.7 of the LADCO Technical Support Document, model performance was assessed by comparing modeled and monitored concentrations with statistical measures recommended by USEPA to assess the reasonableness of the results. The model performance evaluation focused on the magnitude, spatial pattern, and temporal variations of modeled and measured concentrations. The 2011 baseline CAMx modeling data were evaluated against monitored ozone data from the lower Lake Michigan area in order to evaluate the fitness of the databases for use in the modeled attainment test. In summary, model performance for ozone is generally acceptable.

After detailed performance testing of the 2011 base case simulation, the CAMx modeling system was exercised with a 2017 on-the-books emissions control scenario aimed at assessing the effects of future year emission control strategies on ozone in the Midwest. The resulting design values for all monitors in the three-state nonattainment area, along with the separate key Sheboygan nonattainment area monitor, are shown in Table 1.1. This air quality modeling and other supplemental analyses performed to estimate future year ozone concentrations indicate that:

- Existing on the books controls are expected to produce significant improvement in ozone air quality;
- Except for one monitoring station in Sheboygan, Wisconsin, all sites in the Lake Michigan region would be expected to meet the current 2008 ozone standard by the applicable attainment date;

All monitors in the Lake Michigan area were projected to achieve the 2008 NAAQS in 2017, except for Sheboygan, Wisconsin. The projected concentration of 76.1 ppb at Sheboygan is well within the range of being considered attainment with a weight of evidence demonstration.

Table 1.1. Projected Ozone Design Values (ppb) for 2017 in the Chicago and Sheboygan Ozone Nonattainment Areas

AQS ID	State	County	LADCO 2017 w/ CSAPR
170310001	Illinois	Cook	66.3
170310032	Illinois	Cook	64.5
170310064	Illinois	Cook	59.2
170310076	Illinois	Cook	65.9
170311003	Illinois	Cook	55.1
170311601	Illinois	Cook	65.5
170314002	Illinois	Cook	58.8
170314007	Illinois	Cook	53.9
170314201	Illinois	Cook	62.1
170317002	Illinois	Cook	60.3
170436001	Illinois	DuPage	61.0
170890005	Illinois	Kane	65.8
170971007	Illinois	Lake	64.8
171110001	Illinois	McHenry	64.4
171971011	Illinois	Will	58.0
180890022	Indiana	Lake	59.0
180890030	Indiana	Lake	61.0
180892008	Indiana	Lake	59.6
181270024	Indiana	Porter	62.0
181270026	Indiana	Porter	57.9
550590019	Wisconsin	Kenosha	66.4
551170006	Wisconsin	Sheboygan	76.1

2.0 Base Year Emissions Inventory

A base year inventory for 2011 was developed to support the modeled attainment demonstration and State Implementation Plan (SIP) planning process. The methods used to compile the base year inventories target ozone precursor emissions of nitrogen oxides (NOx) and volatile organic material (VOM). Inventories were compiled for point, area, on-road mobile, nonroad, and biogenic emission sectors. Inventories were provided directly from the Illinois statewide database or generated from models (i.e. EGUs, on-road, nonroad, and biogenic). Throughout the inventory development process, LADCO and member states implemented quality assurance procedures and quality control checks to ensure inventories of the highest quality. Procedures outlined in USEPA's guidance documents pertaining to inventory quality assurance were followed by inventory development staff and have yielded complete, accurate and high-quality inventories. Tabular data and graphical information of base year emissions are provided in Section 3 of the accompanying LADCO Technical Support Document (TSD).

3.0 Emissions Control Measures

The modeling analysis described in this document indicates that control measures which have been promulgated at either the state or federal level, referred to as "on-the-books" controls, should be sufficient to allow the Chicago NAA as well as the entire Lake Michigan region, except Sheboygan, Wisconsin, to meet the 2008 ozone NAAQS by the required attainment date. The principle on-the-books emission reduction measures evaluated for this attainment demonstration are those measures that were effective beginning in 2010. These include point source and area source emission standards as follows:

3.1 Existing Regulations effective after 2010

- VOM Reductions by Reasonably Available Control Technology (RACT) Categories in 35 Ill. Adm. Code Part 218 with applicable compliance dates including:
    - RACT for Consumer and Commercial Products Group II
        - Industrial cleaning solvents (1/1/2012)
        - Flat wood paneling coatings (5/1/2012)
        - Flexible packaging printing lines (8/1/2010)
        - Lithographic printing lines (8/1/2010)
        - Letterpress printing lines (8/1/2010)
    - RACT for Consumer and Commercial Products Group III
        - Paper, film, and foil coatings (5/1/2011)
        - Large appliance coatings (5/1/2011)
        - Metal furniture coatings (5/1/2011)
    - RACT for Consumer and Commercial Products Group IV
        - Miscellaneous metal and plastic parts coatings (5/1/2012)
        - Automobile and light-duty truck assembly coatings (5/1/2012)
        - Miscellaneous industrial adhesives (5/1/2012)
        - Fiberglass boat manufacturing (5/1/2012)

- Transport Regulations with effective dates:
    - Clean Air Interstate Rule (CAIR) (2009-2014)
    - Cross State Air Pollution Rule (CSAPR) (2015-present)
    - CSAPR Update Rule (2017-present)

- Illinois' Multi-Pollutant Standards (MPS) and Combined Pollutant Standards (CPS) (35 Ill. Adm. Code Part 225 – ongoing)

- Mercury and Air Toxics Standard

- New Source Performance Standards (NSPS) including:
    - Reciprocating Internal Combustion Engine Standards 40 Code of Federal Regulations (CFR) 60 Subparts IIII and JJJJ
    - Industrial/Commercial/Institutional Steam Generating Units 40 CFR 60 Subpart Db.
    - Crude Oil and Natural Gas Production, Transmission and Distribution 40 CFR 60 Subpart OOOO

- National Emission Standards for Hazardous Air Pollutants (NESHAP)/Maximum Achievable Control Technology (MACT) Standards including:
    - Reciprocating Internal Combustion Engine Standards 40 CFR 63 Subpart ZZZZ
    - Industrial/Commercial/Institutional Boilers and Process Heaters 40 CFR 63 Subpart DDDDD and JJJJJJ

- Standards and Limitations for Organic Material Emissions for Area Sources (Consumer and Commercial Products and Architectural and Industrial Maintenance Coatings rule 35 Ill. Adm. Code Part 223, last updates effective 7/1/2012)

- State Regulations for Stationary Reciprocating Internal Combustion Engines and Turbines (35 Ill. Adm. Code Part 218 Subpart Q, 5/1/2010)

- State Regulations for NOx RACT (35 Ill. Adm. Code 217, 1/1/2015)

- Ongoing reductions from the Enhanced Vehicle Inspection & Maintenance Program

- Ongoing reductions from Tier 2 Motor Vehicle Emissions Standards and Gasoline Sulfur Control Requirements

- Ongoing reductions from On-Highway Heavy-Duty Engine and Vehicle Standards and Highway Diesel Fuel Sulfur Control Requirements

- Federal Nonroad Control Programs Incorporated into MOVES Model (e.g., Nonroad Diesel Rule), plus Evaporative Large Spark Ignition and Recreational Vehicle Standards

- Ongoing reductions from Tier 4 Nonroad Diesel Engine Standards and Diesel Fuel Sulfur Content Restrictions

- Ongoing reductions from Category 3 Marine Diesel Engine Standards

- Ongoing reductions from Marine Compression-Ignition Engine Standards and Locomotive Engine Standards

- Consent Decrees - CITGO and Exxon-Mobil

It should be noted that other regulatory requirements also affect VOM emission sources within the Chicago ozone NAA. These include other MACT, NSPS, and NESHAP limits not mentioned above. The reductions from the state and federal rules meet the requirement for creditability, including the need to be enforceable, permanent, quantifiable, and surplus as required under 40 CFR 51.1110(a)(5).

3.2 New Source Review Provisions

The Illinois Environmental Protection Agency (Illinois EPA) has a fully implemented and SIP-approved New Source Review (NSR) program for major sources in nonattainment areas in 35 Ill.

Adm. Code Part 203. Illinois also implements a minor NSR permit program under Sections 9 and 30 of the Act (415 ILCS 5/9 and 5/39). For major sources in attainment/unclassifiable areas, Illinois continues to administer the federal Prevention of Significant Deterioration regulations under Section 9.1(d) of the Act and 40 CFR 52.21. A source is considered major when the potential to emit VOM or NOx emissions are greater than 100 tons/year. Major sources subject to nonattainment NSR are subject to the NSR offset ratio of 1.15:1 for this area. The nonattainment NSR requirements were already in Illinois' rules, but were also specifically submitted to USEPA as a SIP revision for the 2008 ozone NAAQS on May 24, 2018. These program requirements ensure that the construction and modification of stationary sources do not cause or contribute to a violation of the 2008 ozone NAAQS.

3.3 Stage II gasoline vapor recovery

A Stage II vapor recovery program is required for states with moderate and above nonattainment areas. Due to the fact that most vehicles now have their own vapor recovery systems called onboard refueling vapor recovery, or ORVR, Stage II controls at the pump have been largely redundant or even counter-productive. Illinois submitted a SIP revision to decommission the Stage II requirements by December 31, 2016, which USEPA approved into the SIP (80 FR 13248, 3/13/2015).

3.4 Inspection/Maintenance (I/M) Program

This submission is intended to fulfill the motor vehicle inspection and maintenance (I/M) requirement of Clean Air Act Section 182(b)(4) for the Chicago area for the 2008 ozone NAAQS. The I/M program for the Chicago nonattainment area is governed by:

- 625 ILCS 5/13C – Illinois Vehicle Emissions Inspection Law of 2005
- 35 Illinois Administrative Code 240 – Emissions Standards and Limitations for Mobile Sources
- 35 Illinois Administrative Code 276 – Procedures to be followed in the performance of inspections of Motor Vehicle Emissions

Illinois EPA has been operating an enhanced I/M program in the Chicago area from February 1999 to present. The original approval of I/M program into the SIP was on February 22, 1999, with a subsequent approval on August 13, 2014. These SIP-approved enhanced I/M program requirements remain in place in the Chicago area.

Illinois EPA hereby certifies that the SIP-approved enhanced I/M Program in place for the Chicago area satisfies the I/M requirements under Section 182(b)(4) of the Clean Air Act.

4.0 Reasonable Further Progress (RFP)

Since the Chicago region is classified as a moderate nonattainment area and has previously met the Clean Air Act (CAA) requirement for a 15% Rate of Progress (ROP) VOM reduction plan for the entire area, another 15% ROP plan is not required. Instead, the area must meet the RFP requirement that provides for a 15% emission reduction from the baseline year of 2011 within the first six years

after the baseline year, per 40 CFR 51.1110(a)(2)(i)(A). Illinois EPA is planning on demonstrating the reduction with NOx and VOM emissions that are sufficient to meet the overall 15% reduction from 2011 to 2017 with an extra 3% for contingency.

The 2011 base year inventory, identified in Section 2, was calculated as described in the Illinois Ozone Emission Inventory for 2011 (AQPSTR13-02). However, at the time the 2011 inventory was compiled, the on-road mobile source emissions were calculated by using the 2010 version of the MOVES model. The current version of the MOVES model is 2014a. In addition, after the 2011 inventory and for the 2014 inventory, Illinois EPA had updated the estimates of vehicle registrations (fleet mix) and vehicle miles traveled (VMT). These values, especially VMT, were found to have significant differences from the 2011 values. To maintain the consistency of the inventory, the VMT and vehicle population from 2014 was back-casted to 2011. This was accomplished by using the same growth factor for projecting the vehicle population and VMT from 2014 to 2017, namely a growth rate of 1.2% per year. With this data, MOVES2014a was run to obtain 2011 emissions.

The 2010 version of the MOVES model had previously been used to calculate off-road emissions. This differed from the use of version 2014a of the MOVES model to calculate 2017 emissions. For consistency, the 2011 inventory was recalculated using the 2014a version of MOVES. Illinois EPA used the default data for both the 2011 and 2017 off-road emission inventories. It should also be noted that MOVES does not calculate off-road emissions for aircraft, commercial marine vessels, or locomotives. Those three categories are calculated separately and are included in off-road emissions.

Tables 4.1 and 4.2 identify the emissions for the updated 2011 base year inventory which will replace the previously submitted inventory when the area was designated "marginal." Illinois EPA is asking USEPA to approve this revised 2011 base year inventory as a replacement of the previously submitted 2011 base year inventory approved by USEPA on March 7, 2016 (81 FR 11671).

Table 4.1: Base Year NOx Emissions for 2011 (tons/day)

County	Point Sources	Area Sources	On-road Mobile Sources	Off-road Mobile Sources	Total
Cook	42.52	14.60	182.22	78.83	**318.17**
DuPage	5.49	4.53	45.63	19.19	**74.85**
Grundy Twps	5.39	0.06	0.91	0.99	**7.35**
Kane	3.80	1.77	22.27	14.41	**42.25**
Kendall Twps	0.77	0.19	1.53	1.08	**3.57**
Lake	13.74	3.52	32.47	15.01	**64.74**
McHenry	0.86	1.17	13.99	8.78	**24.80**
Will	47.42	1.30	33.61	17.80	**100.13**
Total	**119.99**	**27.13**	**332.64**	**156.10**	**635.86**

Table 4.2: Base Year VOM Emissions for 2011 (tons/day)

County	Point Sources	Area Sources	On-road Mobile Sources	Off-road Mobile Sources	Total
Cook	27.01	123.60	86.53	52.60	**289.74**
DuPage	4.11	25.77	20.19	16.38	**66.45**
Grundy Twps	1.87	0.51	0.23	0.66	**3.26**
Kane	3.25	13.45	10.48	8.37	**35.55**
Kendall Twps	0.50	1.33	0.70	0.92	**3.45**
Lake	2.14	19.35	14.69	16.89	**53.07**
McHenry	1.21	8.46	6.86	5.39	**21.93**
Will	8.16	17.57	14.56	9.10	**49.40**
Total	**48.26**	**210.04**	**154.24**	**110.31**	**522.85**

To project emissions from 2011 to 2017, growth factors are used. Point and area source categories, along with off-road categories not calculated by the MOVES model, were derived using Version 6.2 of the "Notice of Data Availability of the Environmental Protection Agency's Updated Ozone Transport Modeling Data for the 2008 Ozone NAAQS" – also known as the NODA. This data set projected 2011 emissions to 2017 and 2025.

The growth factors from the NODA were reviewed and applied appropriately to Illinois point sources. In some cases, a source classification code in the 2011 inventory did not have a match in the NODA data. In these cases, a growth factor was used from a similar SCC (i.e., same six digit code). If a similar SCC did not exist, the growth factor was assumed to be 1.0. For the larger NOx emitting units, a growth factor was applied based on actual 2011 to 2016 growth in emissions as reported to the Illinois EPA. Sources falling in the category of actual growth were:

- 031333AAD Winnetka Electric Plant
- 031438ABC Elgin Energy Center LLC
- 063800AAJ Morris Cogeneration LLC
- 097190AAC Waukegan Electric Generating Station
- 197808AAG Elwood Energy LLC
- 197899AAB University Park Energy LLC
- 197899AAC LSP University Park LLC

There were other cases where the NODA predicted that a coal-firing emission unit would shut down. Illinois EPA has previously made comments about this situation (see comment letters dated October 23, 2015, and February 1, 2016, to Administrator McCarthy in Docket EPA-HQ-OAR-2015-0500 for the Cross-State Air Pollution Rule Update). The reality of the situation is that those units will have switched to natural gas and will no longer be base load units. With the fuel switch from coal to natural gas and the reduction in hours of operation, actual emissions of NOx will likely be reduced.

To have a margin of safety, a growth factor of 1.0 was applied to the following units:

- 197809AAO Midwest Generation Joliet 9, Unit 6
- 197809AAO Midwest Generation Joliet 29, Unit 7
- 197809AAO Midwest Generation Joliet 29, Unit 8
- 197810AAK Will County Generating Station Unit 3
- 197810AAK Will County Generating Station Unit 4

Two coal-fired sources were shut down in 2012 – the Crawford Electric Generating Station (031600AIN) and the Fisk Electric Generating Station (031600AMI). Both sources were owned by Midwest Generation. The emissions for these sources were updated to zero in the 2017 inventory.

Area source emissions and the off-road categories of aircraft, commercial marine vessels, and locomotives were grown using the growth factors derived from the NODA.

On-road emissions were calculated using the MOVES2014a model. The inputs included information on the continued phase-in of the Tier 2 motor vehicle standards, the phase-in of the Tier 3 standards beginning in 2017, and continued operation of Illinois EPA's vehicle inspection and maintenance program. All current "on the books" on-road control programs available in the model were used. Vehicle population and vehicle miles traveled were assumed to increase at a rate of 1.2 percent per year from 2011.

Off-road emissions other than aircraft, commercial marine vessels, and locomotives were calculated using the MOVES2014a model. These runs used the implementation of the nonroad control programs available in the model.

Accounting for growth of the point, area, and mobile sectors of the inventory, along with the continued implementation of on the books control, the 2017 inventory is expected to be a reasonable estimate of emissions.

Table 4.3: Projected NOx Emissions for 2017 (tons/day)

County	Point Sources	Area Sources	On-road Mobile Sources	Off-road Mobile Sources	Total
Cook	29.33	14.50	89.71	61.96	**195.50**
DuPage	6.77	4.64	22.72	12.94	**47.07**
Grundy Twps	9.81	0.06	0.45	1.45	**11.76**
Kane	3.36	1.84	11.00	9.69	**25.89**
Kendall Twps	0.87	0.19	0.76	0.73	**2.55**
Lake	15.93	3.74	16.17	11.36	**47.20**
McHenry	0.78	1.21	6.97	5.73	**14.69**
Will	56.72	1.25	16.62	13.43	**88.01**
Total	**123.57**	**27.42**	**164.40**	**117.28**	**432.67**

Table 4.4: Projected VOM Emissions for 2017 (tons/day)

County	Point Sources	Area Sources	On-road Mobile Sources	Off-road Mobile Sources	Total
Cook	26.96	116.65	44.63	38.40	**226.64**
DuPage	4.07	22.98	10.60	12.22	**49.87**
Grundy Twps	1.91	0.48	0.11	0.44	**2.94**
Kane	3.22	12.12	5.43	6.28	**27.05**
Kendall Twps	0.51	1.27	0.37	0.67	**2.81**
Lake	2.14	17.04	7.70	12.45	**39.33**
McHenry	1.14	7.77	3.65	3.90	**16.46**
Will	8.16	16.49	7.59	6.69	**38.92**
Total	**48.10**	**194.79**	**80.08**	**81.05**	**404.02**

The permanent and enforceable measures the state is relying upon to demonstrate RFP are the continued implementation of the existing on-road and off-road control programs listed in the following tables. No specific reduction amount was calculated for each control program but rather included as a whole in the execution of the MOVES model. For on-road vehicles, Illinois EPA included a 1.2% growth per year for vehicle population and vehicle miles traveled. For off-road vehicles, the default change in equipment population included in the MOVES model was used. For both the on-road and off-road sources, the MOVES model showed significant reductions in spite of the growth included in the model.

Table 4.5: On-road Motor Vehicle Control Programs

Regulation	Pollutant(s)	Control Program Description
40 CFR Parts 85 & 86	NOx and VOM	Passenger vehicles, SUVs, and light duty trucks – emissions and fuel standards
40 CFR Part 86	VOM	Light-duty trucks and medium duty passenger vehicles – evaporative standards
40 CFR Part 86	NOx and VOM	Heavy-duty highway compression engines
40 CFR Part 86	NOx and VOM	Heavy-duty spark ignition engines
40 CFR Part 86	NOx and VOM	Motorcycles
40 CFR Parts 59, 80, 85, and 86	VOM	Mobile Source Air Toxics – fuel formulation, passenger vehicle emissions, and portable container emissions
40 CFR Part 600	NOx and VOM	Light duty vehicle corporate average fuel economy standards

Table 4.6: Off-road Motor Vehicle Control Programs

Regulation	Pollutant(s)	Control Program Description
40 CFR Parts 80 and 1039	NOx and VOM	Compress ignition
40 CFR Part 1048	NOx and VOM	Large spark ignition
40 CFR Part 1033	NOx and VOM	Locomotive engines
40 CFR Part 1042	NOx and VOM	Marine compression ignition
40 CFR Part 1045	NOx and VOM	Marine spark ignition
40 CFR Part 1051	NOx and VOM	Recreational vehicle
40 CFR Parts 90 and 1054	NOx and VOM	Mall spark ignition engines < 19 kW – emission standards
40 CFR Parts 54, 60, and 1045	VOM	Small spark ignition engine < 19 kW – evaporative standards

The following table demonstrates how Illinois is meeting the 15% RFP requirement along with the additional 3% contingency requirement. Included in this demonstration are adjustments for the motor vehicle emission budget and reductions in emissions the Illinois EPA does not want to take credit for at this time ("Agency hold-back").

As can been seen in Table 4.7, even though Illinois EPA has not claimed the entirety of reductions available, the requirements of RFP and contingency are met. The Chicago Metropolitan Agency for Planning (CMAP) requested motor vehicle emissions budgets of 204 tons/day for NOx and 133 tons/day for VOM. On-road emissions calculated for 2017 did not meet this level so previously identified reductions were used to achieve the desired budget amounts. Reductions remaining after the adjustment for the vehicle budget are more than sufficient to achieve the overall 18% reduction. However, the Illinois EPA is maintaining these surplus reductions for its own use. This is the reason for the "hold-back" listing and USEPA should <u>not</u> consider the hold-back as part of planned reductions.[1]

1 Note that the Illinois EPA is *not* providing the "Agency Hold-back" as part of the reductions under this Demonstration. As such, the Agency Hold-back remains available to Illinois for future use for growth, conformity, additional contingency, or other measures as deemed necessary by the Illinois EPA.

Table 4.7: Demonstration of RFP (emissions in tons/day)

Step	Description	Formula	NOx	VOM
1	2011 Base Year Inventory		635.86	522.85
2	RFP Reductions totaling 15%		10%	5%
3	Emissions reductions required between 2011 and 2017	Step 1 x Step 2	63.59	26.14
4	Target level for 2017	Step 1 – Step 3	572.27	496.71
5	Contingency percentage		3%	0%
6	Contingency emission reduction requirement	Step 1 x Step 5	19.08	0
7	RFP and contingency reduction requirements	Step 3 + Step 6	82.66	26.14
8	Reductions between 2011 and 2017 Federal on-road control programs Federal off-road control programs Crawford shutdown Fisk shutdown Total		 168.24 38.82 8.11 3.62 218.79	 74.16 29.26 negl. negl. 103.42
9	Adjustments to reductions Agency hold-back Increase for mobile source budget Total		 95.00 39.60 134.60	 19.00 52.92 71.92
10	Creditable reduction	Step 8 – Step 9	84.19	31.50
11	Compare reductions to determine if at least 18% reduction is achieved	Is Step 10 ≥ Step 7?	Yes	Yes
12	RFP + Contingency target level	Step 1 – Step 7	553.20	496.71
13	Projected 2017 emissions		432.67	404.02
14	Compare RFP and contingency target with projected 2017 emissions to determine if RFP and contingency measure requirements are met	Is Step 13 ≤ Step 12?	Yes	Yes

5.0 Reasonably Available Control Technology and Reasonably Available Control Measures

Pursuant to Sections 172 and 182(b) and (f) of the CAA, RACT is required for sources in specified categories for the applicable criteria pollutant and its precursors (VOM and NOx) located in NAAs. USEPA defines RACT as the lowest emission limitation that a particular source is capable of meeting by the application of control technology that is reasonably available considering technological feasibility and economic reasonableness (70 *FR* 71612; November 29, 2005). A source generally consists of several units that emit pollutants.

RACT is not a new requirement under the CAA. Illinois previously addressed RACT requirements in the Chicago area in developing attainment plans for the 1979 and 1997 ozone standards. The RACT requirement for NOx was previously waived under both previous ozone standards. Illinois has adopted new regulations to implement NOx RACT in the NAA, but has not submitted these

regulations for approval in the state SIP. However, Illinois has previously adopted RACT requirements for VOM emissions in the NAA under 35 Ill. Adm. Code Part 218 (see Section 3.1). The Illinois EPA has evaluated the previously adopted regulations and determined that the RACT requirements are still being met for ozone.

5.1 VOM

Sections 172, 182(b)(2), and 182(f) of the CAA require implementation of RACT for sources that are subject to Control Techniques Guidelines (CTGs) promulgated by USEPA. The USEPA has issued CTGs defining RACT for those categories of sources that emit the greatest amounts of VOM emissions, and such sources are referred to as CTG sources. 35 Ill. Adm. Code Part 218 contains the applicable Illinois rules promulgated in response to the CTGs for the Chicago NAA. Illinois EPA has adopted all applicable VOM rules addressing all CTG categories adopted by USEPA through 2018 for which there are existing sources in the Chicago NAA. Negative Declarations for other CTG categories are detailed below.

Non-CTG sources are defined as major VOM sources which are not subject to CTGs, but for which RACT is required. All major sources of ozone precursors located in the ozone NAA that are not subject to specific RACT rules are subject to generic RACT rules. Thus, Illinois has met the obligation to implement RACT on non-CTG VOM sources in the NAA with SIP-approved regulations under 35 Ill. Adm. Code Part 218 Subparts PP, QQ, RR, and TT.

It should be noted that other regulatory requirements also affect VOM emission sources within the Chicago ozone NAA. These include MACT, federal NSPS, and NESHAPs. These programs satisfy the RACT requirements for specific source categories because these rules are more stringent than RACT. Therefore, the Illinois EPA certifies that the existing SIP-approved VOM rules in 35 Ill. Adm. Code Section 218, and the list of Negative Declarations for those CTG categories with no known applicable sources in Illinois listed in 40 CFR 52.720(e) and 52.726(c), plus the new Negative Declaration for the Oil and Natural Gas Industry CTG in Attachment C, fulfills USEPA's RACT requirements for VOM sources in the NAA under Section 182(b)(2) of the CAA.

Negative Declarations – Source Categories not requiring new VOC regulations

Illinois has previously submitted several Negative Declarations relating to CTG categories for which there were no applicable sources found in Illinois that meet the applicability criteria for those CTGs and which did not have appropriate control due to other state or federal requirements. In those cases, it was unnecessary to adopt new state rules or submit SIP revisions to implement those guidelines. For this Attainment Demonstration, the Illinois EPA has evaluated all sources in Illinois to ensure that these Negative Declarations are still valid and appropriate for the CTGs for the Shipbuilding and Ship Repair Industry, Natural Gas/Gasoline Processing Plants, Aerospace Manufacturing and Rework Facilities, Industrial Wastewater, High-Density Polyethylene/Polypropylene Manufacturing, and Vegetable Oil Processing. In that evaluation, Illinois did not identify any sources to which these CTGs would apply that either did not already have appropriate control due to other state or federal requirements or had negligible emissions of VOM. Attachment B provides tables of sources that were identified in the Illinois EPA inventory by SIC code as potentially applicable, and comments explaining why additional regulations are not

necessary to implement the specified CTG. This analysis has verified that these Negative Declarations are still appropriate today, and that there is no need for additional action or SIP revisions to implement those CTGs. Additionally, a new Negative Declaration for the Oil and Natural Gas Industry CTG can be found in Attachment C.

Shipbuilding and Ship Repair Industry

On November 11, 1996, the Illinois EPA submitted to USEPA a Negative Declaration Letter for the Ship Building and Ship Repair Industry. This CTG applies to sources with potential emissions greater than or equal to 25 tons VOC per year for this category. The Illinois EPA determined that there were no such sources.in the Chicago NAA.

Illinois EPA reviewed its most recent inventory to determine if any sources fall under this category. Illinois EPA found four sources that required further review. All four of these sources in the Chicago NAA are barge cleaning sources with VOM emissions limitations under 25 tons/year. The list of sources evaluated can be found in Table B-1 in Attachment B. Therefore, the Negative Declaration is still valid and appropriate for the CTG category.

Natural Gas/Gasoline Processing Plants

On November 14, 1985, the Illinois EPA submitted to USEPA a Negative Declaration Letter for the Natural Gas/Gasoline Processing Plant industry. The Illinois EPA determined that there were no sources of any size in this source category in the Chicago NAA.

Illinois EPA reviewed its most recent inventory to determine if any sources fall under this category. There were 35 sources that required further review. One source (SIC 1321) does have emission units that fall under the CTG. This source was built after Illinois' Negative Declaration for the category and is subject to the control requirements in the New Source Performance Standard ("NSPS") 40 CFR 60 Subpart KKK Standards of Performance for Equipment Leaks of VOC from Onshore Natural Gas Processing Plants. The NSPS standards and control requirements are equivalent to or more stringent than the outdated CTG requirements. Therefore, there is no reason to regulate the source with a redundant state rule based on an outdated CTG.

The other 34 sources (SIC 4922, 4923, and 4924) are natural gas pipelines that are used to transport gas across Illinois to nearby states. None of these sources have emission units that fall under this CTG category. The list of sources evaluated can be found in Table B-2 in Attachment B. Therefore, the Negative Declaration is still valid and appropriate for the CTG category.

Aerospace Manufacturing and Rework Facilities

On October 11, 1996, the Illinois EPA submitted to USEPA a Negative Declaration Letter for the Aerospace Manufacturing and Rework Operations CTG. This CTG applies to sources with potential emissions greater than or equal to 25 tons VOC per year for this category. The Illinois EPA determined that there were no such sources in the Chicago NAA.

Illinois EPA reviewed its most recent inventory to determine if any sources fall under this category and found 11 sources under the 11 SIC codes related to this CTG category that required further review – specifically in SIC codes 3728, 4512, 4581, and 9711. None of these sources have emission units that fall under this CTG category. The list of sources evaluated can be found in Table B-3 in Attachment B. Therefore, the Negative Declaration is still valid and appropriate for the CTG category.

Industrial Wastewater

On December 23, 1999, the Illinois EPA submitted to USEPA a Negative Declaration Letter for the Chicago NAA covering the Industrial Wastewater CTG, which applies to sources with wastewater streams with a specified concentration of pollutant. At that time, the Illinois EPA determined that all sources in the Chicago NAA to which the CTG was applicable were covered by other regulations that were as stringent or more stringent than the CTG. Those sources were two refineries and one chemical plant that were subject to federal regulations covering waste operations that were equally or more stringent than the CTG.

Illinois EPA reviewed its most recent inventory to determine if any sources fall under this category, including: organic chemicals, plastics, and synthetic fibers; pharmaceuticals; pesticides manufacturing; petroleum refining; pulp, paper, and paperboard mills; and hazardous waste treatment, storage, and disposal facilities.

Illinois EPA found 54 sources that required further review. The Illinois EPA examined each unit at these sources and the operating permits of those sources to determine whether a source was a significant source of wastewater or if the CTG was potentially applicable to a source or unit. Of those 54 sources, it was determined that the CTG would be applicable to only eight sources. The wastewater treatment systems at all those sources are complying with regulations that have control requirements for wastewater that are equally or more stringent than the requirements in the CTG. These regulations include NSPS, NESHAP, and Illinois regulations. For example, two of these eight sources are petroleum refinery sources that are covered under a NESHAP or NSPS, and both are also covered under 35 IAC Section 218 Subpart R. The list of sources evaluated can be found in Table B-4 in Attachment B. Therefore, the Negative Declaration is still valid and appropriate for the Industrial Wastewater CTG category.

Other Negative Declarations under the Control Strategy for Ozone 40 CFR 52.726 (c)

High-Density Polyethylene, Polypropylene, and Polystyrene Resins

The "Control of Volatile Organic Compound Emissions from Manufacture of High-Density Polyethylene, Polypropylene, and Polystyrene Resins" CTG covers the manufacture of those three materials. The Illinois EPA previously submitted a Negative Declaration to USEPA that applied to two of those materials, Polyethylene and Polypropylene, and certified that there were no sources manufacturing those materials in the Chicago NAA. The third material, Polystyrene, is regulated by State RACT rules in 35 IAC Section 218 Subpart BB: Polystyrene Plants.

Illinois EPA reviewed its most recent inventory and confirmed that no sources fall under the four SIC codes (2821, 2822, 2823, and 2824) for this CTG category for the manufacture of polyethylene and polypropylene. There are two sources out of 11 under SIC 2821 that manufacture polystyrene resin and are subject to Section 218 Subpart BB Polystyrene Plants, the current RACT rule in Illinois. The list of sources can be found in Table B-5 in Attachment B. Therefore, the Negative Declaration is still valid and appropriate for the CTG category.

Vegetable Oil Processing

The Illinois EPA submitted to USEPA a Negative Declaration Letter for the Vegetable Oil Processing Plant CTG. This CTG applies to sources with potential emissions greater than or equal to 100 tons VOC per year for this category. The Illinois EPA determined there were no such sources in the Chicago NAA. Additionally, Vegetable Oil Processing sources were covered under Section 215 Subpart N. This was prior to Illinois VOM rules being split into separate Parts for rules for nonattainment areas and rules for areas in attainment.

Illinois EPA reviewed its most recent inventory to determine if any sources fall under this category and found one source that required further review. This source is subject to the control requirements in the NESHAP 40 CFR 63 Subpart GGGG for Solvent Extraction for Vegetable Oil Production. The NESHAP standards for control are equivalent to or more stringent than the outdated CTG. Therefore, there is no reason to regulate the source with a redundant state rule based on an outdated CTG. The source is listed in Table B-6 in Attachment B. Thus, the Negative Declaration is still valid and appropriate.

5.2 NOx RACT Waiver

As mentioned previously, the RACT requirement for NOx was previously waived under the 1979 ozone NAAQS and the 1997 ozone NAAQS. Illinois adopted NOx regulations to implement NOx RACT in the NAA under 35 Ill. Adm. Code Section 217, but did not submit these regulations for approval into the SIP.

The Illinois EPA also requests a waiver from the RACT requirement for major stationary sources of NOx, as provided under Section 182(f) of the CAA. Specifically, this request seeks to exempt major stationary sources of NOx (as defined in Section 302 and Subsections 182(c), (d), and (e) of the CAA) from the RACT requirements of 182(b)(2). Section 182(f)(1)(A) provides for a waiver of the NOx RACT requirement if "additional reductions of oxides of nitrogen would not contribute to attainment of the national ambient air quality standard for ozone in the area…" Since attainment is demonstrated with the controls described in this document, which do not include NOx RACT, implementing NOx RACT is not needed for attainment of the standard. Therefore, Illinois EPA is asking for a continuation of the NOx RACT waiver that was approved for the previous two standards.

5.3 Reasonable Available Control Measures

Section 172(c)(1) of the CAA also requires states to demonstrate that all control measures necessary to demonstrate attainment are being adopted as expeditiously as practicable. USEPA interprets Section 172(c)(1) as a requirement that states incorporate into their SIP all reasonably available control measures (RACM) that would advance a region's attainment date.

In practice, this is a negative test showing that there are no other measures that will advance the attainment date for one year. USEPA guidance provides a narrow definition of RACM. The guidance states that measures which can be implemented and produce sufficient benefits to advance the attainment date are RACM, that cost can be a factor in determining whether a measure is reasonable, and that measures that are not enforceable are not RACM. As mentioned above in this section, all reasonable and enforceable control measures have been taken to reduce emissions of VOM and NOx. Therefore, the Illinois EPA has concluded that all measures that were reasonably available and would expedite attainment have already been implemented.

6.0 Weight of Evidence

A weight of evidence analysis is used to strengthen the conclusions presented in the attainment demonstration, or provide additional information that is contrary to the results from the model attainment test. Appendix A contains a section that provides this information and is applicable to a regional scale. Included are demonstrations that the ERTAC Electric Generation Unit (EGU) Projection Tool is conservative and the Annual Energy Outlook forecasts provided by the Energy Information Administration overestimate coal utilization. Both of these will cause the modeled emissions to exceed what would be expected and would dampen the impact of the emission reductions that are in place.

Some additional rules beyond on-the-books control measures that provide emission reductions from sources of NOx and VOM between the 2011 base year and the 2017 attainment year, but were not including in the modeling, were listed in the Modeling Demonstration TSD. Those rules are:

- Consumer products and Architectural and Industrial Maintenance (AIM) requirements
- Stage II removal and low permeable hose requirements
- State-approved NOx regulations

In addition, further emissions reductions in Illinois that are not reflected in modeled emissions are:

- Continued phasing in of: Mercury and Air Toxics Standard (MATS), Reciprocating Internal Combustion Engines (RICE) NESHAP, and Industrial/Commercial/ Institutional Boilers and Process Heaters NESHAP; CSAPR Update;
- NESHAP – Risk and Technology Review including: Mineral Wool Production 40 CFR 63 Subpart DDD; Ferroalloys Production 40 CFR 63 Subpart XXX; Petroleum Refineries 40 CFR 63 Subparts CC and UUU;
- NSPS – Petroleum Refineries 40 CFR 60 Subpart Ja;
- 2017 Light-Duty Vehicle GHG and Corporate Average Fuel Economy Standards;
- Mobile Source Air Toxics Rule;
- Tier 3 Vehicle Emissions and Fuel Standards.

7.0 Contingency Measures

Section 172 (c)(9) of the CAA requires states with ozone nonattainment areas classified as moderate and above to provide for implementation of specific emission control measures if the NAA fails to achieve required RFP reductions or fails to attain the NAAQS within the timeframes specified under the CAA. The CAA requires that contingency measures take effect without further action or within a short time frame by the state or by the USEPA upon failure by the state to meet RFP requirements or attainment of the NAAQS by the required deadline.

The General Preamble for the Implementation of Title I of the Clean Air Act Amendments of 1990 (57 Fed. Reg. 13507, April 16, 1992) states that the contingency measures, in total, must generally be able to provide for three percent reductions from the 2011 baseline emissions. A three percent reduction in VOM emissions equates to 15.69 tons/day or a three percent reduction in NOx emissions equates to 19.08 tons/day. While contingency measures must be fully adopted rules or measures, states can use measures in two different ways. A state can choose to implement contingency measures before any milestone deadline. Alternatively, a state may decide not to implement a contingency measure until an area has actually failed to achieve an RFP or attainment milestone. In the latter situation, the contingency measure emission reduction must be achieved within one year following identification of a milestone failure.

To satisfy the requirements for contingency measures needed for the RFP plan and the attainment plan, Illinois is relying on a mix of Federal and State measures, some of which were required under the CAA and some of which are state-specific. The reductions from the state and federal rules meet the requirement for creditability, including the need to be enforceable, permanent, quantifiable, and surplus as required under 40 CFR 51.1110(a)(5).

Contingency measures to be considered include a 3% reduction already available as shown in Table 4.7. If more is needed, the contingency measures will be selected as appropriate at the time the selection is made. Listed below are example measures that may be considered. The selection of measures will be based upon cost effectiveness, emission-reduction potential, economic considerations, and other factors that Illinois deems appropriate. It is not possible, at this time, to determine what control measure(s) will be appropriate at an unspecified time in the future. Therefore, the list of contingency measures outlined below is not comprehensive. Illinois EPA anticipates that if contingency measures should ever be necessary, it is unlikely that a significant number will be required.

7.1 Point Source Measures

- Continued phasing in of MATS, RICE NESHAP, and Industrial/Commercial/ Institutional Boilers and Process Heaters NESHAP
- NESHAP – Risk and Technology Review including:
    - Pulp and Paper Combustion Sources
    - Nutritional Yeast Manufacturing
    - Publicly-Owned Treatment Works
    - Wet-formed Fiberglass Mat Production

- Leather Finishing Operations
- Portland Cement
- Wood Building Products
- Friction Materials Manufacturing
- Printing, Coating, and Dyeing of Fabrics and Other Textiles
- Surface Coating of Large Appliances
- Surface Coating of Metal Furniture
- Surface Coating of Metal Can
- Surface Coating of Metal Coil
- Plastic Parts and Products Coating
- Hydrochloric Acid Production
- Miscellaneous Metal Parts and Products Coating
- Ethylene Processes
- Auto and Light Duty Trucks
- Asphalt Processing and Roofing Manufacturing
- Boat Manufacturing
- Reinforced Plastics and Composites Production
- Organic Liquids Distribution
- Paper and Other Web Coatings
- Integrated Iron and Steel Manufacturing
- Stationary Combustion Turbines
- Miscellaneous Organic NESHAP
- Solvent Extraction for Vegetable Oil
- Engine Test Cells/Stands
- Cellulose Products Manufacturing
- Site Remediation
- Municipal Solid Waste Landfills
- Miscellaneous Coating Manufacturing
- Taconite Iron Ore Processing
- Iron and Steel Foundries
- Plywood and Composite Wood Products
- Lime Manufacturing
- Rubber Tire Manufacturing

- NSPS – Petroleum Refineries 40 CFR 60 Subpart Ja, Oil and Gas 40 CFR 60 Subpart OOOOa
- Municipal Solid Waste Landfill Emission Guidelines

7.2 Mobile Source Measures

- 2017 Light-Duty Vehicle GHG and Corporate Average Fuel Economy Standards
- Mobile Source Air Toxics Rule
- Tier 3 Vehicle Emissions and Fuel Standards
- Heavy-Duty Vehicle Greenhouse Gas Rules

7.3 Area Source Measures

- Continued roll-in of Standards and Limitations for Organic Material Emissions for Area Sources (Consumer and Commercial Products and Architectural and Industrial Maintenance Coatings rule) – Current California Commercial and Consumer Products revisions made after 2011, for example, Aerosol Adhesive Coatings, Dual Purpose Air Freshener/Disinfectant, etc.

7.4 Contingency Conclusion

As mentioned above, contingency measures, in total, must generally be able to provide for a 3% reduction from the 2011 baseline emissions, which, in this case, equates to 15.69 tons/day of VOM or 19.08 tons/day of NOx. Table 4.7 identifies surplus emission reductions to obtain the required 3% reduction for contingency. The ongoing implementation of the above-listed measures will continue to provide additional sufficient emission reductions within the NAA to satisfy the contingency requirement. More importantly, these measures will help to ensure that the area, once it has attained the 2008 ozone NAAQS, will continue to do so in subsequent years.

8.0 Transportation Conformity

The purpose of this section is to describe and establish the Chicago NAA motor vehicle emissions budgets associated with this attainment demonstration. Average summer weekday motor vehicle emissions budgets are being proposed for the final year of RFP, 2017, for the precursor pollutants NOx and VOM. The budgets were developed using the inventory method of the MOVES model version 2014a. The MOVES model incorporates local inputs such as annual vehicle miles of travel, vehicle fleet characteristics, meteorological conditions, and vehicle and fuel emission control programs.

Section 176(c)(4) of the Clean Air Act Amendments of 1990 requires that transportation plans, programs, and projects which are funded or approved under Title 23 of the United States Code must be determined to conform with State or Federal air implementation plans. A motor vehicle emissions budget is that portion of the total allowable emissions allocated to highway and transit vehicle use that are defined in the implementation plan for a certain year. Section 93.101 of the rule defines a "control strategy [State] implementation plan revision" as a "plan which contains specific strategies for controlling the emissions and reducing ambient levels of pollutants in order to satisfy Clean Air Act requirements of reasonable further progress and attainment." To demonstrate conformity to the motor vehicle emissions budget, emissions from the implementation of a transportation plan or a transportation improvement program must be less than or equal to the budget level (40 CFR § 93.118(a)).

Transportation conformity is determined based on these proposed on-road motor vehicle emissions budgets after USEPA determines that the budgets meet the adequacy criteria of the transportation conformity rule under §93.118(e). The motor vehicle emissions budgets in this submittal are adequate as each of the six criteria under §93.118(e) is satisfied. These six criteria include:

1. The submitted control strategy implementation plan revision or Maintenance Plan was endorsed by the Governor (or his or her designee) and was subject to a State public hearing.

2. Before the control strategy implementation plan or Maintenance Plan was submitted to USEPA, consultation among federal, State, and local agencies occurred; full implementation plan documentation was provided to USEPA; and USEPA's stated concerns, if any, were addressed;

3. The motor vehicle emissions budgets(s) is clearly identified and precisely quantified;

4. The motor vehicle emissions budget(s), when considered together with all other emissions sources, is consistent with all applicable requirements for reasonable further progress, attainment, or maintenance (whichever is relevant to the given implementation plan submission);

5. The motor vehicle emissions budget(s) is consistent with and clearly related to the emissions inventory and the control measures in the submitted control strategy implementation plan revision or Maintenance Plan; and

6. Revisions to previously-submitted control strategy implementation plans explain and document any changes to previously submitted budgets and control measures, impacts on point and area source emissions; any changes to established safety margins; and reasons for the changes (including the basis for any changes related to emissions factors or estimates of vehicle miles traveled).

This SIP and the associated motor vehicle emissions budgets have been developed by Illinois EPA, the designated air quality agency for the State of Illinois. Public notice for comment and the opportunity to request a public hearing on the proposed Attainment Demonstration and associated motor vehicle emissions inventory was posted on the Illinois EPA's public notice website on December XX, 2018. Notification of this hearing, or notice of no hearing requested, was posted on the Illinois EPA's public notice website on ???. Comments on the proposed attainment demonstration and motor vehicle emissions budgets were accepted for 30 days after the public notice and/or public hearing. A "Responsiveness Summary" which addresses the written comments received was prepared and is included in the final submission.

In compliance with criterion #2 above, the Tier 2 Conformity Consultation Team was kept apprised of the various iterations and issues with the proposed motor vehicle budget. The Consultation Team includes representatives from the Federal Highway Administration, Federal Transit Authority, USEPA, CMAP, IDOT, Regional Transportation Authority, and the Illinois EPA. The expected final budget was presented at the Tier II meeting on February 22, 2018.

The motor vehicle emissions budgets proposed and described herein satisfy adequacy criterion #5. The effects of these controls are incorporated into the emissions estimates produced by the MOVES model. In response to adequacy criteria #4 and #6, the narrative of the Chicago Ozone Maintenance Plan discusses the emissions estimates from other sectors and any changes in regulations. Following, in response to adequacy criteria #3, is a discussion of the inputs and assumptions incorporated into the development of the proposed Maintenance Plan motor vehicle emissions budgets.

Vehicle Miles Traveled: The year of data used for VMT was 2014 with data from IDOT. Data regarding fleet mix and VMT was updated since the 2011 inventory. With 2011 data being different and having run a different model, MOVES2010, Illinois EPA received permission from USEPA to back-cast 2014 VMT to 2011 levels. This method was deemed to be more consistent in calculating emissions. The 2014 annual VMT total for the six-county-three-township Chicago NAA was approximately 57.7 billion miles. For future year emission estimates, VMT was grown to the target year at a compound growth rate of 1.2% per year. Applying this growth factor to the 2014 VMT level yields future year annual VMT projections of 59.8 billion for 2017. In a similar manner, the factor of 1.2% was used to obtain 2011 VMT which resulted in approximately 55.7 billion.

Meteorological Data: USEPA guidance for the use of the MOVES model requires the use of representative local temperature and absolute humidity data. Appropriate hourly temperature and humidity values were used to calculate emissions.

Motor Vehicle Emissions Controls: Beyond USEPA's federal motor vehicle control program emissions standards, the primary local motor vehicle emissions control programs that were in place in the Chicago NAA in 2014 and are projected to still be required in 2017 are a vehicle I/M program and the required use of reformulated gasoline (RFG).

Inspection and Maintenance: The current Illinois I/M program, in effect since February 1, 2012, requires biennial On-Board Diagnostics II testing on all model year 1996 and newer light-duty gasoline vehicles (cars and light-duty trucks), and 2007 and newer heavy-duty gasoline vehicles with a gross vehicle weight rating between 8,501 and 14,000 pounds, registered in the I/M testable area. Motorcycles and diesel vehicles are not subject to I/M. The program includes a four-year grace period for new vehicles. The post-2012 I/M program was established when the Illinois legislature amended the Illinois Vehicle Inspection law in 2005 and 2011 as follows:

- End dynamometer testing of vehicles.
- Require an on-board diagnostic-based (OBD) program beginning in February 2007.
- Remove the requirement for testing compliant pre-model year 1996 vehicles.
- End the steady-state idle exhaust and evaporative system integrity (gas cap pressure) tests.
- Exempt pre-2007 model year heavy duty vehicles with a Gross Vehicle Weight Rating (GVWR) between 8,501 and 14,000 pounds.
- Exempt all heavy-duty vehicles with GVWR greater than 14,000.
- Add a visual inspection test for vehicles that are equipped with OBD technology, but for which OBD testing is not possible due to the vehicle's design.

The Chicago I/M program vehicle testing domain includes the urbanized areas in the Chicago NAA. An "I/M Coverage" percentage was developed based on the amount of VMT from vehicles subject to the inspection program compared to total area VMT. The I/M Coverage percentage for the Chicago 2008 ozone NAA is 91.5%.

Fuels: The use of federal RFG has been required in the Chicago NAA since 1995. The ozone Attainment Demonstration assumes the use of northern grade RFG in 2008 and beyond. RFG was and is assumed to contain 10% ethanol. The MOVES model can account for other fuels, such as E85, natural gas, methanol, etc., but for all practical purposes the gallons of such alternative fuels

and hence the number of vehicles using them is very small compared to the number of gasoline and diesel vehicles, therefore, the use of such fuels was not considered.

Gasoline Sulfur: The federal Tier 2 regulations require gasoline sulfur levels to average no greater than 30 ppm with a maximum of 80 ppm beginning in 2007. There are no Illinois gasoline sulfur requirements, therefore, the MOVES default gasoline sulfur levels were used in the emissions modeling.

Diesel Sulfur: The federal Tier 2 regulations limit the level of sulfur in diesel fuel requiring on-highway diesel fuel to 15 ppm beginning in 2006. Illinois diesel sulfur requirements will mimic these requirements beginning in 2017; therefore, the MOVES default diesel sulfur levels were used in the emissions modeling.

Fuel Volatility: The volatility of summer RFG, measured as Reid Vapor Pressure (RVP), is not specifically regulated. However, a fuel's RVP is one of the primary characteristics controlled by refiners in order to meet the RFG performance standards. The MOVES model contains default RVP levels for different seasons of the year based on fuel compliance testing. Therefore, the MOVES default RVP levels were used in the emissions modeling.

Vehicle Registration Distribution: A Chicago area-specific vehicle registration distribution profile based upon 2014 data was developed by Illinois EPA's Division of Mobile Source Programs from vehicle age data for 2013 provided by the Illinois Secretary of State's Department of Motor Vehicles. The registration distribution is the fraction of vehicles of a given vehicle type and age in the fleet of vehicles of that type as a whole. Different vehicle types have different distributions. Chicago-area distributions generally show fewer older vehicles than the nationwide average or default, because vehicles in the Chicago area tend to wear out faster than they do in the rest of the country due to rust from road salt and heavy city driving.

Source Type Population represents the number of vehicles of each MOVES vehicle type in the fleet as a whole within the area under consideration. Accurate local source-type populations were not available; therefore, the MOVES default fractions modified by VMTs by vehicle type were used.

VMT Temporal Fractions are the VMT fractions of annual VMT by month of the year, of weekly VMT by day of the week, and daily VMT by hour of the day. The Illinois EPA used default values from MOVES. Temporal fractions vary by road type.

Speed distributions are the fractions of VMT on a given road type by given vehicle types in various speed ranges. Thus, on a typical urban arterial, a small fraction of the vehicles are traveling at less than 10 miles per hour (mph) plus or minus 5 mph, more at 20 mph, more at 30 mph, most at 40 mph, less at 50 mph, and so on. These fractions differ by hour of the day – in more congested conditions during rush hours, the maximum fraction might be in the 30-mph range rather than the 40-mph range. MOVES uses speed distributions when aggregating emissions (or emission rates) for vehicles at different speeds. The Illinois EPA used the default speed distributions from MOVES.

Ramp fraction is the fraction of total VMT on limited-access highways, such as interstates, that is from on- and off-ramps to or from those highways. Driving on limited-access highways is more or

less at uniform speed, but driving on ramps involves considerable acceleration and deceleration, which affects emissions. The default MOVES ramp fractions are 15% on rural interstates, 10% on urban interstates, and 2% on other freeways and expressways. Illinois does not have actual or observed ramp fraction data so data from CMAP was used.

Road Type Distribution is the fraction of VMT on different road categories within an area under consideration. The Illinois EPA uses VMT data by the Highway Performance Monitoring System functional class published by the Illinois Department of Transportation (IDOT) as the basis of its emission calculations. The road type distributions came from default MOVES values.

The emission rates produced by MOVES estimate that NOx and VOM emissions will be 164.40 tons/day and 80.0 tons/day, respectively. The transportation conformity regulations (40 CFR § 93.118(a)) allow the addition of a portion of this "safety margin" to the motor vehicle emissions estimates. As year 2017 emissions levels are projected to be substantially less than the attainment year 2011 emissions, a fraction of the safety margin is being proposed to be added to the 2017 estimated motor vehicle emissions to establish the motor vehicle emissions budget. CMAP requested a budget of 204 tons/day of NOx and 133 tons/day of VOM. This is an increase of 39.60 tons/day of NOx and 52.92 tons/day of VOM from the original estimate of 2017 emissions. Even with the addition of emissions for the mobile source budget, RFP requirements are still easily met.

The motor vehicle emissions budgets, which reflect the VMT, control program assumptions and safety margin are listed in Table 8.1.

Table 8.1: Proposed Motor Vehicle Emissions Budgets (tons/day)

	Estimated Emissions		Applied Safety Margin		Motor Vehicle Emissions Budgets	
Year	**NOx**	**VOM**	**NOx**	**VOM**	**NOx**	**VOM**
2011	332.64	154.24	-----	-----	-----	-----
2017	164.40	80.08	39.60	52.92	204.00	133.00

9.0 Legal Authority and Resource Commitments

As set forth in earlier SIP revisions, the Illinois EPA has the necessary legal authority to implement the Attainment Demonstration that is being submitted. In brief, the legal authority for the State of Illinois to carry out its implementation plan is established in the Illinois Environmental Protection Act (Act) [415 ILCS 5/1 et seq]. The Act is a comprehensive piece of legislation designed to place the control and enforcement of every type of environmental problem under one body of law.

Pursuant to Section 4(l) of the Act, the Illinois EPA is designated as the air pollution agency for the State for all purposes of the CAA, including developing SIPs and proposing regulations. In accordance with and by the authority granted by the Act, the Illinois EPA will continue providing

adequate funding and personnel to implement the provision of this plan for meeting the air quality standards.

The Illinois Pollution Control Board (Board) has been designated under the Act as the agency responsible for adoption of emission control regulations and has the authority necessary to adopt the type of regulations for the control of VOM emissions.

The Illinois EPA is empowered to enforce the Act and applicable regulations promulgated thereunder (Title VIII of the Act). The Illinois EPA is directed to investigate alleged violations upon the request of the Board or upon receipt of information alleging a violation and may make such other investigations as it shall deem advisable. If such an investigation discloses that a violation may exist, the Illinois EPA shall bring an enforcement action against the violator before the Board in accordance with the Act and applicable State rules.

The Board's orders may be enforced by the Illinois EPA or the State's Attorney of the county in which the violation occurred or by the Attorney General of Illinois (Sections 33(d) and 42 of the Act). Injunctive relief is specifically authorized under Section 43 and 45(b) of the Act. In addition, violation of the Act, or of regulations adopted pursuant to the Act, or knowingly submitting any false information is a criminal misdemeanor (Section 44 of the Act). Section 44 of the Act also provides that it is the duty of every State and local law enforcement officer to enforce the Act and regulations and authorizes the issuance of citations for that purpose.

For further information concerning the requirements under 110(a) of the CAA, Illinois EPA submitted and received approval for the infrastructure SIP for the 2008 ozone NAAQS that addressed the above requirements under 110(a)(1) and (2). (80 FR 51730, 8/26/2015).

ATTACHMENT A

Modeling Demonstration for the 2008 Ozone National Ambient Air Quality Standard for the Lake Michigan Region

Technical Support Document

Lake Michigan Air Directors Consortium

February 3, 2017

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EXECUTIVE SUMMARY

On May 21, 2012 and June 11, 2012, the U.S. Environmental Protection Agency (U.S. EPA) established final air quality designations for the 2008 Ozone National Ambient Air Quality Standard (NAAQS), identifying as ‘‘nonattainment’’ those areas that were violating the NAAQS based on air quality monitoring data from 2008-2010 and 2009-2011, or those areas that were considered to be contributing to a violation of the NAAQS in a nearby area. In these actions, U.S. EPA designated Sheboygan County in eastern Wisconsin, and the Chicago metropolitan area, including all or portions of eight counties in Illinois, two counties in northwest Indiana (Lake and Porter), and one county in southeast Wisconsin (Kenosha) as “marginal” ozone nonattainment areas with an attainment deadline of July 20, 2015. On April 11, 2016, U.S. EPA determined that the Chicago metropolitan area failed to attain the 2008 ozone NAAQS by the applicable attainment date and thus reclassified the area as a “moderate” ozone nonattainment area. On September 28, 2016, U.S. EPA made a similar determination for Sheboygan County.

As a result of these actions, the States of Illinois, Indiana, and Wisconsin must submit SIPs that meet the requirements that apply to “moderate” ozone nonattainment areas by January 1, 2017, including the requirement to submit an attainment demonstration which identifies emissions reduction strategies sufficient to achieve the NAAQS by the attainment date, July 20, 2018. Because the attainment deadline occurs during the 2018 ozone season, attainment must be demonstrated by the end of the 2017 ozone season.

The Lake Michigan Air Directors Consortium (LADCO), in cooperation with the Illinois EPA, the Indiana DEM, and the Wisconsin DNR developed updated air quality analyses to support the development of attainment SIPs for ozone. The analyses include preparation of regional emissions inventories and meteorological data, evaluation and application of regional chemical transport models, and collection and analysis of ambient monitoring data. The technical analyses described in this report are conducted in a manner that is consistent with U.S. EPA’s attainment demonstration guidance (U.S. EPA, 2014B).

Monitoring data, including ozone and precursor concentrations and meteorological parameters, are analyzed to produce a conceptual understanding of the air quality problems. Key findings of the analyses include:

- Ozone monitoring data following the 2008 revision of the ozone NAAQS showed some sites in and downwind of the Chicago metropolitan area to be in violation of the revised standard of 75 parts per billion (ppb). Historical ozone data generally show a downward trend in the region, and most sites are currently meeting the 2008 NAAQS.

- Ozone concentrations are strongly influenced by meteorological conditions, with more high ozone days and higher ozone levels during summers with

above normal temperatures. Ozone concentrations in the Lake Michigan region are also influenced by local-scale wind circulations (lake breezes) which cause elevated concentrations at shoreline sites and decreasing ozone concentrations at sites further from the shoreline.

- Inter- and intra-regional transport of ozone and ozone precursors affects air quality in the Lake Michigan region, and is the principal cause of nonattainment in some areas far from population or industrial centers.

An air quality modeling platform was developed to evaluate the adequacy of current and potential emissions reduction strategies needed to attain the 2008 ozone NAAQS by the 2017 attainment deadline established by U.S. EPA. LADCO conducted "base year" modeling for 2011 for the purpose of evaluating the model's performance against measured air quality data. Model performance for the region was found to be improved over previous modeling efforts, although performance at shoreline locations shows more variability. LADCO considers the performance of the air quality model to be adequate to support the states' attainment SIPs.

Future year strategy modeling was conducted to determine whether existing ("on the books") controls would be sufficient to provide for attainment of the ozone standard and if not, to determine what additional emission reductions would be necessary for attainment. Based on the modeling and other supplemental analyses, the following general conclusions can be made:

- Existing emission reduction control measures are expected to improve ozone air quality in the region between 2011 and 2017.

- Modeling indicates that all monitoring sites in the Chicago nonattainment area, including sites in northwest Indiana, northeast Illinois, and southeast Wisconsin, are expected to meet the 2008 ozone air quality standard by the 2017 ozone season.

- Modeling indicates that one site in eastern Wisconsin, in Sheboygan County, may not meet the 2008 8-hour ozone standard by the 2017 ozone season. This finding of limited residual nonattainment for ozone is consistent with current (2014-2016) monitoring data which continues to show ozone concentrations above the NAAQS in this area (e.g., ozone design values on the order of 76-79 ppb). It is noted that the modeling analysis is, by design, conservative and that air quality in future years may be better than the modeling indicates.

1.0 Introduction

On March 12, 2008, the U.S. EPA revised the primary and secondary NAAQS for ozone, strengthening the standards to a level of 0.075 parts per million (ppm) for a maximum daily 8-hour average. The form of the 8-hour ozone NAAQS remained the same as the previous standard, the annual fourth-highest daily maximum averaged over three consecutive years. When U.S. EPA adopts a new or revises an existing NAAQS, it is required by Section 107(d)(1) of the Clean Air Act (CAA) to designate areas as nonattainment, attainment, or unclassifiable. Accordingly, on May 21, 2012, U.S. EPA designated Sheboygan County in eastern Wisconsin as a “marginal” ozone nonattainment area based on 2008-2010 ambient air quality data. On June 11, 2012, U.S. EPA designated the Chicago metropolitan area, including all or portions of eight counties in Illinois, two counties in northwest Indiana (Lake and Porter), and one partial county in southeast Wisconsin (Kenosha) as a “marginal” ozone nonattainment area based on monitoring data from 2009-2011. The attainment deadline for marginal nonattainment areas to meet the 2008 ozone NAAQS was July 20, 2015.

On April 11, 2016, U.S. EPA determined that the Chicago metropolitan area failed to attain the 2008 ozone NAAQS by the applicable attainment date and thus reclassified the area as a “moderate” ozone nonattainment area. On September 28, 2016, U.S. EPA made a similar determination for Sheboygan County. The Chicago and Sheboygan nonattainment areas are shown in Figure 1.1. As a result of these actions, the States of Illinois, Indiana, and Wisconsin must submit State Implementation Plans (SIPs) that meet the requirements applicable to “moderate” ozone nonattainment areas. The states’ attainment SIPs must include a demonstration which identifies emissions reduction strategies sufficient to achieve the NAAQS by the attainment date, July 20, 2018. Because the attainment deadline occurs during the 2018 ozone season, the effective attainment deadline is the end of the 2017 ozone season.

This Technical Support Document summarizes the air quality analyses conducted by LADCO to support the ozone attainment SIPs for the States of Illinois, Indiana, and Wisconsin. LADCO was established in 1989 by these states and Michigan, to provide technical assessments for and assistance to its member states, and to provide a forum for its member states to discuss regional air quality issues. Ohio and Minnesota have since joined LADCO. The analyses prepared by LADCO include preparation of emissions inventories for the base year (2011) and the projected year of attainment (2017), evaluation and application of the meteorological and photochemical grid models, and analysis of ambient monitoring data.

This Introduction provides an overview of regulatory requirements and background information. Section 2 reviews the ambient monitoring data and presents a conceptual model of ozone in the Lake Michigan region and the Midwest. Section 3 discusses the development of the emissions inventory used for modeling the base year (2011) and the projected year of attainment (2017), and provides emissions summaries for the major emissions sectors for both years. The 2011 base case model performance evaluation

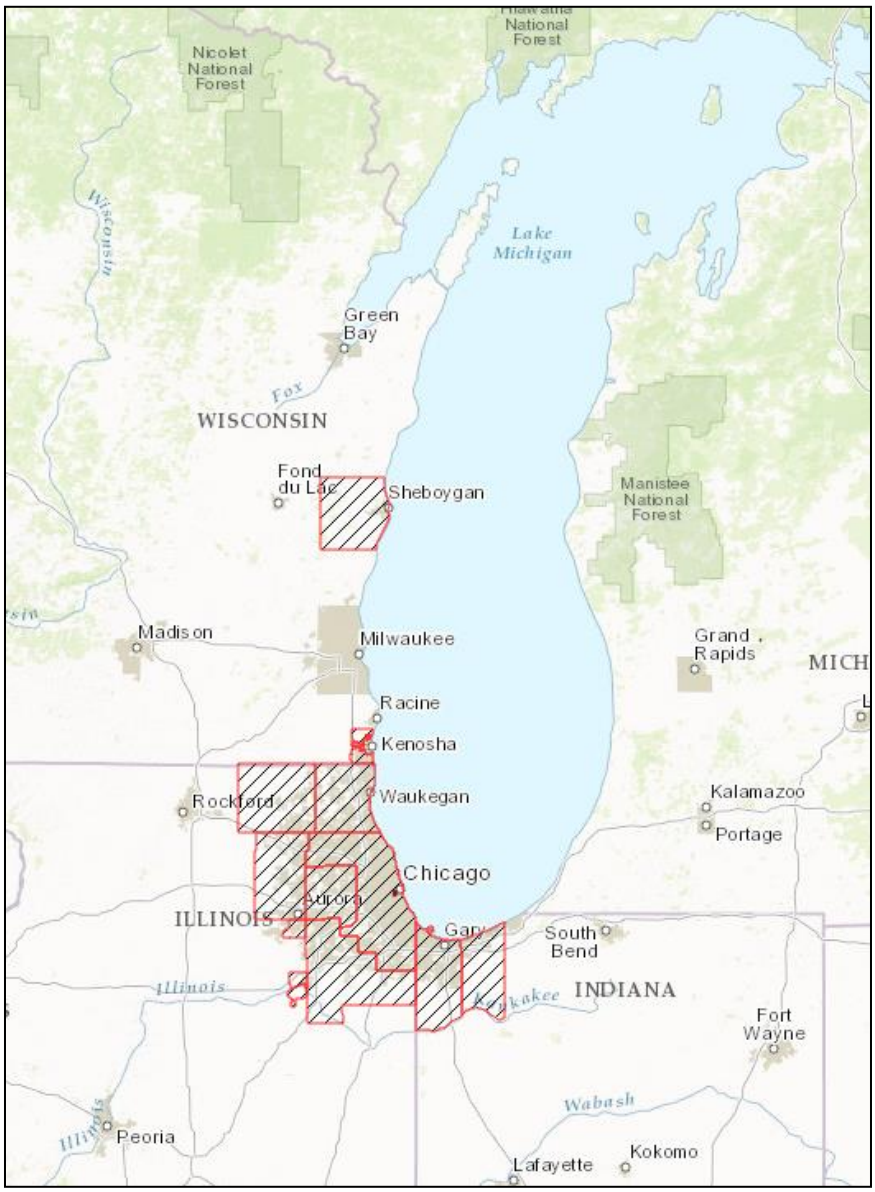

Figure 1.1. Nonattainment Areas in the Lake Michigan Region for the 2008 Ozone National Ambient Air Quality Standard

and the modeling assessment for 2017 are presented in Section 4, along with relevant analyses considered as part of the weight-of-evidence determination. Finally, key study findings are reviewed and summarized in Section 5.

SIP Requirements

As mentioned previously, U.S. EPA designated Sheboygan County in eastern Wisconsin, and the Chicago metropolitan area, including portions of northeast Illinois,

northwest Indiana, and southeast Wisconsin, as "marginal" ozone nonattainment areas for the 2008 8-hour ozone NAAQS. Based on a finding of failure to attain by the applicable attainment date, U.S. EPA subsequently reclassified the Chicago and Sheboygan nonattainment areas as "moderate" ozone nonattainment areas. The states must therefore meet the requirements that apply to "moderate" ozone nonattainment areas, including the following:

- Nonattainment New Source Review, with emissions offsets for new or modified sources at a ratio of 1.15 to 1 tons of emissions;
- Reasonably Available Control Technology (RACT) for existing VOC and NOx emissions sources in the nonattainment areas;
- Additional reductions of VOCs or NOx necessary for the state to demonstrate 15% reduction from baseline emissions within six years;
- Emission reduction measures needed to attain, as demonstrated by a formal modeled attainment demonstration.

This Technical Support Document identifies emissions reduction strategies and includes a modeling assessment of the effectiveness of the strategies in achieving the NAAQS. The states must submit attainment SIPs to U.S. EPA by January 1, 2017. The deadline for meeting the 8-hour ozone NAAQS is July 20, 2018. Because the attainment deadline occurs during the 2018 ozone season, the effective attainment deadline is the end of the 2017 ozone season.

Technical Work: Overview

LADCO worked closely with the States of Illinois, Indiana, and Wisconsin and U.S. EPA Region 5 to develop the technical analyses described in this report.
A "conceptual model" is presented which provides a qualitative description of the region's ozone air quality, based on an analysis of ambient air quality data. These analyses also provide information for evaluating the performance of the air quality model. The data analyses are an integral part of the overall technical support given uncertainties in emissions inventories and modeling.

Base year (2011) and future year (2017) emissions inventories are based on U.S. EPA's modeling platforms, as described in U.S. EPA's "Notice of Availability of the Environmental Protection Agency's Updated Ozone Transport Modeling Data for the 2008 Ozone National Ambient Air Quality Standard (NAAQS)" (U.S. EPA, 2015A). States provided point source and area source emissions data, and MOVES input files and mobile source activity data to U.S. EPA's 2011 National Emissions Inventory (NEI) database. U.S. EPA prepared emissions data for other categories not provided by the states, including nonroad sources, ammonia, fires, and biogenics. LADCO and its contractors developed improved emissions data for its member states for on-road sources and electrical generating units.

The air quality modeling described here can act as the core of states' attainment demonstrations. The modeling methodology described in this Technical Support

Document adheres to U.S. EPA's guidance document: "Draft Modeling Guidance for Demonstrating Attainment of Air Quality Goals for Ozone, $PM_{2.5}$, and Regional Haze" (U.S. EPA, 2014B). LADCO used a combination of models and specified methods to model air quality for an attainment assessment. These included the Weather Research and Forecasting (WRF) model, the Sparse Matrix Operator Kernel Emissions (SMOKE) modeling system, the Eastern Regional Technical Advisory Committee (ERTAC) EGU Forecast Tool, and the Comprehensive Air quality Model with extensions (CAMx). These models and tools are described in greater detail in Sections 3 and 4.

The models used in this technical analysis meet all of the prerequisites stated in U.S. EPA's draft modeling guidance.

2.0 Ambient Data Analyses

On March 12, 2008, U.S. EPA tightened the 8-hour ozone standard to increase public health protection and prevent environmental damage from ground-level ozone. U.S. EPA set the primary (health) standard and secondary (welfare) standard at the same level: 0.075 ppm (75 ppb). The standard is attained if the three-year average of the 4th-highest daily maximum 8-hour average ozone concentrations (i.e., the design value) measured at each monitor within an area is less than or equal to 0.075 ppm.

Current Conditions

Table 2.1 provides 8-hour ozone design values for the period 2010-2016 for monitoring sites with valid design values in the nonattainment areas. A map of the 8-hour ozone design values at each monitoring site in the region for the three-year period 2013-2015 is shown in Figure 2.1. The “hotter” colors represent higher concentrations, where red dots represent sites with design values above the standard. Based on 2013-2015 data, there was one site in violation of the 2008 8-hour ozone NAAQS in the Lake Michigan area. This monitor is located in Sheboygan, Wisconsin. Based on preliminary 2016 data (Figure 2.2), two additional sites within the LADCO region exceed the NAAQS for the three-year period, 2014-2016. These include monitors in each of the nonattainment areas for the 2008 ozone NAAQS: Sheboygan County and the Chicago area.

Meteorology and Transport

Ozone concentrations are significantly influenced by meteorological factors. Ozone production is driven by high temperatures and sunlight, as well as precursor concentrations. Ozone concentrations at a given location are also dependent on wind direction, which governs which sources or source regions are upwind. Figure 2.3 shows the general relationship between hot days (number of days each summer over 90°F, as determined from the nearest airport measurements) and ozone exceedance days (the number of days each summer for which one or more monitors recorded an ozone concentration over 75 ppb).

Qualitatively, ozone episodes in the region are associated with hot weather, clear skies (sometimes hazy), low wind speeds, high solar radiation, and winds with a southerly component. These conditions are often a result of a slow-moving high pressure system to the east of the region. The relative importance of various meteorological factors is discussed later in this section.

Transport of ozone and its precursors is a significant factor and occurs on several spatial scales. Regionally, over a multi-day period, somewhat stagnant summertime conditions can lead to the build-up in ozone and ozone precursor concentrations over a large spatial area. This polluted air mass can be transported long distances, resulting in elevated ozone levels in locations far downwind. An example of such an episode is shown in Figure 2.4 for June 9-11, 2016.

Table 2.1. Design Values for Ozone Monitors in the Chicago and Sheboygan Nonattainment Areas, 2010-2016.*

AQS ID	Site Name	Address	2010	2011	2012	2013	2014	2015	2016
Illinois									
170310001	ALSIP	4500 W. 123RD ST.	69	71	74	71	69	65	69
170310032	CHICAGO--SWFP	3300 E. CHELTENHAM PL.	68	72	81	80	76	68	70
170310076	CHICAGO--COM ED	7801 LAWNDALE	67	69	74	72	70	64	68
170311003	CHICAGO--TAFT	6545 W. HURLBUT ST.	66	67	72	70	NA	66	68
170311601	LEMONT	729 HOUSTON	70	69	74	71	71	66	69
170313103	SCHILLER PARK	4743 MANNHEIM RD.	NA	NA	NA	NA	NA	61	62
170314002	CICERO	1820 S. 51ST AVE.	65	69	74	72	69	62	66
170314007	DES PLAINES	9511 W. HARRISON ST	59	62	67	68	69	68	71
170314201	NORTHBROOK	750 DUNDEE ROAD	NA	NA	78	77	73	67	70
170317002	EVANSTON	531 E. LINCOLN	63	69	79	80	78	70	72
170436001	LISLE	RT. 53	60	63	68	68	67	64	68
170890005	ELGIN	665 DUNDEE RD.	66	69	71	69	68	65	68
170971007	ZION	ILLINOIS BEACH STATE PARK	74	76	82	80	79	71	73
171110001	CARY	FIRST ST. & THREE OAKS RD.	65	67	71	71	69	65	68
171971011	BRAIDWOOD	36400 S. ESSEX RD.	62	63	65	64	65	63	64
Indiana									
180890022	GARY--IITRI	201 MISSISSIPPI ST., IITRI BUNKER	61	62	69	69	69	65	67
180890030	WHITING	1751 OLIVER ST/ WHITING HIGH SCHOOL	64	66	73	70	69	65	NA
180892008	HAMMOND	1300 141 ST STREET	67	68	NA	NA	NA	63	65
181270024	OGDEN DUNES	84 DIANA RD/ WATER TREATMENT PLANT	67	67	72	72	73	68	69
181270026	VALPARAISO	1000 WESLEY ST./ VALPARAISO WATER DEPT.	62	62	63	64	65	63	66
Wisconsin									
550590019	CHIWAUKEE PRAIRIE	CHIWAUKEE PRAIRIE, 11838 FIRST COURT	74	77	84	82	81	75	77
551170006	SHEBOYGAN—KOHLER ANDRAE	KOHLER ANDRE PARK, 1520 Beach Park Rd.	78	81	87	85	81	77	79

***2016 data are preliminary based on AirNow data and may change.

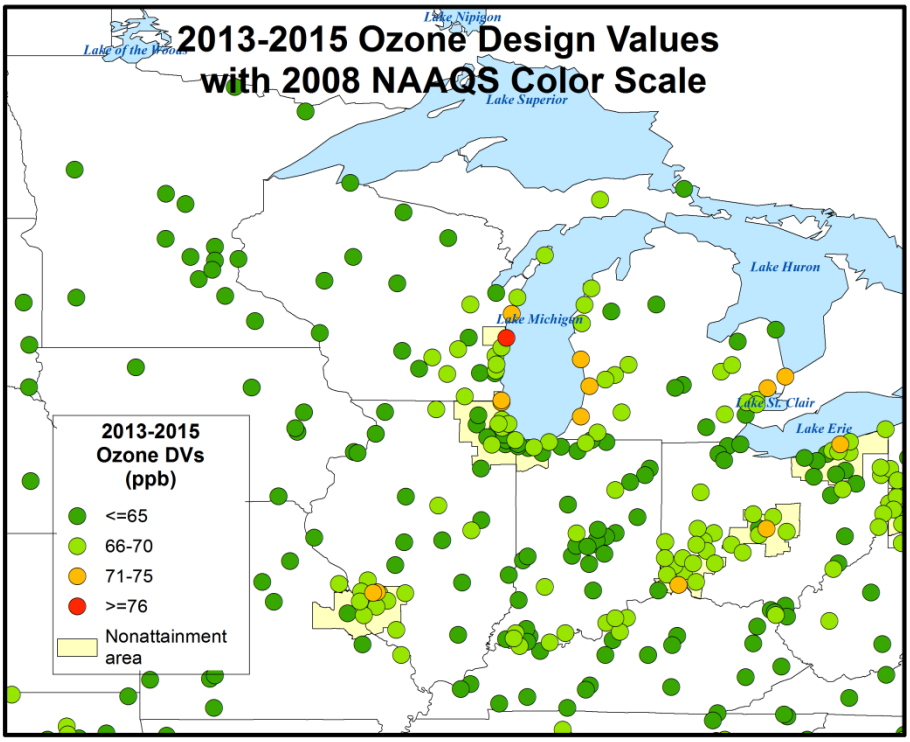

Figure 2.1. 8-hour Ozone Design Values (2013-2015) in the LADCO Region

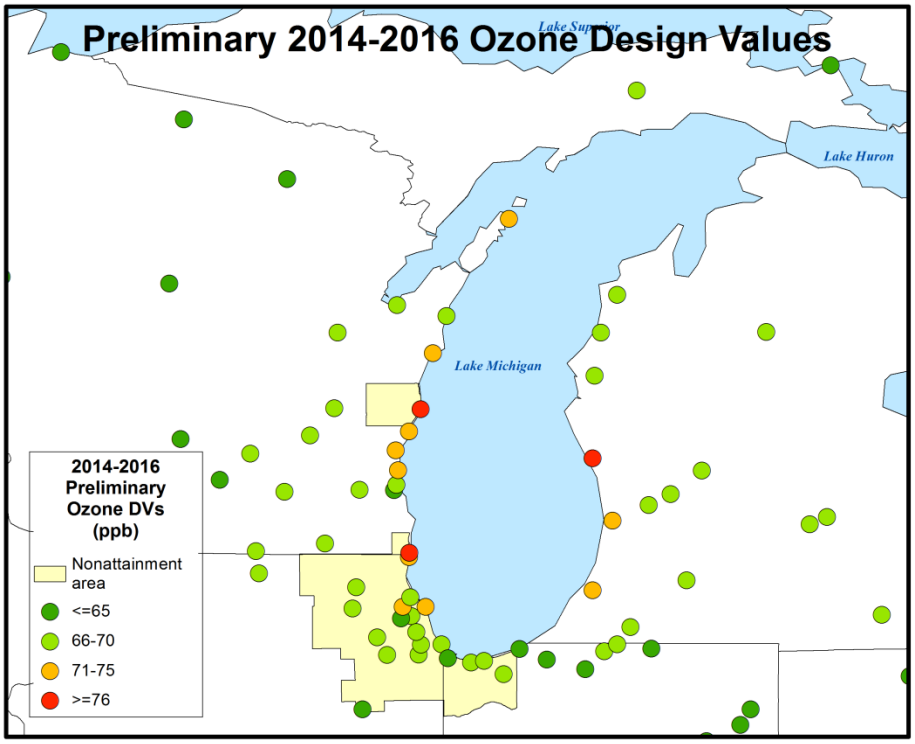

Figure 2.2. 8-hour Ozone Design Values in the Lake Michigan Region (2014-2016) (based on preliminary 2016 data)

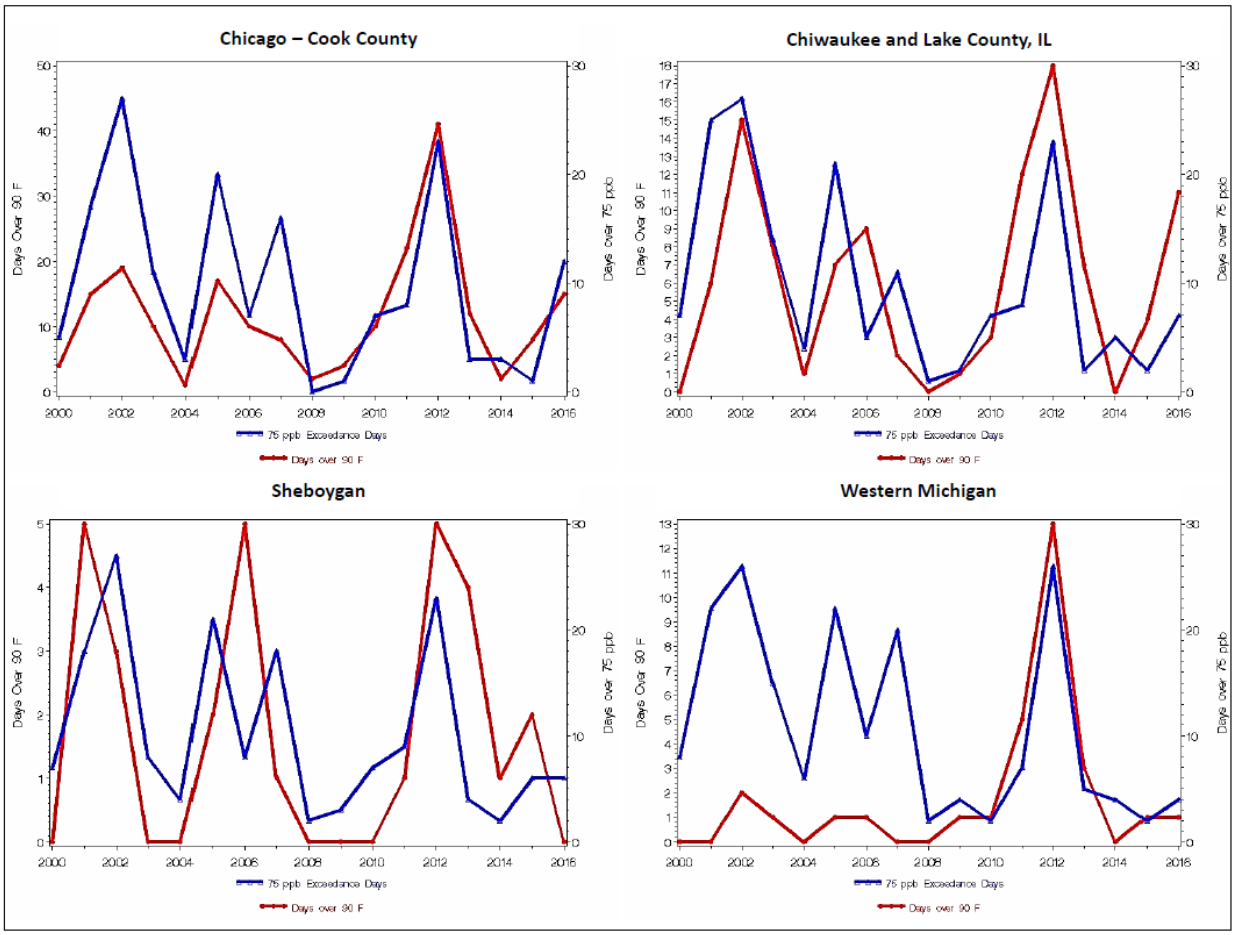

Figure 2.3. Trends in 90-degree Days and 8-hour "Exceedance" Days Around Lake Michigan

Locally, emissions from urban areas add to the regional background leading to ozone concentration hot spots downwind. Depending on the synoptic wind patterns (and local land-lake breezes), different downwind areas are affected. Figure 2.5, for example, shows build-up of ozone on the western shore of Lake Michigan on June 15, 2012, and on the southeastern shore of the lake on June 28, 2012.

Aircraft measurements conducted in prior years in the Lake Michigan area provide evidence of elevated regional background concentrations and "plumes" from urban areas. For one example summer day (August 20, 2003 – see Figure 2.6), the incoming background ozone levels were on the order of 80-100 ppb and the downwind ozone levels over Lake Michigan were on the order of 100-150 ppb (STI, 2004). Although these data are older (aircraft measurements ceased in 2003) and ozone concentrations now are significantly lower, the transport mechanisms remain the same, and the issue of high background ozone affecting nonurban areas and contributing to elevated ozone at locations along the lakeshore is a persistent problem in the region.

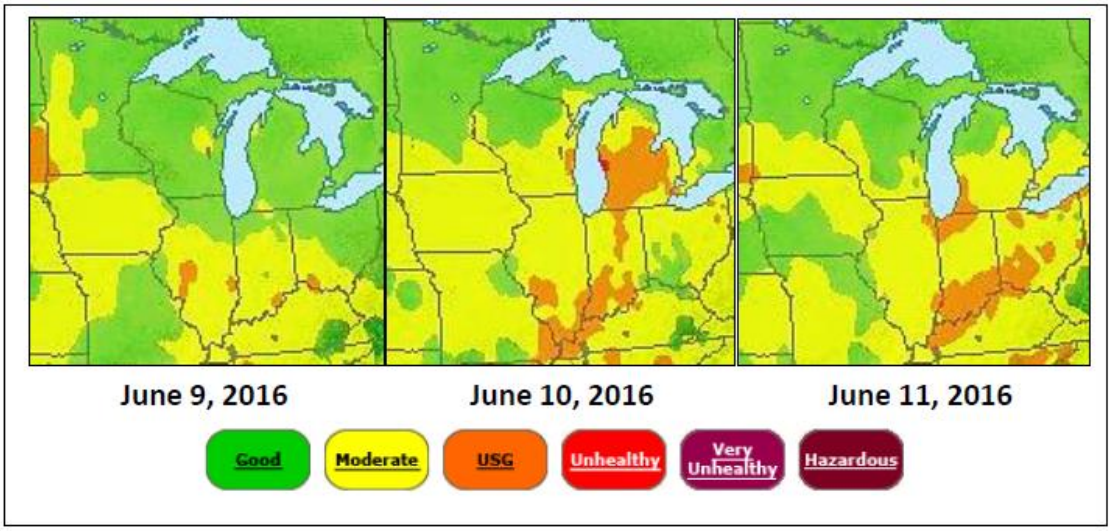

Figure 2.4. Example of Elevated Regional Ozone Concentrations (June 9-11, 2016). (Note: data come from AirNow, showing maximum daily ozone Air Quality Index; hotter colors represent higher concentrations, with orange and red representing concentrations above the 8-hour standard.)

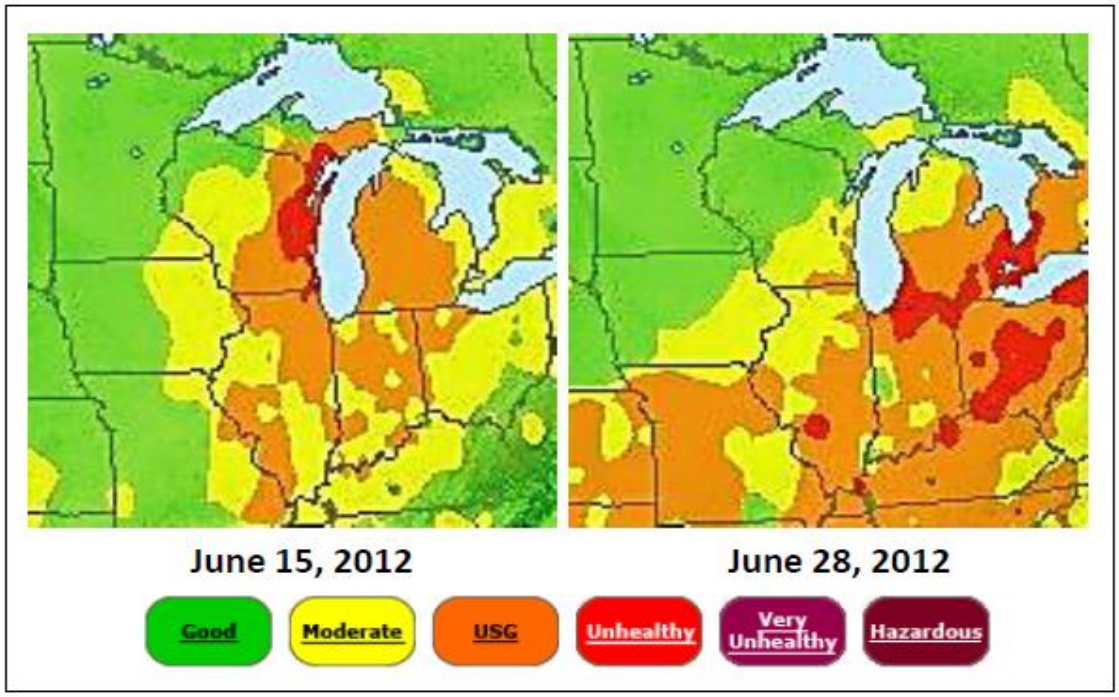

Figure 2.5. Examples of High Ozone Days in the Lake Michigan Area. (Note: data come from AirNow, showing maximum daily ozone Air Quality Index; hotter colors represent higher concentrations, with orange and red representing concentrations above the 8-hour standard.)

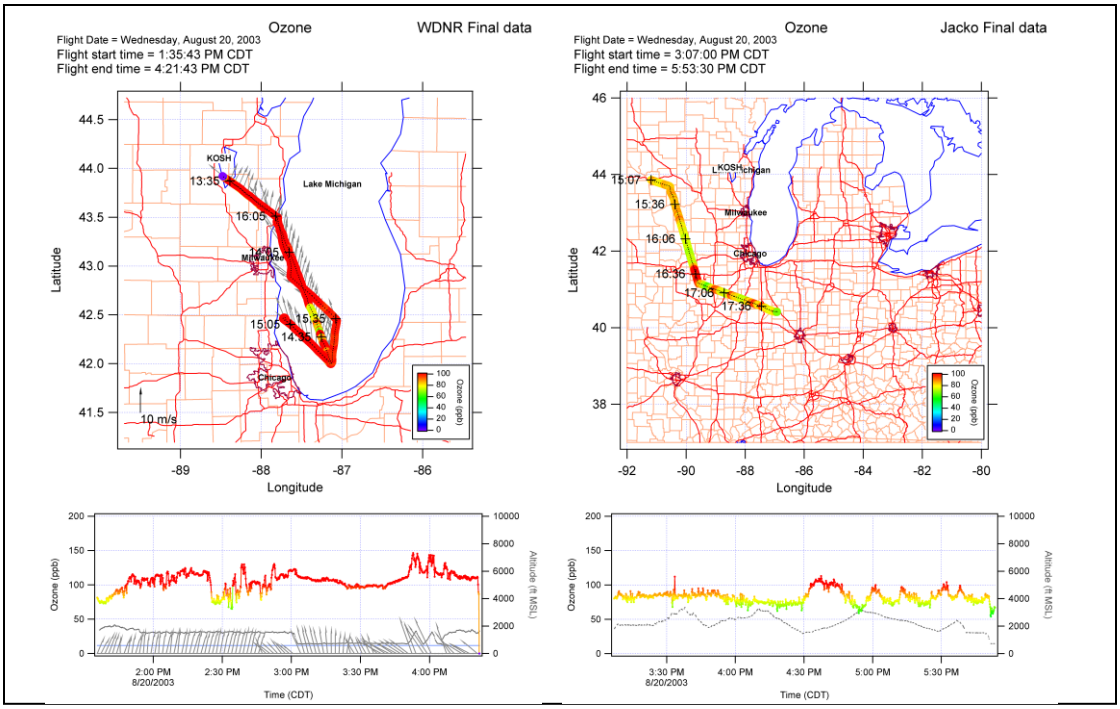

Figure 2.6. Aircraft Ozone Measurements over Lake Michigan (left) and Along Upwind Boundary (right) – August 20, 2003. (Note: aircraft measurements reflect instantaneous values. Flight paths are shown as thick lines, with the color of the lines reflecting ozone concentrations. The wind barbs show southwest to southeast winds)

To understand the source regions likely impacting areas along the Lake Michigan shoreline with high ozone concentrations, LADCO constructed back trajectories using the HYSPLIT model. High ozone days (8-hour peak > 65 ppb) during the period 2012-2015 at Wisconsin shoreline monitors (Manitowoc, Sheboygan, SE Region WDNR Headquarters, and Chiwaukee Prairie) were used to characterize general transport patterns. For each day from May through September, four 72-hour back trajectories were calculated for the maximum 8-hour ozone period, starting at hours 1, 3, 5, and 7. Each trajectory calculation (performed with HYSPLIT) results in 72 latitude/longitude coordinates (endpoints) that mark the position of the air mass in the 72 hours preceding its arrival at the monitor. Because all trajectories start at the monitoring site and disperse from there, the density of endpoints is highest at the site and decreases with distance from the monitor. To remove this central tendency to more clearly show the differences between areas upwind on high and low ozone days, an incremental probability plot is calculated by subtracting endpoints for all-days from the endpoints on high ozone days. The resulting endpoints are plotted in ArcGIS, as shown in Figure 2.7 for all four shoreline monitors combined (left) and for Sheboygan only (right). This analysis shows the areas that are most likely to be upwind on high ozone days in red and the areas that are least likely to be upwind on high ozone days in blue. The results indicate that air masses on high ozone days at these monitors are most likely to travel

through northeast Illinois and northwest Indiana in the hours before high ozone is recorded.

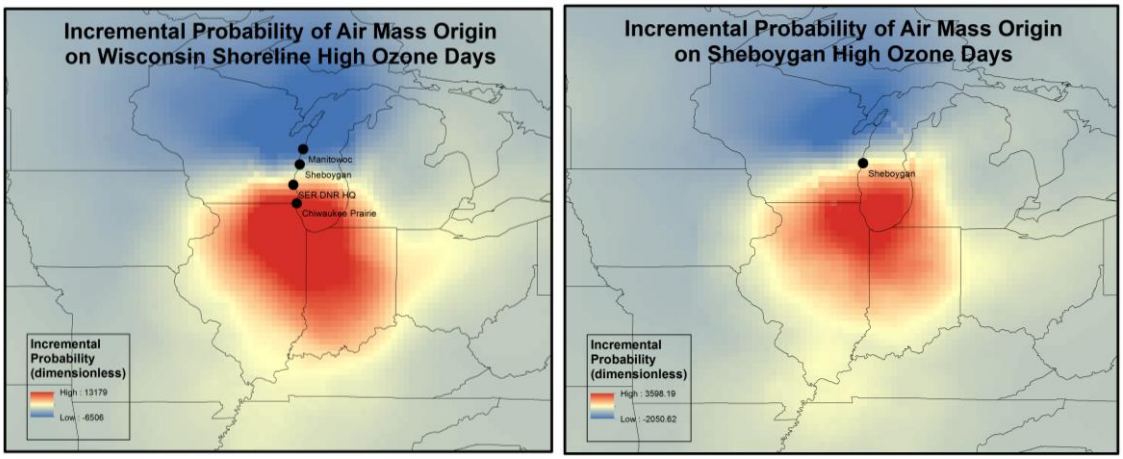

Figure 2.7. Incremental Probability of Air Mass Location in 72 Hours Prior to High Ozone Concentrations at Wisconsin Shoreline Monitors

The following key findings related to transport can be made:

- Ozone transport is a problem affecting many portions of the eastern U.S. The Lake Michigan area (and other areas in the LADCO region) both receives high levels of incoming (transported) ozone and ozone precursors from upwind source areas on many hot summer days, and contributes to the high levels of ozone and ozone precursors affecting downwind receptor areas.

- The presence of a large body of water (i.e., Lake Michigan) influences the formation and transport of ozone in the Lake Michigan area. Depending on large-scale synoptic winds and local-scale lake breezes, different parts of the area experience high ozone concentrations. For example, under southerly flow, high ozone can occur in eastern Wisconsin, and under southwesterly flow, high ozone can occur in western Michigan.

- Downwind shoreline areas around Lake Michigan are affected by transport of ozone from major cities in the Lake Michigan area and from areas further upwind.

Ozone Air Quality Trends

In the last 15 years, considerable progress has been made to meet the 8-hour ozone standard in the Lake Michigan area and regionally. Figure 2.8 shows the decline in 8-hour design values for the Chicago and Sheboygan nonattainment areas since 2002, and Figure 2.9 shows the decline in fourth-high yearly values for the same area and

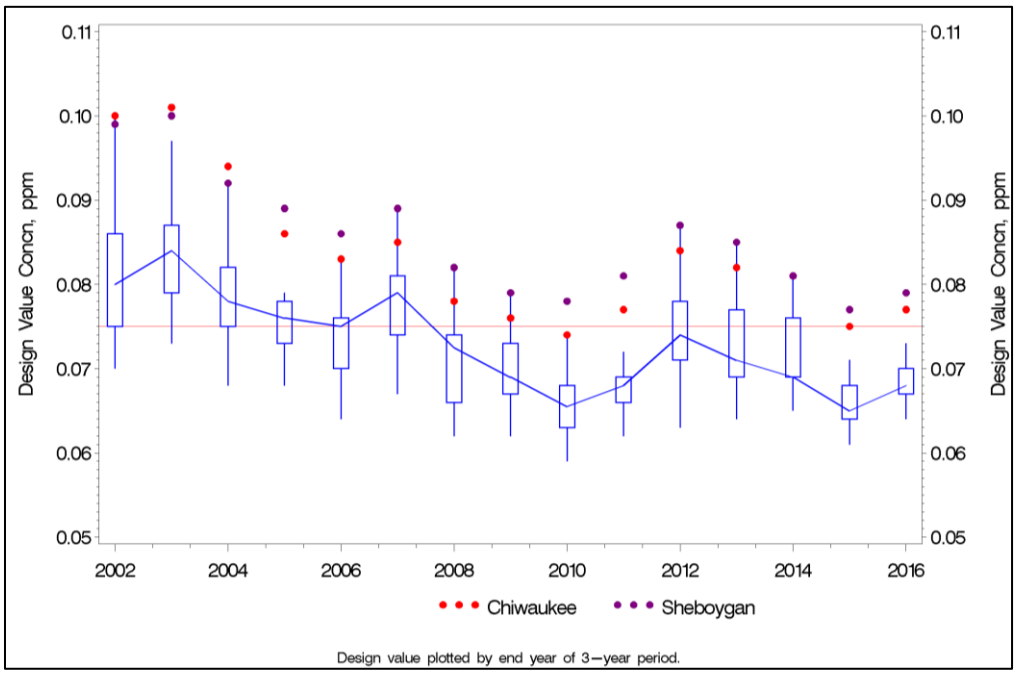

Figure 2.8. Ozone Design Value Trends in the Chicago and Sheboygan Nonattainment Areas

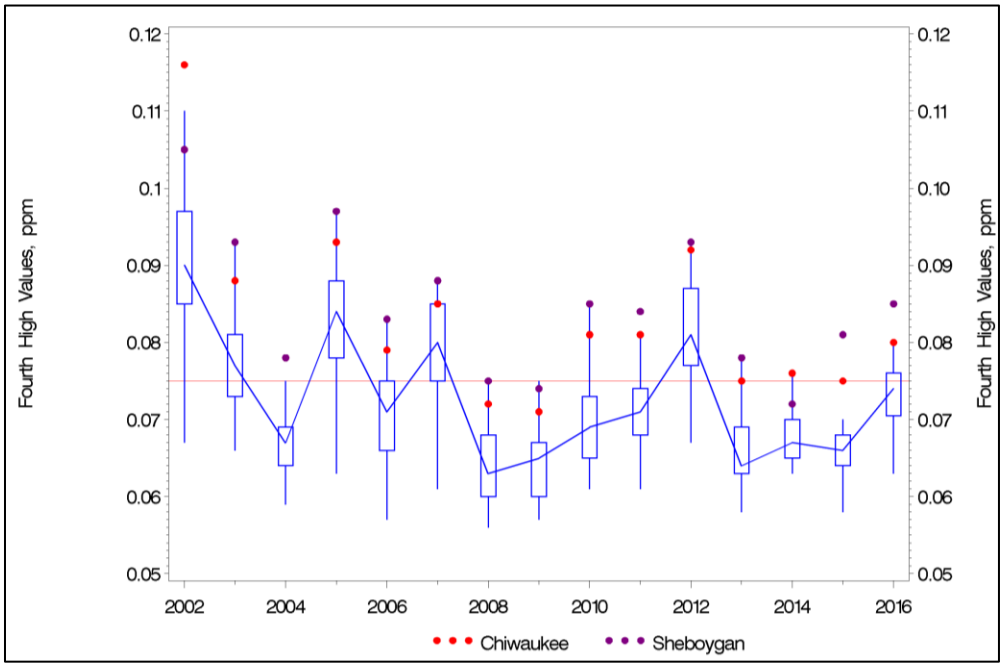

Figure 2.9. Trend in Fourth-High Values in the Chicago and Sheboygan Nonattainment Areas

period. The trend in fourth high values is less pronounced due to year-to-year meteorological variability, which is averaged out in the design value calculation. Both plots show Chiwaukee Prairie and Sheboygan values individually as red and purpledots. The blue boxes indicate the 25th-75th percentiles of the design values and fourth high concentrations for all the nonattainment area monitors, and the whiskers (lines extending from the boxes) show the most extreme point within 1.5 times the interquartile range.

The improvement in ozone concentrations is also seen in the decrease in the number of sites measuring exceedance levels from the 2009-2011 designation period to the most current design value period of 2014-2016 (see Figure 2.10).

Given the effect of meteorology on ambient ozone levels, year-to-year variations in meteorology can make it difficult to assess short term (e.g. – less than 10 years) trends in ozone air quality. Figure 2.11 shows the variability in summer average temperatures for the period from 2005 to 2016, expressed as deviation from long term average temperatures for June-August. This plot shows that 2012 had the hottest summer in that period, and 2009 had the coolest. This pattern is also apparent in the number of 90-degree days each summer, as shown previously in Figure 2.3.

One approach to adjust ozone trends for meteorological influences is through the use of Classification and Regression Trees (CART). CART is a statistical technique which partitions data sets into similar groups (Breiman et al., 1984). A CART analysis was performed using data for the period 2000-2015 for urban and ozone transport areas in the LADCO region. The CART model searches through 60 meteorological variables to determine which are most efficient in predicting ozone. Although the exact selection of predictive variables changes from site to site, the most common predictors were temperature, wind direction, and relative humidity. Only occasionally were upper air variables, transport time or distance, lake breeze, or other variables significant as predictors.

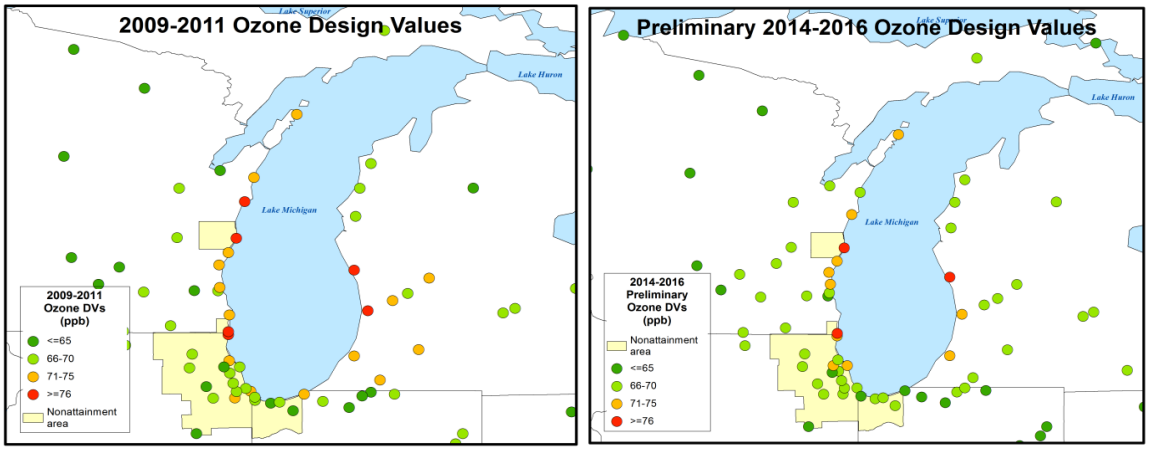

Figure 2.10. Change in Ozone Design Values from 2009-2011 to 2014-2016

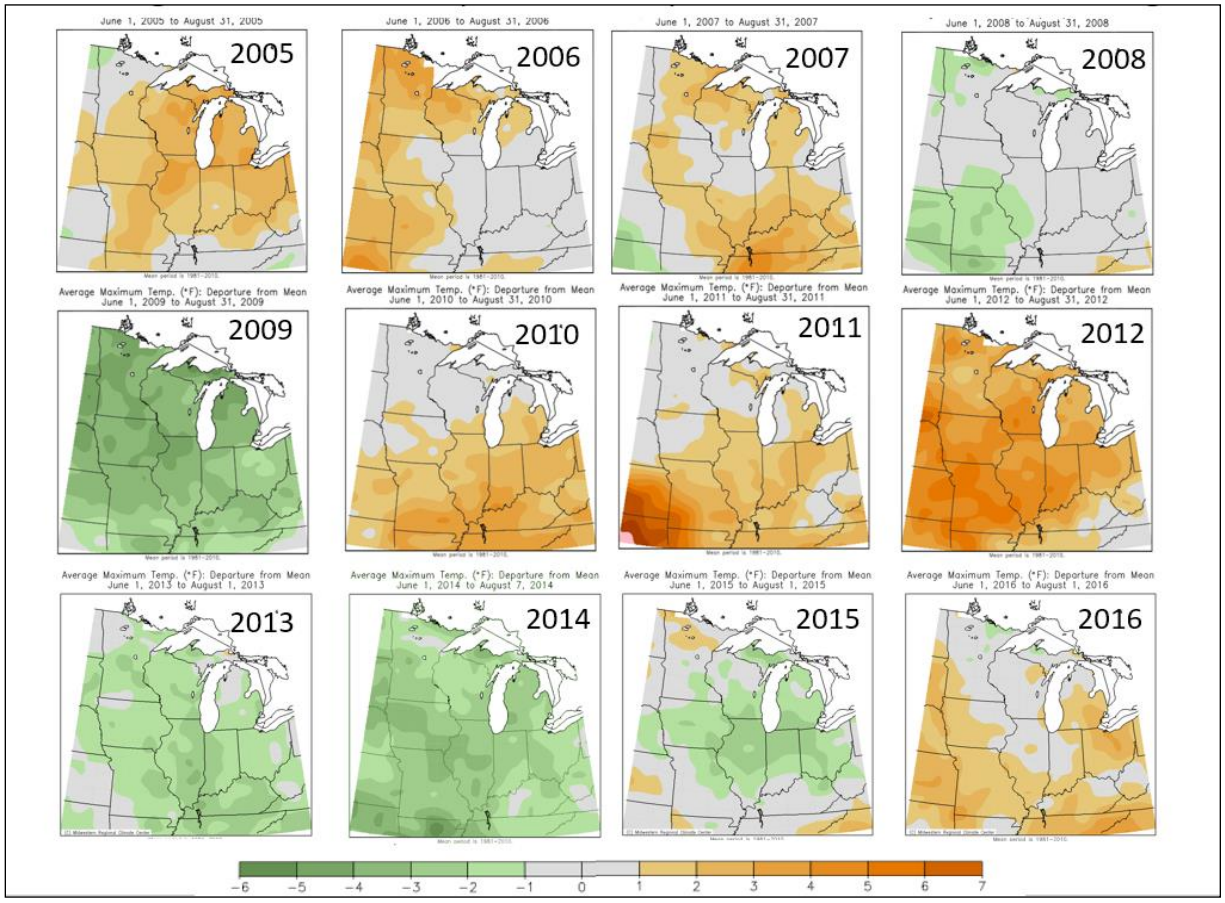

Figure 2.11. Deviation from Long Term Average Temperature, June-August, for 2005-2016

For each monitor, regression trees were developed that classify each summer day (May-September) by its meteorological conditions. Similar days are assigned to nodes, which are equivalent to branches of the regression tree. Ozone time series for the higher concentration nodes are plotted for select areas in Figure 2.12. By grouping days with similar meteorology, the influence of meteorological variability on the trend in ozone concentrations is partially removed; the remaining trend is presumed to be due to trends in precursor emissions or other non-meteorological influences. Trends over the 16-year period ending in 2015 were found to be declining for each monitor or composite area noted. These plots reflect long term trends and are not meant to depict trends over shorter time periods.

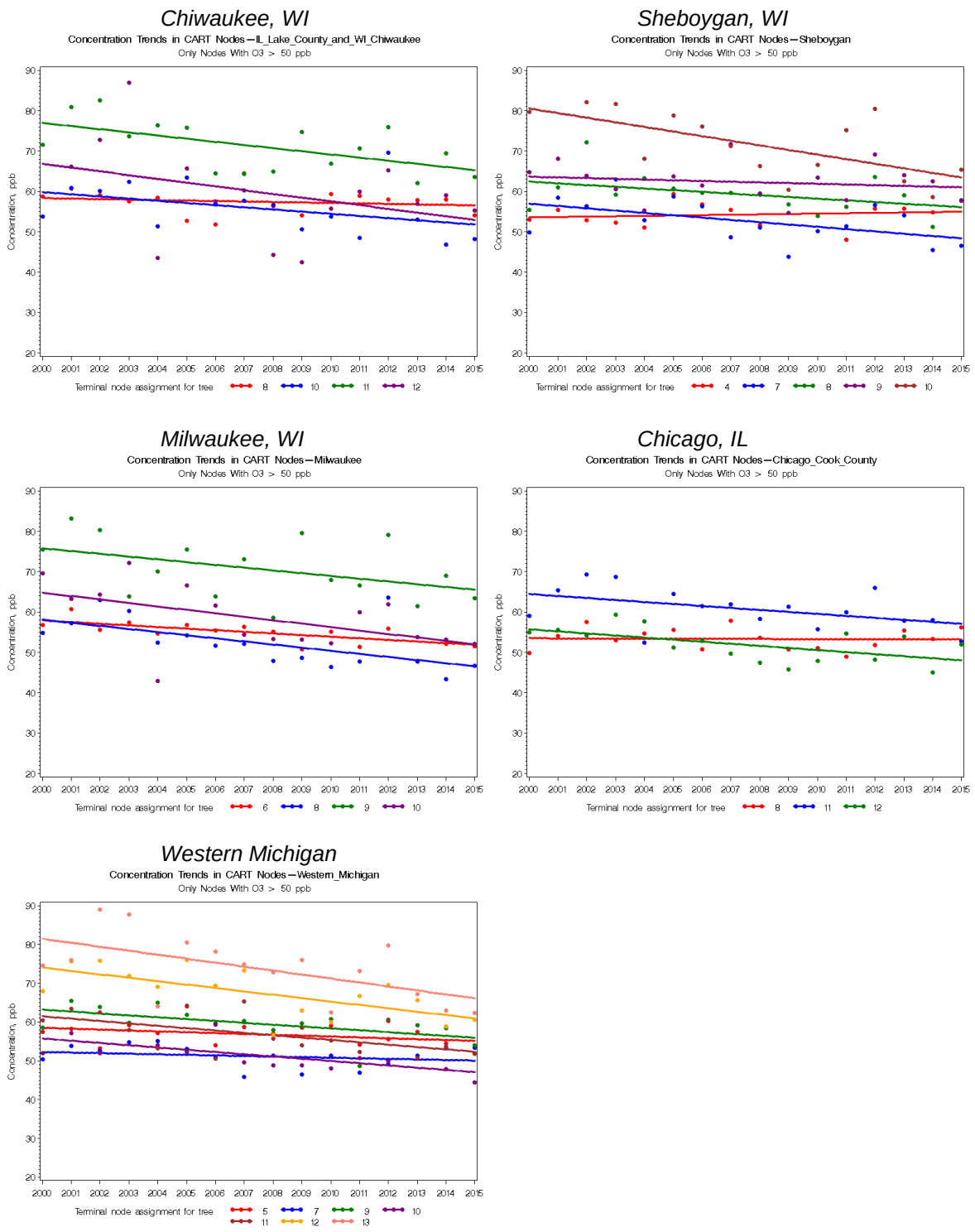

Figure 2.12. Meteorologically Adjusted Ozone Trends Around Lake Michigan

Conceptual Model for Ozone in the Lake Michigan Region

A conceptual model is a qualitative summary of the physical, chemical, and meteorological processes that control the formation and distribution of pollutants in a given region. Based on the data and analyses presented above, and of previous conceptual models and technical support documents developed for the Lake Michigan region, a conceptual model of the behavior, meteorological influences, and causes of high ozone in the Chicago and Sheboygan nonattainment areas is summarized below:

- Current monitoring data show that most sites in the Lake Michigan region are meeting the 2008 8-hour ozone NAAQS. However, three sites in the region exceeded the 8-hour ozone standard of 75 ppb in 2014-16: Chiwaukee Prairie, WI, Sheboygan, WI, and Muskegon, MI. Historical ozone data show a downward trend over the past 15 years, due likely to federal and state emission control programs. Concentrations declined sharply from 2002 through 2010. The rate of decrease appears to have tapered in recent years, although the high year-to-year variability of ozone makes it imprudent to make assumptions about short-term trends.

- Ozone concentrations are strongly influenced by meteorological conditions, with more high ozone days and higher ozone levels during summers with above normal temperatures. Nevertheless, meteorologically adjusted trends show that concentrations have declined even on hot days, providing strong evidence that emission reductions of ozone precursors have been effective.

- Inter- and intra-regional transport of ozone and ozone precursors affects many portions of the LADCO states, and is the principal cause of nonattainment in some areas far from population or industrial centers.

- The presence of Lake Michigan influences the formation, transport, and duration of elevated ozone concentrations along its shoreline. Depending on large-scale synoptic winds and local-scale lake breezes, different parts of the area experience high ozone concentrations. For example, under southerly flow, high ozone can occur in eastern Wisconsin, and under southwesterly flow, high ozone can occur in western Michigan.

- Areas in closer proximity to the Lake shoreline display the most frequent and most elevated ozone concentrations.

- Ozone concentrations have declined since 2000-2002 both inland and along the Lake Michigan shoreline.

3.0 Emissions Inventory Development

This technical analysis relies heavily on emissions and other model inputs prepared by U.S. EPA. U.S. EPA and LADCO rigorously quality assure their emission inventories (U.S. EPA, 2015A). LADCO's emissions modeling quality assurance procedures include reviewing emissions model output files for errors and warnings, comparing emissions between processing steps, checking that speciation, temporal, and spatial allocation factors are applied correctly, and reviewing the air quality model emissions inputs and stack parameters.

U.S. EPA's Modeling Platform

LADCO utilized emissions inventories compiled by U.S. EPA for the years 2011 and 2017 as the starting point for the modeling inventories used in this analysis. U.S. EPA's 2011 emission inventory (Version 2011EH) is based on the 2011 National Emissions Inventory, version 2 (2011NEIv2), which was speciated, temporalized and gridded to provide hourly emissions inputs to support photochemical modeling.

The major sectors of the anthropogenic emissions inventory are:

- Electric generating units (EGUs) include fossil fuel electricity generation. Coal-fired utilities dominate this sector. These sources are defined by discrete stack locations.
- Point sources (point non-EGU) include other industrial sources that do not generate power. This category includes refineries, steel mills, foundries, cement plants and other large industrial facilities.
- Onroad mobile sources (Onroad) includes all onroad transportation related vehicles. Passenger automobiles and medium and heavy freight trucks are the primary vehicles included in this category.
- Nonroad mobile sources (Nonroad) include small and medium engines that are not used on roadways. Examples include lawn and garden equipment, recreational marine, ATVs, and construction equipment. It also includes industrial freight handling equipment such as forklifts and cranes.
- Area sources (Area) are those sources that do not fit into other groups and are spatially diverse in nature. Examples include small industrial activities, consumer solvents, home heating, and commercial and institutional fuel use.
- Marine, aircraft and rail (MAR) includes commercial marine vessels, commercial and private aircraft, and railroad locomotives including those operated at switching yards.

Non-anthropogenic sources such as biogenic emissions and wildfires are also represented in the emissions inventory. For the biggest inventory sectors, the Version 2011 EH inventory relies on hourly 2011 continuous emissions monitoring system (CEMS) data for EGU emissions, hourly on-road mobile emissions, and 2011 day-

specific wildfire and prescribed fire data. Emissions include all criteria pollutants and ozone precursors. See U.S. EPA's Technical Support Document (U.S. EPA, 2015A) for a thorough description of the methodology used to develop the 2011EH emissions inventory. LADCO further updated the inventories for regional on-road mobile sources and EGUs as described in more detail later in this section.

U.S. EPA's projected future emission inventory for the year 2017 is based on the 2011 baseline inventory and incorporates current "on-the-books" emission control measures. See U.S. EPA (2015A) for a thorough description of the methodology used to project future emissions. LADCO developed updated EGU and regional on-road emissions for 2017. The next two sections describe these updates in more detail.

On-Road Motor Vehicles

For the on-road category, LADCO worked with its member states plus Iowa, Missouri, and Kentucky to derive improved inputs for running the MOVES emissions model for the base year 2011 and the projection year 2017. In March 2014, LADCO contracted with Ramboll-Environ to evaluate and develop base year and future year on-road mobile emissions inventories using U.S. EPA's MOVES emissions model. As part of this contractual effort, Ramboll-Environ quality assured the MOVES inputs used by U.S. EPA in developing the NEIv2 inventory. This quality assurance effort identified several problems in the MOVES inputs in NEIv2 (Ramboll-Environ, 2014). For example, Ramboll-Environ reviewed vehicle population data used in the NEIv2 and discovered that the vehicle population data in Ohio differed markedly from that for other Midwestern states, which warranted further review from the State of Ohio (see Figure 3.1). This is just one example of issues identified by Ramboll-Environ in U.S. EPA's NEIv2 on-road inventory.

Based on the findings of the quality assurance effort, LADCO worked with the states noted above to review and update key MOVES inputs, including vehicle type profiles, vehicle miles travelled data (VMT), vehicle speeds, and vehicle inspection and maintenance program characteristics. After extensive review, Ramboll-Environ completed the final MOVES (Version MOVES2014) and provided model-ready inputs to LADCO for 2011 and 2017.

Figure 3.2 illustrates the changes in emissions between the base and future year for the onroad mobile source sector for Illinois, Indiana and Wisconsin. Significant reductions in both VOC and NOx emissions are projected between 2011 and 2017 in all three states.

Figure 3.3 shows the relative contribution of the different components of the onroad mobile source category for VOC emissions. The three emissions components represented in the figure are:

- Rate Per Vehicle (RPV) are emissions related to vehicle counts including start and soak activity

- Rate Per Profile (RPP) are emissions related to evaporative activity from resting vehicles
- Rate Per Distance (RPD) are emissions related to tailpipe emissions that are related to VOC

This figure illustrates that a significant portion of motor vehicle emissions do not come from traditional tailpipe emissions, but instead come from evaporative emissions from fuel tanks, and engine crankcase leaks.

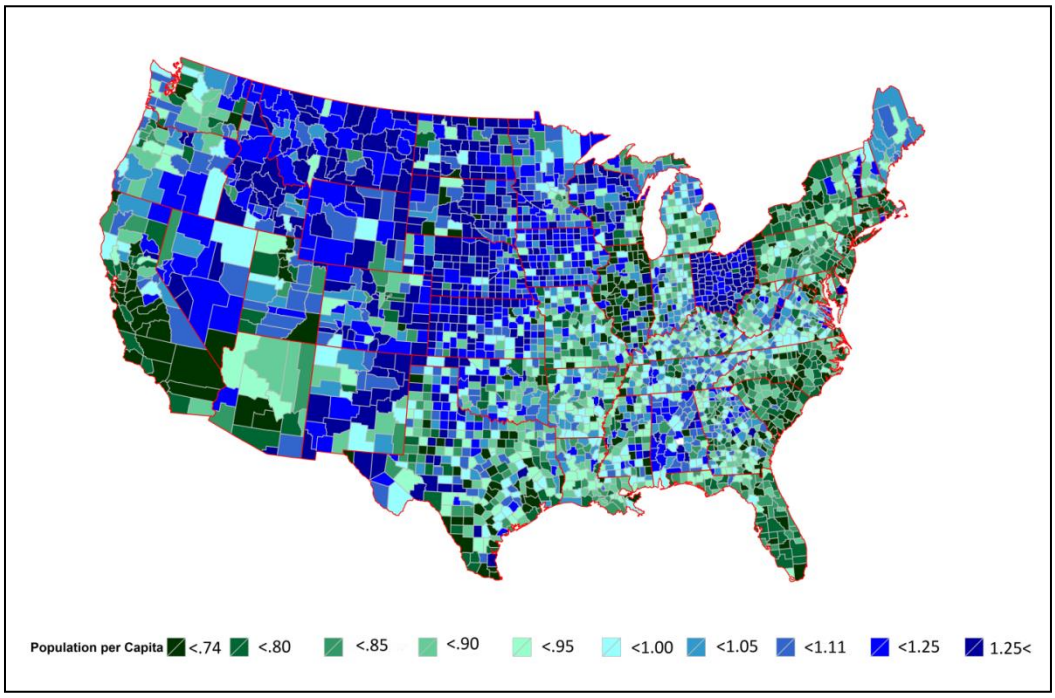

Figure 3.1. Vehicle Population Per Capita Used in the 2011 NEIv2. (Ramboll-Environ, 2014)

Figure 3.4 illustrates the VOC and NOx emissions contribution from different types of vehicles. As shown in the figure, most VOC emissions from onroad sources, and much of the improvement from 2011 to 2017, are from gasoline powered vehicles. In contrast, NOx emissions are dominated by heavy duty diesel trucks. Gasoline powered vehicles are also significant NOx sources but represent a smaller fraction of the total in future years.

Electric Generating Units

LADCO used the ERTAC EGU projection tool (version 2.5L2) to develop future year estimates for 2017. EGU emissions were used in place of U.S. EPA's estimates from

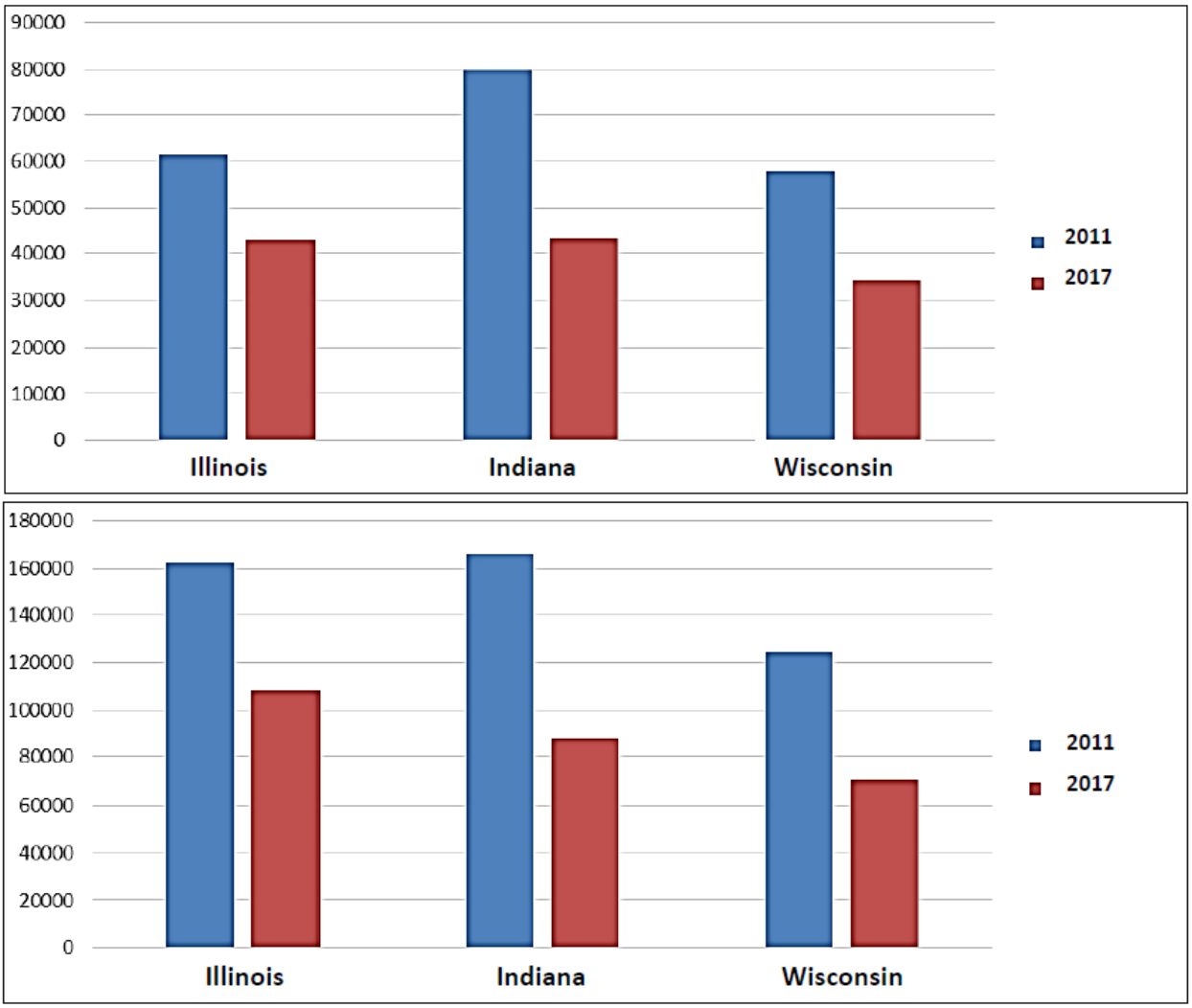

Figure 3.2. Base Year (2011) and Future Year (2017) VOC (top) and NO_X (bottom) Emissions (tons per year) for On-Road Mobile Sources

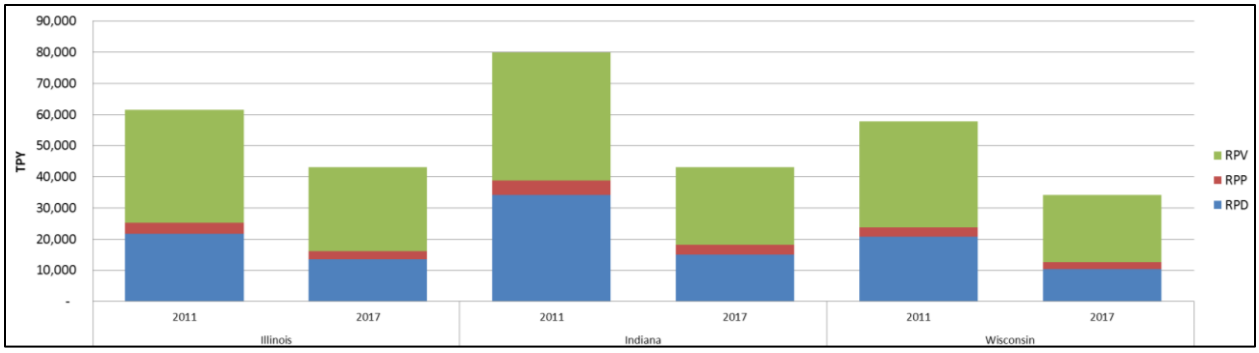

Figure 3.3. VOC Emissions by MOVES Rate Source

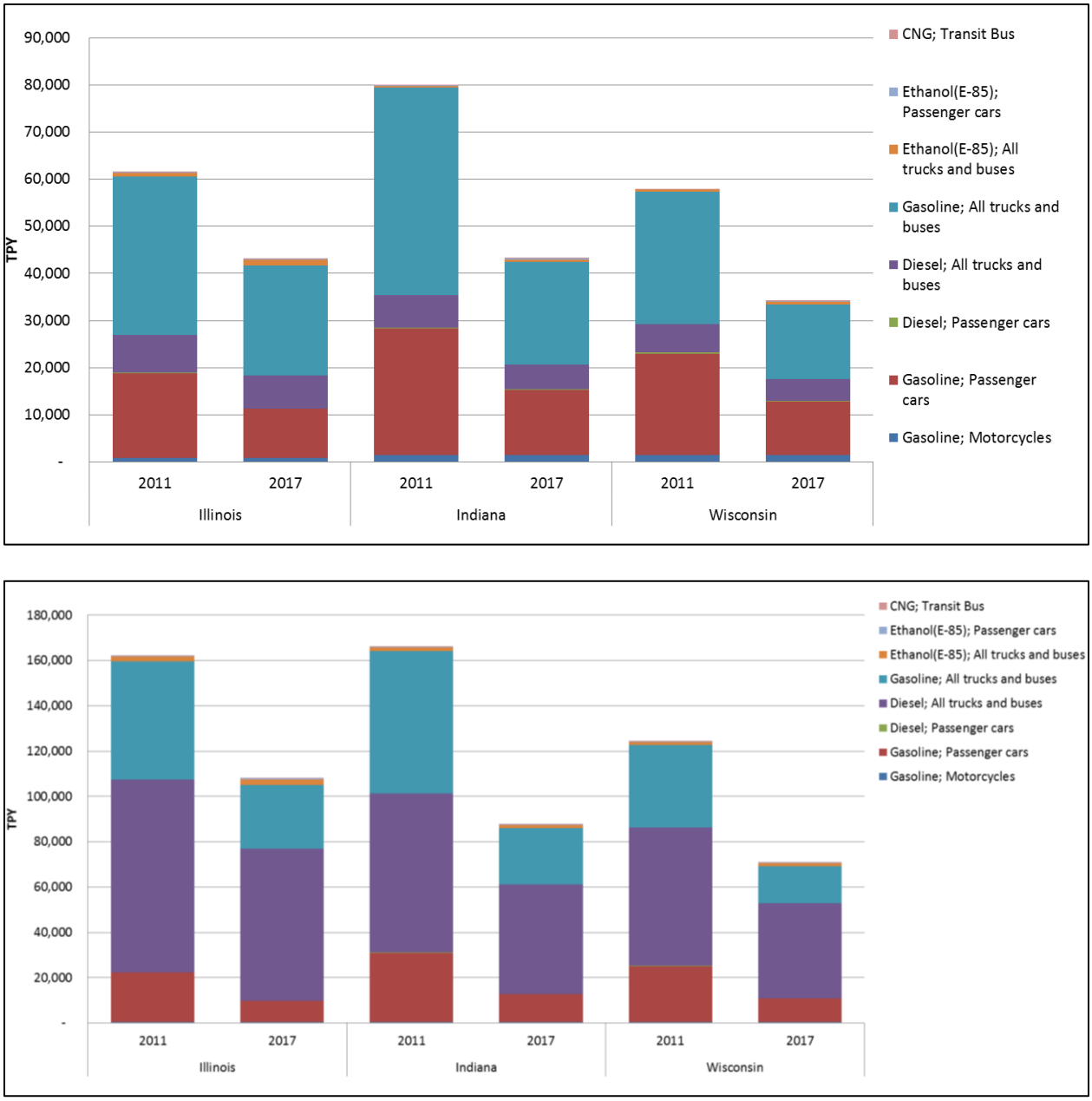

Figure 3.4. Separation of VOC (top) and NOx (bottom) Emissions by MOVES Vehicle Group

the IPM model. ERTAC is a collaborative effort to improve emission inventories among the Northeastern, Mid-Atlantic, Southeastern, and Lake Michigan area states. The ERTAC effort involves state regulators in the eastern half of the country, industry representatives, and staff from several of the MJOs.

The ERTAC EGU Forecast Tool is used to project hourly EGU emissions for 2017. The tool uses base year hourly data from U.S. EPA - Clean Air Markets Division (CAMD)

data, and fuel specific growth rates from the Annual Energy Outlook (AEO) forecast prepared annually by the EIA to estimate future emissions.

The input files used by the ERTAC EGU Forecast Tool are described in Table 3.1. The enhanced summary files provide NOx and SO_2 criteria pollutant data for annual and ozone season time periods.

Table 3.1. Input Files Used by the ERTAC EGU Forecast Tool

Base Year CAMD input file	An improved version of the 2011 base year hourly CAMD CEM data. The file has anomalous data removed, including Non-EGU units and any U.S. EPA substituted data where CEM operation was questionable.
Unit Availability File (UAF)	A table of base year unit-specific information derived from CAMD NEEDS database, state input, EIA Form 860, and data from the North American Electric Reliability Corporation (NERC). States provide additional information on planned new units, unit retirements, fuel switches, and other changes on a frequent basis.
Control File	A table of future unit-specific changes that affect a unit's emissions. State air agency staff has provided this information.
Season Control File	A table of future year unit-specific emission factors. These data are provided by state air agency staff and are especially helpful in characterizing future year emission rates from seasonal control devices.
Growth File	A table of growth factors developed from the EIA - AEO and NERC estimates and other information.
Input Variables File	A table of variables used in the modeling run.
State File	A table of state level emissions caps or budgets applicable in future years.
Group File	A table of emissions caps or budgets applicable to multiple states in future years.
Non-CAMD Hourly File	Provides updates to the CAMD hourly 2011 base year data to correct hourly reported values.

Additional information on the ERTAC EGU Forecast Tool (version 2.5) can be found at: www.marama.org/images/stories/documents/CONUS2.5/C1.01CONUSv2.5ref_2018_05052016_ertac_egu_log.docx. Additional background information on the ERTAC EGU Forecast Tool can be found at: www.ertac.us/index_egu.html and http://www.marama.org/2013-ertac-egu-forecasting-tool-documentation.

To develop inventories for this modeling demonstration, LADCO sought updated information from states and stakeholders on recent EGU unit shutdowns and controls. This effort was initiated in February 2016. LADCO executed the ERTAC EGU Forecast Tool, incorporating the most recent updates and EIA's AEO projection from 2015. ERTAC modeling for these attainment demonstrations incorporated EIA's "High Oil and Gas Reference" projection. This was done because LADCO compared actual coal and natural gas utilization to AEO's 2015 reference case and EIA's "High Oil and Gas Resource" (see Figure 3.5) and found that the AEO2015 reference case forecasts much higher coal use and much lower natural gas use than were actually occurring. LADCO

concluded that the “High Oil and Gas Resource” scenario reflected a much more realistic forecast from which to base its 2017 projection of EGU NO_X emissions. Finally, after the release of ERTAC version 2.5, LADCO obtained new information about unit shutdowns in Michigan and Illinois that were incorporated.

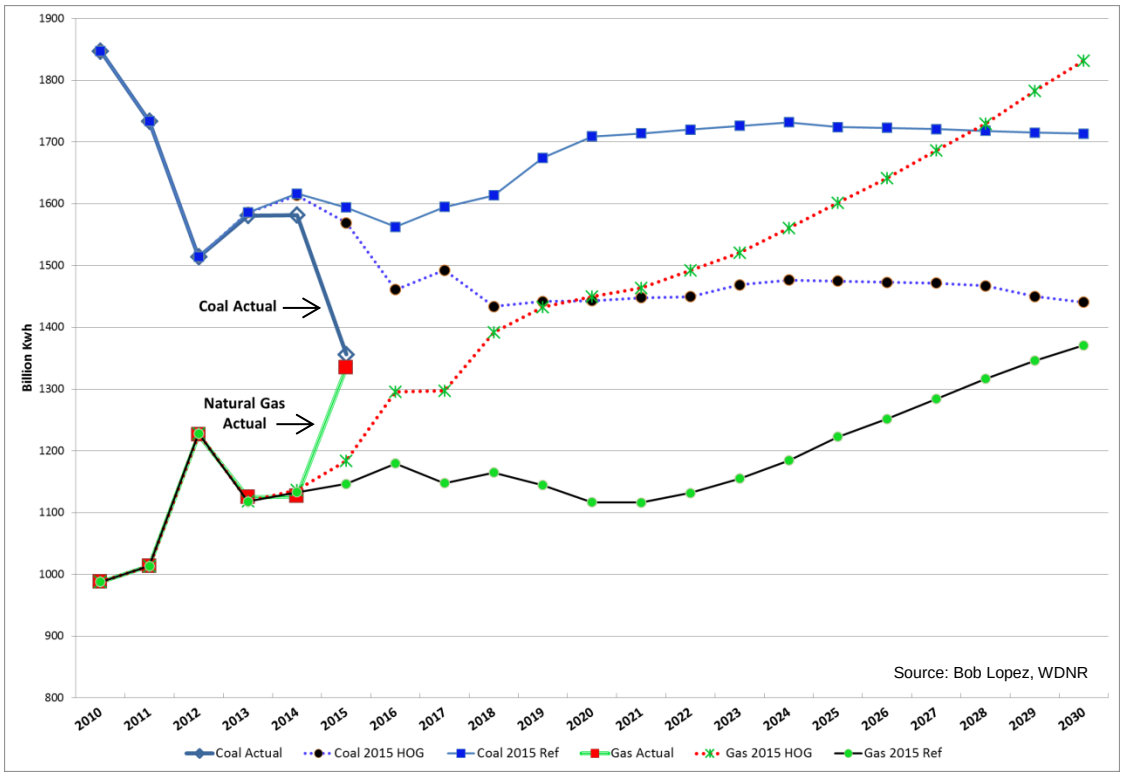

Figure 3.5. 2015 EIA Annual Energy Outlook –
National Forecast of Power Generation for Coal and Natural Gas.
(Note: HOG = high oil and gas, Ref = Reference case.)

It should be noted that the 2017 emissions for EGUs projected by the ERTAC EGU Forecast Tool reflect enforceable “on-the-books” control measures, fuel switches and unit shutdowns. The model does not forecast unit shutdowns or fuel switches or incorporate assumptions about pending regulatory actions such as the Clean Power Plan or the Mercury and Air Toxics Standards. These regulatory programs are expected to reduce emissions from Midwestern EGUs but their impacts are as yet uncertain. LADCO made no attempt to quantify these future reductions and considers the 2017 emissions projections for EGUs to be conservative because future emissions are likely to be less than the emissions used in this analysis.

Control Measures

On September 7, 2016, U.S. EPA finalized an update to the Cross-State Air Pollution Rule (CSAPR). This rule is expected to further reduce NO_X emissions from EGUs in 22

states in the eastern U.S., including five of the states in the LADCO region. These emissions reductions are expected to begin by the start of the 2017 ozone season. LADCO used the ERTAC EGU Forecast Tool to project likely NOx emissions reductions from the revised CSAPR. LADCO's approach assumed that electric utilities would likely optimize their use of existing controls (SNCRs and SCRs) and shift electric generation from higher emitting units to cleaner ones to comply with CSAPR.

LADCO evaluated the likelihood of states meeting the CSAPR ozone season NOx budgets assuming:

- lower NOx emission rates for units controlled with SCRs, in the range from 0.06 to 0.08 lb/mm Btu, for SCR-equipped units operating above those rates in the base year;
- a lower NOx emission rate for units equipped with SNCRs, to 0.2 lb/mm Btu for SNCR-equipped units operating above that rate in the base year;
- electric utilities would shift generation from higher emitting units to cleaner ones, as needed to reduce regional NOx emissions to meet the CSAPR budget.

The results of this analysis are included in Table 3.2. Finding that NOx emissions would exceed the CSAPR NOx budgets for the affected CSAPR region when the most stringent NOx rates for existing equipment were assumed at the baseline loading balance between facilities, LADCO evaluated the effects of shifting electric generation from higher emitting fossil units to lower emitting fossil units. Two such load-shifting scenarios were tested (see Table 3.2). Based on this analysis, it is likely that the CSAPR budget can be achieved in the region using existing controls combined with modest load shifting between fossil-fueled units, assuming meteorological conditions affecting the demand for electricity are similar to base year 2011 conditions. The unit-level emissions resulting from this analysis were used as input to the photochemical air quality model as a future year 2017 control scenario, as described in Section 4 of this TSD. These scenarios were developed based on reasonable assumptions of the likely responses of electric utilities to federal regulatory requirements for the purpose of generating EGU emission rates for this modeling assessment. However, it should be noted that states are required to meet the regulatory requirements of the CSAPR program, not the emissions and generation rates evaluated here.

In addition to CSAPR, U.S. EPA has adopted a number of national rules over the past few years that require or will require VOC and NOx emission reductions. Emissions standards established for mobile sources have been phased in over recent years but fleet turnover will ensure continued emissions reductions for many years in the future. For the LADCO states, these rules have provided emissions reductions between 2011 (base year) and 2017 (attainment year), and have been factored into the modeling assessment. The national rules that will help states achieve the 2008 ozone NAAQS are listed below.

Table 3.2. Evaluation of CSAPR Budgets
(Note: Emissions reflect 2017 NOx tons per ozone season)

State	2017 Base	CSAPR NOx Budget	CSAPR NOx Assurance Levels	2017 NOx (SCR Cap @ 0.08 lb/mm BTU)	2017 NOx (SCR Cap @ 0.07 lb/mm BTU)	2017 NOx (SCR Cap @ 0.06 lb/mm BTU)	2017 NOx Generation Shift Option 1	2017 NOx Generation Shift Option 2
AL	11,346	13,211	15,985	9,404	9,017	8,344	7,958	7,319
AR	17,821	9,210	11,144	17,821	17,821	17,781	13,230	9,373
IA	10,307	11,272	13,639	10,307	10,307	10,288	8,730	7,613
IL	14,650	14,601	17,667	14,325	14,175	13,844	15,017	15,512
IN	39,605	23,303	28,197	31,278	30,118	28,958	23,659	18,319
KS	13,569	8,027	9,713	11,887	11,690	11,494	10,865	9,720
KY	28,329	21,115	25,549	24,487	24,000	23,386	19,542	13,605
LA	16,532	18,639	22,553	16,532	16,532	16,532	14,980	13,714
MD	5,751	3,828	4,632	5,345	5,291	5,157	4,277	3,529
MI	21,696	17,023	20,598	21,696	21,239	20,749	16,294	13,617
MO	24,092	15,780	19,094	20,658	20,186	19,585	16,898	14,776
MS	9,222	6,315	7,641	9,222	9,222	9,222	8,360	6,793
NJ	2,953	2,062	2,495	2,569	2,478	2,387	2,428	2,400
NY	6,768	5,135	6,213	6,560	6,508	6,456	6,456	6,456
OH	27,403	19,522	23,622	20,057	18,824	17,420	15,854	14,199
OK	31,357	11,641	14,086	31,357	31,357	31,357	26,991	22,391
PA	24,125	17,952	21,722	18,372	17,007	15,597	15,851	16,304
TN	8,651	7,736	9,361	8,422	8,210	7,795	7,466	7,178
TX	63,079	52,301	63,284	63,079	63,079	62,912	58,605	52,164
VA	8,567	9,223	11,160	7,814	7,814	7,803	6,896	5,445
WI	8,076	7,915	9,577	8,076	8,076	7,787	7,818	7,852
WV	19,435	17,815	21,556	15,110	14,464	13,798	12,962	11,711
Total	**413,334**	**313,626**	**379,488**	**374,378**	**367,416**	**358,650**	**321,136**	**279,990**

Green indicates state is meeting CSAPR budget for that scenario
Blue indicates state is meeting CSAPR Assurance Level for that scenario

Mobile Source Requirements

- Tier 2 Light-Duty Vehicle Rule
- Tier 3 Tailpipe and Evaporative Emission and Vehicle Fuel Standards
- Heavy-Duty Engine and Vehicle Standards and Highway Diesel Fuel Sulfur Control Requirements
- Clean Air Non-Road Diesel Rule
- Control of Hazardous Air Pollutants from Mobile Sources
- NOx Emission Standards for New Commercial Aircraft Engines
- Control of Emissions for Non-Road Spark Ignition Engines and Equipment
- Emissions Standards for Locomotives and Marine Compression-Ignition Engines

Stationary Source Requirements

- Area Source Boilers, Major Source Boilers and Commercial/Industrial Solid Waste Incinerators NESHAPs

- Reciprocating Internal Combustion Engines NESHAPs
- Mercury and Air Toxics Standards (Note that this modeling demonstration includes reductions from this rule as implemented by early 2016 when modeling was initiated. Further emissions reductions are expected from that have not been accounted for in this analysis.)
- Regional Haze Regulations and Guidelines for Best Available Retrofit Technology

Emissions Summary

Projected VOC and NOx emissions for 2017 are compared to 2011 base year emissions for all emissions categories in Figure 3.6. Emissions of VOC and NO_X are expected to decrease in the Lake Michigan area and regionally between 2011 and 2017 due to "on-the-books" control measures.

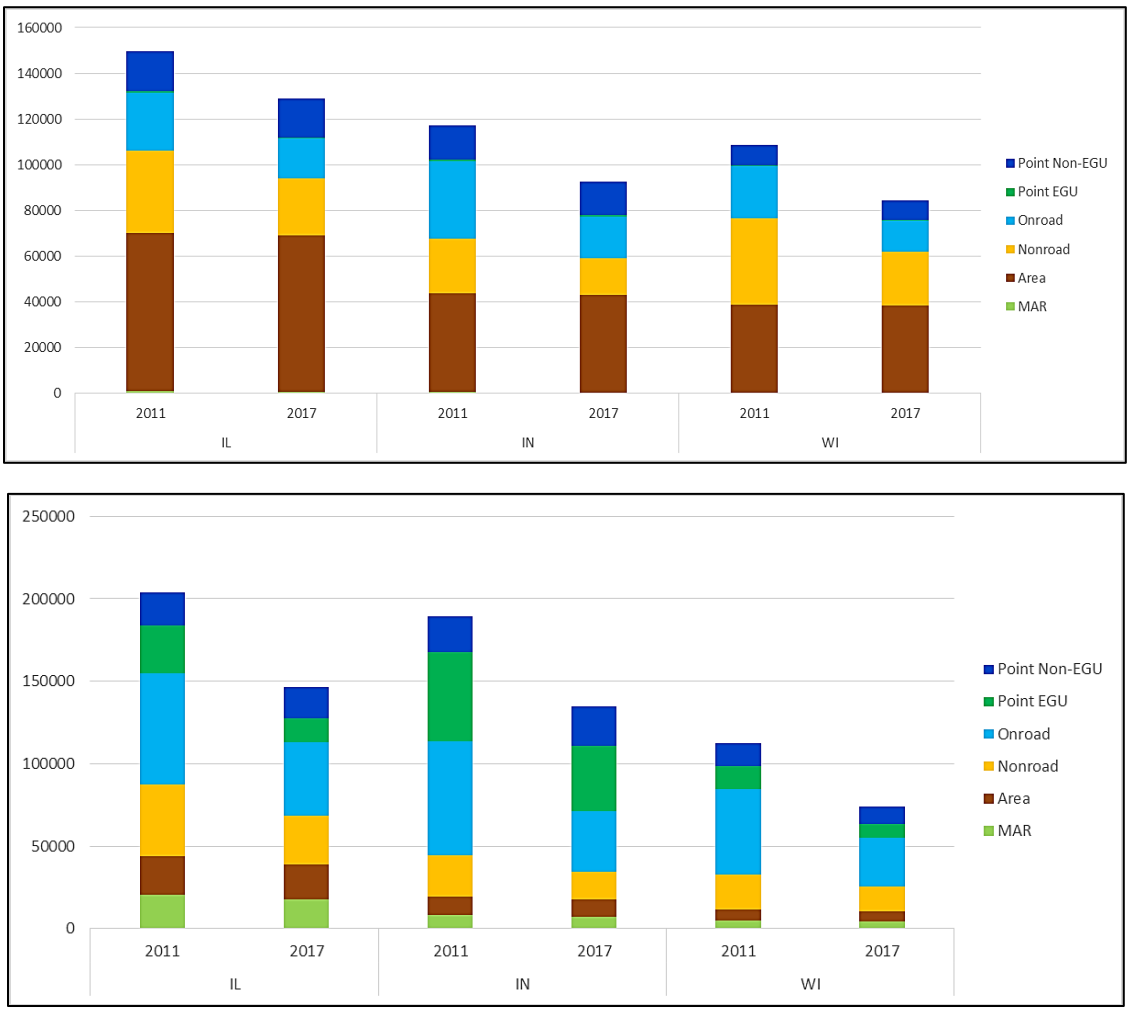

Figure 3.6. Base Year (2011) and Future Year (2017) VOC (top) and NO_X (bottom) Emissions (tons per ozone season).

4.0 Air Quality Modeling

This section reviews the development and evaluation of the modeling system used for the Chicago and Sheboygan ozone attainment test. LADCO, in cooperation with the Illinois EPA, the Indiana DEM, the Wisconsin DNR and U.S. EPA, conducted the modeling assessment described here to support the development of the states' ozone attainment SIPs. The modeling analyses were conducted in accordance with U.S. EPA's attainment demonstration guidelines (U.S. EPA, 2014B).

Selection of Base Year

The calendar year 2011 was selected as the base year for regional ozone modeling, based on the following considerations:

- The 2011 base year is representative of the observed baseline design values for the time period (2008-2010 and 2009-2011) when U.S. EPA established the final air quality designations for the Sheboygan and Chicago areas for the 2008 ozone NAAQS, respectively.
- There are extensive air quality, meteorological, and emissions databases that have been developed for 2011 by U.S. EPA, and others, for regulatory purposes (U.S. EPA, 2015A).
- The 2011 ozone season was fairly typical in terms of meteorology and ozone conduciveness in the Lake Michigan region.

Modeling Platform

The modeling platform consists of emissions and transport models that reflect the spatial and temporal characteristics of the study region. U.S. EPA's modeling guidance details several prerequisites for a model to be used to support an attainment demonstration:

- It should have received a scientific peer review;
- It should be appropriate for the specific application on a theoretical basis;
- It should be used with databases that are available and adequate to support its application; and
- It should be shown to have performed well in past modeling applications.

A summary of the models used in the 2011 modeling platform are shown in Table 4.1.

Table 4.1. 2011 Modeling Platform Components

Model	Type	Managing Organization
WRF	Meteorology	EPA OAQPS
GEOS-CHEM	Global Chemical Transport	EPA OAQPS
SMOKE	Emissions	EPA OAQPS / LADCO
ERTAC	EGU emissions	States, MJOs
CAMx	Regional Photochemical	LADCO

Below is a brief summary of each of the model components:

WRF: The Weather Research and Forecasting (WRF) model was developed collaboratively by the National Center for Atmospheric Research, the National Oceanic and Atmospheric Administration, the Department of Defense's Air Force Weather Agency and Naval Research Laboratory, the Center for Analysis and Prediction of Storms at the University of Oklahoma, and the Federal Aviation Administration, with the participation of university scientists. WRF is a prognostic meteorological model routinely used by U.S. EPA and others for urban- and regional-scale photochemical modeling of $PM_{2.5}$, ozone, and regional haze (U.S. EPA, 2014A).

GEOS-CHEM: Bey et al. (2001) developed the global chemical transport model GEOS-Chem using assimilated meteorological data from the Goddard Earth Observing System (GEOS) of the NASA Global Modeling and Assimilation Office. The model incorporates modules to account for emissions, photochemistry, and deposition. GEOS-Chem is managed by Harvard University and Dalhousie University with support from the U.S. NASA Earth Science Division and the Canadian National and Engineering Research Council.

SMOKE: The SMOKE modeling system is an emissions modeling system that generates hourly gridded, speciated emission inputs of mobile, nonroad, area, point, fire and biogenic emission sources for photochemical grid models. Its purpose is to provide an efficient tool for converting emissions inventory data into the formatted emission files required by an air quality simulation model. For mobile sources, SMOKE actually generates emissions rates based on input mobile-source activity data, using emission factors and outputs from U.S. EPA's MOVES mobile-source emissions model. For EGUs, SMOKE generates hourly emissions based on hourly outputs from the ERTAC EGU Forecast Tool, described below.

ERTAC: ERTAC is a collaborative effort to improve emission inventories among the Northeastern, Mid-Atlantic, Southeastern, and Lake Michigan area states; other member states; industry representatives; and MJOs. ERTAC developed the EGU Forecast Tool for states to use for SIP planning. The tool uses base-year reported EGU data obtained from CAMD and applies growth rates by region and fuel type provided by the EIA to estimate future emissions. The ERTAC EGU Forecast Tool is open-source and has been provided to U.S. EPA.

CAMx: CAMx is a photochemical grid model that is designed for simulating atmospheric transport and chemical transformation of air pollution over urban to regional scales. CAMx is a state-of-the-science open-source air quality model that is computationally efficient with an extensive history of regulatory applications. The selection of CAMx as the primary photochemical grid model is

based on several factors including performance, operational considerations (e.g., ease of application and resource requirements), technical support and documentation, and model extensions (e.g., process analysis, source apportionment, and plume-in-grid).

Meteorological Inputs

Meteorological modeling is an integral part of the modeling platform that provides hourly inputs for the emissions and photochemical models. Ozone modeling requires a full summer of meteorological inputs covering May 1 through September 30, not including model spin-up. Meteorological modeling for the 2011 modeling platform was performed with the Weather Research and Forecast (WRF-ARW V3.4) model operated by U.S. EPA OAQPS. Sea surface temperatures were initialized with a 1km data set from the Group for High Resolution Sea Surface Temperatures (Stammer et al., 2003). The 12km WRF modeling domain is shown in Figure 4.1. LADCO's modeling assessment utilized the WRF meteorological outputs developed by U.S. EPA as described in their Technical Support Document (U.S. EPA, 2014A).

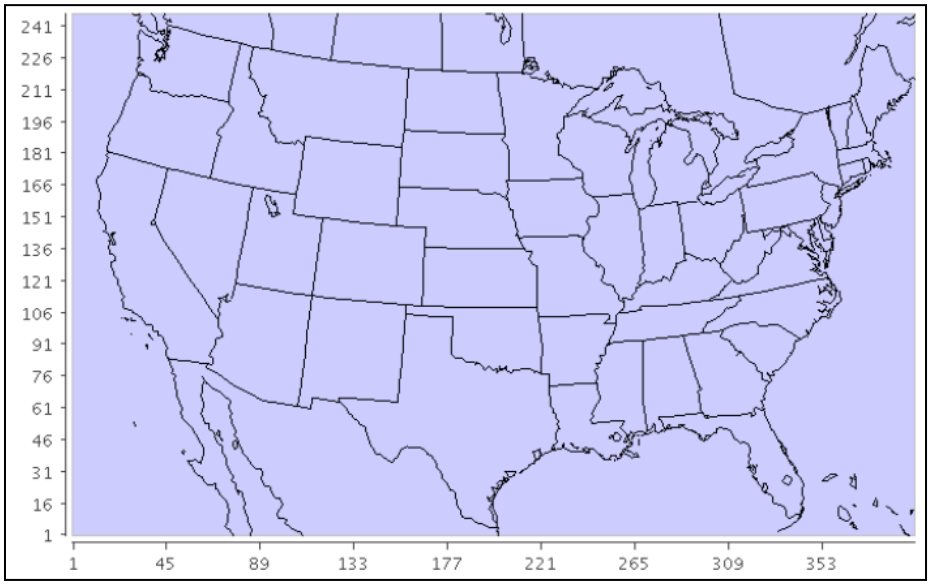

Figure 4.1. Map of WRF Model Domain (U.S. EPA, 2014A)

The 2011 WRF meteorological data has been extensively evaluated on a national scale by U.S. EPA - OAQPS as described in U.S. EPA's Technical Support Document (U.S. EPA, 2014A). A summary of the EPA (2014A) performance conclusions are presented here:

- Surface temperatures are slightly under-predicted, with a slight over-prediction in the early morning hours.

- Wind speeds are slightly over-predicted in the early morning and slightly under-predicted in the evening and night.
- Mixing ratios are generally under-predicted in the central and western US and over-predicted in the eastern states.
- Precipitation is overestimated in elevated terrain such as northern CA and the Pacific Northwest.

Regarding the performance of the WRF meteorological model, U.S. EPA found that, overall, model performance was deemed adequate and an improvement compared with previous meteorological modeling efforts.

Photochemical Model Configuration

Photochemical modeling of criteria air pollutants is performed with the Comprehensive Air quality Model with Extensions (CAMx V6.30[1]). CAMx is commonly used for attainment demonstrations (U.S. EPA, 2014B), has been extensively peer reviewed (Baker and Scheff, 2007; Vizuete et al., 2011), and has performed well in previous applications (Simon et al., 2012).

CAMx is applied following standard procedures recommended by Ramboll-Environ (2015) and U.S. EPA (2014B). Table 4.2 describes the CAMx modeling configuration used by LADCO for this modeling assessment. The model configuration options are based on U.S. EPA's (2016) modeling, although LADCO employed a more recent chemical mechanism (CB6r3).

Table 4.2. CAMx Modeling Configuration

Module	Option
Chemistry Solver	Euler-Backward Iterative
Horizontal Advection Solver	Piecewise Parabolic Method (Colella and Woodward, 1984)
Vertical Diffusion	K-theory
Dry Deposition	Zhang et al. (2003)
Particle Size Distribution	Two-Mode Coarse/Fine (CF)
Chemical Mechanism	CB6r3 (Emery et al., 2015)

Grid Projection and Domain

The 12-km photochemical modeling domain adopted for the 2011 modeling platform is referred to as 12US2 by U.S. EPA and shown in Figure 4.2. There are 25 vertical layers with irregular spacing, finer spacing near the ground and more coarse spacing near the top.

[1] Available at http://www.camx.com/home.aspx

Photolysis Rates

Photolysis rates and ozone columns are provided by the U.S. EPA as part of their 2011 modeling platform.

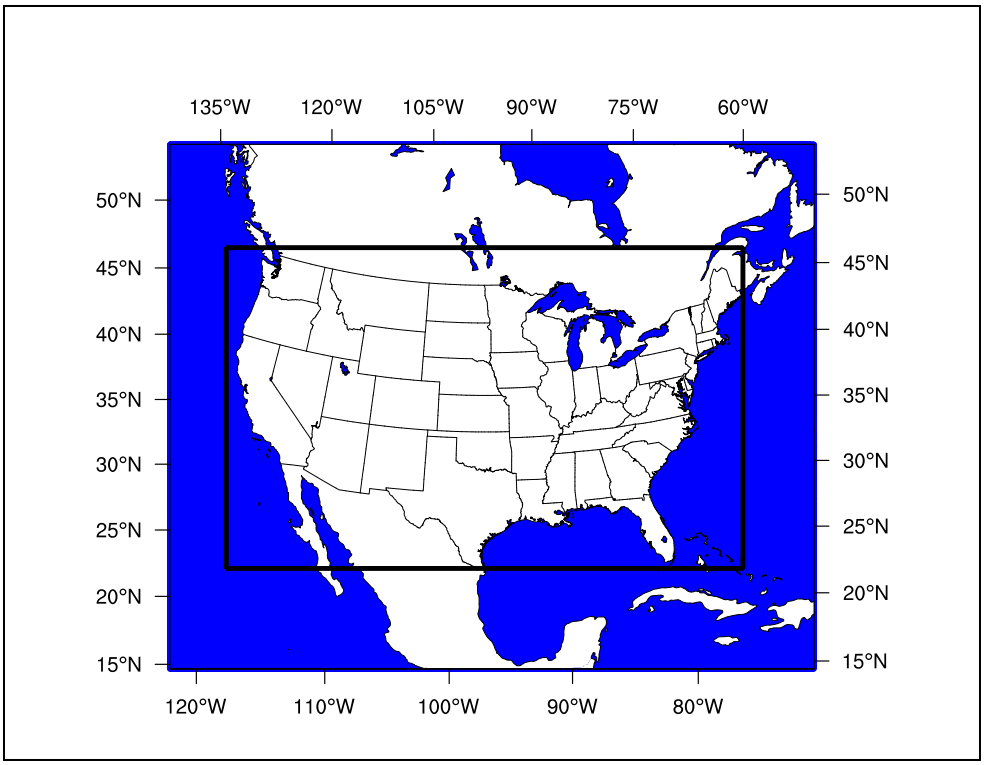

Figure 4.2. Photochemical Modeling Domain (shown in black).

Initial and Boundary Conditions

Initial and boundary conditions are derived from a 2011 global simulation. GEOS-CHEM v8-03-02 is run with 2 x 2.5 degree resolution and up to 38 vertical layers. Global emissions are based on the Emission Database for Global Atmospheric Research with U.S. EPA regional improvements for U.S., Canada, Europe, Mexico, and Asia. See Henderson et al. (2014) for a complete description of the methodology and model evaluation.

Summary of Model Performance Evaluation

LADCO evaluated the 2011 base case modeling to assess the model's ability to reproduce observed ozone and precursor concentrations regionally and in the Lake Michigan area. The model performance evaluation examines the platform's ability to replicate the magnitude, spatial, and temporal pattern of measured concentrations. This exercise is intended to assess whether confidence in the model is warranted and, if so, to what degree. Model performance is assessed by comparing paired modeled and monitored concentrations. Graphical (e.g., spatial plots) and statistical analyses are

presented. Consistent with U.S. EPA's modeling guidance, no rigid acceptance/rejection criteria are used for this study. The model performance results presented here describe how well the model replicates observed ozone concentrations and ozone precursors.

LADCO conducted a performance evaluation of the 2011 modeling platform using ambient monitoring data from the Air Quality System (AQS). The AQS comprises a national database of ambient air pollution including criteria pollutants and particulates. A variety of statistics including mean observed, mean modeled, mean bias, mean error, mean fractional bias, mean fractional error, and correlation coefficient are calculated at each monitor site. A summary of these analyses are provided below. The complete performance evaluation is contained in Appendix A.

Maps of average observed and predicted maximum daily 8-hour ozone (MDA8) considering observations above 60 ppb are shown for the Lake Michigan region and the Midwest in Figures 4.3 and 4.4, respectively. Comparing the two figures, the model performs well in reproducing the locations and magnitudes of elevated ozone concentrations overall, although it is noted that CAMx predicts higher MDA8 at some sites in eastern Wisconsin along the Lake Michigan shoreline.

The performance evaluation uses statistical metrics to evaluate how well the model reproduces ozone measurements. Model "error" is an absolute measure of the deviation or difference between modeled concentrations and observed values, while bias shows the direction of deviation. A positive bias indicates that the model over-predicts observed concentrations, while a negative bias indicates that the model under-predicts. U.S. EPA's modeling guidance does not specify rigid acceptance/rejection criteria for model performance, although ozone model performance is generally considered good if bias is within 15% (positive or negative) and error is within 30%. Simon & Baker (2012) present a thorough discussion and summary of regional modeling performance statistics.

Figure 4.5 depicts the spatial distribution of the model's fractional bias for the Lake Michigan region and the Midwest. The model's bias is within 15% at virtually all locations in the Lake Michigan region and in the Midwest, which is less than the 20% fractional bias reported Simon et al (2012) for past modeling studies.

As shown in Figure 4.6, the mean fractional error is within 20% at most locations in the Midwest. Monitoring sites near Lake Michigan exhibit higher mean fractional error than at other Midwestern locations, likely due to the complexity of the meteorology in the nearshore environment. However, the mean fractional error is still within 20% at all locations near Lake Michigan, which is within the range of 15-30% fractional error reported by Simon et al (2012) for past modeling studies.

The Pearson Correlation Coefficient (*r*) is a measure of the linear dependence between two variables, with a value of 1 indicating perfect correlation and a value of -1 indicating anti-correlation. Overall, the modeled MDA8 ozone is well correlated with observations (Figure 4.7), which indicates that daily increases and decreases predicted by the model

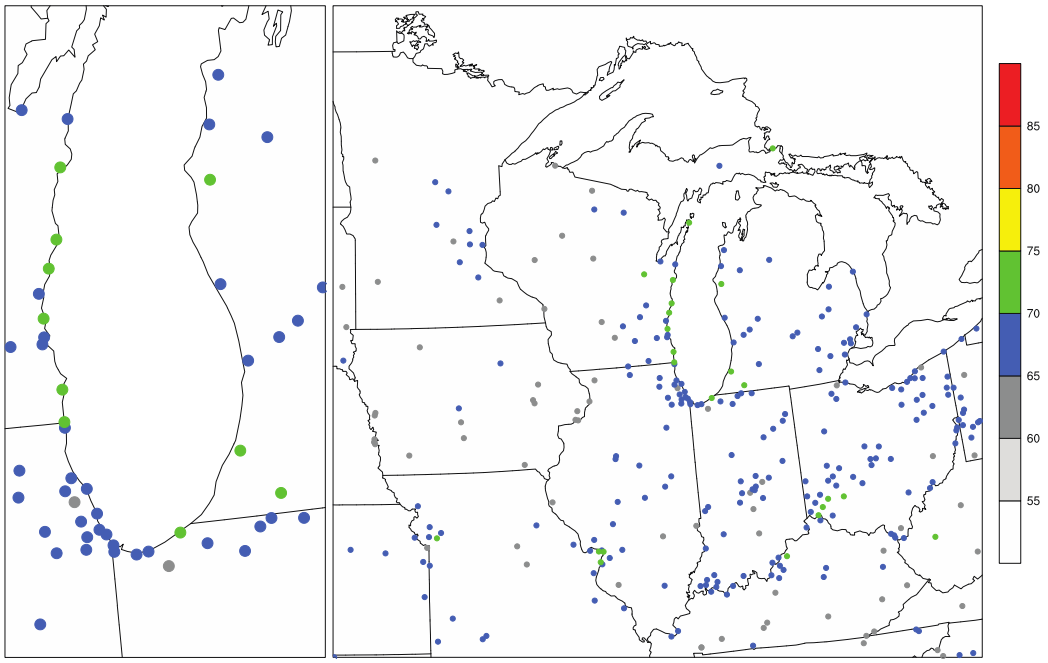

Figure 4.3. 2011 Mean Observed MDA8 Ozone (ppb) with a 60 ppb Ozone Threshold

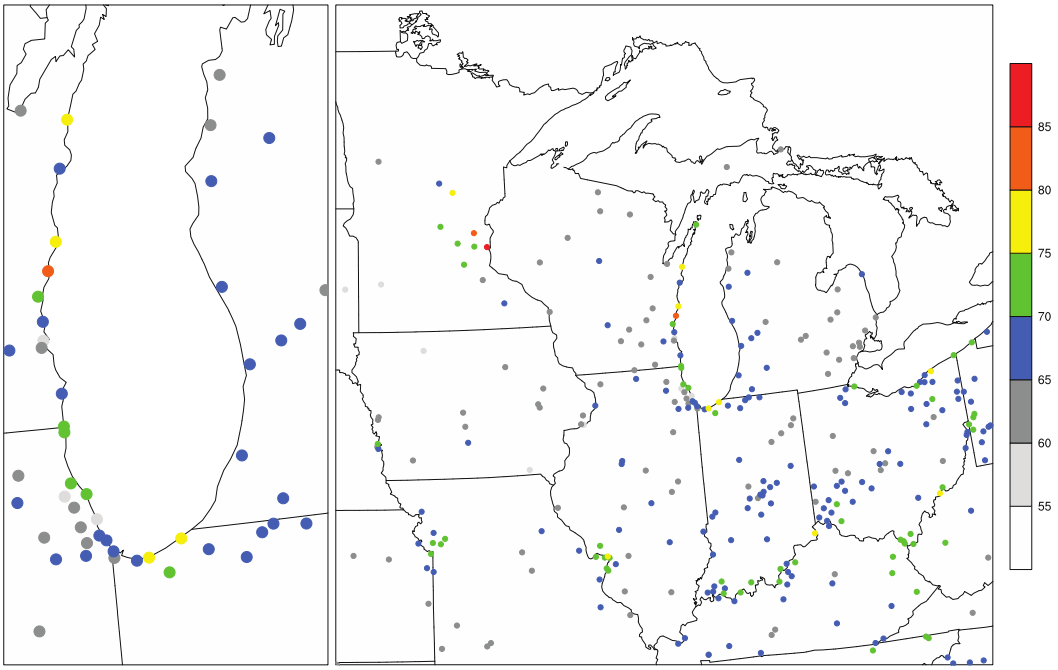

Figure 4.4. 2011 Mean CAMx Predicted MDA8 Ozone (ppb) with a 60 ppb Ozone Threshold.

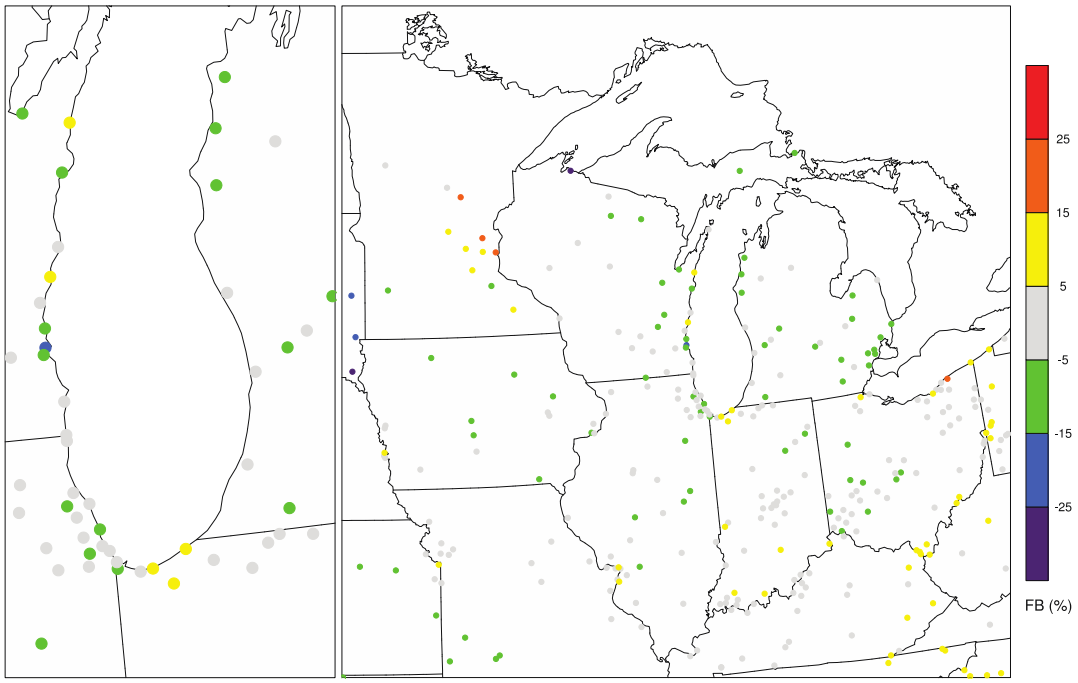

Figure 4.5. 2011 Mean Fractional Bias of MDA8 Ozone (ppb) with a 60 ppb Ozone Threshold

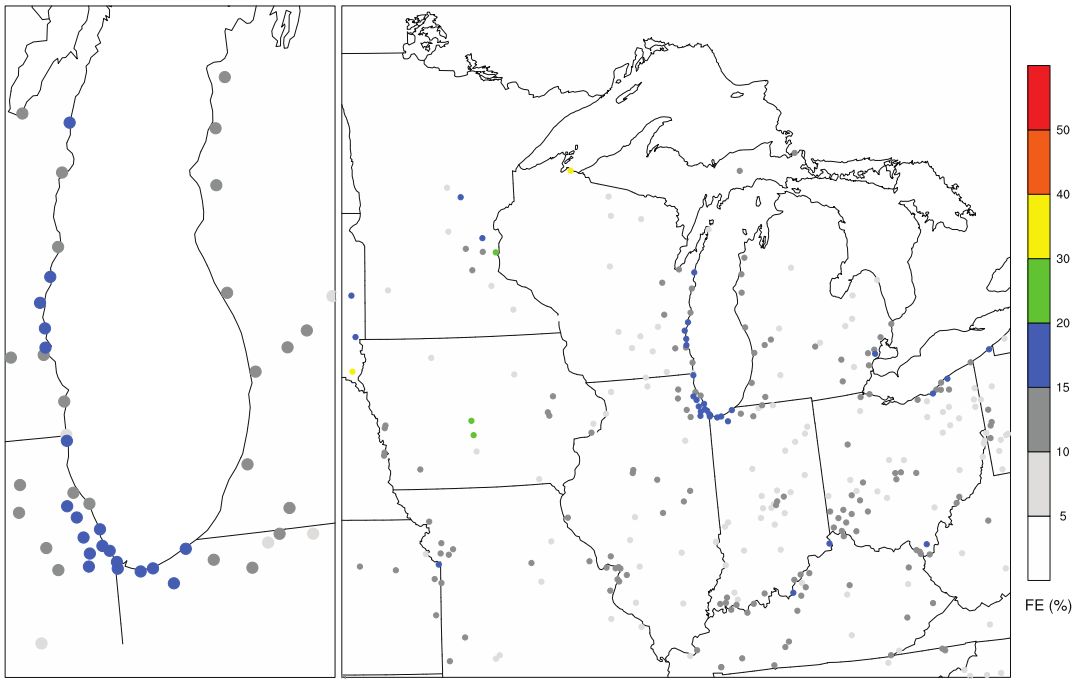

Figure 4.6. 2011 Mean Fractional Error of MDA8 Ozone (ppb) with a 60 ppb Ozone Threshold

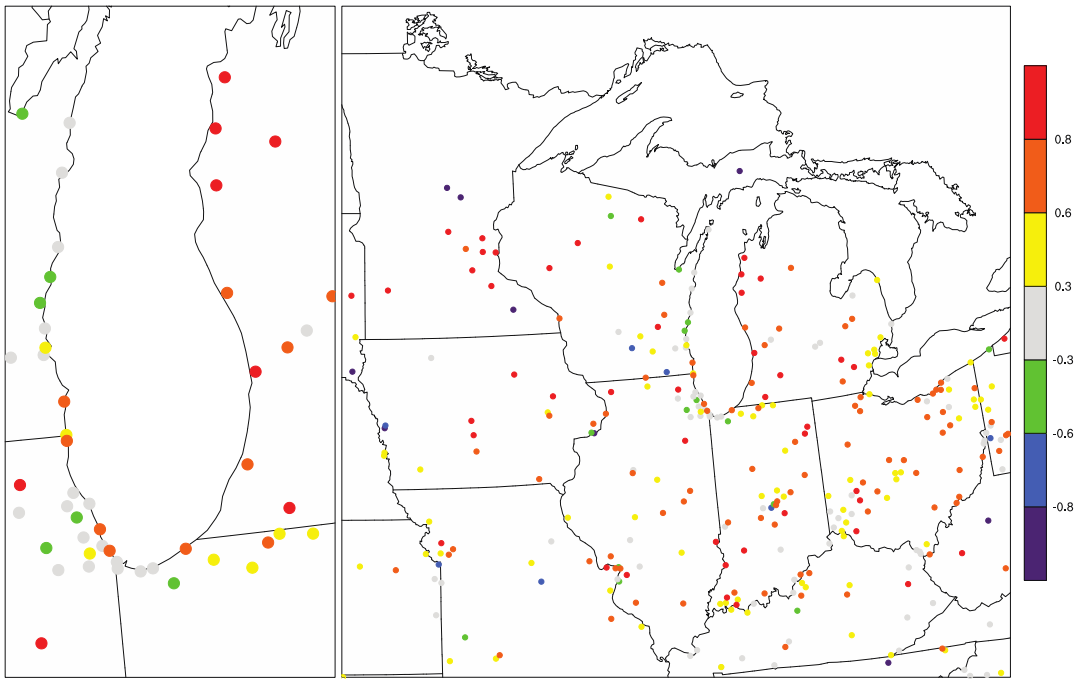

Figure 4.7. 2011 Pearson Correlation Coefficient of MDA8 Ozone (ppb) with a 60 ppb Ozone Threshold

track well with observations. Not all monitors are well correlated with modeling results; some monitors exhibit a low or even negative correlation. The model is not expected to perform perfectly at every individual monitor. Simon et al (2012) reported values ranging from 0.2 to 0.75 for MDA8 ozone.

One easy way to summarize model performance and compare it to the performance goals is through the use of box plots. Box plots summarizing fractional error and fractional bias aggregated by month are shown in Figures 4.8 and 4.9 for the LADCO states and selected cities in the LADCO region, respectively. The dotted lines show performance criteria goals defined from ranges of performance statistics reported by Simon et al (2012). Generally, the modeling results fall within the performance goals, since the model's bias is less than 10% and the model's mean error is less than 20% for most areas. Some sites exhibit strongly positive or negative bias during the months of May and September when there are fewer ozone episodes. The performance of the model in LADCO states is similar to national model performance, although the model tends to have a slightly negative bias predicting MDA8 ozone. This finding is consistent with past modeling studies (Simon et al, 2012).

Focusing on the lakeshore nonattainment sites, time series of modeled and monitored MDA8 ozone for the 2011 ozone season are shown in Figures 4.10 and 4.11 for the monitors at Chiwaukee Prairie and Sheboygan. The modeled values for MDA8 ozone are of similar magnitudes as the measured values and follow temporal variations well. While the model generally under-predicts MDA8 ozone, as described above, the

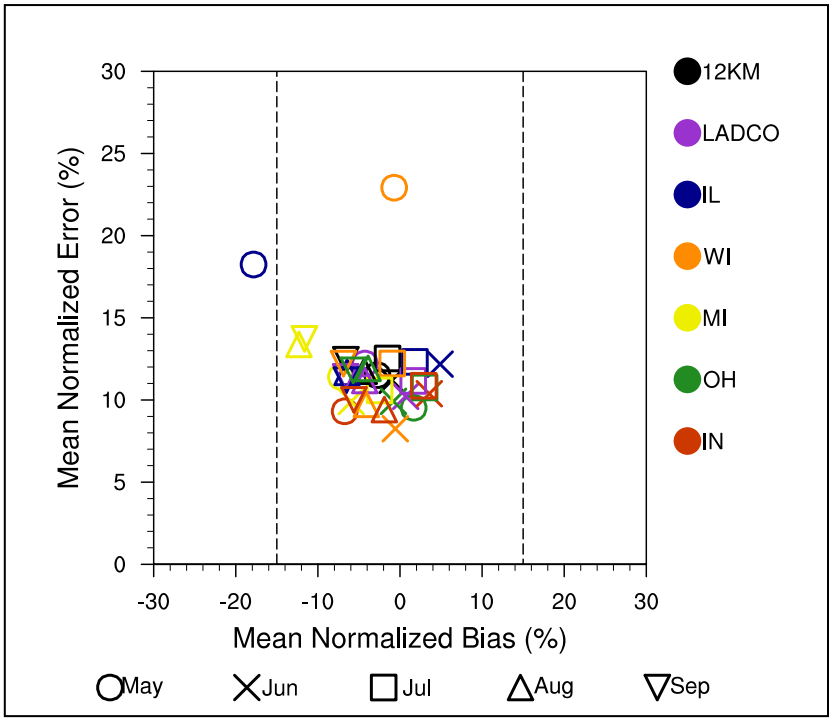

Figure 4.8. MDA8 Ozone Model Performance by Month for the LADCO States, LADCO Aggregated (purple), and National Average (black)

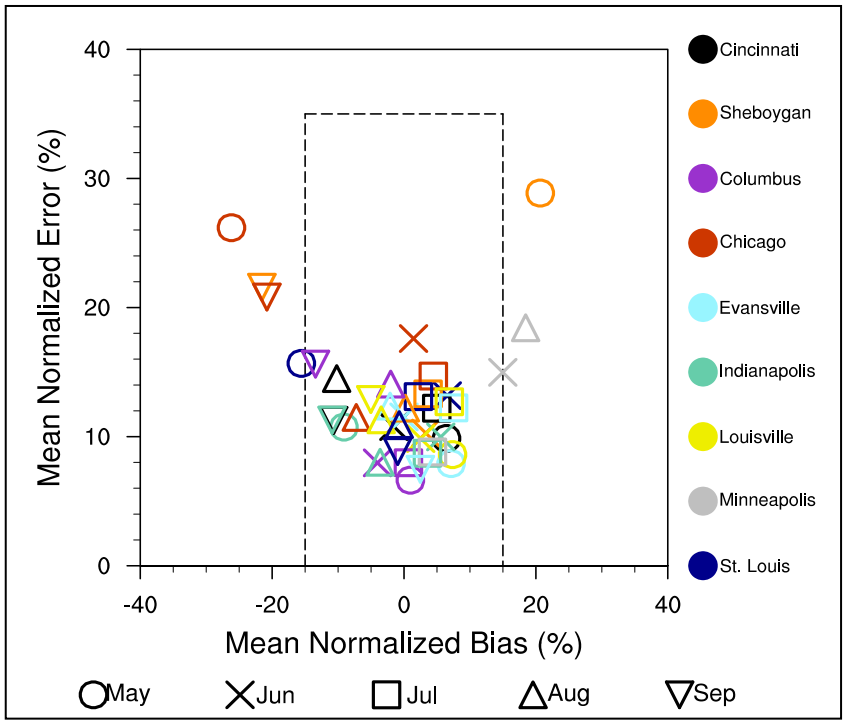

Figure 4.9. MDA8 Ozone Model Performance for Selected Cities in the LADCO Region

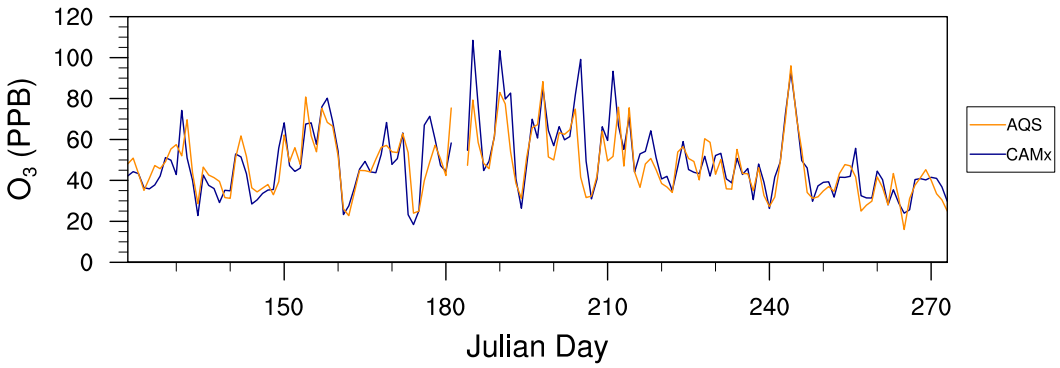

Figure 4.10. MDA8 Ozone Showing Monitoring and Modeling in Chiwaukee Prairie, WI (AQS site ID 550590019)

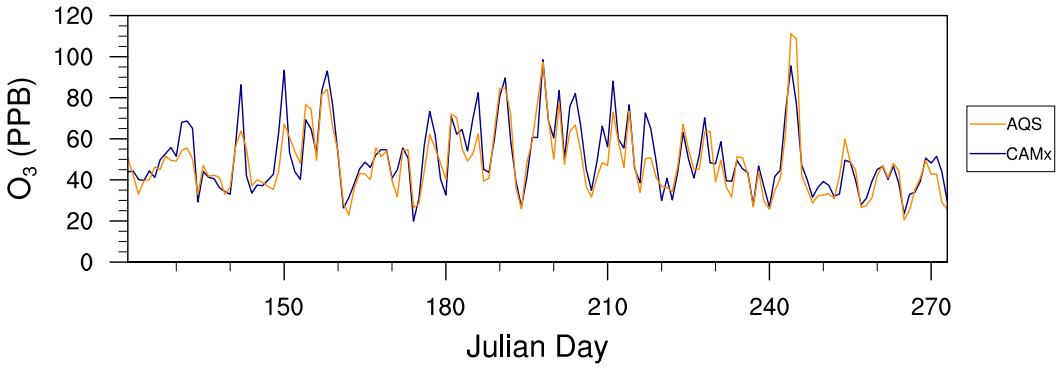

Figure 4.11. Time Series Comparing Observed and Predicted MDA8 Ozone in Sheboygan, WI (AQS site ID 551170006)

Sheboygan and Chiwaukee monitors exhibit a slight over-prediction of MDA8 ozone as shown in Figures 4.10 and 4.11, respectively.

As discussed, U.S. EPA's modeling guidance does not specify rigid acceptance/rejection criteria for model performance, although ozone model performance is generally considered good if bias is within 15% (positive or negative), error is within 30%. The performance of the 2011 modeling platform meets these metrics, both in the Lake Michigan area and in the wider region. This modeling is an improvement over past modeling studies (Simon et al, 2012) and is acceptable for supporting the states' attainment SIPs.

Modeled Attainment Test

An attainment demonstration based on air quality modeling is used to determine whether identified emissions reduction measures are sufficient to reduce projected pollutant concentrations to a level that meets the NAAQS by the statutory deadline

established by U.S. EPA. This modeling analysis uses 2017 as the projection year to demonstrate attainment of the 2008 ozone NAAQS. As described previously in Section 3, LADCO and U.S. EPA developed emissions scenarios for 2017 representing on the books control measures, including CSAPR. These scenarios are evaluated using the CAMx model to determine the likelihood that the 2008 ozone NAAQS will be achieved in the Lake Michigan region in 2017.

LADCO performed this modeling assessment consistent with the draft guidance issued by U.S. EPA in 2014 (U.S. EPA, 2014B). LADCO has estimated the amount of emission reductions expected by 2017 and has applied the CAMx photochemical model to simulate both base year and future year ozone concentrations. In this section, the application of U.S. EPA's "model attainment test" for the ozone nonattainment areas in the Lake Michigan region is described.

The model attainment test uses model estimates in a relative sense to estimate future year design values. U.S. EPA's Air Quality Modeling Group has developed the Modeled Attainment Test Software (MATS[2]) for this purpose. The MATS software computes the fractional changes, or relative response factors of ozone concentrations at each monitor location using results of the model base year and the future year. Meteorological conditions are assumed to be unchanged for the base and projection years. The resulting estimates of future ozone design values are then compared to the NAAQS. If the future ozone design values are less than or equal to the NAAQS, then the analysis suggests that attainment will be reached.[3]

LADCO has used the MATS software according to U.S. EPA's recommended approach (U.S. EPA, 2014B). All modeling results are time shifted to local time to be consistent with monitoring measurements. It should be noted that the modeled attainment test calculates the baseline 2011 design value differently than the method used for calculating the monitored design values shown previously in Table 2.1 (which are three-year averages). U.S. EPA's MATS software calculates the baseline 2011 design value by averaging three successive three-year design values centered on 2011 (2009-2011, 2010-2012, 2011-2013). The baseline 2011 design values are therefore weighted averages using ambient data from 2009-2013 at each location (Abt Associates, 2014).

Table 4.3 summarizes the results of the model attainment test for the 2017 future year that includes ERTAC EGU emissions for 2017 ("LADCO 2017 Base") and LADCO's projection of the impact of U.S. EPA's CSAPR Update Rule ("LADCO 2017 with CSAPR"). Also shown in the table are the 2017 ozone design values projected by U.S. EPA ("EPA 2017"). Baseline 2011 design values for monitoring sites in the Chicago and Sheboygan nonattainment areas are compared to the 2017 design values projected for

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[2] Available at http://www.epa.gov/scram001/modelingapps_mats.htm

[3] It is noted that U.S. EPA is developing new software to replace MATS for performing modeled ozone attainment tests. This new software is called the Software for the Modeled Attainment Test - Community Edition (SMAT-CE). However, the SMAT-CE software is still being tested by U.S. EPA and has not yet been released to the public. Accordingly, LADCO relied on the MATS software (v2.6.1), which is readily available.

each 2017 scenario. While the LADCO projections are generally consistent with U.S. EPA's projections, some of the monitors show higher or lower values. This difference is mostly caused by two factors: 1) differences in model versions (U.S. EPA used CAMx v6.11 and LADCO used CAMx v6.30), and 2) differences in emissions (LADCO used ERTAC for EGU emissions and U.S. EPA used IPM, and LADCO used ENVIRON's MOVES modeling results for onroad emissions).

As shown in Table 4.3, all monitoring locations in the Chicago ozone nonattainment area are projected to meet the level of the 2008 ozone NAAQS (75 ppb) by 2017. The monitor in Sheboygan, WI (AQS site 551170006) is not projected to attain, however, at the emissions levels evaluated.

Table 4.3. Projected Ozone Design Values (ppb) for 2017 in the Chicago and Sheboygan Ozone Nonattainment Areas

AQS ID	State	County	LADCO 2017 Base	LADCO 2017 w/ CSAPR	EPA 2017
170310001	Illinois	Cook	66.5	66.3	67.5
170310032	Illinois	Cook	64.7	64.5	63.7
170310064	Illinois	Cook	59.4	59.2	58.4
170310076	Illinois	Cook	66.1	65.9	67.0
170311003	Illinois	Cook	55.2	55.1	55.9
170311601	Illinois	Cook	65.8	65.5	66.4
170314002	Illinois	Cook	59.0	58.8	57.9
170314007	Illinois	Cook	54.0	53.9	54.1
170314201	Illinois	Cook	62.2	62.1	62.3
170317002	Illinois	Cook	60.4	60.3	61.2
170436001	Illinois	DuPage	61.3	61.0	61.8
170890005	Illinois	Kane	66.0	65.8	66.5
170971007	Illinois	Lake	64.9	64.8	65.0
171110001	Illinois	McHenry	64.7	64.4	65.2
171971011	Illinois	Will	58.2	58.0	58.9
180890022	Indiana	Lake	59.2	59.0	60.2
180890030	Indiana	Lake	61.2	61.0	61.3
180892008	Indiana	Lake	59.7	59.6	59.8
181270024	Indiana	Porter	62.2	62.0	62.5
181270026	Indiana	Porter	58.0	57.9	58.4
550590019	Wisconsin	Kenosha	66.5	66.4	66.7
551170006	Wisconsin	Sheboygan	76.4	76.1	77.0

Weight of Evidence Support for Attainment

U.S. EPA (2014B) recommends accompanying all modeling attainment demonstrations with additional supplemental analysis. Supplemental analysis can be used to support conclusions or provide information contrary to the model test. The following weight of evidence analyses are provided to support the conclusion that the Chicago and Sheboygan area will meet the ozone NAAQS by 2017.

The ERTAC EGU Projection Tool is conservative

The ERTAC EGU Projection Tool is conservative, and by design will likely overestimate future year EGU emissions. As described previously, the ERTAC tool does not use an economics model to forecast future utilization of generating units beyond the forecasts provided by EIA. Economic models attempt to anticipate responses in this sector to future regulatory mandates (such as the Clean Power Plan, and the CSAPR Update Rule) or anticipated fuel prices (especially future prices of natural gas). As a result, economic models, including U.S. EPA's Integrated Planning Model (IPM), predict future controls (if a minimum installation time exists within the forecast), unit shutdowns and fuel conversions that may or may not occur. Figure 4.12 depicts projected EGU

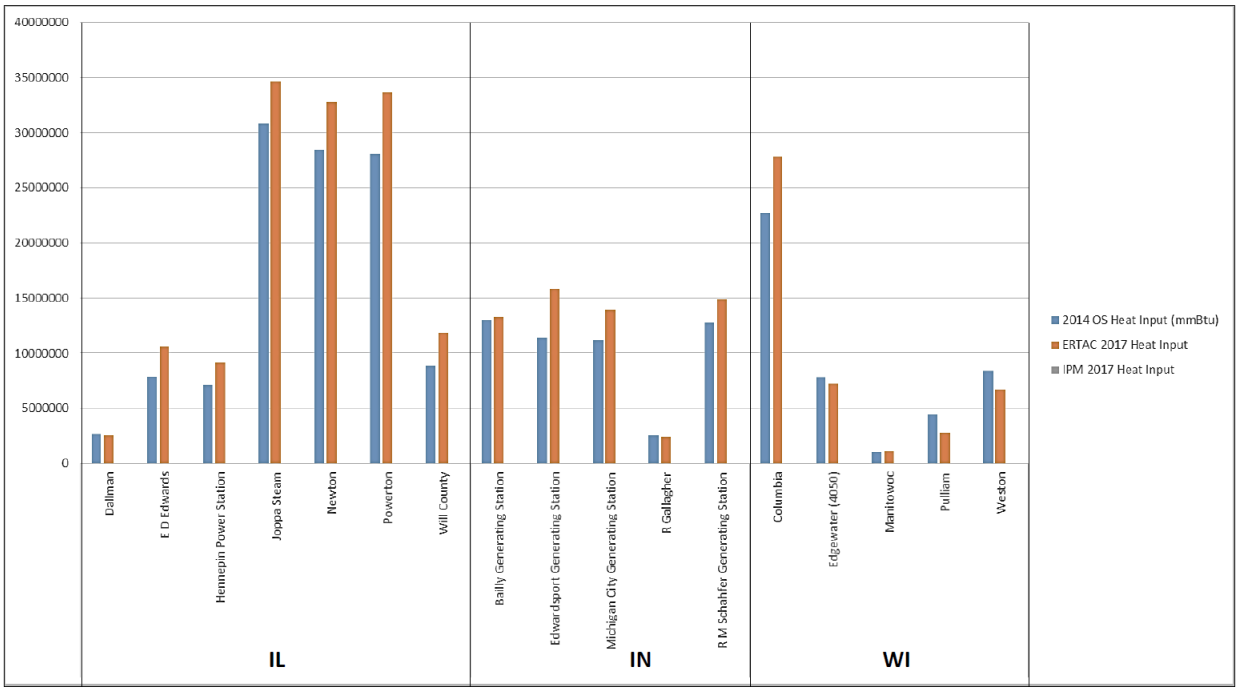

Figure 4.12. Coal Utilization (heat input) Projected by the ERTAC EGU Projection Tool for Power Plants in the LADCO States that IPM Projects to be Shut Down by 2017.

utilization (heat input) for coal-fired power plants in the LADCO states that were projected to shut down in 2017 by IPM but are projected by ERTAC to be still in

operation. The ERTAC EGU Projection Tool only incorporates new controls, unit shutdowns and fuel conversions that have been identified by the states based on commitments made by the utilities and vetted by state staff, and is therefore more conservative than economics models that are anticipating the effects of future regulatory requirements and fuel prices.

Figure 4.13 illustrates these differences for 2017. As shown, NO_X emission projections are consistently higher from ERTAC than from IPM for virtually every state in the region. It follows then the air quality modeling using emissions projected by the ERTAC EGU Projection Tool will be more conservative than modeling based on emissions derived from IPM.

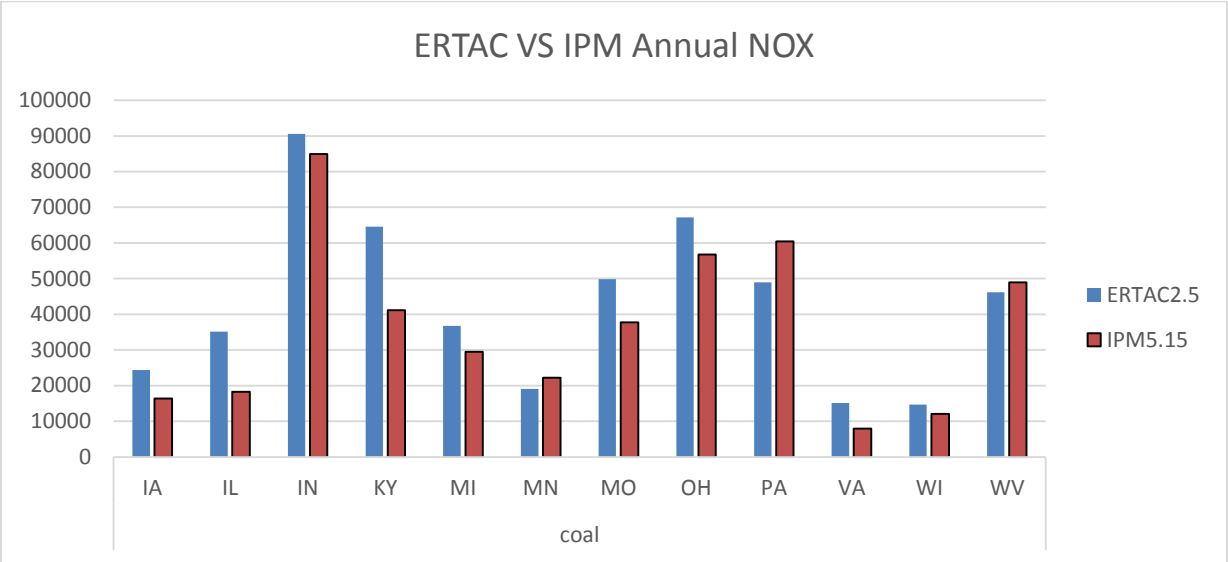

Figure 4.13. Comparison of ERTAC and IPM 2017 NOx Emissions (tons per year)

EIA's forecasts overestimate coal utilization

As mentioned previously, the ERTAC EGU Projection Tool bases projected generation by fuel type on the AEO forecasts provide by EIA. However, EIA's forecasts have historically overestimated the amount of coal expected to be used for generating electricity in future years. Figure 4.14 compares EIA's AEO projections for successive years beginning in 2008. As shown in the figure, EIA has lowered its coal generation forecast each year to account for decreases in coal utilization that actually occurred (shown in solid blue line). Given this inherent bias in EIA's projections, it is likely that the current EIA projection of coal-based electric generation will overestimate coal use in future years. Since the ERTAC EGU Projection Tool incorporates the EIA projection, it follows that projected NO_X emissions from EGUs that are based on this forecast will be conservative.

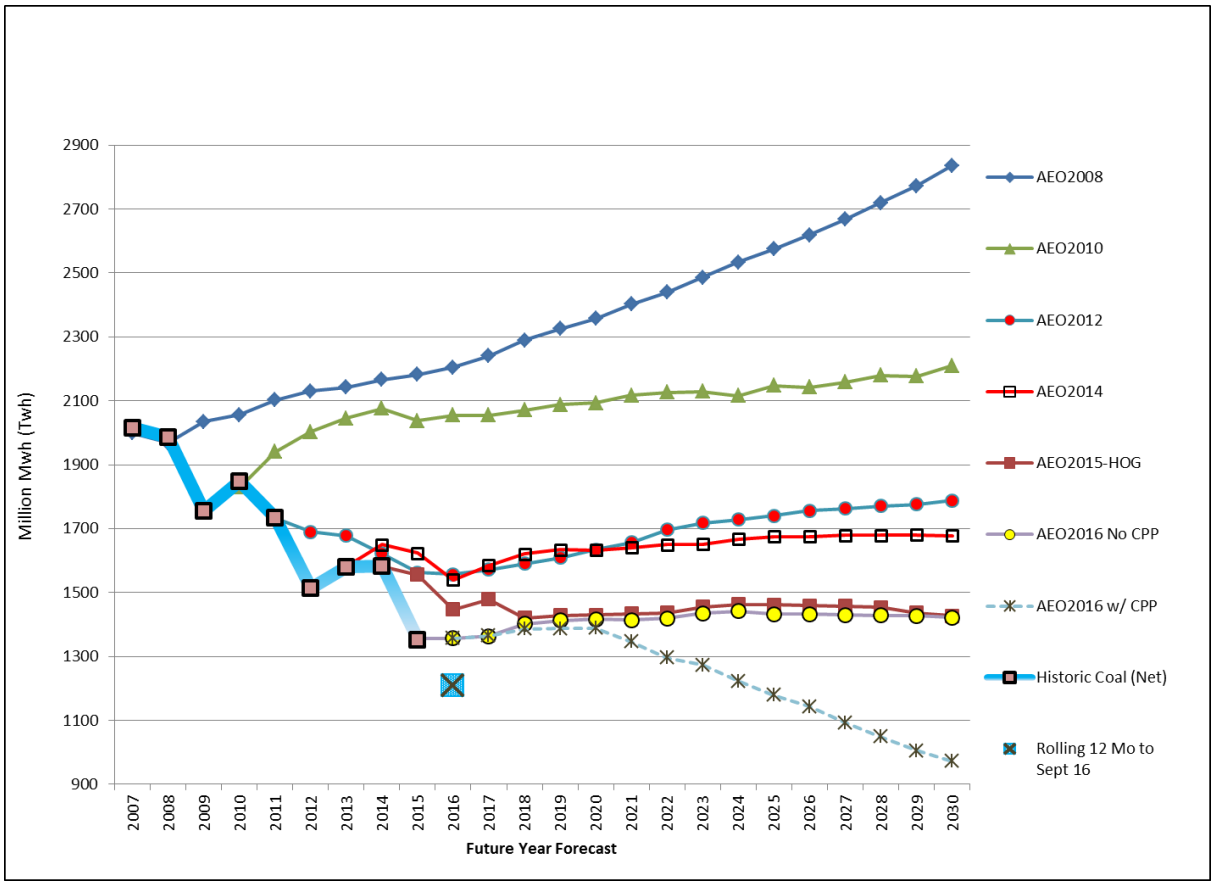

Figure 4.14. Downward Trend in U.S. Coal Net Generation Forecasts from EIA, 2008-2016.

U.S. EPA's regional modeling for 2017 showed that Chicago is expected to attain by 2017

U.S. EPA conducted modeling in 2015 in support of regulatory initiatives regarding the revised ozone NAAQS and interstate transport (for Good Neighbor SIPs/FIPs). (EPA, 2015B) As shown previously in Table 4.3, U.S. EPA's modeling indicates the likelihood that the Chicago area, including Kenosha County, will attain the 2008 ozone NAAQS by the 2017 attainment deadline. U.S. EPA's modeling does not indicate that the Sheboygan monitor will attain by 2017 without further emissions reductions beyond those included in their analysis.

Some emission reductions are expected to occur but have not been included

In addition to the Federal "on-the-books" control measures listed in Section 3, the states have adopted a number of state rules during recent years that require or will require emission reductions from sources of ozone precursors VOC and NOx. These rules will provide emissions reductions between 2011 (base year) and 2017 (attainment year). These measures have not been included in the modeling but are expected to improve

ozone air quality in Chicago and Sheboygan. Such measures include:

- Consumer products and AIM requirements in Illinois and Indiana
- Stage II removal and low permeable hose requirements
- Certain shutdowns and restrictions that have occurred since development of the attainment modeling
- Illinois' NOx regulations for ozone nonattainment areas

Alternate MATS Inputs Yield Range of Future Year Design Values

LADCO has used the MATS software according to U.S. EPA's recommended approach (U.S. EPA, 2014B). As mentioned previously, MATS calculates the baseline 2011 design value differently than the method used for calculating the monitored design values (which are three-year averages). U.S. EPA's MATS software calculates the baseline 2011 design value by averaging three successive three-year design values centered on 2011 (2009-2011, 2010-2012, 2011-2013). The baseline 2011 design values are therefore weighted averages using ambient data from 2009-2013 at each location.

LADCO evaluated the sensitivity of the 2017 projections to an alternate methodology of representing the 2011 baseline design values. Rather than using the five-year weighted average baseline value for 2011, LADCO used MATS to calculate the 2017 design values at key monitoring sites using the actual (three-year) 2011 design values for 2009-2011, 2010-2012, and 2011-2013. The results of this evaluation for the "2017 LADCO Base" and the "2017 LADCO with CSAPR" scenarios are shown in Table 4.4. The results demonstrate the sensitivity of the future year projections to the 2011 ozone baseline design values used in MATS. As described in Section 2, 2012 was a warmer than average summer throughout the Midwest and was very conducive to the production of ozone. Conversely, 2009 and 2010 were cooler than average years and were not as ozone-conducive as 2012. As shown in Table 4.4, the 2011 baseline values which include 2012 (2010-2012 and 2011-2013), yield higher 2017 projected design values than does the 2009-2011 baseline value.

All Chicago area monitors are projected to attain using the alternate methodologies for projecting 2017 ozone design values. Sheboygan is projected to attain based on the 2009-2011 baseline.

Table 4.4. Projected Ozone Design Values (ppb) for 2017 Assuming Alternate 2011 Baseline Design Values

	2017 LADCO Base			2017 w/ CSAPR		
2011 Baseline	**Kenosha**	**Sheboygan**	**Zion**	**Kenosha**	**Sheboygan**	**Zion**
2009-2011	63.2	73.4	62.2	63.1	73.1	62.1
2010-2012	69.0	78.8	67.1	68.8	78.5	67.0
2011-2013	67.3	77.0	65.5	67.2	76.7	65.4

5.0 Conclusions

To support the development of ozone attainment SIPs for the States of Illinois, Indiana, and Wisconsin, LADCO conducted technical analyses including preparation of regional emissions inventories and meteorological modeling data, evaluation and application of a regional chemical transport model, and review of ambient monitoring data.

Analyses of monitoring data were conducted to produce a conceptual model, which is a qualitative summary of the physical, chemical, and meteorological processes that control the formation and distribution of pollutants in a given region. Key findings of the analyses include:

- Ozone monitoring data following the 2008 revision of the ozone NAAQS (2008-2010 and 2009-2011) showed some sites in and downwind of the Chicago metropolitan area to be in violation of the revised standard of 75 parts per billion (ppb).

- Historical ozone data generally show a downward trend in the region, and most sites are currently meeting the 2008 NAAQS.

- Ozone concentrations are strongly influenced by meteorological conditions, with a higher number of ozone days and higher ozone levels during summers with above normal temperatures. Ozone concentrations in the Lake Michigan region are also influenced by local-scale wind circulations (lake breezes) which cause elevated concentrations at shoreline sites and decreasing concentrations at locations further inland.

- Inter- and intra-regional transport of ozone and ozone precursors affects the Lake Michigan region, and can be a principal cause of nonattainment in some areas far from population or industrial centers.

An air quality modeling platform was developed to evaluate the adequacy of current and potential emission reduction strategies needed to demonstrate attainment of the 2008 ozone NAAQS by the 2017 ozone season. LADCO conducted modeling for the base year 2011 to evaluate model performance (i.e., assess the model's ability to reproduce the observed concentrations). Model performance for ozone is considered to be adequate to support the states' attainment SIPs.

Future year strategy modeling was conducted to determine whether existing ("on the books") controls would be sufficient to provide for attainment of the 2008 8-hour ozone standard and, if not, what additional emission reductions would be necessary for attainment. Based on the modeling and other supplemental analyses, the following general conclusions can be made:

- Existing controls are expected to produce significant improvement in ozone concentrations between 2011 and 2017.

- Modeling demonstrates that all monitoring sites in the Chicago nonattainment area, including sites in northwest Indiana, northeast Illinois, and southeast Wisconsin, are expected to meet the 2008 ozone air quality standard by the 2017 ozone season.

- Modeling indicates that one site in eastern Wisconsin, in Sheboygan County, may not meet the 2008 8-hour ozone standard by the 2017 ozone season. This finding of limited residual nonattainment for ozone is consistent with current (2014-2016) monitoring data which continues to show ozone concentrations above the NAAQS in this area (e.g., ozone design values on the order of 76-79 ppb). It is noted that the modeling analysis is, by design, conservative and that air quality in future years may be better than the modeling indicates.

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Appendix A
Model Performance Evaluation

Appendix A: Extended Model Performance Evaluation

This section presents additional model performance analysis. Maps of performance at individual monitors showing mean error and mean bias with an observed 60 ppb MDA8 O_3 threshold are shown in figures A.1 and A.2, respectively.

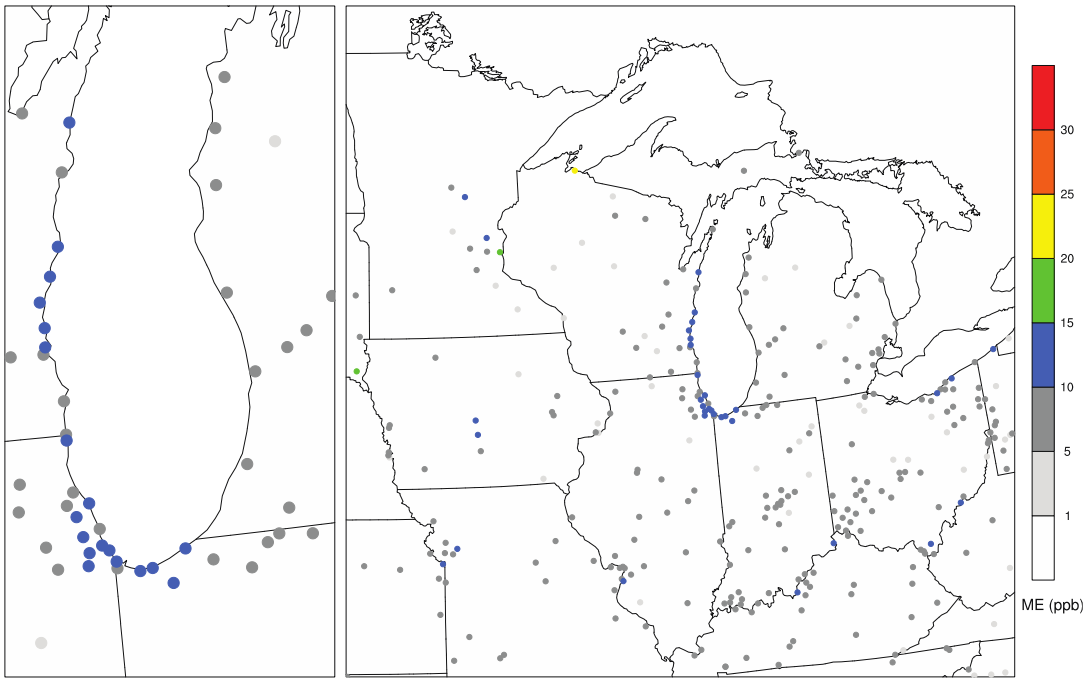

Figure A.1. 2011 mean error of MDA8 ozone (ppb) with a 60 ppb ozone threshold.

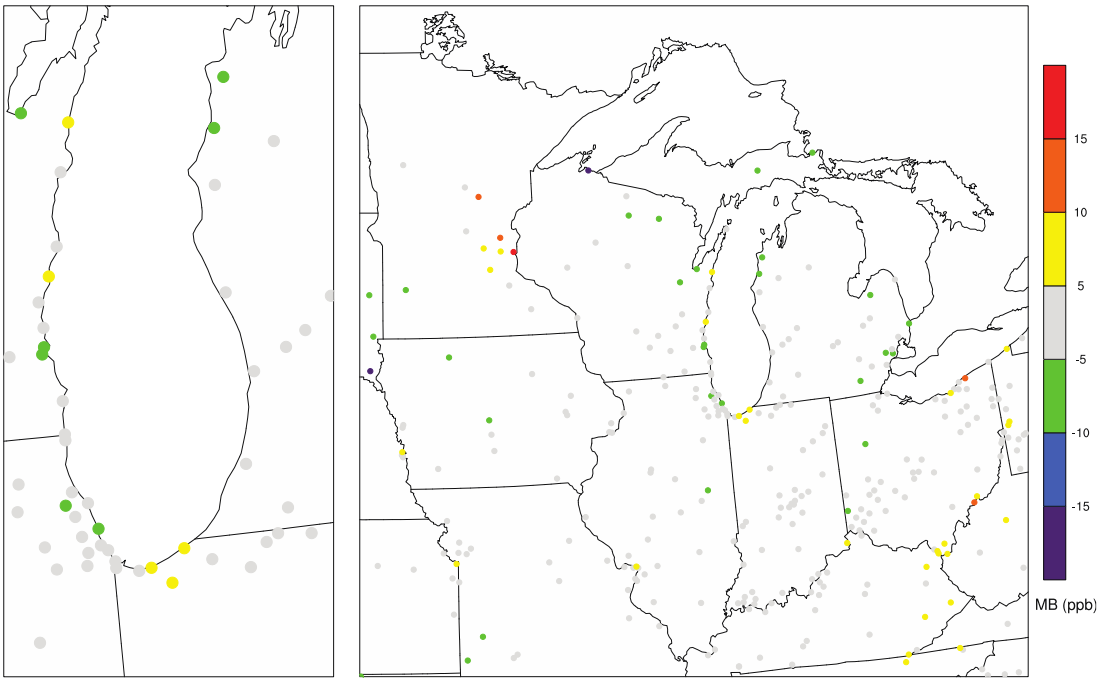

Figure A.2. 2011 mean bias of MDA8 ozone (ppb) with a 60 ppb ozone threshold.

Maps of MDA8 O_3 performance at individual monitors showing mean observed, mean modeled, mean bias, fractional bias, mean error, fractional error, and correlation coefficient with an observed 75 ppb MDA8 O_3 threshold are shown in figures A.3 through A.9, respectively.

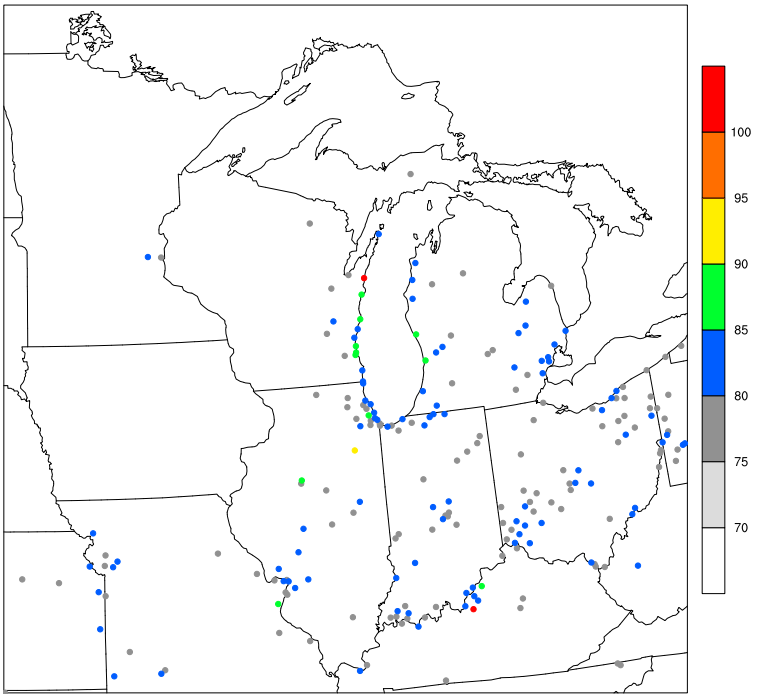

Figure A.3. 2011 mean monitored MDA8 ozone (ppb) with a 75 ppb ozone threshold.

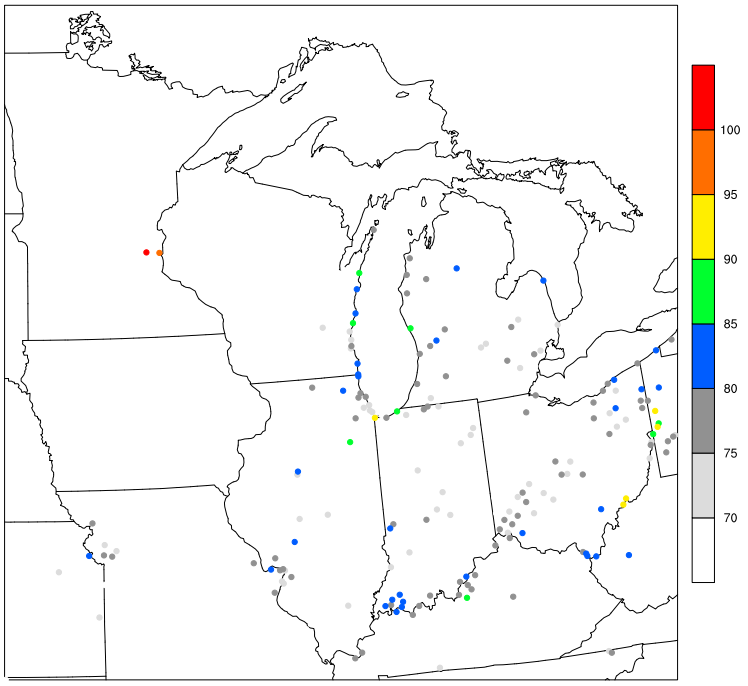

Figure A.4. 2011 mean CAMx predicted MDA8 ozone (ppb) with a 75 ppb ozone threshold.

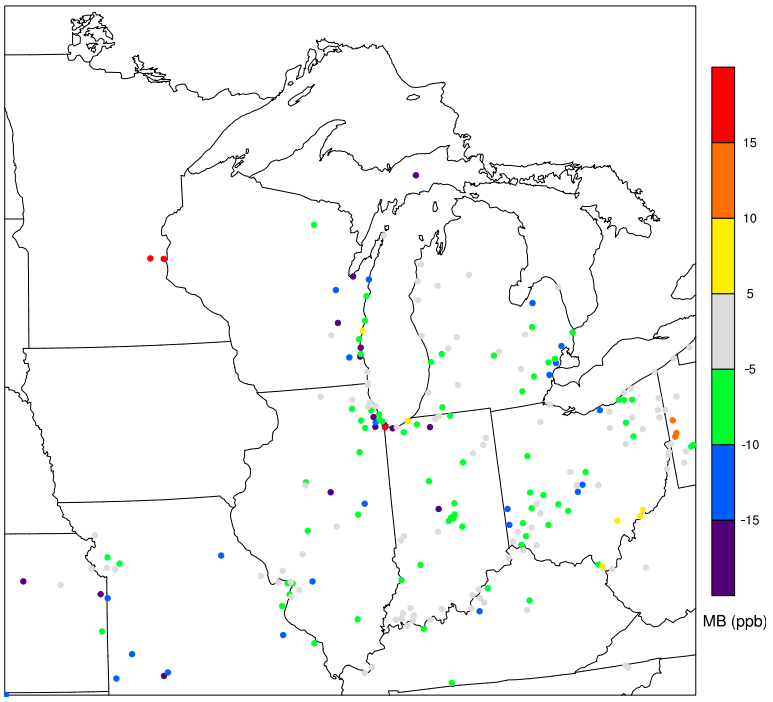

Figure A.5. 2011 mean bias of MDA8 ozone (ppb) with a 75 ppb ozone threshold.

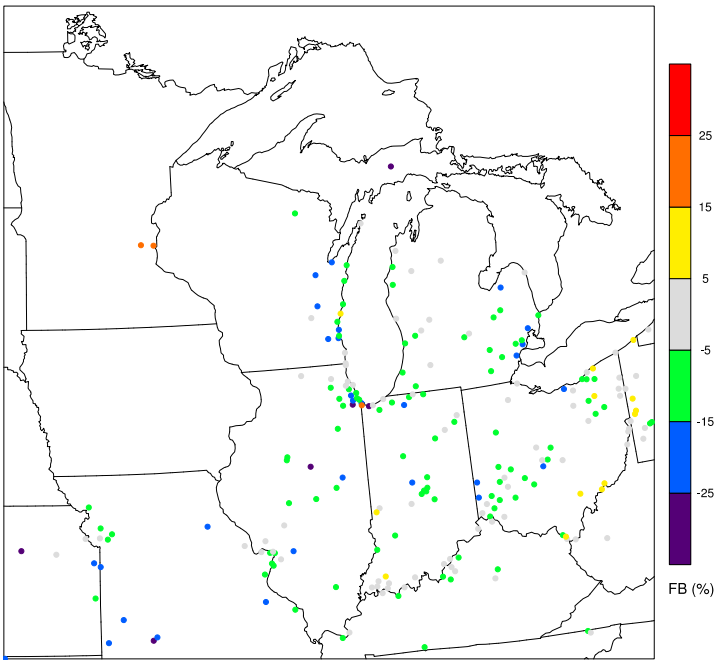

Figure A.6. 2011 mean fractional bias of MDA8 ozone (ppb) with a 75 ppb ozone threshold.

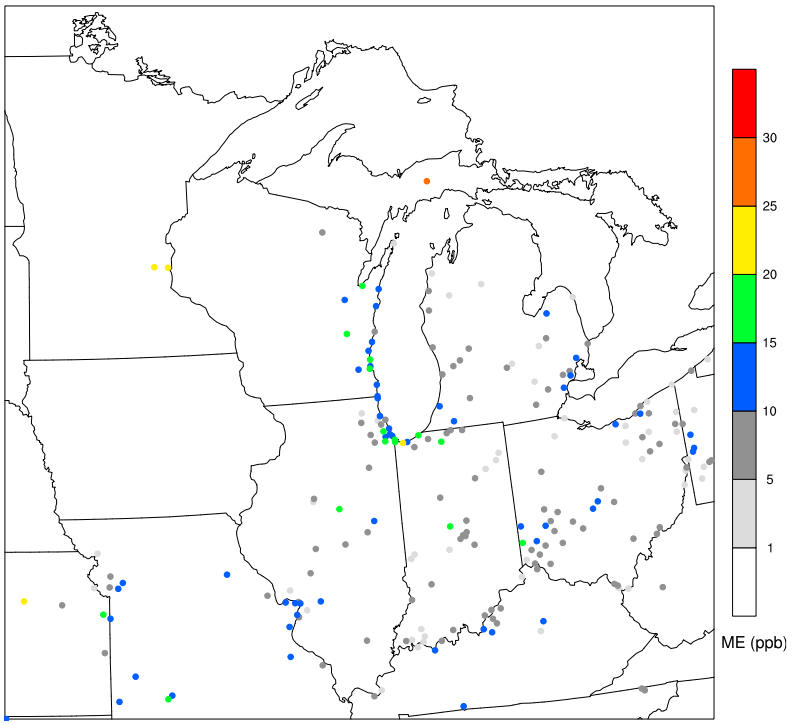

Figure A.7. 2011 mean error of MDA8 ozone (ppb) with a 75 ppb ozone threshold.

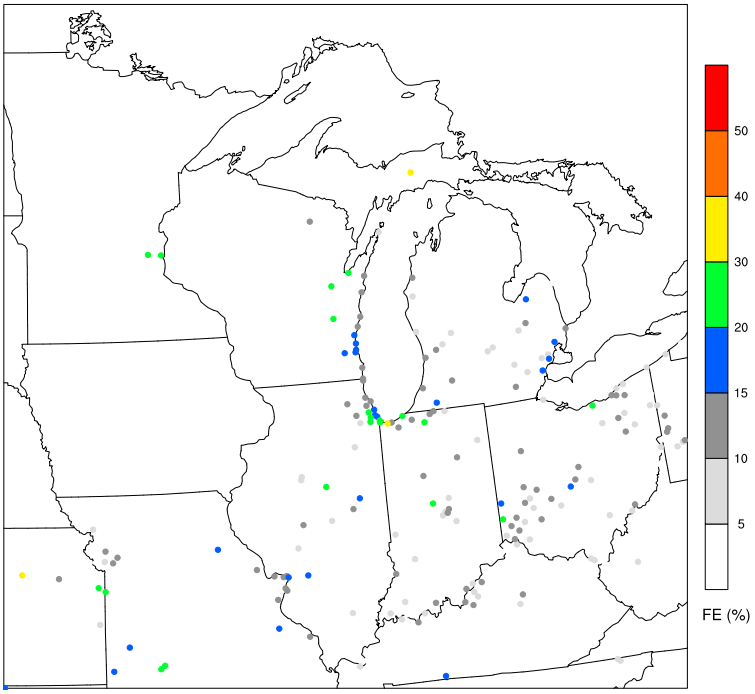

Figure A.8. 2011 mean fractional error of MDA8 ozone (ppb) with a 75 ppb ozone threshold.

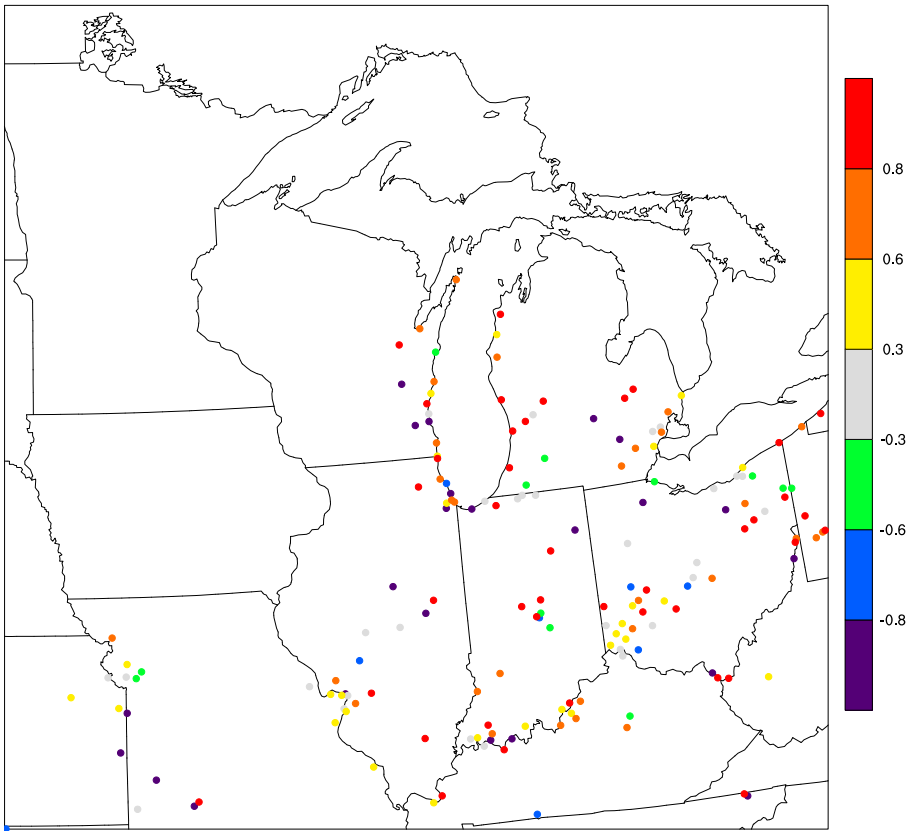

Figure A.9. 2011 Pearson correlation coefficient of MDA8 ozone with a 75 ppb ozone threshold.

Soccer plots of mean normalized bias and mean normalized error are shown in figures A.10 and A11.

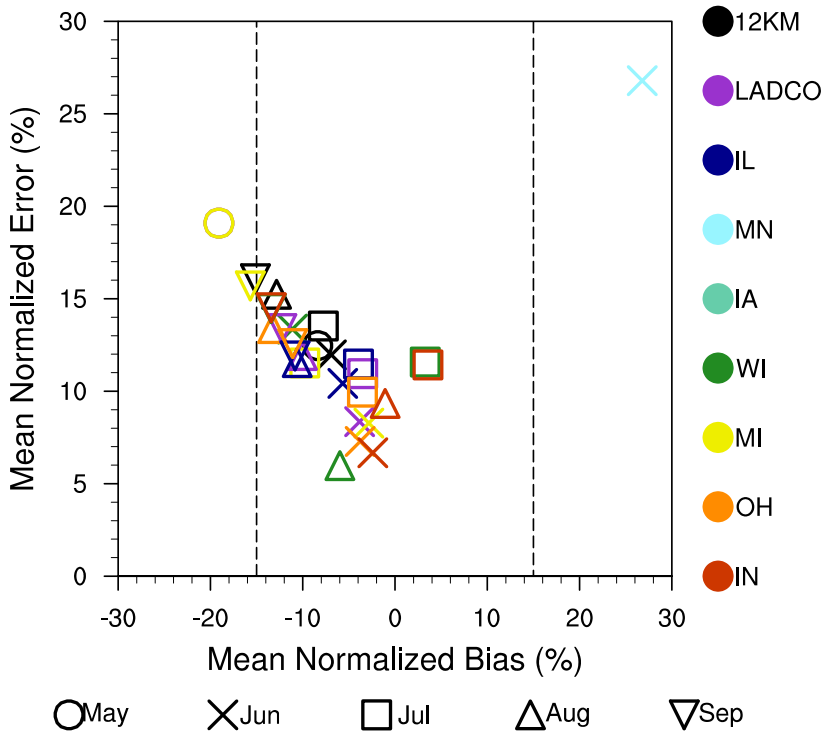

Figure A.10. MDA8 ozone Model Performance by month for the LADCO states, LADCO aggregated (purple), and national average (black) with a 75 ppb ozone threshold.

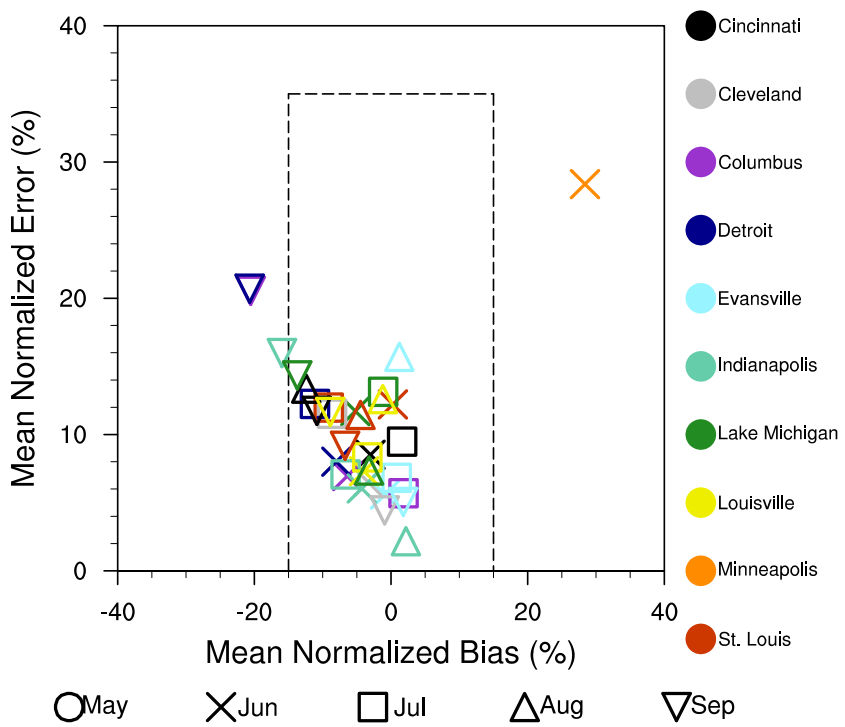

Figure A.11. MDA8 ozone model performance for select LADCO cities with a 75 ppb ozone threshold. Lake Michigan area refers to monitor near the Lake Michigan shoreline.

In general, the model shows a stronger negative bias with 75 ppb threshold compared with a 60 ppb threshold. The performance statistics with a 75 ppb threshold are within the range reported by Simon & Baker (2012).

Figures A.12 and A.13 show hourly ozone from monitors and modeled by CAMx at Sheboygan and Chiwaukee, respectively.

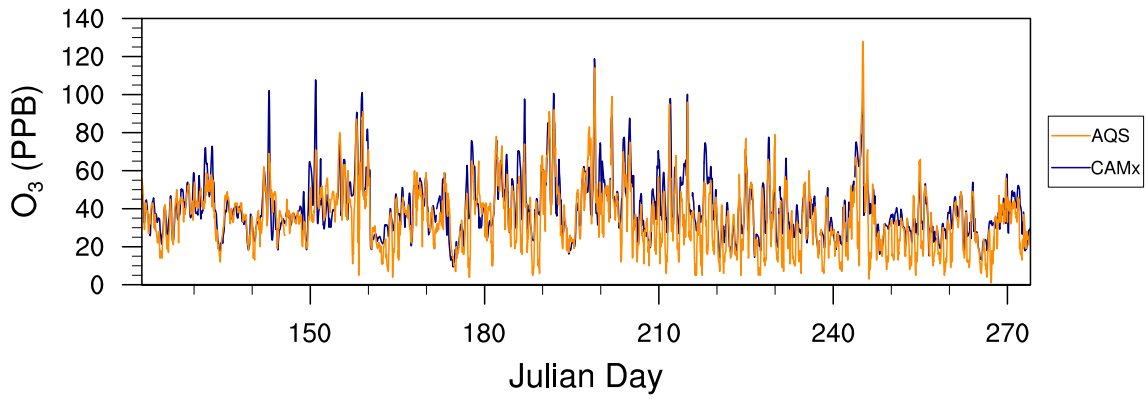

Figure A.12. 1-hour ozone showing monitoring (orange) and modeling (blue) in Sheboygan WI (AQS site ID 551170006).

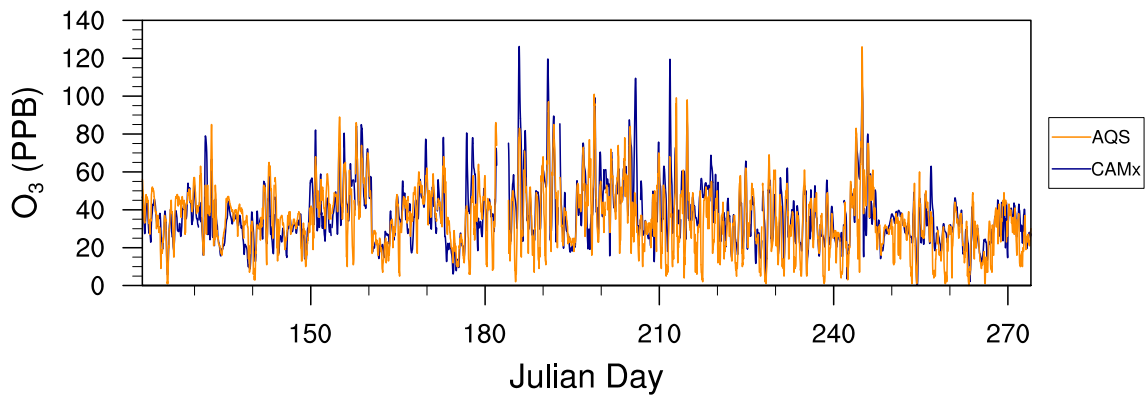

Figure A.13. 1-hour ozone showing monitoring (orange) and modeling (blue) in Chiwaukee Prairie WI (AQS site ID 550590019).

Additional time series of modeled and monitored MDA8 O_3 for monitors in and near the LADCO region are shown in figures A.14 through A.23.

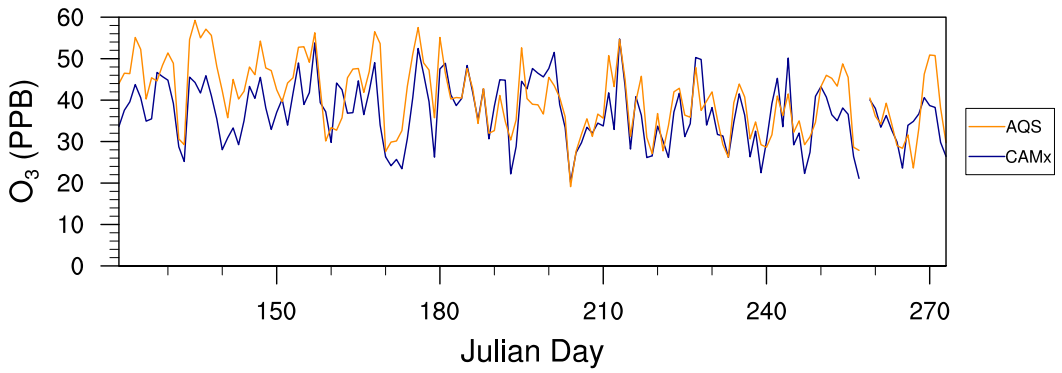

Figure A.14. MDA8 ozone showing monitoring (orange) and modeling (blue) in Voyageurs MN (AQS site ID 271370034).

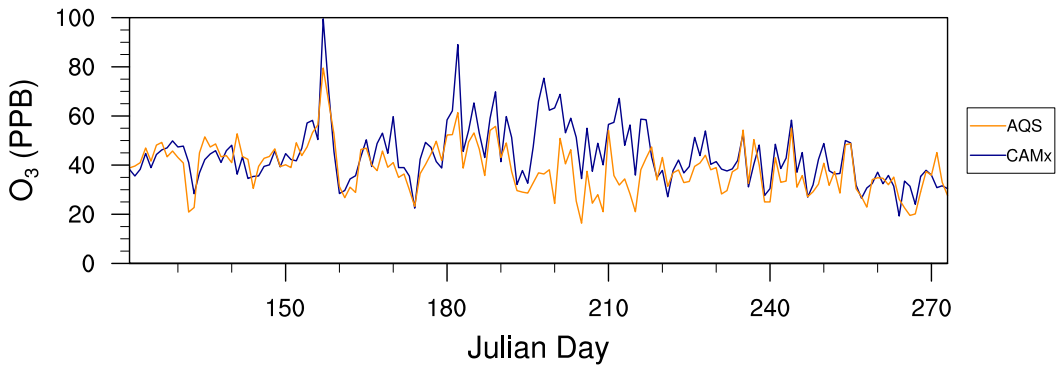

Figure A.15. MDA8 ozone showing monitoring (orange) and modeling (blue) in Stillwater MN (AQS site ID 271636015).

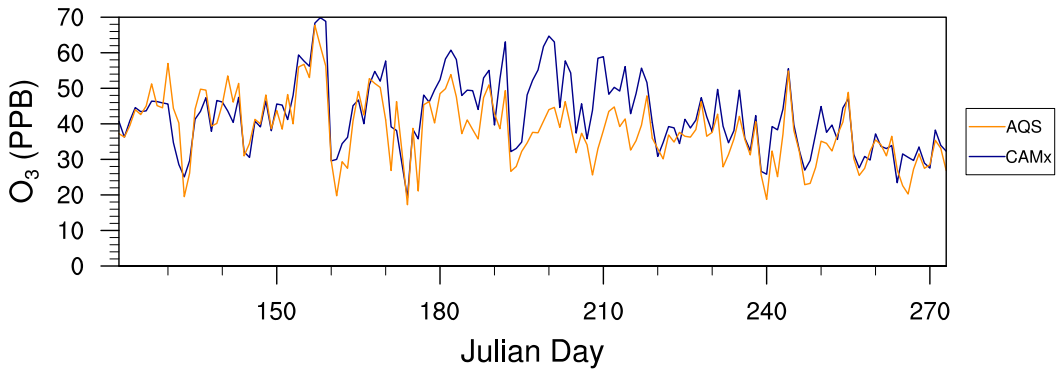

Figure A.16. MDA8 ozone showing monitoring (orange) and modeling (blue) in Rochester MN (AQS site ID 271095008).

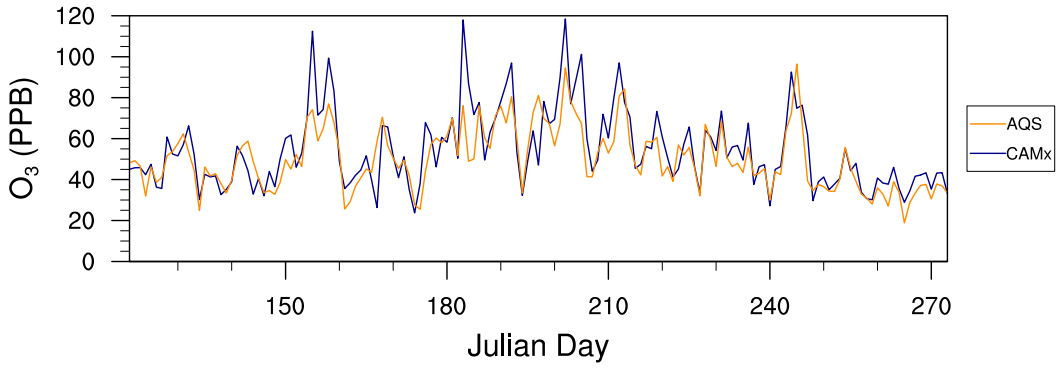

Figure A.17. MDA8 ozone showing monitoring (orange) and modeling (blue) in Michigan City IN (AQS site ID 180910005).

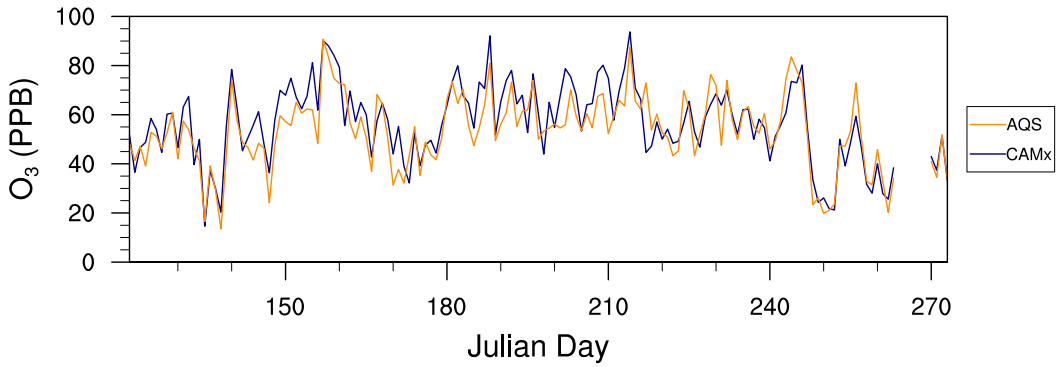

Figure A.18. MDA8 ozone showing monitoring (orange) and modeling (blue) in Charlestown IN (AQS site ID 180190008).

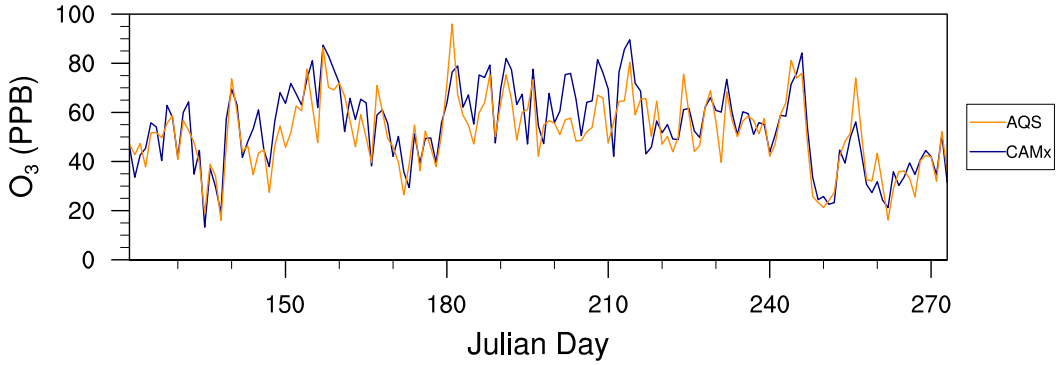

Figure A.19. MDA8 ozone showing monitoring (orange) and modeling (blue) in New Albany IN (AQS site ID 180431004).

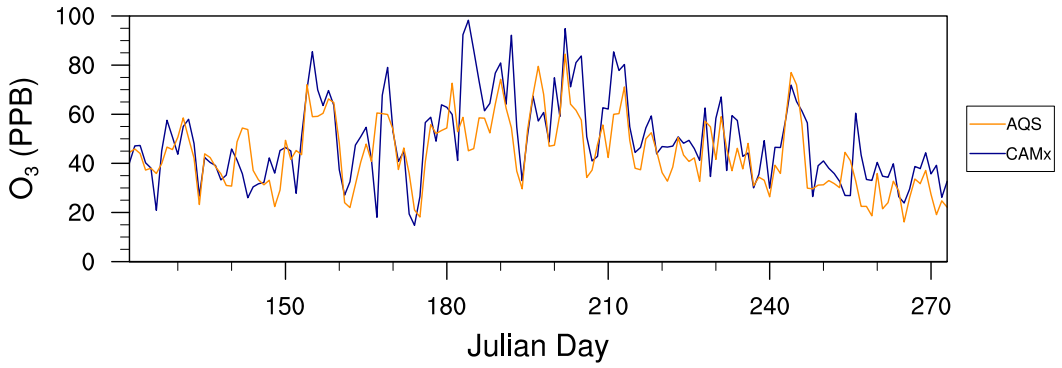

Figure A.19. MDA8 ozone showing monitoring (orange) and modeling (blue) in Chicago IL (AQS site ID 170310063).

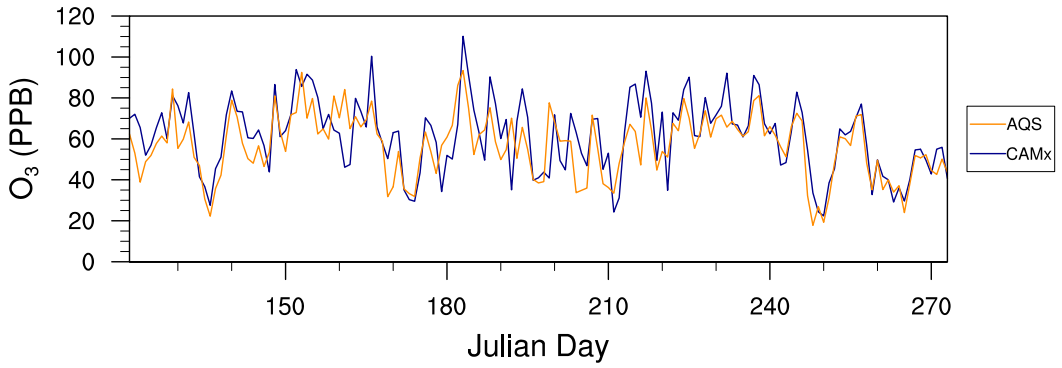

Figure A.19. MDA8 ozone showing monitoring (orange) and modeling (blue) in Atlanta GA (AQS site ID 131210053).

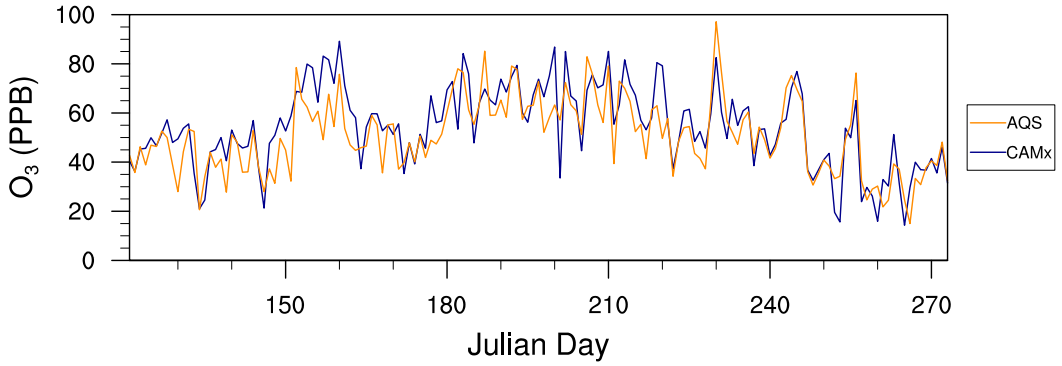

Figure A.20. MDA8 ozone showing monitoring (orange) and modeling (blue) in St. Louis MO (AQS site ID 295100085).

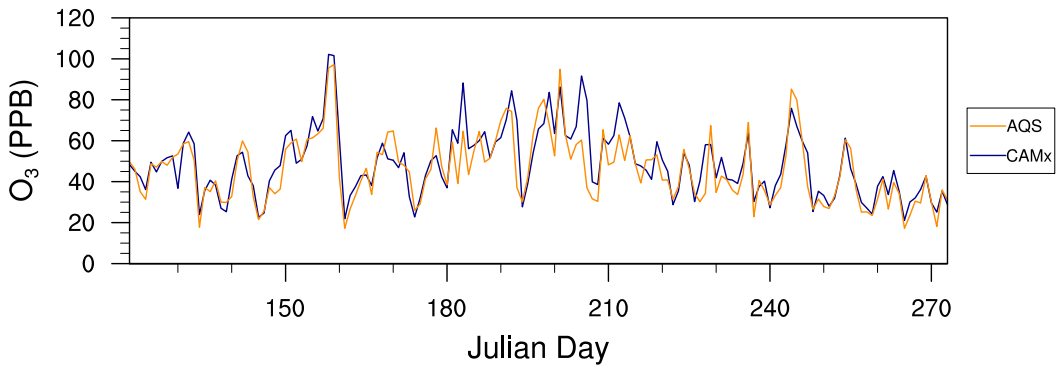

Figure A.21. MDA8 ozone showing monitoring (orange) and modeling (blue) in Holland MI (AQS site ID 260050003).

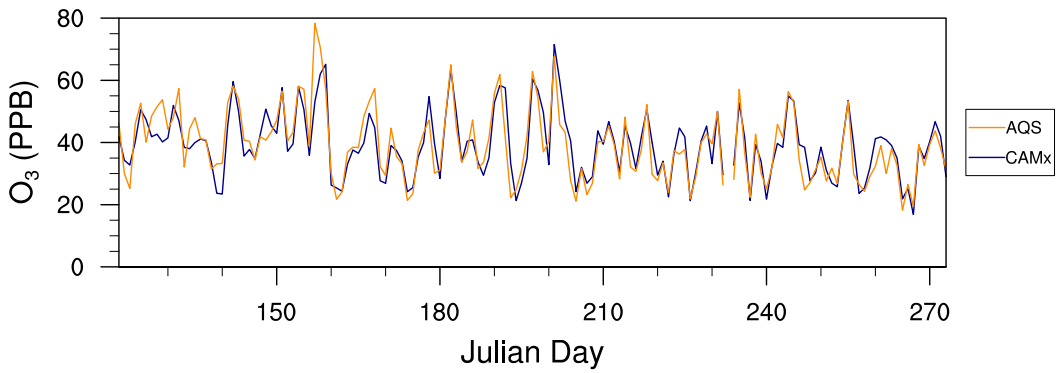

Figure A.22. MDA8 ozone showing monitoring (orange) and modeling (blue) in Seney MI (AQS site ID 261530001).

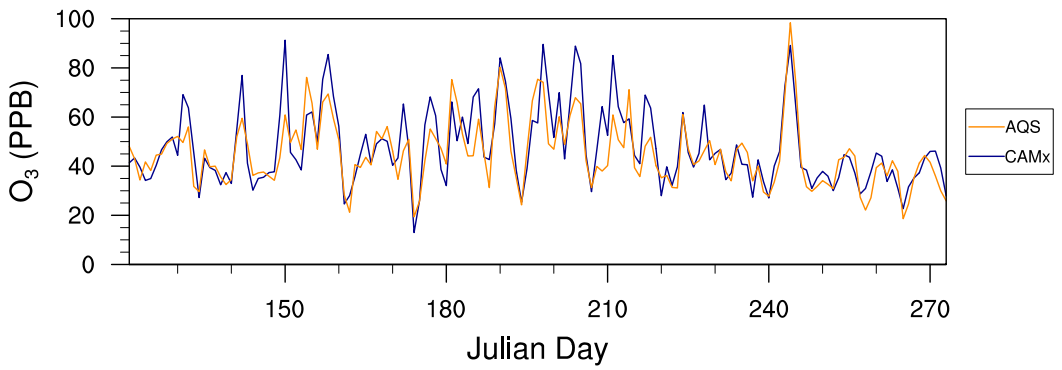

Figure A.23. MDA8 ozone showing monitoring (orange) and modeling (blue) in Ozaukee WI (AQS site ID 550890008).

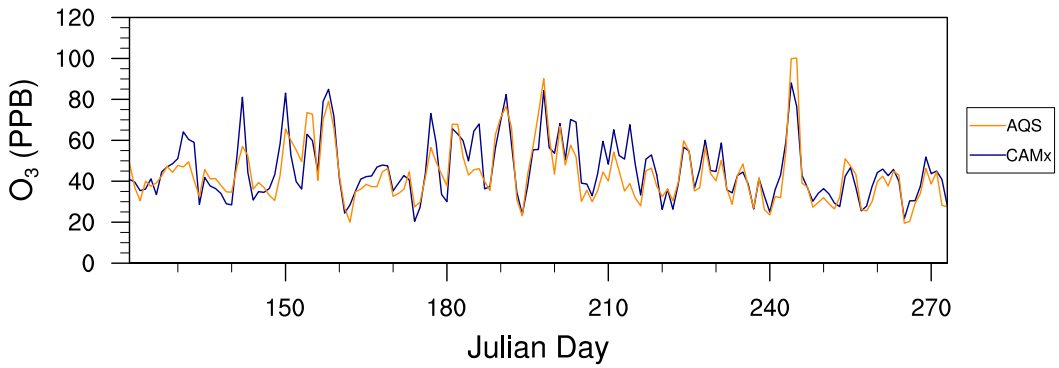

Figure A.23. MDA8 ozone showing monitoring (orange) and modeling (blue) in Manitowoc WI (AQS site ID 550710007).

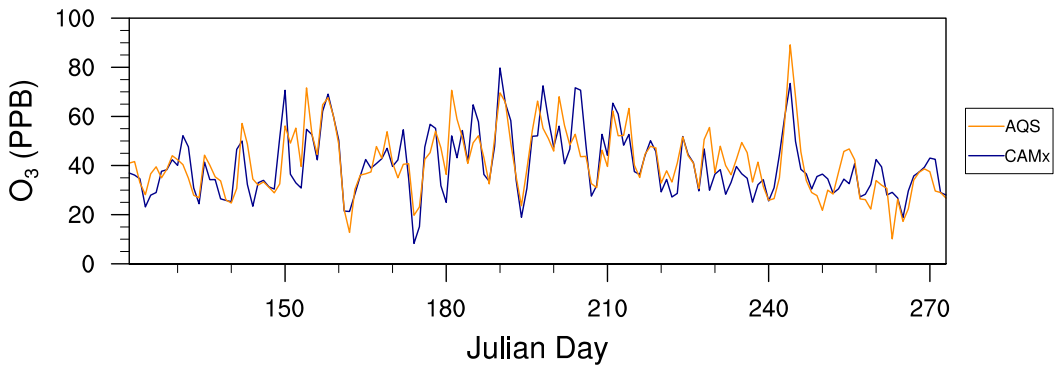

Figure A.23. MDA8 ozone showing monitoring (orange) and modeling (blue) in Milwaukee WI (AQS site ID 550790010).

Maps of 1-hour NO_2 performance at individual monitors showing mean bias, fractional bias, mean error, fractional error, and correlation coefficient are shown in figures A.3 through A.9, respectively.

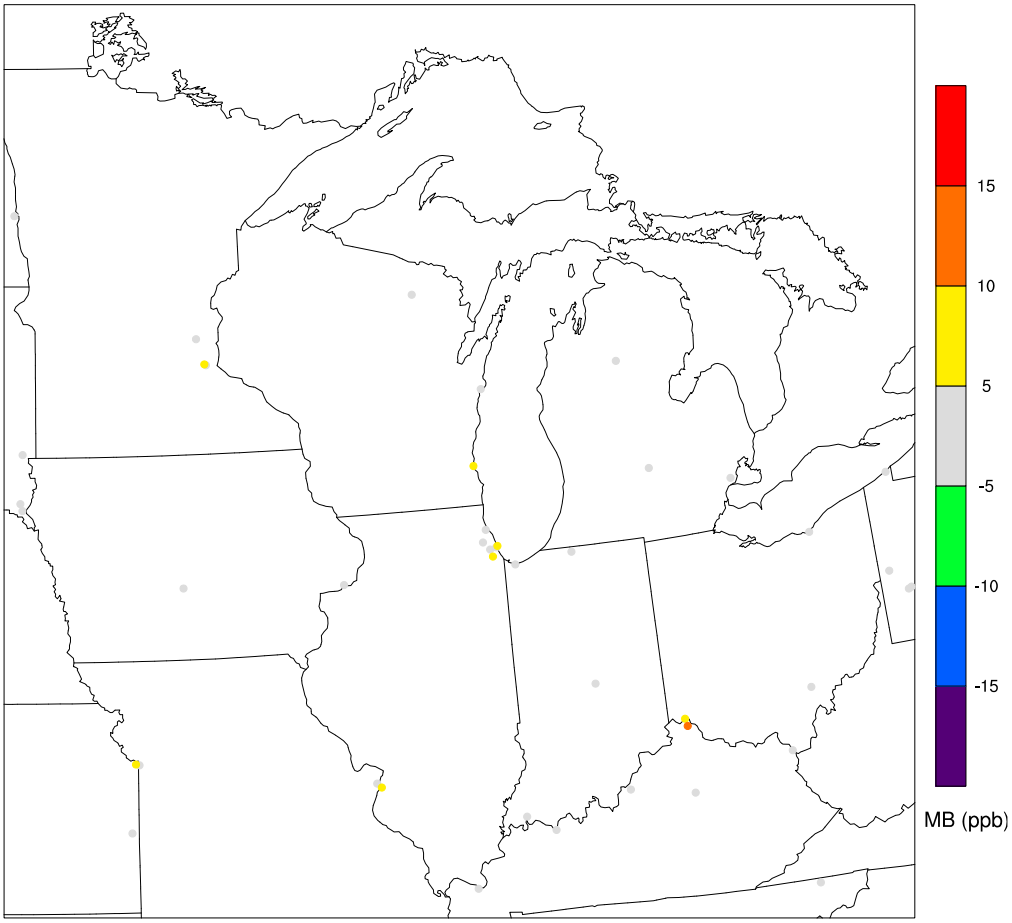

Figure A.24. 2011 mean bias of 1-hour NO_2 (ppb).

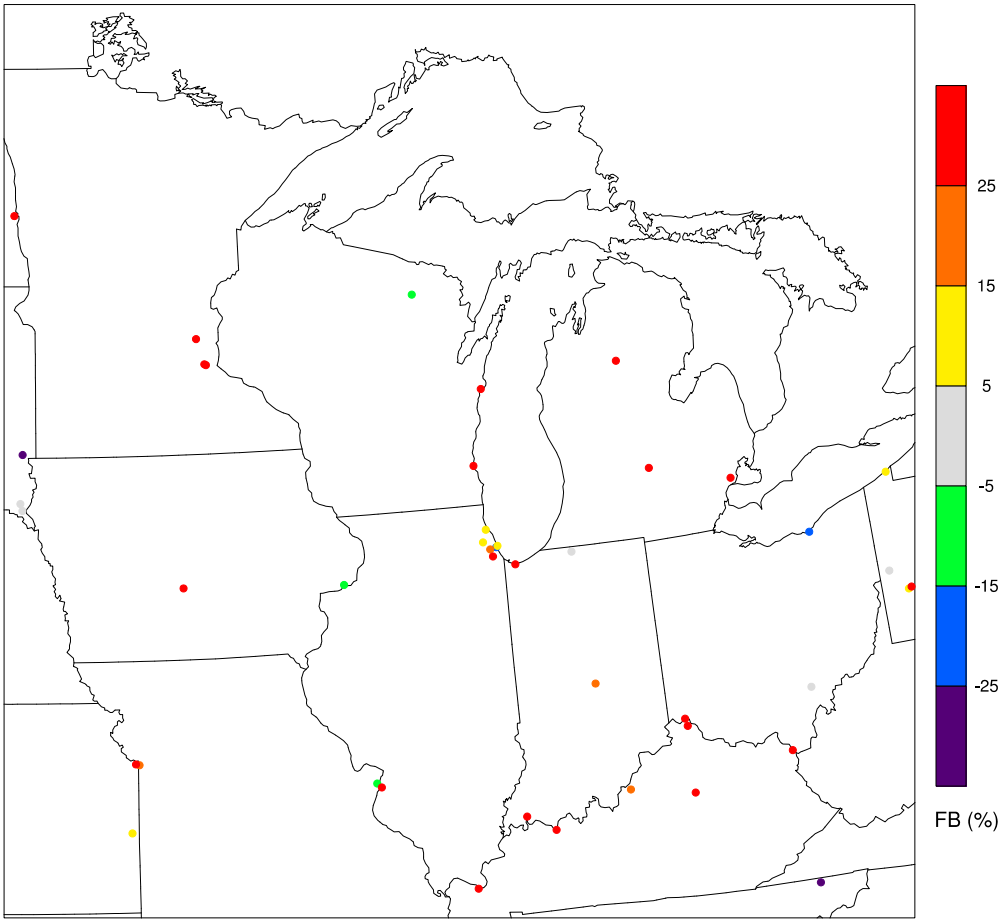

Figure A.25. 2011 fractional bias of 1-hour NO_2 (%).

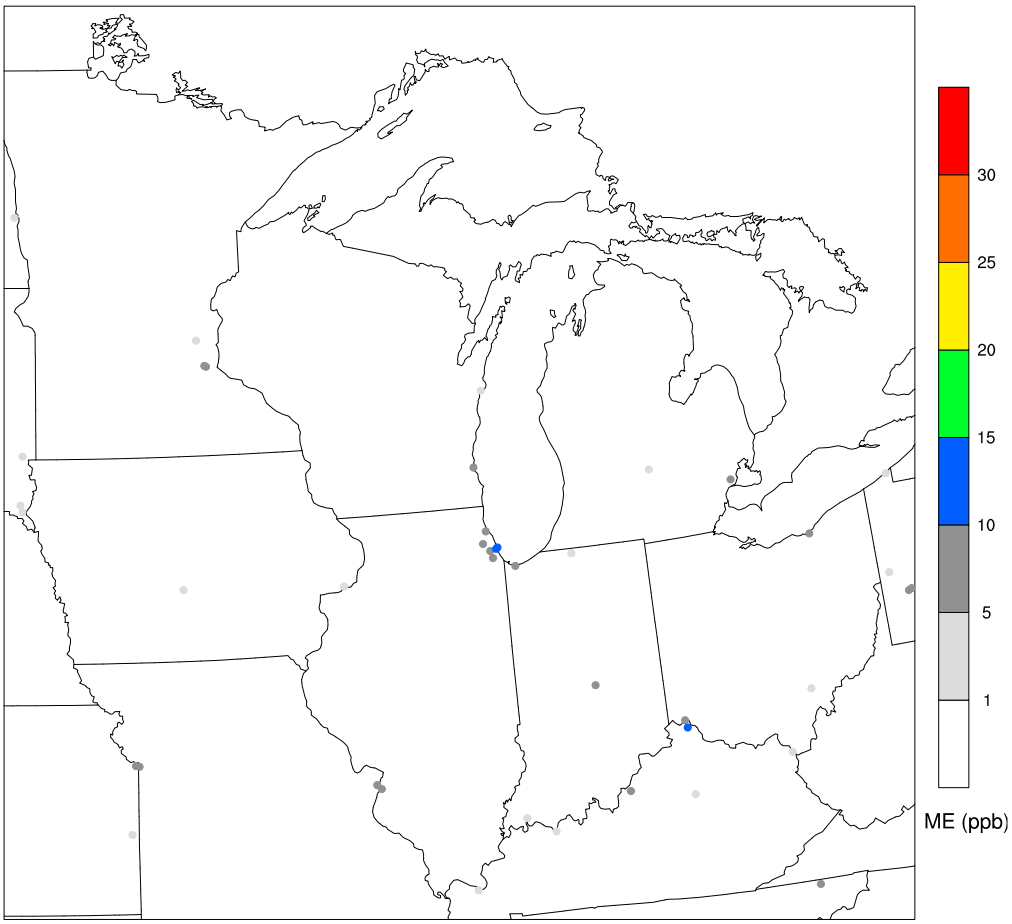

Figure A.26. 2011 mean error of 1-hour NO_2 (ppb).

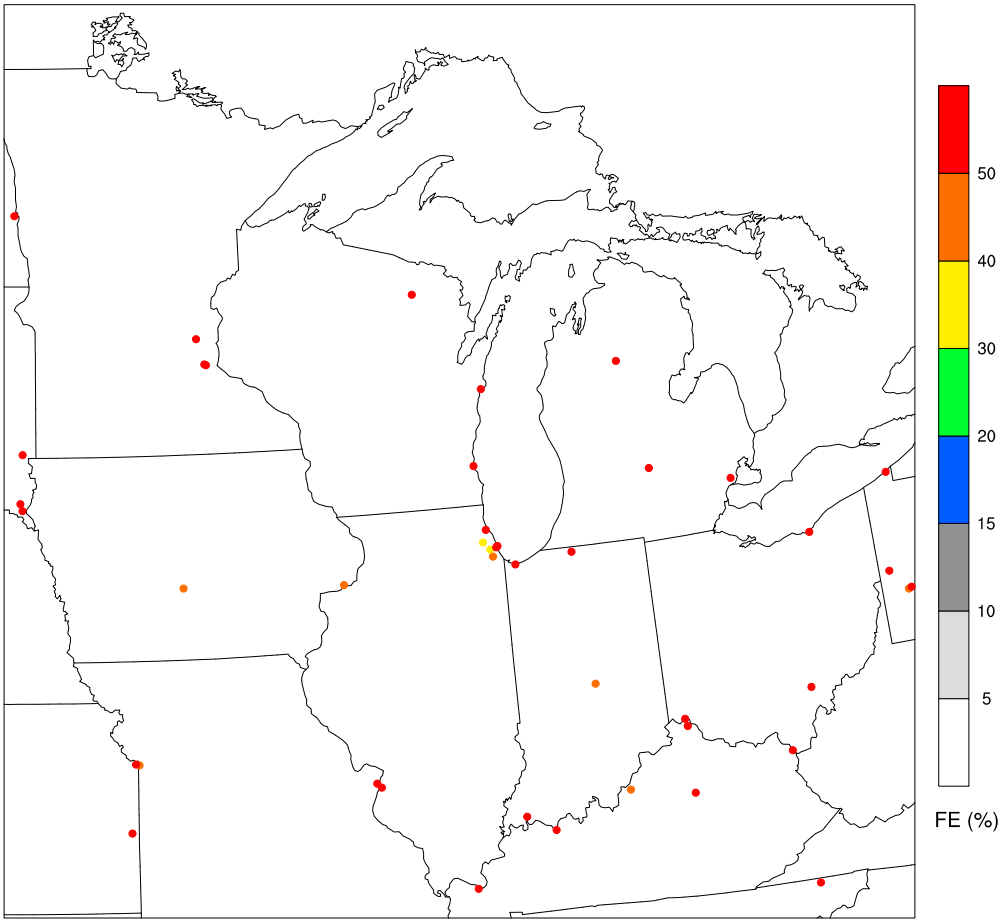

Figure A.27. 2011 fractional error of 1-hour NO_2 (%).

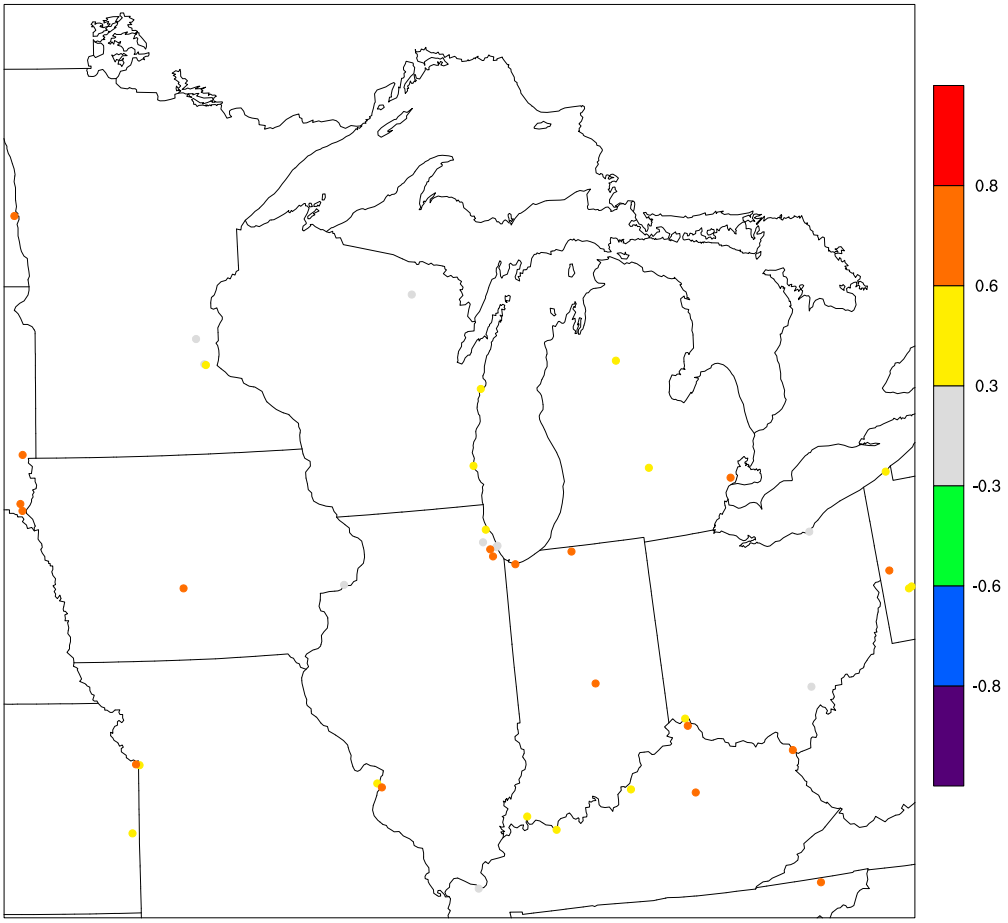

Figure A.28. 2011 Pearson correlation coefficient of 1-hour NO_2.

Attachment B: Negative Declaration Information

Table B-1: Ship Building and Ship Repair Operations

SIC	NAICS	ID Number	Company Name	Comments
3731	336611	031462AAM	Illinois Marine Towing Inc.	No painting operations; barge cleaning operations are limited and subject to Section 218.187; source-wide limit VOM < 25TPY
3731	336611	197800ABL	Illinois Marine Towing Inc.	No painting operations; barge cleaning operations limited to less than 7.0 tons VOM; Construction Permit 14090038.
4491	488390	031806ABI	Full Circle Shipyard LLC	No painting operations; potential emissions from barge cleaning operations are minimal and well below the applicability threshold for the CTG.
4491	488310	197090ABV	Marine Cleaning and Repair LLC	No painting operations; barge cleaning operations are limited to less than 20 tons VOM; Construction Permit 13010008.

Table B-2: Natural Gas/Gasoline Processing Plants

SIC	NAICS	ID Number	Company Name	Comments
1321	211130	063800AAM	Aux Sable Liquid Products	All covered emission units are controlled with equivalent measures by NSPS 40 CFR 60 Subpart KKK; therefore, not relevant.
4922	486210	031288AJD	Peoples Gas Light & Coke Co	Exempt – no applicable operations.
4922	486210	031801AAF	Natural Gas Pipeline Co of America	Exempt – no applicable operations.
4922	486210	063800AAO	Minooka Meter Station	Exempt – no applicable operations.
4922	486210	089809AAH	ANR Pipeline Co	Exempt – no applicable operations.
4922	486210	197035AAL	Vector Pipeline	Exempt – no applicable operations.
4922	486210	197445AAN	Peoples Gas Light and Coke Co	Exempt – no applicable operations.
4922	486210	197800AAQ	ANR Pipeline Co	Exempt – no applicable operations.

4922	486210	197800ABH	Natural Gas Pipeline Co of America	Exempt – no applicable operations.
4922	486210	197800ABI	Natural Gas Pipeline Co of America	Exempt – no applicable operations.
4922	486210	197800ABU	Guardian Pipeline Co	Exempt – no applicable operations.
4922	486210	197800ABV	Midwestern Gas Transmission Co.	Exempt – no applicable operations.
4922	486210	197800ACC	Northern Border Pipeline Co.	Exempt – no applicable operations.
4922	486210	197809ABQ	Natural Gas Pipeline Co	Exempt – no applicable operations.
4922	486210	197811AAE	Peoples Gas Light & Coke Co.	Exempt – no applicable operations.
4922	486210	197817AAA	Natural Gas Pipeline Co. of America	Exempt – no applicable operations.
4923	221210	031600BRA	Peoples Gas Light & Coke Co.	Exempt – no applicable operations.
4923	221210	031600FCP	Peoples Gas Light & Coke Co.	Exempt – no applicable operations.
4923	221210	031600FCQ	Peoples Gas Light & Coke Co.	Exempt – no applicable operations.
4923	486210	097090ABN	North Shore Gas Co.	Exempt – no applicable operations.
4924	221210	031015ACL	Nicor Gas	Exempt – no applicable operations.
4924	221210	031060AAK	Nicor Gas	Exempt – no applicable operations.
4924	221210	031063AJD	Nicor	Exempt – no applicable operations.
4924	221210	031105AAH	Nicor Gas	Exempt – no applicable operations.
4924	221210	031282ACL	Nicor Gas	Exempt – no applicable operations.
4924	221210	031440AKL	Nicor Gas	Exempt – no applicable operations.
4924	221210	031600FHO	Peoples Gas Light & Coke Co.	Exempt – no applicable operations.
4924	221210	043045ABQ	Nicor Gas	Exempt – no applicable operations.
4924	221210	089407ABO	Nicor Gas	Exempt – no applicable operations.
4924	221210	089438AFS	Nicor Gas	Exempt – no applicable operations.
4924	221210	097807AAI	Nicor Gas	Exempt – no applicable operations.

4924	221210	111015ACX	Nicor Gas	Exempt – no applicable operations.
4924	221210	111813AAR	Nicor/Horizon Interconnect	Exempt – no applicable operations.
4924	221210	197045AJM	Nicor Gas	Exempt – no applicable operations.
4924	221210	197095AAF	Nicor Gas	Exempt – no applicable operations.

Table B-3: Aerospace Manufacturing and Rework Facilities

SIC	NAICS	ID Number	Company Name	Comments
3728	336413	031012AFP	Heligear Acquisition Co. dba Northstar Aerospace (Chicago) Inc.	Exempt – VOM emissions limited to less than 25 TPY; etching and plating operations.
4512	481111	031600FXH	United Airlines	Exempt – VOM emissions limited to less than 25 TPY.
4512	481111	031600FXQ	American Airlines	Exempt – no applicable operations.
4512	481111	031600GID	Southwest Airlines-Midway Airport	Exempt – no applicable operations.
4512	481111	031804ABD	United Airlines Inc	Exempt – no applicable operations.
4581	488119	031600DVA	Aircraft Service International Inc dba Menzies Aviation	Exempt – no applicable operations.
4581	488119	031600FQP	Chicago - Dept of Aviation	Exempt – no applicable operations.
4581	488119	031600GGU	City Of Chicago - Midway Airport	Exempt – no applicable operations.
4581	488119	031600GPC	Servisair	Exempt – no applicable operations.
4581	488119	097190AEU	Baxter Healthcare Aviation Inc	Exempt – no applicable operations.
9711	928110	097811AAC	Naval Station Great Lakes	Exempt – no applicable operations.

Table B-4: Industrial Wastewater

SIC	NAICS	ID Number	Company Name	Comments
2099	311999	031201ADA	Rich Products - Niles	Exempt – no applicable operations.
2621	322121	031003AAW	Alsip MiniMill LLC	Exempt – no applicable operations.

2821	325211	031003AAF	Arkema Coating Resins	Exempt – no applicable operations.
2821	325211	031012AEU	Hexion Inc	Exempt – no applicable operations.
2821	325211	031039AAA	Ashland LLC	Exempt – no applicable operations.
2821	325211	031600GJI	MRC Polymers Inc	Exempt – no applicable operations.
2821	325211	063806AAA	Reichhold LLC 2	Exempt – no applicable operations.
2821	325211	089020AAF	Polynt Composites USA Inc	Exempt – no applicable operations.
2821	325211	089483ADK	UV Specialties LLC	Exempt – no applicable operations.
2821	325211	111065AAS	Engineered Polymer Solutions Inc	Exempt – negligible VOM emissions from wastewater tanks.
2821	325211	197110AAO	North American Systems House	Exempt – no applicable operations.
2821	325211	197800AAM	INEOS Styrolution America LLC	Exempt – negligible VOM emissions from wastewater tanks.
2821	325211	197800ACE	Americas Styrenics LLC	Exempt – no applicable operations.
2833	325411	031440ANR	Active Biomaterials	Exempt – no applicable operations.
2833	325411	043407AAW	Glanbia Performance Nutrition	Exempt – no applicable operations.
2833	325411	043467AAD	DSM Nutritional Products Inc.	Exempt – no applicable operations.
2833	325411	111075AAK	Leica Biosystems Richmond Inc.	Exempt – no applicable operations.
2834	325412	031186AGA	Fresenius Kabi USA LLC	Exempt – no applicable operations.
2834	325412	031195ACZ	Morton Grove Pharmaceuticals Inc	Exempt – no applicable operations.
2834	325412	031288AAH	Skokie ISTP LLC	Exempt – no applicable operations.
2834	325412	043070AAZ	Blistex Inc.	Exempt – no applicable operations.
2834	325412	089438AHG	First Priority Inc	Exempt – no applicable operations.
2834	325412	097080ABB	Hospira Inc	Exempt – no applicable operations.
2834	325412	097105AAA	Valent BioSciences Corp.	Exempt – no applicable operations.
2834	325412	097125AAA	AbbVie Inc.	All covered emission units are already well-controlled with

				equivalent measures; therefore, not relevant.
2834	325412	097190ACS	Pfanstiehl Inc.	Exempt – negligible VOM emissions from wastewater tanks.
2834	325412	097809ABI	AbbVie Inc.	Exempt – no applicable operations.
2834	325412	097816AAA	Baxter Healthcare Corp.	Exempt – no applicable operations.
2834	325412	111805AAR	Catalent Pharma Solutions	Exempt – no applicable operations.
2865	325130	031300AAJ	Koppers Inc.	All covered emission units are controlled with more stringent measures by NESHAP 40 CFR 63 Subpart FFFF; therefore, not relevant.
2865	325130	031600GBL	Sherwin Williams Co.	Exempt – no applicable operations.
2865	325130	197085AAO	Apollo Colors Inc.	Exempt – no applicable operations.
2865	325130	197800ABZ	Flint Hills Resources Joliet LLC	All covered emission units are controlled with more stringent measures by NESHAP 40 CFR 63 Subpart G; therefore, not relevant.
2869	325998	031171AAR	Pelron Corp.	Exempt – no applicable operations.
2869	325199	031195ACQ	Regis Technologies Inc.	Exempt – no applicable operations.
2869	325199	031497AAS	Slide Products Inc.	Exempt – no applicable operations.
2869	325199	031600FWM	Cargill Inc.	Exempt – no applicable operations.
2869	325998	031600FXP	Rycoline Products Inc.	Exempt – no applicable operations.
2869	325998	031821ABE	Ester Solutions	All covered emission units are controlled with equivalent measures by Section 218 Subpart C; therefore, not relevant.
2869	325998	063800AAC	Equistar Chemicals LP	All covered emission units are controlled with more stringent measures by NESHAP 40 CFR 63 Subpart FFFF; therefore, not relevant.
2869	325998	063800AAE	Akzo Nobel Surface Chemistry LLC	Exempt – negligible VOM emissions from wastewater tanks.

2869	325998	089803AAG	Radco Industries	Exempt – no applicable operations.
2869	325998	097035AAS	Roquette America Inc.	Exempt – no applicable operations.
2869	325998	097125ABI	Emco Chemical Distributors Inc.	Exempt – negligible VOM emissions from wastewater tanks.
2869	325998	197800AAE	Stepan Co.	All covered emission units are controlled with more stringent measures by NESHAP 40 CFR 63 Subpart G; therefore, not relevant.
2879	325320	031045ABT	Nufarm Americas Inc.	Exempt – no applicable operations.
2879	325320	043482AAW	Clarke Mosquito Control	Exempt – no applicable operations.
2899	325998	031012AAO	Nalco Co.	Exempt – negligible VOM emissions from wastewater tanks.
2911	324110	197090AAI	CITGO Petroleum Corp.	All covered emission units are controlled with more stringent measures by NSPS 40 CFR 60 Subpart QQQ; therefore, not relevant.
2911	324110	197800AAA	Exxon Mobil Oil Corp.	All covered emission units are controlled with more stringent measures by NESHAP 40 CFR 61 Subpart FF; therefore, not relevant.
3469	332119	111405AAC	Kenmode Tool & Engineering	Exempt – negligible VOM emissions from wastewater tanks.
4231	488490	197045AJH	Transport Service Co.	Exempt – negligible VOM emissions from wastewater tanks.
4952	221320	031300AAL	Stickney Water Reclamation Plant	Exempt – no applicable operations.

Table B-5: Manufacture of High-Density Polyethylene, Polypropylene, and Polystyrene Resins

SIC	NAICS	ID Number	Company Name	Comments
2821	325211	031003AAF	Arkema Coating Resins	Exempt – does not manufacture polyethylene, polypropylene, or polystyrene.
2821	325211	031012AEU	Hexion Inc.	Exempt – does not manufacture polyethylene, polypropylene, or polystyrene.

2821	325211	031039AAA	Ashland LLC	Exempt – does not manufacture polyethylene, polypropylene, or polystyrene.
2821	325211	031600GJI	MRC Polymers Inc.	Exempt – does not manufacture polyethylene, polypropylene, or polystyrene.
2821	325211	063806AAA	Reichhold LLC 2	Exempt – does not manufacture polyethylene, polypropylene, or polystyrene.
2821	325211	089020AAF	Polynt Composites USA Inc.	Exempt – does not manufacture polyethylene, polypropylene, or polystyrene.
2821	325211	089483ADK	UV Specialties LLC	Exempt – does not manufacture polyethylene, polypropylene, or polystyrene.
2821	325211	111065AAS	Engineered Polymer Solutions Inc.	Exempt – does not manufacture polyethylene, polypropylene, or polystyrene.
2821	325211	197110AAO	North American Systems House	Exempt – does not manufacture polyethylene, polypropylene, or polystyrene.
2821	325211	197800AAM	INEOS Styrolution America LLC	Subject to Section 218 Subpart BB Polystyrene Plants. Does not manufacture polyethylene or polypropylene.
2821	325211	197800ACE	Americas Styrenics LLC	Subject to Section 218 Subpart BB Polystyrene Plants. Does not manufacture polyethylene or polypropylene.

Table B-6: Vegetable Oil Processing

SIC	NAICS	ID Number	Company Name	Comments
2046	311221	031012ABI	Ingredion Incorporated Argo Plant	All covered emission units are controlled with more stringent measures by NESHAP 40 CFR 63 Subpart GGGG; therefore, not relevant.

Attachment C

Negative Declaration for the Oil and Natural Gas Industry CTG

December 5, 2018

Illinois Environmental Protection Agency
Air Quality Planning Section
1021 North Grand Avenue East
Springfield, IL 62794-9276

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List of Acronyms

CTG	Control Techniques Guidelines
Illinois DNR	Illinois Department of Natural Resources
Illinois EPA	Illinois Environmental Protection Agency
LDAR	Leak Detection and Repair
NAA	Nonattainment Area
NAAQS	National Ambient Air Quality Standards
NAICS	North American Industry Classification System
NESHAP	National Emission Standards for Hazardous Air Pollutants
NOx	Nitrogen Oxides
NSPS	New Source Performance Standard
PTE	Potential to Emit
RACT	Reasonably Available Control Technology
SCC	Source Classification Code
SIP	State Implementation Plan
TPY	tons per year
USEPA	United States Environmental Protection Agency
VOC	Volatile Organic Compounds
VOM	Volatile Organic Material

1.0 Introduction

CAA Section 182(b)(2)(A) requires that for moderate and higher ozone Nonattainment Areas ("NAAs"), states must revise their State Implementation Plan ("SIP") to include Reasonably Available Control Technology ("RACT") for each category of sources covered by Control Techniques Guidelines ("CTG") documents issued by the United States Environmental Protection Agency ("USEPA") between November 15, 1990 and the date of attainment. If a state determines there are no covered sources in a source category, or that a SIP revision is not necessary to achieve RACT-level control for a category, the state can submit a Negative Declaration to USEPA certifying and confirming that no SIP revision or additional action by the state are required. These CTGs provide recommendations to inform state, local, and tribal air agencies what constitutes RACT for a given pollutant and source category and provide guidance and recommendations for air agencies to consider in determining RACT for sources in their jurisdictions.

On October 20, 2016, the USEPA issued a final CTG for the oil and natural gas industry [EPA-453/B-16-001].[1] Since the Chicago NAA is designated as moderate nonattainment for the 2008 ozone National Ambient Air Quality Standard ("NAAQS"), an assessment of potential sources impacted by the Oil and Gas CTG was performed. Illinois has determined that no additional regulations or SIP revisions are necessary to achieve RACT for the source category for any emission source within the Chicago NAA. Therefore, this assessment is a "Negative Declaration" based on emission unit assessments, and a more detailed discussion of this assessment follows.

2.0 Overview of State and Federal Regulations

There are several Federal and State programs in place for controlling VOM emissions from the oil and gas industry. The USEPA promulgated New Source Performance Standards ("NSPS"), 40 CFR part 60 Subpart KKK – *Standards of Performance for Equipment Leaks of VOC from Onshore Natural Gas Processing Plants*, and Subpart OOOO – *Standards of Performance for Crude Oil and Natural Gas Production, Transmission and Distribution*. In addition to the emission sources that were covered previously, the USEPA established new standards to regulate VOM and greenhouse gas emissions from the oil and gas industry in 2016 with NSPS Subpart OOOOa – *Standards of Performance for Crude Oil and Natural Gas Facilities for Which Construction, Modification or Reconstruction Commenced After September 18, 2015*. The latest amendments for Subpart OOOOa established greenhouse gas standards and extended the current VOM standards to previously unregulated equipment. Stationary reciprocating internal combustion engines and combustion turbines used in the oil and natural gas industry are covered under separate NSPS specific to engines and turbines, 40 CFR part 60, Subparts IIII, JJJJ, GG, KKKK. Illinois has RACT requirements in place for sources of VOM emissions in Chicago NAA (Title 35 IAC Part 218[2]), including the majority of emission units in the oil and gas

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[1] USEPA, *"Control Techniques Guidelines for the Oil and Natural Gas Industry."* October 2016. https://www.epa.gov/sites/production/files/2016-10/documents/2016-ctg-oil-and-gas.pdf

[2] Title 35 IAC Part 218, VOM Emission Standards and Limitations for Chicago Area. http://www.ilga.gov/commission/jcar/admincode/035/03500218sections.html

industry (i.e. storage vessels subject to Part 218 Subpart B; pumps and compressors Part 218 Subpart C).

3.0 Affected Area

The Chicago NAA consists of Cook, Du Page, Kane, Lake, McHenry, and Will Counties; Aux Sable Township and Goose Lake Township in Grundy County; and Oswego Township in Kendall County. This area is the only area designated as moderate nonattainment for the 2008 ozone NAAQS[3] in Illinois.

3.1 Affected Oil and Gas Wells in Chicago NAA

The oil and gas producing area of Illinois is part of the Illinois Basin. The Illinois Basin covers southern Illinois, western Kentucky, and western Indiana. The Illinois Department of Natural Resources ("Illinois DNR") regulates and issues permits for oil and gas production wells. Illinois DNR records show there are oil and gas production processes in 40 of the 102 counties in Illinois, with most of the production activity in the southern part of Illinois. A majority of these sites are stripper wells with a daily production of 1.5 barrels per day. There is no record of active oil or gas producing wells in the Chicago NAA.

Additionally, the USEPA-developed Oil and Gas Emission Estimation Tool 2014 v1.5 ("Tool")[4] shows no VOM emissions from oil and gas production for the Chicago NAA. The Tool has two separate modules for exploration and production and generates Source Classification Code ("SCC")-based county-level emissions that include nonpoint and point source emissions. For Illinois, the production module was the only module in the Tool that generated emissions, and only for the southern part of the state. Thus, the Tool showed no oil or gas exploration or production activity in the Chicago NAA.

4.0 Assessment of Potentially Affected Permitted Sources

The oil and natural gas industry includes oil and natural gas operations, extraction and production of crude oil and natural gas, as well as the processing, transmission, storage, and distribution of natural gas. According to the Oil and Gas CTG, the oil industry includes all operations from the well to the point of custody transfer at a petroleum refinery, and the natural gas industry includes all operations from the well to the customer.

In order to identify potentially affected sources in the Chicago NAA for further evaluation, the Illinois EPA reviewed permit data using the North American Industry Classification System ("NAICS") for the oil and gas industry provided by USEPA in the oil and gas NSPS.[5] Illinois

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[3] USEPA, *"8-Hour Ozone (2008) Designated Area/State Information."* https://www3.epa.gov/airquality/greenbook/hbtc.html

[4] More info on the Tool *"EPA Oil and Gas Emissions Estimation Tool Improvements for 2014"* https://www.epa.gov/sites/production/files/2017-11/documents/tool_improvements.pdf

[5] USEPA, "40 CFR part 60, Oil and Natural Gas Sector: Emission Standards for New, Reconstructed, and Modified Sources (81 FR 35824, Table 2)." June 3, 2016. https://www.gpo.gov/fdsys/pkg/FR-2016-06-03/pdf/2016-11971.pdf

EPA permit data shows there are 44 sources matching the NAICS code identified as oil and gas industry in the Chicago NAA. Table 1 lists the NAICS code and number of sources in each category.

Table 1. Oil and Gas Industry Sources in the Chicago NAA by NAICS Code

NAICS Code	Industrial Source Categories	Number of Sources in Chicago NAA
211111	Crude Petroleum and Natural Gas Extraction	--
211112	Natural Gas Liquid Extraction	--
211130	Natural Gas Extraction	1
221210	Natural Gas Distribution	19
486110	Pipeline Distribution of Crude Oil	6
486210	Pipeline Transportation of Natural Gas	18

No sources were identified as having permitted emission units associated with wells, well completions, or associated equipment such as well drilling in the Chicago NAA.

Section 5.0 below evaluates the one source in the Chicago NAA identified as Natural Gas Extraction. All units at that source have been evaluated. Section 6.0 addresses the rest of the identified categories listed in Table 1aside from 13 sources that did not have any emission units covered by this CTG. The evaluations of these sources categories have been conducted on a unit-level basis, based on the unit types covered by the Oil and Gas CTG rather than on a source-wide basis. This unit-level evaluation is more appropriate because these units are not likely to be located at point sources connected directly or indirectly to oil or gas producing well or wellhead.

5.0 Assessment of Natural Gas Extraction Sources

There is one source that was identified by its NAICS code as Natural Gas Extraction in Grundy County in Illinois. Aux Sable Liquid Products Inc. is described as engaged in extracting, processing, fractionating, producing, and supplying natural gas liquids in North America. The Illinois EPA inventory data shows the facility has several VOM emitting units with potential to emit ("PTE") greater than 6 tons per year ("TPY") (see Table 2). These three units are not subject to the Oil and Gas CTG, but are subject to one or more federal rules including NSPS 40 CFR part 60 Subparts A, Kb, RRR, KKK, and OOOO, and NESHAP 40 CFR 63 Subpart CCCCCC. This source is also subject to 40 CFR part 60 Subpart VVa – *Leak Detection and Repair* ("LDAR") program. The Oil and Gas CTG recommends that RACT for sources of this type be equivalent to what is required by Subpart VVa, thus RACT-level control at this source is currently being achieved. Therefore, no additional regulation or SIP revisions are needed for these emission units at this source to meet RACT requirements.

The remaining units at this source are combustion units and several storage tanks with actual VOM emissions of 0.5 TPY or less. These units are subject to Title 35 IAC Part 218[6] and/or

[6] Title 35 IAC Section 218.123 Petroleum Liquid Storage Tanks.
http://www.ilga.gov/commission/jcar/admincode/035/035002180B01230R.html

federal programs, i.e. 40 CFR part 60 subpart Kb. The CTG recommends RACT applies to storage vessels with a PTE of equal to or greater than 6 TPY of VOM, or actual emissions greater than 4 TPY. Therefore, the CTG RACT requirement for storage tanks/vessels do not apply to units at this source. The combustion units are not subject to the CTG since they are not located between the wellhead and point of transfer. Therefore, Aux Sable Liquid Products Inc. is not subject to the Oil and Gas CTG.

Table 2. Aux Sable Liquid Products Inc., VOM Emission Units

State ID Number	SCC	Point Description	2016 VOM (TPY)	Comments
063800AAM	30115320	Butamer process	16.99	Controlled under NSPS
063800AAM	40688801	Y-Grade railcar offloading	13.02	Controlled under NSPS
063800AAM	10200602	2 Heaters (50H-501A and 50H-501B)	9.52	Controlled with low NOx burners
063800AAM	31088801	Propane fugitives	1.44	Not located at an applicable well site
063800AAM	40714601	Storage tank TK501	0.44	Less than 4.0 TPY; controlled with carbon
063800AAM	30190003	Gas Treatment Units (Merox and Amine) and Molecular Sieve	0.43	Controlled with incinerator
063800AAM	31000299	Train #1 and #2 inlet separator (V678 and V653)	0.30	Less than 4.0 TPY; controlled with flare
063800AAM	40729697	Tank 70V-704	0.29	Less than 4.0 TPY; controlled with flare
063800AAM	20200101	2 Engines (50 EG501 and 50 EF502)	0.20	Not located between wellhead and point of transfer
063800AAM	31088801	Ethane regen system fugitives	0.09	Not located at an applicable well site
063800AAM	40700815	Tank TK-506	0.04	Less than 4.0 TPY
063800AAM	10200602	Ethane regen heater H-309	0.00	Low NOx burner
063800AAM	40781605	11 Tanks (70V-701A-D, 70V-702A-B, 70V-703A-B, 70V-705, 70V-717, 50TK-520)	0.00	Less than 4.0 TPY

6.0 Assessment of Potentially Affected Emission Units in the Chicago NAA

The CTG covers selected emission units in the onshore production and processing segments of the oil and natural gas industry (i.e., pneumatic controllers, pneumatic pumps, compressors, equipment leaks, fugitive emissions) and storage vessel VOM emissions in all segments (except distribution) of the oil and natural gas industry (USEPA, Oil and Gas CTG 2016).

To identify potentially affected emission units for further evaluation from the categories listed in Table 1, the Illinois EPA reviewed its point source inventory using SCC codes and emission unit descriptions (i.e., Storage Vessels/Tanks, Pumps, Compressor, Leaks, and Fugitive). Point source data from the Chicago NAA identified 119 emission units related to the source categories identified in section 4.0 (see Appendix, Table 7).

6.1 Storage Vessels

The Oil and Gas CTG recommends RACT be applied to a tank or other vessel in the oil and natural gas industry if an individual storage vessel has a PTE greater than or equal to 6 TPY VOM or actual emissions greater than 4.0 TPY. The CTG recommends RACT apply to:

> "*a tank or other vessel in the oil and natural gas industry that contains an accumulation of crude oil, condensate, intermediate hydrocarbon liquids, or produced water, and that is constructed primarily of non-earthen materials (such as wood, concrete, steel, fiberglass, or plastic) that provide structural support.*"

A search of the Illinois EPA oil and gas point source inventory produced 72 emission units listed as storage tanks in Chicago NAA, with 23 of those units having allowable VOM emissions of greater than or equal to 6 TPY. Based on the CTG applicability recommendations that RACT apply to storage vessels connected directly or indirectly to oil or gas producing well and/or between the wellhead and the point of custody transfer, there are no units in the Chicago NAA affected by the CTG. As noted in section 2.0, there are no oil or gas producing wells in Chicago NAA, therefore, none of the units are connected to oil or gas well and do not apply to this CTG.

Furthermore, the natural gas processing segment and natural gas transmission and storage segment in Chicago NAA, most of the units with allowable VOM emission greater or equal to 6 TPY are storing oil or liquid gasoline and are subject to Title 35 IAC part 218 subpart B; this State rule is part of the SIP which is approved as RACT[7] by USEPA.

6.2 Pneumatic Controllers

For pneumatic controllers, the CTG recommends RACT apply to:

> *"natural gas-driven pneumatic controllers in the oil and natural gas industry located from the wellhead to a natural gas processing plant (including the natural gas processing plant) or from the wellhead to the point of custody transfer to an oil pipeline."*

As mentioned in Section 2.0 there are no oil or gas producing wells or wellheads in the Chicago NAA. For natural gas processing plants, the Illinois EPA point source emission inventory was searched for "Pneumatic Devices" as well as SCC 31000160, 31700101, and 31700102. The search produced no pneumatic controller units or point sources in Chicago NAA. Therefore, the

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[7]USEPA approved list of CTG RACT, Status of SIP Required Elements for Illinois Designated Areas. https://www3.epa.gov/airquality/urbanair/sipstatus/reports/il_elembypoll.html

CTG recommendations for RACT requirements for pneumatic controllers do not apply to any units in the Chicago NAA.

6.3 Pneumatic Pumps

For pneumatic pumps, the CTG recommends RACT apply to:

> *"natural gas-driven chemical/methanol and diaphragm pumps located at natural gas processing plants and well sites."*

Based on the point description "pump," the Chicago NAA oil and gas point source emission inventory was searched. The search produced three emission units listed as pumps. A further evaluation of the identified units shows that they are not located at a gas processing plant or a well site. They are classified as Pipeline Transportation of Crude Oil (NAICS code 486110, see Table 3). Therefore, the CTG recommendations for RACT requirements for pneumatic pumps do not apply to any units in the Chicago NAA.

Table 3. Chicago NAA Oil and Gas Industry Pumps (NAICS 486110)

ID Number	Source Name	SCC	Point Description	Comment
197805AAB	Chicap Pipeline Co.	30600801	Pipeline valves and 10 pumps	Not located at gas plant or well site
197800AAK	ExxonMobil Pipe Line Co.	30600803	Crude oil sump pump	Not located at gas plant or well site
197811AAA	BP Pipelines North America Inc.	20200101	175 HP Emergency fire pump engine	Not located at gas plant or well site; covered by NSPS for engines

6.4 Compressors (Centrifugal and Reciprocating)

For compressors, the CTG recommends RACT apply to:

> *"centrifugal and reciprocating compressors in the oil and natural gas industry located between the wellhead and point of custody transfer to the natural gas transmission and storage segment."*

A search of the Chicago NAA oil and gas point sources emission inventory produced 31 emission units using point source descriptions that contain "compressor," "engine," or SCC codes 31000229, 20200253, and 20200254. A further evaluation of the identified units found that none of the units are connected to wellheads, as there are no oil or gas wells in Chicago NAA (see Table 4). Therefore, the Oil and Gas CTG does not apply to these units.

Furthermore, the VOM-emitting compressors and engines are subject to Federal or State regulations that are equivalent to the requirements of the CTG. Specifically, ANR Pipeline Co. engines listed in Table 4 are compressor engines that transport natural gas along the ANR pipeline system, and are subject to Title 35 IAC Part 218 Subpart B, and to 40 CFR 63 Subpart A

and ZZZZ. The rule requires an add on emission control device, non-selective catalytic reduction, which also controls VOM emissions. Guardian Pipeline Co. engines are located at compressor stations and pump natural gas through interstate transmission pipelines. These engines are controlled by oxidation catalyst systems. Natural Gas Pipeline Co. of America engines are subject to Title 35 IAC Part 218 Subpart B and 40 CFR 60 Subparts A and GG. And North Shore Gas Co. compressors are subject to 40 CFR 63 subpart ZZZZ. Thus, no additional action or SIP revisions are necessary to achieve RACT requirements for compressors related to the Oil and Gas CTG for the Chicago NAA.

Table 4. Chicago NAA Oil and Gas Industry Compressors (NAICS 486210, 211130)

ID Number	Source Name	SCC	Point Description	2016 VOM (TPY)	Comment
093802AAF	ANR Pipeline Co.	20200202	Engine E-1008	84.91	Not located between wellhead and point of transfer
093802AAF	ANR Pipeline Co.	20200202	Engine E-1009	34.94	Not located between wellhead and point of transfer
093802AAF	ANR Pipeline Co.	20200202	Engine E-1007	12.06	Not located between wellhead and point of transfer
111806AAA	ANR Pipeline Co.	20200202	Engine 06-ENG (1550 HP)	11.01	Not located between wellhead and point of transfer
111806AAA	ANR Pipeline Co.	20200202	Engine 07-ENG (1550 HP)	10.83	Not located between wellhead and point of transfer
111806AAA	ANR Pipeline Co.	20200202	Engine 08-ENG (1550 HP)	5.98	Not located between wellhead and point of transfer
111806AAA	ANR Pipeline Co.	20200202	Engine 09-ENG (1550 HP)	5.98	Not located between wellhead and point of transfer
111806AAA	ANR Pipeline Co.	20200202	Engine E-1005	5.20	Not located between wellhead and point of transfer
111806AAA	ANR Pipeline Co.	20200202	Engine E-1006	5.11	Not located between wellhead and point of transfer
197800ABU	Guardian Pipeline Co.	20200254	Engine #5	4.32	Not located between wellhead and point of transfer
197800ABU	Guardian Pipeline Co.	20200254	Engine #4	4.32	Not located between wellhead and point of transfer

197800ABU	Guardian Pipeline Co.	20200254	Engine #2	4.32	Not located between wellhead and point of transfer
197800ABU	Guardian Pipeline Co.	20200254	Engine #3	4.28	Not located between wellhead and point of transfer
197800ABU	Guardian Pipeline Co.	20200254	Engine #1	4.28	Not located between wellhead and point of transfer
063800AAM	Aux Sable Liquid Products	20200101	2 Engines (50-EG501, 50-EG502)	0.20	Not located between wellhead and point of transfer
197811AAA	BP Pipelines North America	20200101	175 HP Emergency Fire Pump Engine	0.11	Not located between wellhead and point of transfer
197811AAA	Natural Gas Pipeline Co. of America	20200201	Engine ENG-10	0.00	Not located between wellhead and point of transfer
197817AAA	Natural Gas Pipeline Co. of America	20200201	Engine ENG-03	0.09	Not located between wellhead and point of transfer
197817AAA	Natural Gas Pipeline Co. of America	20200201	Engine ENG-06	0.09	Not located between wellhead and point of transfer
197817AAA	Natural Gas Pipeline Co. of America	20200201	Engine ENG-02	0.09	Not located between wellhead and point of transfer
197817AAA	Natural Gas Pipeline Co. of America	20200201	Engine ENG-07	0.09	Not located between wellhead and point of transfer
197817AAA	Natural Gas Pipeline Co. of America	20200201	Engine ENG-01	0.09	Not located between wellhead and point of transfer
197817AAA	Natural Gas Pipeline Co. of America	20200201	Engine ENG-04	0.09	Not located between wellhead and point of transfer
197817AAA	Natural Gas Pipeline Co. of America	20200201	Engine ENG-05	0.09	Not located between wellhead and point of transfer
197817AAA	Natural Gas Pipeline Co. of America	20200201	Engine ENG-09	0.09	Not located between wellhead and point of transfer
197817AAA	Natural Gas Pipeline Co. of America	20200201	Engine ENG-08	0.09	Not located between wellhead and point of transfer

097090ABN	North Shore Gas Co.	20200253	Compressor #6	0.02	Not located between wellhead and point of transfer
097090ABN	North Shore Gas Co.	20200253	Compressor #7	0.02	Not located between wellhead and point of transfer
097090ABN	North Shore Gas Co.	20200253	Compressor #8	0.02	Not located between wellhead and point of transfer
097090ABN	North Shore Gas Co.	20200253	Compressor #4	0.02	Not located between wellhead and point of transfer
097090ABN	North Shore Gas Co.	20200253	Compressor #5	0.02	Not located between wellhead and point of transfer

6.5 Equipment Leaks

For equipment leaks. the CTG recommends RACT apply to:

> *"the group of all equipment (except compressors and sampling connection systems) within a process unit located at a natural gas processing plant in VOC service or in wet gas service, and any device or system that is used to control VOC emissions (e.g., a closed vent system). For a piece of equipment to be considered not in VOC service, it must be determined that the VOC content can be reasonably expected never to exceed 10.0 percent by weight. For a piece of equipment to be considered in wet gas service, the piece of equipment must contain or contact the field gas before the extraction step at a natural gas processing plant. Equipment is defined as each pump, pressure relief device, open-ended valve or line, valve, and flange or other connector that is in VOC service or in wet gas service."*

A search of the Chicago NAA oil and gas point source emission inventory using point source descriptions that contain "leaks" produced only one emission unit located at a pipeline transportation of crude oil source (see Table 5). This unit is exempt from the CTG since it is not located at a natural gas processing plant. Furthermore, the unit is subject to 40 CFR 63 Subpart BBBBBB, which includes control requirements for equipment leaks that are equivalent or more stringent than those in the Oil and Gas CTG. Thus, no additional action or SIP revisions are necessary to achieve RACT requirements for equipment leaks related to the Oil and Gas CTG for the Chicago NAA.

Table 5. Chicago NAA Oil and Gas Industry Equipment

ID Number	Source Name	SCC	Point Description	Comment
197811AAA	BP Pipelines North America	40388801	Fugitive emissions: Leaking equipment comp	Not at a natural gas processing plant

6.6 Fugitive Emissions

For fugitive emissions, the CTG recommends RACT apply to:

> *"the collection of fugitive emissions components at well sites with an average production of greater than 15 barrel equivalents per well per day (15 barrel equivalents)139 and the collection of fugitive emissions components at gathering and boosting stations in the production segment. For the purposes of this CTG, fugitive emission reduction recommendations would not apply to well sites that only contain wellheads. Fugitive emissions, for the purposes of applicability of this CTG, means those emissions from a stationary source that could not reasonably pass through a stack, chimney, vent, or other functionally equivalent opening. Equipment leak emissions at natural gas processing plants are covered under chapter 8 of this document."*

A search of the Chicago NAA oil and gas point source emission inventory using point source descriptions that contain "fugitive," excluding fugitive leaks, produced six emission units (see Table 6). These units are not located at well sites and therefore, are not subject to the Oil and Gas CTG. Furthermore, these units are subject to Title 35 IAC Part 218 or 40 CFR part 60, Subpart VVa leak detection and repair ("LDAR") regulations. Both regulations contain requirements for fugitive emissions that are equivalent to or more stringent than those in the Oil and Gas CTG. Thus, no additional action or SIP revisions are necessary to achieve RACT requirements for fugitive emissions related to the Oil and Gas CTG for the Chicago NAA.

Table 6. Chicago NAA Oil and Gas Industry Fugitive Emissions

ID Number	Source Name	SCC	Point Description	Comment
197810AAA	Shell Pipeline Co LP	31088801	Fugitive emissions: valves (1136)	Not located at an applicable well site
197810AAA	Shell Pipeline Co LP	31088801	Fugitive emissions: Pumps and seals (18)	Not located at an applicable well site
197810AAA	Shell Pipeline Co LP	31088801	Fugitive emissions: Flanges (6310)	Not located at an applicable well site
197805AAP	Mobil Pipe Line Co	31000127	Fugitives (valves, pumps, flanges, etc.)	Not located at an applicable well site
063800AAM	Aux Sable Liquid Products	31088801	Propane fugitives	Not located at an applicable well site
063800AAM	Aux Sable Liquid Products	31088801	Ethane regen system fugitives	Not located at an applicable well site

7.0 Conclusion

Illinois EPA reviewed the Chicago NAA emission inventory and performed assessments for sources and units that might potentially require additional regulation pursuant to the Oil and Gas CTG. The Illinois EPA found no oil or gas producing wells, and found no sources or units affected by this CTG in the Chicago NAA for which a SIP revision is necessary to achieve RACT-level control. Most of the sources identified in the oil and gas industry in the Chicago NAA are involved exclusively in the processing, transmission, and distribution of oil and gas. Sources and units that were found to be potentially affected by the Oil and Gas CTG were also found to be exempt and are already controlled by Federal and/or State regulations that include requirements that are equivalent or more stringent than the CTG RACT requirements. Thus, Illinois EPA concludes that there is no further action or SIP revisions necessary to address the requirements of the Oil and Gas CTG for the Chicago NAA.

8.0 Negative Declaration

The Illinois EPA is submitting this Negative Declaration under Sections 111(d) and 129 of the Clean Air Act for the Oil and Gas CTG. This document demonstrates that there is no further action or SIP revisions necessary to address the requirements of the Oil and Gas CTG for the Chicago NAA.

Appendix: List of Chicago NAA Oil and Gas Emission Units

Table 7. List of Potential Emission Units in the Chicago NAA

State ID Number	Source Name	NAICS	Point Description	SCC	Comment
031015ACL	Nicor Gas	221210	2 Gasoline storage tanks	40600603	Exempt-gasoline; less than 4.0 TPY
031060AAK	Nicor Gas	221210	Underground Gasoline storage tank (05-4)	40400404	Exempt-gasoline; less than 4.0 TPY
031063AJD	Nicor	221210	Storage tank #1	40400402	Exempt-gasoline; less than 4.0 TPY
031063AJD	Nicor	221210	Storage tank #2	40301007	Exempt-gasoline; less than 4.0 TPY
031105AAH	Nicor Gas	221210	Gasoline storage tank (10,000 gallons)	40400404	Exempt-gasoline; less than 4.0 TPY
031282ACL	Nicor Gas	221210	Underground Gasoline storage tank (03-1)	40400404	Exempt-gasoline; less than 4.0 TPY
031440AKL	Nicor Gas	221210	Gasoline storage tank (24-1)	40400404	Exempt-gasoline; less than 4.0 TPY
031600FHO	Peoples Gas Light & Coke Co	221210	Gasoline storage tank	40600603	Exempt-gasoline; less than 4.0 TPY
031801AAF	Natural Gas Pipeline Co of America	486210	8820 Natural gas drip tank	40714697	Exempt- emissions less than 4 TPY
031801AAF	Natural Gas Pipeline Co of America	486210	7000 Gallon odorant tank	40799999	Exempt-emissions less than 4 TPY
043045ABQ	Nicor Gas	221210	E-85 Storage tank	40400404	Exempt-gasoline; less than 4.0 TPY
043045ABQ	Nicor Gas	221210	Gasoline storage tank	40400404	Exempt-gasoline; less than 4.0 TPY
063800AAM	Aux Sable Liquid Products	211130	Butamer process	30115320	Controlled under NSPS
063800AAM	Aux Sable Liquid Products	211130	Y-Grade railcar offloading	40688801	Controlled under NSPS
063800AAM	Aux Sable Liquid Products	211130	2 Heaters (50H-501A and 50H-501B)	10200602	Controlled with low NOx burners
063800AAM	Aux Sable Liquid Products	211130	Propane fugitives	31088801	Not located at an applicable well site

State ID Number	Source Name	NAICS	Point Description	SCC	Comment
063800AAM	Aux Sable Liquid Products	211130	Storage tank TK501	40714601	Less than 4.0 TPY; controlled with carbon
063800AAM	Aux Sable Liquid Products	211130	Gas Treatment Units (Merox and Amine) and Molecular Sieve	30190003	Controlled with incinerator
063800AAM	Aux Sable Liquid Products	211130	Train #1 and #2 inlet separator (V678 and V653)	31000299	Less than 4.0 TPY; controlled with flares
063800AAM	Aux Sable Liquid Products	211130	Tank 70V-704	40729697	Less than 4.0 TPY; controlled with flares
063800AAM	Aux Sable Liquid Products	211130	2 Engines (50-EG501 and 50-EG502)	20200101	Not located between wellhead and point of transfer
063800AAM	Aux Sable Liquid Products	211130	Ethane regen system fugitives	31088801	Not located at an applicable well site
063800AAM	Aux Sable Liquid Products	211130	Tank TK-506	40700815	Less than 4.0 TPY
063800AAM	Aux Sable Liquid Products	211130	Ethane regen heater H-309	10200602	Controlled with low NOx burner
063800AAM	Aux Sable Liquid Products	211130	11 Tanks (70V-701A-D, 70V-702A-B, 70V-703A-B, 70V-705, 70V-717, 50TK-520)	40781605	Less than 4.0 TPY
089407ABO	Nicor Gas	221210	E-85 Storage tank	40400497	Exempt-gasoline; less than 4.0 TPY
089407ABO	Nicor Gas	221210	Gasoline storage tank	40400401	Exempt-gasoline; less than 4.0 TPY
089438AFS	Nicor Gas	221210	Underground Gasoline storage tank (09-1)	40301008	Exempt-gasoline; less than 4.0 TPY
093025ABH	Nicor-Yorkville	221210	Storage tank #1	40301007	Less than 4.0 TPY
093802AAF	ANR Pipeline Co	486210	Engine E-1008	20200202	Not located between wellhead and point of transfer
093802AAF	ANR Pipeline Co	486210	Engine E-1009	20200202	Not located between wellhead

State ID Number	Source Name	NAICS	Point Description	SCC	Comment
					and point of transfer
093802AAF	ANR Pipeline Co	486210	Engine E-1007	20200202	Not located between wellhead and point of transfer
093802AAF	ANR Pipeline Co	486210	Engine E-1005	20200202	Not located between wellhead and point of transfer
093802AAF	ANR Pipeline Co	486210	Engine E-1006	20200202	Not located between wellhead and point of transfer
097090ABN	North Shore Gas Co	486210	Compressor #6	20200253	Not located between wellhead and point of transfer
097090ABN	North Shore Gas Co	486210	Compressor #7	20200253	Not located between wellhead and point of transfer
097090ABN	North Shore Gas Co	486210	Compressor #8	20200253	Not located between wellhead and point of transfer
097090ABN	North Shore Gas Co	486210	Compressor #4	20200253	Not located between wellhead and point of transfer
097090ABN	North Shore Gas Co	486210	Compressor #5	20200253	Not located between wellhead and point of transfer
097807AAI	Nicor Gas	221210	Underground gasoline storage tank (08-3)	40400404	Exempt-gasoline; less than 4.0 TPY
111015ACX	Nicor Gas	221210	Gasoline storage tank	40400404	Exempt-gasoline; less than 4.0 TPY
111816AAA	ANR Pipeline Co	486210	Engine 06-ENG (1550 HP)	20200202	Not located between wellhead and point of transfer
111816AAA	ANR Pipeline Co	486210	Engine 07-ENG (1550 HP)	20200202	Not located between wellhead

State ID Number	Source Name	NAICS	Point Description	SCC	Comment
					and point of transfer
111816AAA	ANR Pipeline Co	486210	Engine 08-ENG (1550 HP)	20200202	Not located between wellhead and point of transfer
111816AAA	ANR Pipeline Co	486210	Engine 09-ENG (1550 HP)	20200202	Not located between wellhead and point of transfer
111816AAA	ANR Pipeline Co	486210	Gasoline storage tank	40301001	Exempt-gasoline; less than 4.0 TPY
197045AJM	Nicor Gas	221210	Underground Gasoline storage tank (13-1)	40301008	Exempt-gasoline; less than 4.0 TPY
197095AAF	Nicor Gas	221210	Gasoline storage tank	40301002	Exempt-gasoline; less than 4.0 TPY
197800AAK	Exxon Mobil Pipe Line Co	486110	Crude oil sump pump	30600803	Not located at gas plant or well site
197800AAQ	ANR Pipeline Co	486210	Glycol storage tank (T1)	40705697	Less than 4.0 TPY
197800AAQ	ANR Pipeline Co	486210	Maintenance lube oil storage tank (T3)	40714697	Not located between wellhead and point of transfer
197800AAQ	ANR Pipeline Co	486210	Used lube oil storage tank (T4)	40714697	Not located between wellhead and point of transfer
197800AAQ	ANR Pipeline Co	486210	New Lube oil storage tank (T2)	40714697	Not located between wellhead and point of transfer
197800AAQ	ANR Pipeline Co	486210	6500 gallon storage tank (T5)	40714697	Less than 4.0 TPY
197800ABH	Natural Gas Pipeline Co of America	486210	Odorant storage tank	40703698	Less than 4.0 TPY
197800ABI	Natural Gas Pipeline Co of America	486210	8820 Gallon casing head gasoline drip tank	40714697	Less than 4.0 TPY
197800ABU	Guardian Pipeline Co	486210	Engine #5	20200254	Not located between wellhead and point of transfer

State ID Number	Source Name	NAICS	Point Description	SCC	Comment
197800ABU	Guardian Pipeline Co	486210	Engine #4	20200254	Not located between wellhead and point of transfer
197800ABU	Guardian Pipeline Co	486210	Engine #2	20200254	Not located between wellhead and point of transfer
197800ABU	Guardian Pipeline Co	486210	Engine #1	20200254	Not located between wellhead and point of transfer
197800ABU	Guardian Pipeline Co	486210	Engine #3	20200254	Not located between wellhead and point of transfer
197805AAB	Chicap Pipeline Co	486110	Tank #11	40301109	Not located between wellhead and point of transfer
197805AAB	Chicap Pipeline Co	486110	Tank #15	40301109	Not located between wellhead and point of transfer
197805AAB	Chicap Pipeline Co	486110	Tank #13	40301109	Not located between wellhead and point of transfer
197805AAB	Chicap Pipeline Co	486110	Pipeline valves and 10 pumps	30600801	Not located at gas plant or well site
197805AAB	Chicap Pipeline Co	486110	Tank #12	40301109	Not located between wellhead and point of transfer
197805AAB	Chicap Pipeline Co	486110	Tank #14	40301109	Not located between wellhead and point of transfer
197805AAP	Mobil Pipe Line Co	486110	Roof landing events	40400149	Less than 4.0 TPY
197805AAP	Mobil Pipe Line Co	486110	Tank cleaning events	40400149	Less than 4.0 TPY
197805AAP	Mobil Pipe Line Co	486110	Crude tank #2895	40301142	Not located between wellhead

State ID Number	Source Name	NAICS	Point Description	SCC	Comment
					and point of transfer
197805AAP	Mobil Pipe Line Co	486110	Crude tank #2886	40301132	Not located between wellhead and point of transfer
197805AAP	Mobil Pipe Line Co	486110	Fugitives (valves, pumps, flanges, etc.)	31000127	Not located at an applicable well site
197805AAP	Mobil Pipe Line Co	486110	Corrosion inhibitor storage tank	40301150	Not located between wellhead and point of transfer
197809ABQ	Natural Gas Pipeline Co	486210	Storage tank	40301097	Less than 4.0 TPY
197810AAA	Shell Pipeline Co LP	486110	Fugitive emissions: Valves (1136)	31088801	Not located at an applicable well site
197810AAA	Shell Pipeline Co LP	486110	Fugitive emissions: Pumps and seals (18)	31088801	Not located at an applicable well site
197810AAA	Shell Pipeline Co LP	486110	Fugitive emissions: Flanges (6310)	31088801	Not located at an applicable well site
197810AAA	Shell Pipeline Co LP	486110	Tank 19559	40301117	Not located between wellhead and point of transfer
197810AAA	Shell Pipeline Co LP	486110	Tank 3728	40301117	Not located between wellhead and point of transfer
197810AAA	Shell Pipeline Co LP	486110	Tank 19560	40301117	Not located between wellhead and point of transfer
197810AAA	Shell Pipeline Co LP	486110	Tank 3730	40301075	Not located between wellhead and point of transfer
197810AAA	Shell Pipeline Co LP	486110	Tank 19601	40301075	Not located between wellhead and point of transfer
197810AAA	Shell Pipeline Co LP	486110	Tank 19624	40301117	Not located between wellhead and point of transfer

State ID Number	Source Name	NAICS	Point Description	SCC	Comment
197810AAA	Shell Pipeline Co LP	486110	Tank 3727	40301117	Not located between wellhead and point of transfer
197810AAA	Shell Pipeline Co LP	486110	Tank 3729	40301117	Not located between wellhead and point of transfer
197810AAA	Shell Pipeline Co LP	486110	Tank 3737	40400332	Not located between wellhead and point of transfer
197810AAA	Shell Pipeline Co LP	486110	Tank 3702	40400332	Not located between wellhead and point of transfer
197810AAA	Shell Pipeline Co LP	486110	Tank 19508	40400332	Not located between wellhead and point of transfer
197810AAA	Shell Pipeline Co LP	486110	Tank 3703	40301117	Not located between wellhead and point of transfer
197810AAA	Shell Pipeline Co LP	486110	Tank 3736	40400332	Not located between wellhead and point of transfer
197810AAA	Shell Pipeline Co LP	486110	Tank 3758	40400332	Not located between wellhead and point of transfer
197810AAA	Shell Pipeline Co LP	486110	Tank 3759	40400332	Not located between wellhead and point of transfer
197810AAA	Shell Pipeline Co LP	486110	Tank 3756	40400332	Not located between wellhead and point of transfer
197811AAA	BP Pipelines North America Inc	486110	Group 4: Storage tank 43004	40301102	Exempt-gasoline

State ID Number	Source Name	NAICS	Point Description	SCC	Comment
197811AAA	BP Pipelines North America Inc	486110	Group 4: Storage tank 43002	40400272	Exempt-gasoline
197811AAA	BP Pipelines North America Inc	486110	Group 4: Storage tank 43003	40400272	Exempt-gasoline
197811AAA	BP Pipelines North America Inc	486110	Group 4: Storage tank 43001	40400272	Exempt-gasoline
197811AAA	BP Pipelines North America Inc	486110	Group 4: Storage tank 43000	40301102	Exempt-gasoline
197811AAA	BP Pipelines North America Inc	486110	Group 2: Storage tank 7294	40400304	Not located between wellhead and point of transfer
197811AAA	BP Pipelines North America Inc	486110	Group 1: Storage tank 6971	40400304	Not located between wellhead and point of transfer
197811AAA	BP Pipelines North America Inc	486110	Group 1: Storage tank 6972	40400304	Not located between wellhead and point of transfer
197811AAA	BP Pipelines North America Inc	486110	Group 5: Storage tank 6973	40400304	Not located between wellhead and point of transfer
197811AAA	BP Pipelines North America Inc	486110	Group 3: Storage tank 7295	40400249	Not located between wellhead and point of transfer
197811AAA	BP Pipelines North America Inc	486110	Group 1: Storage tank 7170	40400304	Not located between wellhead and point of transfer
197811AAA	BP Pipelines North America Inc	486110	Group 1: Storage tank 6722	40301142	Not located between wellhead and point of transfer
197811AAA	BP Pipelines North America Inc	486110	Group 1: Storage tank 6825	40400304	Not located between wellhead and point of transfer

State ID Number	Source Name	NAICS	Point Description	SCC	Comment
197811AAA	BP Pipelines North America Inc	486110	Fugitive emissions: Leaking equipment components	40388801	Not at a natural gas processing plant
197811AAA	BP Pipelines North America Inc	486110	175 HP Emergency fire pump engine	20200101	Not located at gas plant or well site; covered by NSPS
197817AAA	Natural Gas Pipeline Co of America	486210	Engine ENG-03	20200201	Not located between wellhead and point of transfer
197817AAA	Natural Gas Pipeline Co of America	486210	Engine ENG-06	20200201	Not located between wellhead and point of transfer
197817AAA	Natural Gas Pipeline Co of America	486210	Engine ENG-02	20200201	Not located between wellhead and point of transfer
197817AAA	Natural Gas Pipeline Co of America	486210	Engine ENG-07	20200201	Not located between wellhead and point of transfer
197817AAA	Natural Gas Pipeline Co of America	486210	Engine ENG-01	20200201	Not located between wellhead and point of transfer
197817AAA	Natural Gas Pipeline Co of America	486210	Engine ENG-04	20200201	Not located between wellhead and point of transfer
197817AAA	Natural Gas Pipeline Co of America	486210	Engine ENG-05	20200201	Not located between wellhead and point of transfer
197817AAA	Natural Gas Pipeline Co of America	486210	Engine ENG-09	20200201	Not located between wellhead and point of transfer
197817AAA	Natural Gas Pipeline Co of America	486210	Engine ENG-08	20200201	Not located between wellhead and point of transfer

State ID Number	Source Name	NAICS	Point Description	SCC	Comment
197817AAA	Natural Gas Pipeline Co of America	486210	Engine ENG-10	20200201	Not located between wellhead and point of transfer
197819AAD	ExxonMobil Pipe Line Co	486110	5 Crude oil storage tanks (338, 339, 340, 341, 342)	40301142	Not located between wellhead and point of transfer