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WISCONSIN
DEPT. OF NATURAL RESOURCES

September 25, 2017

Mr. Robert Kaplan
Acting Regional Administrator
U.S. EPA Region 5 (R-19J)
77 West Jackson Boulevard
Chicago IL 60604-3507

Subject: State Implementation Plan Submittal for Sheboygan County 2008 Ozone NAAQS Moderate Area Attainment Plan

Dear Mr. Kaplan:

In accordance with Section 182(b) of the Clean Air Act (CAA), the Wisconsin Department of Natural Resources (WDNR) submits this State Implementation Plan (SIP) revision for the 2008 ozone National Ambient Air Quality Standards (NAAQS). The WDNR requests SIP approval of the attainment plan for the Sheboygan County 2008 ozone NAAQS nonattainment area (attached). The U.S. Environmental Protection Agency (EPA) reclassified the Sheboygan nonattainment area to "moderate" nonattainment status for the 2008 ozone NAAQS on December 19, 2016 [*81 FR 91841*]. Due to this action, Wisconsin is required to submit a plan to EPA demonstrating how Sheboygan County nonattainment area will attain the 2008 ozone NAAQS. The enclosed plan is submitted to fulfill that requirement.

This SIP submittal meets the completeness requirements of 40 CFR § 51, Appendix V. The WDNR has legal authority under ss. 285.11(6) Wis. Stats., to develop a SIP for prevention, abatement, and control of air pollution. The WDNR provided opportunity for public comment on this SIP submittal and conducted a public hearing in Sheboygan, Wisconsin on July 24, 2017. A copy of the public comment and hearing notice, a summary of comments received, and WDNR's responses to comments are enclosed.

This SIP is being submitted using EPA's electronic SIP (eSIP) submission system. If you have any questions regarding this submittal, please contact David Bizot of my staff at (608) 267-7543 or david.bizot@wisconsin.gov.

Sincerely,

Gail E. Good

Gail E. Good
Director
Air Management Program

cc:

David Bizot – AM/7
Angie Dickens – AM/7
James Bonar-Bridges – LC/8
Doug Aburano – U.S. EPA Region 5 (AR-18J)

Enclosures

1. Sheboygan County 2008 Ozone NAAQS Moderate Area Attainment Plan
2. Public Hearing Notice for Sheboygan County Attainment Plan SIP Submittal
3. Proof of Publication of Public Hearing Notice
4. SIP Certification

ATTAINMENT PLAN

FOR THE

SHEBOYGAN COUNTY, WISCONSIN
2008 8-HOUR OZONE NONATTAINMENT AREA

Developed by:
The Wisconsin Department of Natural Resources

SEPTEMBER 2017

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List of Acronyms

AEI	WDNR's Air Emissions Inventory
CAA	Clean Air Act
CAIR	Clean Air Interstate Rule
CAMx	Comprehensive Air Quality Model with Extensions
CART	Classification and Regression Tree
CD	Consent Decree
CFR	Code of Federal Regulations
CSAPR	Cross-State Air Pollution Rule
CTG	Control Technology Guideline
EGU	Electric Generating Unit
EPA	U.S. Environmental Protection Agency
ERTAC	Eastern Regional Technical Advisory Committee
FID	Facility Identification Number
GEOS-CHEM	Goddard Earth Observing Systems Chemistry Model
GR	Gas Recirculation
GVWR	Gross Vehicle Weight Rating
HC	Hydrocarbon
I/M	Inspection and Maintenance
ICI	Industrial-Commercial-Institutional
IDEM	Indiana Department of Environmental Management
IEPA	Illinois Environmental Protection Agency
LADCO	Lake Michigan Air Directors Consortium
LNB	Low NOx Burner
MACT	Maximum Achievable Control Technology
MAR	Commercial Marine, Aircraft and Rail Locomotive
MATS	Mercury and Air Toxics Standards
MATS	Modeled Attainment Test Software
MDA8	Maximum Daily 8-hour Average Ozone Concentration
mmBtu	Million British Thermal Units
MOVES	Motor Vehicle Emission Simulator
MVEB	Motor Vehicle Emissions Budget
NAAQS	National Ambient Air Quality Standards
NEI	National Emissions Inventory
NESHAP	National Emission Standards for Hazardous Air Pollutants
NMHC	Non-Methane Hydrocarbon
NO	Nitric Oxide
NO_2	Nitrogen Dioxide
NOx	Nitrogen Oxides (NO and NO_2)
OAQPS	U.S. EPA's Office of Air Quality Planning and Standards
OBDII	Vehicle On-Board Diagnostic System.
OFA	Overfire Air
ppb	Parts Per Billion
PTE	Potential To Emit
RACM	Reasonably Available Control Measures
RACT	Reasonably Available Control Technology

RFP	Reasonable Further Progress
RICE	Reciprocating Internal Combustion Engines
ROP	Rate of Progress
SCR	Selective Catalytic Reduction
SIP	State Implementation Plan
SMOKE	Sparse Matrix Operator Kernel Emissions
tpsd	Tons Per Summer Day
VMT	Vehicle Miles of Travel
VOC	Volatile Organic Compound
WDNR	Wisconsin Department of Natural Resources
WRF	Weather Research and Forecasting

1. INTRODUCTION

The Wisconsin Department of Natural Resources (WDNR) has prepared this attainment plan to fulfill the state's Clean Air Act (CAA) state implementation plan (SIP) requirements for the Sheboygan County moderate nonattainment area for the 2008 ozone National Ambient Air Quality Standard (NAAQS). This document was developed in accordance with the U.S. Environmental Protection Agency (EPA)'s draft modeling guidance[1] and the implementation rule for the 2008 ozone NAAQS (80 FR 12264). It includes all required elements for moderate-area attainment plans, including a modeling analysis evaluating whether the area will attain the NAAQS.

1.1. Purpose and Regulatory Requirements

The CAA requires an area not meeting a NAAQS for a specified criteria pollutant to develop or revise its SIP to expeditiously attain and maintain the NAAQS in that nonattainment area. For moderate nonattainment areas, these SIP requirements include:

1) An attainment plan (required under CAA section 182(b)).
2) Reasonably Available Control Technology (RACT) for volatile organic compounds (VOCs) and nitrogen oxides (NOx; CAA section 182(b)(2)).
3) Reasonably Available Control Measures (RACM; CAA section 172(c)(1).
4) Reasonable Further Progress (RFP) reductions in VOC and/or NOx emissions in the area (CAA sections 172(c)(2) and 182(b)(1)).
5) Contingency measures to be implemented in the event of failure to attain the standard (CAA section 172(c)(9)).
6) A vehicle inspection and maintenance (I/M) program, as applicable (CAA section 181(b)(4)).
7) NOx and VOC emission offsets at a ratio of 1.15 to 1 for major source permits (CAA section 182(b)(5)).

This document addresses the first six of these requirements for the Sheboygan County ozone nonattainment area under the 2008 ozone NAAQS. [2]

This attainment plan includes assessments of measured and modeled air quality data. The modeling analyses demonstrate that the Sheboygan County nonattainment area is projected to be within 0.2 parts per billion (ppb) of attaining the 2008 ozone NAAQS in 2017, prior to the July 20, 2018 attainment date. Other analyses recently completed by EPA suggest forecast concentrations of ozone well below the level of the 2008 NAAQS by 2023 (82 FR 1733). Finally, weight of evidence analyses indicate a clear downward trend in average ozone concentrations as measured at the Sheboygan County monitor.

[1] EPA (2014) Draft Modeling Guidance for Demonstrating Attainment of Air Quality Goals for Ozone, $PM_{2.5}$, and Regional Haze, December 3, 2014. https://www3.epa.gov/ttn/scram/guidance/guide/Draft_O3-PM-RH_Modeling_Guidance-2014.pdf

[2] Wisconsin has a Nonattainment New Source Review (NNSR) permitting program that has addressed the seventh requirement.

This document describes how permanent and federally-enforceable control measures in Wisconsin have resulted in substantial reductions of ozone precursor emissions in Sheboygan County. These controls are projected to yield emission reductions that meet RFP requirements. Supplemental analyses are presented as weight of evidence support. These analyses show that ambient levels of ozone and ozone precursors have been substantially reduced in eastern Wisconsin over the past 15 years and that additional emissions reductions within Sheboygan County would not impact attainment year design values. Finally, this document describes how the area has met the other requirements for moderate nonattainment areas for the 2008 ozone NAAQS.

1.2. The Sheboygan 2008 Ozone Nonattainment Area

Historically, exceedances of the federal ozone standards have been recorded along the lakeshore of Lake Michigan, including Sheboygan County. Sheboygan County was designated nonattainment for two previous ozone NAAQS and was redesignated to attainment for the 1979 NAAQS. Sheboygan County monitors have been attaining the 1997 NAAQS for the last three design value years (and had previously monitored attainment for the 2006-08 through 2009-11 design value years). However, this area was not redesignated to attainment before this standard was revoked. This history is shown in Table 1.1.

Table 1.1. Sheboygan County nonattainment history for ozone NAAQS.

Year Promulgated	1979	1997	2008
Level	0.12 ppm	0.08 ppm	0.075 ppm
Averaging Time	1 hour	8 hours	8 hours
WI Nonattainment Area	Sheboygan County	Sheboygan County	Sheboygan County
Classification	Serious/Moderate[a]	Moderate	Marginal (reclassified to Moderate)
Finding of / Redesignation to Attainment	8/26/1996 61 FR 43668	NA[b]	TBD

[a] The Sheboygan nonattainment area was originally classified as “Serious”, but was reclassified from “Serious” to “Moderate” in 1992 (57 FR 56762).

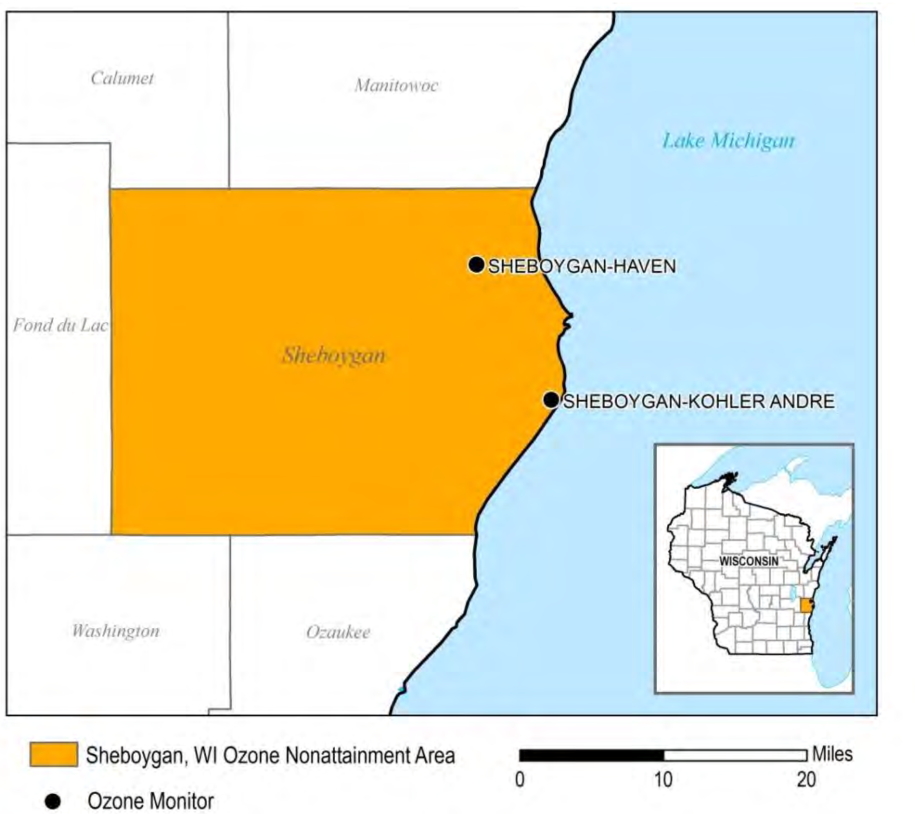
[b] EPA finalized a clean data determination for the 1997 NAAQS for the Sheboygan nonattainment area in 2011 (76 FR 11080). However, the area’s design value exceeded the NAAQS for the 2010-2012 and 2011-2013 design value years. The area has attained the 1997 NAAQS since the 2012-2014 design value year but was not redesignated before the NAAQS was revoked in 2015.

In March 2008, EPA finalized a revision to the 8-hour ozone NAAQS (73 FR 16436). The 2008 ozone NAAQS (0.075 parts per million, ppm) is more stringent than the previous 1997 ozone NAAQS (0.08 ppm). In May 2012, EPA published a final rule that designated all of Sheboygan County as marginal nonattainment for the 2008 ozone NAAQS (77 FR 30088). This nonattainment area (the “Sheboygan nonattainment area”) is shown in Figure 1.1. This nonattainment area designation was based upon EPA’s review of ozone monitoring data collected during the years 2008-2010. On December 19, 2016, EPA reclassified the Sheboygan nonattainment area from marginal to moderate nonattainment status. This reclassification was based on 2012-2014 monitoring data.

Sheboygan County is located in eastern Wisconsin along the western shoreline of Lake Michigan. Sheboygan County had a 2010 population of 115,507, with almost half of the county's population (49,290) living in the largest city, Sheboygan. Sheboygan County is mostly rural, with a population density of 226 persons/square mile in 2010.[3] This county is located just north of the Milwaukee-Waukesha-West Allis Metropolitan Statistical Area.

The lakeshore in Sheboygan County receives high concentrations of ozone transported from emissions sources in upwind regions located to the south, as described in greater detail in Chapter 2 and Section 5.4. As EPA stated its December 19, 2016 reclassification notice, Sheboygan's Kohler Andrae monitor "was not placed to monitor the maximum downwind impacts from the urbanized portion of the Sheboygan area, but to capture maximum downwind impacts from several urban areas along Lake Michigan, including Milwaukee, Wisconsin; Chicago, Illinois; and Gary, Indiana." (81 FR 91842) As will be described further in the document, ozone concentrations measured at this monitor are dominated by emissions originating from upwind areas.

Figure 1.1. Map of the Sheboygan, WI, 2008 ozone nonattainment area ("Sheboygan nonattainment area"), with monitoring locations shown.



[3] http://quickfacts.census.gov/qfd/states/55/55117.html

1.3. Overview of this Attainment Plan

This document is structured as follows:

Chapter 2 outlines a conceptual model for ozone formation in the Lake Michigan region, including Sheboygan County. This chapter describes how synoptic-scale and mesoscale meteorology combine to create high ozone along the Wisconsin lakeshore under particular conditions.

Chapter 3 presents base and future year inventories for Sheboygan County and discusses how these inventories show that the state has met its requirements for RFP and contingency measures. This chapter also outlines the permanent and enforceable emissions reduction measures that have reduced ozone precursor emissions.

Chapter 4 describes the modeled attainment assessment that was completed by the Lake Michigan Air Directors Consortium (LADCO) for the Sheboygan nonattainment area in support of this analysis. This chapter outlines how emission inventories for the modeling were constructed, how the models were run, and discuss the results of the modeled attainment test.

Chapter 5 presents weight of evidence support for this attainment plan. This includes analysis of trends in ozone and ozone precursors, meteorologically adjusted trends in ozone concentrations, and the potential impact of hypothetical additional emissions reductions in Wisconsin on Sheboygan County design values. This chapter also demonstrates the important roles that transport, meteorology and chemistry play in determining ozone concentrations in Sheboygan County.

Chapter 6 describes how the state has met other moderate nonattainment area SIP requirements. These requirements include transportation conformity budgets, RACT programs for NOx, RACM, a vehicle I/M program, and an emission statement program.

Chapter 7 describes how WDNR took public comment on this document.

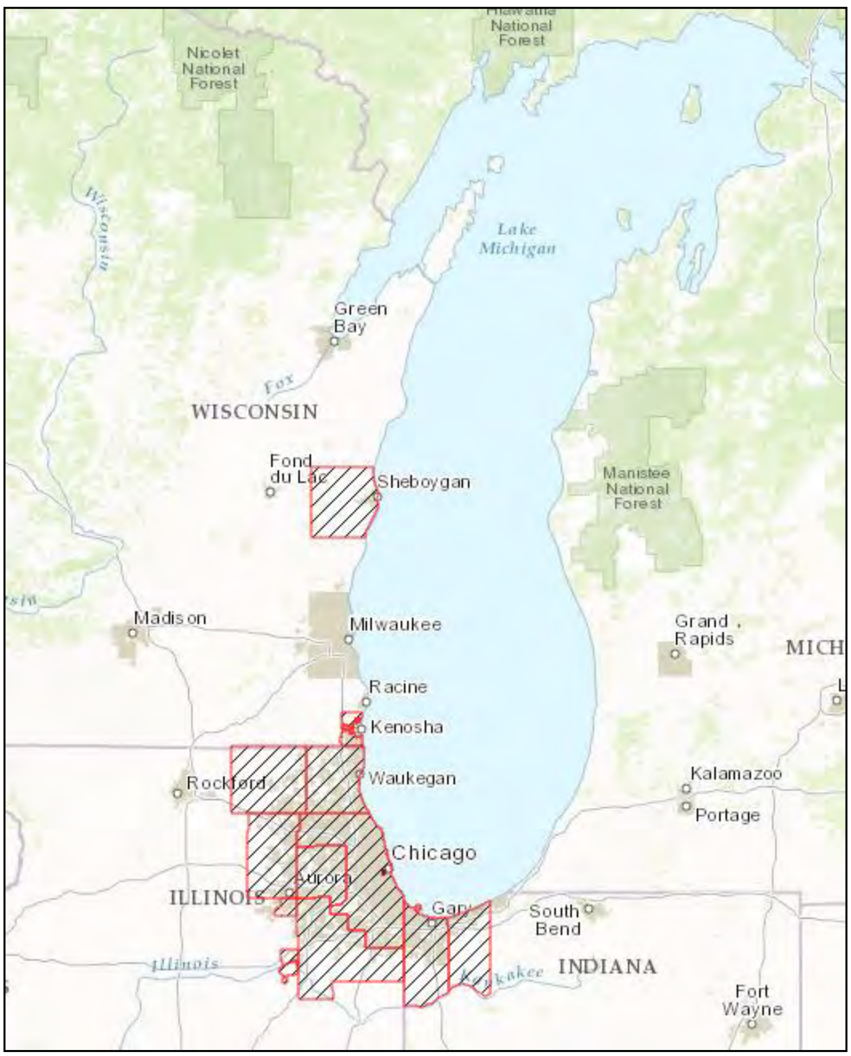
Chapter 8 presents the conclusions of this analysis.

2. THE UNIQUE OZONE DYNAMICS OF THE LAKE MICHIGAN REGION

2.1. Introduction

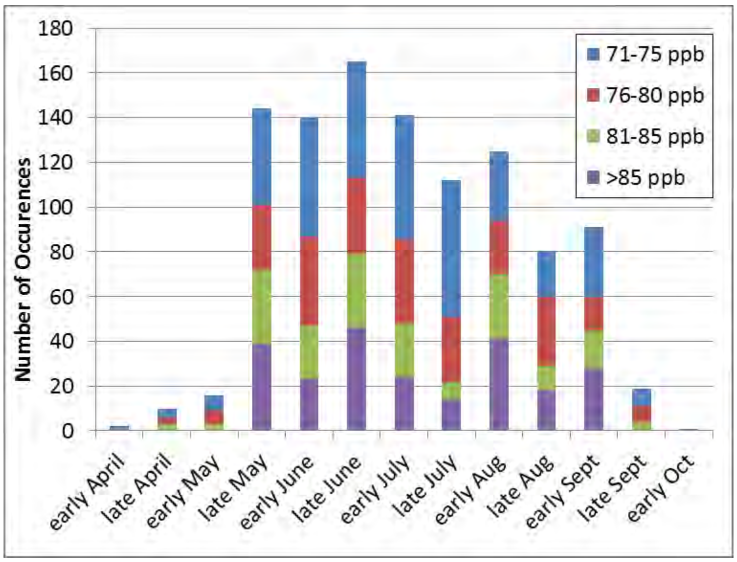
Monitors around Lake Michigan have a long history of ozone concentrations that exceed the level of the NAAQS. Since the promulgation of the original 1979 ozone NAAQS, lakeshore counties in Wisconsin, Illinois, Indiana and Michigan have been designated nonattainment with each subsequent standard. While ozone concentrations have decreased dramatically over time due to implementation of measures controlling ozone precursor emissions, there are still discrete areas with ozone concentrations above established NAAQS. For example, two Lake Michigan areas, Sheboygan County and the area around Chicago, Illinois (Figure 2.1), are currently designated nonattainment for the 2008 ozone NAAQS.

Figure 2.1. A map of the Lake Michigan region, with the Sheboygan and Chicago nonattainment areas for the 2008 ozone NAAQS indicated by hatching (from LADCO, Appendix 9).



Wisconsin's lakeshore monitors most frequently measure ozone concentrations exceeding the 2008 ozone NAAQS from late May through early August, with peak ozone exceedances in late June (Figure 2.2). A smaller number of exceedances occur in late August and early September with ozone concentrations rarely exceeding the 2008 ozone NAAQS before May 15 or after September 15. Ozone concentrations peak in the late spring and early summer because of the abundance of sunlight and heat, both of which contribute to ozone formation. In addition, strong land-lake temperature gradients in late spring and early summer cause lake breeze circulations that can contribute to high ozone concentrations, as discussed below.

Figure 2.2. Distribution of the number of occurrences of maximum daily 8-hour average ozone concentrations (MDA8) at monitors along Wisconsin's Lake Michigan lakeshore. Data are shown for the years 2005-2014.



The unique meteorology of the Lake Michigan area contributes strongly to the elevated ozone levels measured in this area. This meteorology causes transport of significant amounts of ozone from upwind sources to lakeshore counties in Wisconsin and neighboring states. Two types of meteorological patterns affect ozone concentrations in the region:

1) Synoptic scale meteorology[4] transports high concentrations of ozone and ozone precursors northward from source regions to the south and southeast, and
2) Mesoscale meteorology[4] (via land-lake breeze circulation patterns) carries precursors over the lake, where they react to form ozone. Winds then shift to pull the ozone onshore.

This chapter explores the meteorology of this region in greater depth and presents a conceptual model for ozone formation in this area. Subsequent chapters then address the regulatory requirements for this attainment plan, required because of the resultant high ozone concentrations in this region.

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[4] Synoptic scale meteorology refers to weather features of 24-48 hours' duration, whereas mesoscale meteorology refers to weather features of shorter duration.

2.2. The Role of Synoptic-Scale Meteorology on High-Ozone Days

High pressure systems have been shown to generate meteorological conditions favorable to elevated ozone as they move through the eastern U.S. from west to east during late May to early September. These systems are typified by hazy, sunny skies with generally weak, clockwise-rotating winds and relatively shallow mixing such that near-surface pollution concentrations are not diluted by mixing. These meteorological conditions contribute to the buildup of ozone precursors and facilitate formation of ozone via photochemical reactions.

Ozone episodes are generally associated with high pressure systems over the eastern United States that transport pollutants and precursors from the south and east into the Lake Michigan region.[5,6] One study[7] estimated that 50 percent of Wisconsin's ozone exceedance days from 1980 to 1988 under the 1-hour ozone NAAQS occurred when the center of a high pressure system was situated southeast of the area (i.e., Ohio and east thereof). Under these circumstances, high ozone concentrations in the Lake Michigan region may result when polluted air from high emissions regions such as the Ohio River Valley is transported northward along the western side of a high pressure system.[8] In addition, while emissions from the heavily industrialized portions of the Lake Michigan region have decreased dramatically in recent decades (see, e.g., Sections 3 and 5.3), sources in large metropolitan areas along the lakeshore still generate ozone precursor emissions. Pollution from sources in these areas can add to the pool of pollution transported into the Lake Michigan region.[5]

Figure 2.3 shows the synoptic scale weather pattern for one such episode along with the resulting patterns in ozone concentrations. On this day, a high pressure system was located to the southeast, centered over Virginia. Southeasterly to southerly winds on the western side of this system carried pollutants from the Ohio River Valley to Lake Michigan. This episode portrays a common pattern for ozone distributions on episode days: ozone concentrations were lowest in the regions with the highest emissions (in central Chicago and extending into northwestern Indiana) and the highest in rural coastal areas far downwind. During classic transport episodes such as this one, peak ozone concentrations move northward over the course of the day, carried by southerly winds. For example, on the day shown in Figure 2.3, ozone peaked at Wisconsin’s southern Chiwaukee Prairie monitor between 11 a.m. and 1 p.m., at the Kohler Andrae monitor midway up the coast between 2 p.m. and 4 p.m., and at the northern Newport monitor between 4 p.m. and 6 p.m.

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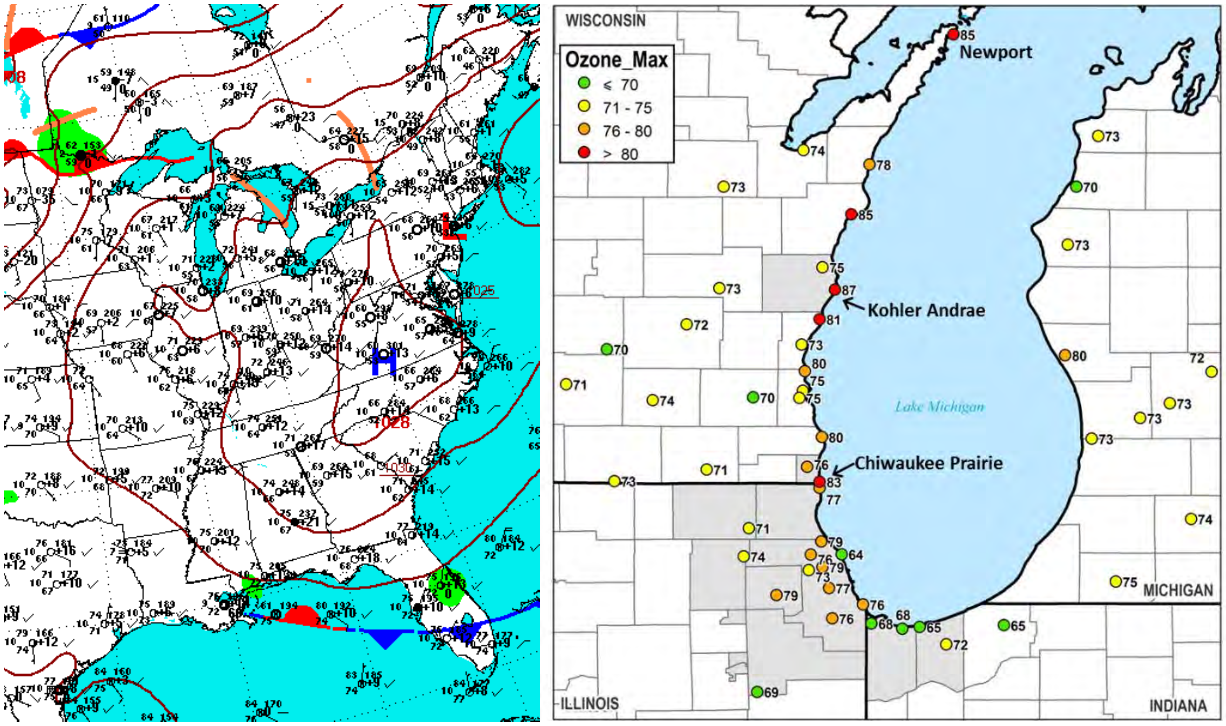
[5] Dye, T.S., P.T. Roberts, and M.E. Korc, 1995: Observations of transport processes for ozone and ozone precursors during the 1991 Lake Michigan Ozone Study. J. App. Meteor, 34: 1877-1889.

[6] Hanna, S.R., and J.C. Chang, 1995: Relations between meteorology and ozone in the Lake Michigan region. J. Applied Meteorology, 34: 670-678.

[7] Haney, J.L., S.G. Douglas, L.R. Chinkin, D.R. Souten, C.S.Burton, and P.T. Roberts, 1989: Ozone Air Quality Scoping Study for the Lower Lake Michigan Air Quality Region, SAI report #SYSAPP-89/101, prepared for US EPA, August, 197 pp.

[8] For example, Ragland, K. and P. Samson, 1977: Ozone and visibility reduction in the Midwest: evidence for large-scale transport. J. Applied Meteorology, 16: 1101–1106.

Figure 2.3. Surface synoptic weather map for 6 a.m. CST for the eastern U.S. (left), and the maximum daily 8-hour average (MDA8) ozone concentrations for the Lake Michigan region (right) for June 19, 2016. The Sheboygan and Chicago ozone nonattainment areas are shaded in gray.



2.3. The Role of Mesoscale Meteorology (Lake Breeze Circulation) on High-Ozone Days

Synoptic meteorological conditions often work in combination with unique lake-induced mesoscale meteorological features to produce the highest ozone concentrations in this region. Historically, Wisconsin's ozone nonattainment areas have been positioned along the state's Lake Michigan shoreline (Figure 2.1). With a surface area of approximately 22,400 square miles, Lake Michigan acts as a large heat sink during the warm months. Figure 2.4 highlights the considerable difference between the over-land air temperatures (measured at Racine, Wisconsin) and overwater air temperatures (measured at a buoy in southern Lake Michigan) during a 5-day ozone episode in June 2002. The strong daytime temperature contrast between the warm land and cold lake can lead to the formation of a thermally-driven circulation cell called the "lake breeze", which runs approximately perpendicular to the Lake Michigan shoreline (Figure 2.5).

As this figure shows, the lake breeze is generally preceded by an early morning land breeze, driven by relatively warm temperatures over the lake. The land breeze can carry ozone precursors emitted from urban areas, primarily Chicago, out over the lake, where they can react to form ozone. The onshore flow of the lake breeze circulation then transports elevated ozone from over the lake into eastern Wisconsin.

Figure 2.4. Hourly surface air temperatures at Racine, WI and at the South Lake Michigan Buoy during an ozone episode on June 20-25, 2002.

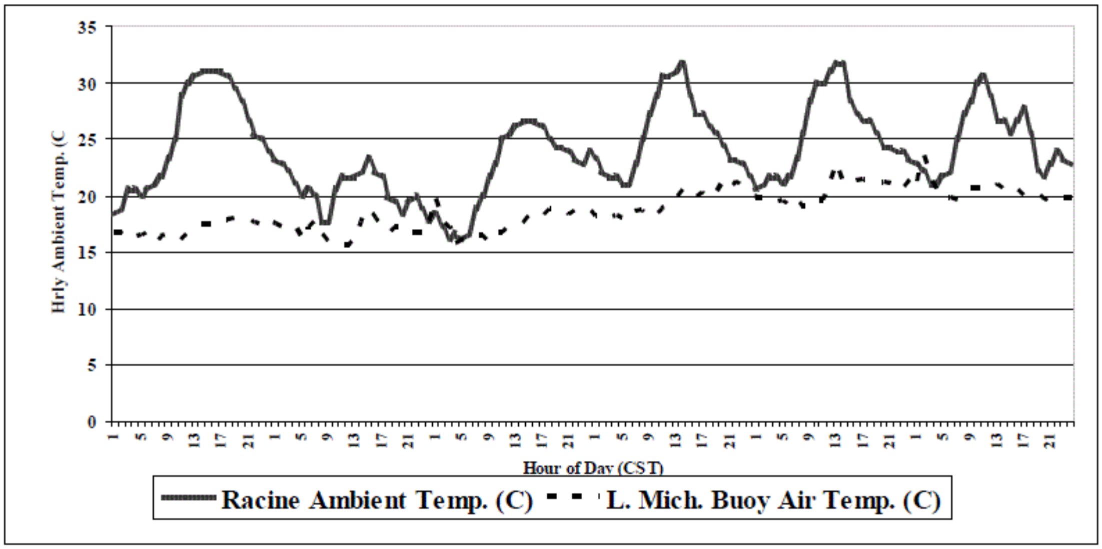
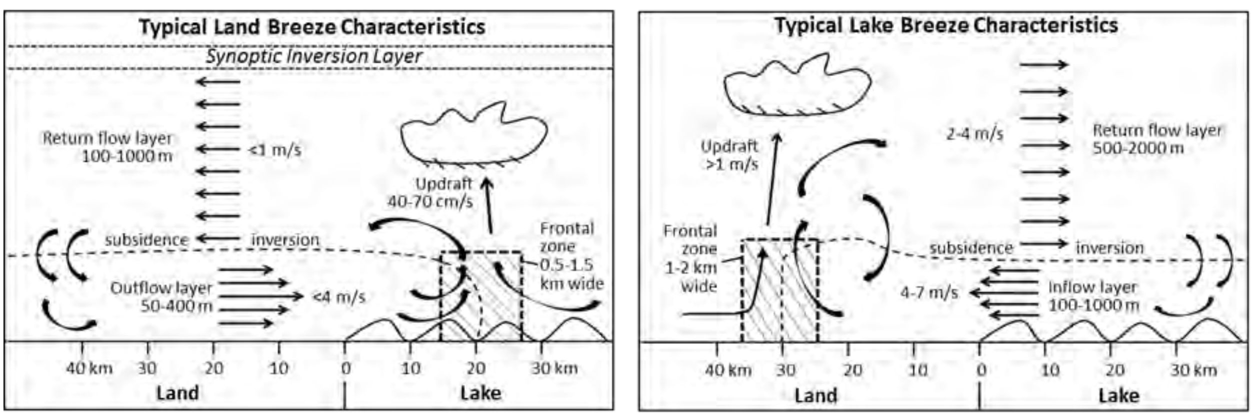


Figure 2.5. Schematic diagrams of the early morning land breeze (left) and late morning/afternoon lake breeze circulations (right) responsible for enhanced ozone production along the Lake Michigan shoreline. (modified from Foley et al., 2011[9])



2.4. Conceptual model for ozone formation in the Lake Michigan region

Synoptic and mesoscale meteorological patterns together drive ozone formation in the region, as described in a conceptual model in Dye et al. (1995).[5] Dye et al. (1995) described this model with a series of inter-related steps. These steps are described below, focusing on the conditions impacting Wisconsin's shoreline:

[9] Foley, T., E. A. Betterton, P.E. R. Jacko, and J. Hillery, 2011: Lake Michigan air quality: The 1994-2003 LADCO Aircraft Project (LAP), Atmos. Env., 45: 3192-3202.

1) A shallow but intensely stable conduction inversion exists just above the relatively cold lake surface (Figure 2.5). During the early morning hours the land breeze and general offshore flow (i.e., southerly to west-southwesterly winds) transport ozone and fresh precursor emissions into the stable air in the conduction layer over Lake Michigan. A primary source region is the Chicago area, located at the southern edge of the lake.

2) By midmorning a sharp horizontal temperature gradient forms along the shoreline between the cold lake air and the increasingly warmer air over the land. This gradient effectively "cuts off" air in the conduction layer from additional injections of shore-emitted precursors. Strong stability in the conduction layer limits dispersion, creating high concentrations of ozone precursors, which can react in this layer.

3) By midmorning, the developing convective boundary layer (CBL) grows and the resulting convection mixes ozone vertically, where it combines with ozone transported from sources outside the region. Ozone concentrations in this air are lower due to the dilutive effects of convective mixing. As this air is transported toward the lake, it is forced to flow up and over the conduction layer (Figure 2.5).

4) This ozone-rich air in both layers is transported northward over Lake Michigan by the prevailing winds. When a lake breeze is present, it produces southerly to south-southeasterly winds along the western shore of Lake Michigan. This wind pattern transports the ozone originating from sources in the south to downwind receptor regions along the eastern Wisconsin lakeshore. On occasion, areas north of Ozaukee County experience elevated ozone levels as a southerly wind intercepts the shoreline where it juts into Lake Michigan.

5) When the ozone-laden air flows onshore in the downwind receptor regions, air with the highest ozone concentrations, located in the lowest 300 meters, mixes with the air at ground level along the shoreline. This causes the highest ozone concentrations to be found along the shoreline. Eventually, air from higher altitudes mixes with air at ground level further inland. This air mass is the remnant of the ozone-diluted CBL air that flowed up and over the conduction layer during the mid-morning hours, which is why ozone concentrations are lower further inland.

This complex meteorology leads to the high ozone concentrations and persistent nonattainment issues faced by the counties along the Lake Michigan shoreline. The impact of this meteorology on the transport of ozone, NOx, and VOCs to Sheboygan County is explored in more detail in Chapter 5.

3. REASONABLE FURTHER PROGRESS (RFP), CONTINGENCY MEASURES, AND IMPLEMENTED CONTROL MEASURES

3.1. Introduction

Sections 172(c)(2) and 182(b)(1) of the federal CAA require states with ozone nonattainment areas classified as moderate or higher to submit plans that show RFP towards attaining the NAAQS. The implementation rule for the 2008 ozone NAAQS[10] defines RFP for moderate nonattainment areas (e.g., Sheboygan County) as a demonstration that there has been at least a 15% emission reduction between the base year (2011) and the attainment year (2017). Because this area has a previously approved 15% VOC rate of progress (ROP) plan (61 FR 11735), the 15% reduction requirement for the 2008 NAAQS can be satisfied with any combination of NOx and VOC reductions. These reductions may come from any SIP-approved or federally promulgated measures implemented after the base-year.

States must also submit requirements for contingency measures that will be implemented if the state fails to attain the standard as required by CAA Section 172(c)(9). These contingency measures must represent one year of emissions reduction progress, equivalent to an additional 3% reduction. States may meet contingency measures by demonstrating an additional 3% reduction in combined NOx and VOC emissions within one year beyond that required for RFP. Inventories for 2018 are included to make this demonstration.

Table 3.1 provides a summary of the Sheboygan County emission inventories (in tons per summer day, or tpsd) for NOx and VOC. Sections 3.2 and 3.3 present the emission inventories by sector (i.e., point, area, onroad and nonroad) for Sheboygan County for the base (section 3.2) and projected (section 3.3) years. These sections also include the supporting methodology used to develop the inventories. Section 3.4 demonstrates that the state has met its RFP requirement for the Sheboygan County nonattainment area, and Section 3.5 outlines contingency measures. Finally, Section 3.6 describes the enforceable control measures that led to the significant reductions in both NOx and VOC emissions.

Table 3.1. Sheboygan County NO_x and VOC emissions (tons per summer day, tpsd).

Pollutant	2011	2017	2018	2011-2017 change (%)	2017-2018 change (%)*
NOx	25.00	15.48	15.02	- 38.1%	-1.9%
VOC	14.68	12.95	12.67	-11.8%	-1.9%

*The % change from 2017 to 2018 was calculated relative to 2011 emissions.

3.2. 2011 Base Year Inventory for RFP

The base year (2011) portion of the RFP requirement is a compilation of all anthropogenic sources of NOx and VOC for an average summer day in 2011, incorporating all control programs in place at that time. The WDNR followed EPA's requirements and guidance to prepare a

[10] Implementation of the 2008 National Ambient Air Quality Standard for Ozone: State Implementation Plan Requirements, 80 FR 12264, March 6, 2015.

comprehensive statewide emission inventory of NOx and VOC emissions for 2011. EPA has approved Wisconsin's 2011 emission inventories for Sheboygan County and other nonattainment areas under the 2008 8-hour ozone standard (81 FR 11673). The following is a description of the methodologies used to develop the sector-specific emission inventory estimates. Appendix 1 includes a more thorough discussion of the methodology used to estimate emissions for 2011. Table 3.2 shows the NOx and VOC emissions (in tpsd) in 2011 for the different sectors.

Table 3.2. Sheboygan County NOx and VOC emissions (tpsd) for nonattainment year 2011.

Pollutant	Point - EGU	Point – Non-EGU	Area	Onroad	Nonroad	Total
NOx	13.64	1.19	1.32	5.37	3.47	25.00
VOC	0.99	1.81	6.17	2.44	3.28	14.68

3.2.1. Point Source Inventory

There are two electric generating unit (EGU) point source facilities located in Sheboygan County: the Edgewater coal-fired power plant and the Sheboygan Falls natural gas fired power plant. For these sources, WDNR used the maximum daily heat input reported in EPA's Clean Air Market Division database for each facility as a conservative estimate of summer day heat input during the 2011 ozone season. The summer day emissions were then calculated by multiplying the maximum daily heat input by an average NOx and VOC emission rate for each facility. Appendix 2 provides the detailed methodology used to calculate EGU summer day emissions.

The 2011 emission inventory for non-EGU point sources were tabulated using the emissions data reported annually by each facility operator to the WDNR air emissions inventory (AEI).[11] The AEI calculates emissions for each individual emissions unit or process line by multiplying fuel or process throughput by the appropriate emission factor that is derived from mass balance analysis, stack testing, continuous emissions monitoring, engineering analysis, or EPA's Factor Information Retrieval database. The emission calculations in the AEI also account for any operating control equipment. Appendix 3 provides a list of non-EGU point source emissions by facility identification number (FID) and facility name for 2011. These non-EGU point source facilities are assumed to operate steadily over 365 days each year. Therefore, summer day emissions are derived by dividing each facility's annual reported emissions by 365 days.

3.2.2. Area Source Inventory

For 2011, area source emission estimates were based on calculations used for submission to the National Emissions Inventory (NEI), unless otherwise indicated. EPA has approved Wisconsin's 2011 NEI data. These emissions were typically calculated using population, gasoline consumption, employment, crop acreage and other activity surrogates associated with the source categories. These categories mainly include industrial, commercial and institutional fuel combustion, solvent utilization, residential wood combustion and agricultural emissions. For each source category, any point source activity or emissions were subtracted from total category-

[11] Under Wisconsin rule NR 438.03, Wis. Adm. Code, a facility operator is required to report NOx or VOC emissions data to the WDNR for any facility emitting 5 or more tons of NOx or 3 or more tons of VOC per year. These sources are considered "point" sources. Smaller stationary sources are considered "area" sources.

specific activity or emissions to calculate area category-specific emissions and avoid double counting. Emission factors were derived from local data, local or national surveys and EPA procedural guidance for the development of emission inventories. Appendix 4 includes tables of area source emissions by source category.

3.2.3. Onroad Inventory

The 2011 onroad emission estimates were developed using the EPA's current mobile source emissions model, the Motor Vehicle Emission Simulator (MOVES2014a). All estimates were made in accordance with current EPA technical guidance. The key inputs used for the MOVES2014a modeling include:

- Vehicle age distributions based on registration data from the Wisconsin Department of Transportation (WDOT);

- Detailed transportation data for Sheboygan County provided by the WDOT, including vehicle miles of travel (VMT) by roadway class for the two general weight classes of light-duty and heavy-duty, and average speed distributions; and

- Control measures, including the Wisconsin vehicle I/M program.

Hot summer day temperatures were input to the model (minimum 65 degrees F, maximum 93 degrees F). This temperature range has been used for all onroad ozone SIP modeling in Sheboygan County since the 1990 CAA Amendments and is based on a WDNR analysis of temperatures on high ozone days.

Appendix 5 provides detailed listings of the estimated onroad emissions and activity data.

3.2.4. Nonroad Inventory

For the purpose of inventory calculation, nonroad mobile sources are divided into two major groups:

- Commercial Marine, Aircraft and Rail Locomotive (MAR)
- All other nonroad categories

Nonroad categories other than MAR include:

- Recreational vehicles
- Construction equipment
- Industrial equipment
- Lawn and garden equipment
- Agricultural equipment
- Commercial equipment
- Logging equipment
- Underground mining equipment
- Oil field equipment

- Pleasure craft
- Railway maintenance equipment

The 2011 nonroad emissions for the non-MAR categories were developed using EPA's MOVES2014a model using the same hot summer day temperatures used for the onroad emissions modeling. The model was run for Sheboygan County for the months of June, July and August. Hot summer day emissions were calculated by dividing the total emissions over these three months by 92 (the number of days in the three months).

Annual emissions for the MAR categories were obtained from EPA's 2011 Emissions Modeling Platform, Version 6.3. This platform allocated the commercial marine emissions in Lake Michigan east of Sheboygan County to the Michigan side of the Lake, reflecting the location of shipping lanes. As a result, no commercial marine emissions were attributed to Sheboygan County. Summer day emissions for the other two MAR categories were estimated by applying annual-to-summer day ratios from inventories by LADCO for the year 2007.

Appendix 6 provides detailed listings of the estimated nonroad emissions data for over 200 subcategories.

3.3. 2017 & 2018 Projected Year Inventories for RFP

Emissions for the attainment year (2017) were projected using the methodological approaches described below. The same approaches were used to project emissions for 2018, which will be used to meet the required contingency. Appendix 7 includes more information on emissions projection methodology. Tables 3.3 and 3.4 show the projected NOx and VOC emissions (in tpsd) in 2017 and 2018 for the different sectors. The application of these inventory projection methodologies also forecasts that the current trend of decreasing NOx and VOC emissions will continue into the near future.

Table 3.3. Sheboygan County NOx and VOC emissions (tpsd) for projected attainment year 2017.

Pollutant	Point - EGU	Point – Non-EGU*	Area	Onroad	Nonroad	Total
NOx	7.14	1.40	1.31	3.29	2.34	15.48
VOC	0.82	2.11	6.13	1.62	2.27	12.95

* Includes projections of emissions for both existing sources and new/modified sources.

Table 3.4. Sheboygan County NOx and VOC projected 2018 emissions (tpsd) for additional year of attainment.

Pollutant	Point - EGU	Point – Non-EGU*	Area	Onroad	Nonroad	Total
NOx	7.14	1.40	1.31	2.96	2.21	15.02
VOC	0.82	2.14	6.07	1.49	2.16	12.67

* Includes projections of emissions for both existing sources and new/modified sources.

3.3.1. Point Source Inventory Projections

As previously stated, the Edgewater and Sheboygan Falls power plants are the two EGU point sources in Sheboygan County. WDNR conservatively based projections of summer day emissions through 2018 on the average of the 99th percentile highest heat input days from the 2011 through 2016 ozone seasons for each facility. These projected heat input values were then multiplied by projected emission rates for each facility to yield projected summer day emissions. The projected NOx emission rates are based on demonstrated emission rates since 2011 and incorporate the committed continued operation of controls. The projected VOC emission rates assume the 2015 demonstrated emission rates for each facility will continue in the future. The details of the EGU projection methodology and calculations are provided in Appendix 2.

Based on this information, NOx emissions are projected to be 7.14 tpsd and VOC emissions to be 0.82 tpsd in both the 2017 and 2018 inventory years for the Edgewater and Sheboygan Falls power plants (Tables 3.3 and 3.4). These projected emission levels do not represent an enforceable emission requirement for daily emissions. Instead, these values represent the reasonably expected summer day maximum emissions for the EGU sector in Sheboygan County.

Non-EGU point source emissions are projected for 2017 and 2018 by applying growth factors to the 2011 base year inventory. These growth factors were developed from Annual Energy Outlook 2014 and 2016 industry-specific energy consumption data.[12,13] Additional emissions for the non-EGU sector were then factored in by projecting emissions for new and modified sources that have been or may be permitted to start operation by 2017. A more detailed description of the methodology for projecting non-EGU point source emissions is provided in Appendix 7, and a list of sources with the applied growth rates and calculated emissions is provided in Appendix 3. It should be noted that Wisconsin's approach to projecting emissions for non-EGU point sources is more conservative than EPA-projected inventories, which typically assume "no-growth" for non-EGU point sources.

3.3.2. Area Source Inventory Projections

EPA's 2011 Emissions Modeling Platform, Version 6.2 includes projections for the years 2017 and 2025.[14] Wisconsin's 2017 area source emissions estimates were based on EPA's 2017 modeling inventory, unless otherwise indicated. Wisconsin's 2018 area source emissions were estimated by interpolating between EPA's 2017 and 2025 modeling inventories, unless otherwise indicated. Projected area source emissions can be found in Appendix 4. Appendix 7 includes more information on emissions projection methodology for area source emissions.

[12] Annual Energy Outlook 2014, 2014. U.S. Energy Information Administration Analysis and Projections Web site. http://www.eia.gov/forecasts/archive/aeo14/ (accessed Feb 15, 2016).
[13] Annual Energy Outlook 2016, 2016. U.S. Energy Information Administration Analysis and Projections Web site. http://www.eia.gov/forecasts/aeo/ (accessed Dec 7, 2016).
[14] ftp://ftp.epa.gov/EmisInventory/2011v6/v2platform/2017emissions/

3.3.3. Onroad Inventory Projections

The 2017 and 2018 projected onroad emissions were developed using the MOVES2014a model, as was the case for the 2011 emissions. Vehicle age distributions were projected using a spreadsheet program developed by EPA. WDOT provided projected transportation data. WDNR increased the onroad mobile source portions of the 2017 and 2018 projected VOC and NOx emissions inventories by 15% to account for uncertainties in future mobile source emission factors as well as activity levels, as agreed upon through the transportation conformity consultative process. The motor vehicle I/M program was assumed to remain in effect. Detailed listings of the projected onroad emissions and activity data are provided in Appendix 5.

3.3.4. Nonroad Inventory Projections

The methodology for the 2017 and 2018 projected nonroad emissions is parallel to the methodology used for the 2011 estimates. For the non-MAR categories, the MOVES2014a model was run at hot summer day temperatures, assuming the model's default growth projections. For the MAR categories, the 2017 emissions were directly obtained from EPA's Version 6.3 Modeling Platform. As was the case for 2011, the Platform's 2017 commercial marine emissions for Sheboygan County were zero, with those emissions to the east of Sheboygan County allocated to the Michigan side of Lake Michigan, reflecting general shipping lanes. The 2018 emissions were linearly extrapolated from the 2011 and 2017 emissions on that platform. Detailed listings of the projected nonroad emissions for over 200 subcategories are provided in Appendix 6.

3.4. Demonstration of RFP

Because Sheboygan County has already met the 15% VOC ROP requirement in addressing a prior ozone NAAQS, the required 15% RFP reduction can come from any combination of NOx and VOC reductions occurring between 2011 and 2017. WDNR compared actual emissions from 2011 to emission estimates from the projected attainment year (2017) and the additional year of attainment (2018) for Sheboygan County, as shown in Tables 3.5 and 3.6 and Figure 3.1. NOx emissions are projected to decrease by 38.1% (9.51 tpsd) between 2011 and 2017. The largest reductions in NOx for the 2011–2017 period are projected from the point source EGU sector (6.50 tpsd), followed by the onroad mobile sector (2.09 tpsd). The EGU reductions are due to consent decree requirements detailed in Section 3.6, while the onroad mobile reductions are due to the federal and state mobile source control programs also detailed in Section 3.6. VOC emissions are projected to decrease by 11.8% (1.73 tpsd) over this same time period. The largest VOC reductions are from the nonroad mobile sector (1.01 tpsd) followed by the onroad mobile sector (0.81 tpsd).

Overall, the combined reduction in NOx and VOC emissions on a percent basis between the base year (2011) and the projected attainment year (2017) is 49.9%. This reduction level is well in excess of the required 15% reduction, demonstrating that the RFP requirement is satisfied for the Sheboygan nonattainment area. Examination of the onroad and nonroad portions of the inventory demonstrate that the required 15% reduction was met through permanent and enforceable measures. Vehicle miles of travel in Sheboygan County were projected to increase from 2011 to 2017 (Appendix 5). However, the combined reductions in NOx and VOC emissions from onroad and nonroad sources during this period was 25.3% of total emissions. Permanent and enforceable measures from the mobile sector alone therefore accounted for emissions reductions in excess of 15% of total emissions.

Table 3.5. Sheboygan County comparison of NOx emissions (tpsd) by source type.

Sector	2011	2017	2018	2011-2017 change (%)*	2017-2018 change (%)*
Point - EGU	13.64	7.14	7.14	-47.7%	0.0%
Point - Non-EGU†	1.19	1.40	1.40	+17.7%	-0.3%
Area	1.32	1.31	1.31	-0.8%	0.0%
Onroad	5.37	3.29	2.96	-38.8%	-6.1%
Nonroad	3.47	2.34	2.21	-32.4%	-3.8%
TOTAL	**25.00**	**15.48**	**15.02**	**-38.1%**	**-1.9%**

*The percent changes from 2011-2017 and 2017-2018 were calculated relative to 2011 emissions.
†Includes projections of emissions for both existing sources and new/modified sources.

Table 3.6. Sheboygan County comparison of VOC emissions (tpsd) by source type.

Sector	2011	2017	2018	2011-2017 change (%)*	2017-2018 change (%)*
Point - EGU	0.99	0.82	0.82	-17.0%	0.0%
Point - Non-EGU†	1.81	2.11	2.14	+16.7%	+1.5%
Area	6.17	6.13	6.07	-0.7%	-0.9%
Onroad	2.44	1.62	1.49	-33.4%	-5.5%
Nonroad	3.28	2.27	2.16	-30.9%	-3.5%
TOTAL	**14.68**	**12.95**	**12.67**	**-11.8%**	**-1.9%**

*The percent changes from 2011-2017 and 2017-2018 were calculated relative to 2011 emissions.
†Includes projections of emissions for both existing sources and new/modified sources.

3.5. Contingency Measures

The state must also include contingency measures representing one year of emissions reduction progress, equivalent to an additional 3% reduction. These measures must be implemented within one year of an area failing to attain the NAAQS. Table 3.5 shows that NOx emissions are projected to decrease an additional 1.9% from 2017 to 2018. Similarly, Table 3.6 shows that VOC emissions are projected to decrease an additional 1.9% from 2017 to 2018. Overall, NOx and VOC emissions are projected to decrease by a combined 3.7% from 2017 to 2018. This means that even if Sheboygan County does not attain the 2008 NAAQS in the 2017 attainment year, NOx and VOC emissions are projected to decrease by more than 3% in the following year without the state needing to do anything to trigger such reductions. Accordingly, these emissions reductions serve as the progress-related contingency measures for the Sheboygan County nonattainment area under the 2008 ozone NAAQS.

Figure 3.1. Sheboygan County (top) NOx and (bottom) VOC emissions by source type.

3.6. Control Strategies for Ozone Precursor Emissions

This section documents the permanent and enforceable control measures that have reduced emissions in Sheboygan County. Many of the control measures listed have been implemented under long-standing programs (that began prior to 2011).[15] These measures will continue to contribute to emissions reductions through the 2017 ozone season, facilitating attainment by the July 20, 2018 attainment date. However, this discussion highlights those control measures and

[15] Section 5.3 shows emission trends extending back to 2002.

emission reductions that have occurred since 2011. Other federal control programs reducing emissions in both the larger nonattainment area and transport regions are also discussed.

It is important to note that the sources of NOx and VOC emissions from Sheboygan County are already very well-controlled.

3.6.1. Point Source Control Measures

NOx Control Measures

Wisconsin NOx RACT – Wisconsin has implemented RACT for major NOx sources (sources with a potential to emit (PTE) of 100 tons or greater per year) in a number of areas, including all of Sheboygan County, as part of compliance requirements for the 1997 ozone NAAQS[16]. The NOx RACT requirements are codified under ss. NR 428.20 to 428.25, Wis. Adm. Code. Affected facilities were required to first comply with NOx RACT emission limitations beginning May 1, 2009.

Table 3.7 shows that approximately 85% of annual point source NOx emissions in Sheboygan County during 2015 originated from two coal-fired boilers operated by Wisconsin Power and Light (WPL) at the Edgewater electric utility plant. Another boiler at Edgewater was retired in 2015 and last run in 2013.

Edgewater's boilers have been subject to NOx emissions limitations under a consent decree (CD) since 2013. Under the CD, Edgewater coal-fired boiler B23 has a NOx cap of 250 tons per year and was required to retire, refuel or repower by December 31, 2015. Boiler B23 was retired in 2015. Edgewater coal-fired boiler B24 has a limitation of 0.170 pounds per million British thermal units (mmBTU) on a 30-day rolling average and 0.150 lb/mmBTU on a 12-month rolling average, with a requirement to retire, refuel or repower by December 31, 2018. Edgewater coal-fired boiler B25 has a limitation of 0.080 lb/mmBTU on a 30-day rolling average and 0.070 lb/mmBTU on a 12-month rolling average. The CD control requirements are permanent and federally enforceable under the Title I permit 13-POY-154-R1.

In 2015, approximately 146 individual emission units were responsible for the remaining 14.7% of NOx emitted by point sources in the Sheboygan County nonattainment area. These emission units are at smaller facilities that do not have PTEs above major source thresholds or are individual emissions units that are relatively small in PTE or operate infrequently (e.g., batch heat treat furnaces, emergency generators, auxiliary boilers) and therefore are not subject to NOx RACT requirements. If the owners of these facilities modify or add sources such that total facility potential emissions increase above 100 tons per year, the facilities and emission units become subject to state NOx RACT requirements. In addition, any new emission units at these facilities would be subject to performance standards under s. NR 428.05, Wis. Adm. Code, as discussed in section 6.2.

[16] Wisconsin's NOx RACT program is described in greater detail in Section 6.2.

Table 3.7. 2008-2015 NOx emissions and requirements for point sources in the Sheboygan County nonattainment area.

FID	Facility	2008 NOx (Annual Tons)	2011 NOx (Annual Tons)	2015 NOx (Annual Tons)	2008 – 2015 Emissions Change	Permanent and Enforceable Control Measures
460033090	WPL-Edgewater Power Plant: Boilers B23, B24 & B25	4,503.0	3,297.6	1,453.4	-67.7%	Boiler B23: retired in 2015 Boiler B24: 0.15 lb/mmBTU (required to refuel or retire by Dec 31, 2018) Boiler B25: 0.07 lb/mmBTU (May 2013)
	Percent of Total	95.1%	88.3%	85.3%		
Multiple	Balance of Emission Units (NOx tons)	231.7	435.2	250.7	8.2%	Emission units become subject to NOx RACT if facilities exceed 100 TPY PTE in the future.
	Percent of Total	4.9%	11.7%	14.7%		
	Number of Emission Units	148	151	146		
Total		**4,734.7**	**3,732.8**	**1,704.0**	**-64.0%**	

Wisconsin NOx Control - Wisconsin codified NOx rules under ss. NR 428.04 to 428.12. Affected sources were required to first comply with the NOx emission limitations beginning February 1, 2001. The ch. NR 428 codified NOx limitations contributed to the NOx emission reductions as shown in Table 3.7. The Wisconsin NOx control program in ch. NR 428 also implemented emission limitations to ensure that any new source is installed with NOx emissions control equipment.

Federal NOx Transport Rules – Beginning January 1, 2009 EGUs in 22 states east of the Mississippi (including Wisconsin) became subject to ozone season NOx emission budgets under the Clean Air Interstate Rule (CAIR). CAIR addresses the broad regional interstate transport of NOx affecting attainment and maintenance of the 1997 ozone NAAQS as required under CAA s. 110(a)(2)(D)[17]. CAIR resulted in a significant reduction of NOx emissions during the ozone season in areas contributing to Sheboygan County over the 2009-2014 period.

Table 3.8 shows emission levels for EGUs affected by the CAIR rule through 2014 for states upwind of the Sheboygan County area. The states listed (in decreasing order of contribution) are those states contributing more than 1% of the 2008 standard (0.75 ppb) to the Sheboygan Kohler-Andre monitor[18]. Between 2008 and 2014, total EGU emissions across these states decreased by approximately 24%. Emission reductions were proportionately larger, ranging from 24% to

[17] The first transport rule promulgated by EPA was the NOx SIP Call in 2003. The EGU requirements are subsumed by the CAIR rule. However, NOx emissions for some larger industrial sources in states contributing to Wisconsin continue to be regulated under the NOx SIP Call.
[18] Contributions as determined by EPA in the final CSAPR rule, 76 FR 48208, August 8, 2011.

54.4%, for the three states contributing the most to Sheboygan County ozone concentrations: Illinois, Indiana, and Wisconsin.

Starting with the 2015 ozone season, the Cross-State Air Pollution Rule (CSAPR) replaced CAIR to reduce interstate NOx transport relative to the 1997 ozone NAAQS. CSAPR implemented NOx budgets for the impacted states in two phases. Phase I limits NOx emissions in 2015 and 2016. EPA published the CSAPR Update (81 FR 74504) in 2016 to address NOx transport affecting the attainment and maintenance of the 2008 ozone NAAQS (79 FR 16436). The CSAPR Update establishes Phase II NOx budgets starting with the 2017 ozone season.

Table 3.8. EGU NOx emitted under the CAIR program in states contributing > 0.75 ppb (1% of the 2008 NAAQS) in Sheboygan County.

State	CSAPR Modeled Contribution to Sheboygan County[a] (ppb)	Ozone Season NOx Emissions (Tons)			Percent Reduction		
		2008	2011	2014	2008 - 2011	2011 – 2014	2008 – 2014
Illinois	28.209	29,891	25,755	17,132	13.8%	33.5%	42.7%
Indiana	11.244	53,016	48,926	40,247	7.7%	17.7%	24.1%
Wisconsin	8.437	19,947	13,818	9,087	30.7%	34.2%	54.4%
Michigan	3.117	38,437	32,780	24,981	14.7%	23.8%	35.0%
Ohio	3.027	52,479	43,346	32,181	17.4%	25.8%	38.7%
Kentucky	2.007	39,324	40,055	33,896	-1.9%	15.4%	13.8%
Missouri	1.812	34,820	26,912	31,235	22.7%	-16.1%	10.3%
W. Virginia	1.167	25,398	23,431	28,681	7.7%	-22.4%	-12.9%
Pennsylvania	1.159	53,545	64,885	44,005	-21.2%	32.2%	17.8%
Virginia	0.865	17,392	15,620	9,695	10.2%	37.9%	44.3%
Arkansas	0.840	16,561	17,868	18,135	-7.9%	-1.5%	-9.5%
Louisiana	0.767	24,031	22,785	18,278	5.2%	19.8%	23.9%
Total		**404,842**	**376,180**	**307,554**	**7.1%**	**18.2%**	**24.0%**

[a] Ozone contributions as determined by EPA in the final CSAPR rule, 76 FR 48208, August 8, 2011.
Source: EPA Clean Air Markets Division, Database of reported emissions.

Wisconsin VOC Control Measures

VOC RACT/CTG – Wisconsin has implemented VOC RACT to fulfill control technology guideline (CTG) requirements for the Wisconsin nonattainment areas under the 1997 ozone NAAQS, which includes Sheboygan County[19]. These VOC RACT/CTG requirements are codified under chapters NR 419 through 424, Wis. Adm. Code. The list of the CTGs in place in Wisconsin is provided in Appendix 8. All of these CTG requirements were implemented and effective prior to the 2011 base year.

[19] Wisconsin's VOC RACT program is described in greater detail in Section 6.3

Table 3.9 lists the point sources emitting VOCs in the Sheboygan County nonattainment area in 2015. This assessment shows that approximately 80% of 2015 VOC emissions come from non-combustion sources. The non-combustion VOC sources are subject to source specific National Emission Standards for Hazardous Air Pollutant (NESHAP) requirements and/or VOC RACT / CTG rules as applicable. As indicated in Table 3.9, the majority of these non-combustion-related emissions are subject to various NESHAP rules that have become effective since 2011. These NESHAP rules implement good operation practices that minimize VOC emissions or apply direct emission limitations on total hydrocarbons (including VOCs). The specifics of each NESHAP rule is further described below in the section “Federal / Regional VOC Control Measures”. These rules aid in controlling VOC emissions, but these rules were implemented prior to 2011 with no additional incremental reduction expected between 2011 and 2017.

Table 3.9 shows that approximately 20% of VOC point source emissions in 2015 came from combustion activities or processes. These combustion sources include two utility boilers, which accounted for about 13% of total VOC emissions. The remaining combustion emissions originated from a number of industrial boilers, reciprocating engines, and various space and process heating units. It should be noted, however, that although the combustion NESHAP requirements are expected to minimize VOC emissions, the incremental emission reductions due to these rules are expected to be relatively small and hard to quantify.

Federal VOC Control Measures for Point Sources

A number of federal NESHAP rules have been implemented to control hazardous pollutants. These rules include requirements to control hazardous organic pollutants through ensuring complete combustion of fuels or implementing requirements for emissions of total hydrocarbons. Under either approach, the rules act to reduce total VOC emitted by the affected sources. These NESHAP rules apply to both major and area source facilities. Major sources are those facilities emitting more than 10 tons per year of a single hazardous air pollutant or more than 25 tons per year of all hazardous air pollutants in total. Area sources are those facilities that emit less than the major source thresholds for hazardous air pollutants.

Table 3.9. 2015 VOC emissions and requirements for point sources in the Sheboygan County nonattainment area.

FID	Facility	Unit	Annual VOC (Tons)	Percent of Total	Permanent and Enforceable Control Measures
Combustion Sources					
230006260	WPL-Edgewater Power Plant	B24 & B25	92.4	13.3%	MATS Combustion Requirements
Multiple	Industrial, Commercial and Institutional boilers and Process Heaters	117 units	20.9	3.0%	ICI Boiler and process heater NESHAP combustion requirements[a]
Multiple	Reciprocating Engines	20 units	24.1	3.5%	RICE NESHAP requirements[a]
Multiple	Other small combustion units	7 units	1.5	0.2%	Individual emission units subject to NESHAPs as applicable
Subtotal =		**146 units**	**138.8**	**20.0%**	
Non-Combustion Sources					
460032870	Kohler Co. Metals Processing	9 units	55.7	8.0%	Iron and Steel Foundries NESHAP requirements[a]
460038810	Sheboygan Paint Company	2 units	37.9	5.5%	Miscellaneous Coating Manufacturing NESHAP requirements[a]
460041230 460141330	Nemak (2 plants)	7 units	27.5	4.0%	Secondary Aluminum Production NESHAP requirements[a]
460034630	Bemis Manufacturing - Plant B	4 units	19.8	2.9%	Plywood and Composite Wood Products NESHAP requirements[a]
Multiple	Iron Foundries (2)	12 units	15.8	2.3%	Iron and Steel Foundries Area Source NESHAP requirements[a]
Multiple	Specific NESHAP source categories as applicable	19 units	11.5	1.7%	Individual emission units subject to NESHAP requirements[a]
Multiple	Individual emission units subject to VOC RACT / CTGs as applicable	103 units	386.0	55.7%	Individual emission units subject to VOC RACT / CTGs as applicable
Subtotal =		**156 units**	**554.3**	**80.0%**	
Total =			**693.1**	**100.0%**	

[a]The emissions units are subject to either major source or area source NESHAP emission requirements based on size thresholds. The applicability of requirements and exemptions for each unit has not been determined for purposes of this assessment. Natural gas-fired boilers and processes at area sources are not subject to requirements.

These NESHAP measures apply to sources within the Sheboygan County nonattainment area, but also nationally, thereby reducing the transport of VOC emissions into the nonattainment area. The NESHAP rules that will likely contribute to VOC emission reductions in the 2017 ozone season include the following:

- *Mercury and Air Toxics (MATS) NESHAP* – On February 16, 2012 EPA promulgated the MATS rule under part 63 subpart UUUUU. Emission requirements were fully applicable by April 16, 2015. Affected sources were required to conduct energy assessments and combustion tuning to ensuring complete combustion.

- *Major Source Industrial, Commercial, and Institutional (ICI) Boiler and Process Heater NESHAP* – On March 21, 2011, EPA promulgated the "National Emission Standards for Hazardous Air Pollutants for Major Sources: Industrial, Commercial, and Institutional Boilers and Process Heaters" under part 63 subpart DDDDD. This NESHAP requires all boilers and process heaters, including natural gas fired units, at major source facilities to perform an initial energy assessment and perform periodic tune-ups by January 31, 2016. This action is intended to ensure complete combustion.

- *Area Source (non-major point sources) ICI Boiler and Process Heater NESHAP* – On March 21, 2011 EPA promulgated the "National Emission Standards for Hazardous Air Pollutants for Area Sources: Industrial, Commercial, and Institutional Boilers" under part 63 subpart JJJJJJ. This NESHAP requires solid fuel and oil fuel fired boilers operated by sources that are below the major source threshold to begin periodic combustion tuning by March 21, 2014.

- *Internal Combustion Engine Rules* – EPA has promulgated three rules which limit the total amount of hydrocarbon emissions from internal combustion engines - the "National Emission Standards for Hazardous Pollutants for Reciprocating Internal Combustion Engines" (RICE Maximum Achievable Control Technology, MACT) was promulgated on June 15, 2004 under Part 63, subpart ZZZZ and revised in January 2008 and March 2010, with the two revisions impacting additional RICE units; the "Standards of Performance for Stationary Spark Ignition Internal Combustion Engines" promulgated on January 18, 2008 under Part 60, subpart JJJJ; and "Standards of Performance for Stationary Compression Ignition Internal Combustion Engines promulgated on July 11, 2006 under Part 60, subpart IIII. These rules implement hydrocarbon emission limitations prior to and after 2011 based on compliance dates. These rules also act to continuously reduce emissions as existing stationary engines are replaced by new, cleaner-burning engines.

- *Other NESHAPs Applicable to Sheboygan County Sources* – Since the mid-1990's EPA has promulgated multiple NESHAPs for major and area stationary sources. Theses NESHAPs require controls or other types of hazardous air pollutant emissions reductions from specific types of emission units. The following non-combustion NESHAPs are applicable to sources in Sheboygan County:

- Iron and Steel Foundries NESHAP under part 63, subpart EEEEE (major source), promulgated on April 22, 2004; and subpart ZZZZZ (area source), promulgated on January 2, 2008.

- Secondary Aluminum Production under part 63, subpart RRR (major and area sources), promulgated on March 23, 2000.

- Plywood and Composite Wood Products under part 63, subpart DDDD (major source), promulgated on July 30, 2004.

- Miscellaneous Coating Manufacturing under part 63, subpart HHHHH (major source), promulgated on December 11, 2003.

- Five other NESHAPs[20] apply to sources in Sheboygan County that each contributes less than 1% of total VOCs.

3.6.2. Area Source Control Measures

As noted for point sources, Wisconsin has implemented all of the necessary VOC RACT/CTG rules under chs. NR 419 through 424, Wis. Adm. Code. A number of these rules limit VOC emissions from area sources as noted in Appendix 8. Wisconsin previously had a Stage 2 vehicle refueling vapor recovery program in place. However, the Stage 2 program was removed from Wisconsin's ozone SIP on November 4, 2013 (78 FR 65875) with EPA approval because the equipment was found to interface negatively with onboard vapor recovery systems required on gasoline fueled new vehicles after 1998. As stage 2 equipment was removed, refueling facility VOC emissions decreased slightly due to reduced fugitive underground storage tank VOC venting. This SIP revision was based on a technical showing of net benefit as required under CAA Sections 110(l) and 193 in order to prevent SIP backsliding.

There are also a number of federal programs in place which reduce area source VOC emissions. VOC emission standards for consumer and commercial products were promulgated under 40 CFR Part 59. This program was implemented prior to 2011 and will continue to maintain reduced VOCs emitted from this source category. Future emission levels will vary depending on population and activity use factors. Another federal rule, the area source hazardous air pollutant control rule, also controls area VOC emissions associated with fuel storage and transfer activities (40 CFR 63, Subpart R, BBBBBB, and CCCCCC).

3.6.3. Onroad Source Control Measures

Both NOx and VOC emissions from on-road mobile sources are substantially controlled through federal new vehicle emission standards programs and fuel standards that impact both tailpipe emissions and evaporative losses. Although initial compliance dates in many cases were prior to 2011, these regulations have continued to reduce areawide emissions as fleets turn over to newer

[20] Wood Furniture NESHAPs, Chemical Manufacturing NESHAPs (for area sources), Oil-Water Separators and Organic-Water Separators NESHAPs, Miscellaneous Metal Parts and Products NESHAPs, and Clay Ceramic Manufacturing NESHAPs (for area sources).

vehicles. All of these programs apply nationally and have reduced emissions both within the nonattainment areas and contributing ozone precursor transport areas. The federal programs contributing to reductions in ozone precursor emissions include those listed in Table 3.10.

Table 3.10. Federal onroad mobile source regulations contributing to attainment.

On-road Control Program	Pollutants	Model Year[a]	Regulation
Passenger vehicles, SUVs, and light duty trucks – emissions and fuel standards	VOC & NOx	2004 – 2009+ (Tier 2) 2017+ (Tier 3)	40 CFR Part 85 & 86
Light-duty trucks and medium duty passenger vehicle – evaporative standards	VOC	2004 - 2010	40 CFR Part 86
Heavy-duty highway compression engines	VOC & NOx	2007+	40 CFR Part 86
Heavy-duty spark ignition engines	VOC & NOx	2005 – 2008+	40 CFR Part 86
Motorcycles	VOC & NOx	2006 – 2010 (Tier 1 & 2)	40 CFR Part 86
Mobile Source Air Toxics – fuel formulation, passenger vehicle emissions, and portable container emissions	Organic Toxics & VOC	2009 - 2015[b]	40 CFR Part 59, 80, 85, & 86
Light duty vehicle corporate average fuel economy standards	Fuel efficiency (VOC and NOx)	2012-2016 & 2017-2025	40 CFR Part 600

[a]The range in model years affected can reflect phasing of requirements based on engine size or initial years for replacing earlier tier requirements.

[b]The range in model years reflects phased implementation of fuel, passenger vehicle, and portable container emission requirements as well as the phasing by vehicle size and type.

One additional ongoing CAA-required program limits on-road VOC and NOx emissions in Sheboygan County. This program is the Wisconsin-administered I/M program and is required for Sheboygan County. The Wisconsin I/M program was first implemented in 1984 and has gone through several modifications and enhancements since that time[21]. The I/M program requirements are codified in ch. NR 485, Wis. Adm. Code. The I/M program reduces average vehicle VOC and NOx emissions and garners some level of continued incremental reduction as fleets turn over to new vehicles.

[21] Wisconsin's I/M program is described in greater detail in Section 6.5.

3.6.4. Nonroad Source Control Measures

Similar to on-road sources, VOC and NOx emitted by non-road mobile sources are significantly controlled via federal standards for new engines. These programs therefore reduce ozone precursor emissions generated within Sheboygan County and in the broader regional areas contributing to ozone transport. Table 3.11 lists the non-road source categories and applicable federal regulations. The non-road regulations continue to slowly lower average unit and total sector emissions as equipment fleets are replaced each year (approximately 20 years for complete fleet turnover) pulling the highest emitting equipment out of circulation or substantially reducing its use. The new engine tier requirements are implemented in conjunction with fuel programs regulating fuel sulfur content. The fuel programs enable achievement of various new engine tier VOC and NOx emission limits.

Table 3.11. Federal nonroad mobile source regulations contributing to attainment.

Nonroad Control Program	Pollutants	Model Year[a]	Regulation
Aircraft	HC & NOx	2000 – 2005+	40 CFR Part 87
Compression Ignition[b]	NMHC & NOx	2000 – 2015+ (Tier 4)	40 CFR Part 89 & 1039
Large Spark Ignition	HC & NOx	2007+	40 CFR Part 1048
Locomotive Engines	HC & NOx	2012 – 2014 (Tier 3) 2015+ (Tier 4)	40 CFR Part 1033
Marine Compression Ignition	HC & NOx	2012 – 2018	40 CFR Part 1042
Marine Spark Ignition	HC & NOx	2010+	40 CFR Part 1045
Recreational Vehicle[c]	HC & NOx	2006 – 2012 (Tier 1 – 3) (phasing dependent on vehicle type)	40 CFR Part 1051
Small Spark Ignition Engine < 19[d] Kw – emission standards	HC & NOx	2005 – 2012 (Tier 2 & 3) (phasing based on both Tier and engine size)	40 CFR Part 90 & 1054
Small Spark Ignition Engine < 19 Kw – evaporative standards	HC & NOx	2008 – 2016 (phasing based on both engine size and category)	40 CFR Part 1045, 54, & 60

HC – Hydrocarbon (VOCs)
NMHC – Non-Methane Hydrocarbon (VOCs)
[a] The range in model years affected can reflect phasing of requirements based on engine size or initial years for replacing earlier tier requirements.
[b] Compression ignition applies to diesel non-road compression engines including engines operated in construction, agricultural, and mining equipment.
[c] Recreational vehicles include snowmobiles, off-road motorcycles, and all-terrain vehicles.
[d] Small spark ignition engines include engines operated in lawn and hand-held equipment.

4. MODELED ATTAINMENT ASSESSMENT

One of the requirements for moderate nonattainment areas is a modeled assessment of the likelihood that a nonattainment area will attain the NAAQS. Wisconsin is relying on photochemical modeling conducted by LADCO to make this assessment for the Sheboygan nonattainment area for the 2008 ozone NAAQS. LADCO developed an air quality modeling platform to evaluate the adequacy of current and potential emissions reduction strategies relative to regional attainment of the 2008 ozone NAAQS by the 2017 ozone season. The technical support document for this modeling analysis is included as Appendix 9. In addition to discussing how the model was set up, evaluated and run (including the emissions inventories used), this appendix presents additional regional data analyses and weight of evidence support for this attainment plan. The modeling analysis, summarized in this section, demonstrates that Sheboygan's Kohler Andrae monitor is projected to be within 0.2 ppb of attaining the 2008 ozone NAAQS by the 2017 ozone season. However, as LADCO notes in its technical support document, "the modeling analysis is, by design, conservative…air quality in future years may be better than the modeling indicates,"[22] In addition, the uncertainties in the model performance (described in Section 4.2.3) further suggest that the 0.2 ppb deviation from modeled attainment is likely to be within the margin of error of the model.

4.1. Emission Inventories for Photochemical Modeling

The emission inventories used for the photochemical modeling rely heavily on emissions and other model inputs prepared by EPA. Both EPA and LADCO extensively quality assure their emission inventories.[23] LADCO's emissions modeling quality assurance procedures include reviewing emissions model output files for errors, 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.

4.1.1. Base Case Modeling for 2011 and 2017

LADCO utilized emissions inventories compiled by EPA for the years 2011 and 2017 as the starting point for the modeling inventories used in this analysis. EPA's 2011 emission inventory (Version 2011EH) is based on the 2011 NEI, version 2 (2011NEIv2), which was speciated, temporalized and gridded to provide hourly emissions inputs to support photochemical modeling. Emissions include all criteria pollutants and precursors, and some hazardous air pollutants. See EPA's Technical Support Document[23] for a thorough description of the methodology used to develop the 2011EH emissions inventory. 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 and sector-specific forecasts for activity changes from 2011-2017.

[22] See Appendix 9, p. 47. Factors resulting in conservative modeling results include use of the ERTAC EGU Projection Tool and EIA's coal utilization forecasts.
[23] EPA, 2015. Notice of Availability of the Environmental Protection Agency's Updated Ozone Transport Modeling Data for the 2008 Ozone National Ambient Air Quality Standard (NAAQS). Available at https://www.epa.gov/airmarkets/noda-epas-updated-ozone-transport-modeling

LADCO updated the 2011 and 2017 EPA inventories for regional onroad mobile sources and EGUs. EGU emissions were updated to use outputs from the Eastern Regional Technical Advisory Committee (ERTAC) EGU Forecast Tool. LADCO used improved outputs to the MOVES emissions model for 2011 and 2017 to update the onroad mobile source emissions estimates. These updates are described in greater detail in Appendix 9.

4.1.2. Modeling with Additional Control Measures for 2017

LADCO modeled a scenario for the year 2017 that included the additional emission reductions projected to occur from implementation of the CSAPR Update (see section 3.6.1). This rule will 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 required to be in place by the beginning of the 2017 ozone season. LADCO used the ERTAC EGU Forecast Tool to project likely NOx emissions reductions from the CSAPR Update. LADCO's approach assumed that electric utilities would likely optimize their use of existing controls (selective catalytic reduction, SCR, and selective non-catalytic reduction systems) and moderately shift electric generation from higher emitting units to cleaner ones to in order to comply with reduced 2017 CSAPR state ozone season NOx budgets. See Appendix 9 for more information.

In addition to CSAPR, 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 and 2017 and have been factored into the modeling assessment.

Figure 4.1 compares projected VOC and NOx emissions for 2017 (considering all control measures) with 2011 base year emissions for all emissions categories. Emissions of VOCs and NO_X are expected to decrease substantially from Wisconsin, Illinois, and Indiana and regionally between 2011 and 2017 due to "on-the-books," enforceable control measures. These three states contribute the most ozone to Sheboygan's Kohler Andrae monitor, as discussed in Section 5.4.1.

4.2. Photochemical Modeling for Ozone

LADCO, in cooperation with the Illinois Environmental Protection Agency (IEPA), the Indiana Department of Environmental Management (IDEM), and WDNR, 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 and related modeling guidelines[24].

4.2.1. Selection of Base Year

[24] EPA, 2014. Draft Modeling Guidance for Demonstrating Attainment of Air Quality Goals for Ozone, $PM_{2.5}$, and Regional Haze. Available at http://www.epa.gov/ttn/scram/guidance/guide/Draft_O3-PM-RH_Modeling_Guidance-2014.pdf

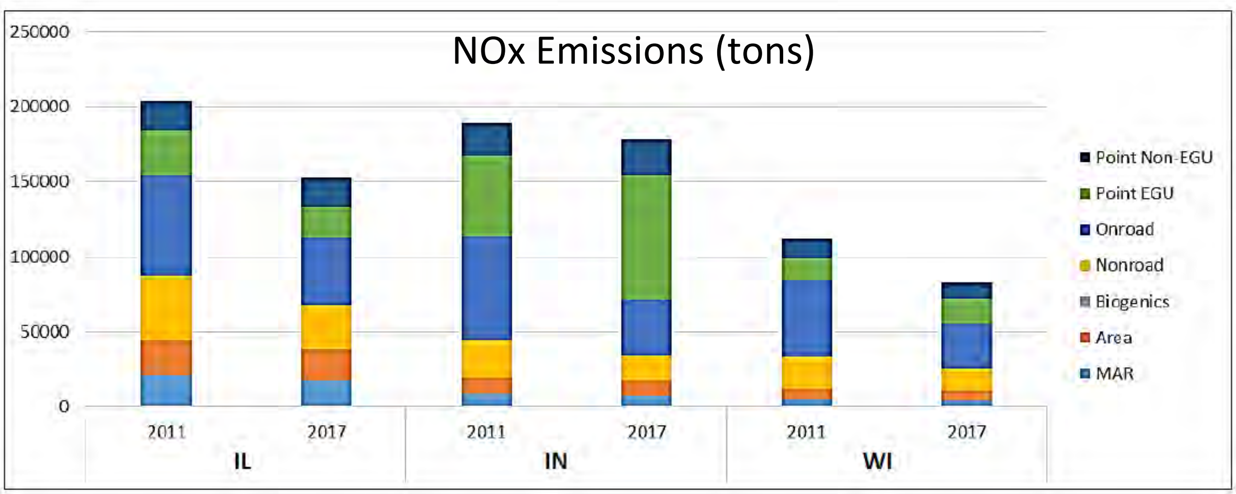
The calendar year 2011 was selected as the base year for regional ozone modeling, based on the following considerations:

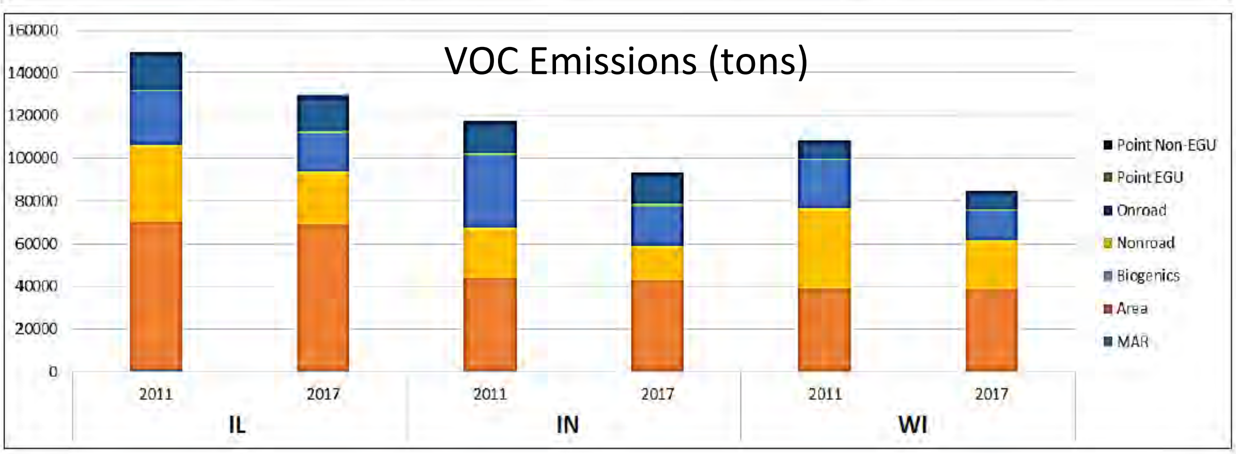
- The 2011 base year is representative of the observed baseline design values for the time period (2009-2011) when EPA established the final air quality designations for another regional nonattainment area (Chicago) for the 2008 ozone NAAQS.[25]

- There are extensive air quality, meteorological, and emissions databases that have been developed for 2011 by EPA, and others, for regulatory purposes.[23]

- The 2011 ozone season was typical in terms of meteorology and ozone conduciveness in the Lake Michigan region.

Figure 4.1. Base year (2011) and future year (2017) emissions of (top) NOx and (bottom) VOCs from Wisconsin, Illinois and Indiana. Emissions are shown in tons per year for the entire state (not just the nonattainment area). Data for 2017 include reductions due to the CSAPR Update rule.





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[25] Designations for Sheboygan County and most areas in the country were made using 2008-2010 data.

4.2.2. Modeling Platform

The modeling platform consists of emissions and transport models that reflect the spatial and temporal characteristics of the study region. A summary of the models used in the 2011 modeling platform are shown in Table 4.1. Meteorological modeling for the 2011 modeling platform was performed with the Weather Research and Forecast (WRF-ARW V3.4) model operated by EPA Office of Air Quality Planning and Standards (OAQPS). LADCO's modeling assessment utilized the WRF meteorological outputs developed by EPA.[26] The 2011 WRF meteorological data has been extensively evaluated on a national scale by EPA.[24] Appendix 9 describes the meteorological inputs in greater detail.

Table 4.1. Modeling platform components.

Model	Type	Managing Organization
WRF	Meteorology	EPA OAQPS[a]
GEOS-CHEM	Global Chemical Transport	EPA OAQPS
SMOKE	Emissions	EPA OAQPS / LADCO
CAMx	Regional Photochemical	LADCO

[a] OAQPS is EPA's Office of Air Quality Planning and Standards.

Photochemical modeling of criteria air pollutants is performed with the Comprehensive Air quality Model with Extensions (CAMx V6.30[27]). CAMx is commonly used for attainment plans[24], has been extensively peer reviewed[28,29] and has performed well in previous applications[30]. Emissions inventory data is converted into the formatted emission files required by the CAMx model using the Sparse Matrix Operator Kernel Emissions (SMOKE) modeling system. Initial and boundary conditions are derived from a 2011 global simulation run using the Goddard Earth Observing Systems Chemistry (GEOS-CHEM) model. The CAMx photochemical model outputs hourly concentrations of tropospheric pollutants including ozone, NOx, and various groupings of VOCs. Hourly results are post-processed to daily averages, maximum daily 8-hour average (MDA8) ozone concentrations, or annual averages for the purpose of assessing and projecting monitor design values in the context of regional attainment demonstrations. Appendix 9 describes the model configuration in greater detail.

[26] U.S. EPA, 2014. Meteorological Model Performance for Annual 2011 WRF v3.4 Simulation. Available at http://www.epa.gov/ttn/scram/reports/MET_TSD_2011_final_11-26-14.pdf
[27] Available at http://www.camx.com/home.aspx
[28] Baker, K., Scheff, P., 2007. Photochemical Model Performance for $PM_{2.5}$ Sulfate, Nitrate, Ammonium, and Precursor Species SO_2 , HNO_3, and NH_3 at Background Monitor Locations in the Central and Eastern United States. Atmospheric Environment, 41, 6185- 6195.
[29] Vizuete, W., Jeffries, H.E., Tesche, T.W., Olaguer, E.P., Couzo, E., 2011. Issues with Ozone Attainment Methodology for Houston, TX. J. Air Waste Manage. Assoc., 61, 238-253.
[30] Simon, H., Baker, K.R., Phillips, S., 2012. Compilation and Interpretation of Photochemical Model Performance Statistics Published Between 2006 and 2012. Atmospheric Environment, 61, 124-139.

4.2.3. 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.

EPA's modeling guidance does not specify rigid acceptance/rejection criteria for model performance. However, ozone model performance is generally considered good if bias is within 15% (positive or negative) and error is within 30% for MDA8 values. Simon et al.[30] present a thorough discussion and summary of regional modeling performance statistics. The model's bias is within 15% at virtually all ozone monitor locations in the Lake Michigan region and in the Midwest, which shows that the model is performing well at predicting MDA8. The mean fractional error is within 20% at all locations near Lake Michigan. The relatively low error and bias suggest that the model is performing adequately for the immediate attainment assessment purpose. See Appendix 9 for more information about model performance.

4.2.4. Modeled Attainment Test

CAA Section 182(b) requires states to submit an attainment plan, including air quality modeling results, to identify whether emissions reduction measures are sufficient to reduce projected pollutant concentrations to a level that meets the NAAQS by the statutory deadline established by EPA. This modeling analysis uses 2017 as the projection year to demonstrate attainment of the 2008 ozone NAAQS. The emissions scenarios previously discussed were evaluated using the CAMx model to determine the likelihood that the 2008 ozone NAAQS will be achieved in the Sheboygan County nonattainment area in 2017. LADCO performed this modeling assessment consistent with the draft guidance issued by EPA in 2014.[24] 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.

The model attainment test uses the photochemical model to estimate future year design values via the Modeled Attainment Test Software (MATS)[31]. The MATS software computes the fractional changes, or relative response factors, of ozone concentrations at each monitor location based on a comparison of the modeled air quality in the base and future years. Meteorological conditions are assumed to be unchanged for the base and projection years. Modeled relative reduction factors are then applied to a weighted baseline 2011 design value, which is determined by averaging three successive three-year design values centered on 2011 (i.e., 2009-2011, 2010-2012, 2011-2013). 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

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

analysis suggests that attainment will be reached. LADCO has used the MATS software according to EPA's recommended approach.[24,32]

Table 4.2 summarizes the results of the model attainment test for the 2017 future year with LADCO's projection of the impact of EPA's CSAPR Update. As shown in Table 4.2, Sheboygan's Kohler Andrae monitor is projected to have a 2017 design value of 76.1 ppb, which is within 0.2 ppb of attaining the 2008 ozone NAAQS (75 ppb, with decimal places truncated) by 2017.

Table 4.2. Projected ozone design values (ppb) for 2017 in the Sheboygan County nonattainment area.[33]

AQS ID	Monitor	2017 projection
551170006	Kohler Andrae	76.1

4.3. Modeling-Related Weight of Evidence Support for Attainment

A number of other analyses suggest that ozone precursor emissions may be overestimated in the modeling, such that the model may over-predict ozone concentrations in Sheboygan County. These analyses also show that Sheboygan County would be projected to attain the 2008 ozone NAAQS given slightly less conducive meteorology than the 2011 meteorology used in the modeling.

Appendix 9 describes a number of reasons why the modeled projections for 2017 ozone concentrations may overestimate emissions of ozone precursors, and thus ozone concentrations, in 2017. Several of the emissions projections used are considered conservative, meaning that they overestimate future emissions from these sources. The sectors that are believed to have conservative emissions forecasts include EGUs and future coal utilization at EGUs.

LADCO also projected ozone design values assuming a range of 2011 baseline design values, as shown in Table 4.3. This analysis found that the projected design value at the Kohler Andrae monitor is very sensitive to the choice of baseline. When design values were projected from a 2009-2011 baseline (rather than the weighted 2009-2013 baseline), the Kohler Andrae monitor was projected to attain the 2008 NAAQS in 2017, with a design value of 73.1 ppb (Table 4.3). In contrast, use of 2010-2012 or 2011-2013 baselines projected design values that exceed the NAAQS. This suggests that the Kohler Andrae monitor would attain the NAAQS given meteorology similar to that observed in 2009-2011. It is notable that the meteorology during these years was similar to, and even more ozone-conducive than, the years 2008-2010, which were the years used to designate Sheboygan County as nonattainment of the 2008 ozone NAAQS. This suggests that Sheboygan County would attain the NAAQS under conditions similar to those present when the county was designated.

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[32] Abt Associates, 2014. Modeled Attainment Test Software: User's Manual. Available at: https://www3.epa.gov/ttn/scram/guidance/guide/MATS_2-6-1_manual.pdf

[33] A design value was not determined for the Sheboygan Haven monitor because this monitor did not begin operation until 2014 and thus does not have a 2011 design value from which to project future design values.

Table 4.3. Projected ozone design values (ppb) for 2017 in the Sheboygan County ozone nonattainment area assuming alternate 2011 baseline design values.

Modeling scenario	2011 Baseline		
	2009-2011	2010-2012	2011-2013
2017 projection	73.1	78.5	76.7

5. WEIGHT OF EVIDENCE ANALYSIS: OZONE AND OZONE PRECURSOR TRENDS AND MODELING OF EMISSION REDUCTIONS

5.1. Introduction

EPA recommends that states submit supplemental analyses in support of any attainment forecast. These analyses are intended to provide additional support for the required modeled attainment assessment. Such supplemental analyses are part of a "weight of evidence" showing that an area will attain a standard. This section presents and discusses trends in ambient ozone and ozone precursor concentrations and forms the core of such a showing relative to Sheboygan County.

These weight-of-evidence analyses indicate that ozone concentrations adjusted for meteorology are continuing to decrease at Sheboygan's Kohler Andrae monitor. As previously discussed, application of the modeled attainment test projects that this monitor will be within 0.2 ppb of attaining the 2008 NAAQS in 2017 (Table 4.2). In addition, Wisconsin emissions of ozone precursors are roughly half of their 2002 levels, and monitored concentrations of NOx and VOCs in Wisconsin have decreased by similar magnitudes.

Ozone concentrations measured at the Kohler Andrae monitor are largely determined by a number of factors that are outside of the state's control. Crucially, most of the ozone at Sheboygan comes from transported ozone and ozone precursors originating in upwind states. Wisconsin sources that impact the area are already well-controlled and contribute very little to the elevated ozone concentrations observed at Sheboygan. Recent LADCO modeling confirms the state may have very little ability to further reduce ozone concentrations at this site. Increasing VOC concentrations in upwind states may also be contributing to elevated ozone concentrations in Sheboygan County. Finally, the nonlinear chemistry of ozone formation may also be affecting ozone concentration trends in Sheboygan. This section will cover these factors in detail.

5.2. Trends in Ambient Ozone Concentrations

WDNR currently monitors ozone at two locations within the Sheboygan County nonattainment area (Figure 1.1). The Kohler Andrae monitor has operated since 1997, and the Haven monitor is a special purpose monitor that began operation in 2014.

5.2.1. Trends in Monitored Ozone Concentrations

Figure 5.1 shows trends in the annual fourth high MDA8 ozone concentration and design values for monitors in the Sheboygan nonattainment area. Since 1998, ozone concentrations have decreased considerably. Annual fourth high values at the lakeshore Kohler Andrae monitor have decreased from 90-105 ppb before 2004 to 78-85 ppb since 2013. Design values have decreased from 92-100 ppb before 2004 to 77-79 ppb in 2015 and 2016. The largest reductions occurred during the early years of this period, with design values decreasing by 10 ppb from 2000 to 2008[34] but only 3 ppb from 2008 to 2016 (Table 5.1).

[34] Values for 2008 are shown because this year is the midpoint of the record shown here. Recent trends would show steeper decreases if starting with an earlier year and variable trends if starting with a more recent year. Because the

Figure 5.1. Trends in annual fourth high maximum daily 8-hour ozone concentrations and design values for the monitors in Sheboygan County, Wisconsin.

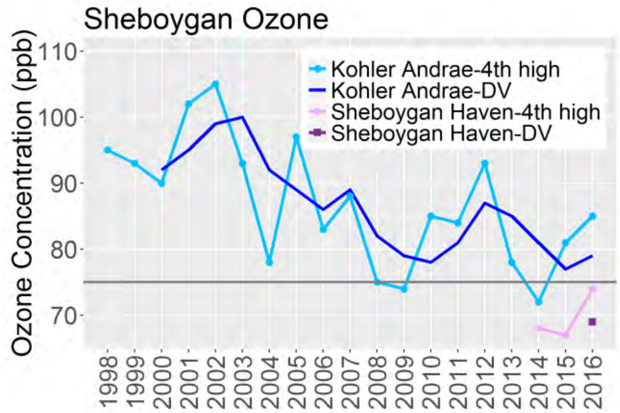


Table 5.1. Ozone design values for Sheboygan nonattainment area monitors for 1998-2000, 2006-2008, and 2014-2016 (preliminary), along with the change between these values. Data for 2008 are shown because this is the midpoint in the record.[34]

		Design Value (ppb)			Change (ppb)		
Site ID	**Site**	**1998-2000**	**2006-2008**	**2014-2016***	**2000-2008**	**2008-2016**	**2000-2016**
55-117-0006	Kohler Andrae	92	82	79	-10	-3	-13
55-117-0009	Sheboygan Haven			69			

WDNR began operating a new monitor, Sheboygan Haven, a few miles inland from the lakeshore in 2014. In contrast to the Kohler Andrae monitor, whose objective is to measure regional transport, the Sheboygan Haven monitor is placed to measure population exposure. Annual fourth high MDA8 concentrations and design values at this monitor have been consistently below the level of the 2008 ozone NAAQS and 4-14 ppb lower than those at the lakeshore monitor (Figure 5.1 and Table 5.1), although the interannual trends are fairly similar.

Meteorological variability significantly affects ozone concentrations and can obscure trends over shorter time periods. For example, 2012 had an extremely hot summer with a high frequency of elevated ozone concentrations, and 2008 and 2009 had relatively cool summers with a lower frequency of elevated ozone concentrations. The next two sections discuss the impact of meteorology on ozone concentrations at this location and show that when adjusted for meteorology, ozone concentrations are continuing to decrease.

5.2.2. Influence of Temperature on Ozone Concentrations

impacts of meteorological variability tend to dwarf long-term trends when assessed over short time periods, it is difficult to meaningfully assess trends in ozone concentrations over short (less than a decade) time periods without controlling for meteorological factors.

Temperature is an important and well-known driver of ozone formation, with much more ozone produced at high temperatures than at low temperatures. Figure 5.2 compares annual fourth high MDA8 concentrations at Kohler Andrae with two different measures of temperature at the Milwaukee Airport. Cooling degree days give a measure of how warm the whole year was, with higher overall temperatures leading to higher cooling degree days.[35] In comparison, the count of days with temperatures over 90° indicates how often extreme temperatures occurred in a year. The correlations between ozone concentrations and temperature are very clear from Figure 5.2. The highest ozone concentrations occurred in years with the highest temperatures, measured using both parameters, and vice versa. This figure also suggests that the amount of ozone produced for a given temperature level has decreased over time. For example, comparison of the years 2002 with 2012 shows that the fourth high MDA8 value was much lower in 2012 relative to 2002 (93 ppb versus 105 ppb) even though temperatures were similar between the years. Comparison of 2004 with 2014, relatively cool, low-ozone years, yields a similar conclusion: the fourth high MDA8 value was much lower in 2014 versus 2004 (72 ppb versus 78 ppb), even though the two years had similar temperatures. These reductions are presumably due to reduced emissions of ozone precursors, as described in Chapter 3 and Section 5.3. The next part of this document explores these relationships in more detail and attempts to adjust ozone concentrations for different meteorological factors.

5.2.3. Ozone Trends Adjusted for Meteorology

Because of the large effect of meteorology, particularly temperature, on ozone concentrations, meteorologically driven variability in ozone concentrations often obscures trends in ozone due to factors such as permanently reduced rates of precursor emissions. For this reason, it is important to adjust ozone concentrations for meteorology in order to examine trends in ozone concentrations due to precursor emission reductions and other factors. This section describes two such efforts to remove the effect of meteorology from ozone trends. Both sets of analyses show that when adjusted for meteorology, ozone concentrations in Sheboygan are continuing to decrease.

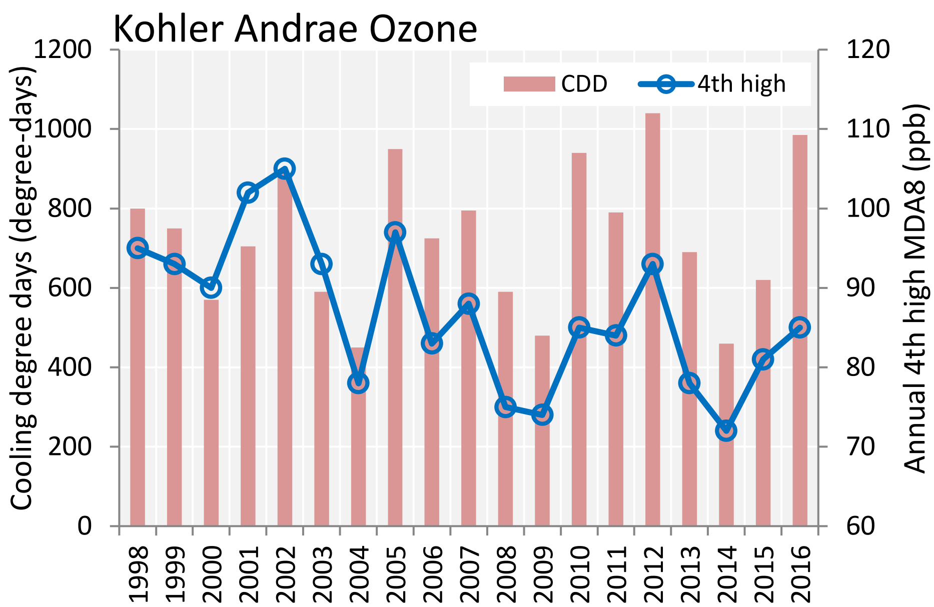
CART Analysis

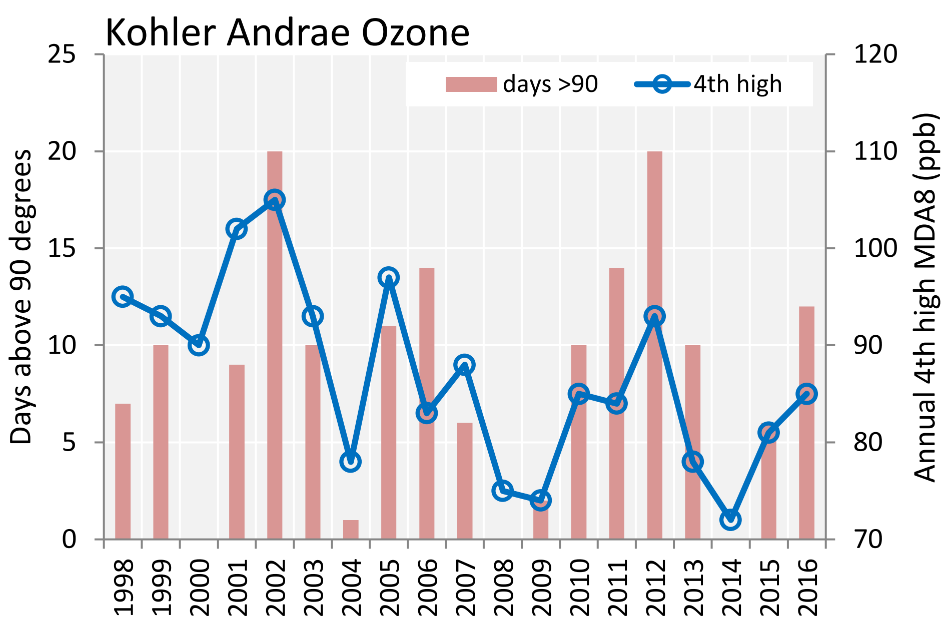
Classification and Regression Tree (CART) analysis allows comparison of ozone concentrations on days with similar meteorological conditions. This analysis partially controls for the influence of year-to-year meteorological variability on ozone concentrations. CART analysis produces average ozone concentrations for a number of different classes of days (determined by meteorology) for each year under review. This analysis therefore allows examination of ozone concentration trends over long periods resulting from non-meteorological factors, including permanent and enforceable reductions in emissions of ozone precursors impacting the sites.

Figure 5.2. Trends in (top) cooling degree days (relative to 65 °F) and (bottom) days with temperatures above 90 °F at Milwaukee Airport, plotted with annual fourth high

[35] Cooling degree days are measured in degree-days relative to 65° (in this case) and are a total sum of the days during which temperatures were over 65° multiplied by the temperature difference between measured temperatures and 65° during each hour with elevated temperatures. Cooling degree days are used as a relative measure of how much you would need to cool a space to keep temperatures steady at 65°.

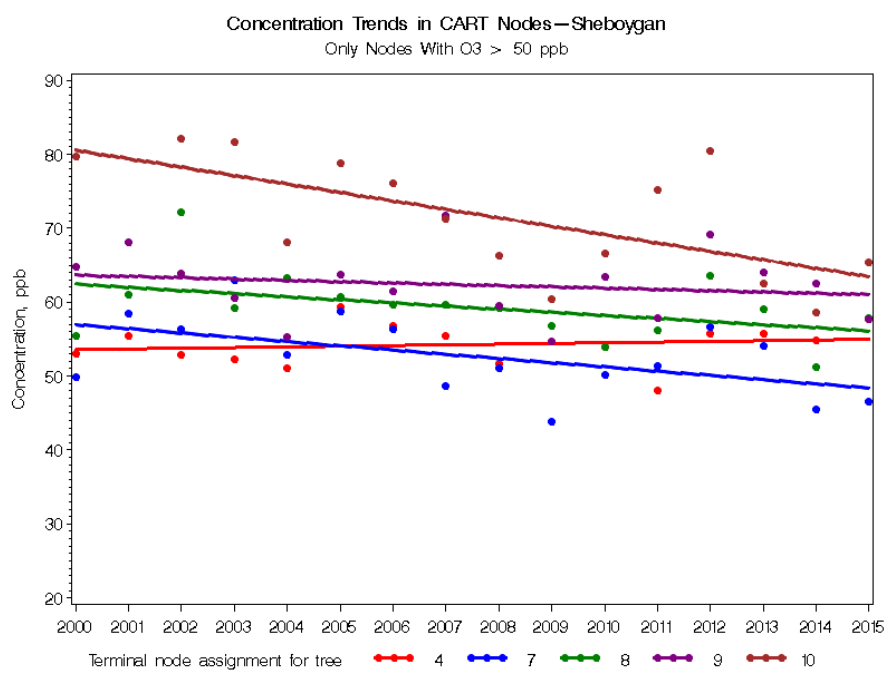
maximum daily 8-hour average (MDA8) ozone concentrations at Kohler Andrae. Climatological data is from the Wisconsin State Climatology Office website (http://www.aos.wisc.edu/~sco/clim-history/index.html).





A CART analysis conducted by LADCO visualized changes in ozone concentrations under different meteorological conditions over 16 years from 2000-2015. Figure 5.3 shows average ozone concentrations from 2000 through 2015 for the five sets of meteorological conditions ("nodes") with the highest ozone concentrations for Sheboygan's Kohler Andrae monitor. The data shown for each node are the average ozone concentrations on all days with a particular set of meteorological conditions.[36] (Note that the timeframe analyzed incorporates a period predating the 2008 standard.) Average ozone concentrations decreased under four of the five sets of meteorological conditions over this time period. The greatest decreases came from the node with the highest concentrations in the early 2000s (node 10). This analysis suggests that the observed long-term decreases in ozone concentrations are due to reductions in ozone precursors (discussed in Chapter 3 and section 5.3) rather than solely due to meteorological factors. This analysis is presented in more detail in Appendix 10, which presents the meteorological conditions represented by each node.

Figure 5.3. Concentration trends from the CART analysis for the Sheboygan Kohler Andrae monitor. Data points show the average ozone concentration for days sharing certain meteorological conditions ("nodes"). Only meteorological nodes with an average ozone concentration above 50 ppb are shown.



[36] For example, Node 10 in Figure 5.14 shows the average ozone concentrations for days characterized by temperatures at 925 millibar above 68.4° and average afternoon winds of greater than 3.22 m/s from the south.

Ozone-Temperature Correlations

Plots of ozone versus temperature, separated by time period, also show reductions over time in the "conduciveness" of the atmosphere to form ozone given a certain amount of heat. Figure 5.4 shows plots of two ozone parameters versus four temperature parameters for individual months, with data grouped into three-year blocks.[37] (Appendix 10 shows many more of these plots, comparing different ozone and temperature parameters and comparing with temperatures at another location. The graphs shown here are those that had the best correlation coefficients.) These graphs confirm the earlier observations that ozone concentrations tend to increase with increasing temperature (Section 5.2.2). They also show that the amount of ozone produced at a given temperature level has decreased between almost every 3-year period. For example, comparison of trends in the number of days with MDA8 above 75 ppb ("hot days") with the number of days above 80 degrees suggests that the number of hot days for a month with 15 days above 80 degrees has decreased in almost every progressive time period. These values decreased from around 7 days in 1999-2001 to 5 days in 2002-2004, 3.8 days in 2005-07, and 1.2 days in 2008-10. The exception to this trend is that the ozone values for 2008-10 generally were lower than those for 2011-13 and above or very near those for 2014-16. It is likely that ozone during the years 2008-10 was lower than during the other years because of the economic recession, which lowered emissions because of less economic activity. This impact is apparent in monitored NOx (Figure 5.7) and VOC (Figure 5.8) concentrations and was confirmed by a recent research study[38].

In all of these graphs, the trend line for the most recent set of years, 2014-16, is the lowest, indicating that these years yielded the lowest amount of ozone for a given amount of warmth. This analysis confirms the conclusion of the CART analysis that ozone concentrations, when controlled for meteorology, have continued to decrease, even in the last few years. These findings suggest that, independent of meteorology, reductions in ozone precursor emissions (discussed in Chapter 3 and section 5.3) are continuing to drive decreases in ambient ozone concentrations. The analysis furthermore suggests that the apparent "flatness" of the trend in monitored ozone concentrations since 2008 likely reflects variable meteorology, in concert with a return to more typical economic activity levels, rather than a true leveling off in the pattern of declining ozone concentrations. This is evident from the finding that 2014-16 showed reduced relative ozone compared to the 2011-2013 period and similar concentrations relative to 2008-10, a unique period of both lower ozone formation propensity and lowered relative economic activity.

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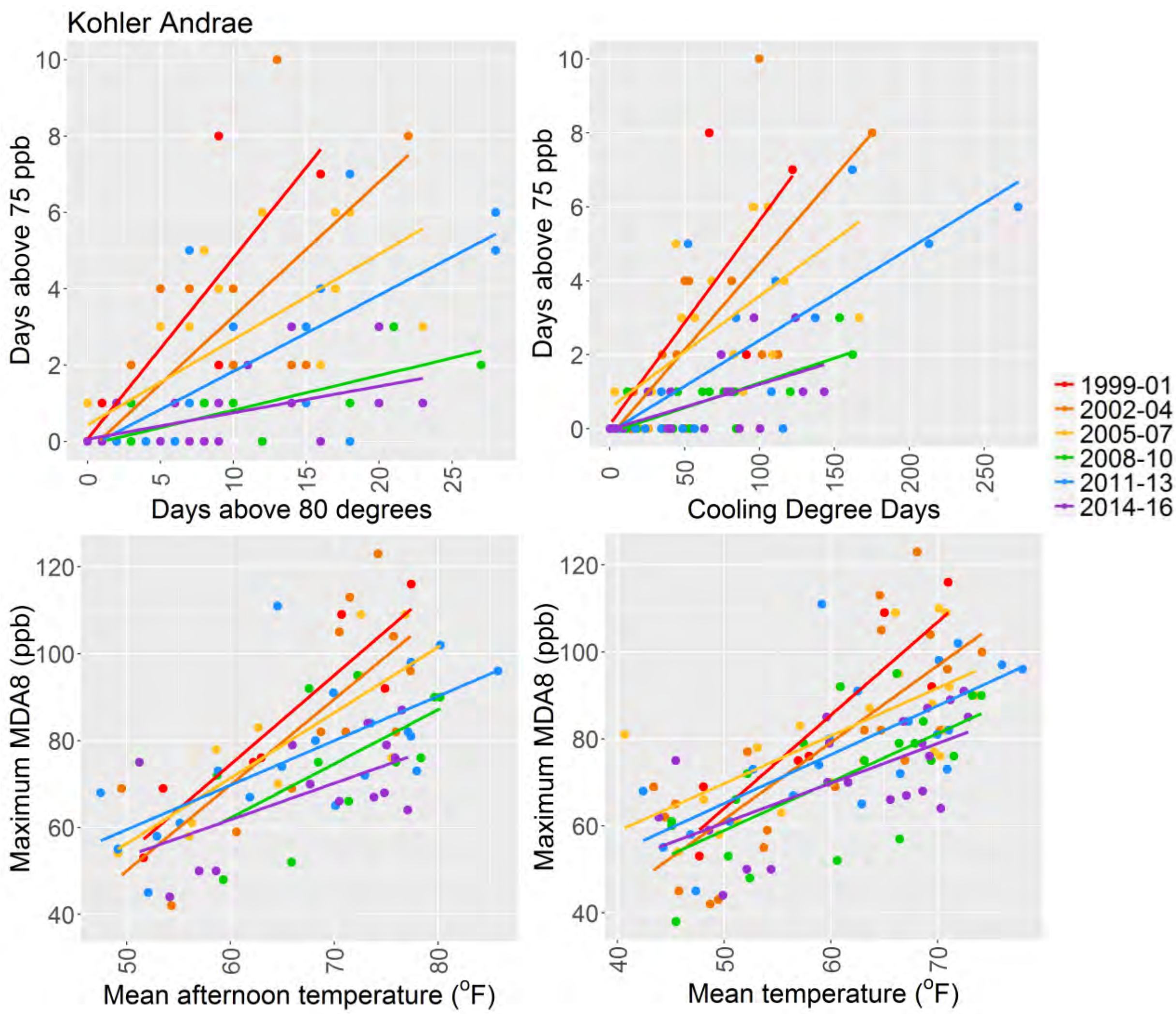
[37] Temperature data is shown for the inland Horicon monitor rather than for the Kohler Andrae monitor itself because temperature at the lakeshore monitor can be greatly affected by localized lake breeze events, which would not impact temperature upwind where the ozone is formed. Using Horicon temperatures removes localized impacts and should be reflective of regional temperatures. Correlations relative to temperatures at the Milwaukee Airport were conducted and are shown in Appendix 10. However, the correlations with temperatures at Horicon were stronger.

[38] Tong et al. (2016) Impact of the 2008 Global Recession on air quality over the United States: Implications for surface ozone levels from changes in NOx emissions. *Geophys. Res. Letters*, 10.1002/2016GL069885.

Figure 5.4. Trends in monthly averages of two ozone concentration parameters (days with maximum daily 8-hour average, MDA8, over 75 ppb and maximum MDA8) plotted versus four different temperature parameters. Data are grouped into three-year groups. Ozone was measured at the Kohler Andrae monitor whereas temperature was measured at the inland Horicon monitor.[37]



5.3. Trends in Ambient Ozone Precursor Concentrations

5.3.1. NOx and VOC Roles in Ozone Formation and Emission Trends

Ozone is formed from the reaction of NOx and VOCs in the presence of sunlight. Ozone formation involves a number of different reactions. Partly because of the interactions between these different reactions, rates of ozone formation often respond non-linearly to reductions in ozone precursor concentrations. For example, under some circumstances, ozone formation may be NOx-limited, such that reductions in NOx emission cause reductions in ozone concentrations. Under NOx-limited conditions, VOC reductions may not affect ozone concentrations. Under other conditions, ozone formations may be VOC-limited. Currently, ozone formation in most of the eastern U.S. is believed to be NOx-limited[39]. The primary exception to this assumed NOx-limitation is in the largest urban centers, which often have high NOx concentrations and where ozone formation may be limited by the concentrations of the less-abundant VOCs. Because of this complex chemistry, approaches to decreasing ozone concentrations have relied on reductions in both NOx and VOC emissions.

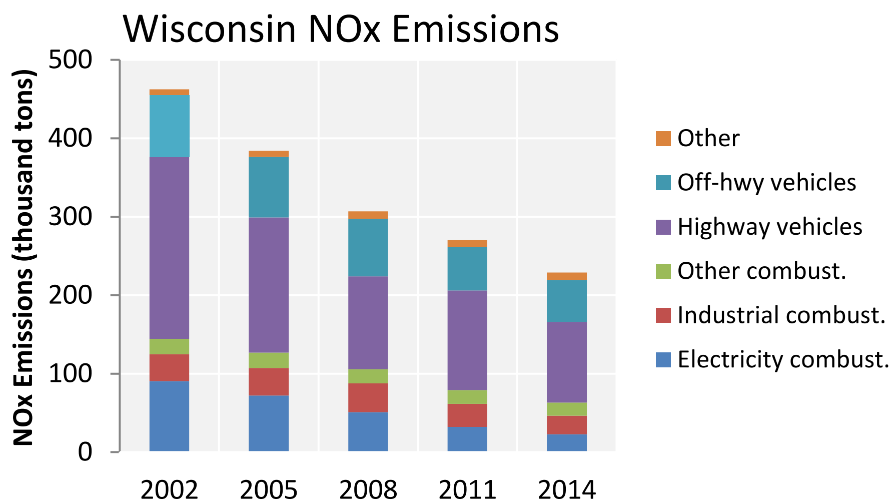
NOx consists of nitric oxide (NO) and nitrogen dioxide (NO_2). Most NOx is emitted as NO, which reacts fairly rapidly in the atmosphere to form NO_2, which has a longer lifetime in the atmosphere and can be transported longer distances. VOCs are a complex mixture of hundreds of different types of organic compounds, including compounds that contain only carbon and hydrogen ("hydrocarbons") and compounds that also include oxygen, nitrogen, sulfur and/or other elements. Some VOCs are emitted directly by anthropogenic sources, including benzene and toluene, whereas others are formed in the atmosphere from reaction of other VOCs. These "secondary VOCs" include formaldehyde and acetaldehyde, which are important "carbonyl" compounds.[40]

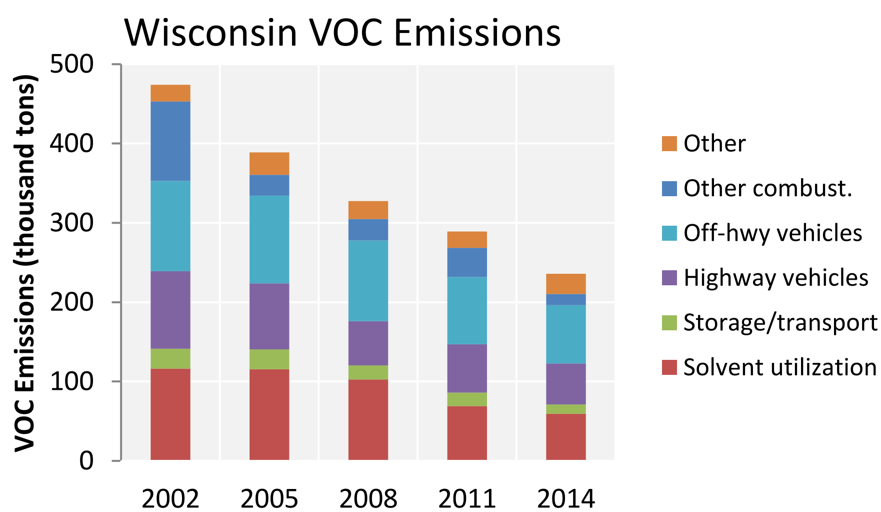
Emissions of both NOx and VOCs have decreased dramatically in the last few decades from Wisconsin and other U.S. states. Emissions of NOx from sources in Wisconsin decreased by 51% from 2002 to 2014, and emissions of VOCs decreased 50% in this same timeframe (Figure 5.5). These reductions resulted from the control programs described in Section 3.6, as well as earlier programs. Most of the NOx reductions came from the utility, highway vehicle, and off-highway vehicle sectors, whose emissions have decreased by 76%, 56% and 46%, respectively. VOC emissions reductions primarily occurred in the solvent utilization, highway vehicle, off-highway vehicle and other combustion sectors, whose emissions decreased by 41%, 48%, 35% and 63%, respectively. Emissions inventories for 2011 and projections for 2017 are discussed in more detail in Chapter 3. Emissions of both pollutants are projected to continue to decrease through 2017 and beyond.

[39] See, for example, EPA (2013) Integrated Science Assessment for Ozone and Related Photochemical Oxidants. http://ofmpub.epa.gov/eims/eimscomm.getfile?p_download_id=511347

[40] Carbonyl compounds contain a carbon-oxygen double bond.

Figure 5.5. Statewide NOx (top) and VOC (bottom) emissions by sector for the years 2002 through 2014. Data from the National Emissions Inventory (NEI), with updates to the mobile source sectors by EPA.[41]





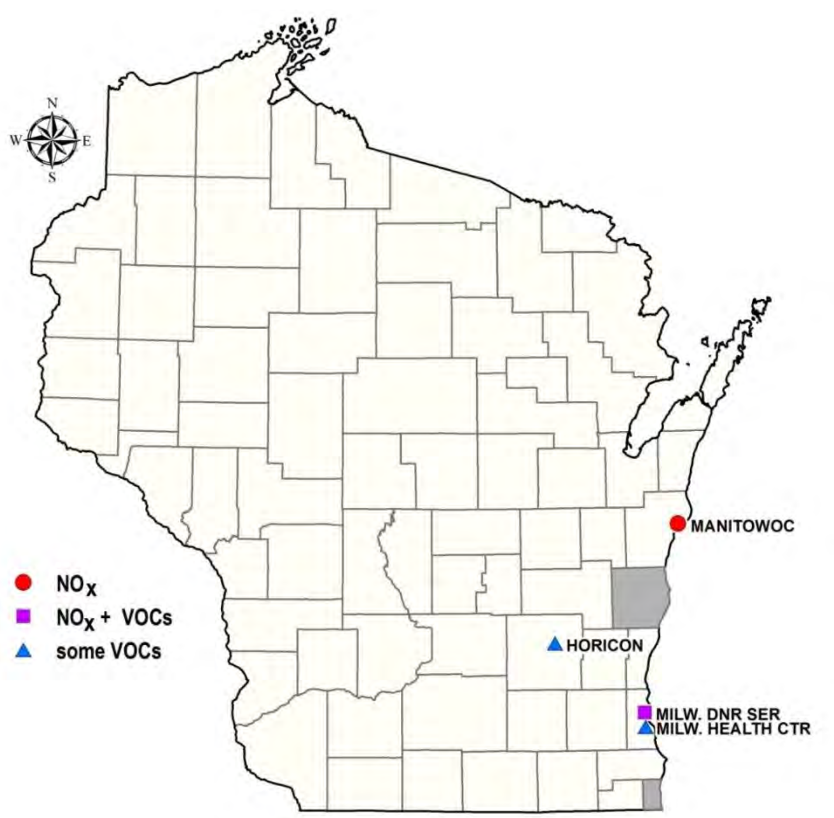
[41] Data for 2014 is from https://www.epa.gov/air-emissions-inventories/national-emissions-inventory-nei. Data from earlier years is from https://www.epa.gov/air-emissions-inventories/air-pollutant-emissions-trends-data.

5.3.2. Trends in Ambient NOx Concentrations in Wisconsin

Trends at existing monitors can provide insight into how ambient concentration along the lakeshore and in nearby inland counties have changed. Note that NOx may be transported variable distances under the same meteorological conditions that transport ozone (discussed in Section 2.2). This means that concentrations measured at a given location may include NOx from both local and regional (upwind) sources.

WDNR monitored ambient NOx concentrations in 2015 at two locations in the eastern part of the state (Figure 5.6), one urban (Milwaukee SER) and one rural (Manitowoc).[42] Neither of these monitors is located within the Sheboygan County nonattainment area. However, NOx concentrations and concentration trends in Sheboygan are likely similar to those measured at the Manitowoc monitor. Manitowoc County is located immediately north of Sheboygan County, and both counties receive transported ozone and ozone precursors from upwind (southerly) areas on high-ozone days.

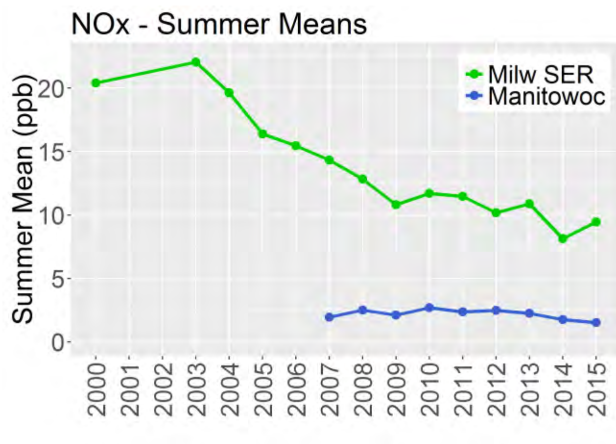
Figure 5.6. Monitoring locations for ambient NOx and VOCs in Wisconsin. The Sheboygan and Kenosha County nonattainment areas are shaded in gray.



[42] Monitoring NOx and VOC concentrations is relatively complicated, labor-intensive and expensive. Consequently, measurements of these pollutants in Wisconsin (and in most states) have been very limited, both spatially and temporally (i.e., many measurements are only made in the summer). There is only one location in Wisconsin at which both NOx and VOCs are measured (Milwaukee SER).

Average summer NOx concentrations were highest in all years at the urban (Milwaukee SER) monitor, followed by Manitowoc, which is located along the northern Lake Michigan shoreline (Figure 5.7). Average NOx concentrations at the Milwaukee SER monitor have decreased significantly since monitoring began in 2000. From 2000 to 2015, mean summer NOx concentrations decreased 54%, with the largest changes coming between 2003 and 2009 (Figure 5.7). NOx concentrations have continued to decrease, although the rate of decrease appears to have slowed. The 54% reduction in ambient NOx concentrations at Milwaukee SER (54% from 2000 to 2015) is similar in size to the reduction in NOx emissions from the entire state of Wisconsin (51% from 2002 to 2014; Figure 5.5) over a similar time period. The dip in concentrations in 2009 likely reflects the effect of the economic recession on economic activity.

Figure 5.7. Trends in ambient NOx concentrations at Wisconsin monitors during the summer months (June-August).



NOx concentrations at Manitowoc increased slightly from 2007, when measurements began, until 2010 and have decreased fairly steadily since then. However, given the much lower concentration of NOx at Manitowoc, the magnitude of these changes is much smaller than at Milwaukee SER.

Due to their geographic proximity, NOx concentrations and concentration trends in Sheboygan are likely similar to those measured at the Manitowoc monitor. NOx concentrations at Sheboygan are likely low, although probably higher than those at Manitowoc due to Sheboygan's closer proximity to the emission sources in and around Milwaukee and Chicago. Similarly, NOx concentrations at Sheboygan are likely decreasing, as they are at both Manitowoc and Milwaukee SER.

5.3.3. Trends in Ambient VOC Concentrations in Wisconsin

WDNR measured concentrations of 56 VOC compounds at one urban location (Milwaukee SER) and a smaller set of VOC measurements at two other locations, one urban (Milwaukee SER) and one rural (Horicon; Figure 5.6).[42] None of these monitors is located within the current Sheboygan County nonattainment area. However, as with NOx, trends at the existing monitors can provide insight about concentration changes in the region. The VOC compounds monitored at the Milwaukee SER site included 53 hydrocarbons and three carbonyls (formaldehyde, acetaldehyde and acetone). At the other two monitors, the compounds measured included the three carbonyls and a smaller subset of hydrocarbons. A complete listing of the VOCs measured at the different sites, along with their concentrations for a subset of years, is in Appendix 10. This document shows trends in the sums of compound classes, with VOCs separated into carbonyl and hydrocarbon classes. Because only a subset of hydrocarbons were measured at the Milwaukee Health Center and Horicon-Mayville sites, hydrocarbon sums are not shown here for those sites. Appendix 10 also shows trends in sub-classes of hydrocarbons (including n-alkanes, branched and cyclic hydrocarbons, unsaturated hydrocarbons, aromatic hydrocarbons and isoprene). VOCs were measured year-round at the Horicon-Mayville and Milwaukee Health Center sites but only monitored during the summer months (June-August) at the Milwaukee SER site.

Summer average concentrations of carbonyls were lowest at the rural Horicon-Mayville site and highest at the Milwaukee Health Center site in most years (Figure 5.8). There was a clear though uneven decrease in carbonyls at the Milwaukee SER and Horicon-Mayville sites.[43] The trend at the Milwaukee Health Center site was more variable. However, concentrations at this monitor decreased fairly consistently from 2010 to 2015.[44] Overall, carbonyl concentrations decreased by 12%-15% at the Milwaukee monitors and 2% at Horicon-Mayville over each site's monitoring period (Figure 5.8). However, reductions from concentration peaks (around 2005-2006) were significantly greater.

Summer average total hydrocarbons at the Milwaukee SER site showed a large (45%) but variable decrease between 2000 and 2015 (Figure 5.8). This is similar in magnitude to the reduction in VOC emissions from the entire state over a similar time period (50% from 2002 to 2014; Figure 5.5). Concentrations of all of the sub-classes of anthropogenic hydrocarbons also decreased during this time period (Appendix 10). As discussed for NOx, the minimum in 2009, and likely the lower concentrations in 2008 and 2010, probably reflect decreased emissions due to lower economic activity because of the recession. Appendix 10 shows graphical trends in these hydrocarbon compound class averages, as well as showing the concentrations and percent changes in concentrations of individual VOC compounds.

This data supports a conclusion that VOC concentrations in Sheboygan County are likely also decreasing. However, the specific magnitude of the concentrations and concentration decreases in Sheboygan County is unknown due to the lack of VOC monitoring in the county.

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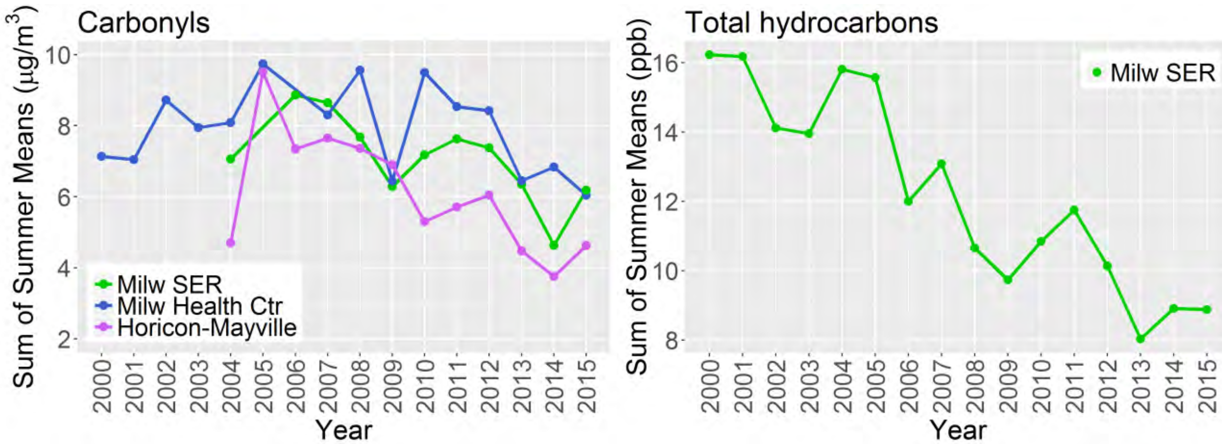
[43] The minimum in carbonyl VOCs in 2009 at both Milwaukee sites likely reflects decreased economic activity during the recession. Carbonyl concentrations appeared especially low in 2004, the first year of measurement at both the Milwaukee SER and Horicon-Mayville sites. This may be because the summer of 2004 was very cool, which can affect formation of secondary VOCs like formaldehyde and acetaldehyde.

[44] The larger amount of variability at the Milwaukee Health Center site likely results because these samples are only collected once every 12 days (as opposed to every 6 days at Milwaukee SER currently), so that fewer measurements are averaged together for each summer. As a result, one unusual measurement can have a greater influence on the average.

Figure 5.8. Trends in summer mean concentrations of two different classes of VOCs, (left) carbonyls and (right) hydrocarbons. Hydrocarbons are not shown for the Milwaukee Health Center or Horicon-Mayville monitors because only a few compounds were measured at these sites.



5.3.4. Comparison of Trends in Emissions and Monitored Concentrations

Figure 5.9 compares trends in emissions and monitored concentrations of ozone precursors, as well as monitored ozone concentrations. All trends are normalized to their value in 2008 in order to directly compare the different parameters. This comparison shows that monitored NOx concentrations in Milwaukee tracked inventoried statewide NOx emissions relatively well (Figure 5.9). NOx emissions and concentrations in Milwaukee were both 1.5-1.7 times higher in 2002 relative to 2008. NOx emissions and Milwaukee concentrations in 2014 decreased by similar amounts from their 2008 values. NOx concentrations at the downwind, rural Manitowoc monitor were much lower than those in Milwaukee and were more decoupled from statewide emissions, although they showed similar reductions in 2014 relative to 2008.

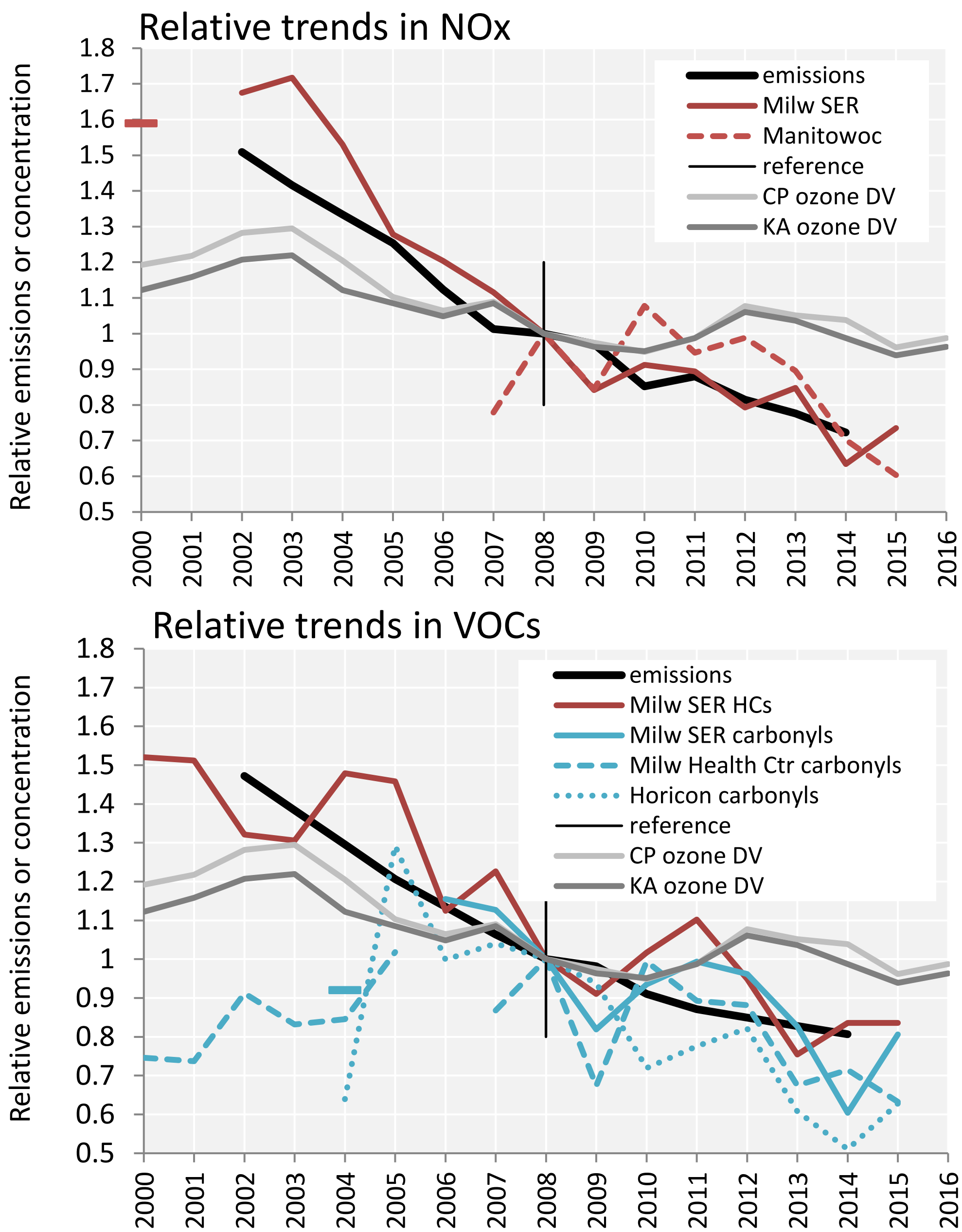
Similarly, trends in hydrocarbon VOCs at the Milwaukee SER monitor tracked statewide VOC emissions fairly well, although monitored concentrations were more variable than emissions (Figure 5.9). Emissions and monitored hydrocarbon concentrations both decreased from 1.3-1.5 times 2008 levels in 2002 to 0.8 times 2008 levels in 2014. Monitored concentrations of carbonyl VOCs were more variable than were hydrocarbons but also roughly follow the emission trends. In particular, urban carbonyl concentrations have seemed to track emissions since roughly 2006. Most hydrocarbon VOCs are directly emitted from sources, whereas carbonyls can be formed from reactions in the atmosphere, so it is unsurprising that these two types of VOCs have somewhat different trends. However, overall, monitored VOC concentrations have decreased as VOC emissions have decreased.

While monitored ozone concentrations have decreased during this time period, the magnitude of this decrease has not tracked NOx or VOC emission or concentration trends very closely (Figure 5.9). Ozone concentrations have decreased at a much slower rate than have either precursor emissions or monitored precursor concentrations. This slower rate of reductions likely results from a variety of factors that affect ozone formation and cause its concentrations to be nonlinear with the concentrations of ozone precursor concentrations. These factors include:

- Meteorological variability between years.
- The nonlinearity of ozone chemistry.
- The influence of ozone transported from upwind regions in the U.S. and from other countries.

The role of these different factors in contributing to ozone formation and trends are discussed in more detail in Sections 5.2 and 5.4.

Figure 5.9. Trends in (top) NOx and (bottom) VOC statewide emissions and monitored concentrations in Wisconsin, along with ozone design values at the Kohler Andrae (KA) and Chiwaukee Prairie (CP, in Kenosha County) monitors. All values were normalized to their value in 2008 to allow comparisons of relative reductions over time. HC = hydrocarbon VOCs, and carbonyls are a class of VOCs including formaldehyde, acetaldehyde and acetone. Emissions data is from EPA (https://www.epa.gov/air-emissions-inventories/air-pollutant-emissions-trends-data).



5.4. Influence of Transport and Chemistry on Ozone Trends

Ozone concentrations can be influenced by several other factors besides local emissions of ozone precursors and meteorology. These factors, which include transport of ozone into the area and ozone formation chemistry, are beyond the control of Wisconsin, including Sheboygan County. This part of the document examines the role of each of these factors in determining ozone concentrations in Sheboygan County.

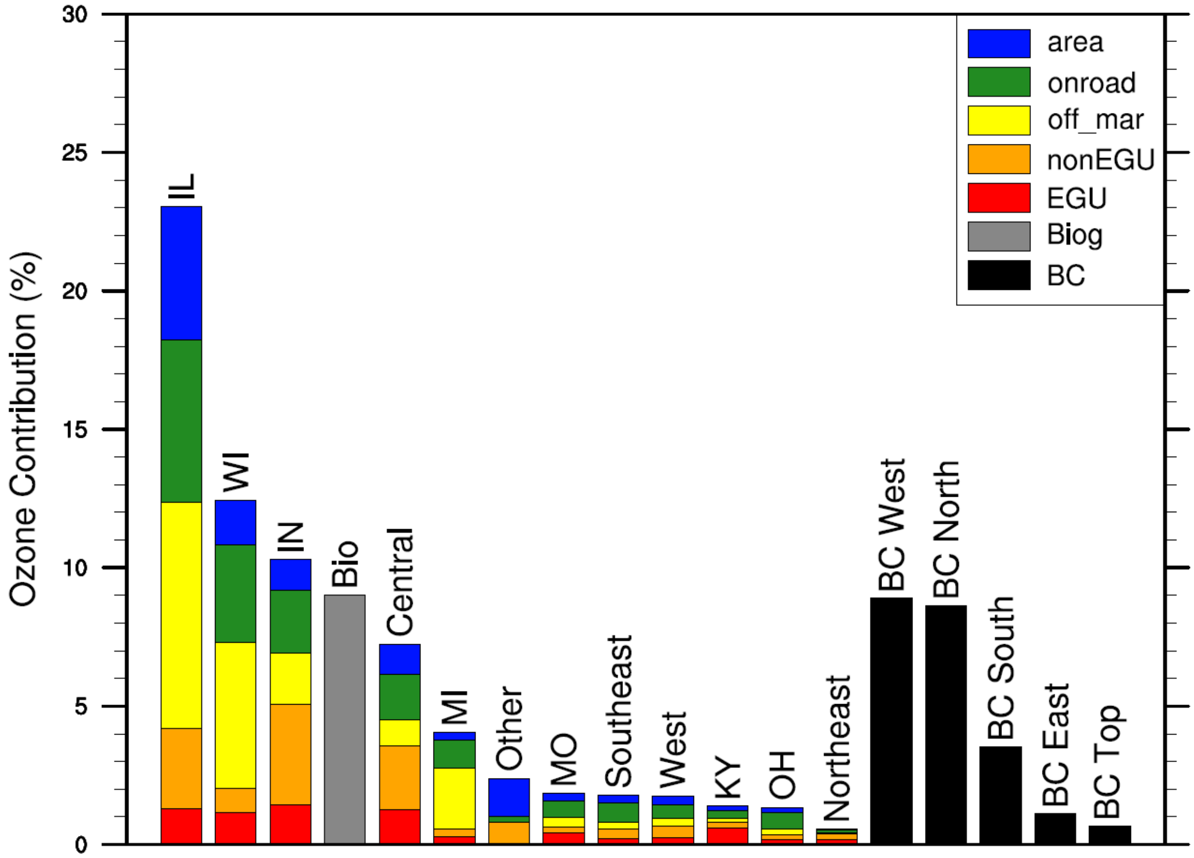
5.4.1. Influence of Transport on Ozone, NOx and VOC

One of the most important factors contributing to elevated ozone concentrations in Wisconsin's ozone nonattainment areas is transport of ozone and ozone precursors from upwind areas. Recent source apportionment modeling from LADCO found that out-of-state emissions were responsible for approximately 87% of the measured ozone concentrations at the Sheboygan Kohler Andrae monitor; in contrast, Wisconsin sources contributed less than 13% (Figure 5.10). Six nearby states together contributed 42% of the measured ozone, while contributions from outside the U.S. ("boundary conditions") and from natural sources ("biogenics") contributed 31%. This modeling similarly showed that out-of-state contributions dominate measured ozone concentrations at the state's other ozone nonattainment area, in eastern Kenosha County. The transport of such large amounts of ozone and ozone precursors from areas outside Wisconsin significantly limits the state's ability to reduce high ozone concentrations within its borders.

To further examine the role of ozone transport to this nonattainment area, it is informative to investigate how pollutant concentrations vary with wind direction. Winds from different directions transport pollutants from different upwind origins. The coastline south of the Kohler Andrae monitor is oriented at roughly 215°, running roughly southwest to northeast (Figure 1.1). Figure 5.11 shows two analyses of ozone and wind data at this monitor for hours when ozone concentrations exceeded the 2008 standard. This data shows that high ozone concentrations almost always occurred when winds were from the south to south-southwest (Figure 5.11). Roughly 86% of ozone came to the Kohler Andrae monitor from 166°-215° during high-ozone hours – the result of lake breeze and direct pollutant transport from the south over Lake Michigan. In contrast, only 6% of the ozone came from over land (216°-035°) and 7% arrived from more easterly directions over the lake (036°-165°).

These findings confirm that ozone concentrations in the nonattainment area are dominated by ozone transported into the area. High ozone concentrations at this monitor almost never occurred when winds came from over Wisconsin's landmass, and local emission sources contribute very little to ozone measured at the Kohler Andrae monitor during high-ozone hours. Instead, transport of ozone over the lake from the south is the dominant contributor to ozone at this site. This transport most often occurs during a lake breeze event, but may also occur with synoptic southerly winds (see Chapter 2).

Figure 5.10. Ozone source apportionment modeling from LADCO for Sheboygan's Kohler Andrae monitor. Colors correspond to emission source categories (see Chapter 3).[45]



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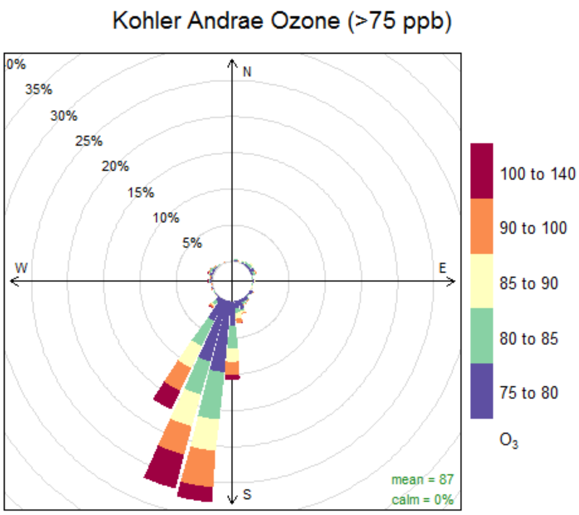
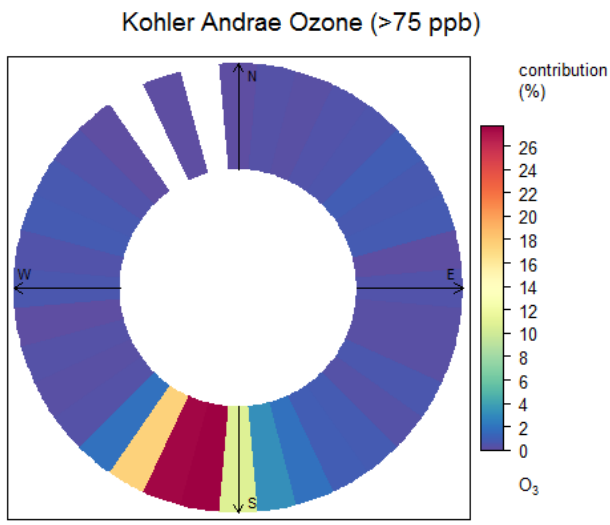
[45] The Central region includes MN, IA, NE, KS, OK, TX, AR and LA. The Southeast region includes MS, AL, GA, FL, TN, VA, NC and SC. The West region includes WA, OR, CA, NV, ID, MT, WY, UT, CO, AZ, NM, ND and SD. The Northeast region includes ME, NH, VT, MA, RI, CT, NY, NJ, PA, DE, MD, and WV. BC is boundary conditions, which are contributions from outside the U.S.

Figure 5.11. (left) One-hour ozone concentrations above 75 ppb plotted by wind direction and (right) percent contributions of ozone above 75 ppb from different wind directions for the Kohler Andrae monitor. The length of the paddle in the pollution rose (left) indicates the frequency of that concentration-wind direction combination, and the color indicates the concentration (in ppb). Data are for 2000-2015, as available.



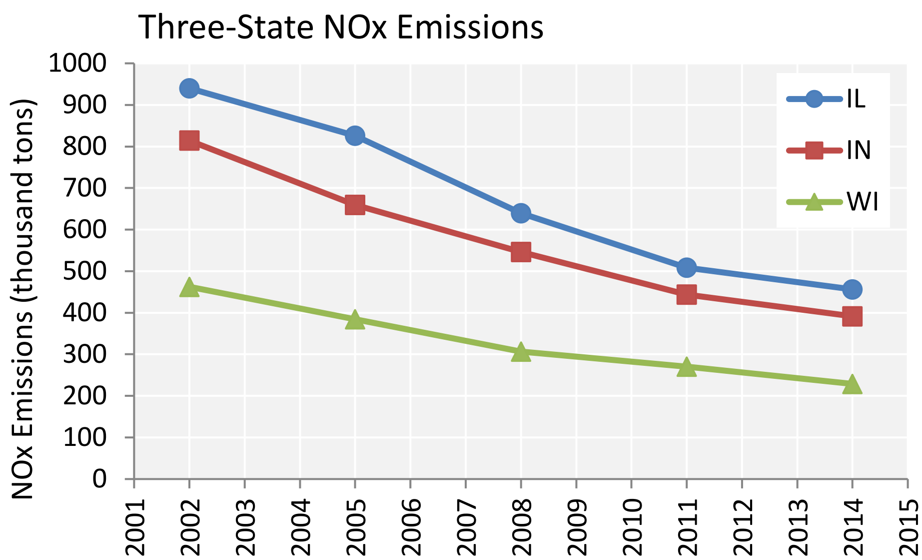


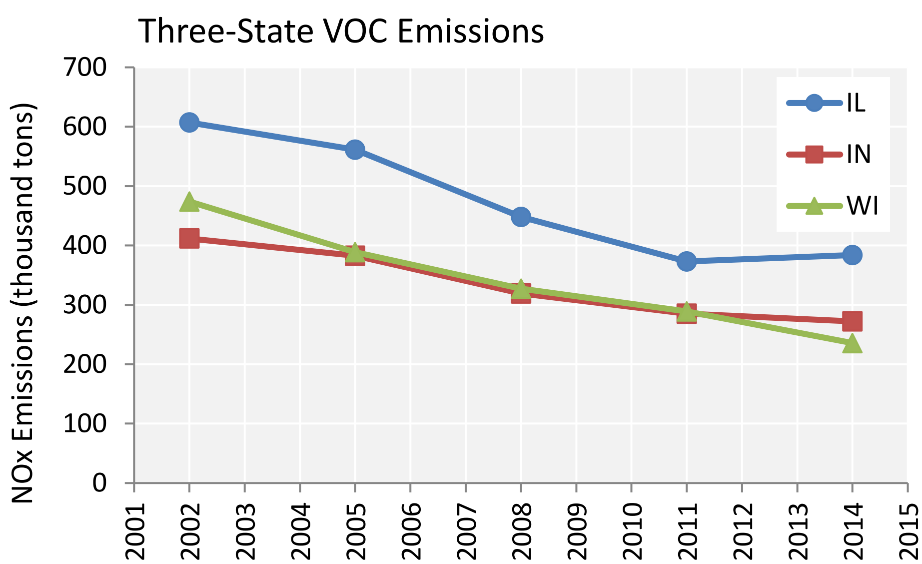
5.4.2. Trends in Upwind State Emissions and Concentrations of VOCs and NOx

Emissions from neighboring states that contribute to high ozone concentrations in Sheboygan County (see Figure 5.10) have decreased by similar proportions to those that occurred from Wisconsin sources. For example, NOx emissions decreased 55% from Illinois and 52% from Indiana during this timeframe (Figure 5.12). Similarly, VOC emissions decreased 42% from Illinois and 34% from Indiana. However, VOC emissions from these states remained relatively constant from 2011 to 2014 (Figure 5.12).[46]

[46] 2014 emissions for all states were taken directly from the NEI (https://www.epa.gov/air-emissions-inventories/national-emissions-inventory-nei). Emissions from previous years were taken from EPA's emissions trends webpage (https://www.epa.gov/air-emissions-inventories/air-pollutant-emissions-trends-data). Data for some sectors on the trends webpage are taken directly from the NEI, but mobile source emissions for past years were adjusted to use the current mobile source model and modeling approach. It is possible that the "flatness" of VOC trends in Illinois and Indiana results in 2011 and 2014 is an artifact of the different sources used for these two years. However, since 2011 emissions were adjusted to current methodology, this seems unlikely. Similarly, such a result was not observed for Wisconsin VOC emissions, which continued to decrease in 2014 (Figure 5.5).

Figure 5.12. Statewide emissions of (top) NOx and (bottom) VOCs from the three states that contribute the most to ozone in Sheboygan. Data sources as cited in Figure 5.5.





Emissions from Wisconsin's fossil-fueled EGUs are particularly well-controlled, especially relative to contributing neighboring states.[47] Figure 5.13 shows that ozone season NOx emissions from Wisconsin's EGUs are a small fraction of total EGU emissions from the broader region; in fact, Wisconsin's NOx emission rate is the lowest of the 14 central states examined, including the immediate upwind states of Illinois and Indiana. This analysis suggests that additional controls on Wisconsin's already well-controlled EGUs are unlikely to have a significant impact on air quality locally or regionally. However, reducing emissions from higher-emitting EGUs in upwind states are likely to reduce ozone concentrations transported into Wisconsin.

Monitored NOx concentrations in the two upwind states that contribute most to ozone at the Kohler Andrae monitor, Illinois and Indiana, have decreased steadily from 2000 through 2015 (Appendix 10).[48] These reductions are similar to those seen for Wisconsin's NOx monitors (Figure 5.7) and indicate that the absolute contributions of NOx from these states to ozone at Sheboygan has likely decreased substantially over this time period. At the same time, these states remain the first and third largest contributors to ozone at the Kohler Andrae monitor (Figure 5.10).

In contrast, monitored concentrations of VOCs in the Chicago area have either remained flat or increased over the last 15 years (Figure 5.14). At Illinois's monitors, total hydrocarbon concentrations increased by more than 5 ppb from 2009 to 2015, and total carbonyl concentrations at these monitors in 2015 were more than three times their minimum values from the mid-2000s. VOC concentrations at Indiana's Chicago-area monitors varied substantially, but appeared to either remain steady or even increase from the mid-2000s to 2015. This monitoring data, combined with the lack of any apparent VOC emissions decrease in Illinois and Indiana from 2011 to 2014, suggests that Wisconsin's lakeshore may be receiving relatively more VOCs from these states than in the past. This may be contributing to the elevated ozone concentrations measured at Sheboygan's Kohler Andrae monitor. However, the actual impact of these changes will depend on how sensitive ozone formation chemistry is to additional VOCs, as discussed in Sections 5.3.1 and 5.4.3.

[47] The controls on Wisconsin EGUs are described in Section 3.6.1.
[48] NOx and VOC data were downloaded from EPA's Air Quality System database.

Figure 5.13. Ozone season (May-September) statewide average (top) total NOx emissions and (bottom) NOx emission rate for EGUs in states in the central U.S.

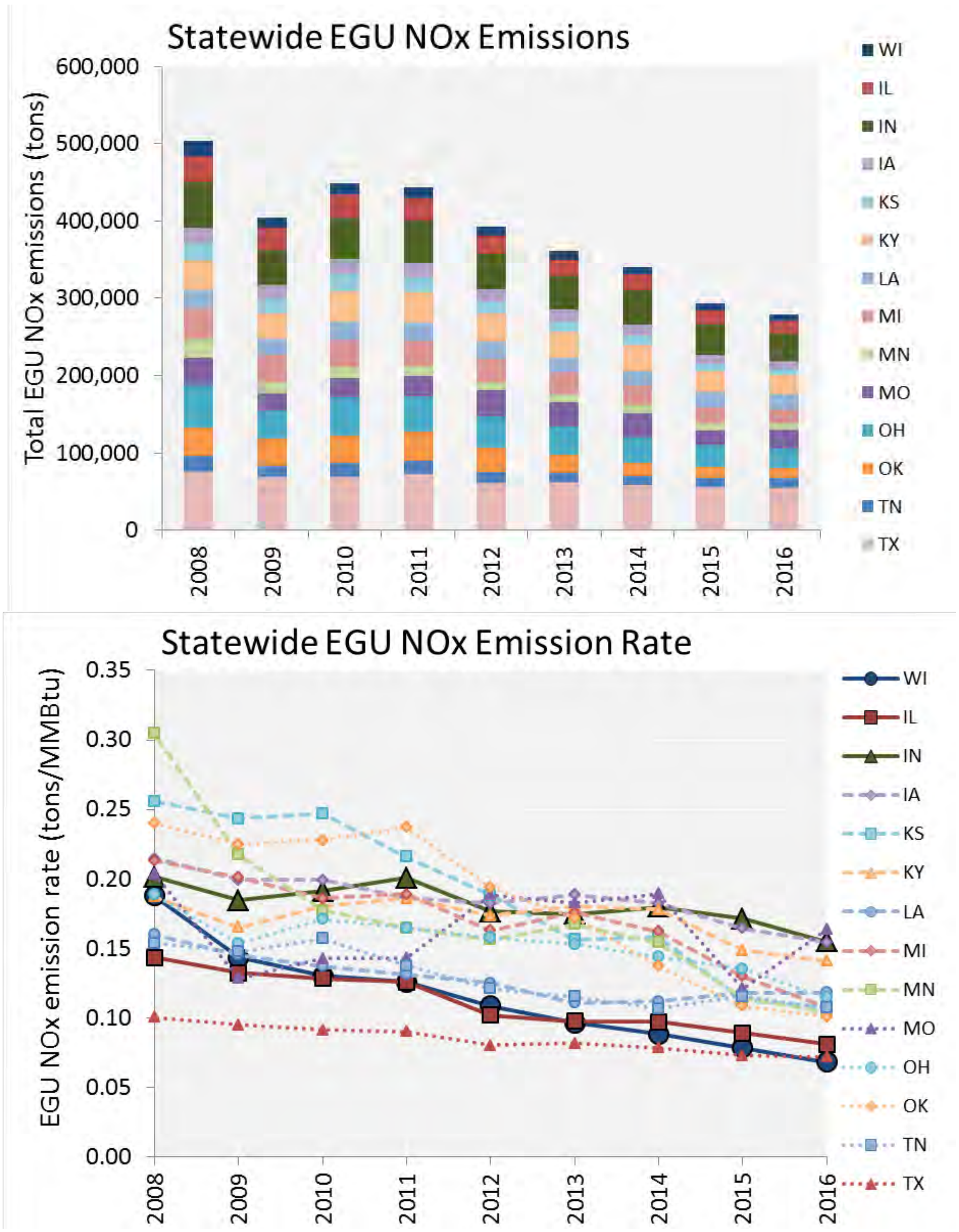
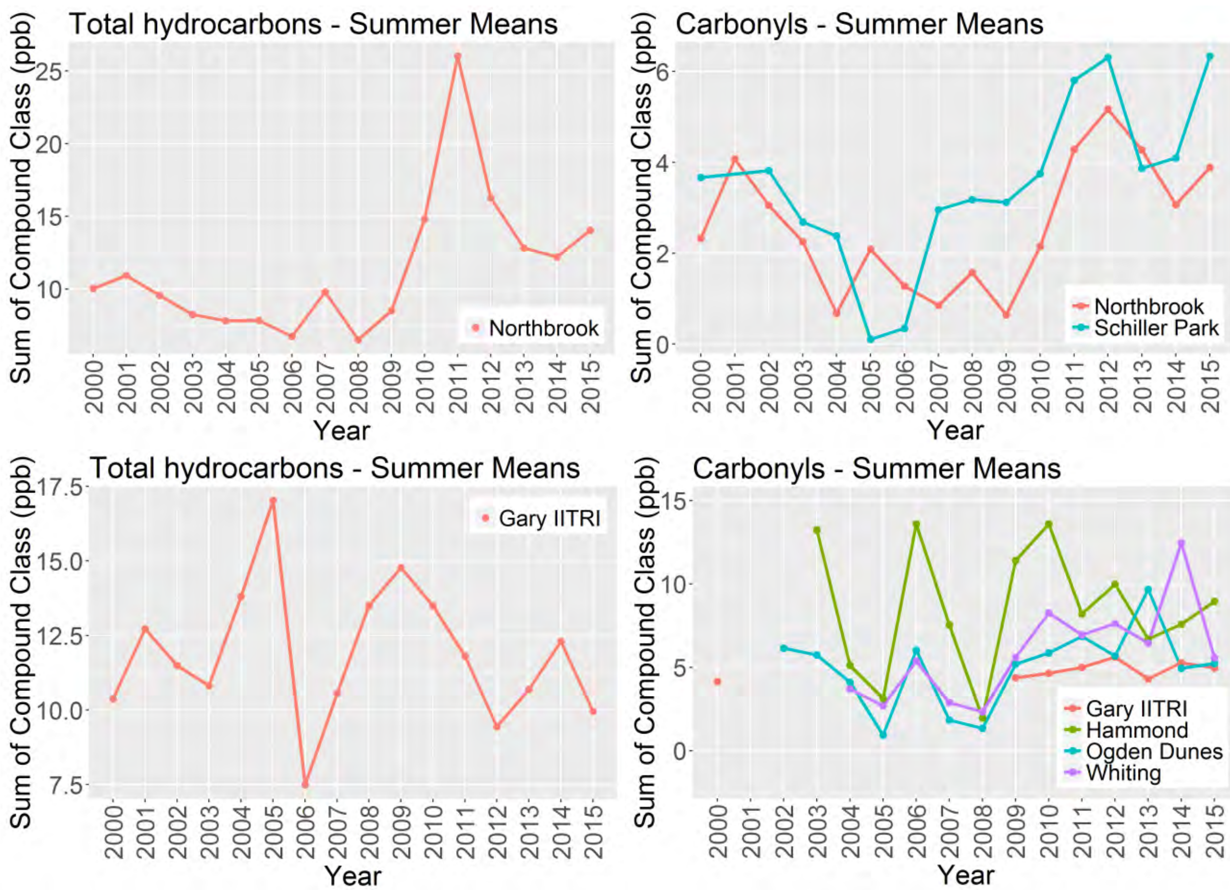


Figure 5.14. Trends in mean summer VOC concentrations of (left) hydrocarbons and (right) carbonyls for Chicago area monitors in (top) Illinois and (bottom) Indiana.



5.4.3. Influence of Ozone Formation Chemistry on Ozone Concentrations

As discussed in Section 5.3.1, ozone formation is known to be nonlinear with concentrations of NOx and VOC. At some points it may be sensitive to changes in NOx concentrations, but at others sensitive to changes in VOC concentrations. Under other circumstances, primarily in heavily polluted urban centers, high NOx concentrations have been shown to react with ozone, lowering its concentration locally via “titration”. However, in those situations the titrated ozone generally reforms ozone further downwind. Precursor concentrations can also affect the rates at which ozone is formed via complex chemical processes. Overall, the chemistry of ozone formation is extremely complicated.

Understanding of ozone chemistry in the region is not current. The large changes in NOx and VOC concentrations have likely changed the susceptibility of ozone formation to changes in precursor concentrations, as well as to other factors (as shown for meteorology in the Section 5.2.3). However, the last major field study to make direct measurements of ozone chemistry in the Lake Michigan region ended in 2003.[49] At that time, NOx and VOC concentrations were 1.5 to 2 times higher than today (Figures 5.7 and 5.8), and ozone design values were more than 20 ppb higher in Sheboygan (Figure 5.1).

Examination of the changes in the weekday/weekend effect on ozone formation demonstrate that ozone chemistry in the region has in fact changed over time. Studies of this effect have been used to gain insight into the sensitivity of ozone concentrations to reductions in NOx emissions. Such studies take advantage of the fact that NOx emissions and concentrations tend to be lower on weekends than during the week (Figure 5.15), primarily due to decreased heavy vehicle traffic. As has been found in other studies in this[50] and other[51] regions, average ozone concentrations at the Kohler Andrae monitor in 2001-2005 increased over the weekend, reaching a maximum on Sunday, when NOx concentrations are at their lowest (Figure 5.15). This effect has been attributed to reduced titration of ozone by high NOx concentrations on weekdays and other related effects.[52,52] Similar findings in the region have been interpreted as suggesting that controlling urban NOx emissions in isolation might not be an effective local pollution control strategy, a finding disputed by other concurrent studies.[50]

Figure 5.15 shows that the weekday/weekend effect decreased dramatically by 2006-2010. For the most recent time period examined, 2011-2016, average ozone concentrations remained virtually constant between the different days of the week for this site. The same results were found for all sites along Wisconsin's and Illinois's Lake Michigan lakeshore (not shown), as well as in other parts of the country[53]. This updated analysis suggests that ozone formation chemistry has changed over the last 15 years, and that concern with NOx reduction strategies that may have existed in the early 2000s may be gone. However, other lines of evidence suggest that reductions in NOx emissions exclusively may cause slight increases in ozone concentrations (well below the level of the NAAQS) in portions of major urban centers. More work is required to fully evalute the current chemistry of ozone formation in this region.

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[49] Several field campaigns have been conducted to study ozone over Lake Michigan, most notably the Lake Michigan Ozone Study (LMOS) in 1991 and LADCO Airplane Project from 1994-2003. A field campaign to help better understand current regional ozone chemistry, the Lake Michigan Ozone Study 2017, is scheduled for May-June 2017. The results of this field campaign should allow better understanding of ozone chemistry and more accurate evaluation of control strategies for future attainment demonstrations, if needed.

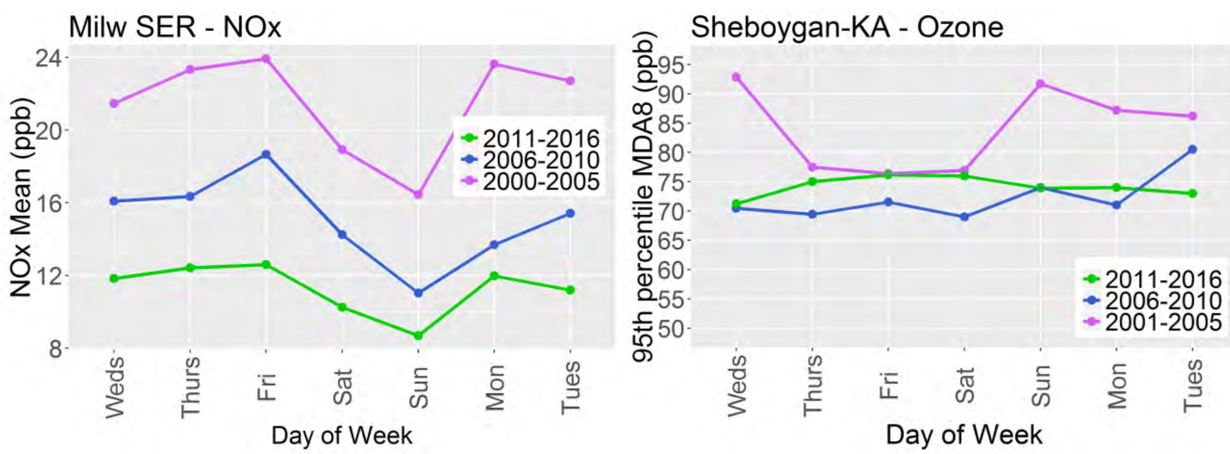
[50] LADCO (2008) Regional Air Quality Analyses for Ozone, PM2.5, and Regional Haze: Final Technical Support Document, April 25, 2008. http://www.ladco.org/reports/technical_support_document/tsd/tsd_version_iv_april_25_2008_final.pdf

[51] For example, Murphy et al. (2007) The weekend effect within and downwind of Sacramento – Part 1: Observations of ozone, nitrogen oxides, and VOC reactivity. *Atmos. Chem. Phys*., **7**, 5327-5339.

[52] These effects may, however, be complicated by the relatively long lifetimes of ozone and ozone precursors, such that ozone formed on one day might affect a site a day or two later.

[53] Wolff et al. (2013) The vanishing ozone weekday/weekend effect. *J. Air Waste Mgmt. Assoc*., **63**: 292-299.

Figure 5.15. Average (left) NOx concentrations for the Milwaukee SER monitor and (right) 95th percentile maximum daily 8-hour average (MDA8) ozone concentrations for the Kohler Andrae monitor for each day of the week, grouped into five- or six-year groups.



5.5. EPA Modeling for Future Year 2023

On January 6, 2017, EPA released the results of photochemical modeling conducted as a preliminary assessment of interstate ozone transport contributions relative to the 2015 ozone NAAQS (82 FR 1733). That assessment forecasts an average design value of 71.0 ppb at the Kohler Andrae monitor in 2023 and a maximum design value of 73.3 ppb.[54] This modeling suggests that ozone design value at the Kohler Andrae monitor will decrease by roughly 5 ppb over the next six years, from LADCO's modeled value of 76.1 ppb in 2017 (Table 4.2) to EPA's modeled value of 71.0 ppb in 2023. It is notable that even EPA's maximum modeled design value for 2023 (73.3 ppb) is projected to be well below the critical level for the 2008 standard (75.9 ppb).

This modeling forecasts continuation of the steady reductions in ozone concentrations that have occurred in the last two decades. These improvements primarily reflect the steady turnover of the onroad vehicle and nonroad engine fleets, continued expansion of energy efficiency measures, and the ongoing transition in EGU fleets from coal to natural gas and renewable energy. EPA's own projections of ozone concentrations in Sheboygan County, therefore, also support the likelihood of the area to attain the 2008 NAAQS in the near future.

5.6. The Impact of Hypothetical Additional Emissions Reductions in Wisconsin

As described in section 5.4.1, analysis of ozone data indicates that Wisconsin sources contribute little to ozone concentrations in Sheboygan County. To assess what impact further emissions reductions from Wisconsin sources could potentially have on ozone concentrations at Sheboygan's Kohler Andrae monitor, LADCO conducted refined photochemical modeling for WDNR. This modeling examined the impact of two hypothetical emission reduction scenarios

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[54] This modeling uses the same 2011 base year as used in LADCO's modeling for the 2008 ozone NAAQS (Chapter 4).

on projected 2017 design values at the 13 monitors located in a 10-county area along Wisconsin's lakeshore, including the Kohler Andrae monitor in Sheboygan County:

- Scenario 1: A 10 percent reduction in NO_x emissions and a 10 percent reduction in VOC emissions from all sectors (except from onroad and biogenics[55]) from the 10-county lakeshore area (shown in Figure 5.16). The southern lakeshore counties were selected because they would be expected to contribute the most of any area of the state to ozone concentrations at the Kohler Andrae monitor on high-ozone days, due to the prevailing southerly winds.
- Scenario 2: Completely eliminating ("zeroing out") all anthropogenic NOx and VOC emissions from Sheboygan County. This scenario eliminated emissions from all sectors except for biogenic emissions, which were held constant.

Neither Scenario 1 nor Scenario 2 is feasible. These "what if" modeling scenarios were conducted with the objective of determining whether Wisconsin's lakeshore counties, on their own, have any ability to further reduce ozone design values at lakeshore monitors (including the Kohler Andrae monitor). These modeling runs help further examine the role of transported emissions in driving ozone in this area to determine whether transported ozone effectively overwhelms the impact of any potential additional reduction in local emissions.

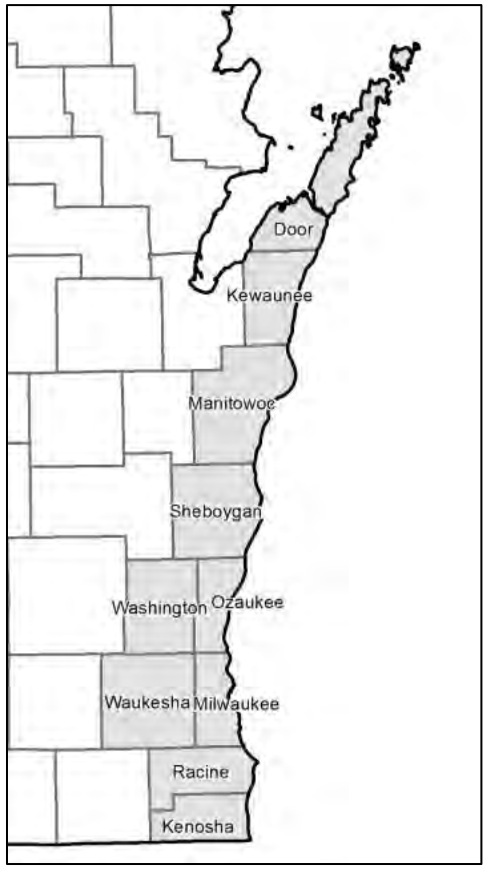
5.6.1. Methodology

The projected design values were calculated using two approaches. In the first approach, design values were calculated based on projections for all grid cells bordering the cell containing the monitor (a "3x3" grid cell area). The second approach only considered projections for the grid cell containing the monitor (a "1x1" grid cell area).[56] This modeling was compared with the modeling scenario described in Chapter 4.

[55] Reductions in onroad and biogenics sector emissions were not made since Wisconsin lacks any meaningful way to significantly and practically further control emissions from these sectors.

[56] The 3x3 grid cell approach is used by EPA for its modeled attainment tests and is their suggested default for state/regional modeling applications. Each grid cell is 12 kilometers by 12 kilometers. In this approach, the highest projected value from a 3x3 set of grid cells (9 grid cells total) is used to represent the 2011 base year and projected 2017 concentrations. A relative reduction factor is determined based on both these values and applied to a weighted 5-year design value centered on 2011 and based on monitored values at each site.

Figure 5.16. Map showing the 10 Wisconsin counties (shaded in gray) whose emissions were reduced as part of the Scenario 1 modeling run.



The results of these modeling runs are shown in Table 5.2. As shown in this table, neither scenario is projected to have a significant impact on design values at the Kohler Andrae monitor, and neither is projected to bring the monitor into attainment of the 2008 ozone NAAQS.[57] In particular:

5.6.2. Scenario 1 Results

The projected design value for the Kohler Andrae monitor showed almost no change in response to the 10 percent emissions cut across the 10-county area, decreasing by only 0.1 ppb under both grid cell approaches. This means that large, additional emissions reductions from Wisconsin's

[57] The impacts of both modeling scenarios on ozone design values at other monitors along Wisconsin's Lake Michigan lakeshore are shown in Section 5.2 of the document "Supplemental Information for 2015 Ozone National Ambient Air Quality Standard (NAAQS) Area Designations", available at http://dnr.wi.gov/topic/AirQuality/documents/OzoneTSD20170420.pdf

lakeshore area, including the greater Milwaukee area, have no meaningful impact on the projected design value at the Kohler Andrae monitor.

5.6.3. Scenario 2 Results

The results from the model run that eliminated all anthropogenic emissions from Sheboygan County were even more striking. Specifically, under the 3x3 grid cell approach, the design value at the Kohler Andrae monitor showed no decrease at all. Under the 1x1 approach, the design value at this monitor was actually predicted to *increase* by 0.6 ppb. Sheboygan County, therefore, has no ability to reduce ozone concentrations at the Kohler Andrae monitor.

Table 5.2. Model projected 2017 design values (DVs, in ppb) and changes in design values (ppb) for the Sheboygan Kohler Andrae monitor. Values are shown for the 2017 base case modeling run and for two hypothetical emission reduction scenarios (described in the text). Design values are calculated considering modeled concentrations in either a 3x3 grid cell area or just the grid cell containing the monitor (1x1). Modeling was conducted by LADCO.

	3x3 DVs		1x1 DVs	
Modeling Scenario	**DV**	**change**	**DV**	**change**
Base Case Scenario	76.1	-	77	-
10% Cut Run	76	-0.1	76.9	-0.1
Zero-Out Sheboygan Run	76.1	0	77.6	+0.6

LADCO modeling results clearly show that further reductions in nearby source emissions would have little, if any, impact on the monitored ozone concentrations at Sheboygan County's Kohler Andrae monitor. Local emissions are essentially decoupled from the ozone concentrations monitored at this monitor. These findings suggest that the traditional approach of regulating nearby emissions to reduce ozone concentrations would not be effective in this location. These results are also entirely consistent with what is understood about ozone transport and formation in this region as described earlier in this document.

5.7. Conclusion

Sheboygan County faces several attainment challenges that are beyond the control of both the county and the state of Wisconsin. Modeling completed in support of this plan shows that 87% of the ozone at Sheboygan's Kohler Andrae monitor originates from out of state, with six neighboring states contributing over 40%. Emissions of NOx and VOCs from Wisconsin sources have continually decreased over the past decade and a half. As a result, monitored NOx and VOC concentrations have decreased over this time period, as have meteorologically adjusted ozone concentrations. However, modeling projects that unrealistic additional emissions reductions from Wisconsin's lakeshore counties and the Milwaukee metropolitan area would not have a meaningful impact on ozone design values in Sheboygan County. Furthermore, completely eliminating all anthropogenic emissions from Sheboygan County is not projected to decrease the design value at the Kohler Andrae monitor at all. Given the influence of prevailing winds on ozone transport (see Section 5.4.1), this suggests that the state may have limited, if any, ability to further reduce ozone concentrations at this site in the near term. Taken together, these weight-of-evidence analyses demonstrate that air quality in Sheboygan County has improved significantly. However, the ability of Sheboygan County to attain the 2008 ozone NAAQS is highly dependent on out-of-state emissions, ozone chemistry and formation, and weather.

6. OTHER MODERATE AREA SIP REQUIREMENTS

6.1. Transportation Conformity

Transportation conformity is required under CAA section 176 (c) (42 U.S.C 7506(c)) to ensure that federally funded or approved highway and transit activities are consistent with ("conform to") the purpose of the SIP. "Conform to" the purpose of the SIP means that transportation activities will not cause or contribute to new air quality violations, worsen existing violations, or delay timely attainment of the relevant NAAQS or any interim milestones. Transportation conformity applies to designated nonattainment and maintenance areas for transportation-related criteria pollutants: ozone, fine particles ($PM_{2.5}$), coarse particles (PM_{10}), carbon monoxide, and nitrogen dioxide. EPA's transportation conformity rule (40 CFR Parts 51 and 93) establishes the criteria and procedures for determining whether metropolitan transportation plans, metropolitan transportation improvement programs, federally supported highways projects, and federally supported transit projects conform to the SIP.

Sheboygan County currently demonstrates transportation conformity using the "Motor Vehicle Emissions Budget (MVEB) Test" (40 CFR 93.119). WDNR submitted an early progress SIP with updated MVEBs for the Sheboygan County nonattainment area on January 16, 2015. On April 1, 2015, EPA found the MVEBs for Wisconsin's 8-hour ozone nonattainment area were adequate for use in transportation conformity determinations (80 FR 17428).

EPA requirements outlined in 40 CFR 93.118(e) (4) stipulate that MVEBs for NOx and VOC are established as part of a control strategy implementation plan revision or maintenance plan. MVEBs are necessary to demonstrate conformance of transportation plans and improvement programs with the SIP.

6.1.1. Motor Vehicle Emissions Model

The EPA's MOVES2014a model is used to derive estimates of hot summer day emissions for ozone precursors of NOx and VOCs. Numerous variables can affect these emissions, especially the size of the vehicle fleet (the number of vehicles on the road), the fleet's age, the distribution of vehicle types, and the VMT. The transportation information is derived from a travel demand model. Appendix 5 contains key data used to develop inputs to MOVES2014a.[58]

6.1.2. Motor Vehicle Emissions Budgets (MVEBs)

Table 6.1 contains the MVEBs for the Sheboygan County 2008 ozone NAAQS nonattainment area for the years 2017 and 2018. Since assumptions change over time, it is necessary to have a margin of safety that will accommodate the impact of refined assumptions in the process. 40 CFR 93.101 defines safety margin as the amount by which the total projected emissions from all sources of a given pollutant are less than the total emissions that would satisfy the applicable requirement for RFP, attainment, or maintenance. WDNR increased the on-road mobile source

[58] The complete set of inputs to MOVES2014a is too lengthy to include in this document. However, electronic copies of the inputs can be obtained from WDNR by sending an email to christopher.bovee@wisconsin.gov or by phone at (608) 266-5542.

portions of the 2017 and 2018 projected emissions inventories by 15% for Sheboygan County to account for uncertainties in future mobile source emissions.

For the Sheboygan County nonattainment area, transportation conformity will be based on the submitted MVEBs after EPA determines that the budgets meet the adequacy criteria of the transportation conformity rule. Once these budgets are found adequate by EPA, they will replace the MVEBs established for the 2008 ozone early progress plan (80 FR 17428). Table 6.1 identifies the 2017 and 2018 MVEBs for the Sheboygan County 2008 ozone attainment plan for use in transportation conformity analyses.

Table 6.1. Motor vehicle emissions budgets (MVEBs) for Sheboygan County for 2017 and 2018.

Year	Emissions (tons per hot summer day)	
	VOC	NO_x
2017	1.62	3.29
2018	1.49	2.96

6.2. Reasonably Available Control Technology (RACT) Program for NOx

Wisconsin's NOx RACT program was first adopted by the state in July 2007 as codified under s. NR 428.20 to 428.26, Wis. Adm. Code. The program was approved by EPA into the SIP in October 2009 (75 FR 64155). This program was established to fulfill NOx RACT requirements for southeast Wisconsin counties, including Sheboygan County, that were designated moderate nonattainment under the 1997 ozone NAAQS.

WDNR has determined that Wisconsin's current NOx RACT program fulfills RACT requirements under the 2008 ozone NAAQS. The basis for this determination is:

1) Wisconsin's existing NOx RACT program applies to major sources with a potential-to-emit of 100 tons per year and thus meets the necessary applicability requirements.

2) A review of control technology indicates that a new assessment of control technology conducted for the 2008 ozone NAAQS would not change the determination of RACT under Wisconsin's existing program.

6.2.1. Major Source Applicability

EPA set applicability of RACT for non-CTG facilities at an emissions threshold of 100 tons per year (TPY) or more based on a facility's PTE[59]. Wisconsin applied this threshold for the applicability of emission limitations under the current RACT program. Since EPA has already approved Wisconsin's RACT program for moderate nonattainment areas, this existing program likewise satisfies RACT applicability for Sheboygan's moderate nonattainment designation under the 2008 ozone NAAQS.

[59] EPA, 1988, *Issues Relating to VOC Regulation Cutpoints, Deficiencies, and Deviations, Clarification to Appendix D of November 24, 1987 Federal Register,* May 25, 1988.

6.2.2. Control Technology

The 2008 ozone implementation rule provides that states can show their existing NOx RACT programs fulfill requirements for the 2008 NAAQS[60]. EPA states this demonstration should be based on a review of RACT control technologies for conditions in 2008. If this review indicates there would be no incremental difference in control technologies between the existing program and the updated assessment, the existing program can be certified as meeting RACT under the 2008 NAAQS. Even in the case that an updated RACT could result in additional emission reductions, EPA indicates that such an action would likely not be cost-effective. EPA states:

> *"In cases where controls were applied due to the 1-hour or 1997 NAAQS ozone RACT requirement, we expect any incremental emissions reductions from the application of a second round of RACT controls may be small and, therefore, the cost for advancing that small additional increment of reduction may not be reasonable."*

Wisconsin's NOx RACT program was first implemented in 2007 based on an assessment of the control technologies and cost information available at that time. As a result, WDNR expects little, if any, change in the assessment of RACT control technology between 2007 and 2008, as required under the implementation rule. The RACT assessments would be based on essentially the same information.

However, to ensure this conclusion is correct, WDNR reviewed the current Wisconsin RACT requirements that could apply for emission units operating in Sheboygan County in 2008. The RACT source categories and control technologies found applicable are presented in Table 6.2. WDNR's review showed that two coal-fired boilers operated at the Edgewater power plant fall in the RACT source category of coal-fired boilers greater than 1,000 mmBtu per hour. These two boilers accounted for approximately 95% of 2008 NO_x emissions. WDNR also identified other emission units that could potentially be subject to RACT emission limits, regardless of facility PTE, if they were larger or operated more frequently. This exercise provided insight into other types of sources that could potentially be subject to RACT in the future in Sheboygan County. After reviewing the identified source categories and applicable control technologies, WDNR has concluded there would be no change in RACT if an updated assessment of control technology were performed based on 2008, or even 2015, information.

[60] EPA, 2015, *Implementation of the 2008 National Ambient Air Quality Standards for Ozone: Requirements for State Implementation Plans*, 80 FR 12279, March 6, 2015.

Table 6.2. RACT control technology required for different source categories under Wisconsin's NOx RACT program.

Source Category	RACT Control Technology
Coal-fired boilers > 1000 mmBtu/hr	SCR
IC engine emergency generators	Exempt
Rich Burn IC engines > 500 hp	NSCR 80 – 90% Control
Simple cycle combustion turbines	DLN
Asphalt plants > 65 mmBtu/hr*	LNB
Natural gas-fired boiler > 100 mmBtu/hr*	LNB/OFA/GR
Natural gas-fired process heaters > 100 mmBtu/hr*	LNB
Natural gas-fired furnaces > 75 mmBtu/hr*	LNB/OFA/GR

*WDNR found that these types of emission sources operating in nonattainment area, however, the sources are not above thresholds for applicability of RACT emission limitations.
SCR = Selective Catalytic Reduction, NSCR = nonselective catalytic reduction, DLNB, = Dry Low NOx Burner, LNB = Low NOx Burner, OFA = Overfire Air, GR = Gas Recirculation

Thus, based on equivalency in major source applicability and RACT control technology, WDNR concludes that Wisconsin's current NOx RACT program under ss. NR 428.20 to 25 fulfills RACT requirements for the 2008 ozone NAAQS.

6.3. Reasonably Available Control Technology (RACT) Program for VOCs

Section 182(b)(2) of the CAA requires states with moderate nonattainment areas to implement RACT under section 172(c)(1) with respect to each of the following:

- Each category of VOC sources in the nonattainment area covered by an EPA control technique guideline (CTG) document issued between the date of the enactment of the 1990 CAA and the date of attainment.

- All VOC sources in the area covered by any CTG issued before the enactment date of the 1990 CAA.

- All other major stationary VOC sources that are located in ozone nonattainment areas.

As a part of its SIP, the WDNR has adopted and implemented administrative rules requiring existing major stationary sources of VOCs in ozone nonattainment areas to meet VOC RACT. These rules apply to Sheboygan County because of its nonattainment status under the 1997 ozone NAAQS. These VOC RACT/CTG requirements are codified under chapters NR 419 through 424, Wis. Adm. Code. The list of the CTGs in place in Wisconsin is provided in Appendix 8. All of these CTG requirements were implemented and effective prior to the 2011 base year. In addition, Wisconsin has adopted MACT rules further controlling air toxics, which include many VOCs, from major sources throughout the state. The above-listed Wisconsin administrative rules and federal regulations collectively comprise a comprehensive VOC emissions control program covering high-emitting stationary sources of VOCs in the Sheboygan County nonattainment area.

6.4. Evaluation of Reasonably Available Control Measures (RACM)

CAA Section 172(c)(1) requires that states implement any reasonably available control measures necessary for attainment of the NAAQS. As detailed in 40 CFR 51.1108(d), any control measures needed for attainment must be implemented by the beginning of the attainment year ozone season, April 15, 2017. With this submittal, Wisconsin is demonstrating that attainment is achieved and therefore no additional control measures are required for that purpose.

However, additional control measures are required for RACM if they can advance the attainment date by a year or more. This means that any measures advancing the attainment date by a year would have needed to be in place by April 15, 2016. Since this date has already passed, WDNR has concluded there is no possibility of implementing any level of additional control prior to this date. Accordingly, no additional controls or emission reductions requirements in Sheboygan County are applicable for RACM under the 2008 ozone NAAQS.

6.5. Motor Vehicle Inspection and Maintenance (I/M) Program

The general purpose of motor vehicle I/M programs is to reduce emissions from in-use motor vehicles in need of repairs and thereby contribute to state and local efforts to improve air quality and to attain the NAAQS. Wisconsin's I/M program has been in operation since 1984. It was originally implemented in accordance with the 1977 CAA Amendments and operated in the six counties of Kenosha, Milwaukee, Ozaukee, Racine, Washington and Waukesha. Sheboygan County was added to the program in July 1993, resulting in a seven-county program area that has remained to the present. Vehicles were originally tested by measuring tailpipe emissions using a steady-state idle test. Tampering inspections were added in 1989. The I/M program is jointly administered by WDNR and the Wisconsin Department of Transportation throughout the course of the program.

The 1990 CAA Amendments set additional requirements for I/M programs. For moderate areas, a "basic" program was required under section 182(b)(4). For serious or worse areas, an "enhanced" program was required under section 182(c)(3). EPA's requirements for basic and enhanced I/M programs are found in [40 CFR part 51, subpart S].

Wisconsin's I/M program transitioned to an enhanced program in December 1995. The major enhancement involved adding new test procedures to more effectively identify high-emitting vehicles. These new test procedures included a transient emissions test in which tailpipe emissions were measured while the vehicle was driven on a dynamometer (a treadmill-type device). Improving repairs and public convenience were also major focuses of the enhancement effort.

Since July of 2001, all model year (MY) 1996 and later cars and light trucks have been inspected by scanning the vehicle's computerized second generation on-board diagnostic (OBDII) system instead of measuring tailpipe emissions. As of July 2008, the program dropped tailpipe testing entirely and has inspected all vehicles by scanning the OBDII system. This change was the result of statutory changes in the State's 2007-2009 biennial budget which exempted model years of vehicles not federally-required to be equipped with the OBDII technology (MY 1995 and earlier cars and light trucks and MY 2006 and earlier heavy trucks). To help offset the emissions reductions lost from exempting the pre-OBDII vehicles, the program increased the testable fleet for MYs 2007 and later by adding gasoline-powered vehicles between 10,001 to 14,000 pounds gross vehicle weight rating (GVWR) and diesel-powered vehicles of all weights up to 14,000 pounds GVWR.

EPA fully approved Wisconsin's I/M program on August 16, 2001 (66 FR 42949), including the program's legal authority and administrative requirements in the Wisconsin Statutes and Wisconsin Administrative Code. On June 7, 2012, WDNR submitted a SIP revision to EPA covering all the changes to the program since EPA fully approved the program in 2001. This submittal included a demonstration under section 110(l) of the CAA addressing lost emission reductions associated with the program changes. The EPA approved this SIP revision on September 19, 2013 (78 FR 57501).

Legal authority and administrative requirements for the Wisconsin I/M program are found in sections 110.20 and 285.30 of the Wisconsin Statutes and Chapters NR 485 and Trans 131 of the Wisconsin Administrative Code.

6.6. Source Emission Statement

Marginal areas are required to submit an emissions statement under Section 182(a)(3)(B) of the CAA (78 FR 34202). The emission statement must:

> … require that the owner or operator of each stationary source of oxides of nitrogen or volatile organic compounds provide the state with a statement, in such form as the Administrator may prescribe (or an equivalent alternative developed by the state), for classes or categories of sources, showing the actual emissions of oxides of nitrogen and volatile organic compounds from that source. The first such statement shall be submitted within 3 years after the date of the enactment of the CAA Amendments of 1990. Subsequent statements shall be submitted at least every year thereafter. The statement shall contain a certification that the information contained in the statement is accurate to the best knowledge of the individual certifying the statement (78 FR 34202).

EPA has proposed that this SIP submittal of the emissions statement program be due two years after the effective date of designations (78 FR 34203).

In July 1992, EPA published a guidance memorandum on source emission statements titled, ‘Guidance on the Implementation of an Emission Statement Program.’ Further guidance was provided to clarify the source emission statement requirements were applicable to all areas designated nonattainment for the 1997 ozone NAAQS and classified as marginal or higher under subpart 2, part D, title I of the CAAA. The Implementation Rule for the 2008 ozone NAAQS similarly applies the memorandum ‘‘Emission Statement Requirements Under 8-hour Ozone NAAQS Implementation,’’ dated March 14, 2006, to all areas designated nonattainment for the 2008 ozone NAAQS and classified as marginal or higher under subpart 2 (80 FR 12264).

Sheboygan County has an emissions statement program in place due to historic nonattainment designations for an earlier ozone NAAQS. The 2008 Ozone Implementation Rule indicates that:

> … if an area has a previously approved emission statement rule in force for the 1997 ozone NAAQS or the 1-hour ozone NAAQS that covers all portions of the nonattainment area for the 2008 ozone NAAQS, such rule should be sufficient for purposes of the emissions statement requirement for the 2008 ozone NAAQS. The state should review the existing rule to ensure it is adequate and, if it is, may rely on it to meet the emission statement requirement for the 2008 ozone NAAQS (80 FR 12264, 12291).

WDNR has the authority under Chapter NR 438 of the Wisconsin Administrative Code to require annual NOx and VOC emission reporting from any facility in the state that emits a pollutant above the thresholds specified in the code. This includes facilities in nonattainment areas such as Sheboygan County. Chapter NR 438 is available at http://docs.legis.wisconsin.gov/code/admin_code/nr/400/438.pdf

EPA approved Wisconsin's emission reporting program as satisfying the CAA emission statement requirement on December 6, 1993 (58 FR 64155). This Federal Register notice is included as Appendix 11.

7. PUBLIC PARTICIPATION

In accordance with section 110(a)(2) of the CAA, the WDNR published a notice on the WDNR website (http://dnr.wi.gov/topic/AirQuality/Input.html) on June 23, 2017 stating that it would hold a public hearing on this 2008 ozone NAAQS attainment plan for Sheboygan County. The WDNR also posted the notice of availability of this request on the WDNR website. This public hearing took place on Monday, July 24, 2017 at 10:00 am at the Mead Public Library in Sheboygan (710 N. 8 Street, Sheboygan, WI 53081) in the Public Conference Room. The attainment plan was available for public comment through July 26, 2017.

WDNR received one written public comment and two verbal comments at the public hearing. WDNR made minor additions and revisions to the text in response to these comments. The comments and WDNR responses are described in Appendix 12.

8. CONCLUSIONS

In submitting this attainment plan, Wisconsin is fulfilling its CAA SIP requirements for the Sheboygan County moderate nonattainment area for the 2008 ozone NAAQS. Air quality modeling projects that air quality in Sheboygan County will be within 0.2 ppb of attaining the 2008 ozone NAAQS by the July 20, 2018 moderate area attainment date. Additional air quality monitoring data confirms that concentrations of ozone (when adjusted for meteorology) and ozone precursors have decreased dramatically over the last 15 years in the nonattainment area. A substantial weight of evidence demonstration supports a near-future attainment forecast for Sheboygan County for the 2008 ozone NAAQS. In addition, Wisconsin has met the required RFP emission reductions due to an array of permanent and enforceable measures. The state has also met other obligations required of moderate nonattainment areas.

Modeling completed in support of this plan shows that 87% of the ozone at Sheboygan's Kohler Andrae monitor originates from out of state, with six neighboring states contributing over 40%. Modeling also indicates that even large and unrealistic additional reductions in NOx and/or VOC emissions from all Wisconsin lakeshore counties and the Milwaukee metropolitan area in 2017 would not have a meaningful impact on ozone design values in Sheboygan County. This modeling further shows that eliminating all emissions within Sheboygan County would not reduce attainment year design values. The ability of Sheboygan County to attain the 2008 ozone NAAQS, therefore, is entirely dependent upon out-of-state emissions, ozone chemistry and formation, and weather.

This evidence supports a finding that Wisconsin has met its attainment planning, assessment, and progress-related emission control obligations under the CAA relative to the 2008 ozone NAAQS for the Sheboygan County nonattainment area.

APPENDIX 1

2011 Wisconsin Emission Inventory Documentation

Table of Contents

ABBREVIATIONS

AI	Active Ingredient
BTU	British Thermal Unit
CAMD	Clean Air Markets Division
CLF	Crop Life Foundation
DOE	Department of Energy
DPR	Department of Pesticide Regulation
EGU	Electric Generating Unit
EIA	Energy Information Administration
EIIP	Emission Inventory Improvement Program
EP	Emission Potential
ERTAC	Eastern Regional Technical Advisory Committee
FHWA	Federal Highway Administration
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
HAP	Hazardous Air Pollutants
HPMS	Highway Performance Monitoring System
IC	Internal Combustion
LADCO	Lake Michigan Air Directors Consortium
LPG	Liquid Petroleum Gas
MACT	Maximum Achievable Control Technology
MAR	Commercial Marine Aircraft and Rail Locomotive
MCD	Minor Civil Divisions
MOVES	Motor Vehicle Emission Simulator
MPO	Metropolitan Planning Organization
NAICS	North American Industrial Classification System
NEC	Not Elsewhere Classified
NEI	National Emissions Inventory
NMIM	National Mobile Inventory Model
NOx	Nitrogen Oxides
OBD	On-Board Diagnostics
OSHA	Occupational Safety and Health Administration
PAD	Petroleum Administration for Defense
PM	Particulate Matter
POTW	Publicly Owned Treatment Work
RIA	Regulatory Impact Analysis
SAF	Spatial Apportioning Factor
SCC	Source Classification Code
SED	State Energy Data
SEDS	State Energy Data System
SEWRPC	Southeastern Wis. Regional Planning Commission
SIP	State Implementation Plan
SLT	State, Local and Tribal

VMT	Vehicle-Miles of Travel
VOC	Volatile Organic Compounds
WDNR	Wisconsin Department of Natural Resources
WDOT	Wisconsin Department of Transportation

1. Introduction

This appendix provides additional information for the sector-specific nitrogen oxides (NOx) and volatile organic compounds (VOC) tons per summer day (tpsd) emission estimates in section 3.2 (2011 Base Year Inventory for RFP) of the Wisconsin Department of Natural Resources (WDNR) Sheboygan County ozone attainment demonstration. For the U.S. Environmental Protection Agency (EPA) to approve an attainment demonstration for ozone, a state must show that improvement in air quality is due to permanent and enforceable reductions in emissions. This is accomplished in part by developing and comparing a nonattainment year (2011) emissions inventory and attainment year (2017) emissions inventory.

2. Emissions Calculation Methodologies

2.1 Point Sources

Point sources are industrial, commercial or institutional stationary facilities which are normally located in permanent sites, and which emit specific air pollutants in great enough quantities to warrant individual quantification. To better enable detailed control evaluations, the point source emission inventories (EIs) include all reporting sources at that facility regardless of the magnitude of reported emissions. For this attainment demonstration portable point sources, such as asphalt plants and rock crushers, were reported under nonpoint sources to be consistent with other states. The 2011 point source emission inventory was created using annually reported point source emissions, the EPA's Clean Air Markets Division (CAMD) database and approved EPA techniques for emissions calculation (e.g., emission factors). Additional details for electric generating unit (EGU) emissions are located in Appendix 2.

Whenever feasible, federal, state and local controls were factored into the emission calculations. Emissions were estimated by collecting process-level information from each facility that qualifies for inclusion into the state's point source database. In Wisconsin, this information is normally collected via an internet or a computer diskette submittal, and subsequently loaded into the point source database. Process, boiler, fugitive and tank emissions are typically calculated using throughput information multiplied by an emission factor for that process. Emission factor sources included mass balance, stack testing, continuous emissions monitors, engineering judgment and EPA's Factor Information Retrieval (FIRE) database. Missing data elements such as Source Classification Codes (SCC), North American Industrial Classification System (NAICS) codes and seasonal throughput percentages were added into the state's point source database. Process level confidential data were removed while retaining any associated emissions.

2.2 Nonpoint (Area) Sources

Nonpoint sources are stationary sources that are too small and/or too numerous to be tracked individually in the point source inventory; the nonpoint inventory quantifies emissions collectively. These sources include commercial/institutional, industrial and residential sources such as gasoline stations, dry cleaners, consumer and commercial products, industrial solvent use, auto refinishing and wood combustion.

At least every three years state and local agencies are required to submit emissions data to EPA in order to develop the periodic National Emissions Inventory (NEI). The NEI is a comprehensive and detailed estimate of annual total air emissions of both criteria and hazardous air pollutants (HAPs) from all air emissions sources. The NEI is prepared by the EPA based primarily upon emissions estimates and emissions model inputs provided by State, Local and Tribal (SLT) air agencies, and supplemented by data developed by the EPA. These inventories are used to measure overall emission reduction trends and include emission estimates from stationary point and nonpoint (area) sources, onroad mobile sources and nonroad mobile sources.

For the 2011 nonattainment year, nonpoint source NOx and VOC emissions inventory estimates were based on 2011 NEI version 2 unless indicated otherwise in the category-specific methodologies provided below. EPA has approved Wisconsin's 2011 NEI values. These emissions were typically calculated using population, gasoline consumption, employment, crop acreages and other activity surrogates associated with the source categories. These categories mainly include industrial, commercial and institutional fuel combustion, solvent utilization, residential wood combustion and agricultural emissions. For each source category, any point source activity or emissions were subtracted from total category-specific activity or emissions to calculate nonpoint category-specific emissions and avoid double counting. Emission factors were derived from local data, local or national surveys and EPA procedural guidance for the development of emission inventories. Emission calculation methodologies used in developing 2011 nonpoint emissions inventory are described in sections 2.2.1 through 2.2.6.

2.2.1 Stationary Source Fuel Combustion

2.2.1.1 Industrial Source Fuel Combustion

The fuel combustion at stationary nonpoint sources within the industrial sector is presented in this section. This component is not reported in the point source inventory as the emissions are too small. For Sheboygan County, industrial fuel combustion emissions were computed for the following fuel types: distillate oil, residual oil, liquid petroleum gas (LPG), natural gas, kerosene, and wood. As carried over from 2008 National Emissions Inventory (NEI), it was assumed that coal has not been consumed in Sheboygan County under industrial source fuel combustion category.

Pollutants Calculated: NO_x, VOC

Activity Data:
Total sales statistics for the industrial sector energy consumption in Wisconsin were obtained from the U.S. Department of Energy (DOE)'s Energy Information Administration (EIA). Their annual publication, the State Energy Data (SED) report, provides total consumption for most fuel oils and kerosene.[1] A separate EIA data source was used for distillate fuel oil. Year 2009 SED were used to estimate 2011 emissions because these were the latest year consumption data available at the time this work was performed in 2012.

[1] U.S. Energy Information Administration, http://www.eia.gov

Emission Factors:
The EPA has compiled criteria and hazardous air pollutant emission factors for nonpoint source industrial fuel combustion categories.[2] Since only VOC and NO_x were considered in developing this redesignation request emission estimates, the emission factors for these two pollutants are listed in the table 1.

Table 1: Emission Factors for Industrial Source Fuel Combustion (lb / unit of fuel throughput)

Pollutant	EIS Pollutant code	(TON) Coal Bit/ Subbit	(1000 gal) Distillate Oil - blr	(1000 gal) Diesel - eng	(1000 gal) Residual Oil	(1000 gal) Liquid Petroleum Gas	(MMCF) Natural Gas	(1000 gal) Kerosene	(TON) Wood
Nitrogen Oxides	NOx	11.000	20.000	604.000	55.000	14.230	100.000	19.290	0.220
Volatile Organic Compounds	VOC	0.050	0.200	-	0.280	0.520	5.500	0.190	0.017

Fuel Consumption Adjustments:
Fuel consumption associated with non-energy purposes in the industrial sector were adjusted by subtracting the volume of fuel consumption for non-energy uses from the volume of total fuel combustion.

Emissions Calculation:
In calculating emissions for industrial fuel combustion, state-level fuel consumption estimates were first developed, which represent the relevant activity. These were then allocated to the county-level, and then the resulting county-level consumption estimates were multiplied by appropriate emission factors.

General equation for emissions calculation is:

$$Emissions = (Fuel\ Use\ in\ Wisconsin) \times (Emission\ Factor\ per\ Pollutant)$$

To avoid double counting, point source estimates were subtracted from total emissions:

$$Emissions_{Area} = \left(Emissions_{Total\ Stationary}\right) - (Emission_{\ Point})$$

2.2.1.1.a Distillate Oil

SCC	SCC Level 1	SCC Level 2	SCC Level 3	SCC Level 4
2102004000	Stationary Source Fuel Combustion	Industrial	Distillate Oil	Total: Boilers and IC Engines

This industrial sector category included all boilers and internal combustion (IC) engines that use distillate oil as fuel. The activity is estimated in thousand barrels of distillate oil consumed using the EIA's fuel oil and kerosene sales as the data source. To avoid double-counting of distillate oil consumption between the nonpoint and nonroad sector emission inventories, EPA used more

[2] Emission factors from EPA: ici_fuel_combustion_by_state directory at ftp://ftp.epa.gov/EmisInventory/2011nei/doc/, accessed on 10-23-2012

detailed distillate oil consumption estimates reported in EIA's Fuel Oil and Kerosene Sales, and assumptions used in the regulatory impact analysis (RIA) for EPA's nonroad diesel emissions rulemaking.[3,4]

For fuels where boiler and engine emission factors are considered and only one emission factor was available, that single emission factor was applied to both the boiler and engine types. The Eastern Regional Technical Advisory Committee (ERTAC) approved emission factors based on nonpoint compilation performed by EPA and were used for emissions estimation. In developing the 2011 NEI, distillate fuel oil types No.1, No.2 and No.4 were combined for the emissions calculation since the fraction of fuel oil No.4 is relatively small.

2.2.1.1.b Residual Oil

SCC	SCC Level 1	SCC Level 2	SCC Level 3	SCC Level 4
2102005000	Stationary Source Fuel Combustion	Industrial	Residual Oil	Total: All Boiler Types

This industrial sector category included all boilers that use residual oil as fuel. The activity is estimated in thousand barrels of residual oil consumed using the EIA's State Energy Data System (SEDS) as the data source.

2.2.1.1.c Natural Gas

SCC	SCC Level 1	SCC Level 2	SCC Level 3	SCC Level 4
2102006000	Stationary Source Fuel Combustion	Industrial	Natural Gas	Total: Boilers and IC Engines

This industrial sector category included all boilers and IC engines that use natural gas as fuel. The activity is estimated in million cubic feet of natural gas consumed using EIA's SEDS as the data source.

2.2.1.1.d Liquid Petroleum Gas (LPG)

SCC	SCC Level 1	SCC Level 2	SCC Level 3	SCC Level 4
2102007000	Stationary Source Fuel Combustion	Industrial	Liquefied Petroleum Gas (LPG)	Total: All Combustor Types

This industrial sector category included all boilers that use LPG as fuel. The activity is estimated in thousand barrels of LPG consumed using EIA's SEDS as the data source.

2.2.1.1.e Wood

SCC	SCC Level 1	SCC Level 2	SCC Level 3	SCC Level 4
2102008000	Stationary Source Fuel Combustion	Industrial	Wood	Total: All Boiler Types

[3] Energy Information Administration, U.S. Department of Energy, *Fuel Oil and Kerosene Sales*, data available from http://www.eia.gov/dnav/pet/pet_cons_821use_dcu_nus_a.htm.
[4] U.S. Environmental Protection Agency, "Draft Regulatory Impact Analysis: Control of Emissions from Nonroad Diesel Engines," EPA420-R-03-008, Office of Transportation and Air Quality, April 2003.

This industrial sector category included all boilers that use wood as fuel. The activity is estimated in tons of wood consumed. The emission factors are from webFIRE.

2.2.1.1.f Kerosene

SCC	SCC Level 1	SCC Level 2	SCC Level 3	SCC Level 4
2102011000	Stationary Source Fuel Combustion	Industrial	Kerosene	Total: All Boiler Types

This industrial sector category included all boilers that use kerosene as fuel. The activity is estimated in thousand barrels of kerosene consumed using EIA's SEDS as the data source.

2.2.1.2 Commercial/Institutional Fuel Combustion

The emission estimates for fuel combustion at stationary nonpoint sources within the commercial/institutional sector is presented in this section for Sheboygan County. Emissions were computed for the following fuel types: coal, distillate oil, residual oil, LPG, natural gas, and kerosene.

Pollutants: NO_x, VOC

Activity Data:
EIA survey data developed by the DOE is the source for activity data. However, such survey information included in SEDS reports requires certain adjustments to identify the commercial/institutional coal consumption. To estimate 2011 emissions, year 2009 data were used as these were the latest year consumption data available at the time this work was performed in 2012.

Emission Factors:
ERTAC approved emission factors based on nonpoint compilation performed by EPA were used for emissions estimates of most of the fuel categories except wood. The EPA has compiled criteria and hazardous air pollutant emission factors for nonpoint source commercial/institutional fuel combustion categories[5].The emission factors for commercial/institutional wood combustion were downloaded from WebFIRE, the EPA's online emissions factor repository, retrieval and development tool (Table 2).

Table 2: Emission Factors for Commercial/Institutional Fuel Combustion (lb /unit of fuel throughput)

Pollutant	EIS Pollutant code	(TON) Coal Bit/ Subbit	(1000 gal) Distillate Oil - blr	(1000 gal) Diesel-eng	(1000 gal) Residual Oil	(1000 gal) Liquid Petroleum Gas	(MMCF) Natural Gas	(1000 gal) Kerosene	(TON) Wood
Nitrogen Oxides	NOx	11.000	20.000	604.000	55.000	8.698	100.000	19.290	2.860

[5] Emission factors from EPA: ici_fuel_combustion_by_state directory at ftp://ftp.epa.gov/EmisInventory/2011nei/doc/, accessed on 10-23-2012

Volatile Organic Compounds	VOC	0.050	0.340	-	1.130	0.478	5.500	0.190	0.221

Point Source Adjustments
Emissions assigned for point sources were subtracted from the total emissions to estimate the adjusted area source emissions. To make such emissions adjustment for area sources, activity data was used. The activity assigned for point sources was subtracted from the total activity to estimate the area source activity.

2.2.1.2.a Coal

This category covers air emissions from coal combustion in the commercial/institutional sector for space and water heating. The category includes small boilers, furnaces, heaters, and other heating units that are not inventoried as point sources. This sector represents the coal combustion in wholesale and retail businesses, health institutions, social and educational institutions, and Federal, state and local government institutions.

SCC	SCC Level 1	SCC Level 2	SCC Level 3	SCC Level 4
2103002000	Stationary Source Fuel Combustion	Commercial/Institutional	Bituminous/Subbituminous Coal	Total: All Boiler Types

Pollutants: NO_x

Activity data for commercial/institutional coal combustion in Wisconsin were obtained from the EIA's SED Report.[6] It was assumed that only bituminous/subbituminous coal is used in space heating and water heating equipment that combust coal.

Control Adjustments
Regulations for coal combustion are generally applicable to point sources and do not apply to the area sources in this category.

County Allocation of State Activity Data
State-level commercial/institutional fuel combustion by fuel type was allocated to each county using the ratio of the number of commercial/institutional sector employees in each county to the total number of commercial/institutional sector employees in the state. Initially prepared state-wide emission estimations were allocated into county-level using adjustments based employment data and heating degree days. The employment information was obtained from the State Department of Labor.[7]

Commercial/Institutional Spatial Apportioning Factor (SAF) for Inventory County:

[6] U.S. Energy Information Administration, http://www.eia.gov/state/?sid=WI

[7] Emissions Inventory Improvement Program (EIIP) Area Source Method Abstract – Residential and Commercial/Institutional Fuel Oil and Kerosene Combustion: http://www.epa.gov/ttn/chief/eiip/techreport/volume03

$$SAF_{Coal,Inventory\ County} = \frac{HDD_{Inventory\ County} *\ SE_{Coal,Inventory\ County}}{\sum_{\substack{All\ Counties\\ in\ State}} \left(HDD_{County} *\ SE_{Coal,County}\right)}$$

where:
$HDD_{Inventory\ County}$ = annual heating degree days for inventory county
$SE_{Coal,\ Inventory\ County}$ = Standard Industrial Classification (SIC) 50-99 employment numbers for inventory county
HDD_{County} = annual heating degree days for each county in the state
$SE_{Coal,\ County}$ = SIC 50-99 employment for each county in the state

The spatial apportioning factor is used to allocate the state coal total to the county-level using the following equation:

$$Fuel_{\ Coal,Inventory\ County} = SAF_{\ Coal,Inventory\ County} \times Fuel_{\ Coal,Total\ State}$$

where:
$Fuel_{\ Coal,Inventory\ County}$ = total coal consumed annually in the inventory county
$Fuel_{\ Coal,Total\ State}$ = total coal consumed annually in the state
$SAF_{\ Coal,Inventory\ County}$ = spatial apportioning factor for coal in inventory county

Annual commercial/institutional emissions for coal were calculated using following equation:

$$Emissions_{coal,commercial/Institutional} = \left(Fuel_{Coal\ ,Inventory\ County} \times EF_{Coal,Commercial/Institutional}\right)/2000$$

where:
$Fuel_{\ Coal,Inventory\ County}$ = total fuel type *x* consumed annually in the inventory county
$EF_{Coal,Commercial/Institutional}$= commercial/institutional emission factor for coal

2.2.1.2.b Fuel Oil: Distillate Oil, Residual Oil, and Kerosene

SCC	SCC Level 1	SCC Level 2	SCC Level 3	SCC Level 4
2103004000	Stationary Source Fuel Combustion	Commercial/Institutional	Distillate Oil	Total: Boilers and IC Engines
2103005000	Stationary Source Fuel Combustion	Commercial/Institutional	Residual Oil	Total: All Boiler Types
2103011000	Stationary Source Fuel Combustion	Commercial/Institutional	Kerosene	Total: All Combustor Types

This category includes small boilers, furnaces, heaters, and other heating units that use distillate oil, residual oil or kerosene as the fuel source and are not inventoried as point sources. Such combustion sources typically occur at wholesale and retail businesses, health institutions, social and educational institutions, and federal, state and local government institutions and are considered in developing the inventory for this category. Distillate oil grades No.1, No.2 and No.4 are combined for emissions calculation.

Pollutants: NO_x, VOC

The activity is estimated in thousand barrels of fuel oil type consumed. This value represents the number of barrels of distillate oil consumed in this sector during fuel combustion. Fuel oil sales were obtained from the DOE's EIA.[8] Their annual SED report provides total consumption by fuel type for distillate oil, residual oil, and kerosene.

Commercial/Institutional Spatial Apportioning Factor (SAF) for Inventory County:

$$SAF_{Inventory\ County} = \frac{HDD_{Inventory\ County} * SE_{Inventory\ County}}{\sum_{\substack{All\ Counties \\ in\ State}} \left(HDD_{County} * SE_{County}\right)}$$

where:
HDD *Inventory County* = annual heating degree days for inventory county
SE *Inventory County* = Standard Industrial Classification (SIC) 50-99 employment numbers for inventory county
HDD *County* = annual heating degree days for each county in the state
SE *County* = SIC 50-99 employment for each county in the state

The spatial apportioning factor is used to allocate the state fuel total to the county level using the following equation:

$$Fuel_{x,Inventory\ County} = SAF_{x,Inventory\ County} \times Fuel_{x,Total\ State}$$

where:
$Fuel_{x,Inventory\ County}$ = total fuel type *x* consumed annually in the inventory county
$Fuel_{x,Total\ State}$ = total fuel type *x* consumed annually in the state
$SAF_{x,Inventory\ County}$ = Spatial Apportioning Factor for fuel type *x* in inventory county
(*Note*: Fuel type *x* could be distillate oil, residual oil, or kerosene.)

Annual commercial/institutional emissions were calculated using following equation:

$$Emissions_{Commercial/Institutional} = \left(Fuel_{x\ ,Inventory\ County} \times EF_{x\ ,Commercial/Institutional}\right)/2000$$

where:
$Fuel_{x,Inventory\ County}$ = total fuel type *x* consumed annually in the inventory county
$EF_{x,Commercial/Institutional}$ = commercial/institutional emission factor for fuel type *x*

[8] U.S Department of Energy, Energy Information Administration, Office of Oil and Gas, Petroleum Marketing Monthly, "Annual Report on Sales of Fuel Oil and Kerosene, 2011".

2.2.1.2.c Liquid Petroleum Gas (LPG)

SCC	SCC Level 1	SCC Level 2	SCC Level 3	SCC Level 4
2103007000	Stationary Source Fuel Combustion	Commercial/Institutional	Liquified Petroleum Gas (LPG)	Total: All Combustor Types
2103006000	Stationary Source Fuel Combustion	Commercial/Institutional	Natural Gas	Total: Boilers and IC Engines

This source category covers air emissions from LPG combustion in the commercial/institutional sector. This category includes small boilers, furnaces, heaters, and other heating units that use LPG as fuel and are not inventoried as point sources. Such combustion sources typically occur at wholesale and retail businesses, health institutions, social and educational institutions, and federal, state and local government institutions.[9]

Pollutants: NO_x, VOC

The activity is estimated in thousand barrels of LPG consumed. The activity data source is the EIA's SEDS.

Annual commercial/institutional LPG combustion related emissions were calculated using following equation:

$$Emissions_{LPG,Commercial/Institutional} = \left(LPG_{Inventory\ County} \times EF_{LPG\ ,commercial/Institutional}\right)/2000$$

where:

$LPG_{Inventory\ County}$ = total annual LPG consumption in the inventory county

$EF_{LPG,commercial/Institutional}$ = commercial/institutional emission factor for LPG

2.2.1.2.d Natural Gas

SCC	SCC Level 1	SCC Level 2	SCC Level 3	SCC Level 4
2103006000	Stationary Source Fuel Combustion	Commercial/Institutional	Natural Gas	Total: Boilers and IC Engines

This source category covers air emissions from natural gas (NG) combustion in the commercial/institutional sector. This category includes small boilers, furnaces, heaters, and other heating units that use natural gas as the fuel source and are not inventoried as point sources. Such combustion sources typically occur at wholesale and retail businesses, health institutions, social and educational institutions, and federal, state and local government institutions.

[9] Emissions Inventory Improvement Program (EIIP) Area Source Method Abstract – Natural Gas and LPG Combustion: http://www.epa.gov/ttn/chief/eiip/techreport/volume03

Pollutants: NO_x, VOC

The activity is estimated in million cubic feet of natural gas consumed. The activity data source is the EIA's SEDS.

Annual commercial/institutional natural gas combustion related emissions were calculated using following equation:

$$Emissions_{NG,Commercial/Institutional} = \left(NG_{Inventory\ County} \times EF_{NG\ ,commercial/Institutional}\right)/2000$$

where:

$NG_{Inventory\ County}$ = total annual natural gas consumption in the inventory county

$EF_{NG,commercial/Institutional}$ = commercial/institutional emission factor for natural gas

2.2.1.3 Residential Fuel Combustion

This category covers air emissions from fuel combustion in the residential sector for space and water heating. The category includes small boilers, furnaces, heaters, and other heating units that are not inventoried as point sources. For coal, distillate oil, natural gas, LPG, wood, and kerosene sources listed below, WDNR adopted EPA estimates for 2011 NEI. However, for the completeness of this document, appropriate methods are described in the sections 2.2.1.3.a through 2.2.1.3.f.

SCC	SCC Level 1	SCC Level 2	SCC Level 3	SCC Level 4
2104001000	Stationary Source Fuel Combustion	Residential	Anthracite Coal	All Boiler Types
2104002000	Stationary Source Fuel Combustion	Residential	Bituminous/Subbituminous Coal	All Boiler Types
2104004000	Stationary Source Fuel Combustion	Residential	Distillate Oil	Total Boilers and IC Engines
2104006000	Stationary Source Fuel Combustion	Residential	Natural Gas	Total: Boilers and IC Engines
2104007000	Stationary Source Fuel Combustion	Residential	Liquid Petroleum Gas (LPG)	Total: All Combustion Types
2104011000	Stationary Source Fuel Combustion	Residential	Kerosene	Total: All Combustor Types

Activity data for residential fuel combustion were obtained from the DOE's EIA's SED Report.[10] The number of households at county-level that use certain fuel type for heating purposes were accessed from U.S. Census Bureau data. Residential and commercial fuel deliveries were separated out by obtaining samples of sales data from local fuel distributors. Emission factors for NO_x and VOC are from AP-42.[11]

[10] U.S. Energy Information Administration, http://www.eia.gov/state/?sid=WI

[11] U.S. Environmental Protection Agency. Compilation of Air Pollutant Emission Factors, 5th Edition, AP-42, Volume I: Stationary Point and Area Sources. Research Triangle Park, North Carolina. 1996.

2.2.1.3.a Coal

This sector represents the emission estimations for coal combustion in residential units.

Pollutants: NOx

Coal combustion emission factors from AP-42 were used. It was assumed that the residential coal combustion units consume 100% of bituminous/subbituminous coal. Anthracite coal consumption was assumed to be zero percent.

Point source adjustments for area sources were estimated by subtracting the activity data for point sources from total activity values. Regulations for coal combustion are generally applicable to point sources and do not apply to the area sources in this category.[12]

Emissions Calculation[13]
Annual emissions are calculated for each county using emission factors and activity as:

$$E_{x,p} = FC_x \times (1 - CE_{x,p}) \times EF_{x,p}$$

where:
$E_{x,p}$ = annual emissions for fuel type *x* and pollutant *p* (lb/year),
FC_x = annual county-level fuel consumption for fuel type *x*,
$CE_{x,p}$ = control efficiency for fuel type *x* and pollutant *p*, and
$EF_{x,p}$ = emission factor for fuel type *x* and pollutant *p*.

County level fuel consumption is calculated using:

$$FC_x = A_{State} \text{ x } Ratio_{Anth,\ Bit} \text{ x } Ratio_{County\ houses}$$

where:
A_{State} = total tons of coal reported by the EIA,
$Ratio_{Anth,\ Bit}$ = ratio of anthracite and bituminous coal distribution for the residential sector
$Ratio_{County\ houses}$ = county allocation ratio based on number of houses burning coal.

2.2.1.3.b Distillate Oil

The distillate oil burned in residential units is covered in this category. For this category, WDNR adopted the EPA estimates for NEI 2011.

Pollutants: NO_x, VOC

[12] Residential and Commercial/Institutional Coal Combustion, http://www.epa.gov/ttn/chief/eiip/techreport/volume03/coal.pdf
[13] U.S.EPA, residential_coal_2104001000_2104002000_documentation_2011, accessed from ftp://ftp.epa.gov/EmisInventory/2011nei/doc/

Activity data is available in the State Energy Data consumption tables published by the EIA.[14] In developing 2011 NEI, year 2009 consumption data were used. To allocate the state-wide distillate oil consumption data to county-level, U.S. Census Bureau's house heating fuel type data were used.[15] In developing 2011 NEI, no control factors were assumed for this category.

Emission factors
Criteria pollutant emission factors for distillate oil are from AP-42.[16] For all counties in the United States, the distillate oil consumed by residential combustion is assumed to be No. 2 fuel oil with a heating value of 140,000 Btu per gallon.

Emissions Calculation
To calculate emissions, state-level distillate oil consumption was obtained from the EIA and allocated to the county level using the activity data and emissions factors. The county-level oil consumption is multiplied by the emission factors to calculate emissions as:

$$E_{x,p} = FC_x \times EF_{x,p}$$

where:
$E_{x,p}$ = annual emissions for fuel type *x* and pollutant *p*
FC_x = annual fuel consumption for fuel type *x*
$EF_{x,p}$ = emission factor for fuel type *x* and pollutant *p*

And $FC_x = A_{State} \text{ x } (H_{county} / H_{State})$

where:
A_{State} = state activity data from EIA
H_{County} = number of houses in the county using distillate oil as the primary heating fuel
H_{State} = number of houses in the state using distillate oil as the primary heating fuel

2.2.1.3.c Natural Gas

The natural gas that is burned in residential units is covered in this category.

Pollutants: NO_x, VOC

Activity data is available in the SED consumption tables published by the EIA.[17] Year 2009 consumption data were used to develop 2011 NEI. To allocate the state-wide natural gas consumption data to county-level, U.S. Census Bureau's house heating fuel type data were

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[14] U.S. Department of Energy, Energy Information Administration (EIA). State Energy Data 2009 Consumption. Washington, DC 2012. Internet Address: http://www.eia.doe.gov/emeu/states/sep_use/total/csv/use_all_phy.csv, accessed February 2012.
[15] https://www.census.gov/hhes/www/housing/census/historic/fuels.html
[16] U.S. Environmental Protection Agency. Compilation of Air Pollutant Emission Factors, 5th Edition, AP-42, Volume I: Stationary Point and Area Sources. Research Triangle Park, North Carolina. 1996.
[17] U.S. Department of Energy, Energy Information Administration (EIA). State Energy Data 2009 Consumption. Washington, DC 2012. Internet Address: http://www.eia.doe.gov/emeu/states/sep_use/total/csv/use_all_phy.csv, accessed February 2012.

used.[18] State natural gas consumption was allocated to each county using the ratio of the number of houses burning natural gas in each county to the total number of houses burning natural gas in the State. In developing 2011 NEI, no control factors were assumed for this category.

Criteria pollutant emission factors for natural gas are from AP-42.[19]

Emissions Calculation

Emissions are calculated for each county using emission factors and activity as:

$$E_{x,p} = FC_x \times EF_{x,p}$$

where:

$E_{x,p}$ = annual emissions for fuel type x and pollutant p,
FC_x = annual fuel consumption for fuel type x,
$EF_{x,p}$ = emission factor for fuel type x and pollutant p,

and $FC_x = A_{State} \text{ x } (H_{county} / H_{State})$

where :

A_{State} = state activity data from EIA,
H_{County} = number of houses in the county using natural gas as the primary heating fuel,
H_{State} = number of houses in the state using natural gas as the primary heating fuel.

2.2.1.3.d Liquid Petroleum Gas (LPG)

The LPG that is burned in residential units is covered in this category.

Pollutants: NO_x, VOC

Activity data is available in the SED consumption tables published by the EIA.[20] In developing 2011 NEI, year 2009 volume of LPG consumed was used. To allocate the state-wide LPG consumption data to county-level, U.S. Census Bureau's house heating fuel type data were used.[21] State LPG consumption was allocated to each county using the ratio of the number of houses burning LPG in each county to the total number of houses burning LPG in the state. In developing 2011 NEI, no control factors were assumed for this category.

[18] https://www.census.gov/hhes/www/housing/census/historic/fuels.html
[19] U.S. Environmental Protection Agency. Compilation of Air Pollutant Emission Factors, 5th Edition, AP-42, Volume I: Stationary Point and Area Sources. Research Triangle Park, North Carolina. 1996.
[20] U.S. Department of Energy, Energy Information Administration (EIA). State Energy Data 2009 Consumption. Washington, DC 2012. Internet Address: http://www.eia.doe.gov/emeu/states/sep_use/total/csv/use_all_phy.csv, accessed February 2012.
[21] https://www.census.gov/hhes/www/housing/census/historic/fuels.html

Criteria pollutant emission factors for LPG are from AP-42.[22] Some emission factors were revised based on recommendations by an ERTAC advisory panel composed of state and EPA personnel.[23]

Emissions Calculation

Emissions are calculated for each county using emission factors and activity as:

$$E_{x,p} = FC_x \times EF_{x,p}$$

where:

$E_{x,p}$ = annual emissions for fuel type *x* and pollutant *p*,
FC_x = annual fuel consumption for fuel type *x*,
$EF_{x,p}$ = emission factor for fuel type *x* and pollutant *p*,

And $FC_x = A_{State} \text{ x } (H_{County} / H_{State})$

where :

A_{State} = state activity data from EIA
H_{County} = number of houses in the county using LPG as the primary heating fuel
H_{State} = number of houses in the state using LPG as the primary heating fuel.

2.2.1.3.e Wood

Residential wood combustion primarily includes wood burning in different types of woodstoves and fireplaces. To develop activity data for residential wood burning, there are two main methods; residential wood survey and Census Bureau/ EIA data approach. Since WDNR adopted EPA estimates for residential wood burning category, the data presented were generated using Census Bureau's EIA approach.

Pollutants: NO_x, VOC

Residential wood burned at the state level is apportioned to the county level using U.S. Census data on households that use wood as a primary fuel. The equation is:

$$Wood\ Consumption_{Inventory\ County} = Wood\ Consumption_{\ State} \times \frac{Wood\ Burning\ Hourseholds_{Invnetory\ County}}{Wood\ Burning\ Households_{\ State}}$$

[22] U.S. Environmental Protection Agency. Compilation of Air Pollutant Emission Factors, 5th Edition, AP-42, Volume I: Stationary Point and Area Sources. Research Triangle Park, North Carolina. 1996.
[23] ftp://ftp.epa.gov/EmisInventory/2011nei/doc/

State level wood use (in cords) is available in the EIA's SED Report. State and county statistics on wood-burning households are available from the U.S. Census Bureau. Cords of wood are converted to pounds of wood using factors provided in AP-42, Appendix A.[24]

Emissions Calculation

Emissions are calculated for each county using emission factors and activity data:

$$\mathrm{E}_{Wood,p} = Wood\ Consumption_{Inventory\ County} \times \mathrm{EF}_{Wood,p}$$

where:

$\mathrm{E}_{Wood,p}$ = annual emissions for wood for pollutant p
$Wood\ Consumption_{Inventory\ County}$ = annual wood consumption in inventory county
$\mathrm{EF}_{Wood,p}$ = emission factor for wood for pollutant p

2.2.1.3.f Kerosene

Kerosene burned in residential units is covered in this category. Residential heating, cooking, and other equipment operations using kerosene are included in the emission estimates.

Activity data is available in the State Energy Data consumption tables published by the EIA.[25] In developing 2011 NEI, year 2009 volume of kerosene consumed was used. To allocate the state-level kerosene consumption data to county-level, U.S. Census Bureau's house heating fuel type data were used.[26] State kerosene consumption was allocated to each county using the ratio of the number of houses burning kerosene in each county to the total number of houses burning kerosene in the state. In developing 2011 NEI, no control factors were assumed for this category.

Criteria pollutant emission factors for kerosene are from AP-42. Emission factors for distillate oil were used for kerosene, but the distillate oil emission factors were multiplied by a factor of 135/140 to convert them for this use. This factor is based on the ratio of the heat content of kerosene (135,000 Btu/gallon) to the heat content of distillate oil (140,000 Btu/gallon). [27]

Emissions Calculation

Emissions are calculated for each county using emission factors and activity as:

$$\mathrm{E}_{x,p} = \mathrm{FC}_x \times \mathrm{EF}_{x,p}$$

where:

[24] http://www.epa.gov/ttn/chief/eiip/techreport/volume03/iii02_apr2001.pdf
[25] U.S. Department of Energy, Energy Information Administration (EIA). State Energy Data 2009 Consumption. Washington, DC 2012. Internet Address: http://www.eia.doe.gov/emeu/states/sep_use/total/csv/use_all_phy.csv, accessed February 2012.
[26] https://www.census.gov/hhes/www/housing/census/historic/fuels.html
[27] U.S. Environmental Protection Agency. Compilation of Air Pollutant Emission Factors, 5th Edition, AP-42, Volume I: Stationary Point and Area Sources. Research Triangle Park, North Carolina. 1996.

$E_{x,p}$ = annual emissions for fuel type *x* and pollutant *p*,
FC_x = annual fuel consumption for fuel type *x*,
$EF_{x,p}$ = emission factor for fuel type *x* and pollutant *p*,

And $FC_x = A_{State} \times (H_{county} / H_{State})$
where:

A_{State} = state activity data from EIA
H_{County} = number of houses in the county using kerosene as the primary heating fuel
H_{State} = number of houses in the state using kerosene as the primary heating fuel

2.2.2. Industrial Processes: Food and Kindred Products-Commercial Cooking

SCC	SCC Level 1	SCC Level 2	SCC Level 3	SCC Level 4
2302002100	Industrial Processes	Food and Kindred Products: SIC 20	Commercial Cooking-Charbroiling	Conveyorized Charbroiling
2302002200	Industrial Processes	Food and Kindred Products: SIC 20	Commercial Cooking-Charbroiling	Under-fired Charbroiling
2302003000	Industrial Processes	Food and Kindred Products: SIC 20	Commercial Cooking-Frying	Deep Fat Frying
2302003100	Industrial Processes	Food and Kindred Products: SIC 20	Commercial Cooking-Frying	Flat Griddle Frying
2302003200	Industrial Processes	Food and Kindred Products: SIC 20	Commercial Cooking-Frying	Clamshell Griddle Frying

In developing 2011 NEI, WDNR adopted EPA estimates for commercial cooking categories. This source category covers air emissions from all types of commercial meat cooking based on five equipment types listed above.

Chain-driven (conveyorized) charbroilers have conveyor belts to carry the meat, broiling the top and the bottom of the food simultaneously, through the flame area mostly using natural gas. This appliance normally produces lower particulate matter (PM) and VOC emissions than under-fired charbroilers.

Under-fired charbroilers contribute the bulk of emissions for the commercial cooking sector. The equipment consists of three main components - a heating source mostly burning natural gas, a high-temperature radiant surface to hold the food, and a slotted grill. When grease from the meat falls onto the high-temperature radiant surface, both PM and VOC emissions occur.

Deep Fat Fryers use an exposed hot metal surfaces filled with cooking oil that is continuously heating. When the raw food is cooked in deep fat fryers, most of the water at the surface of the product vaporizes during the cooking process generating oil mist and oil distillation, resulting PM and VOC emissions.

Griddles consist of an exposed metal plate used to cook food quickly with a small quantity of oil. The emissions include light oil particulates causing PM and VOC emissions. In this process of cooking, the food is not immersed in heated oil. Most griddles are gas fired, but fuel type does not affect emissions of PM or VOC.

Clam Shell Griddles employs a two-sided cooking configuration, lowering an upper hot plate on top of the food product to cook that side while a lower plate cooks the bottom of the product. The cooking time and the emissions are relatively low for this method.

Activity
County-level population data, obtained from the US Census Bureau's county-level population estimates for the 2010 Census were used as the activity.[28]

Emission factors
Per capita emission factors for each Source Classification Code (SCC) and pollutant were developed and reviewed by ERTAC advisory panel composed of state and EPA representatives.

Control Factors
No control factors were directly applied to develop the commercial cooking categories in 2011 NEI.

Emission Estimation
Emissions are calculated for each county using emission factors and activity as:

$$E_{x,p} = A_x \times EF_{x,p}$$

where:

$E_{x,p}$ = annual emissions for category x and pollutant p;
A_x = 2010 county-level population data associated with category x;
$EF_{x,p}$ = emission factor for category x and pollutant p (lb/person).

2.2.3 Solvent Utilization

2.2.3.1 Surface Coating

SCC	SCC Level 1	SCC Level 2	SCC Level 3	SCC Level 4
2401001000	Solvent Utilization	Surface Coating	Architectural Surface Coating	Total: All Solvent Types
2401005000	Solvent Utilization	Surface Coating	Automobile Refinishing: SIC 7532	Total: All Solvent Types
2401065000	Solvent Utilization	Surface Coating	Electronic and Other Electrical: SIC 36 - 363	Total: All Solvent Types
2401015000	Solvent Utilization	Surface Coating	Factory Finished Wood: SIC 2426 thru 242	Total: All Solvent Types
2401100000	Solvent Utilization	Surface Coating	Industrial Maintenance Coatings	Total: All Solvent Types

[28] DOC, 2011: U.S. Department of Commerce, Bureau of the Census, *County Intercensal Estimates (2000-2010)*, Washington, DC. http://www.census.gov/popest/data/intercensal/county/county2010.html

SCC	SCC Level 1	SCC Level 2	SCC Level 3	SCC Level 4
2401055000	Solvent Utilization	Surface Coating	Machinery and Equipment: SIC 35	Total: All Solvent Types
2401080000	Solvent Utilization	Surface Coating	Marine: SIC 373	Total: All Solvent Types
2401025000	Solvent Utilization	Surface Coating	Metal Furniture: SIC 25	Total: All Solvent Types
2401090000	Solvent Utilization	Surface Coating	Miscellaneous Manufacturing	Total: All Solvent Types
2401070000	Solvent Utilization	Surface Coating	Motor Vehicles: SIC 371	Total: All Solvent Types
2401200000	Solvent Utilization	Surface Coating	Other Special Purpose Coatings	Total: All Solvent Types
2401030000	Solvent Utilization	Surface Coating	Paper, Film, Foil: SIC 26	Total: All Solvent Types
2401020000	Solvent Utilization	Surface Coating	Wood Furniture: SIC 25	Total: All Solvent Types
2401008000	Solvent Utilization	Surface Coating	Traffic Markings	Total: All Solvent Types

For most of the surface coatings, solvents containing VOCs are used if the coatings are not water-based. During application and as the coating dries, VOCs are emitted into the atmosphere. To estimate the emissions by primary sources from surface coating operations, the amount of coating used and the VOC content of the coating have been considered. While the coating dries and hardens, VOCs are emitted as reaction byproducts. To estimate the emissions by secondary sources, the amount of solvents used to clean such application equipment is used.

Product reformulation, product substitution and/or recycling of unused coating may be practiced in order to control the amount of primary emissions. Water-based coatings, powder coatings, and low-organic solvent coatings could be substituted as a control approach. However, since Occupational Safety and Health Administration (OSHA) regulations limit worker exposure to solvents, OSHA rules can indirectly affect the VOC content of coatings and the solvents used in them. The OSHA exposure limits vary with compound toxicity and as a result, manufacturers must consider the composition of coatings during product development to minimize the exposure hazards.

2.2.3.1.a Non-Industrial Surface Coating: Architectural Coating

In developing 2011 NEI, WDNR adopted EPA estimates from the architectural surface coating category. Architectural surface coating is an area source that occurs from home owners and contractors painting homes, buildings, and signs. These operations consist of applying a thin layer of coating such as paint, paint primer, varnish, or lacquer to architectural surfaces, and the use of solvents as thinners and for cleanup.[29]

Pollutant: VOC

[29] Emission Inventory Improvement Program, Technical Report Series Volume 3: Area Sources, Chapter 3: Architectural Surface Coating

The activity is determined as the per capita usage factor by dividing the national total architectural surface coating quantities for organic solvent and water based coatings by the U.S. population for that year. The population data is available from U.S. Census Bureau.[30]

To estimate the VOC emitted by this source category, the amount of VOC in surface coatings should be determined using one of the two methods listed here. The first approach is the surveying architectural surface coating use in the inventory area. The survey should include product type, product amount distributed by type, product density, and VOC content of the product. The second method uses a population-based estimation. Again, there are two population-based approaches: (1) National average per-gallon emission factors applied to national per capita usage rates, or; (2) Regulatory state or local per-gallon emission limits applied to national per capita usage rates.[30]

Spatial Allocation
In preparation of an inventory, spatial allocation could be applied in two possible approaches: (1) allocation of state or regional activity to a county-level, and (2) allocation of county-level emission estimates to a modeling grid cell.

Since this source category is almost always used in and on buildings where people live or work, considering the square footage is a preferred method for spatial allocation. Such databases are available in the tax assessor's office and accessible for use in a state inventory. Land use data from county planning departments or population distributions available from the Census Bureau are used for these spatial approaches.

Temporal Resolution
Seasonal influence on architectural surface coating temporally apportions the emissions estimates into different quarters for a particular year. Since temperatures below 50^{o}F are not suitable for painting, the first and fourth quarters limit the activity by decreasing the surface coating usage in most areas. Majority of the activity occurs during the second and third quarters which cover the months of April through September. During this active season, it is assumed that coating usage may take place 7 days a week.

Emissions Calculation:
The following equation was used to estimate the total amount of VOC emitted in the inventory area from architectural surface coating operations.[31]

$$ASE_{VOC} = \sum_{c=1}^{C} \sum_{s=1}^{S} TAC_{c,s} \times SC_{c,s} \times F_{VOC,s}$$

where:
ASE_{VOC} = total emissions of *VOC* from architectural surface coating operations, for all coatings (*C*) with all solvents (*S*)
$TAC_{s,c}$ = total architectural surface coating consumed in the inventory area for each coating (*c*) with each solvent (*s*) containing *VOC*

[30] U.S. Census Bureau, "Population Estimates," at http://www.census.gov/popest/estimates.html.
[31] Emission Inventory Improvement Program, Technical Report Series Volume 3: Area Sources, Chapter 3: Architectural Surface Coating

$SC_{c,s}$ = amount of solvent (s) in each coating (c)
$F_{VOC,s}$ = fraction of VOC in each solvent (s)

Point Source Adjustments
Usually, the application of architectural surface coating is generally defined as an area source; it is not required to subtract point source emission estimates from the total. Uncertainty may apply on the variability of per capita paint usage. For example, per capita usage may be lower than the national average in urban areas of high-density housing, in milder climates, or where wooden buildings are not common. Also, paint usage may be higher in corrosive environments or in areas where wooden structures predominate. The solvent content of the same paint is also variable. The total quantities of paint used or the type of paints used are very different from the national average.

2.2.3.1.b Industrial Surface Coating

Industrial surface coating includes paints, enamels, varnishes, lacquers, and other product finishes. Some of those coatings contain a solvent-based liquid carrier; others use a water-based liquid carrier but still contain a small portion of solvents. Solvents are also used to clean up painting equipment.

Pollutant: VOC

In developing 2011 NEI, WDNR updated the EPA provided emissions estimates for most surface coating categories using total employment data for each county and adopted EPA estimates for industrial maintenance, traffic markings, and other special purposes categories as listed in table 3.

Table 3: List of Industrial Surface Coating Categories as updated or adopted by WDNR for 2011

SCC	SCC Level 3	WDNR updated EPA estimates	WDNR adopted EPA estimates
2401005000	Automobile refinishing	Yes	-
2401065000	Electronic and other electrical coatings	Yes	-
2401015000	Factory finished wood	Yes	-
2401100000	Industrial maintenance	-	Yes
2401055000	Machinery and equipment	Yes	-
2401080000	Marine manufacturing	Yes	-
2401025000	Metal furniture	Yes	-
2401090000	Miscellaneous manufacturing	Yes	-
2401070000	Motor vehicles	Yes	-
2401200000	Other Special Purposes	-	Yes
2401030000	Paper, Film and Foil	Yes	-
2401020000	Wood Furniture	Yes	-
2401008000	Traffic Markings	-	Yes

2010 county level employment data, state-level employment data and county business pattern data were downloaded from U.S. Census Bureau. Activity data is defined the pounds of solvent sold divided by the county employment for a specific category. Emissions factors, developed by ERTAC solvent working group were used for the calculations. Emission factors define the pounds of VOC per employee per year. Final emissions were calculated from adjusted county employment values and emission factors. Adjusted county employment values indicate the total employment in each county for a surface coating category based on the county business patterns.

Emissions Calculation
2010 county level employment data, state-level employment data and county business pattern data were downloaded from U.S. Census Bureau. Emissions factors, developed by ERTAC solvent working group, define the pounds of VOC per employee per year and were used for the calculations. Final emissions were calculated from adjusted county employment values and emission factors. Adjusted county employment values indicate the total employment in each county for automobile refinishing category based on county business patterns. Application of controls requires information about control efficiency, rule effectiveness and rule penetration. For example, VOC content of the surface coating products could be controlled by regulation.

The emissions for categories listed in Table 3 except industrial maintenance, traffic markings, and other special purposes categories could be calculated using following equations.

The basic calculation is:

$$Emissions = (Adjusted\ County\ Employment) \times (Emission\ Factor)$$

The calculation in detail is:

$$Emissions_s = \frac{Emp_{i,s} \times EF_s \times [1 - (RE \times RP \times EC)]}{2000} - Emissions_{Point\ Sources,s}$$

where:
$Emissions_s$= VOC emissions in tons per year from surface coating category s
$Emp_{i,s}$= number of employees in inventory county for surface coating category s
EF_s = VOC emission factor for surface coating category s
CE = control efficiency
RE = rule effectiveness
RP =rule penetration
$Emissions_{Point\ Sources,s}$= point source emissions from surface coating category s

For calculating VOC emissions from industrial maintenance and other special purpose categories, following basic equation was used.

$$Emissions = (Population) \times (Per\ Capita\ Emission\ Factor)$$

County-level population estimates were downloaded from the U.S. Census Bureau. Emission factors used for the calculation were developed by ERTAC solvent working group.
For calculating VOC emissions from traffic markings, following basic equation was used.

$$Emissions = (Number\ of\ Road\ Miles\ Paved) \times (Emission\ Factor\ per\ Road\ Mile)$$

The activity data was determined using the road miles paved obtained from the Department of Transportation. Emission factors were developed by ERTAC solvent working group.

2.2.3.2 Degreasing

SCC	SCC Level 1	SCC Level 2	SCC Level 3	SCC Level 4
2415000000	Solvent Utilization	Degreasing	All Processes/All Industries	Total: All Solvent Types

Pollutant: VOC

In developing 2011 NEI for this category, WDNR updated the EPA estimated emissions using adjusted total employment data for each county. The state-wide employment data was allocated to county-level using County Business Patterns for the counties of Wisconsin.[32] EPA provided emission factors for VOC.[33]

The basic calculation is:

$$Emissions = (Adjusted\ County\ Employment) \times (Emission\ Factor)$$

To adjust point source emissions, the degreasing emissions from facilities identified as point sources were subtracted from the area source inventory to avoid double counting. Application of controls requires information about control efficiency, rule effectiveness and rule penetration.

The calculation in detail is:

$$Emissions_d = \left[\frac{Emp_i \times EF_d}{2000} \times [1 - (CE_d \times RE_d \times RP_d)]\right] - Emissions_{Point\ Sources,d}$$

where:
$Emissions_d$ = emissions of VOC in tons/day from degreasing
Emp_i = 2010 employment of county *i*
EF_d = VOC emissions factor for degreasing
CE_d = control efficiency for degreasing
RE_d = rule effectiveness for degreasing
RP_d = rule penetration for degreasing
$Emissions_{Point\ Sources,d}$ = point source emissions from degreasing

2.2.3.3 Dry Cleaning

[32] U.S. Census Bureau, 2010 County Business Patterns accessed from http://www.census.gov/econ/cbp/download/index.htm and/or http://censtats.census.gov/cgi-bin/cbpnaic/cbpsel.pl
[33] ftp://ftp.epa.gov/EmisInventory/2011nei/doc/

SCC	SCC Level 1	SCC Level 2	SCC Level 3	SCC Level 4
2420000000	Solvent Utilization	Dry Cleaning	All Processes	Total: All Solvent Types

Dry cleaning facilities utilize solvents in their cleaning process which causes the emission of VOCs into the ambient air. WDNR updated the EPA estimated emissions using the adjusted total employment data for each county.

Pollutants: VOC

The basic calculation is:

$$Emissions = (Adjusted\ County\ Employment) \times (Emission\ Factor)$$

Activity data included the employee estimates allocated to counties based on county business patterns in Wisconsin.[33] The EPA provided emission factors that were developed by ERTAC.

Emissions are calculated for each county using emission factors and activity data:

$Emissions_{i,p}$ = (Emp_i) x (Emission Factor $_p$)

where:
Emissions $_{i,p}$= annual emissions for inventory county i and pollutant p
Emp $_i$ = adjusted employment data associated with county i
Emission Factor $_p$ = emission factor for pollutant y

2.2.3.4 Graphic Arts

SCC	SCC Level 1	SCC Level 2	SCC Level 3	SCC Level 4
2425000000	Solvent Utilization	Graphic Arts	All Processes	Total: All Solvent Types

Graphic arts include operations that are involved in the printing of newspapers, magazines, books and other printed materials. There are six basic types of graphic arts methods: lithography, gravure, letterpress, flexography, screen printing and metal decorating called platelets. In developing 2011 NEI, WDNR updated the EPA provided emissions estimates using the adjusted total employment data for each county.

Activity data includes the specific type of printing operation and total number of employees involve in each of those operation types.[34] Emission factors define the pounds of VOC per capita per year as developed by ERTAC. Types of printing ink and the type of product and the production volume are also important in estimating emissions.

[34] U.S. Department of Labor, Bureau of Labor Statistics, "Occupational Employment Statistics", found at http://www.bls.gov/oes/current/oes_dc.htm

It is assumed that emissions from graphic arts industry are distributed uniformly throughout the year as no significant seasonal fluctuations in the production of this category were observed. To determine seasonal emissions, the fraction of the year that corresponds to the season of interest can be multiplied by annual emissions to obtain seasonal emissions.[35]

Emission calculation

The basic calculation is:
$Emissions_{i,p}$ = (Emp_i) x (Emission Factor $_p$)

where:
Emissions $_{i,p}$= annual emissions for inventory county *i* and pollutant *p*
Emp $_i$ = adjusted employment data associated with county *i*
Emission Factor $_p$ = emission factor for pollutant *y*

Adjustment for point sources:

$$Emissions_{Area\ Sources} = Emissions_{All\ Stationary\ Sources} - Emissions_{Point\ Sources}$$

2.2.3.5 Miscellaneous Non-industrial: Consumer and Commercial

SCC	SCC Level 1	SCC Level 2	SCC Level 3	SCC Level 4
2460600000	Solvent Utilization	Miscellaneous Non-industrial: Consumer and Commercial	All Adhesives and Sealants	Total: All Solvent Types
2460400000	Solvent Utilization	Miscellaneous Non-industrial: Consumer and Commercial	All Automotive Aftermarket Products	Total: All Solvent Types
2460200000	Solvent Utilization	Miscellaneous Non-industrial: Consumer and Commercial	All Household Cleaning Products	Total: All Solvent Types
2460500000	Solvent Utilization	Miscellaneous Non-industrial: Consumer and Commercial	All Coatings and Related Products	Total: All Solvent Types
2460800000	Solvent Utilization	Miscellaneous Non-industrial: Consumer and Commercial	All FIFRA Related Products	Total: All Solvent Types
2460900000	Solvent Utilization	Miscellaneous Non-industrial: Consumer and Commercial	Miscellaneous Products (Not Otherwise Covered)	Total: All Solvent Types
2460100000	Solvent Utilization	Miscellaneous Non-industrial: Consumer and Commercial	Personal Care Products	Total: All Solvent Types

Pollutant: VOC

In developing 2011 NEI, WDNR adopted EPA estimated emissions.

[35] http://www.epa.gov/ttn/chief/eiip/techreport/volume03/iii07.pdf

Emissions Calculation

Emissions are calculated for each county using emission factors and activity as:

$$E_{x,p} = A \times EF_{x,p}$$

where:

$E_{x,p}$ = annual emissions for category x and pollutant p;
A = 2010 county-level population;
$EF_{x,p}$ = emission factor for category x and pollutant p (lb/person).

The emission factors used in the emission estimates were developed by ERTAC.

Non-industrial solvents that are used in commercial or consumer applications and may emit VOCs are estimated under several different categories: adhesives and sealants, automotive aftermarket products, household cleaning products, coatings and related products, Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) related products, personal care products, and other related miscellaneous products. Adhesives and sealants category includes cements, glues, and pastes. These compounds form a bond between one or more substrates. For auto aftermarket category, two main types of products are: detailing products and maintenance and repair products. The detailing products sub-category includes the products used for cosmetic purposes on cleaning, polishing, and waxing. The maintenance and repair sub-category includes products used as engine and part cleaners, carburetor fuel injector cleaners, lubricants, antifreeze, radiator cleaners, and brake fluids.

Household products include hard surface cleaners, laundry products, fabric and carpet care products, dishwashing products, waxes and polishes, air fresheners, shoe and leather care products, and other miscellaneous household products. Coatings and related products category includes aerosol spray paint and other coating-related products. FIFRA regulated products include consumer pesticides that are used in home, garden, and other commercial disinfectant and antimicrobial applications. Personal care products include hair care products, deodorants, antiperspirants, perfumes, colognes, and nail care products.

There may be uncertainties for the emission estimations in these categories due to fluctuations in per capita usage for different geographical locations with seasonal variations. The changes associated with product formulations may also influence the estimates.

2.2.3.6 Miscellaneous Non-industrial: Commercial

2.2.3.6.a Agricultural pesticide Application

SCC	SCC Level 1	SCC Level 2	SCC Level 3	SCC Level 4
2461850000	Solvent Utilization	Miscellaneous Non-industrial: Commercial	Pesticide Application: Agricultural	All processes

Pesticides are substances used to control nuisance species and can be classified by targeted pest group: weeds (herbicides), insects (insecticides), fungi (fungicides), and rodents (rodenticides).

They can be further described by their chemical characteristics: synthetics, non-synthetics (petroleum products), and inorganics. Different pesticides are made through various combinations of the pest-killing material, also called the active ingredient (AI), and various solvents. The solvents act as carriers for AI. Both types of ingredients contain VOC that may be emitted to the air during application or after application as a result of evaporation. In estimating potential VOC emissions, the crop-specific and regional specific pesticide application rates should be considered.[36]

Emissions were estimated by summing the product of the activity data and the emissions factor for each pesticide and crop type at the county-level:

$$\text{Total VOC Emissions}_{County} = \Sigma\,(A_{Pesticide,Crop} \times EF)$$

The default emission factor is expressed as the pounds of VOC that evaporate per pound of pesticide AI applied and was calculated using the following equation:

$$EF = ER \times VOC$$

where: EF = emission factor (lb VOC / lb AI)
ER = evaporation rate of applied pesticide (expressed as a fraction)
VOC = weighted pesticide VOC content (lb VOC / lb AI)

The equations discussed here are based on EPA recommendations provided in the Emissions Inventory Improvement Program (EIIP) guidance.[37]

The pesticide specific VOC emission potential (EP) of reactive organic gases (i.e., the weight percentage of product that contributes to VOC emissions) and the weight percent of active ingredient from the Department of Pesticide Regulation (DPR) database were used to calculate the weighted average VOC content.

$$VOC = \Sigma_{pesticides}[((AI/(\%AI/100))*(EP/100))/AI]*[(AI/(\%AI/100))/T]$$

where: VOC = weighted pesticide VOC content (lb VOC / lb AI)
AI = active ingredient applied (lb)
%AI = weight percent of AI in pesticide mixture
EP = emissions potential of reactive organic gases (expressed as % of pesticide weight)
T = total weight of all pesticides applied (lb)

The AI applied was calculated from the AI application rates reported in the Crop Life Foundation (CLF) database and the harvested acres reported in the Department of Agriculture's Census of Agriculture. The national pesticide usage (T), reported as pounds of pesticides applied, was calculated using the following equation:

[36] Agricultural_Pesticides_2461850000_Documentation downloaded from ftp://ftp.epa.gov/EmisInventory/2011nei/doc/
[37] United States Environmental Protection Agency, "*Pesticides - Agricultural and Nonagricultural*", Vol. 3, Ch. 9, Section 5.1, p. 9.5-4, Emissions Inventory Improvement Program, June 2001.

$$T = \Sigma_{Pesticides} AI/(\%AI/100)$$

The activity for pesticide application is the pounds of active ingredient applied and is calculated using the following equation:

$$A = HA \times R \times I \times AT$$

where: A = pounds of active ingredient applied by pesticide by county
HA = crop-specific harvested acres in county
R = crop-specific pounds of pesticide applied per year per harvested acre
I = pounds of active ingredient per pound of pesticide
AT = percent of crop acres in the state treated with the active ingredient

2.2.4 Storage and Transport

2.2.4.1 Portable Fuel Containers: Residential

SCC	SCC Level 1	SCC Level 2	SCC Level 3	SCC Level 4
2501011011	Storage and Transport	Petroleum and Petroleum Product Storage	Residential Portable Fuel Containers	Permeation
2501011012	Storage and Transport	Petroleum and Petroleum Product Storage	Residential Portable Fuel Containers	Evaporation
2501011013	Storage and Transport	Petroleum and Petroleum Product Storage	Residential Portable Fuel Containers	Spillage During Transport
2501011014	Storage and Transport	Petroleum and Petroleum Product Storage	Residential Portable Fuel Containers	Refilling at the Pump-Vapor Displacement
2501011015	Storage and Transport	Petroleum and Petroleum Product Storage	Residential Portable Fuel Containers	Refilling at the Pump-Spillage
2501011016	Storage and Transport	Petroleum and Petroleum Product Storage	Residential Portable Fuel Containers	Refueling Equipment-Vapor Displacement
2501011017	Storage and Transport	Petroleum and Petroleum Product Storage	Residential Portable Fuel Containers	Refueling Equipment-Spillage

For 2011 NEI, WDNR adopted the EPA estimated emissions for residential portable fuel containers. However, for this attainment demonstration, WDNR back-calculated VOC emissions for these categories from EPA's 2017 and 2025 emission estimates in its 2011 Emissions Modeling Platform, Version 6.2.[38] This was done due to a suspected methodology change by EPA (which led to significantly lower VOC emission estimates) for VOC emission estimates for these categories after 2011. Back-calculating 2011 emissions from EPA's 2017 and 2025 estimates is assumed to more accurately reflect EPA's updated methodology after 2011.

These categories are associated with the emissions from the fuel containers commonly known as "gas cans" and contribute VOC emissions to the ambient air in different ways.

2.2.4.2 Portable Fuel Containers: Commercial

[38] ftp://ftp.epa.gov/EmisInventory/2011v6/v2platform/2017emissions/

SCC	SCC Level 1	SCC Level 2	SCC Level 3	SCC Level 4
2501012011	Storage and Transport	Petroleum and Petroleum Product Storage	Commercial Portable Fuel Containers	Permeation
2501012012	Storage and Transport	Petroleum and Petroleum Product Storage	Commercial Portable Fuel Containers	Evaporation
2501012013	Storage and Transport	Petroleum and Petroleum Product Storage	Commercial Portable Fuel Containers	Spillage During Transport
2501012014	Storage and Transport	Petroleum and Petroleum Product Storage	Commercial Portable Fuel Containers	Refilling at the Pump-Vapor Displacement
2501012015	Storage and Transport	Petroleum and Petroleum Product Storage	Commercial Portable Fuel Containers	Refilling at the Pump-Spillage
2501012016	Storage and Transport	Petroleum and Petroleum Product Storage	Commercial Portable Fuel Containers	Refueling Equipment-Vapor Displacement
2501012017	Storage and Transport	Petroleum and Petroleum Product Storage	Commercial Portable Fuel Containers	Refueling Equipment-Spillage

WDNR did not adopt the EPA estimated 2011 emissions for commercial portable fuel containers due to a suspected methodology change by EPA (which led to significantly lower VOC emission estimates) for VOC emission estimates for these categories after 2011. Instead, WDNR staff back-calculated VOC emissions for these categories from EPA's 2017 and 2025 emission estimates in its 2011 Emissions Modeling Platform, Version 6.2.[39]

2.2.4.3 Petroleum and Petroleum Product Storage

SCC	SCC Level 1	SCC Level 2	SCC Level 3	SCC Level 4
2501050120	Storage and Transport	Petroleum and Petroleum Product Storage	Bulk Terminals: All Evaporative Losses	Gasoline
2501055120	Storage and Transport	Petroleum and Petroleum Product Storage	Bulk Plants: All Evaporative Losses	Gasoline
2501060051	Storage and Transport	Petroleum and Petroleum Product Storage	Gasoline Service Stations	Stage 1: Submerged Filling
2501060052	Storage and Transport	Petroleum and Petroleum Product Storage	Gasoline Service Stations	Stage 1: Splash Filling
2501060053	Storage and Transport	Petroleum and Petroleum Product Storage	Gasoline Service Stations	Stage 1: Balanced Submerged Filling
2501060201	Storage and Transport	Petroleum and Petroleum Product Storage	Gasoline Service Stations	Underground Tank: Breathing and Emptying
2501060100	Storage and Transport	Petroleum and Petroleum Product Storage	Gasoline Service Stations	Stage 2: Total Refueling
2501070100	Storage and Transport	Petroleum and Petroleum Product Storage	Diesel Service Stations	Stage 2: Total Refueling
2505030120	Storage and Transport	Petroleum and Petroleum Product Storage	Truck	Gasoline
2505040120	Storage and Transport	Petroleum and Petroleum Product Storage	Pipeline	Gasoline

For 2011 NEI, WDNR adopted the EPA estimated data for emissions from the petroleum and petroleum product storage categories, except for SCC 2501060100 which was estimated by WDNR staff. For the completeness of this document, the emission estimation approaches to determine VOC content in each category is discussed below. The information discussed for these

[39] ftp://ftp.epa.gov/EmisInventory/2011v6/v2platform/2017emissions/

categories are directly from EIIP's Gasoline Marketing document and EPA's Gasoline Distribution Stage I Documentation, unless indicated otherwise below.[40,41]

Pollutants: VOC

These emissions occur as gasoline vapors are released into the atmosphere. Stage I emissions are produced by displacement of gasoline vapors from the storage tanks during the transfer of gasoline from tank trucks to storage tanks at the service station and released into the atmosphere. These Stage I processes are subject to EPA's maximum available control technology (MACT) standards for gasoline distribution. Emissions from gasoline distribution at bulk terminals and bulk plants take place when gasoline is loaded into a storage tank or tank truck, from working losses (for fixed roof tanks), and from working losses and roof seals (for floating roof tanks). Working losses consist of both breathing and emptying losses. The procedures and equations discussed for the categories of bulk gasoline terminals listed above are based on EIIP.[40]

Total gasoline distribution is used as the activity. The Federal Highway Administration (FHWA) annually publishes Highway Statistics, which contains gasoline consumption data for each state. County-wide estimates can be made by apportioning these statewide totals by the percentage of state gasoline station sales occurring within each county. County-wide service station gasoline sales data are available from the Bureau of the Census's Census of Retail Trade.[41]

Emissions from tank trucks in transit occur when gasoline vapor evaporates from (1) loaded tank trucks during transportation of gasoline from bulk terminals/plants to service stations, and (2) empty tank trucks returning from service stations to bulk terminals/plants. Pipeline emissions result from the valves and pumps found at pipeline pumping stations and from the valves, pumps, and storage tanks at pipeline breakout stations. Stage I gasoline distribution emissions also occur when gasoline vapors are displaced from storage tanks during unloading of gasoline from tank trucks at service stations (Gasoline Service Station Unloading) and from gasoline vapors evaporating from service station storage tanks and from the lines going to the pumps (Underground Storage Tank Breathing and Emptying).[41]

There are no generally accepted activity-based VOC emission factors for the pipelines and bulk terminals sectors because they are generally treated as point sources whose emissions are estimated using site-specific information. For both categories, EPA allocated national VOC emissions in a two-step manner. First, EPA allocated emissions based on 2008 gasoline supply data reported by the U.S. DOE. Next, EPA allocated emissions based on employment data reported in the 2007 County Business Patterns.[41]

The basic equation for emission estimation is:

$$Emissions = Emission\ Factor\ \times Activity\ Level$$

Detailed equations for category-wise emission estimations are listed below.

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[40] EIIP, Chapter 11, Gasoline Marketing (Stage I & Stage II): http://www.epa.gov/ttn/chief/eiip/techreport/volume03/iii11_apr2001.pdf

[41] Gasoline_Distribution_Statge I_Documentation_2011: ftp://ftp.epa.gov/EmisInventory/2011nei/doc/

2.2.4.3.a Gasoline Distribution Stage I, Bulk plant

Emissions from gasoline distribution at bulk plants take place when gasoline is loaded into a storage tank or tank truck, from working losses (for fixed roof tanks), and from working losses and roof seals (for floating roof tanks). Working losses consist of both breathing and emptying losses.

$$E_{voc} = C_g \times P \times EF_{voc}$$

where:
E_{voc} = national VOC emissions
C_g = national gasoline consumption
P = proportion passing through bulk plants
EF_{voc} = VOC emission factor

2.2.4.3.b Gasoline Distribution Stage I, Submerged Filling and Balanced Submerged Filling

This category estimates the VOC emissions from displacement of gasoline vapors from the storage tanks during the transfer of gasoline from tank trucks to storage tanks at the service station.

$$E_i = \frac{\left(G_i \times F_{i,method} \times EF_{method}\right) + \left(G_i \times F_{i,method} \times EF_{method}\right)}{2000}$$

where:
E_i = emissions of VOC in tons per day from tank truck unloading per county *i*
G_i = gallons of gasoline sold in county *i* during 2011
$F_{i,method}$ = fraction of gasoline dispensed per county *i* per filling method (balanced submerged or submerged) during 2011
EF_{method} = emission factor per filling method for tank truck unloading

2.2.4.3.c Gasoline Distribution Stage I, Pipeline (SCC: 2505040120) and Bulk Terminal

Pipeline emissions result from the valves and pumps found at pipeline pumping stations and from the valves, pumps, and storage tanks at pipeline breakout stations. Emissions from gasoline distribution at bulk terminals takes place when gasoline is loaded into a storage tank or tank truck, from working losses (for fixed roof tanks), and from working losses and roof seals (for floating roof tanks). Working losses consist of both breathing and emptying losses. There are no generally accepted activity based VOC emission factors for the pipelines and bulk terminals sectors because they are generally treated as point sources whose emissions are estimated using site-specific information. For pipelines, EPA allocated emissions to Petroleum Administration for Defense (PAD) districts based on the total amount of finished motor gasoline moved by pipeline in each PAD district in the inventory year. EPA allocated pipeline emissions in each PAD district to counties based on County Business Patterns employment data. Because employment data for NAICS code 48691 (Pipeline Transportation of Refined Petroleum

Products) are often withheld due to confidentiality reasons, EPA used the number of employees in NAICS code 42471 (Petroleum Bulk Stations and Terminals) for this allocation.[41]

2.2.4.3.d Gasoline Distribution Stage I, Tank Trucks in Transit

Emissions from gasoline tank trucks in transit include the evaporation of petroleum vapor from loaded tank trucks during transportation of gasoline from bulk plants/terminals to the service stations or other dispensing outlets and from empty tank trucks. These losses are caused by leaking delivery trucks, pressure in the tank, and thermal effects on the vapor and on the liquid.

$$E_{TT} = \frac{(Fuel_i \times A \times EF_{TT})}{2000}$$

E_{TT} = emissions of VOC in tons per day from tank trucks in transit
$Fuel_i$ = thousand gallons of fuel sold in county *i*
A = throughput adjustment factor
EF_{TT} = emission factor for tank trucks in transit

2.2.4.3.e Gasoline Service Station, Underground Tank Breathing and Emptying

Underground tank breathing occurs when gasoline is drawn out of the tanks and into the pump lines. During this process air moves into the tank evaporating gasoline and emitting vapors.

Emission factor is the amount of VOC per thousand gallons of fuel throughput.

Point source adjustments: No subtraction of point sources from total emissions is necessary for this category.

Emission calculation:

$$E_{utb} = \frac{(E_i \times EF_{utb})}{2000}$$

where:
E_{utb} = emissions of VOC in tons per day from underground tank breathing and emptying
F_i = thousand gallons of fuel sold in county *i*
EF_{utb} = emission factor for underground tank breathing and emptying

2.2.4.3.f Gasoline Service Stations, Stage II: Total Refueling

Stage II displacement of gasoline vapors from vehicle gasoline tanks during vehicle refueling is discussed in this category. Refueling emissions have two mechanisms of introducing emissions to the environment: (1) vapor displacement from the vehicle fuel tank during refilling; and (2) gasoline spillage during refueling. For this category, a point source adjustment is not necessary.

Stage II refueling emissions for 2011 were estimated by WDNR staff using the EPA's MOVES2014a model with the same activity inputs used for the onroad modeling. During 2011, a Stage II vapor recovery program (vapor recovery nozzles at gas pumps) was in effect in nine eastern Wisconsin counties, including Sheboygan County. To model the effects of this program, MOVES2014a provides the following two inputs: (1) vapor displacement reductions and (2) spillage reductions.

WDNR used a vapor displacement reduction of 56%. This value is specified in EPA guidance for programs with minimal inspection frequency (less than annual).[42]

WDNR used a spillage reduction percentage of 50%. This percentage is the standard percentage used in the MOVES2014a model for all areas in the United States having a Stage II vapor recovery program.

2.2.5 Waste Disposal

2.2.5.1 Publicly Owned Treatment Works (POTW)

SCC	SCC Level 1	SCC Level 2	SCC Level 3	SCC Level 4
2630020000	Waste Disposal, Treatment, and Recovery	Wastewater Treatment	Public Owned	Total Processed

For 2011 NEI, WDNR adopted the EPA estimated data for emissions from the publicly owned treatment works category. POTWs includes intercepting sewers, outfall sewers, sewage collection systems, pumping, power, and other equipment used to treat wastewater generated by multiple sources from industrial, commercial, and domestic sectors.

Pollutants: VOC

Flow rate, measured in million gallons per day, is considered as the activity. The emission factor for VOC in pounds of VOC per million gallons of waste water discharged was provided by ERTAC.

Adjustment for point sources
It is important to note that the emission estimates for this category represent total emissions. It is necessary to determine whether there are point source emissions in SCCs 50100701 through 50100781 and 50100791 through 50182599 that need to be subtracted to yield the nonpoint source emission estimates for this category.

[42] "Procedures for Emission Inventory Preparation; Volume IV: Mobile Sources", Section 3.3.6.1, U.S. EPA, EPA-420-R-92-009, December 1992. (The reduction percentages in this document and section are specified for use in the EPA's current technical guidance for the MOVES model: "MOVES2014 and MOVES2014a Technical Guidance: Using MOVES to Prepare Emission Inventories for State Implementation Plans and Transportation Conformity", EPA-420-B-15-093, November 2015.)

Emission Calculations:

Annual VOC emissions were calculated using the following equation:

$$E_{POTW} = \frac{F_{i,j} \times EF_{POTW} \times 365}{2000}$$

where:
E_{POTW} = VOC emissions in tons per year
$F_{i,j}$ = daily flow into POTW j in county i
EF_{POTW} = VOC emission factor for POTW

State-wide emissions were allocated to county-level using county proportion of population data.[43]

2.2.6 Miscellaneous Non-Industrial not elsewhere classified (NEC)

2.2.6.1 Other Combustion: Cremation

SCC	SCC Level 1	SCC Level 2	SCC Level 3	SCC Level 4
2810060100	Miscellaneous Area Sources	Other Combustion	Cremation	Humans

The WDNR adopted EPA's estimates for this category. The EPA estimates may be adjusted by updating the number of bodies cremated in year 2008 in provided spread sheets. The Cremation Association of North America's estimate of the percentage of bodies cremated in the United States in 2008 and the average body weight of bodies cremated during an emission test evaluation of a crematory at Woodlawn Cemetery in Bronx, New York is available for online access.[44, 45] Emission factors are available in WebFIRE. The estimated number of deaths in each state in the United States for a specific year could be obtained from the National Center for Health Statistic's Report.

Emission Calculation

$$E_C = \frac{N_C \times W_{Avg} \times EF_C}{2000}$$

where:
E_C = emissions from crematories
N_C = number of bodies cremated in a specific year in a county
W_{Avg} = average body weight in pounds
EF_C = emission factor per pollutant for cremation

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[43] U.S. Census Bureau, "Population Estimates," at http://www.census.gov/popest/estimates.html.
[44] Cremation Association of North America, *2007 Statistics and Projections to the Year 2025: 2008 Preliminary Data*, August 2009, available at http://www.cremationassociation.org/
[45] U.S. Environmental Protection Agency, Emission Test Evaluation of a Crematory at Woodlawn Cemetery in the Bronx, NY, Final Test Report, Vol. 1. Office of Air Quality Planning and Standard Emission Measurement Center, Research Triangle Park, NC, September 1999.

2.3 Onroad Mobile Sources

Onroad mobile sources are motorized mobile equipment that are primarily used on public roadways. Examples of onroad mobile sources include cars, trucks, buses and road motorcycles. The emissions reported in this document were estimated by the Motor Vehicle Emission Simulator (MOVES), the EPA's recommended mobile source model. The version used was MOVES2014a. All estimates were made in accordance with the following EPA technical guidance:

- MOVES2014a User's Guide (U.S. EPA, Office of Transportation and Air Quality, Assessment and Standards Division, November 2015, EPA 420-B-15-095).
- MOVES2014 and MOVES2014a Technical Guidance: Using MOVES to Prepare Emission Inventories for State Implementation Plans and Transportation Conformity (U.S. EPA, Office of Transportation and Air Quality, Assessment and Standards Division, November 2015, EPA-420-B-15-093).

The onroad mobile NOx and VOC emissions for Sheboygan County for 2011 (as well as the 2017 and 2018 projections) are presented in Appendix 5, broken down by source type (vehicle class), fuel type and road type. Tables summarizing vehicle activity data are presented in Appendix 5 after the emissions tables.

2.3.1 Transportation Data

The modeling inputs to MOVES include detailed transportation data (e.g., vehicle-miles of travel by vehicle class, road class and hour of day, and average speed distributions), requiring support from the state agency conducting transportation modeling in Sheboygan County, the Wisconsin Department of Transportation (WDOT). WDOT maintains transportation network inventory data for the state. WDOT has developed and validated travel simulation models to estimate and forecast vehicle-miles of travel (VMT) and average speed distributions for the state, including detailed data for Sheboygan County.

WDOT provided to WDNR their most recent transportation modeling data for Sheboygan County on October 14, 2016. The data covers the five years 2010, 2015, 2025, 2035 and 2045. For each of these years, the data includes average weekday vehicle-miles of travel (VMT), vehicle-hours of travel (VHT) and average speed; all broken down by 14 5-mph speed bins within 13 roadway classes within two general vehicle classes. For these data "weekday" includes only the three middle weekdays (Tuesday, Wednesday and Thursday).

The 14 speed bins are: 0-5 mph, 5-10 mph, … 60-65 mph and 65+ mph.

The 13 roadway classes are:

- Interstate
- Freeway
- Ramp
- Expressway
- Urban Principal Arterial
- Urban Minor Arterial

- Urban Collector
- Urban Local
- Rural Principal Arterial
- Rural Minor Arterial
- Rural Major Collector
- Rural Minor Collector
- Rural Local

The two general vehicle classes are: Auto and Truck

2.3.2 Descriptions of MOVES Modeling Inputs

2.3.2.1 Vehicle-Miles of Travel (VMT)

WDNR made the following adjustments to the 2010 VMT provided by WDOT to develop 2011 VMT estimates for input to MOVES2014a:

- **2010 to 2011**: The 2010 average weekday (Tuesday-Thursday) VMT provided by WDOT was 2,731,175. VMT data reported by WDOT (see: http://wisconsindot.gov/Pages/projects/data-plan/veh-miles/default.aspx) indicates that VMT in Sheboygan County was about 3.1% lower in 2011 than in 2010 (average annual day VMT of 2,706,644 in 2010 and 2,622,748 in 2011). Thus, the 2010 average weekday (Tu-Th) VMT provided by WDOT was adjusted down by about 3.1% to 2,646,519.

- **Average weekday (Tuesday-Thursday) to summer weekday (Monday-Friday)**: As recommended in the EPA technical guidance, the onroad inventories for ozone SIPs are based on *summer* weekday VMT, where "weekday" includes all five of the weekdays. Statewide VMT summaries by day-of-week and month-of-year provided by WDOT during June of 2014 indicate that VMT on a July weekday (Mon-Fri) is about 16% greater than VMT on an average weekday (Tue-Thur). WDNR ran MOVES2014a using temporal adjustment factors that resulted in a summer (July) weekday (Mon-Fri) VMT of **3,077,240**, which is 16.3% greater than the average weekday (Tue-Thur) VMT of 2,646,519.

- **Two vehicle classes to five classes:** WDOT provided VMT data for two general vehicle classes (Auto and Truck). The MOVES model requires that VMT be broken down further. For example, the VMT can be broken down to the five Highway Performance Monitoring System (HPMS) classes of:
    - 10 - Motorcycles
    - 25 - Light Duty Vehicles
    - 40 - Buses
    - 50 - Single Unit Trucks
    - 60 - Combination Trucks

  WDOT verified to WDNR that their class of "Auto" corresponds to HPMS classes 10 and 25 and their class of "Truck" corresponds to HPMS classes of 40, 50 and 60. Thus, WDNR allocated the VMT in the two WDOT classes to the five HPMS classes by utilizing the MOVES2014a default VMT distribution for Sheboygan County for those five HPMS classes.

2.3.2.2 VMT by Hour of Day

WDNR used the MOVES2014a default hourly VMT distributions.

2.3.2.3 Vehicle Population

WDNR estimated vehicle populations for each vehicle class by dividing annual VMT by the MOVES defaults for average annual mileage accumulation.

2.3.2.4 Average Speed Distribution

WDNR adjusted the 14-bin speed distribution provided by WDOT to the 16-bin speed distribution required by the MOVES model. Since the speed limit for interstate highways in Sheboygan County was lower in 2011 (65 mph) than presently (70 mph), WDNR did not allocate any of the VHT in the WDOT's highest speed bin (65+ mph) to the highest speed bin in MOVES (72.5 mph to 77.5 mph).

2.3.2.5 Vehicle Age Distribution

Local vehicle age distributions were developed for five source types: passenger cars, passenger trucks, light commercial trucks, intercity buses and school buses. The EPA default distributions were used for the other eight source types: motorcycles, transit buses and six medium to heavy truck classes. WDNR calculated the local distributions from a file of select fields from the state's registration database as of March 2014, provided by the WDOT. WDNR calculated a 2014 distribution for a seven county region including Sheboygan County. WDNR adjusted the 2014 distributions back to 2011 based on differences between the EPA default age distributions for those two years.

2.3.2.6 Road Type Distribution

MOVES requires that VMT for each of the 13 source types (see section 2.3.2.5 immediately above) be allocated to the following four roadway classes:

- Rural – Restricted Access
- Rural – Unrestricted Access
- Urban – Restricted Access
- Urban – Unrestricted Access

For each of the two WDOT vehicle classes (Auto and Truck), WDNR allocated VMT from the 13 WDOT roadway classes to the 4 MOVES roadway classes as follows:

Table 4: Allocation of VMT to the Four MOVES Roadway Classes

	Rural Restricted	Rural Unrestricted	Urban Restricted	Urban Unrestricted
Interstate	71.65%		28.35%	
Freeway	10.44%		89.56%	
Ramp	60.68%		39.32%	
Expressway	10.44%		89.56%	
Urban Principal Arterial				100%
Urban Minor Arterial				100%
Urban Collector				100%
Urban Local				100%
Rural Principal Arterial		100%		
Rural Minor Arterial		100%		
Rural Major Collector		100%		
Rural Minor Collector		100%		
Rural Local		100%		

Since the WDOT's four restricted access classes (Interstate, Freeway, Ramp and Expressway) do not have a rural/urban breakdown, WDNR calculated the rural/urban splits from a WDOT 2011 VMT summary for Sheboygan County, which did have VMT broken down by rural and urban for all roadway classes.

The resulting road type distributions for the two vehicle classes of Auto and Truck were then allocated to distributions for each of the 13 MOVES source types by utilizing the MOVES2014a default road type distributions for Sheboygan County for those 13 source types.

2.3.2.7 Ramp Fraction

The WDOT transportation modeling data included VHT values for ramp travel, allowing WDNR to calculate the ramp fractions.

2.3.2.8 Fuel Formulation and Supply

The MOVES defaults currently provide the best available fuel data and therefore were used.

2.3.2.9 Vehicle Inspection and Maintenance Program

Sheboygan County is within the seven-county southeastern Wisconsin vehicle inspection program region. On-Board Diagnostic (OBD) checks were assumed for most model year 1996 and newer passenger cars, passenger trucks and light commercial trucks.

2.3.2.10 Meteorology Data

Temperatures conducive to peak ozone formation were assumed for the summer weekday modeling. The WDNR has consistently used the same minimum and maximum temperatures for onroad modeling for ozone state implementation plans (SIP's) since the early 1990's. The temperatures were developed from an analysis of peak ozone days and have minimum/maximum values of 65/93 degrees Fahrenheit for Sheboygan County.

2.4 Nonroad Mobile Sources

Nonroad mobile sources are motorized mobile equipment and other small and large engines that are primarily used off public roadways. Examples of nonroad mobile sources include commercial marine, construction, lawn and garden, locomotive and agricultural equipment.

For purposes of inventory calculation, nonroad mobile sources are divided into two major groups:

- Commercial Marine, Aircraft and Rail Locomotive (MAR)
- All other nonroad categories

Nonroad categories other than MAR include:

- Recreational vehicles
- Construction equipment
- Industrial equipment
- Lawn and garden equipment
- Agricultural equipment
- Commercial equipment
- Logging equipment
- Underground mining equipment
- Oil field equipment
- Pleasure craft
- Railway maintenance equipment

A detailed listing of the nonroad emissions for each of the over 200 nonroad source subcategories, which include both the MAR and non-MAR subcategories, is presented in Appendix 6.

2.4.1 Non-MAR Sources

The 2011 nonroad emissions for the non-MAR categories were developed using the EPA's MOVES2014a model, using hot summer day temperatures. The model was run for Sheboygan County for the months of June, July and August. Hot summer day emissions were calculated by dividing the total emissions over these three months by 92 (the number of days in the three months).

2.4.2 MAR Sources

Annual emissions for the MAR categories were obtained from the EPA's 2011 Emissions Modeling Platform, Version 6.3. This modeling platform provides countywide annual emission estimates for the year 2011 and projections for the year 2017. This platform had zero commercial marine emissions for Sheboygan County. Instead, the platform allocated the commercial marine emissions in Lake Michigan east of Sheboygan County to the Michigan side of the lake, reflecting general shipping lanes. Summer day emissions for the other two MAR categories were estimated by applying annual-to-summer-day ratios from inventories by the Lake Michigan Air Directors Consortium (LADCO) for the year 2007. These ratios (annual/summer day) are:

- Aircraft: 361.11 for NOx; 357.35 for VOC
- Rail Locomotive: 362.00 for both NOx and VOC

Appendix 6 provides detailed listings of the estimated nonroad emissions data for the over 200 subcategories.

APPENDIX 2

EGU Inventory Methodology and Emissions for 2011, 2017 and 2018

This appendix provides the methodology for EGU sector NOx and VOC tons per summer day (tpsd) emission estimates in sections 3.2 (2011 Base Year Inventory for RFP) and 3.3 (2017 & 2018 Projected Year Inventories for RFP) of the Wisconsin Department of Natural Resources (WDNR) Sheboygan County attainment demonstration.

2.1 EGU 2011 Base Year Emissions

There are two electric generating unit (EGU) point source facilities located in Sheboygan County: the Edgewater coal-fired power plant and the Sheboygan Falls natural gas fired power plant. The 2011 NOx emissions, emission rates and fuel consumption for the generating units at these facilities were derived from data reported by the utility to EPA's Clean Air Markets Division (CAMD) database. WDNR used the ozone season day with the 99th percentile highest heat input for each unit at each facility during the ozone season to represent summer day operations during the 2011 ozone season. Using this 99th percentile value provides a conservative but reasonable representation of maximum summer day operation.

The summer day emissions were then calculated by multiplying the maximum summer day heat input in 2011 by the average emission rate for the 2011 ozone season. The NOx emission rates were derived from the CAMD emissions data for the 2011 ozone season. This base data and the tons per summer day emissions calculated from this data are provided in Table 2.1.1. In 2011, the NOx emissions are 13.16 tpsd for Edgewater and 0.48 tpsd for Sheboygan Falls.

The VOC summer day emissions are also derived by multiplying the maximum day heat input by an average VOC emission rate. The base data used in the calculation and the resulting emissions are provided in Table 2.1.1. In this case, however, VOC emissions are not monitored by continuous emissions monitors and reported to the CAMD database as is done for NOx. Therefore, the VOC emission rate was derived by dividing the annual VOC emissions reported to the WDNR Air Emissions Inventory (AEI) by the annual heat input reported to the CAMD database for 2011. The data applied in deriving the VOC emission rate are shown in Table 2.1.2. Multiplying these VOC emission rates for each year by the maximum heat input resulted in 0.94 tpsd of VOC in 2011 for Edgewater and 0.04 tpsd for Sheboygan Falls.

Note: emissions from non-electric generating emission units at the plant (i.e., units other than the three coal boilers at Edgewater or the two natural gas turbines at Sheboygan Falls) are not included because they are insignificant (less than 0.1% of the total plant emissions on a tons per year basis) compared to the boiler or turbine emissions.

Table 2.1.1. EGU Summer Day Operation and Emissions in 2011.

Variable	Edgewater			Sheboygan Falls	
	Unit 3	Unit 4	Unit 5	Unit 1	Unit 2
Summer Day Heat Input (mmBtu) [1]	14,994	68,770	93,778	17,551	17,440
NOx Rate (lbs/mmBtu) [2]	0.195	0.141	0.146	0.028	0.026
NOx (tpsd)	1.46	4.86	6.84	0.25	0.23
VOC Rate (lbs/mmBtu) [3]	0.0107			0.0025	
VOC (tpsd)	0.94			0.04	

[1] Heat input is for the day with the 99th percentile highest heat input during the 2011 ozone season.
[2] Emission rate derived from EPA CAMD ozone season NOx emissions and heat input.
[3] Calculated in Table 2.1.2.

Table 2.1.2. VOC Annual Emissions and Emission Rates.

Variable	Edgewater	Sheboygan Falls
Annual VOC (tons) [1]	110.3	0.3
Annual Heat Input (mmBtu) [2]	176,587	34,927
VOC Rate (lbs/mmBtu) [3]	0.0107	0.0025

[1] Emissions reported to the WDNR Air Emissions Inventory.
[2] Heat input reported to the CAMD database.
[3] Calculated by the equation (annual VOC tons x 2000 lbs/ton) / annual Heat Input (mmBtu).

2.2 EGU 2017 and 2018 Projected Emissions

The Edgewater and Sheboygan Falls power plants are anticipated to continue operation at close to their current levels through 2018. Following the same methodology as used in calculating 2011 emissions, WDNR projected summer day emissions for the power plants by multiplying a projected maximum daily heat input by a projected average ozone season emission rate. The data used in this calculation and resulting emissions are summarized in Table 2.2.1.

To determine the appropriate projected maximum heat input, the WDNR first evaluated historical maximum day ozone season values for 2011 through 2016 as listed in Tables 2.2.2 and 2.2.3. WDNR determined the maximum summer day heat inputs representative of recent operation to be the following: for Edgewater unit 4 and Sheboygan Falls units 1 and 2, the average of the 99th percentile daily values over the 2011-2016 period; for Edgewater unit 5, the average of the 99th percentile daily values over the 2014-2016 period; and for Edgewater unit 3, a heat input of “0”.

The WDNR evaluated historical data in determining an appropriate NOx emission rate for calculating projected emissions. For Edgewater: unit 3 retired in 2013; unit 4 has operated selective non-catalytic reduction (SNCR) for the entire 2011-2016 period for controlling NOx emissions; and unit 5 operated SNCR from 2011 to 2013 and selective catalytic reduction (SCR) from 2014 to 2016 for controlling NOx emissions. Sheboygan Falls units 1 and 2 have operated fairly steadily for the 2011-2016 period. Accordingly, the projected ozone season NOx emission rates in Tables 2.2.2 and 2.2.3 were determined by averaging the emission rates for the 2011-2016 period for Edgewater unit 4 and Sheboygan Falls units 1 and 2 and for the 2014-2016 period for Edgewater unit 5. These rates reflect controls as of 2016 and are reasonable, conservative representations of the future expected emission rates.

Based on this information, NOx emissions projected for 2017 and 2018 are calculated to be 6.60 tpsd for Edgewater and 0.54 tpsd for Sheboygan Falls. It should be noted that these NOx tpsd values are not intended to constitute daily enforceable emission limitations on the power plants. The values represent the best reasonable approximation of the controls in place, a compliance margin, and projected maximum actual summer day emissions that could be expected going into the future.

VOC emissions are calculated by assuming the VOC emission factors of 0.0094 Lbs/mmBtu (Edgewater) and 0.0004 Lbs/mmBtu (Sheboygan Falls) demonstrated during the 2015 ozone season will continue through 2018. There is no action anticipated that would significantly reduce these values. Multiplying the maximum day heat input values by these emission rates yields 0.81 tpsd of VOC for Edgewater and 0.01 tpsd of VOC for Sheboygan Falls. The base information used in these calculations and the resulting VOC emissions are shown in Table 2.2.1.

Table 2.2.1. EGU 2017 and 2018 Emissions (tpsd).

Variable	Projected Values			
	Edgewater			Sheboygan Falls
	Unit 3	Unit 4	Unit 5	Units 1 & 2
Summer Day Heat Input (mmBtu) [1]	Retired	70,036	103,079	38,684
NOx Rate (lbs/mmBtu) [2]	Retired	0.138	0.034	0.028
NOx (tpsd)	Retired	4.82	1.78	0.542
VOC Rate (lbs/mmBtu) [3]	0.0094			0.0004
VOC (tpsd)	0.81			0.01

[1] Heat input is: for Edgewater unit 4 and Sheboygan Falls units 1 and 2, the average of the 99th percentile daily values over the 2011-2016 ozone seasons; and for Edgewater unit 5, the average of the 99th percentile daily values over the 2014-2016 ozone seasons.
[2] Ozone season NOx emission rates derived from EPA CAMD ozone season NOx emissions and heat input.
[3] The VOC projected emission rates are assumed to be the same as the 2015 derived emission rates. The 2015 rates were derived in the same manner as the 2011 rates in Table 2.1.2, using: for Edgewater, annual VOC tons of 92.4 and an annual heat input of 19,755,615 mmBtu; for Sheboygan Falls, annual VOC tons of 0.1 and an annual heat input of 411,260 mmBtu.

Table 2.2.2. Ozone Season Maximum Daily Heat Input and NOx Emissions for Edgewater Power Plant.

Year	Ozone Season Average NOx Emission Rate (lbs/mmBtu) [1]			Ozone Season Maximum Daily Heat Input (mmBtu) [2]			Calculated NOx Emissions (tpsd) [3]		
	Unit 3	Unit 4	Unit 5	Unit 3	Unit 4	Unit 5	Unit 3	Unit 4	Unit 5
2011	0.195	0.141	0.146	14,994	68,770	93,778	1.46	4.86	6.84
2012	0.159	0.142	0.152	8,729	73,762	94,452	0.69	5.24	7.19
2013	Retired	0.136	0.044	Retired	72,811	100,543	Retired	4.94	2.24
2014	Retired	0.140	0.032	Retired	66,905	102,911	Retired	4.68	1.63
2015	Retired	0.128	0.035	Retired	68,216	93,942	Retired	4.36	1.66
2016	Retired	0.139	0.036	Retired	69,754	112,385	Retired	4.85	2.05

[1] Derived from ozone season heat input and NOx emissions reported to the CAMD database for each year.
[2] The heat input for the ozone season day with the 99th percentile highest daily heat input.
[3] Calculated by multiplying the ozone season average emission rate by the ozone season maximum daily heat input.

Table 2.2.3. Ozone Season Maximum Daily Heat Input and NOx Emissions for Sheboygan Falls Power Plant.

Year	Ozone Season Average NOx Emission Rate – Units 1 & 2 (lbs/mmBtu) [1]	Ozone Season Maximum Daily Heat Input – Units 1 & 2 [2]	Calculated NOx Emissions – Units 1 & 2 (tpsd) [3]
2011	0.027	34,927	0.48
2012	0.026	43,423	0.57
2013	0.029	39,541	0.57
2014	0.030	35,650	0.53
2015	0.028	38,083	0.54
2016	0.028	40,479	0.56

[1] Derived from ozone season heat input and NOx emissions reported to the CAMD database for each year.
[2] The heat input for the ozone season day with the 99th percentile highest daily heat input.
[3] Calculated by multiplying the ozone season average emission rate by the ozone season maximum daily heat input.

APPENDIX 3

Point Non-EGU Emissions for 2011, 2017 and 2018

This appendix provides a list of Sheboygan County point source non-EGU tons per summer day (tpsd) emissions by facility identification number (FID) and facility name for 2011, 2017 and 2018. The sum of NOx and VOC emissions from these facilities were used for the non-EGU sector NOx and VOC tpsd emission estimates in sections 3.2 (2011 Base Year Inventory for RFP) and 3.3 (2017 & 2018 Projected Year Inventories for RFP) of the Wisconsin Department of Natural Resources (WDNR) Sheboygan County attainment plan.

Table 3.1. 2011 Point Non-EGU Emissions for Sheboygan County [1]

FID	FACILITY NAME	COUNTY	POLLUTANT	2011 (tpsd)	2011 (tons)
460006360	Sheboygan Wastewater Treatment Plant [2]	Sheboygan	NOx	8.13E-03	2.97
460008120	Pemco Inc.	Sheboygan	NOx	1.03E-03	0.38
460008230	Georgia-Pacific Corrugated Llc	Sheboygan	NOx	7.81E-03	2.85
460012740	Old Wisconsin Sausage Co Plant 2	Sheboygan	NOx	3.72E-03	1.36
460013510	Curt G. Joa, Incorporated	Sheboygan	NOx	1.10E-03	0.40
460023520	Manning Lighting, Inc.	Sheboygan	NOx	9.02E-04	0.33
460023740	Lakeshore Display Co., Inc.	Sheboygan	NOx	4.29E-04	0.16
460027810	Aldrich Chemical Company	Sheboygan	NOx	2.15E-05	0.01
460029460	Nemschoff Chairs, Inc.	Sheboygan	NOx	2.07E-04	0.08
460029570	Nemschoff Chairs Inc	Sheboygan	NOx	3.19E-03	1.16
460032760	Milk Specialties Global Adell (prev Adell Corp.)	Sheboygan	NOx	3.23E-02	11.79
460032870	Kohler Co-Metals Processing Complex	Sheboygan	NOx	6.34E-01	231.39
460033420	Johnsonville Foods	Sheboygan	NOx	2.17E-02	7.90
460034410	Bemis Mfg. Co. - Plant D	Sheboygan	NOx	3.34E-03	1.22
460034630	Bemis Mfg. Co. Plant B	Sheboygan	NOx	1.04E-02	3.78
460034740	Plastics Engineering Co N 15th St Plant	Sheboygan	NOx	4.24E-02	15.49
460034960	Austin Gray Iron Foundry	Sheboygan	NOx	4.17E-04	0.15
460035180	The Vollrath Company, Llc	Sheboygan	NOx	1.12E-02	4.10
460035730	Willman Industries	Sheboygan	NOx	5.30E-03	1.94
460036170	The Mayline Co.(Wood Plant)	Sheboygan	NOx	1.22E-03	0.45
460036280	Aurora Sheboygan Memorial Medical Center	Sheboygan	NOx	8.28E-03	3.02
460037820	Sheboygan Co Highway Commission	Sheboygan	NOx	1.77E-02	6.46
460038700	Kohler Co - Town Of Mosel Plant	Sheboygan	NOx	6.52E-02	23.80
460040460	Anr Pipeline Co.(Kewaskum Comp. Station)	Sheboygan	NOx	4.80E-02	17.52
460041230	Nemak USA Inc - Taylor Drive (prev J. L. French Corp.)	Sheboygan	NOx	2.78E-02	10.16
460041670	Hexion Inc (prev Momentive Specialty Chemicals Inc)	Sheboygan	NOx	4.32E-02	15.78
460061250	Richardson Yacht Interiors	Sheboygan	NOx	9.90E-04	0.36
460086990	Times Printing Co Inc	Sheboygan	NOx	3.46E-03	1.26
460094470	Bremer Manufacturing	Sheboygan	NOx	2.07E-03	0.75
460098760	Plymouth Foam Incorporated	Sheboygan	NOx	6.60E-03	2.41
460106570	American Excelsior	Sheboygan	NOx	4.70E-04	0.17

460119330	Bemis Wood Flour Mill	Sheboygan	NOx	2.40E-04	0.09
460141330	J.L. French Corporation, Gateway Plant	Sheboygan	NOx	1.36E-01	49.50
460141660	Lakeland College	Sheboygan	NOx	5.17E-03	1.89
460145840	The Mayline Co.(Steel Plant)	Sheboygan	NOx	1.58E-03	0.58
460147820	Kohler Company - Vitreous Plant	Sheboygan	NOx	1.84E-02	6.73
460147930	Kohler Co-Engine Plant	Sheboygan	NOx	8.10E-03	2.96
460153980	Aurora Medical System - Valley View Medical	Sheboygan	NOx	1.92E-03	0.70
999872390	Sheboygan County Highway Department	Sheboygan	NOx	7.40E-03	2.70
460008120	Pemco Inc.	Sheboygan	ROG	6.99E-03	2.55
460006360	Sheboygan Wastewater Treatment Plant [2]	Sheboygan	ROG	3.18E-03	1.16
460008230	Georgia-Pacific Corrugated Llc	Sheboygan	ROG	1.05E-02	3.82
460012740	Old Wisconsin Sausage Co Plant 2	Sheboygan	ROG	7.32E-03	2.67
460013510	Curt G. Joa, Incorporated	Sheboygan	ROG	9.15E-03	3.34
460022530	Sheboygan Paperbox Co.	Sheboygan	ROG	7.59E-02	27.71
460023520	Manning Lighting, Inc.	Sheboygan	ROG	1.22E-03	0.45
460023740	Lakeshore Display Co., Inc.	Sheboygan	ROG	4.55E-02	16.61
460027480	Kieffer & Co., Inc.	Sheboygan	ROG	5.79E-03	2.11
460027810	Aldrich Chemical Company	Sheboygan	ROG	6.52E-02	23.80
460029460	Nemschoff Chairs, Inc.	Sheboygan	ROG	3.22E-02	11.74
460029570	Nemschoff Chairs Inc	Sheboygan	ROG	3.94E-02	14.36
460032760	Milk Specialties Global Adell (prev Adell Corp.)	Sheboygan	ROG	1.98E-03	0.72
460032870	Kohler Co-Metals Processing Complex	Sheboygan	ROG	1.56E-01	56.78
460033420	Johnsonville Foods	Sheboygan	ROG	1.44E-02	5.24
460034410	Bemis Mfg. Co. - Plant D	Sheboygan	ROG	1.54E-02	5.61
460034630	Bemis Mfg. Co. Plant B	Sheboygan	ROG	4.69E-01	171.05
460034740	Plastics Engineering Co N 15th St Plant	Sheboygan	ROG	2.03E-02	7.43
460034960	Austin Gray Iron Foundry	Sheboygan	ROG	8.18E-03	2.98
460035180	The Vollrath Company, Llc	Sheboygan	ROG	6.18E-04	0.23
460035730	Willman Industries	Sheboygan	ROG	7.04E-02	25.71
460036170	The Mayline Co.(Wood Plant)	Sheboygan	ROG	1.21E-03	0.44
460036280	Aurora Sheboygan Memorial Medical Center	Sheboygan	ROG	4.54E-04	0.17
460037820	Sheboygan Co Highway Commission	Sheboygan	ROG	1.20E-03	0.44
460038700	Kohler Co - Town Of Mosel Plant	Sheboygan	ROG	2.58E-02	9.42
460038810	Sheboygan Paint Co.	Sheboygan	ROG	1.58E-01	57.50
460039470	Poly Vinyl Company Inc	Sheboygan	ROG	8.89E-03	3.24

460040460	Anr Pipeline Co.(Kewaskum Comp. Station)	Sheboygan	ROG	9.41E-04	0.34
460041230	Nemak USA Inc - Taylor Drive (prev J. L. French Corp.)	Sheboygan	ROG	1.12E-02	4.08
460041670	Hexion Inc (prev Momentive Specialty Chemicals Inc)	Sheboygan	ROG	6.27E-02	22.87
460061250	Richardson Yacht Interiors	Sheboygan	ROG	1.20E-02	4.39
460086990	Times Printing Co Inc	Sheboygan	ROG	3.36E-02	12.26
460094470	Bremer Manufacturing	Sheboygan	ROG	4.13E-05	0.02
460098760	Plymouth Foam Incorporated	Sheboygan	ROG	1.48E-01	54.17
460100080	Ajs & Associates, Inc	Sheboygan	ROG	6.57E-03	2.40
460106570	American Excelsior	Sheboygan	ROG	2.48E-02	9.07
460119330	Bemis Wood Flour Mill	Sheboygan	ROG	1.27E-05	0.00
460120760	Lakeland Sports Center	Sheboygan	ROG	5.88E-03	2.15
460130440	Saco Polymers Inc	Sheboygan	ROG	2.04E-02	7.45
460141330	Nemak Gateway Plant (prev J.L. French Corp.)	Sheboygan	ROG	4.94E-02	18.03
460141660	Lakeland College	Sheboygan	ROG	2.85E-04	0.10
460145730	Westshore Industries	Sheboygan	ROG	1.76E-02	6.43
460145840	The Mayline Co.(Steel Plant)	Sheboygan	ROG	4.74E-02	17.30
460147820	Kohler Company - Vitreous Plant	Sheboygan	ROG	1.17E-03	0.43
460147930	Kohler Co-Engine Plant	Sheboygan	ROG	6.32E-02	23.07
460148150	Universal Lithographers	Sheboygan	ROG	1.09E-02	3.99
460153980	Aurora Medical System - Valley View Medical	Sheboygan	ROG	1.05E-04	0.04
460157500	Certain Teed	Sheboygan	ROG	9.04E-03	3.30
460169600	Franzen Lithoscreen Inc.	Sheboygan	ROG	3.07E-02	11.19
999872390	Sheboygan County Highway Department	Sheboygan	ROG	6.04E-04	0.22
TOTAL		**SHEBOYGAN**	**NOx**	**1.19**	**435**
			ROG	**1.81**	**661**

[1] Tons per summer day (tpsd) emissions were calculated by dividing annual emissions by 365 days.
[2] Emissions for FID 460006360 (Sheboygan Wastewater Treatment Plant) are based on 2013 reported emissions, as that was the earliest year of reported emissions.

Table 3.2. 2017 & 2018 Point Non-EGU Emissions for Sheboygan County

FID	FACILITY NAME	NAICS	POLLUTANT	2011 (tpsd)	2017 GF [1]	2018 GF [1]	2017 (tpsd)	2018 (tpsd)
Existing Sources								
460006360	Sheboygan Wastewater Treatment Plant [2]	221320	NOx	8.13E-03	N/A	N/A	8.13E-03	8.13E-03
460008120	Pemco Inc.	33329	NOx	1.03E-03	1.05	1.05	1.08E-03	1.08E-03
460008230	Georgia-Pacific Corrugated Llc	322211	NOx	7.81E-03	0.86	0.85	6.72E-03	6.63E-03
460012740	Old Wisconsin Sausage Co Plant 2	311612	NOx	3.72E-03	1.11	1.12	4.13E-03	4.17E-03
460013510	Curt G. Joa, Incorporated	333291	NOx	1.10E-03	1.05	1.05	1.16E-03	1.16E-03
460023520	Manning Lighting, Inc.	33232	NOx	9.02E-04	1.03	1.01	9.31E-04	9.15E-04
460023740	Lakeshore Display Co., Inc.	32199	NOx	4.29E-04	1.21	1.26	5.21E-04	5.41E-04
460027810	Aldrich Chemical Company	325188	NOx	2.15E-05	1.05	1.09	2.25E-05	2.34E-05
460029460	Nemschoff Chairs, Inc.	33712	NOx	2.07E-04	N/A	N/A	Shut down	Shut down
460029570	Nemschoff Chairs Inc	337127	NOx	3.19E-03	N/A	N/A	3.19E-03	3.19E-03
460032760	Milk Specialties Global Adell (prev Adell Corp.)	311514	NOx	3.23E-02	1.11	1.12	3.59E-02	3.62E-02
460032870	Kohler Co-Metals Processing Complex	33299	NOx	6.34E-01	1.03	1.01	6.54E-01	6.43E-01
460033420	Johnsonville Foods	311612	NOx	2.17E-02	1.11	1.12	2.41E-02	2.43E-02
460034410	Bemis Mfg. Co. - Plant D	32612	NOx	3.34E-03	0.99	1.01	3.31E-03	3.39E-03
460034630	Bemis Mfg. Co. Plant B	32619	NOx	1.04E-02	0.99	1.01	1.03E-02	1.05E-02
460034740	Plastics Engineering Co N 15th St Plant	32521	NOx	4.24E-02	1.046633	1.086213	4.44E-02	4.61E-02
460034960	Austin Gray Iron Foundry	33151	NOx	4.17E-04	0.80	0.79	3.35E-04	3.31E-04
460035180	The Vollrath Company, Llc	33211	NOx	1.12E-02	1.03	1.01	1.16E-02	1.14E-02
460035730	Willman Industries	33151	NOx	5.30E-03	0.80	0.79	4.25E-03	4.20E-03
460036170	The Mayline Co.(Wood Plant)	33721	NOx	1.22E-03	N/A	N/A	1.22E-03	1.22E-03
460036280	Aurora Sheboygan Memorial Medical Center	622110	NOx	8.28E-03	1.08	1.07	8.98E-03	8.88E-03
460037820	Sheboygan Co Highway Commission	32412	NOx	1.77E-02	N/A	N/A	1.77E-02	1.77E-02
460038700	Kohler Co - Town Of Mosel Plant	33531	NOx	6.52E-02	1.43	1.47	9.32E-02	9.61E-02
460040460	Anr Pipeline Co.(Kewaskum Comp. Station)	48621	NOx	4.80E-02	N/A	N/A	4.80E-02	4.80E-02
460041230	Nemak USA Inc - Taylor Drive (prev J. L. French Corp.)	331521	NOx	2.78E-02	N/A	N/A	2.78E-02	2.78E-02
460041670	Hexion Inc (prev Momentive Specialty Chemicals Inc)	32521	NOx	4.32E-02	1.05	1.09	4.53E-02	4.70E-02

FID	FACILITY NAME	NAICS	POLLUTANT	2011 (tpsd)	2017 GF [1]	2018 GF [1]	2017 (tpsd)	2018 (tpsd)
460061250	Richardson Yacht Interiors	337122	NOx	9.90E-04	N/A	N/A	9.90E-04	9.90E-04
460086990	Times Printing Co Inc	32311	NOx	3.46E-03	0.86	0.85	2.98E-03	2.94E-03
460094470	Bremer Manufacturing	331524	NOx	2.07E-03	1.11	1.11	2.29E-03	2.29E-03
460098760	Plymouth Foam Incorporated	326140	NOx	6.60E-03	0.99	1.01	6.54E-03	6.69E-03
460106570	American Excelsior	32615	NOx	4.70E-04	0.99	1.01	4.65E-04	4.76E-04
460119330	Bemis Wood Flour Mill	32199	NOx	2.40E-04	1.21	1.26	2.91E-04	3.03E-04
460141330	J.L. French Corporation, Gateway Plant	331314	NOx	1.36E-01	1.11	1.11	1.50E-01	1.50E-01
460141660	Lakeland College	611310	NOx	5.17E-03	1.08	1.07	5.61E-03	5.55E-03
460145840	The Mayline Co.(Steel Plant)	33721	NOx	1.58E-03	N/A	N/A	1.58E-03	1.58E-03
460147820	Kohler Company - Vitreous Plant	32711	NOx	1.84E-02	N/A	N/A	1.84E-02	1.84E-02
460147930	Kohler Co-Engine Plant	333618	NOx	8.10E-03	1.05	1.05	8.48E-03	8.49E-03
460153980	Aurora Medical System - Valley View Medical	6221	NOx	1.92E-03	1.08	1.07	2.08E-03	2.06E-03
999872390	Sheboygan County Highway Department	21232	NOx	7.40E-03	1.22	1.25	9.02E-03	9.26E-03
460006360	Sheboygan Wastewater Treatment Plant [2]	221320	ROG	3.18E-03	N/A	N/A	3.18E-03	3.18E-03
460008120	Pemco Inc.	33329	ROG	6.99E-03	1.05	1.05	7.32E-03	7.33E-03
460008230	Georgia-Pacific Corrugated Llc	322211	ROG	1.05E-02	0.86	0.85	9.01E-03	8.89E-03
460012740	Old Wisconsin Sausage Co Plant 2	311612	ROG	7.32E-03	1.11	1.12	8.13E-03	8.21E-03
460013510	Curt G. Joa, Incorporated	333291	ROG	9.15E-03	1.05	1.05	9.59E-03	9.59E-03
460022530	Sheboygan Paperbox Co.	32221	ROG	7.59E-02	0.86	0.85	6.54E-02	6.45E-02
460023520	Manning Lighting, Inc.	33232	ROG	1.22E-03	1.03	1.01	1.26E-03	1.24E-03
460023740	Lakeshore Display Co., Inc.	32199	ROG	4.55E-02	1.21	1.26	5.52E-02	5.74E-02
460027480	Kieffer & Co., Inc.	33995	ROG	5.79E-03	N/A	N/A	5.79E-03	5.79E-03
460027810	Aldrich Chemical Company	325188	ROG	6.52E-02	1.05	1.09	6.82E-02	7.08E-02
460029460	Nemschoff Chairs, Inc.	33712	ROG	3.22E-02	N/A	N/A	Shut down	Shut down
460029570	Nemschoff Chairs Inc	337127	ROG	3.94E-02	N/A	N/A	3.94E-02	3.94E-02
460032760	Milk Specialties Global Adell (prev Adell Corp.)	311514	ROG	1.98E-03	1.11	1.12	2.20E-03	2.22E-03
460032870	Kohler Co-Metals Processing Complex	33299	ROG	1.56E-01	1.03	1.01	1.61E-01	1.58E-01
460033420	Johnsonville Foods	311612	ROG	1.44E-02	1.11	1.12	1.60E-02	1.61E-02
460034410	Bemis Mfg. Co. - Plant D	32612	ROG	1.54E-02	0.99	1.01	1.52E-02	1.56E-02
460034630	Bemis Mfg. Co. Plant B	32619	ROG	4.69E-01	0.99	1.01	4.64E-01	4.75E-01
460034740	Plastics Engineering Co N 15th St Plant	32521	ROG	2.03E-02	1.05	1.09	2.13E-02	2.21E-02
460034960	Austin Gray Iron Foundry	33151	ROG	8.18E-03	0.80	0.79	6.56E-03	6.48E-03

FID	FACILITY NAME	NAICS	POLLUTANT	2011 (tpsd)	2017 GF [1]	2018 GF [1]	2017 (tpsd)	2018 (tpsd)
460035180	The Vollrath Company, Llc	33211	ROG	6.18E-04	1.03	1.01	6.38E-04	6.27E-04
460035730	Willman Industries	33151	ROG	7.04E-02	0.80	0.79	5.65E-02	5.58E-02
460036170	The Mayline Co.(Wood Plant)	33721	ROG	1.21E-03	N/A	N/A	1.21E-03	1.21E-03
460036280	Aurora Sheboygan Memorial Medical Center	622110	ROG	4.54E-04	1.08	1.07	4.92E-04	4.87E-04
460037820	Sheboygan Co Highway Commission	32412	ROG	1.20E-03	N/A	N/A	1.20E-03	1.20E-03
460038700	Kohler Co - Town Of Mosel Plant	33531	ROG	2.58E-02	1.43	1.47	3.69E-02	3.80E-02
460038810	Sheboygan Paint Co.	32551	ROG	1.58E-01	1.05	1.09	1.65E-01	1.71E-01
460039470	Poly Vinyl Company Inc	32612	ROG	8.89E-03	0.99	1.01	8.80E-03	9.01E-03
460040460	Anr Pipeline Co.(Kewaskum Comp. Station)	48621	ROG	9.41E-04	N/A	N/A	9.41E-04	9.41E-04
460041230	Nemak USA Inc - Taylor Drive (prev J. L. French Corp.)	331521	ROG	1.12E-02	N/A	N/A	1.12E-02	1.12E-02
460041670	Hexion Inc (prev Momentive Specialty Chemicals Inc)	32521	ROG	6.27E-02	1.05	1.09	6.56E-02	6.81E-02
460061250	Richardson Yacht Interiors	337122	ROG	1.20E-02	N/A	N/A	1.20E-02	1.20E-02
460086990	Times Printing Co Inc	32311	ROG	3.36E-02	0.86	0.85	2.89E-02	2.85E-02
460094470	Bremer Manufacturing	331524	ROG	4.13E-05	1.11	1.11	4.57E-05	4.58E-05
460098760	Plymouth Foam Incorporated	326140	ROG	1.48E-01	0.99	1.01	1.47E-01	1.50E-01
460100080	Ajs & Associates, Inc	32192	ROG	6.57E-03	1.21	1.26	7.97E-03	8.29E-03
460106570	American Excelsior	32615	ROG	2.48E-02	0.99	1.01	2.46E-02	2.52E-02
460119330	Bemis Wood Flour Mill	32199	ROG	1.27E-05	1.21	1.26	1.54E-05	1.61E-05
460120760	Lakeland Sports Center	33639	ROG	5.88E-03	1.18	1.18	6.96E-03	6.92E-03
460130440	Saco Polymers Inc	325991	ROG	2.04E-02	1.05	1.09	2.14E-02	2.22E-02
460141330	Nemak Gateway Plant (prev J.L. French Corp.)	331314	ROG	4.94E-02	1.11	1.11	5.46E-02	5.47E-02
460141660	Lakeland College	611310	ROG	2.85E-04	1.08	1.07	3.08E-04	3.05E-04
460145730	Westshore Industries	33712	ROG	1.76E-02	N/A	N/A	Shut down	Shut down
460145840	The Mayline Co.(Steel Plant)	33721	ROG	4.74E-02	N/A	N/A	4.74E-02	4.74E-02
460147820	Kohler Company - Vitreous Plant	32711	ROG	1.17E-03	N/A	N/A	1.17E-03	1.17E-03
460147930	Kohler Co-Engine Plant	333618	ROG	6.32E-02	1.05	1.05	6.62E-02	6.63E-02
460148150	Universal Lithographers	32311	ROG	1.09E-02	0.86	0.85	9.40E-03	9.28E-03
460153980	Aurora Medical System - Valley View Medical	6221	ROG	1.05E-04	1.08	1.07	1.14E-04	1.13E-04
460157500	Certain Teed	32799	ROG	9.04E-03	N/A	N/A	9.04E-03	9.04E-03
460169600	Franzen Lithoscreen Inc.	32311	ROG	3.07E-02	0.86	0.85	2.64E-02	2.60E-02
999872390	Sheboygan County Highway Department	21232	ROG	6.04E-04	1.22	1.25	7.36E-04	7.56E-04

FID	FACILITY NAME	NAICS	POLLUTANT	2011 (tpsd)	2017 GF [1]	2018 GF [1]	2017 (tpsd)	2018 (tpsd)
Sub-total – Existing Sources			**NOx**	**1.191**	**---**	**---**	**1.265**	**1.261**
			ROG	**1.810**	**---**	**---**	**1.771**	**1.798**
New & Modified Sources [3]								
N/A	N/A	N/A	NOx	N/A	N/A	N/A	**0.137**	**0.137**
N/A	N/A	N/A	VOC	N/A	N/A	N/A	**0.342**	**0.342**
TOTAL (Existing + New/Modified Sources)			**NOx**	**1.19**	**---**	**---**	**1.40**	**1.40**
			VOC	**1.81**	**---**	**---**	**2.11**	**2.14**

[1] GF = Growth factor (see Appendix 7 for how the growth factors were derived).
[2] Emissions for FID 460006360 (Sheboygan Wastewater Treatment Plant) are based on 2013 reported emissions, as that was the earliest year of reported emissions.
[3] See Appendix 7 for how projected emissions were derived for new and modified sources.

APPENDIX 4

Area Source Emissions for 2011, 2017 and 2018

This appendix provides a list of Sheboygan County area source tons per summer day (tpsd) emissions by source classification code (SCC) for 2011, 2017 and 2018. The sum of NOx and VOC emissions from the different SCCs were used for the area source sector NOx and VOC tpsd emission estimates in sections 3.2 (2011 Base Year Inventory for RFP) and 3.3 (2017 & 2018 Projected Year Inventories for RFP) of the Wisconsin Department of Natural Resources (WDNR) Sheboygan County attainment plan.

Table 4.1. Area Source 2011 and Projected 2017 and 2018 Emissions for Sheboygan County

FIPS	SCC	POLLUTANT	2011 (tpsd)	2017 (tpsd)	2025 (tpsd)	2018 est (tpsd)
55117	2102002000	NOx	0.00E+00	0.00E+00	0.00E+00	0.00E+00
55117	2102004001	NOx	2.22E-03	1.50E-03	1.53E-03	1.51E-03
55117	2102004002	NOx	1.24E-02	1.37E-02	1.39E-02	1.37E-02
55117	2102005000	NOx	1.29E-03	2.94E-04	2.86E-04	2.93E-04
55117	2102006000	NOx	1.34E-01	1.53E-01	1.57E-01	1.54E-01
55117	2102007000	NOx	3.52E-04	3.97E-04	4.24E-04	4.01E-04
55117	2102008000	NOx	0.00E+00	0.00E+00	0.00E+00	0.00E+00
55117	2102011000	NOx	1.06E-04	1.17E-04	1.20E-04	1.18E-04
55117	2103002000	NOx	1.51E-02	4.20E-03	4.19E-03	4.20E-03
55117	2103004001	NOx	8.01E-03	4.70E-03	4.68E-03	4.70E-03
55117	2103004002	NOx	2.71E-01	2.60E-01	2.59E-01	2.60E-01
55117	2103005000	NOx	0.00E+00	0.00E+00	0.00E+00	0.00E+00
55117	2103006000	NOx	1.91E-01	1.84E-01	1.84E-01	1.84E-01
55117	2103007000	NOx	1.56E-02	1.56E-02	1.56E-02	1.56E-02
55117	2103008000	NOx	1.27E-04	1.59E-04	1.59E-04	1.59E-04
55117	2103011000	NOx	3.04E-08	3.04E-08	3.04E-08	3.04E-08
55117	2104004000	NOx	2.00E-02	2.00E-02	2.00E-02	2.00E-02
55117	2104006000	NOx	4.03E-01	4.03E-01	4.03E-01	4.03E-01
55117	2104007000	NOx	8.09E-02	8.09E-02	8.09E-02	8.09E-02
55117	2104008100	NOx	1.29E-02	1.37E-02	1.31E-02	1.37E-02
55117	2104008210	NOx	8.64E-03	7.81E-03	7.42E-03	7.76E-03
55117	2104008220	NOx	2.98E-03	3.49E-03	3.32E-03	3.47E-03
55117	2104008230	NOx	8.41E-04	9.85E-04	9.36E-04	9.79E-04
55117	2104008310	NOx	3.79E-02	3.53E-02	3.36E-02	3.51E-02
55117	2104008320	NOx	9.75E-03	1.14E-02	1.09E-02	1.14E-02
55117	2104008330	NOx	9.47E-03	1.11E-02	1.05E-02	1.10E-02
55117	2104008400	NOx	3.76E-03	5.83E-03	5.55E-03	5.80E-03

FIPS	SCC	POLLUTANT	2011 (tpsd)	2017 (tpsd)	2025 (tpsd)	2018 est (tpsd)
55117	2104008510	NOx	1.07E-02	7.98E-03	7.59E-03	7.93E-03
55117	2104008610	NOx	3.38E-03	3.59E-03	3.41E-03	3.57E-03
55117	2104008700	NOx	2.17E-02	2.30E-02	2.19E-02	2.29E-02
55117	2104009000	NOx	2.61E-04	2.77E-04	3.00E-04	2.80E-04
55117	2104011000	NOx	4.12E-04	4.12E-04	4.12E-04	4.12E-04
55117	2610000100	NOx	6.30E-04	6.30E-04	6.30E-04	6.30E-04
55117	2610000400	NOx	5.08E-04	5.08E-04	5.08E-04	5.08E-04
55117	2610000500	NOx	1.60E-02	1.60E-02	1.60E-02	1.60E-02
55117	2610030000	NOx	2.67E-02	2.67E-02	2.67E-02	2.67E-02
55117	2810060100	NOx	1.03E-03	1.03E-03	1.03E-03	1.03E-03
55117	2102002000	VOC	0.00E+00	0.00E+00	0.00E+00	0.00E+00
55117	2102004001	VOC	2.22E-05	2.46E-08	2.50E-08	2.46E-08
55117	2102005000	VOC	6.56E-06	3.48E-09	3.39E-09	3.47E-09
55117	2102006000	VOC	7.36E-03	8.48E-03	8.77E-03	8.51E-03
55117	2102007000	VOC	1.29E-05	1.45E-05	1.55E-05	1.46E-05
55117	2102008000	VOC	0.00E+00	0.00E+00	0.00E+00	0.00E+00
55117	2102011000	VOC	1.05E-06	1.15E-06	1.18E-06	1.16E-06
55117	2103002000	VOC	6.85E-05	4.85E-05	4.84E-05	4.85E-05
55117	2103004001	VOC	1.36E-04	1.30E-07	1.30E-07	1.30E-07
55117	2103005000	VOC	0.00E+00	0.00E+00	0.00E+00	0.00E+00
55117	2103006000	VOC	1.05E-02	1.00E-02	1.02E-02	1.00E-02
55117	2103007000	VOC	5.70E-04	5.70E-04	5.70E-04	5.70E-04
55117	2103008000	VOC	9.83E-06	1.23E-05	1.23E-05	1.23E-05
55117	2103011000	VOC	5.20E-10	5.20E-10	5.20E-10	5.20E-10
55117	2104004000	VOC	7.77E-04	7.77E-04	7.77E-04	7.77E-04
55117	2104006000	VOC	2.36E-02	2.36E-02	2.36E-02	2.36E-02
55117	2104007000	VOC	2.97E-03	2.97E-03	2.97E-03	2.97E-03
55117	2104008100	VOC	9.40E-02	9.98E-02	9.12E-02	9.88E-02
55117	2104008210	VOC	1.64E-01	1.48E-01	1.35E-01	1.46E-01

FIPS	SCC	POLLUTANT	2011 (tpsd)	2017 (tpsd)	2025 (tpsd)	2018 est (tpsd)
55117	2104008220	VOC	1.57E-02	1.84E-02	1.68E-02	1.82E-02
55117	2104008230	VOC	6.31E-03	7.39E-03	6.74E-03	7.31E-03
55117	2104008310	VOC	7.18E-01	6.75E-01	6.16E-01	6.67E-01
55117	2104008320	VOC	5.13E-02	6.01E-02	5.49E-02	5.95E-02
55117	2104008330	VOC	7.10E-02	8.31E-02	7.59E-02	8.22E-02
55117	2104008400	VOC	4.06E-05	6.29E-05	5.75E-05	6.23E-05
55117	2104008510	VOC	6.86E-02	5.11E-02	4.66E-02	5.05E-02
55117	2104008610	VOC	1.24E-01	1.31E-01	1.20E-01	1.30E-01
55117	2104008700	VOC	1.58E-01	1.67E-01	1.53E-01	1.66E-01
55117	2104009000	VOC	1.34E-03	1.43E-03	1.54E-03	1.44E-03
55117	2104011000	VOC	1.60E-05	1.60E-05	1.60E-05	1.60E-05
55117	2302002100	VOC	2.49E-03	2.49E-03	2.49E-03	2.49E-03
55117	2302002200	VOC	6.84E-03	6.84E-03	6.84E-03	6.84E-03
55117	2302003000	VOC	1.18E-03	1.18E-03	1.18E-03	1.18E-03
55117	2302003100	VOC	9.18E-04	9.18E-04	9.18E-04	9.18E-04
55117	2302003200	VOC	2.96E-05	2.96E-05	2.96E-05	2.96E-05
55117	2401001000	VOC	3.70E-01	3.70E-01	3.70E-01	3.70E-01
55117	2401005000	VOC	9.78E-02	9.78E-02	9.78E-02	9.78E-02
55117	2401008000	VOC	6.24E-04	6.24E-04	6.24E-04	6.24E-04
55117	2401015000	VOC	1.11E-02	1.11E-02	1.11E-02	1.11E-02
55117	2401025000	VOC	4.76E-01	4.76E-01	4.76E-01	4.76E-01
55117	2401065000	VOC	2.70E-03	2.70E-03	2.70E-03	2.70E-03
55117	2401070000	VOC	1.66E-02	1.66E-02	1.66E-02	1.66E-02
55117	2401075000	VOC	1.34E-04	1.34E-04	1.34E-04	1.34E-04
55117	2401090000	VOC	8.08E-02	8.08E-02	8.08E-02	8.08E-02
55117	2401100000	VOC	9.54E-02	9.54E-02	9.54E-02	9.54E-02
55117	2401200000	VOC	1.01E-02	1.01E-02	1.01E-02	1.01E-02
55117	2415000000	VOC	4.29E-01	4.29E-01	4.29E-01	4.29E-01
55117	2420000000	VOC	3.23E-07	3.23E-07	3.23E-07	3.23E-07

FIPS	SCC	POLLUTANT	2011 (tpsd)	2017 (tpsd)	2025 (tpsd)	2018 est (tpsd)
55117	2425000000	VOC	1.05E-01	1.05E-01	1.05E-01	1.05E-01
55117	2460100000	VOC	3.01E-01	3.01E-01	3.01E-01	3.01E-01
55117	2460200000	VOC	2.85E-01	2.85E-01	2.85E-01	2.85E-01
55117	2460400000	VOC	2.15E-01	2.15E-01	2.15E-01	2.15E-01
55117	2460500000	VOC	1.50E-01	1.50E-01	1.50E-01	1.50E-01
55117	2460600000	VOC	9.02E-02	9.02E-02	9.02E-02	9.02E-02
55117	2460800000	VOC	2.82E-01	2.82E-01	2.82E-01	2.82E-01
55117	2460900000	VOC	1.11E-02	1.11E-02	1.11E-02	1.11E-02
55117	2461021000	VOC	1.12E-01	1.12E-01	1.12E-01	1.12E-01
55117	2461022000	VOC	2.70E-02	2.70E-02	2.70E-02	2.70E-02
55117	2461850000	VOC	2.22E-01	2.18E-01	2.19E-01	2.18E-01
55117	2501011011	VOC	7.01E-03	8.19E-03	9.76E-03	8.39E-03
55117	2501011012	VOC	7.87E-03	9.19E-03	1.10E-02	9.41E-03
55117	2501011013	VOC	0.00E+00	0.00E+00	0.00E+00	0.00E+00
55117	2501011014	VOC	1.46E-03	1.71E-03	2.04E-03	1.75E-03
55117	2501011015	VOC	0.00E+00	0.00E+00	0.00E+00	0.00E+00
55117	2501012011	VOC	3.23E-04	3.58E-04	4.04E-04	3.64E-04
55117	2501012012	VOC	2.65E-04	2.93E-04	3.31E-04	2.98E-04
55117	2501012013	VOC	0.00E+00	0.00E+00	0.00E+00	0.00E+00
55117	2501012014	VOC	4.45E-03	4.93E-03	5.56E-03	5.01E-03
55117	2501012015	VOC	0.00E+00	0.00E+00	0.00E+00	0.00E+00
55117	2501050120	VOC	4.88E-01	4.85E-01	3.98E-01	4.74E-01
55117	2501055120	VOC	1.53E-01	1.47E-01	1.20E-01	1.44E-01
55117	2501060051	VOC	0.00E+00	0.00E+00	0.00E+00	0.00E+00
55117	2501060052	VOC	0.00E+00	0.00E+00	0.00E+00	0.00E+00
55117	2501060053	VOC	5.84E-02	5.60E-02	4.59E-02	5.47E-02
55117	2501060100	VOC	1.59E-01	1.63E-01	1.45E-01	1.45E-01
55117	2501060201	VOC	6.70E-02	6.42E-02	5.27E-02	6.27E-02
55117	2501080050	VOC	4.37E-02	4.37E-02	4.37E-02	4.37E-02

FIPS	SCC	POLLUTANT	2011 (tpsd)	2017 (tpsd)	2025 (tpsd)	2018 est (tpsd)
55117	2501080100	VOC	2.27E-03	2.27E-03	2.27E-03	2.27E-03
55117	2505030120	VOC	4.38E-03	4.20E-03	3.44E-03	4.10E-03
55117	2505040120	VOC	1.67E-01	1.66E-01	1.36E-01	1.63E-01
55117	2610000100	VOC	2.85E-03	2.85E-03	2.85E-03	2.85E-03
55117	2610000400	VOC	1.93E-03	1.93E-03	1.93E-03	1.93E-03
55117	2610000500	VOC	3.71E-02	3.71E-02	3.71E-02	3.71E-02
55117	2610030000	VOC	3.80E-02	3.80E-02	3.80E-02	3.80E-02
55117	2630020000	VOC	5.95E-03	5.95E-03	5.95E-03	5.95E-03
55117	2801500000	VOC	0.00E+00	0.00E+00	1.57E-06	1.96E-07
55117	2810060100	VOC	3.60E-06	3.60E-06	3.60E-06	3.60E-06
Total		**NOx**	**1.32**	**1.31**	**1.31**	**1.31**
		VOC	**6.17**	**6.13**	**5.82**	**6.07**

*Values marked in red font indicate WDNR staff estimates.

APPENDIX 5

Onroad Emissions and Activity Data for 2011, 2017 and 2018

This appendix provides detailed listings of the estimated onroad daily emissions and activity data for Sheboygan County for 2011, 2017 and 2018. The sum of NOx and VOC emissions from the different onroad source types were used for the onroad sector NOx and VOC tons per summer day (tpsd) emission estimates in sections 3.2 (2011 Base Year Inventory for RFP) and 3.3 (2017 & 2018 Projected Year Inventories for RFP) of the Wisconsin Department of Natural Resources (WDNR) Sheboygan County attainment plan.

Table 5.1

2011 Onroad NO_X and VOC Emissions: tons per summer weekday (tpswd)
Sheboygan County

Source Type	Fuel Type	Road Type	Sheboygan County – Year 2011			
			NO_x Emissions (tpswd)	VOC Emissions (tpswd)		
			Total	Exhaust	Evaporative	Total
Motorcycle	Gasoline	Off-Network	0.0001	0.0005	0.0368	0.0373
Motorcycle	Gasoline	Rural Restricted	0.0029	0.0028	0.0012	0.0040
Motorcycle	Gasoline	Rural Unrestricted	0.0067	0.0085	0.0049	0.0134
Motorcycle	Gasoline	Urban Restricted	0.0026	0.0027	0.0012	0.0039
Motorcycle	Gasoline	Urban Unrestricted	0.0021	0.0031	0.0019	0.0050
Passenger Car	Gasoline	Off-Network	0.2951	0.3215	0.4009	0.7224
Passenger Car	Gasoline	Rural Restricted	0.1715	0.0337	0.0118	0.0455
Passenger Car	Gasoline	Rural Unrestricted	0.3027	0.0703	0.0361	0.1063
Passenger Car	Gasoline	Urban Restricted	0.1778	0.0368	0.0145	0.0513
Passenger Car	Gasoline	Urban Unrestricted	0.1391	0.0346	0.0186	0.0533
Passenger Car	Diesel	Off-Network	0.0012	0.0026	0.0000	0.0026
Passenger Car	Diesel	Rural Restricted	0.0007	0.0003	0.0000	0.0003
Passenger Car	Diesel	Rural Unrestricted	0.0013	0.0008	0.0000	0.0008
Passenger Car	Diesel	Urban Restricted	0.0007	0.0004	0.0000	0.0004
Passenger Car	Diesel	Urban Unrestricted	0.0006	0.0004	0.0000	0.0004
Passenger Car	Ethanol (E-85)	Off-Network	0.0000	0.0000	0.0000	0.0000
Passenger Car	Ethanol (E-85)	Rural Restricted	0.0000	0.0000	0.0000	0.0000
Passenger Car	Ethanol (E-85)	Rural Unrestricted	0.0000	0.0000	0.0000	0.0000
Passenger Car	Ethanol (E-85)	Urban Restricted	0.0000	0.0000	0.0000	0.0000
Passenger Car	Ethanol (E-85)	Urban Unrestricted	0.0000	0.0000	0.0000	0.0000
Passenger Truck	Gasoline	Off-Network	0.3061	0.3592	0.1743	0.5336
Passenger Truck	Gasoline	Rural Restricted	0.2117	0.0388	0.0055	0.0443
Passenger Truck	Gasoline	Rural Unrestricted	0.3997	0.0882	0.0193	0.1075
Passenger Truck	Gasoline	Urban Restricted	0.1939	0.0372	0.0061	0.0433
Passenger Truck	Gasoline	Urban Unrestricted	0.1467	0.0351	0.0081	0.0431
Passenger Truck	Diesel	Off-Network	0.0044	0.0033	0.0000	0.0033
Passenger Truck	Diesel	Rural Restricted	0.0088	0.0016	0.0000	0.0016
Passenger Truck	Diesel	Rural Unrestricted	0.0215	0.0045	0.0000	0.0045
Passenger Truck	Diesel	Urban Restricted	0.0086	0.0017	0.0000	0.0017
Passenger Truck	Diesel	Urban Unrestricted	0.0083	0.0018	0.0000	0.0018
Passenger Truck	Ethanol (E-85)	Off-Network	0.0000	0.0000	0.0000	0.0001
Passenger Truck	Ethanol (E-85)	Rural Restricted	0.0000	0.0000	0.0000	0.0000
Passenger Truck	Ethanol (E-85)	Rural Unrestricted	0.0000	0.0000	0.0000	0.0000
Passenger Truck	Ethanol (E-85)	Urban Restricted	0.0000	0.0000	0.0000	0.0000
Passenger Truck	Ethanol (E-85)	Urban Unrestricted	0.0000	0.0000	0.0000	0.0000
Light Commercial Truck	Gasoline	Off-Network	0.1064	0.1261	0.0671	0.1932
Light Commercial Truck	Gasoline	Rural Restricted	0.0681	0.0143	0.0024	0.0168
Light Commercial Truck	Gasoline	Rural Unrestricted	0.1354	0.0371	0.0084	0.0455
Light Commercial Truck	Gasoline	Urban Restricted	0.0627	0.0142	0.0027	0.0169
Light Commercial Truck	Gasoline	Urban Unrestricted	0.0494	0.0150	0.0035	0.0185
Light Commercial Truck	Diesel	Off-Network	0.0040	0.0034	0.0000	0.0034
Light Commercial Truck	Diesel	Rural Restricted	0.0078	0.0016	0.0000	0.0016
Light Commercial Truck	Diesel	Rural Unrestricted	0.0193	0.0046	0.0000	0.0046
Light Commercial Truck	Diesel	Urban Restricted	0.0075	0.0017	0.0000	0.0017
Light Commercial Truck	Diesel	Urban Unrestricted	0.0074	0.0018	0.0000	0.0018
Light Commercial Truck	Ethanol (E-85)	Off-Network	0.0000	0.0000	0.0000	0.0000

Source Type	Fuel Type	Road Type	Sheboygan County – Year 2011			
			NO_x Emissions (tpswd)	VOC Emissions (tpswd)		
			Total	Exhaust	Evaporative	**Total**
Light Commercial Truck	Ethanol (E-85)	Rural Restricted	0.0000	0.0000	0.0000	0.0000
Light Commercial Truck	Ethanol (E-85)	Rural Unrestricted	0.0000	0.0000	0.0000	0.0000
Light Commercial Truck	Ethanol (E-85)	Urban Restricted	0.0000	0.0000	0.0000	0.0000
Light Commercial Truck	Ethanol (E-85)	Urban Unrestricted	0.0000	0.0000	0.0000	0.0000
Intercity Bus	Diesel	Off-Network	0.0000	0.0000	0.0000	0.0000
Intercity Bus	Diesel	Rural Restricted	0.0034	0.0002	0.0000	0.0002
Intercity Bus	Diesel	Rural Unrestricted	0.0058	0.0004	0.0000	0.0004
Intercity Bus	Diesel	Urban Restricted	0.0041	0.0003	0.0000	0.0003
Intercity Bus	Diesel	Urban Unrestricted	0.0030	0.0002	0.0000	0.0002
Transit Bus	Gasoline	Off-Network	0.0000	0.0000	0.0000	0.0000
Transit Bus	Gasoline	Rural Restricted	0.0000	0.0000	0.0000	0.0000
Transit Bus	Gasoline	Rural Unrestricted	0.0000	0.0000	0.0000	0.0000
Transit Bus	Gasoline	Urban Restricted	0.0000	0.0000	0.0000	0.0000
Transit Bus	Gasoline	Urban Unrestricted	0.0000	0.0000	0.0000	0.0000
Transit Bus	Diesel	Off-Network	0.0000	0.0000	0.0000	0.0000
Transit Bus	Diesel	Rural Restricted	0.0061	0.0004	0.0000	0.0004
Transit Bus	Diesel	Rural Unrestricted	0.0080	0.0006	0.0000	0.0006
Transit Bus	Diesel	Urban Restricted	0.0074	0.0005	0.0000	0.0005
Transit Bus	Diesel	Urban Unrestricted	0.0041	0.0003	0.0000	0.0003
Transit Bus	CNG	Off-Network	0.0000	0.0000	0.0000	0.0000
Transit Bus	CNG	Rural Restricted	0.0005	0.0001	0.0000	0.0001
Transit Bus	CNG	Rural Unrestricted	0.0006	0.0001	0.0000	0.0001
Transit Bus	CNG	Urban Restricted	0.0006	0.0001	0.0000	0.0001
Transit Bus	CNG	Urban Unrestricted	0.0003	0.0001	0.0000	0.0001
School Bus	Gasoline	Off-Network	0.0001	0.0001	0.0000	0.0001
School Bus	Gasoline	Rural Restricted	0.0001	0.0000	0.0000	0.0000
School Bus	Gasoline	Rural Unrestricted	0.0001	0.0001	0.0000	0.0001
School Bus	Gasoline	Urban Restricted	0.0001	0.0000	0.0000	0.0000
School Bus	Gasoline	Urban Unrestricted	0.0001	0.0000	0.0000	0.0000
School Bus	Diesel	Off-Network	0.0000	0.0000	0.0000	0.0000
School Bus	Diesel	Rural Restricted	0.0081	0.0009	0.0000	0.0009
School Bus	Diesel	Rural Unrestricted	0.0109	0.0018	0.0000	0.0018
School Bus	Diesel	Urban Restricted	0.0098	0.0013	0.0000	0.0013
School Bus	Diesel	Urban Unrestricted	0.0057	0.0010	0.0000	0.0010
Refuse Truck	Gasoline	Off-Network	0.0001	0.0001	0.0000	0.0001
Refuse Truck	Gasoline	Rural Restricted	0.0003	0.0001	0.0000	0.0001
Refuse Truck	Gasoline	Rural Unrestricted	0.0003	0.0001	0.0000	0.0001
Refuse Truck	Gasoline	Urban Restricted	0.0002	0.0001	0.0000	0.0001
Refuse Truck	Gasoline	Urban Unrestricted	0.0001	0.0000	0.0000	0.0000
Refuse Truck	Diesel	Off-Network	0.0000	0.0000	0.0000	0.0000
Refuse Truck	Diesel	Rural Restricted	0.0132	0.0006	0.0000	0.0006
Refuse Truck	Diesel	Rural Unrestricted	0.0129	0.0008	0.0000	0.0008
Refuse Truck	Diesel	Urban Restricted	0.0107	0.0006	0.0000	0.0006
Refuse Truck	Diesel	Urban Unrestricted	0.0046	0.0003	0.0000	0.0003
Single Unit Short-haul Truck	Gasoline	Off-Network	0.0142	0.0138	0.0110	0.0248
Single Unit Short-haul Truck	Gasoline	Rural Restricted	0.0157	0.0027	0.0003	0.0030
Single Unit Short-haul Truck	Gasoline	Rural Unrestricted	0.0235	0.0059	0.0006	0.0065
Single Unit Short-haul Truck	Gasoline	Urban Restricted	0.0191	0.0037	0.0003	0.0040
Single Unit Short-haul Truck	Gasoline	Urban Unrestricted	0.0102	0.0030	0.0003	0.0033
Single Unit Short-haul Truck	Diesel	Off-Network	0.0038	0.0003	0.0000	0.0003
Single Unit Short-haul Truck	Diesel	Rural Restricted	0.0618	0.0077	0.0000	0.0077
Single Unit Short-haul Truck	Diesel	Rural Unrestricted	0.1041	0.0170	0.0000	0.0170
Single Unit Short-haul Truck	Diesel	Urban Restricted	0.0734	0.0100	0.0000	0.0100
Single Unit Short-haul Truck	Diesel	Urban Unrestricted	0.0489	0.0080	0.0000	0.0080

Source Type	Fuel Type	Road Type	Sheboygan County – Year 2011			
			NO_x Emissions (tpswd)	VOC Emissions (tpswd)		
			Total	Exhaust	Evaporative	**Total**
Single Unit Long-haul Truck	Gasoline	Off-Network	0.0004	0.0004	0.0003	0.0008
Single Unit Long-haul Truck	Gasoline	Rural Restricted	0.0006	0.0001	0.0000	0.0001
Single Unit Long-haul Truck	Gasoline	Rural Unrestricted	0.0010	0.0003	0.0000	0.0003
Single Unit Long-haul Truck	Gasoline	Urban Restricted	0.0008	0.0002	0.0000	0.0002
Single Unit Long-haul Truck	Gasoline	Urban Unrestricted	0.0004	0.0001	0.0000	0.0002
Single Unit Long-haul Truck	Diesel	Off-Network	0.0001	0.0000	0.0000	0.0000
Single Unit Long-haul Truck	Diesel	Rural Restricted	0.0036	0.0005	0.0000	0.0005
Single Unit Long-haul Truck	Diesel	Rural Unrestricted	0.0062	0.0012	0.0000	0.0012
Single Unit Long-haul Truck	Diesel	Urban Restricted	0.0044	0.0007	0.0000	0.0007
Single Unit Long-haul Truck	Diesel	Urban Unrestricted	0.0029	0.0005	0.0000	0.0005
Motor Home	Gasoline	Off-Network	0.0008	0.0011	0.0031	0.0042
Motor Home	Gasoline	Rural Restricted	0.0013	0.0003	0.0000	0.0003
Motor Home	Gasoline	Rural Unrestricted	0.0024	0.0007	0.0001	0.0008
Motor Home	Gasoline	Urban Restricted	0.0020	0.0005	0.0001	0.0005
Motor Home	Gasoline	Urban Unrestricted	0.0012	0.0004	0.0001	0.0005
Motor Home	Diesel	Off-Network	0.0001	0.0000	0.0000	0.0000
Motor Home	Diesel	Rural Restricted	0.0011	0.0001	0.0000	0.0001
Motor Home	Diesel	Rural Unrestricted	0.0021	0.0004	0.0000	0.0004
Motor Home	Diesel	Urban Restricted	0.0015	0.0002	0.0000	0.0002
Motor Home	Diesel	Urban Unrestricted	0.0011	0.0002	0.0000	0.0002
Combination Short-haul Truck	Gasoline	Off-Network	0.0000	0.0000	0.0000	0.0000
Combination Short-haul Truck	Gasoline	Rural Restricted	0.0000	0.0000	0.0000	0.0000
Combination Short-haul Truck	Gasoline	Rural Unrestricted	0.0000	0.0000	0.0000	0.0000
Combination Short-haul Truck	Gasoline	Urban Restricted	0.0000	0.0000	0.0000	0.0000
Combination Short-haul Truck	Gasoline	Urban Unrestricted	0.0000	0.0000	0.0000	0.0000
Combination Short-haul Truck	Diesel	Off-Network	0.0000	0.0001	0.0000	0.0001
Combination Short-haul Truck	Diesel	Rural Restricted	0.1265	0.0057	0.0000	0.0057
Combination Short-haul Truck	Diesel	Rural Unrestricted	0.1247	0.0077	0.0000	0.0077
Combination Short-haul Truck	Diesel	Urban Restricted	0.1026	0.0054	0.0000	0.0054
Combination Short-haul Truck	Diesel	Urban Unrestricted	0.0439	0.0028	0.0000	0.0028
Combination Long-haul Truck	Diesel	Off-Network	0.4255	0.1100	0.0000	0.1100
Combination Long-haul Truck	Diesel	Rural Restricted	0.3663	0.0169	0.0000	0.0169
Combination Long-haul Truck	Diesel	Rural Unrestricted	0.3553	0.0215	0.0000	0.0215
Combination Long-haul Truck	Diesel	Urban Restricted	0.2938	0.0152	0.0000	0.0152
Combination Long-haul Truck	Diesel	Urban Unrestricted	0.1217	0.0076	0.0000	0.0076
ALL (Total)	**ALL (Total)**	**ALL (Total)**	**5.3736**	**1.5943**	**0.8417**	**2.4360**
Motorcycle	ALL	ALL	0.0144	0.0177	0.0460	0.0637
Passenger Car	ALL	ALL	1.0909	0.5014	0.4819	0.9834
Passenger Truck	ALL	ALL	1.3098	0.5714	0.2132	0.7846
Light Commercial Truck	ALL	ALL	0.4679	0.2199	0.0841	0.3040
Intercity Bus	ALL	ALL	0.0164	0.0011	0.0000	0.0011
Transit Bus	ALL	ALL	0.0278	0.0021	0.0000	0.0021
School Bus	ALL	ALL	0.0350	0.0051	0.0001	0.0051
Refuse Truck	ALL	ALL	0.0424	0.0026	0.0001	0.0027
Single Unit Short-haul Truck	ALL	ALL	0.3747	0.0720	0.0125	0.0846
Single Unit Long-haul Truck	ALL	ALL	0.0204	0.0040	0.0004	0.0045
Motor Home	ALL	ALL	0.0135	0.0039	0.0034	0.0073
Combination Short-haul Truck	ALL	ALL	0.3978	0.0217	0.0000	0.0217
Combination Long-haul Truck	ALL	ALL	1.5627	0.1712	0.0000	0.1712
ALL (Total)	**ALL (Total)**	**ALL (Total)**	**5.3736**	**1.5943**	**0.8417**	**2.4360**

Source Type	Fuel Type	Road Type	Sheboygan County – Year 2011			
			NO_x Emissions (tpswd)	VOC Emissions (tpswd)		
			Total	Exhaust	Evaporative	**Total**
ALL	Gasoline	ALL	2.8758	1.3138	0.8417	2.1554
ALL	Diesel	ALL	2.4956	0.2801	0.0000	0.2801
ALL	CNG	ALL	0.0020	0.0003	0.0000	0.0003
ALL	Ethanol (E-85)	ALL	0.0001	0.0001	0.0000	0.0001
ALL (Total)	**ALL (Total)**	**ALL (Total)**	**5.3736**	**1.5943**	**0.8417**	**2.4360**
ALL	ALL	Off-Network	1.1625	0.9427	0.6937	1.6364
ALL	ALL	Rural Restricted	1.0802	0.1296	0.0212	0.1508
ALL	ALL	Rural Unrestricted	1.5446	0.2723	0.0695	0.3418
ALL	ALL	Urban Restricted	0.9844	0.1332	0.0249	0.1581
ALL	ALL	Urban Unrestricted	0.6019	0.1165	0.0325	0.1490
ALL (Total)	**ALL (Total)**	**ALL (Total)**	**5.3736**	**1.5943**	**0.8417**	**2.4360**

Table 5.2

2017 Onroad NO_X and VOC Emissions: tons per summer weekday (tpswd)
Sheboygan County

Source Type	Fuel Type	Road Type	Sheboygan County – Year 2017			
			NO_x Emissions (tpswd)	VOC Emissions (tpswd)		
			Total	Exhaust	Evaporative	Total
Motorcycle	Gasoline	Off-Network	0.0001	0.0007	0.0388	0.0395
Motorcycle	Gasoline	Rural Restricted	0.0028	0.0024	0.0012	0.0036
Motorcycle	Gasoline	Rural Unrestricted	0.0065	0.0069	0.0051	0.0120
Motorcycle	Gasoline	Urban Restricted	0.0031	0.0027	0.0015	0.0043
Motorcycle	Gasoline	Urban Unrestricted	0.0022	0.0027	0.0020	0.0047
Passenger Car	Gasoline	Off-Network	0.1751	0.1934	0.2698	0.4632
Passenger Car	Gasoline	Rural Restricted	0.0647	0.0129	0.0058	0.0187
Passenger Car	Gasoline	Rural Unrestricted	0.0995	0.0224	0.0173	0.0398
Passenger Car	Gasoline	Urban Restricted	0.0789	0.0162	0.0084	0.0246
Passenger Car	Gasoline	Urban Unrestricted	0.0480	0.0115	0.0094	0.0209
Passenger Car	Diesel	Off-Network	0.0008	0.0011	0.0000	0.0011
Passenger Car	Diesel	Rural Restricted	0.0004	0.0001	0.0000	0.0001
Passenger Car	Diesel	Rural Unrestricted	0.0006	0.0002	0.0000	0.0002
Passenger Car	Diesel	Urban Restricted	0.0005	0.0001	0.0000	0.0001
Passenger Car	Diesel	Urban Unrestricted	0.0003	0.0001	0.0000	0.0001
Passenger Car	Ethanol (E-85)	Off-Network	0.0002	0.0003	0.0003	0.0006
Passenger Car	Ethanol (E-85)	Rural Restricted	0.0001	0.0000	0.0000	0.0000
Passenger Car	Ethanol (E-85)	Rural Unrestricted	0.0001	0.0000	0.0000	0.0000
Passenger Car	Ethanol (E-85)	Urban Restricted	0.0001	0.0000	0.0000	0.0000
Passenger Car	Ethanol (E-85)	Urban Unrestricted	0.0000	0.0000	0.0000	0.0000
Passenger Truck	Gasoline	Off-Network	0.1655	0.1811	0.1268	0.3079
Passenger Truck	Gasoline	Rural Restricted	0.0783	0.0154	0.0031	0.0185
Passenger Truck	Gasoline	Rural Unrestricted	0.1241	0.0272	0.0108	0.0381
Passenger Truck	Gasoline	Urban Restricted	0.0842	0.0167	0.0041	0.0208
Passenger Truck	Gasoline	Urban Unrestricted	0.0481	0.0113	0.0047	0.0160
Passenger Truck	Diesel	Off-Network	0.0041	0.0016	0.0000	0.0016
Passenger Truck	Diesel	Rural Restricted	0.0053	0.0007	0.0000	0.0007
Passenger Truck	Diesel	Rural Unrestricted	0.0122	0.0019	0.0000	0.0019
Passenger Truck	Diesel	Urban Restricted	0.0062	0.0009	0.0000	0.0009
Passenger Truck	Diesel	Urban Unrestricted	0.0050	0.0008	0.0000	0.0008
Passenger Truck	Ethanol (E-85)	Off-Network	0.0006	0.0007	0.0006	0.0013
Passenger Truck	Ethanol (E-85)	Rural Restricted	0.0003	0.0001	0.0000	0.0001
Passenger Truck	Ethanol (E-85)	Rural Unrestricted	0.0004	0.0001	0.0001	0.0001
Passenger Truck	Ethanol (E-85)	Urban Restricted	0.0003	0.0001	0.0000	0.0001
Passenger Truck	Ethanol (E-85)	Urban Unrestricted	0.0001	0.0000	0.0000	0.0001
Light Commercial Truck	Gasoline	Off-Network	0.0700	0.0797	0.0487	0.1283
Light Commercial Truck	Gasoline	Rural Restricted	0.0304	0.0065	0.0013	0.0078
Light Commercial Truck	Gasoline	Rural Unrestricted	0.0532	0.0141	0.0046	0.0187
Light Commercial Truck	Gasoline	Urban Restricted	0.0331	0.0074	0.0017	0.0091
Light Commercial Truck	Gasoline	Urban Unrestricted	0.0205	0.0060	0.0020	0.0079
Light Commercial Truck	Diesel	Off-Network	0.0035	0.0022	0.0000	0.0022
Light Commercial Truck	Diesel	Rural Restricted	0.0046	0.0008	0.0000	0.0008
Light Commercial Truck	Diesel	Rural Unrestricted	0.0104	0.0021	0.0000	0.0021
Light Commercial Truck	Diesel	Urban Restricted	0.0052	0.0010	0.0000	0.0010
Light Commercial Truck	Diesel	Urban Unrestricted	0.0042	0.0009	0.0000	0.0009
Light Commercial Truck	Ethanol (E-85)	Off-Network	0.0001	0.0002	0.0001	0.0003

Source Type	Fuel Type	Road Type	Sheboygan County – Year 2017			
			NO_x Emissions (tpswd)	VOC Emissions (tpswd)		
			Total	Exhaust	Evaporative	Total
Light Commercial Truck	Ethanol (E-85)	Rural Restricted	0.0001	0.0000	0.0000	0.0000
Light Commercial Truck	Ethanol (E-85)	Rural Unrestricted	0.0001	0.0000	0.0000	0.0000
Light Commercial Truck	Ethanol (E-85)	Urban Restricted	0.0001	0.0000	0.0000	0.0000
Light Commercial Truck	Ethanol (E-85)	Urban Unrestricted	0.0000	0.0000	0.0000	0.0000
Intercity Bus	Diesel	Off-Network	0.0000	0.0000	0.0000	0.0000
Intercity Bus	Diesel	Rural Restricted	0.0025	0.0001	0.0000	0.0001
Intercity Bus	Diesel	Rural Unrestricted	0.0040	0.0003	0.0000	0.0003
Intercity Bus	Diesel	Urban Restricted	0.0038	0.0002	0.0000	0.0002
Intercity Bus	Diesel	Urban Unrestricted	0.0022	0.0002	0.0000	0.0002
Transit Bus	Gasoline	Off-Network	0.0000	0.0000	0.0000	0.0000
Transit Bus	Gasoline	Rural Restricted	0.0000	0.0000	0.0000	0.0000
Transit Bus	Gasoline	Rural Unrestricted	0.0000	0.0000	0.0000	0.0000
Transit Bus	Gasoline	Urban Restricted	0.0000	0.0000	0.0000	0.0000
Transit Bus	Gasoline	Urban Unrestricted	0.0000	0.0000	0.0000	0.0000
Transit Bus	Diesel	Off-Network	0.0000	0.0000	0.0000	0.0000
Transit Bus	Diesel	Rural Restricted	0.0039	0.0002	0.0000	0.0002
Transit Bus	Diesel	Rural Unrestricted	0.0047	0.0004	0.0000	0.0004
Transit Bus	Diesel	Urban Restricted	0.0059	0.0004	0.0000	0.0004
Transit Bus	Diesel	Urban Unrestricted	0.0026	0.0002	0.0000	0.0002
Transit Bus	CNG	Off-Network	0.0000	0.0000	0.0000	0.0000
Transit Bus	CNG	Rural Restricted	0.0004	0.0000	0.0000	0.0000
Transit Bus	CNG	Rural Unrestricted	0.0004	0.0001	0.0000	0.0001
Transit Bus	CNG	Urban Restricted	0.0006	0.0001	0.0000	0.0001
Transit Bus	CNG	Urban Unrestricted	0.0002	0.0000	0.0000	0.0000
School Bus	Gasoline	Off-Network	0.0000	0.0000	0.0000	0.0001
School Bus	Gasoline	Rural Restricted	0.0000	0.0000	0.0000	0.0000
School Bus	Gasoline	Rural Unrestricted	0.0000	0.0000	0.0000	0.0000
School Bus	Gasoline	Urban Restricted	0.0000	0.0000	0.0000	0.0000
School Bus	Gasoline	Urban Unrestricted	0.0000	0.0000	0.0000	0.0000
School Bus	Diesel	Off-Network	0.0000	0.0000	0.0000	0.0000
School Bus	Diesel	Rural Restricted	0.0053	0.0005	0.0000	0.0005
School Bus	Diesel	Rural Unrestricted	0.0065	0.0011	0.0000	0.0011
School Bus	Diesel	Urban Restricted	0.0080	0.0010	0.0000	0.0010
School Bus	Diesel	Urban Unrestricted	0.0036	0.0006	0.0000	0.0006
Refuse Truck	Gasoline	Off-Network	0.0000	0.0001	0.0000	0.0001
Refuse Truck	Gasoline	Rural Restricted	0.0001	0.0000	0.0000	0.0000
Refuse Truck	Gasoline	Rural Unrestricted	0.0001	0.0000	0.0000	0.0000
Refuse Truck	Gasoline	Urban Restricted	0.0001	0.0000	0.0000	0.0000
Refuse Truck	Gasoline	Urban Unrestricted	0.0000	0.0000	0.0000	0.0000
Refuse Truck	Diesel	Off-Network	0.0000	0.0000	0.0000	0.0000
Refuse Truck	Diesel	Rural Restricted	0.0067	0.0003	0.0000	0.0003
Refuse Truck	Diesel	Rural Unrestricted	0.0062	0.0004	0.0000	0.0004
Refuse Truck	Diesel	Urban Restricted	0.0068	0.0003	0.0000	0.0003
Refuse Truck	Diesel	Urban Unrestricted	0.0024	0.0001	0.0000	0.0001
Single Unit Short-haul Truck	Gasoline	Off-Network	0.0110	0.0109	0.0097	0.0206
Single Unit Short-haul Truck	Gasoline	Rural Restricted	0.0057	0.0011	0.0002	0.0013
Single Unit Short-haul Truck	Gasoline	Rural Unrestricted	0.0081	0.0024	0.0004	0.0028
Single Unit Short-haul Truck	Gasoline	Urban Restricted	0.0085	0.0018	0.0002	0.0021
Single Unit Short-haul Truck	Gasoline	Urban Unrestricted	0.0038	0.0013	0.0002	0.0015
Single Unit Short-haul Truck	Diesel	Off-Network	0.0052	0.0003	0.0000	0.0003
Single Unit Short-haul Truck	Diesel	Rural Restricted	0.0310	0.0032	0.0000	0.0032
Single Unit Short-haul Truck	Diesel	Rural Unrestricted	0.0489	0.0069	0.0000	0.0069
Single Unit Short-haul Truck	Diesel	Urban Restricted	0.0452	0.0051	0.0000	0.0051
Single Unit Short-haul Truck	Diesel	Urban Unrestricted	0.0243	0.0034	0.0000	0.0034

Source Type	Fuel Type	Road Type	Sheboygan County – Year 2017			
			NO_x Emissions (tpswd)	VOC Emissions (tpswd)		
			Total	Exhaust	Evaporative	**Total**
Single Unit Long-haul Truck	Gasoline	Off-Network	0.0003	0.0003	0.0003	0.0007
Single Unit Long-haul Truck	Gasoline	Rural Restricted	0.0002	0.0000	0.0000	0.0001
Single Unit Long-haul Truck	Gasoline	Rural Unrestricted	0.0003	0.0001	0.0000	0.0001
Single Unit Long-haul Truck	Gasoline	Urban Restricted	0.0003	0.0001	0.0000	0.0001
Single Unit Long-haul Truck	Gasoline	Urban Unrestricted	0.0001	0.0001	0.0000	0.0001
Single Unit Long-haul Truck	Diesel	Off-Network	0.0002	0.0000	0.0000	0.0000
Single Unit Long-haul Truck	Diesel	Rural Restricted	0.0019	0.0002	0.0000	0.0002
Single Unit Long-haul Truck	Diesel	Rural Unrestricted	0.0031	0.0005	0.0000	0.0005
Single Unit Long-haul Truck	Diesel	Urban Restricted	0.0028	0.0003	0.0000	0.0003
Single Unit Long-haul Truck	Diesel	Urban Unrestricted	0.0015	0.0002	0.0000	0.0002
Motor Home	Gasoline	Off-Network	0.0006	0.0009	0.0026	0.0035
Motor Home	Gasoline	Rural Restricted	0.0007	0.0002	0.0000	0.0002
Motor Home	Gasoline	Rural Unrestricted	0.0012	0.0004	0.0001	0.0005
Motor Home	Gasoline	Urban Restricted	0.0013	0.0003	0.0000	0.0004
Motor Home	Gasoline	Urban Unrestricted	0.0007	0.0003	0.0000	0.0003
Motor Home	Diesel	Off-Network	0.0001	0.0000	0.0000	0.0000
Motor Home	Diesel	Rural Restricted	0.0009	0.0001	0.0000	0.0001
Motor Home	Diesel	Rural Unrestricted	0.0015	0.0002	0.0000	0.0002
Motor Home	Diesel	Urban Restricted	0.0015	0.0002	0.0000	0.0002
Motor Home	Diesel	Urban Unrestricted	0.0009	0.0001	0.0000	0.0001
Combination Short-haul Truck	Gasoline	Off-Network	0.0000	0.0000	0.0000	0.0000
Combination Short-haul Truck	Gasoline	Rural Restricted	0.0000	0.0000	0.0000	0.0000
Combination Short-haul Truck	Gasoline	Rural Unrestricted	0.0000	0.0000	0.0000	0.0000
Combination Short-haul Truck	Gasoline	Urban Restricted	0.0000	0.0000	0.0000	0.0000
Combination Short-haul Truck	Gasoline	Urban Unrestricted	0.0000	0.0000	0.0000	0.0000
Combination Short-haul Truck	Diesel	Off-Network	0.0000	0.0001	0.0000	0.0001
Combination Short-haul Truck	Diesel	Rural Restricted	0.0605	0.0024	0.0000	0.0024
Combination Short-haul Truck	Diesel	Rural Unrestricted	0.0559	0.0032	0.0000	0.0032
Combination Short-haul Truck	Diesel	Urban Restricted	0.0617	0.0028	0.0000	0.0028
Combination Short-haul Truck	Diesel	Urban Unrestricted	0.0211	0.0012	0.0000	0.0012
Combination Long-haul Truck	Diesel	Off-Network	0.3754	0.0816	0.0000	0.0816
Combination Long-haul Truck	Diesel	Rural Restricted	0.2285	0.0094	0.0000	0.0094
Combination Long-haul Truck	Diesel	Rural Unrestricted	0.2065	0.0117	0.0000	0.0117
Combination Long-haul Truck	Diesel	Urban Restricted	0.2285	0.0105	0.0000	0.0105
Combination Long-haul Truck	Diesel	Urban Unrestricted	0.0756	0.0044	0.0000	0.0044
ALL (Total)	**ALL (Total)**	**ALL (Total)**	**2.8575**	**0.8282**	**0.5825**	**1.4107**
Motorcycle	ALL	ALL	0.0148	0.0154	0.0487	0.0641
Passenger Car	ALL	ALL	0.4693	0.2583	0.3111	0.5694
Passenger Truck	ALL	ALL	0.5348	0.2585	0.1504	0.4089
Light Commercial Truck	ALL	ALL	0.2355	0.1208	0.0584	0.1792
Intercity Bus	ALL	ALL	0.0125	0.0008	0.0000	0.0008
Transit Bus	ALL	ALL	0.0187	0.0014	0.0000	0.0014
School Bus	ALL	ALL	0.0236	0.0033	0.0000	0.0033
Refuse Truck	ALL	ALL	0.0224	0.0013	0.0000	0.0013
Single Unit Short-haul Truck	ALL	ALL	0.1917	0.0364	0.0106	0.0471
Single Unit Long-haul Truck	ALL	ALL	0.0109	0.0019	0.0004	0.0022
Motor Home	ALL	ALL	0.0094	0.0027	0.0028	0.0055
Combination Short-haul Truck	ALL	ALL	0.1993	0.0097	0.0000	0.0097
Combination Long-haul Truck	ALL	ALL	1.1145	0.1177	0.0000	0.1177
ALL (Total)	**ALL (Total)**	**ALL (Total)**	**2.8575**	**0.8282**	**0.5825**	**1.4107**

Source Type	**Fuel Type**	**Road Type**	**Sheboygan County – Year 2017**			
			NO_x Emissions (tpswd)	**VOC Emissions (tpswd)**		
			Total	Exhaust	Evaporative	**Total**
ALL	Gasoline	ALL	1.2319	0.6576	0.5812	1.2388
ALL	Diesel	ALL	1.6214	0.1688	0.0000	0.1688
ALL	CNG	ALL	0.0016	0.0002	0.0000	0.0002
ALL	Ethanol (E-85)	ALL	0.0026	0.0015	0.0013	0.0028
ALL (Total)	**ALL (Total)**	**ALL (Total)**	**2.8575**	**0.8282**	**0.5825**	**1.4107**
ALL	ALL	Off-Network	0.8130	0.5553	0.4979	1.0531
ALL	ALL	Rural Restricted	0.5352	0.0567	0.0116	0.0684
ALL	ALL	Rural Unrestricted	0.6547	0.1026	0.0384	0.1410
ALL	ALL	Urban Restricted	0.5870	0.0681	0.0161	0.0843
ALL	ALL	Urban Unrestricted	0.2676	0.0455	0.0184	0.0639
ALL (Total)	**ALL (Total)**	**ALL (Total)**	**2.8575**	**0.8282**	**0.5825**	**1.4107**
Safety Margin			15%			15%
Emissions Budget			**3.2861**			**1.6222**

Table 5.3

2018 Onroad NO_X and VOC Emissions: tons per summer weekday (tpswd) Sheboygan County

Source Type	Fuel Type	Road Type	Sheboygan County – Year 2018			
			NO_x Emissions (tpswd)	VOC Emissions (tpswd)		
			Total	Exhaust	Evaporative	Total
Motorcycle	Gasoline	Off-Network	0.0001	0.0007	0.0388	0.0396
Motorcycle	Gasoline	Rural Restricted	0.0028	0.0023	0.0012	0.0036
Motorcycle	Gasoline	Rural Unrestricted	0.0065	0.0068	0.0051	0.0119
Motorcycle	Gasoline	Urban Restricted	0.0031	0.0027	0.0015	0.0042
Motorcycle	Gasoline	Urban Unrestricted	0.0022	0.0026	0.0021	0.0047
Passenger Car	Gasoline	Off-Network	0.1572	0.1770	0.2530	0.4300
Passenger Car	Gasoline	Rural Restricted	0.0558	0.0113	0.0053	0.0166
Passenger Car	Gasoline	Rural Unrestricted	0.0844	0.0191	0.0161	0.0352
Passenger Car	Gasoline	Urban Restricted	0.0679	0.0140	0.0078	0.0219
Passenger Car	Gasoline	Urban Unrestricted	0.0406	0.0097	0.0087	0.0184
Passenger Car	Diesel	Off-Network	0.0007	0.0009	0.0000	0.0009
Passenger Car	Diesel	Rural Restricted	0.0003	0.0001	0.0000	0.0001
Passenger Car	Diesel	Rural Unrestricted	0.0005	0.0001	0.0000	0.0001
Passenger Car	Diesel	Urban Restricted	0.0004	0.0001	0.0000	0.0001
Passenger Car	Diesel	Urban Unrestricted	0.0002	0.0000	0.0000	0.0000
Passenger Car	Ethanol (E-85)	Off-Network	0.0003	0.0004	0.0005	0.0009
Passenger Car	Ethanol (E-85)	Rural Restricted	0.0001	0.0000	0.0000	0.0000
Passenger Car	Ethanol (E-85)	Rural Unrestricted	0.0001	0.0000	0.0000	0.0001
Passenger Car	Ethanol (E-85)	Urban Restricted	0.0001	0.0000	0.0000	0.0000
Passenger Car	Ethanol (E-85)	Urban Unrestricted	0.0001	0.0000	0.0000	0.0000
Passenger Truck	Gasoline	Off-Network	0.1483	0.1617	0.1214	0.2831
Passenger Truck	Gasoline	Rural Restricted	0.0692	0.0134	0.0030	0.0164
Passenger Truck	Gasoline	Rural Unrestricted	0.1072	0.0232	0.0104	0.0335
Passenger Truck	Gasoline	Urban Restricted	0.0741	0.0146	0.0039	0.0185
Passenger Truck	Gasoline	Urban Unrestricted	0.0415	0.0096	0.0045	0.0141
Passenger Truck	Diesel	Off-Network	0.0041	0.0015	0.0000	0.0015
Passenger Truck	Diesel	Rural Restricted	0.0048	0.0006	0.0000	0.0006
Passenger Truck	Diesel	Rural Unrestricted	0.0110	0.0016	0.0000	0.0016
Passenger Truck	Diesel	Urban Restricted	0.0056	0.0008	0.0000	0.0008
Passenger Truck	Diesel	Urban Unrestricted	0.0045	0.0007	0.0000	0.0007
Passenger Truck	Ethanol (E-85)	Off-Network	0.0008	0.0010	0.0009	0.0020
Passenger Truck	Ethanol (E-85)	Rural Restricted	0.0004	0.0001	0.0000	0.0001
Passenger Truck	Ethanol (E-85)	Rural Unrestricted	0.0005	0.0001	0.0001	0.0002
Passenger Truck	Ethanol (E-85)	Urban Restricted	0.0004	0.0001	0.0000	0.0001
Passenger Truck	Ethanol (E-85)	Urban Unrestricted	0.0002	0.0000	0.0000	0.0001
Light Commercial Truck	Gasoline	Off-Network	0.0617	0.0698	0.0448	0.1146
Light Commercial Truck	Gasoline	Rural Restricted	0.0263	0.0056	0.0012	0.0068
Light Commercial Truck	Gasoline	Rural Unrestricted	0.0453	0.0119	0.0042	0.0160
Light Commercial Truck	Gasoline	Urban Restricted	0.0285	0.0063	0.0016	0.0079
Light Commercial Truck	Gasoline	Urban Unrestricted	0.0175	0.0050	0.0018	0.0068
Light Commercial Truck	Diesel	Off-Network	0.0035	0.0021	0.0000	0.0021
Light Commercial Truck	Diesel	Rural Restricted	0.0041	0.0007	0.0000	0.0007
Light Commercial Truck	Diesel	Rural Unrestricted	0.0093	0.0018	0.0000	0.0018
Light Commercial Truck	Diesel	Urban Restricted	0.0047	0.0008	0.0000	0.0008
Light Commercial Truck	Diesel	Urban Unrestricted	0.0037	0.0008	0.0000	0.0008
Light Commercial Truck	Ethanol (E-85)	Off-Network	0.0002	0.0003	0.0002	0.0005

Source Type	Fuel Type	Road Type	Sheboygan County – Year 2018			
			NO_x Emissions (tpswd)	VOC Emissions (tpswd)		
			Total	Exhaust	Evaporative	Total
Light Commercial Truck	Ethanol (E-85)	Rural Restricted	0.0001	0.0000	0.0000	0.0000
Light Commercial Truck	Ethanol (E-85)	Rural Unrestricted	0.0001	0.0000	0.0000	0.0000
Light Commercial Truck	Ethanol (E-85)	Urban Restricted	0.0001	0.0000	0.0000	0.0000
Light Commercial Truck	Ethanol (E-85)	Urban Unrestricted	0.0000	0.0000	0.0000	0.0000
Intercity Bus	Diesel	Off-Network	0.0000	0.0000	0.0000	0.0000
Intercity Bus	Diesel	Rural Restricted	0.0023	0.0001	0.0000	0.0001
Intercity Bus	Diesel	Rural Unrestricted	0.0036	0.0003	0.0000	0.0003
Intercity Bus	Diesel	Urban Restricted	0.0035	0.0002	0.0000	0.0002
Intercity Bus	Diesel	Urban Unrestricted	0.0020	0.0001	0.0000	0.0001
Transit Bus	Gasoline	Off-Network	0.0000	0.0000	0.0000	0.0000
Transit Bus	Gasoline	Rural Restricted	0.0000	0.0000	0.0000	0.0000
Transit Bus	Gasoline	Rural Unrestricted	0.0000	0.0000	0.0000	0.0000
Transit Bus	Gasoline	Urban Restricted	0.0000	0.0000	0.0000	0.0000
Transit Bus	Gasoline	Urban Unrestricted	0.0000	0.0000	0.0000	0.0000
Transit Bus	Diesel	Off-Network	0.0000	0.0000	0.0000	0.0000
Transit Bus	Diesel	Rural Restricted	0.0035	0.0002	0.0000	0.0002
Transit Bus	Diesel	Rural Unrestricted	0.0042	0.0003	0.0000	0.0003
Transit Bus	Diesel	Urban Restricted	0.0053	0.0003	0.0000	0.0003
Transit Bus	Diesel	Urban Unrestricted	0.0023	0.0002	0.0000	0.0002
Transit Bus	CNG	Off-Network	0.0000	0.0000	0.0000	0.0000
Transit Bus	CNG	Rural Restricted	0.0004	0.0000	0.0000	0.0000
Transit Bus	CNG	Rural Unrestricted	0.0004	0.0001	0.0000	0.0001
Transit Bus	CNG	Urban Restricted	0.0006	0.0001	0.0000	0.0001
Transit Bus	CNG	Urban Unrestricted	0.0002	0.0000	0.0000	0.0000
School Bus	Gasoline	Off-Network	0.0000	0.0000	0.0000	0.0000
School Bus	Gasoline	Rural Restricted	0.0000	0.0000	0.0000	0.0000
School Bus	Gasoline	Rural Unrestricted	0.0000	0.0000	0.0000	0.0000
School Bus	Gasoline	Urban Restricted	0.0000	0.0000	0.0000	0.0000
School Bus	Gasoline	Urban Unrestricted	0.0000	0.0000	0.0000	0.0000
School Bus	Diesel	Off-Network	0.0000	0.0000	0.0000	0.0000
School Bus	Diesel	Rural Restricted	0.0050	0.0005	0.0000	0.0005
School Bus	Diesel	Rural Unrestricted	0.0061	0.0010	0.0000	0.0010
School Bus	Diesel	Urban Restricted	0.0077	0.0009	0.0000	0.0009
School Bus	Diesel	Urban Unrestricted	0.0034	0.0006	0.0000	0.0006
Refuse Truck	Gasoline	Off-Network	0.0000	0.0001	0.0000	0.0001
Refuse Truck	Gasoline	Rural Restricted	0.0001	0.0000	0.0000	0.0000
Refuse Truck	Gasoline	Rural Unrestricted	0.0001	0.0000	0.0000	0.0000
Refuse Truck	Gasoline	Urban Restricted	0.0001	0.0000	0.0000	0.0000
Refuse Truck	Gasoline	Urban Unrestricted	0.0000	0.0000	0.0000	0.0000
Refuse Truck	Diesel	Off-Network	0.0000	0.0000	0.0000	0.0000
Refuse Truck	Diesel	Rural Restricted	0.0057	0.0002	0.0000	0.0002
Refuse Truck	Diesel	Rural Unrestricted	0.0053	0.0003	0.0000	0.0003
Refuse Truck	Diesel	Urban Restricted	0.0059	0.0003	0.0000	0.0003
Refuse Truck	Diesel	Urban Unrestricted	0.0020	0.0001	0.0000	0.0001
Single Unit Short-haul Truck	Gasoline	Off-Network	0.0099	0.0099	0.0086	0.0185
Single Unit Short-haul Truck	Gasoline	Rural Restricted	0.0050	0.0010	0.0001	0.0011
Single Unit Short-haul Truck	Gasoline	Rural Unrestricted	0.0071	0.0021	0.0003	0.0024
Single Unit Short-haul Truck	Gasoline	Urban Restricted	0.0075	0.0016	0.0002	0.0018
Single Unit Short-haul Truck	Gasoline	Urban Unrestricted	0.0033	0.0011	0.0002	0.0013
Single Unit Short-haul Truck	Diesel	Off-Network	0.0054	0.0003	0.0000	0.0003
Single Unit Short-haul Truck	Diesel	Rural Restricted	0.0268	0.0027	0.0000	0.0027
Single Unit Short-haul Truck	Diesel	Rural Unrestricted	0.0424	0.0058	0.0000	0.0058
Single Unit Short-haul Truck	Diesel	Urban Restricted	0.0393	0.0043	0.0000	0.0043
Single Unit Short-haul Truck	Diesel	Urban Unrestricted	0.0210	0.0029	0.0000	0.0029

Source Type	Fuel Type	Road Type	Sheboygan County – Year 2018			
			NO_x Emissions (tpswd)	VOC Emissions (tpswd)		
			Total	Exhaust	Evaporative	**Total**
Single Unit Long-haul Truck	Gasoline	Off-Network	0.0003	0.0003	0.0003	0.0006
Single Unit Long-haul Truck	Gasoline	Rural Restricted	0.0002	0.0000	0.0000	0.0000
Single Unit Long-haul Truck	Gasoline	Rural Unrestricted	0.0003	0.0001	0.0000	0.0001
Single Unit Long-haul Truck	Gasoline	Urban Restricted	0.0003	0.0001	0.0000	0.0001
Single Unit Long-haul Truck	Gasoline	Urban Unrestricted	0.0001	0.0000	0.0000	0.0001
Single Unit Long-haul Truck	Diesel	Off-Network	0.0002	0.0000	0.0000	0.0000
Single Unit Long-haul Truck	Diesel	Rural Restricted	0.0017	0.0002	0.0000	0.0002
Single Unit Long-haul Truck	Diesel	Rural Unrestricted	0.0028	0.0004	0.0000	0.0004
Single Unit Long-haul Truck	Diesel	Urban Restricted	0.0025	0.0003	0.0000	0.0003
Single Unit Long-haul Truck	Diesel	Urban Unrestricted	0.0014	0.0002	0.0000	0.0002
Motor Home	Gasoline	Off-Network	0.0006	0.0008	0.0023	0.0031
Motor Home	Gasoline	Rural Restricted	0.0006	0.0001	0.0000	0.0002
Motor Home	Gasoline	Rural Unrestricted	0.0010	0.0003	0.0001	0.0004
Motor Home	Gasoline	Urban Restricted	0.0011	0.0003	0.0000	0.0003
Motor Home	Gasoline	Urban Unrestricted	0.0006	0.0002	0.0000	0.0002
Motor Home	Diesel	Off-Network	0.0001	0.0000	0.0000	0.0000
Motor Home	Diesel	Rural Restricted	0.0008	0.0001	0.0000	0.0001
Motor Home	Diesel	Rural Unrestricted	0.0014	0.0002	0.0000	0.0002
Motor Home	Diesel	Urban Restricted	0.0014	0.0002	0.0000	0.0002
Motor Home	Diesel	Urban Unrestricted	0.0008	0.0001	0.0000	0.0001
Combination Short-haul Truck	Gasoline	Off-Network	0.0000	0.0000	0.0000	0.0000
Combination Short-haul Truck	Gasoline	Rural Restricted	0.0000	0.0000	0.0000	0.0000
Combination Short-haul Truck	Gasoline	Rural Unrestricted	0.0000	0.0000	0.0000	0.0000
Combination Short-haul Truck	Gasoline	Urban Restricted	0.0000	0.0000	0.0000	0.0000
Combination Short-haul Truck	Gasoline	Urban Unrestricted	0.0000	0.0000	0.0000	0.0000
Combination Short-haul Truck	Diesel	Off-Network	0.0000	0.0001	0.0000	0.0001
Combination Short-haul Truck	Diesel	Rural Restricted	0.0532	0.0021	0.0000	0.0021
Combination Short-haul Truck	Diesel	Rural Unrestricted	0.0493	0.0028	0.0000	0.0028
Combination Short-haul Truck	Diesel	Urban Restricted	0.0545	0.0024	0.0000	0.0024
Combination Short-haul Truck	Diesel	Urban Unrestricted	0.0186	0.0011	0.0000	0.0011
Combination Long-haul Truck	Diesel	Off-Network	0.3688	0.0781	0.0000	0.0781
Combination Long-haul Truck	Diesel	Rural Restricted	0.2070	0.0084	0.0000	0.0084
Combination Long-haul Truck	Diesel	Rural Unrestricted	0.1869	0.0105	0.0000	0.0105
Combination Long-haul Truck	Diesel	Urban Restricted	0.2076	0.0094	0.0000	0.0094
Combination Long-haul Truck	Diesel	Urban Unrestricted	0.0684	0.0040	0.0000	0.0040
ALL (Total)	**ALL (Total)**	**ALL (Total)**	**2.5714**	**0.7427**	**0.5506**	**1.2933**
Motorcycle	ALL	ALL	0.0148	0.0152	0.0488	0.0640
Passenger Car	ALL	ALL	0.4086	0.2328	0.2915	0.5242
Passenger Truck	ALL	ALL	0.4728	0.2289	0.1444	0.3733
Light Commercial Truck	ALL	ALL	0.2049	0.1050	0.0538	0.1588
Intercity Bus	ALL	ALL	0.0115	0.0007	0.0000	0.0007
Transit Bus	ALL	ALL	0.0170	0.0013	0.0000	0.0013
School Bus	ALL	ALL	0.0224	0.0031	0.0000	0.0031
Refuse Truck	ALL	ALL	0.0193	0.0011	0.0000	0.0011
Single Unit Short-haul Truck	ALL	ALL	0.1677	0.0316	0.0094	0.0410
Single Unit Long-haul Truck	ALL	ALL	0.0097	0.0016	0.0003	0.0020
Motor Home	ALL	ALL	0.0083	0.0024	0.0025	0.0048
Combination Short-haul Truck	ALL	ALL	0.1756	0.0084	0.0000	0.0084
Combination Long-haul Truck	ALL	ALL	1.0388	0.1105	0.0000	0.1105
ALL (Total)	**ALL (Total)**	**ALL (Total)**	**2.5714**	**0.7427**	**0.5506**	**1.2933**

Source Type	Fuel Type	Road Type	Sheboygan County – Year 2018			
			NO_x Emissions (tpswd)	VOC Emissions (tpswd)		
			Total	Exhaust	Evaporative	**Total**
ALL	Gasoline	ALL	1.0785	0.5855	0.5487	1.1342
ALL	Diesel	ALL	1.4877	0.1548	0.0000	0.1548
ALL	CNG	ALL	0.0016	0.0002	0.0000	0.0002
ALL	Ethanol (E-85)	ALL	0.0036	0.0021	0.0019	0.0041
ALL (Total)	**ALL (Total)**	**ALL (Total)**	**2.5714**	**0.7427**	**0.5506**	**1.2933**
ALL	ALL	Off-Network	0.7622	0.5051	0.4708	0.9758
ALL	ALL	Rural Restricted	0.4764	0.0499	0.0110	0.0608
ALL	ALL	Rural Unrestricted	0.5759	0.0889	0.0362	0.1251
ALL	ALL	Urban Restricted	0.5223	0.0597	0.0152	0.0750
ALL	ALL	Urban Unrestricted	0.2346	0.0392	0.0174	0.0566
ALL (Total)	**ALL (Total)**	**ALL (Total)**	**2.5714**	**0.7427**	**0.5506**	**1.2933**
Safety Margin			15%			15%
Emissions Budget			**2.9571**			**1.4873**

Table 5.4

Vehicle Activity Data Output from the MOVES2014a Model
Years 2011, 2017 and 2018
Sheboygan County

Source Type	Fuel Type	Road Type	Sheboygan County					
			Vehicle Population			Vehicle-Miles of Travel Summer Weekday		
			2011	2017	2018	2011	2017	2018
Motorcycle	Gasoline	Off-Network	2,935	3,124	3,144			
Motorcycle	Gasoline	Rural Restricted				3,716	3,938	3,967
Motorcycle	Gasoline	Rural Unrestricted				9,847	10,011	10,063
Motorcycle	Gasoline	Urban Restricted				3,410	4,362	4,399
Motorcycle	Gasoline	Urban Unrestricted				3,430	3,690	3,708
Passenger Car	Gasoline	Off-Network	41,407	43,749	43,952			
Passenger Car	Gasoline	Rural Restricted				282,307	295,015	296,782
Passenger Car	Gasoline	Rural Unrestricted				551,541	553,186	555,290
Passenger Car	Gasoline	Urban Restricted				305,241	385,143	387,833
Passenger Car	Gasoline	Urban Unrestricted				257,320	273,140	274,021
Passenger Car	Diesel	Off-Network	175	320	337			
Passenger Car	Diesel	Rural Restricted				1,152	2,370	2,528
Passenger Car	Diesel	Rural Unrestricted				2,250	4,444	4,730
Passenger Car	Diesel	Urban Restricted				1,245	3,094	3,304
Passenger Car	Diesel	Urban Unrestricted				1,050	2,194	2,334
Passenger Car	Ethanol (E-85)	Off-Network	3	99	149			
Passenger Car	Ethanol (E-85)	Rural Restricted				25	725	1,081
Passenger Car	Ethanol (E-85)	Rural Unrestricted				49	1,359	2,022
Passenger Car	Ethanol (E-85)	Urban Restricted				27	946	1,412
Passenger Car	Ethanol (E-85)	Urban Unrestricted				23	671	998
Passenger Truck	Gasoline	Off-Network	28,820	30,126	30,175			
Passenger Truck	Gasoline	Rural Restricted				221,713	227,133	227,113
Passenger Truck	Gasoline	Rural Unrestricted				501,605	493,199	492,086
Passenger Truck	Gasoline	Urban Restricted				216,861	268,241	268,484
Passenger Truck	Gasoline	Urban Unrestricted				189,137	196,814	196,257
Passenger Truck	Diesel	Off-Network	486	577	587			
Passenger Truck	Diesel	Rural Restricted				3,875	4,448	4,508
Passenger Truck	Diesel	Rural Unrestricted				8,766	9,658	9,767

Source Type	Fuel Type	Road Type	Sheboygan County					
			Vehicle Population			Vehicle-Miles of Travel Summer Weekday		
			2011	2017	2018	2011	2017	2018
Passenger Truck	Diesel	Urban Restricted				3,790	5,253	5,329
Passenger Truck	Diesel	Urban Unrestricted				3,305	3,854	3,895
Passenger Truck	Ethanol (E-85)	Off-Network	7	233	354			
Passenger Truck	Ethanol (E-85)	Rural Restricted				56	1,931	2,903
Passenger Truck	Ethanol (E-85)	Rural Unrestricted				127	4,192	6,290
Passenger Truck	Ethanol (E-85)	Urban Restricted				55	2,280	3,432
Passenger Truck	Ethanol (E-85)	Urban Unrestricted				48	1,673	2,509
Light Commercial Truck	Gasoline	Off-Network	6,781	7,365	7,395			
Light Commercial Truck	Gasoline	Rural Restricted				48,889	52,967	53,652
Light Commercial Truck	Gasoline	Rural Unrestricted				109,766	114,141	115,367
Light Commercial Truck	Gasoline	Urban Restricted				47,466	62,092	62,958
Light Commercial Truck	Gasoline	Urban Unrestricted				41,248	45,393	45,855
Light Commercial Truck	Diesel	Off-Network	383	417	423			
Light Commercial Truck	Diesel	Rural Restricted				2,793	3,001	3,062
Light Commercial Truck	Diesel	Rural Unrestricted				6,272	6,467	6,583
Light Commercial Truck	Diesel	Urban Restricted				2,712	3,518	3,593
Light Commercial Truck	Diesel	Urban Unrestricted				2,357	2,572	2,617
Light Commercial Truck	Ethanol (E-85)	Off-Network	1	47	74			
Light Commercial Truck	Ethanol (E-85)	Rural Restricted				10	394	613
Light Commercial Truck	Ethanol (E-85)	Rural Unrestricted				23	850	1,318
Light Commercial Truck	Ethanol (E-85)	Urban Restricted				10	462	719
Light Commercial Truck	Ethanol (E-85)	Urban Unrestricted				9	338	524
Intercity Bus	Diesel	Off-Network	4	5	5			
Intercity Bus	Diesel	Rural Restricted				262	279	282
Intercity Bus	Diesel	Rural Unrestricted				471	474	477
Intercity Bus	Diesel	Urban Restricted				331	438	444
Intercity Bus	Diesel	Urban Unrestricted				237	255	256
Transit Bus	Gasoline	Off-Network	0	0	0			
Transit Bus	Gasoline	Rural Restricted				7	10	10
Transit Bus	Gasoline	Rural Unrestricted				12	17	18
Transit Bus	Gasoline	Urban Restricted				9	15	16
Transit Bus	Gasoline	Urban Unrestricted				6	9	9
Transit Bus	Diesel	Off-Network	15	17	17			
Transit Bus	Diesel	Rural Restricted				459	462	467
Transit Bus	Diesel	Rural Unrestricted				839	800	805
Transit Bus	Diesel	Urban Restricted				588	737	748
Transit Bus	Diesel	Urban Unrestricted				425	432	435
Transit Bus	CNG	Off-Network	2	2	3			
Transit Bus	CNG	Rural Restricted				62	74	77

Source Type	Fuel Type	Road Type	Sheboygan County					
			Vehicle Population			Vehicle-Miles of Travel Summer Weekday		
			2011	2017	2018	2011	2017	2018
Transit Bus	CNG	Rural Unrestricted				113	128	133
Transit Bus	CNG	Urban Restricted				79	118	123
Transit Bus	CNG	Urban Unrestricted				57	69	72
School Bus	Gasoline	Off-Network	3	2	2			
School Bus	Gasoline	Rural Restricted				25	17	17
School Bus	Gasoline	Rural Unrestricted				46	30	30
School Bus	Gasoline	Urban Restricted				32	27	27
School Bus	Gasoline	Urban Unrestricted				23	16	16
School Bus	Diesel	Off-Network	145	174	176			
School Bus	Diesel	Rural Restricted				1,404	1,499	1,515
School Bus	Diesel	Rural Unrestricted				2,566	2,595	2,615
School Bus	Diesel	Urban Restricted				1,800	2,397	2,428
School Bus	Diesel	Urban Unrestricted				1,298	1,404	1,413
Refuse Truck	Gasoline	Off-Network	3	2	2			
Refuse Truck	Gasoline	Rural Restricted				51	23	19
Refuse Truck	Gasoline	Rural Unrestricted				52	22	19
Refuse Truck	Gasoline	Urban Restricted				44	24	21
Refuse Truck	Gasoline	Urban Unrestricted				18	8	7
Refuse Truck	Diesel	Off-Network	46	58	59			
Refuse Truck	Diesel	Rural Restricted				1,160	1,291	1,301
Refuse Truck	Diesel	Rural Unrestricted				1,183	1,247	1,252
Refuse Truck	Diesel	Urban Restricted				987	1,369	1,384
Refuse Truck	Diesel	Urban Unrestricted				405	457	459
Single Unit Short-haul Truck	Gasoline	Off-Network	515	603	603			
Single Unit Short-haul Truck	Gasoline	Rural Restricted				5,223	5,923	6,004
Single Unit Short-haul Truck	Gasoline	Rural Unrestricted				8,240	8,852	8,944
Single Unit Short-haul Truck	Gasoline	Urban Restricted				6,054	8,560	8,700
Single Unit Short-haul Truck	Gasoline	Urban Unrestricted				3,569	4,101	4,139
Single Unit Short-haul Truck	Diesel	Off-Network	1,017	1,260	1,275			
Single Unit Short-haul Truck	Diesel	Rural Restricted				11,872	13,006	13,111
Single Unit Short-haul Truck	Diesel	Rural Unrestricted				18,731	19,437	19,531
Single Unit Short-haul Truck	Diesel	Urban Restricted				13,762	18,795	18,997
Single Unit Short-haul Truck	Diesel	Urban Unrestricted				8,114	9,005	9,039
Single Unit Long-haul Truck	Gasoline	Off-Network	17	13	12			
Single Unit Long-haul Truck	Gasoline	Rural Restricted				175	63	54
Single Unit Long-haul Truck	Gasoline	Rural Unrestricted				276	94	80
Single Unit Long-haul Truck	Gasoline	Urban Restricted				202	91	78
Single Unit Long-haul Truck	Gasoline	Urban Unrestricted				119	43	37
Single Unit Long-haul Truck	Diesel	Off-Network	47	66	68			

Source Type	Fuel Type	Road Type	Sheboygan County					
			Vehicle Population			Vehicle-Miles of Travel Summer Weekday		
			2011	2017	2018	2011	2017	2018
Single Unit Long-haul Truck	Diesel	Rural Restricted				760	1,002	1,035
Single Unit Long-haul Truck	Diesel	Rural Unrestricted				1,197	1,495	1,540
Single Unit Long-haul Truck	Diesel	Urban Restricted				880	1,446	1,498
Single Unit Long-haul Truck	Diesel	Urban Unrestricted				518	692	711
Motor Home	Gasoline	Off-Network	241	265	261			
Motor Home	Gasoline	Rural Restricted				312	309	298
Motor Home	Gasoline	Rural Unrestricted				655	613	590
Motor Home	Gasoline	Urban Restricted				462	569	550
Motor Home	Gasoline	Urban Unrestricted				327	327	315
Motor Home	Diesel	Off-Network	128	186	193			
Motor Home	Diesel	Rural Restricted				166	217	221
Motor Home	Diesel	Rural Unrestricted				348	431	436
Motor Home	Diesel	Urban Restricted				245	400	407
Motor Home	Diesel	Urban Unrestricted				174	230	233
Combination Short-haul Truck	Gasoline	Off-Network	1	0	0			
Combination Short-haul Truck	Gasoline	Rural Restricted				4	1	1
Combination Short-haul Truck	Gasoline	Rural Unrestricted				4	1	1
Combination Short-haul Truck	Gasoline	Urban Restricted				3	1	1
Combination Short-haul Truck	Gasoline	Urban Unrestricted				1	0	0
Combination Short-haul Truck	Diesel	Off-Network	330	361	361			
Combination Short-haul Truck	Diesel	Rural Restricted				9,835	11,156	11,531
Combination Short-haul Truck	Diesel	Rural Unrestricted				10,253	11,017	11,349
Combination Short-haul Truck	Diesel	Urban Restricted				8,449	11,947	12,382
Combination Short-haul Truck	Diesel	Urban Unrestricted				3,497	4,019	4,136
Combination Long-haul Truck	Diesel	Off-Network	350	411	419			
Combination Long-haul Truck	Diesel	Rural Restricted				36,404	36,493	36,667
Combination Long-haul Truck	Diesel	Rural Unrestricted				35,762	33,960	34,010
Combination Long-haul Truck	Diesel	Urban Restricted				30,206	37,750	38,033
Combination Long-haul Truck	Diesel	Urban Unrestricted				11,867	12,053	12,058
ALL (Total)	**ALL (Total)**	**ALL (Total)**	**83,859**	**89,484**	**90,050**	**3,077,240**	**3,326,005**	**3,347,514**
Motorcycle	ALL	ALL	2,935	3,124	3,144	20,403	22,001	22,136
Passenger Car	ALL	ALL	41,585	44,168	44,439	1,402,230	1,522,287	1,532,335
Passenger Truck	ALL	ALL	29,312	30,936	31,116	1,149,338	1,218,676	1,222,573
Light Commercial Truck	ALL	ALL	7,165	7,829	7,892	261,555	292,195	296,861
Intercity Bus	ALL	ALL	4	5	5	1,301	1,446	1,459
Transit Bus	ALL	ALL	16	20	20	2,656	2,871	2,912
School Bus	ALL	ALL	148	176	178	7,193	7,986	8,061

Source Type	Fuel Type	Road Type	Sheboygan County					
			Vehicle Population			Vehicle-Miles of Travel Summer Weekday		
			2011	2017	2018	2011	2017	2018
Refuse Truck	ALL	ALL	49	60	61	3,900	4,442	4,461
Single Unit Short-haul Truck	ALL	ALL	1,531	1,863	1,879	75,565	87,680	88,466
Single Unit Long-haul Truck	ALL	ALL	64	79	80	4,127	4,926	5,032
Motor Home	ALL	ALL	369	451	455	2,688	3,095	3,050
Combination Short-haul Truck	ALL	ALL	331	362	362	32,045	38,143	39,401
Combination Long-haul Truck	ALL	ALL	350	411	419	114,240	120,256	120,767
ALL (Total)	**ALL (Total)**	**ALL (Total)**	**83,859**	**89,484**	**90,050**	**3,077,240**	**3,326,005**	**3,347,514**
ALL	Gasoline	ALL	80,721	85,249	85,547	2,819,447	3,018,232	3,027,835
ALL	Diesel	ALL	3,125	3,853	3,923	257,020	291,561	295,456
ALL	CNG	ALL	2	2	3	312	390	404
ALL	Ethanol (E-85)	ALL	11	380	578	462	15,822	23,820
ALL (Total)	**ALL (Total)**	**ALL (Total)**	**83,859**	**89,484**	**90,050**	**3,077,240**	**3,326,005**	**3,347,514**
ALL	ALL	Off-Network	83,859	89,484	90,050			
ALL	ALL	Rural Restricted				632,717	663,747	668,818
ALL	ALL	Rural Unrestricted				1,270,993	1,278,721	1,285,345
ALL	ALL	Urban Restricted				644,949	820,076	827,299
ALL	ALL	Urban Unrestricted				528,581	563,461	566,052
ALL (Total)	**ALL (Total)**	**ALL (Total)**	**83,859**	**89,484**	**90,050**	**3,077,240**	**3,326,005**	**3,347,514**

APPENDIX 6

Nonroad Emissions for 2011, 2017 and 2018

This appendix provides detailed listings of the estimated nonroad emissions data for over 200 subcategories for Sheboygan County for 2011, 2017 and 2018. The sum of NOx and VOC emissions from the different nonroad source types were used for the nonroad sector NOx and VOC tons per summer day (tpsd) emission estimates in sections 3.2 (2011 Base Year Inventory for RFP) and 3.3 (2017 & 2018 Projected Year Inventories for RFP) of the Wisconsin Department of Natural Resources (WDNR) Sheboygan County attainment plan.

Table 6.1

2011 Nonroad NO_X and VOC Emissions: tons per summer day (tpsd) Sheboygan County

SCC	Segment Description	SCC Description	Emissions from	Sheboygan County 2011 Emissions	
				NOx	VOC
2260001010	Recreational	2-Stroke Motorcycles: Off-Road	MOVES	0.0028	0.4234
2260001020	Recreational	2-Stroke Snowmobiles	MOVES	0.0000	0.0441
2260001030	Recreational	2-Stroke All Terrain Vehicles	MOVES	0.0040	0.4936
2260001060	Recreational	2-Stroke Specialty Vehicle Carts	MOVES	0.0011	0.0048
2260002006	Construction	2-Stroke Tampers/Rammers	MOVES	0.0001	0.0046
2260002009	Construction	2-Stroke Plate Compactors	MOVES	0.0000	0.0002
2260002021	Construction	2-Stroke Paving Equipment	MOVES	0.0000	0.0002
2260002027	Construction	2-Stroke Signal Boards	MOVES	0.0000	0.0000
2260002039	Construction	2-Stroke Concrete/Industrial Saws	MOVES	0.0003	0.0115
2260002054	Construction	2-Stroke Crushing/Proc. Equipment	MOVES	0.0000	0.0000
2260003030	Industrial	2-Stroke Sweepers/Scrubbers	MOVES	0.0000	0.0002
2260003040	Industrial	2-Stroke Other General Industrial Equipment	MOVES	0.0000	0.0000
2260004015	Lawn/Garden	2-Stroke Rotary Tillers < 6 HP (Residential)	MOVES	0.0001	0.0017
2260004016	Lawn/Garden	2-Stroke Rotary Tillers < 6 HP (Commercial)	MOVES	0.0001	0.0026
2260004020	Lawn/Garden	2-Stroke Chain Saws < 6 HP (Residential)	MOVES	0.0004	0.0134
2260004021	Lawn/Garden	2-Stroke Chain Saws < 6 HP (Commercial)	MOVES	0.0006	0.0292
2260004025	Lawn/Garden	2-Stroke Trimmers/Edgers/Brush Cutters (Res.)	MOVES	0.0010	0.0330
2260004026	Lawn/Garden	2-Stroke Trimmers/Edgers/Brush Cutters (Com.)	MOVES	0.0011	0.0296
2260004030	Lawn/Garden	2-Stroke Leafblowers/Vacuums (Residential)	MOVES	0.0007	0.0235
2260004031	Lawn/Garden	2-Stroke Leafblowers/Vacuums (Commercial)	MOVES	0.0010	0.0295
2260004035	Lawn/Garden	2-Stroke Snowblowers (Residential)	MOVES	0.0000	0.0046
2260004036	Lawn/Garden	2-Stroke Snowblowers (Commercial)	MOVES	0.0000	0.0003
2260004071	Lawn/Garden	2-Stroke Commercial Turf Equipment	MOVES	0.0000	0.0000
2260005035	Agriculture	2-Stroke Sprayers	MOVES	0.0000	0.0007
2260006005	Commercial	2-Stroke Light Commercial Generator Set	MOVES	0.0000	0.0011
2260006010	Commercial	2-Stroke Light Commercial Pumps	MOVES	0.0003	0.0076
2260006015	Commercial	2-Stroke Light Commercial Air Compressors	MOVES	0.0000	0.0000
2260006035	Commercial	2-Stroke Hydro Power Units	MOVES	0.0000	0.0000
2260007005	Logging	2-Stroke Logging Equipment Chain Saws > 6 HP	MOVES	0.0000	0.0009
2265001010	Recreational	4-Stroke Motorcycles: Off-Road	MOVES	0.0021	0.0189
2265001030	Recreational	4-Stroke All Terrain Vehicles	MOVES	0.0185	0.2153
2265001050	Recreational	4-Stroke Golf Carts	MOVES	0.0103	0.0323
2265001060	Recreational	4-Stroke Specialty Vehicle Carts	MOVES	0.0010	0.0045
2265002003	Construction	4-Stroke Asphalt Pavers	MOVES	0.0002	0.0003
2265002006	Construction	4-Stroke Tampers/Rammers	MOVES	0.0000	0.0000
2265002009	Construction	4-Stroke Plate Compactors	MOVES	0.0002	0.0012
2265002015	Construction	4-Stroke Rollers	MOVES	0.0002	0.0005
2265002021	Construction	4-Stroke Paving Equipment	MOVES	0.0005	0.0021
2265002024	Construction	4-Stroke Surfacing Equipment	MOVES	0.0002	0.0007
2265002027	Construction	4-Stroke Signal Boards	MOVES	0.0000	0.0000
2265002030	Construction	4-Stroke Trenchers	MOVES	0.0005	0.0013
2265002033	Construction	4-Stroke Bore/Drill Rigs	MOVES	0.0002	0.0009
2265002039	Construction	4-Stroke Concrete/Industrial Saws	MOVES	0.0007	0.0019
2265002042	Construction	4-Stroke Cement & Mortar Mixers	MOVES	0.0005	0.0030
2265002045	Construction	4-Stroke Cranes	MOVES	0.0001	0.0001
2265002054	Construction	4-Stroke Crushing/Proc. Equipment	MOVES	0.0001	0.0002
2265002057	Construction	4-Stroke Rough Terrain Forklifts	MOVES	0.0001	0.0001
2265002060	Construction	4-Stroke Rubber Tire Loaders	MOVES	0.0002	0.0001
2265002066	Construction	4-Stroke Tractors/Loaders/Backhoes	MOVES	0.0003	0.0007
2265002072	Construction	4-Stroke Skid Steer Loaders	MOVES	0.0004	0.0005

SCC	Segment Description	SCC Description	Emissions from	Sheboygan County 2011 Emissions	
				NOx	VOC
2265002078	Construction	4-Stroke Dumpers/Tenders	MOVES	0.0001	0.0004
2265002081	Construction	4-Stroke Other Construction Equipment	MOVES	0.0001	0.0001
2265003010	Industrial	4-Stroke Aerial Lifts	MOVES	0.0039	0.0042
2265003020	Industrial	4-Stroke Forklifts	MOVES	0.0085	0.0053
2265003030	Industrial	4-Stroke Sweepers/Scrubbers	MOVES	0.0012	0.0019
2265003040	Industrial	4-Stroke Other General Industrial Equipment	MOVES	0.0019	0.0084
2265003050	Industrial	4-Stroke Other Material Handling Equipment	MOVES	0.0002	0.0003
2265003060	Industrial	4-Stroke Industrial AC/Refrigeration	MOVES	0.0000	0.0000
2265003070	Industrial	4-Stroke Terminal Tractors	MOVES	0.0003	0.0002
2265004010	Lawn/Garden	4-Stroke Lawn mowers (Residential)	MOVES	0.0125	0.1515
2265004011	Lawn/Garden	4-Stroke Lawn mowers (Commercial)	MOVES	0.0039	0.0297
2265004015	Lawn/Garden	4-Stroke Rotary Tillers < 6 HP (Residential)	MOVES	0.0010	0.0126
2265004016	Lawn/Garden	4-Stroke Rotary Tillers < 6 HP (Commercial)	MOVES	0.0021	0.0176
2265004025	Lawn/Garden	4-Stroke Trimmers/Edgers/Brush Cutters (Res.)	MOVES	0.0001	0.0008
2265004026	Lawn/Garden	4-Stroke Trimmers/Edgers/Brush Cutters (Com.)	MOVES	0.0001	0.0006
2265004030	Lawn/Garden	4-Stroke Leafblowers/Vacuums (Residential)	MOVES	0.0001	0.0015
2265004031	Lawn/Garden	4-Stroke Leafblowers/Vacuums (Commercial)	MOVES	0.0051	0.0131
2265004035	Lawn/Garden	4-Stroke Snowblowers (Residential)	MOVES	0.0000	0.0093
2265004036	Lawn/Garden	4-Stroke Snowblowers (Commercial)	MOVES	0.0000	0.0006
2265004040	Lawn/Garden	4-Stroke Rear Engine Riding Mowers (Res.)	MOVES	0.0027	0.0173
2265004041	Lawn/Garden	4-Stroke Rear Engine Riding Mowers (Comm.)	MOVES	0.0005	0.0013
2265004046	Lawn/Garden	4-Stroke Front Mowers (Commercial)	MOVES	0.0006	0.0022
2265004051	Lawn/Garden	4-Stroke Shredders < 6 HP (Commercial)	MOVES	0.0003	0.0022
2265004055	Lawn/Garden	4-Stroke Lawn & Garden Tractors (Residential)	MOVES	0.0361	0.1692
2265004056	Lawn/Garden	4-Stroke Lawn & Garden Tractors (Commercial)	MOVES	0.0065	0.0168
2265004066	Lawn/Garden	4-Stroke Chippers/Stump Grinders (Comm.)	MOVES	0.0012	0.0020
2265004071	Lawn/Garden	4-Stroke Commercial Turf Equipment (Comm.)	MOVES	0.0197	0.0588
2265004075	Lawn/Garden	4-Stroke Other Lawn & Garden Equip. (Res.)	MOVES	0.0013	0.0100
2265004076	Lawn/Garden	4-Stroke Other Lawn & Garden Equip. (Com.)	MOVES	0.0007	0.0054
2265005010	Agriculture	4-Stroke 2-Wheel Tractors	MOVES	0.0001	0.0003
2265005015	Agriculture	4-Stroke Agricultural Tractors	MOVES	0.0006	0.0005
2265005020	Agriculture	4-Stroke Combines	MOVES	0.0000	0.0000
2265005025	Agriculture	4-Stroke Balers	MOVES	0.0010	0.0013
2265005030	Agriculture	4-Stroke Agricultural Mowers	MOVES	0.0001	0.0003
2265005035	Agriculture	4-Stroke Sprayers	MOVES	0.0017	0.0048
2265005040	Agriculture	4-Stroke Tillers > 5 HP	MOVES	0.0022	0.0106
2265005045	Agriculture	4-Stroke Swathers	MOVES	0.0015	0.0016
2265005055	Agriculture	4-Stroke Other Agricultural Equipment	MOVES	0.0018	0.0019
2265005060	Agriculture	4-Stroke Irrigation Sets	MOVES	0.0008	0.0007
2265006005	Commercial	4-Stroke Light Commercial Generator Set	MOVES	0.0114	0.0622
2265006010	Commercial	4-Stroke Light Commercial Pumps	MOVES	0.0030	0.0132
2265006015	Commercial	4-Stroke Light Commercial Air Compressors	MOVES	0.0017	0.0051
2265006025	Commercial	4-Stroke Light Commercial Welders	MOVES	0.0033	0.0086
2265006030	Commercial	4-Stroke Light Commercial Pressure Wash	MOVES	0.0047	0.0257
2265006035	Commercial	4-Stroke Hydro Power Units	MOVES	0.0002	0.0008
2265007010	Logging	4-Stroke Logging Equipment Shredders > 6 HP	MOVES	0.0001	0.0003
2265007015	Logging	4-Stroke Logging Equipment Skidders	MOVES	0.0000	0.0000
2265008005	Airport	4-Stroke Airport Support Equipment	USEPA	0.0000	0.0000
2265010010	Oil Field	4-Stroke Other Oil Field Equipment	MOVES	0.0000	0.0000
2267001060	Recreational	LPG Specialty Vehicle Carts	MOVES	0.0003	0.0001
2267002003	Construction	LPG Asphalt Pavers	MOVES	0.0001	0.0000
2267002015	Construction	LPG Rollers	MOVES	0.0001	0.0000
2267002021	Construction	LPG Paving Equipment	MOVES	0.0000	0.0000
2267002024	Construction	LPG Surfacing Equipment	MOVES	0.0000	0.0000
2267002030	Construction	LPG Trenchers	MOVES	0.0002	0.0000
2267002033	Construction	LPG Bore/Drill Rigs	MOVES	0.0001	0.0000
2267002039	Construction	LPG Concrete/Industrial Saws	MOVES	0.0001	0.0000

SCC	Segment Description	SCC Description	Emissions from	Sheboygan County 2011 Emissions	
				NOx	VOC
2267002045	Construction	LPG Cranes	MOVES	0.0001	0.0000
2267002054	Construction	LPG Crushing/Proc. Equipment	MOVES	0.0000	0.0000
2267002057	Construction	LPG Rough Terrain Forklifts	MOVES	0.0002	0.0000
2267002060	Construction	LPG Rubber Tire Loaders	MOVES	0.0002	0.0001
2267002066	Construction	LPG Tractors/Loaders/Backhoes	MOVES	0.0000	0.0000
2267002072	Construction	LPG Skid Steer Loaders	MOVES	0.0004	0.0001
2267002081	Construction	LPG Other Construction Equipment	MOVES	0.0002	0.0000
2267003010	Industrial	LPG Aerial Lifts	MOVES	0.0084	0.0018
2267003020	Industrial	LPG Forklifts	MOVES	0.4146	0.0909
2267003030	Industrial	LPG Sweepers/Scrubbers	MOVES	0.0020	0.0004
2267003040	Industrial	LPG Other General Industrial Equipment	MOVES	0.0008	0.0002
2267003050	Industrial	LPG Other Material Handling Equipment	MOVES	0.0004	0.0001
2267003070	Industrial	LPG Terminal Tractors	MOVES	0.0007	0.0001
2267004066	Lawn/Garden	LPG Chippers/Stump Grinders (Commercial)	MOVES	0.0007	0.0001
2267005055	Agriculture	LPG Other Agricultural Equipment	MOVES	0.0000	0.0000
2267005060	Agriculture	LPG Irrigation Sets	MOVES	0.0000	0.0000
2267006005	Commercial	LPG Light Commercial Generator Sets	MOVES	0.0054	0.0009
2267006010	Commercial	LPG Light Commercial Pumps	MOVES	0.0010	0.0002
2267006015	Commercial	LPG Light Commercial Air Compressors	MOVES	0.0009	0.0002
2267006025	Commercial	LPG Light Commercial Welders	MOVES	0.0012	0.0003
2267006030	Commercial	LPG Light Commercial Pressure Washers	MOVES	0.0000	0.0000
2267006035	Commercial	LPG Hydro Power Units	MOVES	0.0000	0.0000
2267008005	Airport	LPG Airport Support Equipment	USEPA	0.0000	0.0000
2268002081	Construction	CNG Other Construction Equipment	MOVES	0.0000	0.0000
2268003020	Industrial	CNG Forklifts	MOVES	0.0296	0.0232
2268003030	Industrial	CNG Sweepers/Scrubbers	MOVES	0.0000	0.0000
2268003040	Industrial	CNG Other General Industrial Equipment	MOVES	0.0000	0.0000
2268003060	Industrial	CNG AC/Refrigeration	MOVES	0.0000	0.0000
2268003070	Industrial	CNG Terminal Tractors	MOVES	0.0001	0.0000
2268005055	Agriculture	CNG Other Agricultural Equipment	MOVES	0.0000	0.0000
2268005060	Agriculture	CNG Irrigation Sets	MOVES	0.0001	0.0001
2268006005	Commercial	CNG Light Commercial Generator Sets	MOVES	0.0017	0.0010
2268006010	Commercial	CNG Light Commercial Pumps	MOVES	0.0001	0.0000
2268006015	Commercial	CNG Light Commercial Air Compressors	MOVES	0.0001	0.0000
2268006020	Commercial	CNG Light Commercial Gas Compressors	MOVES	0.0006	0.0003
2268008005	Airport	CNG Airport Support Equipment	USEPA	0.0000	0.0000
2268010010	Oil Field	CNG Other Oil Field Equipment	MOVES	0.0000	0.0000
2270001060	Recreational	Diesel Specialty Vehicle Carts	MOVES	0.0033	0.0009
2270002003	Construction	Diesel Pavers	MOVES	0.0091	0.0008
2270002006	Construction	Diesel Tampers/Rammers (unused)	MOVES	0.0000	0.0000
2270002009	Construction	Diesel Plate Compactors	MOVES	0.0003	0.0001
2270002015	Construction	Diesel Rollers	MOVES	0.0241	0.0021
2270002018	Construction	Diesel Scrapers	MOVES	0.0253	0.0016
2270002021	Construction	Diesel Paving Equipment	MOVES	0.0015	0.0001
2270002024	Construction	Diesel Surfacing Equipment	MOVES	0.0011	0.0001
2270002027	Construction	Diesel Signal Boards	MOVES	0.0032	0.0004
2270002030	Construction	Diesel Trenchers	MOVES	0.0125	0.0012
2270002033	Construction	Diesel Bore/Drill Rigs	MOVES	0.0146	0.0012
2270002036	Construction	Diesel Excavators	MOVES	0.0837	0.0067
2270002039	Construction	Diesel Concrete/Industrial Saws	MOVES	0.0009	0.0001
2270002042	Construction	Diesel Cement & Mortar Mixers	MOVES	0.0006	0.0001
2270002045	Construction	Diesel Cranes	MOVES	0.0241	0.0017
2270002048	Construction	Diesel Graders	MOVES	0.0208	0.0017
2270002051	Construction	Diesel Off-highway Trucks	MOVES	0.0826	0.0052
2270002054	Construction	Diesel Crushing/Proc. Equipment	MOVES	0.0045	0.0003
2270002057	Construction	Diesel Rough Terrain Forklifts	MOVES	0.0328	0.0031
2270002060	Construction	Diesel Rubber Tire Loaders	MOVES	0.1133	0.0083

SCC	Segment Description	SCC Description	Emissions from	Sheboygan County 2011 Emissions	
				NOx	VOC
2270002066	Construction	Diesel Tractors/Loaders/Backhoes	MOVES	0.0805	0.0167
2270002069	Construction	Diesel Crawler Tractors	MOVES	0.0950	0.0069
2270002072	Construction	Diesel Skid Steer Loaders	MOVES	0.0557	0.0147
2270002075	Construction	Diesel Off-Highway Tractors	MOVES	0.0125	0.0008
2270002078	Construction	Diesel Dumpers/Tenders	MOVES	0.0002	0.0001
2270002081	Construction	Diesel Other Construction Equipment	MOVES	0.0122	0.0009
2270003010	Industrial	Diesel Aerial Lifts	MOVES	0.0119	0.0032
2270003020	Industrial	Diesel Forklifts	MOVES	0.1020	0.0083
2270003030	Industrial	Diesel Sweepers/Scrubbers	MOVES	0.0538	0.0045
2270003040	Industrial	Diesel Other General Industrial Equipment	MOVES	0.0619	0.0051
2270003050	Industrial	Diesel Other Material Handling Equipment	MOVES	0.0032	0.0006
2270003060	Industrial	Diesel AC/Refrigeration	MOVES	0.0474	0.0041
2270003070	Industrial	Diesel Terminal Tractors	MOVES	0.0628	0.0054
2270004031	Lawn/Garden	Diesel Leafblowers/Vacuums (Commercial)	MOVES	0.0000	0.0000
2270004036	Lawn/Garden	Diesel Snowblowers (Commercial)	MOVES	0.0000	0.0000
2270004046	Lawn/Garden	Diesel Front Mowers (Commercial)	MOVES	0.0112	0.0014
2270004056	Lawn/Garden	Diesel Lawn & Garden Tractors (Commercial)	MOVES	0.0022	0.0003
2270004066	Lawn/Garden	Diesel Chippers/Stump Grinders (Commercial)	MOVES	0.0167	0.0016
2270004071	Lawn/Garden	Diesel Commercial Turf Equipment (Comm.)	MOVES	0.0016	0.0001
2270004076	Lawn/Garden	Diesel Other Lawn & Garden Equipment (Comm)	MOVES	0.0000	0.0000
2270005010	Agriculture	Diesel 2-Wheel Tractors	MOVES	0.0000	0.0000
2270005015	Agriculture	Diesel Agricultural Tractors	MOVES	1.0035	0.0950
2270005020	Agriculture	Diesel Combines	MOVES	0.1056	0.0093
2270005025	Agriculture	Diesel Balers	MOVES	0.0005	0.0001
2270005030	Agriculture	Diesel Agricultural Mowers	MOVES	0.0001	0.0000
2270005035	Agriculture	Diesel Sprayers	MOVES	0.0083	0.0011
2270005040	Agriculture	Diesel Tillers > 6 HP	MOVES	0.0000	0.0000
2270005045	Agriculture	Diesel Swathers	MOVES	0.0078	0.0009
2270005055	Agriculture	Diesel Other Agricultural Equipment	MOVES	0.0213	0.0022
2270005060	Agriculture	Diesel Irrigation Sets	MOVES	0.0134	0.0013
2270006005	Commercial	Diesel Light Commercial Generator Sets	MOVES	0.0267	0.0032
2270006010	Commercial	Diesel Light Commercial Pumps	MOVES	0.0063	0.0007
2270006015	Commercial	Diesel Light Commercial Air Compressors	MOVES	0.0145	0.0013
2270006025	Commercial	Diesel Light Commercial Welders	MOVES	0.0080	0.0023
2270006030	Commercial	Diesel Light Commercial Pressure Washer	MOVES	0.0009	0.0001
2270006035	Commercial	Diesel Hydro Power Units	MOVES	0.0006	0.0001
2270007015	Logging	Diesel Logging Equip Fell/Bunch/Skidders	MOVES	0.0017	0.0001
2270008005	Airport	Diesel Airport Support Equipment	USEPA	0.0000	0.0000
2270010010	Oil Field	Diesel Other Oil Field Equipment	MOVES	0.0000	0.0000
2275001000	Aircraft	Military Aircraft	USEPA	0.0001	0.0005
2275020000	Aircraft	Commercial Aviation	USEPA	0.0000	0.0000
2275050000	Aircraft	General Aviation	USEPA	0.0055	0.0121
2275060000	Aircraft	Air Taxi	USEPA	0.0022	0.0029
2275070000	Aircraft	Aircraft Auxiliary Power Units	USEPA	0.0000	0.0000
2280000000	Comm. Mar.	All Commercial Marine Vessels	USEPA	0.0000	0.0000
2282005010	Pleasure Craft	2-Stroke Outboards	MOVES	0.0378	0.4761
2282005015	Pleasure Craft	2-Stroke Personal Watercraft	MOVES	0.0152	0.1206
2282010005	Pleasure Craft	4-Stroke Inboards	MOVES	0.1708	0.1842
2282020005	Pleasure Craft	Diesel Inboards	MOVES	0.1718	0.0079
2282020010	Pleasure Craft	Diesel Outboards	MOVES	0.0001	0.0000
2285002006	Railroad	Diesel Locomotives	USEPA	0.0894	0.0039
2285002015	Railroad	Diesel Railway Maintenance	MOVES	0.0005	0.0001
2285004015	Railroad	4-Stroke Gasoline Railway Maintenance	MOVES	0.0000	0.0000
2285006015	Railroad	LPG Railway Maintenance	MOVES	0.0000	0.0000
ALL (Total)	**ALL (Total)**	**ALL (Total)**		**3.4669**	**3.2823**

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Table 6.2

2017 Nonroad NO_X and VOC Emissions: tons per summer day (tpsd)
Sheboygan County

SCC	Segment Description	SCC Description	Emissions from	Sheboygan County 2017 Emissions	
				NOx	VOC
2260001010	Recreational	2-Stroke Motorcycles: Off-Road	MOVES	0.0038	0.3559
2260001020	Recreational	2-Stroke Snowmobiles	MOVES	0.0000	0.0395
2260001030	Recreational	2-Stroke All Terrain Vehicles	MOVES	0.0055	0.2666
2260001060	Recreational	2-Stroke Specialty Vehicle Carts	MOVES	0.0006	0.0032
2260002006	Construction	2-Stroke Tampers/Rammers	MOVES	0.0001	0.0046
2260002009	Construction	2-Stroke Plate Compactors	MOVES	0.0000	0.0002
2260002021	Construction	2-Stroke Paving Equipment	MOVES	0.0000	0.0002
2260002027	Construction	2-Stroke Signal Boards	MOVES	0.0000	0.0000
2260002039	Construction	2-Stroke Concrete/Industrial Saws	MOVES	0.0003	0.0117
2260002054	Construction	2-Stroke Crushing/Proc. Equipment	MOVES	0.0000	0.0000
2260003030	Industrial	2-Stroke Sweepers/Scrubbers	MOVES	0.0000	0.0001
2260003040	Industrial	2-Stroke Other General Industrial Equipment	MOVES	0.0000	0.0000
2260004015	Lawn/Garden	2-Stroke Rotary Tillers < 6 HP (Residential)	MOVES	0.0001	0.0015
2260004016	Lawn/Garden	2-Stroke Rotary Tillers < 6 HP (Commercial)	MOVES	0.0001	0.0028
2260004020	Lawn/Garden	2-Stroke Chain Saws < 6 HP (Residential)	MOVES	0.0004	0.0146
2260004021	Lawn/Garden	2-Stroke Chain Saws < 6 HP (Commercial)	MOVES	0.0007	0.0323
2260004025	Lawn/Garden	2-Stroke Trimmers/Edgers/Brush Cutters (Res.)	MOVES	0.0012	0.0309
2260004026	Lawn/Garden	2-Stroke Trimmers/Edgers/Brush Cutters (Com.)	MOVES	0.0013	0.0325
2260004030	Lawn/Garden	2-Stroke Leafblowers/Vacuums (Residential)	MOVES	0.0007	0.0212
2260004031	Lawn/Garden	2-Stroke Leafblowers/Vacuums (Commercial)	MOVES	0.0012	0.0325
2260004035	Lawn/Garden	2-Stroke Snowblowers (Residential)	MOVES	0.0000	0.0020
2260004036	Lawn/Garden	2-Stroke Snowblowers (Commercial)	MOVES	0.0000	0.0001
2260004071	Lawn/Garden	2-Stroke Commercial Turf Equipment	MOVES	0.0000	0.0000
2260005035	Agriculture	2-Stroke Sprayers	MOVES	0.0000	0.0008
2260006005	Commercial	2-Stroke Light Commercial Generator Set	MOVES	0.0000	0.0012
2260006010	Commercial	2-Stroke Light Commercial Pumps	MOVES	0.0003	0.0086
2260006015	Commercial	2-Stroke Light Commercial Air Compressors	MOVES	0.0000	0.0000
2260006035	Commercial	2-Stroke Hydro Power Units	MOVES	0.0000	0.0001
2260007005	Logging	2-Stroke Logging Equipment Chain Saws > 6 HP	MOVES	0.0000	0.0011
2265001010	Recreational	4-Stroke Motorcycles: Off-Road	MOVES	0.0022	0.0181
2265001030	Recreational	4-Stroke All Terrain Vehicles	MOVES	0.0178	0.2102
2265001050	Recreational	4-Stroke Golf Carts	MOVES	0.0083	0.0278
2265001060	Recreational	4-Stroke Specialty Vehicle Carts	MOVES	0.0009	0.0033
2265002003	Construction	4-Stroke Asphalt Pavers	MOVES	0.0001	0.0002
2265002006	Construction	4-Stroke Tampers/Rammers	MOVES	0.0000	0.0000
2265002009	Construction	4-Stroke Plate Compactors	MOVES	0.0001	0.0006
2265002015	Construction	4-Stroke Rollers	MOVES	0.0001	0.0004
2265002021	Construction	4-Stroke Paving Equipment	MOVES	0.0003	0.0012
2265002024	Construction	4-Stroke Surfacing Equipment	MOVES	0.0001	0.0004
2265002027	Construction	4-Stroke Signal Boards	MOVES	0.0000	0.0000
2265002030	Construction	4-Stroke Trenchers	MOVES	0.0003	0.0007
2265002033	Construction	4-Stroke Bore/Drill Rigs	MOVES	0.0001	0.0004
2265002039	Construction	4-Stroke Concrete/Industrial Saws	MOVES	0.0005	0.0016
2265002042	Construction	4-Stroke Cement & Mortar Mixers	MOVES	0.0003	0.0018
2265002045	Construction	4-Stroke Cranes	MOVES	0.0000	0.0000
2265002054	Construction	4-Stroke Crushing/Proc. Equipment	MOVES	0.0000	0.0001
2265002057	Construction	4-Stroke Rough Terrain Forklifts	MOVES	0.0000	0.0000
2265002060	Construction	4-Stroke Rubber Tire Loaders	MOVES	0.0001	0.0000
2265002066	Construction	4-Stroke Tractors/Loaders/Backhoes	MOVES	0.0002	0.0005
2265002072	Construction	4-Stroke Skid Steer Loaders	MOVES	0.0002	0.0003

SCC	Segment Description	SCC Description	Emissions from	Sheboygan County 2017 Emissions	
				NOx	VOC
2265002078	Construction	4-Stroke Dumpers/Tenders	MOVES	0.0000	0.0003
2265002081	Construction	4-Stroke Other Construction Equipment	MOVES	0.0001	0.0001
2265003010	Industrial	4-Stroke Aerial Lifts	MOVES	0.0016	0.0017
2265003020	Industrial	4-Stroke Forklifts	MOVES	0.0015	0.0008
2265003030	Industrial	4-Stroke Sweepers/Scrubbers	MOVES	0.0003	0.0005
2265003040	Industrial	4-Stroke Other General Industrial Equipment	MOVES	0.0005	0.0021
2265003050	Industrial	4-Stroke Other Material Handling Equipment	MOVES	0.0001	0.0001
2265003060	Industrial	4-Stroke Industrial AC/Refrigeration	MOVES	0.0000	0.0000
2265003070	Industrial	4-Stroke Terminal Tractors	MOVES	0.0001	0.0000
2265004010	Lawn/Garden	4-Stroke Lawn mowers (Residential)	MOVES	0.0082	0.0799
2265004011	Lawn/Garden	4-Stroke Lawn mowers (Commercial)	MOVES	0.0027	0.0172
2265004015	Lawn/Garden	4-Stroke Rotary Tillers < 6 HP (Residential)	MOVES	0.0007	0.0067
2265004016	Lawn/Garden	4-Stroke Rotary Tillers < 6 HP (Commercial)	MOVES	0.0014	0.0103
2265004025	Lawn/Garden	4-Stroke Trimmers/Edgers/Brush Cutters (Res.)	MOVES	0.0000	0.0005
2265004026	Lawn/Garden	4-Stroke Trimmers/Edgers/Brush Cutters (Com.)	MOVES	0.0001	0.0005
2265004030	Lawn/Garden	4-Stroke Leafblowers/Vacuums (Residential)	MOVES	0.0001	0.0008
2265004031	Lawn/Garden	4-Stroke Leafblowers/Vacuums (Commercial)	MOVES	0.0028	0.0109
2265004035	Lawn/Garden	4-Stroke Snowblowers (Residential)	MOVES	0.0000	0.0048
2265004036	Lawn/Garden	4-Stroke Snowblowers (Commercial)	MOVES	0.0000	0.0003
2265004040	Lawn/Garden	4-Stroke Rear Engine Riding Mowers (Res.)	MOVES	0.0017	0.0122
2265004041	Lawn/Garden	4-Stroke Rear Engine Riding Mowers (Comm.)	MOVES	0.0003	0.0011
2265004046	Lawn/Garden	4-Stroke Front Mowers (Commercial)	MOVES	0.0004	0.0016
2265004051	Lawn/Garden	4-Stroke Shredders < 6 HP (Commercial)	MOVES	0.0002	0.0012
2265004055	Lawn/Garden	4-Stroke Lawn & Garden Tractors (Residential)	MOVES	0.0222	0.1199
2265004056	Lawn/Garden	4-Stroke Lawn & Garden Tractors (Commercial)	MOVES	0.0040	0.0138
2265004066	Lawn/Garden	4-Stroke Chippers/Stump Grinders (Comm.)	MOVES	0.0007	0.0015
2265004071	Lawn/Garden	4-Stroke Commercial Turf Equipment (Comm.)	MOVES	0.0127	0.0411
2265004075	Lawn/Garden	4-Stroke Other Lawn & Garden Equip. (Res.)	MOVES	0.0009	0.0062
2265004076	Lawn/Garden	4-Stroke Other Lawn & Garden Equip. (Com.)	MOVES	0.0005	0.0033
2265005010	Agriculture	4-Stroke 2-Wheel Tractors	MOVES	0.0001	0.0002
2265005015	Agriculture	4-Stroke Agricultural Tractors	MOVES	0.0003	0.0003
2265005020	Agriculture	4-Stroke Combines	MOVES	0.0000	0.0000
2265005025	Agriculture	4-Stroke Balers	MOVES	0.0007	0.0010
2265005030	Agriculture	4-Stroke Agricultural Mowers	MOVES	0.0001	0.0002
2265005035	Agriculture	4-Stroke Sprayers	MOVES	0.0012	0.0031
2265005040	Agriculture	4-Stroke Tillers > 5 HP	MOVES	0.0021	0.0090
2265005045	Agriculture	4-Stroke Swathers	MOVES	0.0012	0.0013
2265005055	Agriculture	4-Stroke Other Agricultural Equipment	MOVES	0.0014	0.0015
2265005060	Agriculture	4-Stroke Irrigation Sets	MOVES	0.0004	0.0003
2265006005	Commercial	4-Stroke Light Commercial Generator Set	MOVES	0.0077	0.0438
2265006010	Commercial	4-Stroke Light Commercial Pumps	MOVES	0.0020	0.0079
2265006015	Commercial	4-Stroke Light Commercial Air Compressors	MOVES	0.0010	0.0031
2265006025	Commercial	4-Stroke Light Commercial Welders	MOVES	0.0020	0.0068
2265006030	Commercial	4-Stroke Light Commercial Pressure Wash	MOVES	0.0031	0.0161
2265006035	Commercial	4-Stroke Hydro Power Units	MOVES	0.0001	0.0005
2265007010	Logging	4-Stroke Logging Equipment Shredders > 6 HP	MOVES	0.0001	0.0003
2265007015	Logging	4-Stroke Logging Equipment Skidders	MOVES	0.0000	0.0000
2265008005	Airport	4-Stroke Airport Support Equipment	USEPA	0.0000	0.0000
2265010010	Oil Field	4-Stroke Other Oil Field Equipment	MOVES	0.0000	0.0000
2267001060	Recreational	LPG Specialty Vehicle Carts	MOVES	0.0002	0.0000
2267002003	Construction	LPG Asphalt Pavers	MOVES	0.0000	0.0000
2267002015	Construction	LPG Rollers	MOVES	0.0000	0.0000
2267002021	Construction	LPG Paving Equipment	MOVES	0.0000	0.0000
2267002024	Construction	LPG Surfacing Equipment	MOVES	0.0000	0.0000
2267002030	Construction	LPG Trenchers	MOVES	0.0001	0.0000
2267002033	Construction	LPG Bore/Drill Rigs	MOVES	0.0001	0.0000
2267002039	Construction	LPG Concrete/Industrial Saws	MOVES	0.0000	0.0000

SCC	Segment Description	SCC Description	Emissions from	Sheboygan County 2017 Emissions	
				NOx	VOC
2267002045	Construction	LPG Cranes	MOVES	0.0001	0.0000
2267002054	Construction	LPG Crushing/Proc. Equipment	MOVES	0.0000	0.0000
2267002057	Construction	LPG Rough Terrain Forklifts	MOVES	0.0001	0.0000
2267002060	Construction	LPG Rubber Tire Loaders	MOVES	0.0001	0.0000
2267002066	Construction	LPG Tractors/Loaders/Backhoes	MOVES	0.0000	0.0000
2267002072	Construction	LPG Skid Steer Loaders	MOVES	0.0002	0.0000
2267002081	Construction	LPG Other Construction Equipment	MOVES	0.0001	0.0000
2267003010	Industrial	LPG Aerial Lifts	MOVES	0.0052	0.0011
2267003020	Industrial	LPG Forklifts	MOVES	0.1549	0.0227
2267003030	Industrial	LPG Sweepers/Scrubbers	MOVES	0.0011	0.0001
2267003040	Industrial	LPG Other General Industrial Equipment	MOVES	0.0003	0.0000
2267003050	Industrial	LPG Other Material Handling Equipment	MOVES	0.0002	0.0000
2267003070	Industrial	LPG Terminal Tractors	MOVES	0.0006	0.0001
2267004066	Lawn/Garden	LPG Chippers/Stump Grinders (Commercial)	MOVES	0.0003	0.0000
2267005055	Agriculture	LPG Other Agricultural Equipment	MOVES	0.0000	0.0000
2267005060	Agriculture	LPG Irrigation Sets	MOVES	0.0000	0.0000
2267006005	Commercial	LPG Light Commercial Generator Sets	MOVES	0.0044	0.0007
2267006010	Commercial	LPG Light Commercial Pumps	MOVES	0.0006	0.0001
2267006015	Commercial	LPG Light Commercial Air Compressors	MOVES	0.0004	0.0001
2267006025	Commercial	LPG Light Commercial Welders	MOVES	0.0005	0.0001
2267006030	Commercial	LPG Light Commercial Pressure Washers	MOVES	0.0000	0.0000
2267006035	Commercial	LPG Hydro Power Units	MOVES	0.0000	0.0000
2267008005	Airport	LPG Airport Support Equipment	USEPA	0.0000	0.0000
2268002081	Construction	CNG Other Construction Equipment	MOVES	0.0000	0.0000
2268003020	Industrial	CNG Forklifts	MOVES	0.0111	0.0059
2268003030	Industrial	CNG Sweepers/Scrubbers	MOVES	0.0000	0.0000
2268003040	Industrial	CNG Other General Industrial Equipment	MOVES	0.0000	0.0000
2268003060	Industrial	CNG AC/Refrigeration	MOVES	0.0000	0.0000
2268003070	Industrial	CNG Terminal Tractors	MOVES	0.0000	0.0000
2268005055	Agriculture	CNG Other Agricultural Equipment	MOVES	0.0000	0.0000
2268005060	Agriculture	CNG Irrigation Sets	MOVES	0.0000	0.0000
2268006005	Commercial	CNG Light Commercial Generator Sets	MOVES	0.0013	0.0008
2268006010	Commercial	CNG Light Commercial Pumps	MOVES	0.0000	0.0000
2268006015	Commercial	CNG Light Commercial Air Compressors	MOVES	0.0000	0.0000
2268006020	Commercial	CNG Light Commercial Gas Compressors	MOVES	0.0007	0.0003
2268008005	Airport	CNG Airport Support Equipment	USEPA	0.0000	0.0000
2268010010	Oil Field	CNG Other Oil Field Equipment	MOVES	0.0000	0.0000
2270001060	Recreational	Diesel Specialty Vehicle Carts	MOVES	0.0029	0.0006
2270002003	Construction	Diesel Pavers	MOVES	0.0051	0.0005
2270002006	Construction	Diesel Tampers/Rammers (unused)	MOVES	0.0000	0.0000
2270002009	Construction	Diesel Plate Compactors	MOVES	0.0003	0.0000
2270002015	Construction	Diesel Rollers	MOVES	0.0145	0.0015
2270002018	Construction	Diesel Scrapers	MOVES	0.0141	0.0014
2270002021	Construction	Diesel Paving Equipment	MOVES	0.0010	0.0001
2270002024	Construction	Diesel Surfacing Equipment	MOVES	0.0008	0.0001
2270002027	Construction	Diesel Signal Boards	MOVES	0.0031	0.0003
2270002030	Construction	Diesel Trenchers	MOVES	0.0095	0.0008
2270002033	Construction	Diesel Bore/Drill Rigs	MOVES	0.0114	0.0010
2270002036	Construction	Diesel Excavators	MOVES	0.0384	0.0050
2270002039	Construction	Diesel Concrete/Industrial Saws	MOVES	0.0007	0.0001
2270002042	Construction	Diesel Cement & Mortar Mixers	MOVES	0.0005	0.0001
2270002045	Construction	Diesel Cranes	MOVES	0.0139	0.0013
2270002048	Construction	Diesel Graders	MOVES	0.0096	0.0013
2270002051	Construction	Diesel Off-highway Trucks	MOVES	0.0494	0.0052
2270002054	Construction	Diesel Crushing/Proc. Equipment	MOVES	0.0030	0.0002
2270002057	Construction	Diesel Rough Terrain Forklifts	MOVES	0.0201	0.0021
2270002060	Construction	Diesel Rubber Tire Loaders	MOVES	0.0692	0.0064

SCC	Segment Description	SCC Description	Emissions from	Sheboygan County 2017 Emissions	
				NOx	VOC
2270002066	Construction	Diesel Tractors/Loaders/Backhoes	MOVES	0.0589	0.0112
2270002069	Construction	Diesel Crawler Tractors	MOVES	0.0527	0.0054
2270002072	Construction	Diesel Skid Steer Loaders	MOVES	0.0480	0.0102
2270002075	Construction	Diesel Off-Highway Tractors	MOVES	0.0086	0.0007
2270002078	Construction	Diesel Dumpers/Tenders	MOVES	0.0002	0.0000
2270002081	Construction	Diesel Other Construction Equipment	MOVES	0.0083	0.0007
2270003010	Industrial	Diesel Aerial Lifts	MOVES	0.0105	0.0024
2270003020	Industrial	Diesel Forklifts	MOVES	0.0474	0.0056
2270003030	Industrial	Diesel Sweepers/Scrubbers	MOVES	0.0281	0.0031
2270003040	Industrial	Diesel Other General Industrial Equipment	MOVES	0.0372	0.0038
2270003050	Industrial	Diesel Other Material Handling Equipment	MOVES	0.0025	0.0004
2270003060	Industrial	Diesel AC/Refrigeration	MOVES	0.0409	0.0026
2270003070	Industrial	Diesel Terminal Tractors	MOVES	0.0243	0.0039
2270004031	Lawn/Garden	Diesel Leafblowers/Vacuums (Commercial)	MOVES	0.0000	0.0000
2270004036	Lawn/Garden	Diesel Snowblowers (Commercial)	MOVES	0.0000	0.0000
2270004046	Lawn/Garden	Diesel Front Mowers (Commercial)	MOVES	0.0113	0.0011
2270004056	Lawn/Garden	Diesel Lawn & Garden Tractors (Commercial)	MOVES	0.0024	0.0003
2270004066	Lawn/Garden	Diesel Chippers/Stump Grinders (Commercial)	MOVES	0.0139	0.0013
2270004071	Lawn/Garden	Diesel Commercial Turf Equipment (Comm.)	MOVES	0.0011	0.0001
2270004076	Lawn/Garden	Diesel Other Lawn & Garden Equipment (Comm)	MOVES	0.0000	0.0000
2270005010	Agriculture	Diesel 2-Wheel Tractors	MOVES	0.0000	0.0000
2270005015	Agriculture	Diesel Agricultural Tractors	MOVES	0.7267	0.0681
2270005020	Agriculture	Diesel Combines	MOVES	0.0804	0.0075
2270005025	Agriculture	Diesel Balers	MOVES	0.0005	0.0001
2270005030	Agriculture	Diesel Agricultural Mowers	MOVES	0.0001	0.0000
2270005035	Agriculture	Diesel Sprayers	MOVES	0.0065	0.0008
2270005040	Agriculture	Diesel Tillers > 6 HP	MOVES	0.0000	0.0000
2270005045	Agriculture	Diesel Swathers	MOVES	0.0062	0.0007
2270005055	Agriculture	Diesel Other Agricultural Equipment	MOVES	0.0157	0.0016
2270005060	Agriculture	Diesel Irrigation Sets	MOVES	0.0088	0.0009
2270006005	Commercial	Diesel Light Commercial Generator Sets	MOVES	0.0233	0.0025
2270006010	Commercial	Diesel Light Commercial Pumps	MOVES	0.0054	0.0006
2270006015	Commercial	Diesel Light Commercial Air Compressors	MOVES	0.0103	0.0009
2270006025	Commercial	Diesel Light Commercial Welders	MOVES	0.0074	0.0015
2270006030	Commercial	Diesel Light Commercial Pressure Washer	MOVES	0.0008	0.0001
2270006035	Commercial	Diesel Hydro Power Units	MOVES	0.0005	0.0000
2270007015	Logging	Diesel Logging Equip Fell/Bunch/Skidders	MOVES	0.0006	0.0001
2270008005	Airport	Diesel Airport Support Equipment	USEPA	0.0000	0.0000
2270010010	Oil Field	Diesel Other Oil Field Equipment	MOVES	0.0000	0.0000
2275001000	Aircraft	Military Aircraft	USEPA	0.0001	0.0005
2275020000	Aircraft	Commercial Aviation	USEPA	0.0000	0.0000
2275050000	Aircraft	General Aviation	USEPA	0.0055	0.0121
2275060000	Aircraft	Air Taxi	USEPA	0.0022	0.0029
2275070000	Aircraft	Aircraft Auxiliary Power Units	USEPA	0.0000	0.0000
2280000000	Comm. Mar.	All Commercial Marine Vessels	USEPA	0.0000	0.0000
2282005010	Pleasure Craft	2-Stroke Outboards	MOVES	0.0438	0.2771
2282005015	Pleasure Craft	2-Stroke Personal Watercraft	MOVES	0.0194	0.0492
2282010005	Pleasure Craft	4-Stroke Inboards	MOVES	0.1398	0.1496
2282020005	Pleasure Craft	Diesel Inboards	MOVES	0.1691	0.0093
2282020010	Pleasure Craft	Diesel Outboards	MOVES	0.0001	0.0000
2285002006	Railroad	Diesel Locomotives	USEPA	0.0868	0.0035
2285002015	Railroad	Diesel Railway Maintenance	MOVES	0.0004	0.0001
2285004015	Railroad	4-Stroke Gasoline Railway Maintenance	MOVES	0.0000	0.0000
2285006015	Railroad	LPG Railway Maintenance	MOVES	0.0000	0.0000
ALL (Total)	**ALL (Total)**	**ALL (Total)**		**2.3420**	**2.2694**

Table 6.3

2018 Nonroad NO_X and VOC Emissions: tons per summer day (tpsd) Sheboygan County

SCC	Segment Description	SCC Description	Emissions from	Sheboygan County 2011 Emissions	
				NOx	VOC
2260001010	Recreational	2-Stroke Motorcycles: Off-Road	MOVES	0.0039	0.3447
2260001020	Recreational	2-Stroke Snowmobiles	MOVES	0.0000	0.0385
2260001030	Recreational	2-Stroke All Terrain Vehicles	MOVES	0.0057	0.2197
2260001060	Recreational	2-Stroke Specialty Vehicle Carts	MOVES	0.0006	0.0031
2260002006	Construction	2-Stroke Tampers/Rammers	MOVES	0.0001	0.0046
2260002009	Construction	2-Stroke Plate Compactors	MOVES	0.0000	0.0002
2260002021	Construction	2-Stroke Paving Equipment	MOVES	0.0000	0.0002
2260002027	Construction	2-Stroke Signal Boards	MOVES	0.0000	0.0000
2260002039	Construction	2-Stroke Concrete/Industrial Saws	MOVES	0.0003	0.0117
2260002054	Construction	2-Stroke Crushing/Proc. Equipment	MOVES	0.0000	0.0000
2260003030	Industrial	2-Stroke Sweepers/Scrubbers	MOVES	0.0000	0.0001
2260003040	Industrial	2-Stroke Other General Industrial Equipment	MOVES	0.0000	0.0000
2260004015	Lawn/Garden	2-Stroke Rotary Tillers < 6 HP (Residential)	MOVES	0.0001	0.0015
2260004016	Lawn/Garden	2-Stroke Rotary Tillers < 6 HP (Commercial)	MOVES	0.0001	0.0028
2260004020	Lawn/Garden	2-Stroke Chain Saws < 6 HP (Residential)	MOVES	0.0004	0.0149
2260004021	Lawn/Garden	2-Stroke Chain Saws < 6 HP (Commercial)	MOVES	0.0007	0.0328
2260004025	Lawn/Garden	2-Stroke Trimmers/Edgers/Brush Cutters (Res.)	MOVES	0.0012	0.0313
2260004026	Lawn/Garden	2-Stroke Trimmers/Edgers/Brush Cutters (Com.)	MOVES	0.0013	0.0330
2260004030	Lawn/Garden	2-Stroke Leafblowers/Vacuums (Residential)	MOVES	0.0008	0.0215
2260004031	Lawn/Garden	2-Stroke Leafblowers/Vacuums (Commercial)	MOVES	0.0012	0.0330
2260004035	Lawn/Garden	2-Stroke Snowblowers (Residential)	MOVES	0.0000	0.0020
2260004036	Lawn/Garden	2-Stroke Snowblowers (Commercial)	MOVES	0.0000	0.0001
2260004071	Lawn/Garden	2-Stroke Commercial Turf Equipment	MOVES	0.0000	0.0000
2260005035	Agriculture	2-Stroke Sprayers	MOVES	0.0000	0.0008
2260006005	Commercial	2-Stroke Light Commercial Generator Set	MOVES	0.0000	0.0013
2260006010	Commercial	2-Stroke Light Commercial Pumps	MOVES	0.0003	0.0087
2260006015	Commercial	2-Stroke Light Commercial Air Compressors	MOVES	0.0000	0.0000
2260006035	Commercial	2-Stroke Hydro Power Units	MOVES	0.0000	0.0001
2260007005	Logging	2-Stroke Logging Equipment Chain Saws > 6 HP	MOVES	0.0000	0.0011
2265001010	Recreational	4-Stroke Motorcycles: Off-Road	MOVES	0.0022	0.0179
2265001030	Recreational	4-Stroke All Terrain Vehicles	MOVES	0.0174	0.2073
2265001050	Recreational	4-Stroke Golf Carts	MOVES	0.0083	0.0280
2265001060	Recreational	4-Stroke Specialty Vehicle Carts	MOVES	0.0008	0.0032
2265002003	Construction	4-Stroke Asphalt Pavers	MOVES	0.0001	0.0002
2265002006	Construction	4-Stroke Tampers/Rammers	MOVES	0.0000	0.0000
2265002009	Construction	4-Stroke Plate Compactors	MOVES	0.0001	0.0006
2265002015	Construction	4-Stroke Rollers	MOVES	0.0001	0.0004
2265002021	Construction	4-Stroke Paving Equipment	MOVES	0.0003	0.0012
2265002024	Construction	4-Stroke Surfacing Equipment	MOVES	0.0001	0.0004
2265002027	Construction	4-Stroke Signal Boards	MOVES	0.0000	0.0000
2265002030	Construction	4-Stroke Trenchers	MOVES	0.0002	0.0007
2265002033	Construction	4-Stroke Bore/Drill Rigs	MOVES	0.0001	0.0004
2265002039	Construction	4-Stroke Concrete/Industrial Saws	MOVES	0.0005	0.0016
2265002042	Construction	4-Stroke Cement & Mortar Mixers	MOVES	0.0003	0.0017
2265002045	Construction	4-Stroke Cranes	MOVES	0.0000	0.0000
2265002054	Construction	4-Stroke Crushing/Proc. Equipment	MOVES	0.0000	0.0001
2265002057	Construction	4-Stroke Rough Terrain Forklifts	MOVES	0.0000	0.0000
2265002060	Construction	4-Stroke Rubber Tire Loaders	MOVES	0.0001	0.0000
2265002066	Construction	4-Stroke Tractors/Loaders/Backhoes	MOVES	0.0002	0.0005
2265002072	Construction	4-Stroke Skid Steer Loaders	MOVES	0.0002	0.0003

SCC	Segment Description	SCC Description	Emissions from	Sheboygan County 2011 Emissions	
				NOx	VOC
2265002078	Construction	4-Stroke Dumpers/Tenders	MOVES	0.0000	0.0003
2265002081	Construction	4-Stroke Other Construction Equipment	MOVES	0.0001	0.0001
2265003010	Industrial	4-Stroke Aerial Lifts	MOVES	0.0014	0.0015
2265003020	Industrial	4-Stroke Forklifts	MOVES	0.0011	0.0006
2265003030	Industrial	4-Stroke Sweepers/Scrubbers	MOVES	0.0002	0.0005
2265003040	Industrial	4-Stroke Other General Industrial Equipment	MOVES	0.0005	0.0018
2265003050	Industrial	4-Stroke Other Material Handling Equipment	MOVES	0.0001	0.0001
2265003060	Industrial	4-Stroke Industrial AC/Refrigeration	MOVES	0.0000	0.0000
2265003070	Industrial	4-Stroke Terminal Tractors	MOVES	0.0001	0.0000
2265004010	Lawn/Garden	4-Stroke Lawn mowers (Residential)	MOVES	0.0080	0.0766
2265004011	Lawn/Garden	4-Stroke Lawn mowers (Commercial)	MOVES	0.0027	0.0175
2265004015	Lawn/Garden	4-Stroke Rotary Tillers < 6 HP (Residential)	MOVES	0.0007	0.0065
2265004016	Lawn/Garden	4-Stroke Rotary Tillers < 6 HP (Commercial)	MOVES	0.0014	0.0101
2265004025	Lawn/Garden	4-Stroke Trimmers/Edgers/Brush Cutters (Res.)	MOVES	0.0000	0.0005
2265004026	Lawn/Garden	4-Stroke Trimmers/Edgers/Brush Cutters (Com.)	MOVES	0.0001	0.0005
2265004030	Lawn/Garden	4-Stroke Leafblowers/Vacuums (Residential)	MOVES	0.0001	0.0008
2265004031	Lawn/Garden	4-Stroke Leafblowers/Vacuums (Commercial)	MOVES	0.0027	0.0110
2265004035	Lawn/Garden	4-Stroke Snowblowers (Residential)	MOVES	0.0000	0.0048
2265004036	Lawn/Garden	4-Stroke Snowblowers (Commercial)	MOVES	0.0000	0.0003
2265004040	Lawn/Garden	4-Stroke Rear Engine Riding Mowers (Res.)	MOVES	0.0016	0.0120
2265004041	Lawn/Garden	4-Stroke Rear Engine Riding Mowers (Comm.)	MOVES	0.0003	0.0011
2265004046	Lawn/Garden	4-Stroke Front Mowers (Commercial)	MOVES	0.0004	0.0016
2265004051	Lawn/Garden	4-Stroke Shredders < 6 HP (Commercial)	MOVES	0.0002	0.0012
2265004055	Lawn/Garden	4-Stroke Lawn & Garden Tractors (Residential)	MOVES	0.0215	0.1182
2265004056	Lawn/Garden	4-Stroke Lawn & Garden Tractors (Commercial)	MOVES	0.0040	0.0139
2265004066	Lawn/Garden	4-Stroke Chippers/Stump Grinders (Comm.)	MOVES	0.0007	0.0015
2265004071	Lawn/Garden	4-Stroke Commercial Turf Equipment (Comm.)	MOVES	0.0129	0.0417
2265004075	Lawn/Garden	4-Stroke Other Lawn & Garden Equip. (Res.)	MOVES	0.0009	0.0060
2265004076	Lawn/Garden	4-Stroke Other Lawn & Garden Equip. (Com.)	MOVES	0.0005	0.0032
2265005010	Agriculture	4-Stroke 2-Wheel Tractors	MOVES	0.0001	0.0002
2265005015	Agriculture	4-Stroke Agricultural Tractors	MOVES	0.0003	0.0003
2265005020	Agriculture	4-Stroke Combines	MOVES	0.0000	0.0000
2265005025	Agriculture	4-Stroke Balers	MOVES	0.0007	0.0009
2265005030	Agriculture	4-Stroke Agricultural Mowers	MOVES	0.0001	0.0002
2265005035	Agriculture	4-Stroke Sprayers	MOVES	0.0012	0.0030
2265005040	Agriculture	4-Stroke Tillers > 5 HP	MOVES	0.0021	0.0087
2265005045	Agriculture	4-Stroke Swathers	MOVES	0.0011	0.0012
2265005055	Agriculture	4-Stroke Other Agricultural Equipment	MOVES	0.0013	0.0014
2265005060	Agriculture	4-Stroke Irrigation Sets	MOVES	0.0004	0.0003
2265006005	Commercial	4-Stroke Light Commercial Generator Set	MOVES	0.0075	0.0432
2265006010	Commercial	4-Stroke Light Commercial Pumps	MOVES	0.0019	0.0080
2265006015	Commercial	4-Stroke Light Commercial Air Compressors	MOVES	0.0010	0.0031
2265006025	Commercial	4-Stroke Light Commercial Welders	MOVES	0.0020	0.0069
2265006030	Commercial	4-Stroke Light Commercial Pressure Wash	MOVES	0.0031	0.0163
2265006035	Commercial	4-Stroke Hydro Power Units	MOVES	0.0001	0.0005
2265007010	Logging	4-Stroke Logging Equipment Shredders > 6 HP	MOVES	0.0001	0.0002
2265007015	Logging	4-Stroke Logging Equipment Skidders	MOVES	0.0000	0.0000
2265008005	Airport	4-Stroke Airport Support Equipment	USEPA	0.0000	0.0000
2265010010	Oil Field	4-Stroke Other Oil Field Equipment	MOVES	0.0000	0.0000
2267001060	Recreational	LPG Specialty Vehicle Carts	MOVES	0.0002	0.0000
2267002003	Construction	LPG Asphalt Pavers	MOVES	0.0000	0.0000
2267002015	Construction	LPG Rollers	MOVES	0.0000	0.0000
2267002021	Construction	LPG Paving Equipment	MOVES	0.0000	0.0000
2267002024	Construction	LPG Surfacing Equipment	MOVES	0.0000	0.0000
2267002030	Construction	LPG Trenchers	MOVES	0.0001	0.0000
2267002033	Construction	LPG Bore/Drill Rigs	MOVES	0.0001	0.0000
2267002039	Construction	LPG Concrete/Industrial Saws	MOVES	0.0000	0.0000

SCC	Segment Description	SCC Description	Emissions from	Sheboygan County 2011 Emissions	
				NOx	VOC
2267002045	Construction	LPG Cranes	MOVES	0.0000	0.0000
2267002054	Construction	LPG Crushing/Proc. Equipment	MOVES	0.0000	0.0000
2267002057	Construction	LPG Rough Terrain Forklifts	MOVES	0.0001	0.0000
2267002060	Construction	LPG Rubber Tire Loaders	MOVES	0.0001	0.0000
2267002066	Construction	LPG Tractors/Loaders/Backhoes	MOVES	0.0000	0.0000
2267002072	Construction	LPG Skid Steer Loaders	MOVES	0.0002	0.0000
2267002081	Construction	LPG Other Construction Equipment	MOVES	0.0001	0.0000
2267003010	Industrial	LPG Aerial Lifts	MOVES	0.0047	0.0010
2267003020	Industrial	LPG Forklifts	MOVES	0.1453	0.0198
2267003030	Industrial	LPG Sweepers/Scrubbers	MOVES	0.0010	0.0001
2267003040	Industrial	LPG Other General Industrial Equipment	MOVES	0.0003	0.0000
2267003050	Industrial	LPG Other Material Handling Equipment	MOVES	0.0002	0.0000
2267003070	Industrial	LPG Terminal Tractors	MOVES	0.0006	0.0001
2267004066	Lawn/Garden	LPG Chippers/Stump Grinders (Commercial)	MOVES	0.0003	0.0000
2267005055	Agriculture	LPG Other Agricultural Equipment	MOVES	0.0000	0.0000
2267005060	Agriculture	LPG Irrigation Sets	MOVES	0.0000	0.0000
2267006005	Commercial	LPG Light Commercial Generator Sets	MOVES	0.0041	0.0007
2267006010	Commercial	LPG Light Commercial Pumps	MOVES	0.0006	0.0001
2267006015	Commercial	LPG Light Commercial Air Compressors	MOVES	0.0004	0.0000
2267006025	Commercial	LPG Light Commercial Welders	MOVES	0.0005	0.0001
2267006030	Commercial	LPG Light Commercial Pressure Washers	MOVES	0.0000	0.0000
2267006035	Commercial	LPG Hydro Power Units	MOVES	0.0000	0.0000
2267008005	Airport	LPG Airport Support Equipment	USEPA	0.0000	0.0000
2268002081	Construction	CNG Other Construction Equipment	MOVES	0.0000	0.0000
2268003020	Industrial	CNG Forklifts	MOVES	0.0104	0.0051
2268003030	Industrial	CNG Sweepers/Scrubbers	MOVES	0.0000	0.0000
2268003040	Industrial	CNG Other General Industrial Equipment	MOVES	0.0000	0.0000
2268003060	Industrial	CNG AC/Refrigeration	MOVES	0.0000	0.0000
2268003070	Industrial	CNG Terminal Tractors	MOVES	0.0000	0.0000
2268005055	Agriculture	CNG Other Agricultural Equipment	MOVES	0.0000	0.0000
2268005060	Agriculture	CNG Irrigation Sets	MOVES	0.0000	0.0000
2268006005	Commercial	CNG Light Commercial Generator Sets	MOVES	0.0013	0.0007
2268006010	Commercial	CNG Light Commercial Pumps	MOVES	0.0000	0.0000
2268006015	Commercial	CNG Light Commercial Air Compressors	MOVES	0.0000	0.0000
2268006020	Commercial	CNG Light Commercial Gas Compressors	MOVES	0.0007	0.0003
2268008005	Airport	CNG Airport Support Equipment	USEPA	0.0000	0.0000
2268010010	Oil Field	CNG Other Oil Field Equipment	MOVES	0.0000	0.0000
2270001060	Recreational	Diesel Specialty Vehicle Carts	MOVES	0.0028	0.0006
2270002003	Construction	Diesel Pavers	MOVES	0.0046	0.0005
2270002006	Construction	Diesel Tampers/Rammers (unused)	MOVES	0.0000	0.0000
2270002009	Construction	Diesel Plate Compactors	MOVES	0.0003	0.0000
2270002015	Construction	Diesel Rollers	MOVES	0.0130	0.0014
2270002018	Construction	Diesel Scrapers	MOVES	0.0123	0.0014
2270002021	Construction	Diesel Paving Equipment	MOVES	0.0009	0.0001
2270002024	Construction	Diesel Surfacing Equipment	MOVES	0.0008	0.0001
2270002027	Construction	Diesel Signal Boards	MOVES	0.0031	0.0003
2270002030	Construction	Diesel Trenchers	MOVES	0.0091	0.0008
2270002033	Construction	Diesel Bore/Drill Rigs	MOVES	0.0108	0.0009
2270002036	Construction	Diesel Excavators	MOVES	0.0322	0.0049
2270002039	Construction	Diesel Concrete/Industrial Saws	MOVES	0.0007	0.0001
2270002042	Construction	Diesel Cement & Mortar Mixers	MOVES	0.0005	0.0001
2270002045	Construction	Diesel Cranes	MOVES	0.0124	0.0013
2270002048	Construction	Diesel Graders	MOVES	0.0080	0.0012
2270002051	Construction	Diesel Off-highway Trucks	MOVES	0.0460	0.0050
2270002054	Construction	Diesel Crushing/Proc. Equipment	MOVES	0.0027	0.0002
2270002057	Construction	Diesel Rough Terrain Forklifts	MOVES	0.0180	0.0019
2270002060	Construction	Diesel Rubber Tire Loaders	MOVES	0.0627	0.0063

SCC	Segment Description	SCC Description	Emissions from	Sheboygan County 2011 Emissions	
				NOx	VOC
2270002066	Construction	Diesel Tractors/Loaders/Backhoes	MOVES	0.0554	0.0105
2270002069	Construction	Diesel Crawler Tractors	MOVES	0.0464	0.0053
2270002072	Construction	Diesel Skid Steer Loaders	MOVES	0.0467	0.0096
2270002075	Construction	Diesel Off-Highway Tractors	MOVES	0.0080	0.0007
2270002078	Construction	Diesel Dumpers/Tenders	MOVES	0.0002	0.0000
2270002081	Construction	Diesel Other Construction Equipment	MOVES	0.0077	0.0007
2270003010	Industrial	Diesel Aerial Lifts	MOVES	0.0103	0.0023
2270003020	Industrial	Diesel Forklifts	MOVES	0.0425	0.0056
2270003030	Industrial	Diesel Sweepers/Scrubbers	MOVES	0.0247	0.0030
2270003040	Industrial	Diesel Other General Industrial Equipment	MOVES	0.0332	0.0036
2270003050	Industrial	Diesel Other Material Handling Equipment	MOVES	0.0024	0.0004
2270003060	Industrial	Diesel AC/Refrigeration	MOVES	0.0410	0.0025
2270003070	Industrial	Diesel Terminal Tractors	MOVES	0.0197	0.0039
2270004031	Lawn/Garden	Diesel Leafblowers/Vacuums (Commercial)	MOVES	0.0000	0.0000
2270004036	Lawn/Garden	Diesel Snowblowers (Commercial)	MOVES	0.0000	0.0000
2270004046	Lawn/Garden	Diesel Front Mowers (Commercial)	MOVES	0.0113	0.0011
2270004056	Lawn/Garden	Diesel Lawn & Garden Tractors (Commercial)	MOVES	0.0025	0.0003
2270004066	Lawn/Garden	Diesel Chippers/Stump Grinders (Commercial)	MOVES	0.0133	0.0013
2270004071	Lawn/Garden	Diesel Commercial Turf Equipment (Comm.)	MOVES	0.0011	0.0001
2270004076	Lawn/Garden	Diesel Other Lawn & Garden Equipment (Comm)	MOVES	0.0000	0.0000
2270005010	Agriculture	Diesel 2-Wheel Tractors	MOVES	0.0000	0.0000
2270005015	Agriculture	Diesel Agricultural Tractors	MOVES	0.6798	0.0648
2270005020	Agriculture	Diesel Combines	MOVES	0.0760	0.0072
2270005025	Agriculture	Diesel Balers	MOVES	0.0004	0.0001
2270005030	Agriculture	Diesel Agricultural Mowers	MOVES	0.0001	0.0000
2270005035	Agriculture	Diesel Sprayers	MOVES	0.0062	0.0007
2270005040	Agriculture	Diesel Tillers > 6 HP	MOVES	0.0000	0.0000
2270005045	Agriculture	Diesel Swathers	MOVES	0.0059	0.0007
2270005055	Agriculture	Diesel Other Agricultural Equipment	MOVES	0.0147	0.0015
2270005060	Agriculture	Diesel Irrigation Sets	MOVES	0.0080	0.0008
2270006005	Commercial	Diesel Light Commercial Generator Sets	MOVES	0.0226	0.0024
2270006010	Commercial	Diesel Light Commercial Pumps	MOVES	0.0053	0.0006
2270006015	Commercial	Diesel Light Commercial Air Compressors	MOVES	0.0096	0.0009
2270006025	Commercial	Diesel Light Commercial Welders	MOVES	0.0072	0.0014
2270006030	Commercial	Diesel Light Commercial Pressure Washer	MOVES	0.0008	0.0001
2270006035	Commercial	Diesel Hydro Power Units	MOVES	0.0004	0.0000
2270007015	Logging	Diesel Logging Equip Fell/Bunch/Skidders	MOVES	0.0004	0.0001
2270008005	Airport	Diesel Airport Support Equipment	USEPA	0.0000	0.0000
2270010010	Oil Field	Diesel Other Oil Field Equipment	MOVES	0.0000	0.0000
2275001000	Aircraft	Military Aircraft	USEPA	0.0001	0.0005
2275020000	Aircraft	Commercial Aviation	USEPA	0.0000	0.0000
2275050000	Aircraft	General Aviation	USEPA	0.0055	0.0121
2275060000	Aircraft	Air Taxi	USEPA	0.0022	0.0029
2275070000	Aircraft	Aircraft Auxiliary Power Units	USEPA	0.0000	0.0000
2280000000	Comm. Mar.	All Commercial Marine Vessels	USEPA	0.0000	0.0000
2282005010	Pleasure Craft	2-Stroke Outboards	MOVES	0.0442	0.2527
2282005015	Pleasure Craft	2-Stroke Personal Watercraft	MOVES	0.0199	0.0419
2282010005	Pleasure Craft	4-Stroke Inboards	MOVES	0.1340	0.1442
2282020005	Pleasure Craft	Diesel Inboards	MOVES	0.1684	0.0095
2282020010	Pleasure Craft	Diesel Outboards	MOVES	0.0001	0.0000
2285002006	Railroad	Diesel Locomotives	USEPA	0.0864	0.0034
2285002015	Railroad	Diesel Railway Maintenance	MOVES	0.0003	0.0001
2285004015	Railroad	4-Stroke Gasoline Railway Maintenance	MOVES	0.0000	0.0000
2285006015	Railroad	LPG Railway Maintenance	MOVES	0.0000	0.0000
ALL (Total)	**ALL (Total)**	**ALL (Total)**		**2.2106**	**2.1554**

APPENDIX 7

2017 and 2018 Wisconsin Emissions Projections Documentation - Methodology

This appendix provides additional information for the sector-specific NOx and VOC tons per summer day (tpsd) emission estimates in section 3.3 (2017 & 2018 Projected Year Inventories for RFP) of the Wisconsin Department of Natural Resources (WDNR) Sheboygan County ozone attainment plan. For the U.S. Environmental Protection Agency (EPA) to approve an attainment plan for ozone, a state must show that improvement in air quality is due to permanent and enforceable reductions in emissions. This is accomplished in part by developing and comparing a nonattainment year (2011) emissions inventory and attainment year (2017) emissions inventory. Emissions were also projected for 2018 in order to meet the required contingency.

This appendix includes:

Appendix 7.1 – EGU Inventory Methodology for 2017 and 2018

See Appendix 2 for the projection methodology related to EGUs.

Appendix 7.2 – Point Non-EGU Inventory Methodology for 2017 and 2018

7.2.1 – Growth Factors from AEO 2014/2016 for Existing Sources

Non-EGU point source projected 2017 and 2018 emissions were derived by first applying growth factors to the 2011 base year inventory. These growth factors were developed from Annual Energy Outlook (AEO) 2014 and AEO 2016 industry-specific energy consumption data, summarized in Table 7.2.1. Growth in energy consumption was assumed to correspond linearly with growth in emissions. A second step in projecting emissions – accounting for potential emissions increases resulting from the modification of existing sources or the installation of new sources – is described in section 7.2.2 below.

Table 7.2.1. Growth Factors from AEO 2014/2016 Used for Projecting Wisconsin Non-EGU Point Source Emissions in Sheboygan County.

NAICS	NAICS Description	AEO 2014/2016 Industrial or Commercial Sub-sector [1]	AEO 2014/2016 Energy Consumption (trillion Btu) [1,2]			Growth Factors (from 2011) [3]	
			2011	2017	2018	2017 GF	2018 GF
6221	General Medical and Surgical Hospitals	Commercial sector energy consumption (natural gas and distillate fuel oil) for East North Central U.S.	0.75	0.81	0.80	1.08	1.07
21232	Sand, Gravel, Clay, and Ceramic and Refractory Minerals Mining and Quarrying	Non-manufacturing Industry - Mining	2,466	3,005	3,084	1.22	1.25
32192	Wood Container and Pallet Manufacturing	Other Manufacturing - Wood Products	273	331	344	1.21	1.26
32199	All Other Wood Product Manufacturing	Other Manufacturing - Wood Products	273	331	344	1.21	1.26
32199	All Other Wood Product Manufacturing	Other Manufacturing - Wood Products	273	331	344	1.21	1.26
32221	Paperboard Container Manufacturing	Paper Industry	2,018	1,738	1,715	0.86	0.85
32311	Printing	Paper Industry	2,018	1,738	1,715	0.86	0.85
32311	Printing	Paper Industry	2,018	1,738	1,715	0.86	0.85
32311	Printing	Paper Industry	2,018	1,738	1,715	0.86	0.85
32412	Asphalt Paving, Roofing, and Saturated Materials Manufacturing	Not available	N/A	N/A	N/A	1.00	1.00
32521	Resin and Synthetic Rubber Manufacturing	Bulk Chemical Industry	2,441	2,555	2,651	1.05	1.09
32521	Resin and Synthetic Rubber Manufacturing	Bulk Chemical Industry	2,441	2,555	2,651	1.05	1.09

NAICS	NAICS Description	AEO 2014/2016 Industrial or Commercial Sub-sector [1]	AEO 2014/2016 Energy Consumption (trillion Btu) [1,2]			Growth Factors (from 2011) [3]	
			2011	2017	2018	2017 GF	2018 GF
32551	Resin and Synthetic Rubber Manufacturing	Bulk Chemical Industry	2,441	2,555	2,651	1.05	1.09
32612	Plastics Pipe, Pipe Fitting, and Unlaminated Profile Shape Manufacturing	Other Manufacturing - Plastics	302	299	306	0.99	1.01
32612	Plastics Pipe, Pipe Fitting, and Unlaminated Profile Shape Manufacturing	Other Manufacturing - Plastics	302	299	306	0.99	1.01
32615	Urethane and Other Foam Product (except Polystyrene) Manufacturing	Other Manufacturing - Plastics	302	299	306	0.99	1.01
32619	Other Plastics Product Manufacturing	Other Manufacturing - Plastics	302	299	306	0.99	1.01
32711	Pottery, Ceramics, and Plumbing Fixture Manufacturing	Not available	N/A	N/A	N/A	1.00	1.00
32799	All Other Nonmetallic Mineral Product Manufacturing	Not available	N/A	N/A	N/A	1.00	1.00
33151	Foundries - Steel	Iron and Steel Industry	1,362	1,093	1,080	0.80	0.79
33151	Foundries - Steel	Iron and Steel Industry	1,362	1,093	1,080	0.80	0.79
33211	Forging and Stamping	Metal Based Durables Industry - Fabricated Metal Products	331	341	336	1.03	1.01
33232	Ornamental and Architectural Metal Products Manufacturing	Metal Based Durables Industry - Fabricated Metal Products	331	341	336	1.03	1.01
33299	All Other Fabricated Metal Product Manufacturing	Metal Based Durables Industry - Fabricated Metal Products	331	341	336	1.03	1.01
33329	Industrial Machinery Manufacturing	Metal Based Durables Industry - Machinery	177	186	186	1.05	1.05
33531	Electrical Equipment Manufacturing	Metal Based Durables Industry - Electrical Equipment	69	98	101	1.43	1.47
33639	Other Motor Vehicle Parts Manufacturing	Metal Based Durables Industry - Transportation	330	391	388	1.18	1.18
33712	Household and Institutional Furniture Manufacturing	Not available	N/A	N/A	N/A	1.00	1.00
33712	Household and Institutional Furniture Manufacturing	Not available	N/A	N/A	N/A	1.00	1.00
33721	Office Furniture (including Fixtures) Manufacturing	Not available	N/A	N/A	N/A	1.00	1.00
33721	Office Furniture (including Fixtures) Manufacturing	Not available	N/A	N/A	N/A	1.00	1.00
33995	Sign Manufacturing	Not available	N/A	N/A	N/A	1.00	1.00

NAICS	NAICS Description	AEO 2014/2016 Industrial or Commercial Sub-sector [1]	AEO 2014/2016 Energy Consumption (trillion Btu) [1,2]			Growth Factors (from 2011) [3]	
			2011	2017	2018	2017 GF	2018 GF
48621	Pipeline Transportation of Natural Gas	Not available	N/A	N/A	N/A	1.00	1.00
221320	Sewage Treatment Facilities	Not available	N/A	N/A	N/A	1.00	1.00
311514	Dry, Condensed, and Evaporated Dairy Product Manufacturing	Food Industry	1,114	1,237	1,249	1.11	1.12
311612	Meat Processed from Carcasses	Food Industry	1,114	1,237	1,249	1.11	1.12
311612	Meat Processed from Carcasses	Food Industry	1,114	1,237	1,249	1.11	1.12
322211	Corrugated and Solid Fiber Box Manufacturing	Paper Industry	2,018	1,738	1,715	0.86	0.85
325188	Other Basic Inorganic Chemical Manufacturing	Bulk Chemical Industry	2,441	2,555	2,651	1.05	1.09
325991	Custom Compounding of Purchased Resins	Bulk Chemical Industry	2,441	2,555	2,651	1.05	1.09
326140	Polystyrene Foam Product Manufacturing	Other Manufacturing - Plastics	302	299	306	0.99	1.01
331314	Secondary Smelting and Alloying of Aluminum	Aluminum Industry	351	388	388	1.11	1.11
331521	Nonferrous Metal Foundries	Not available	N/A	N/A	N/A	1.00	1.00
331524	Aluminum Foundries (except Die-Casting)	Aluminum Industry	351	388	388	1.11	1.11
333291	Metal Valve Manufacturing	Metal Based Durables Industry - Machinery	177	186	186	1.05	1.05
333618	Other Engine Equipment Manufacturing	Metal Based Durables Industry - Machinery	177	186	186	1.05	1.05
337122	Nonupholstered Wood Household Furniture Manufacturing	Not available	N/A	N/A	N/A	1.00	1.00
337127	Institutional Furniture Manufacturing	Not available	N/A	N/A	N/A	1.00	1.00
611310	Colleges, Universities, and Professional Schools	Commercial sector energy consumption (natural gas and distillate fuel oil) for East North Central U.S.	0.75	0.81	0.80	1.08	1.07
622110	General Medical and Surgical Hospitals	Commercial sector energy consumption (natural gas and distillate fuel oil) for East North Central U.S.	0.75	0.81	0.80	1.08	1.07

[1] Source: http://www.eia.gov/forecasts/aeo/index.cfm

[2] 2011 energy consumption values are from AEO 2014; 2017 and 2018 projected energy consumption values are from AEO 2016.

[3] Growth factors for the entire 2011-2017 and 2011-2018 periods were calculated by dividing the 2017 or 2018 energy consumption values by the 2011 energy consumption value. If energy consumption values were not available from AEO for a NAICS category, a growth factor of 1.00 (i.e., no growth) was applied.

7.2.2 – Modified and New Source Emissions

Section 172(c)(4) of the Clean Air Act (CAA) requires identification and quantification of potential emissions from new or modified sources when developing emission inventories for attainment and maintenance purposes. The point source emissions inventory described in section 7.2.1 above includes projections of emissions growth determined by applying general regional growth factors. However, this methodology alone does not distinguish emissions associated with modified and new sources. Therefore, as a second step the WDNR reviewed permitting actions for sources in Sheboygan County from 2010 to 2015 (five years). A summary of the permitting activity and associated potential emissions is shown in Table 7.2.2. The resulting emissions from this exercise are added to the projected emissions for *existing* point source non-EGU, to yield the *total* projected point source non-EGU emissions for 2017 and 2018 found in section 3.3 of the Sheboygan County ozone attainment demonstration (see also Appendix 3, Table 3.2 for the addition of new/modified sources to existing sources). This approach may add emissions which overlap with existing source grown emissions, but it provides a more conservative estimate of future emissions. It should be noted that this future projection of emissions does not limit the amount of future emissions allowed from modified and new sources. This is consistent with the CAA which allows for the installation of new or modification of sources subject to requirements of the New Source Review (NSR) or Prevention of Significant Deterioration (PSD) programs.

Table 7.2.2. Permitting Actions for Existing Source and New Emission Sources – 2010 to 2015.

Construction Permit Class	Year	Potential Emissions Increase (TPY)		Estimated Daily Average (TPD) [1]		Project Description
		NOx	VOC	NOx	VOC	
Minor action [2]	2012	0.00	53.1	-	0.145	Installation of stain spray booths, dye/toner spray booth, and sealer/topcoat spray booth
Minor action [2]	2014	50	39.8	0.137	0.109	Installation of generator reliability test cells
Minor action [2]	2014	0.00	31.87	-	0.087	Installation of presses to process low pentane bead shaped product; installation of pre-expander; installation of natural gas boiler (12 mmBtu/hr capacity)
Total	---	**50**	**125**	**0.14**	**0.34**	---

[1] The tons per day (TPD) daily emissions are calculated by dividing annual potential emissions by 365 days. These are also assumed to be equivalent to tons per summer day (tpsd) emissions.

[2] A minor action is a permitting action that falls below the major source threshold of 100 tons per year (TPY) or significant emissions increase threshold of 40 TPY.

Appendix 7.3 – Area Source Inventory Methodology for 2017 and 2018

As mentioned in section 3.3 of the attainment demonstration main document, EPA's 2011 Emissions Modeling Platform, Version 6.2 includes projections for the years 2017 and 2025. Wisconsin's 2017 area source emissions estimates were based primarily on EPA's 2017 modeling inventory, while the 2018 area source emissions were estimated primarily by interpolating between EPA's 2017 and 2025 modeling inventories. The exception is that WDNR staff projected emissions from vehicle refueling at gasoline stations (Stage II refueling) using the EPA's MOVES2014a model with the same activity inputs used for the onroad modeling. Unlike 2011, no Stage II vapor recovery program was modeled for 2017 and 2018. Owing to most vehicles now having their own vapor recovery system, called onboard refueling vapor recovery or ORVR, Stage II controls at the pump are largely redundant or even counter-productive. Wisconsin submitted a SIP revision removing Stage II requirements, and EPA approved the revision in November 2013. Even without a Stage II program in the projection years, emissions from Stage II refueling are less in 2018 than in 2011, owing to the larger percentage of vehicles having ORVR.

The projected area source emissions can be found in Appendix 4.

Appendix 7.4 – Onroad Inventory Methodology for 2017 and 2018

The 2017 and 2018 projected onroad emissions were developed using the MOVES2014a model, as was the case for the 2011 emissions. Unless otherwise stated in this appendix, the methodology WDNR used for 2017 and 2018 is the same methodology WDNR used for year 2011, as described in Appendix 1.

Vehicle age distributions were projected from a base 2014 distribution using the Age Distribution Projection Tool developed by the EPA (see: https://www.epa.gov/moves/tools-develop-or-convert-moves-inputs). This macro-based excel file projects a base year age distribution by source type to a future distribution using a similar algorithm to what EPA used to generate the national projected age distributions in MOVES2014.

The Wisconsin Department of Transportation (WDOT) provided WDNR transportation data for the years 2010, 2015, 2025, 2035 and 2045 for an average annual weekday (where "weekday" consists of the middle three days of the workweek: Tuesday, Wednesday and Thursday). These datasets show a VMT growth rate for Sheboygan County of about 0.67% per year from 2010 to 2015, about 0.64% per year from 2015 to 2025, about 0.60% per year from 2025 to 2035 and about 0.56% per year from 2035 to 2045. As described in Appendix 1, WDNR calculated 2011 VMT using the WDOT-reported change in VMT from 2010 to 2011 (about a 3.1% decrease). WDNR calculated 2017 and 2018 VMT by linearly interpolating between 2015 and 2025. As described in Appendix 1, WDNR increased the average weekday (Tu-Th) VMT by about 16.3% to obtain summer weekday (Mo-Fr) VMT. Table 4.4.1 shows the average weekday (Tu-Th) VMT values provided by WDOT (or interpolated by WDNR) and the summer weekday (Mo-Fr) VMT values outputted by MOVES2014a.

Table 4.4.1. Vehicle-Miles of Travel for Sheboygan County

Year	Vehicle-Miles of Travel	
	Average Weekday (Tu-Th)	Summer Weekday (Mo-Fr)
2010	2,731,175	Not Calculated
2011	2,646,519	3,077,240
2015	2,823,472	Not Calculated
2017	2,860,465	3,326,005
2018	2,878,961	3,347,514
2025	3,008,435	Not Calculated
2035	3,193,399	Not Calculated
2045	3,378,362	Not Calculated

Unlike the speed distribution for 2011, the speed distributions for 2017 and 2018 did include positive values for the highest speed bin in MOVES (72.5 mph to 77.5 mph) for restricted access travel. This change reflected the 5 mph speed limit increase (65 mph to 70 mph) which took effect in 2015 on certain restricted access roadways throughout Wisconsin, including Interstate Highway 43 in Sheboygan County. MOVES2014a predicts an increase in NOx and VOC emissions from this increase in speed.

Emissions were increased by a 15% safety margin, as agreed through the transportation conformity consultative process.

The motor vehicle I/M program was assumed to remain in effect for 2017 and 2018.

Detailed listing of the projected onroad emissions and activity data are provided in Appendix 5.

Appendix 7.5 – Nonroad Inventory Methodology for 2017 and 2018

The methodology for the 2017 and 2018 projected nonroad emissions is parallel to the methodology used for the 2011 estimates.

For all source categories except commercial marine, aircraft and rail locomotive (MAR), the MOVES2014a model was run for Sheboygan County at hot summer day temperatures, assuming the model's default growth projections.

For the MAR categories, the countywide 2017 emissions were directly obtained from EPA's Version 6.3 Modeling Platform. As was the case for 2011, the Platform's 2017 commercial marine emissions for Sheboygan County were zero, with those emissions to the east of Sheboygan County allocated to the Michigan side of Lake Michigan, reflecting general shipping lanes. The 2018 emissions were linearly extrapolated from the 2011 and 2017 Modeling Platform emissions.

Detailed listings of the projected nonroad emissions for over 200 subcategories are provided in Appendix 6.

APPENDIX 8

Wisconsin VOC RACT Regulations

Table 1. Volatile Organic Compounds (VOC) Control Technique Guidelines Incorporated into Wisconsin Administrative Code.

Source	Title (Description)	EPA CTG Report No.	Wis. Adm. Code Incorporation	Emissions Inventory Classification[1]
Petroleum and Gasoline Sources				
Bulk Gasoline Plants	Control of Volatile Organic Emissions from Bulk Gasoline Plants [bulk gasoline plant unloading, loading and storage]	EPA-450/2-77-035	NR 420.04(2)	Stationary Point Source
Refinery Equipment - Vacuum Producing Systems, Wastewater Separators, and Process Unit Turnarounds	Control of Refinery Vacuum Producing Systems, Wastewater Separators, and Process Unit Turnarounds	EPA-450/2-77-025	NR 420.05(1), (2) and (3)	Stationary Point Source
Refinery Equipment - Control of VOC Leaks	Control of Volatile Organic Compound Leaks from Petroleum Refinery Equipment	EPA-450/2-78-036	NR 420.05(4)	Stationary Point Source
Refinery Equipment - Control of VOC Leaks	Control of Volatile Organic Compound Equipment Leaks from Natural Gas/Gasoline Processing Plants	EPA-450/3-83-007	NR 420.05(4)	Stationary Point Source
Tanks - Fixed Roof	Control of Volatile Organic Emissions from Storage of Petroleum Liquids in Fixed-Roof Tanks	EPA-450/2-77-036	NR 420.03(5)	Stationary Point Source
Tanks - External Floating Roofs	Control of Volatile Organic Emissions from Petroleum Liquid Storage in External Floating Roof Tanks	EPA-450/2-78-047	NR 420.03(6) and (7)	Stationary Point Source
Gasoline Loading Terminals	Control of Hydrocarbons from Tank Truck Gasoline Loading Terminals	EPA-450/2-77-026	NR 420.04(1)	Stationary Point Source
Tank Trucks	Control of Volatile Organic Compound Leaks from Gasoline Tank Trucks and Vapor Collection Systems	EPA-450/2-78-051	NR 420.04(4)	Stationary Area Source
Gasoline Delivery - Stage I Vapor Control Systems	Design Criteria for Stage I Vapor Control Systems – Gasoline Service Stations	EPA-450/R-75-102	NR 420.04(3)	Stationary Area Source
Surface Coating				

Source	Title (Description)	EPA CTG Report No.	Wis. Adm. Code Incorporation	Emissions Inventory Classification[1]
Automobile & Light-duty Truck	Control Techniques Guidelines for Automobile and Light-Duty Truck Assembly Coatings	EPA 453/R-08-006	NR 422.09	Stationary Point Source
Cans	Control of Volatile Organic Emissions from Existing Stationary Sources – Volume II: Surface Coating of Cans, Coils, Paper, Fabrics, Automobiles, and Light-Duty Trucks	EPA-450/2-77-008	NR 422.05	Stationary Point Source
Coils	Control of Volatile Organic Emissions from Existing Stationary Sources – Volume II: Surface Coating of Cans, Coils, Paper, Fabrics, Automobiles, and Light-Duty Trucks	EPA-450/2-77-008	NR 422.06	Stationary Point Source
Fabric & Vinyl	Control of Volatile Organic Emissions from Existing Stationary Sources – Volume II: Surface Coating of Cans, Coils, Paper, Fabrics, Automobiles, and Light-Duty Trucks	EPA-450/2-77-008	NR 422.08	Stationary Point Source
Flat Wood Paneling	Control of Volatile Organic Emissions from Existing Stationary Sources – Volume VII: Factory Surface Coating of Flat Wood Paneling	EPA-450/2-78-032	NR 422.13	Stationary Point Source
	Control Techniques Guidelines for Flat Wood Paneling Coatings	EPA-453/R-06-004	NR 422.131	Stationary Point Source
Large Appliances	Control of Volatile Organic Emissions from Existing Stationary Sources – Volume V: Surface Coating of Large Appliances	EPA-450/2-77-034	NR 422.11	Stationary Point Source
	Control Techniques Guidelines for Large Appliance Coatings	EPA 453/R-07-004	NR 422.115	Stationary Point Source
Magnet Wire	Control of Volatile Organic Emissions from Existing Stationary Sources – Volume IV: Surface Coating of Insulation of Magnet Wire	EPA-450/2-77-033	NR 422.12	Stationary Point Source
Metal Furniture	Control of Volatile Organic Emissions from Existing Stationary Sources – Volume III: Surface Coating of Metal Furniture	EPA-450/2-77-032	NR 422.1	Stationary Point Source

Source	Title (Description)	EPA CTG Report No.	Wis. Adm. Code Incorporation	Emissions Inventory Classification[1]
	Control Techniques Guidelines for Metal Furniture Coatings	EPA 453/R-07-005	NR 422.105	Stationary Point Source
Metal Parts, miscellaneous	Control Techniques Guidelines for Miscellaneous Metal and Plastic Parts Coatings	EPA 453/R-08-003	NR 422.15	Stationary Point Source
	Fire Truck and Emergency Response Vehicle Manufacturing - surface coating	(covered under Misc. Metal Parts CTG)	NR 422.151	Stationary Point Source
Paper, Film and Foil	Control of Volatile Organic Emissions from Existing Stationary Sources – Volume II: Surface Coating of Cans, Coils, Paper, Fabrics, Automobiles, and Light-Duty Trucks	EPA-450/2-77-008	NR 422.07	Stationary Point Source
	Control Techniques Guidelines for Paper, Film, and Foil Coatings	EPA 453/R-07-003	NR 422.075	Stationary Point Source
Plastic Parts - Coatings	Control Techniques Guidelines for Miscellaneous Metal and Plastic Parts Coatings	EPA 453/R-08-003	NR 422.083	Stationary Point Source
Traffic Markings	Reduction of Volatile Organic Compound Emissions from the Application of Traffic Markings	EPA-450/3-88-007	NR 422.17	Stationary Area Source
Wood Furniture	Control of Volatile Organic Compound Emissions from Wood Furniture Manufacturing Operations	EPA-453/R-96-007	NR 422.125	Stationary Point Source
Graphic Arts				
Rotogravure & Flexography	Control of Volatile Organic Emissions from Existing Stationary Sources – Volume VIII: Graphic Arts-Rotogravure and Flexography	EPA-450/2-78-033	NR 422.14	Stationary Point Source
Flexible Packaging	Control Techniques Guidelines for Flexible Package Printing	EPA-453/R-06-003	NR 422.141	Stationary Point Source
Letterpress	Control Techniques Guidelines for Offset Lithographic Printing and Letterpress Printing	EPA-453/R-06-002	NR 422.144	Stationary Point Source

Source	Title (Description)	EPA CTG Report No.	Wis. Adm. Code Incorporation	Emissions Inventory Classification[1]
Lithographic	Control Techniques Guidelines for Offset Lithographic Printing and Letterpress Printing	EPA-453/R-06-002	NR 422.142 and 422.143	Stationary Point Source
Solvents				
Dry Cleaning	Control of Volatile Organic Emissions from Perchloroethylene Dry Cleaning Systems	EPA-450/2-78-050	NR 423.05	Stationary Area Source
Dry Cleaning	Control of Volatile Organic Compound Emissions from Large Petroleum Dry Cleaners	EPA-450/3-82-009	NR 423.05	Stationary Area Source
Industrial Cleaning	Control Techniques Guidelines for Industrial Cleaning Solvents	EPA-453/R-06-001	NR 423.035 and 423.037	Stationary Area Source
Metal Cleaning	Control of Volatile Organic Emissions from Solvent Metal Cleaning	EPA-450/2-77-022	NR 423.03	Stationary Area Source
Chemical				
Pharmaceutical	Control of Volatile Organic Emissions from Manufacture of Synthesized Pharmaceutical Products	EPA-450/2-78-029	NR 421.03	Stationary Point Source
Polystyrene	Control of Volatile Organic Compound Emissions from Manufacture of High-Density Polyethylene, Polypropylene, and Polystyrene Resins	EPA-450/3-83-008	NR 421.05	Stationary Point Source
Rubber	Control of Volatile Organic Emissions from Manufacture of Pneumatic Rubber Tires	EPA-450/2-78-030	NR 421.04	Stationary Point Source
Synthetic Organic	Control of Volatile Organic Compound Emissions from Air Oxidation Processes in Synthetic Organic Chemical Manufacturing Industry	EPA-450/3-84-015	NR 421.07	Stationary Point Source
Synthetic Organic	Control of Volatile Organic Compound Emissions from Reactor Processes and Distillation Operations in Synthetic Organic Chemical Manufacturing Industry	EPA-450/4-91-031	NR 421.07	Stationary Point Source
Synthetic Resin	Control of Volatile Organic Compound Leaks from Synthetic Organic Chemical Polymer and	EPA-450/3-83-006	NR 421.05	Stationary Point Source

Source	Title (Description)	EPA CTG Report No.	Wis. Adm. Code Incorporation	Emissions Inventory Classification[1]
	Resin Manufacturing Equipment			
Manufacturing				
Asphalt	Control of Volatile Organic Emissions from Use of Cutback Asphalt	EPA-450/2-77-037	NR 422.16	Stationary Area Source

[1]For purposes of this table, an “Area” source is defined as a nonpoint or fugitive emission source.

Appendix 9

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

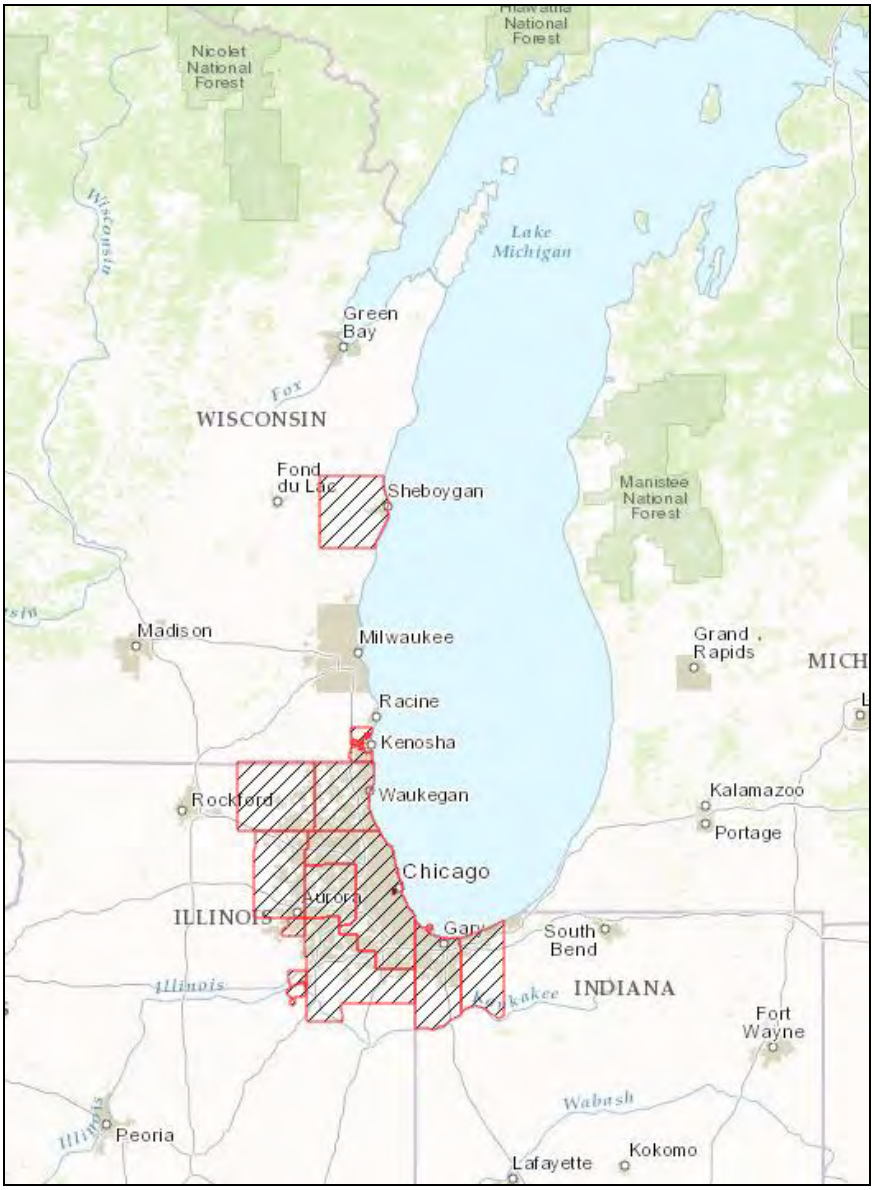

Figure 1.1. Nonattainment Areas in the Lake Michigan Region for the 2008 Ozone National Ambient Air Quality Standard

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.

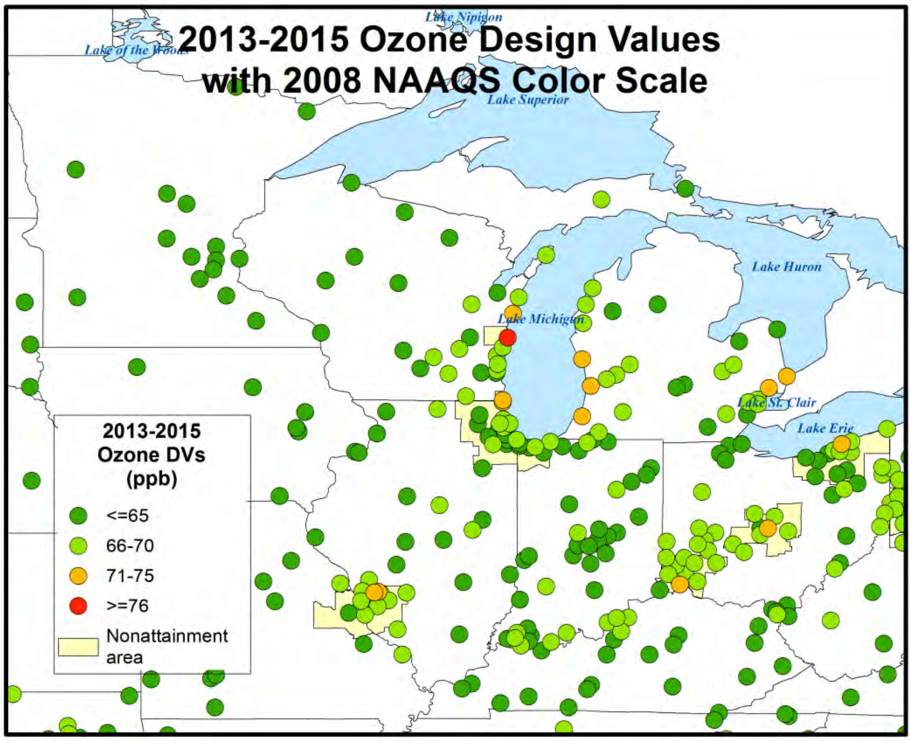

Figure 2.1. 8-hour Ozone Design Values (2013-2015) in the LADCO Region

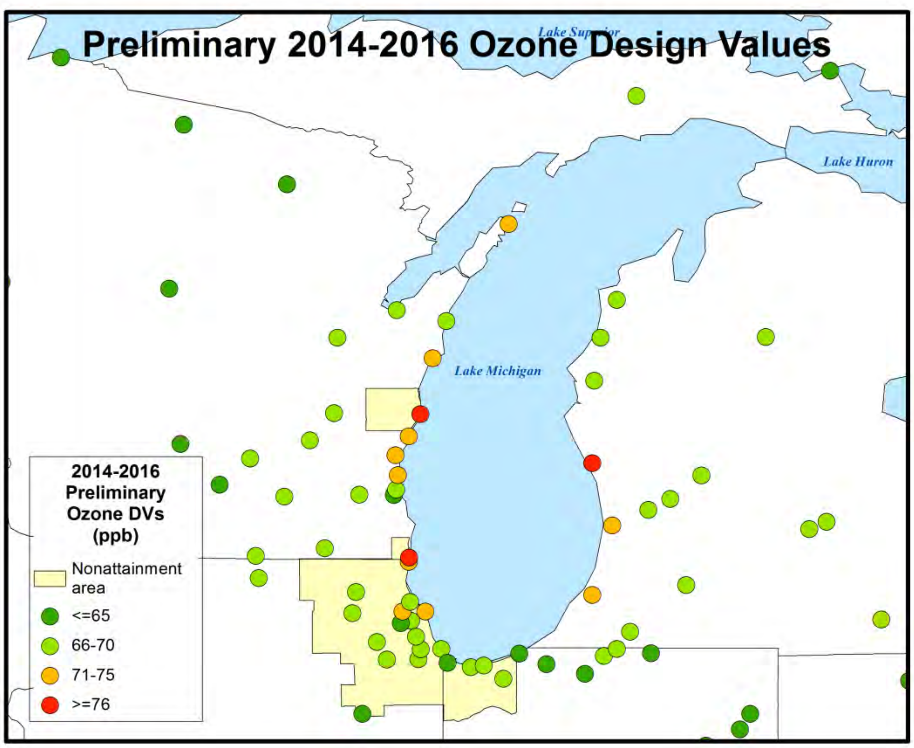

Figure 2.2. 8-hour Ozone Design Values in the Lake Michigan Region (2014-2016) (based on preliminary 2016 data)

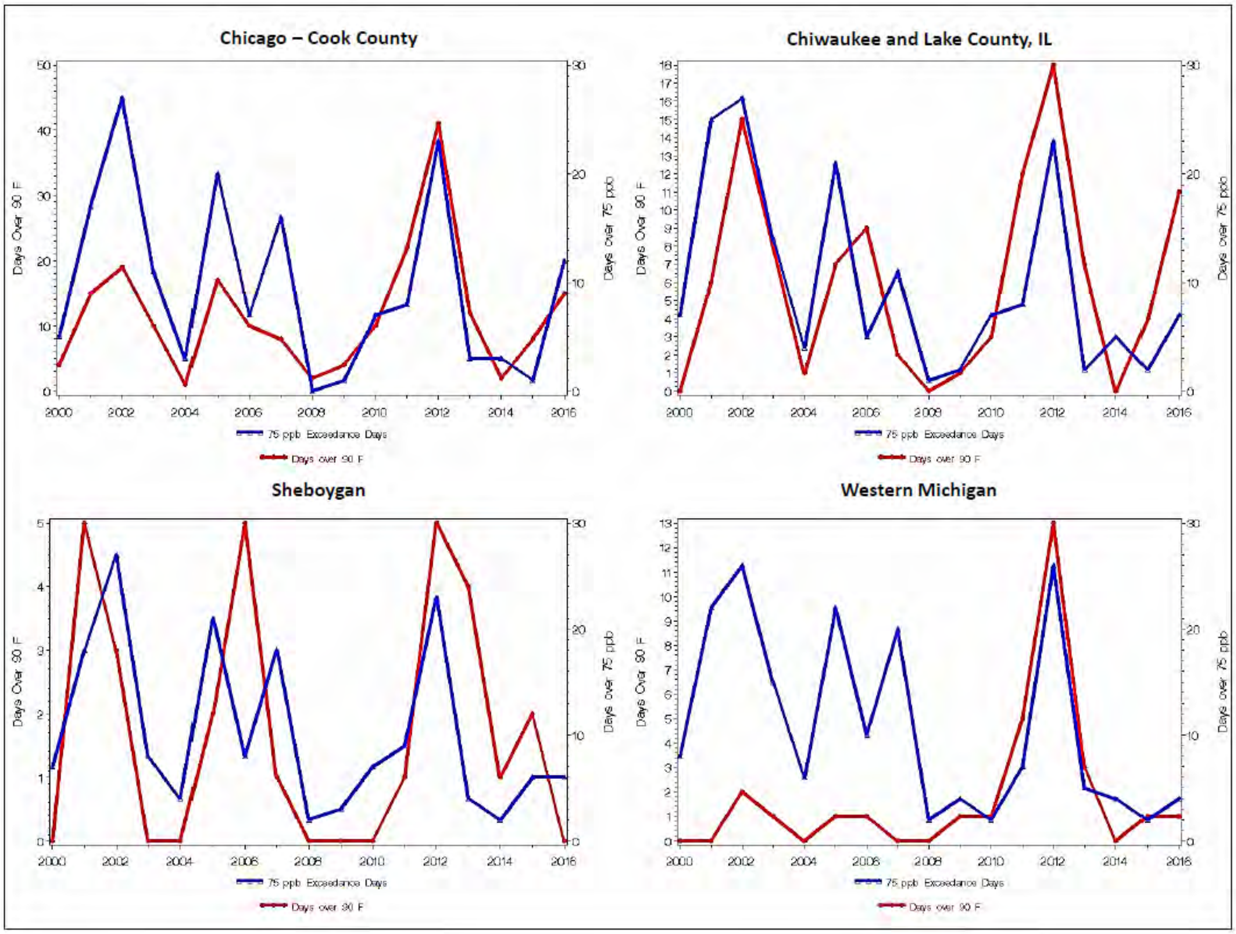

Figure 2.3. Trends in 90-degree Days and 8-hour "Exceedance" Days Around Lake Michigan

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.

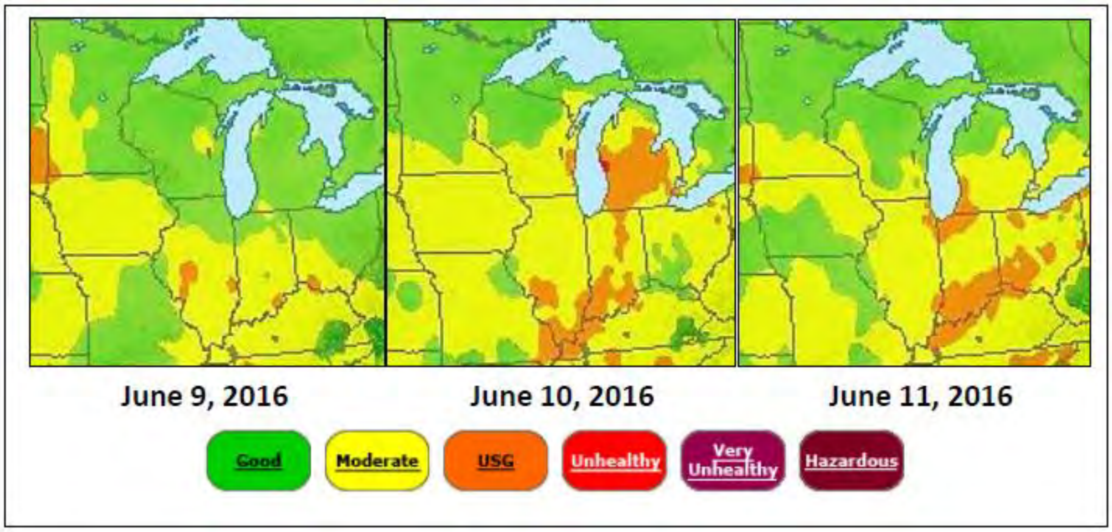

Figure 2.4. Example of Elevated Regional Ozone Concentrations (June 9-11, 2016). (Note: data come from AirNow, showing maximum daily ozone Air Quality Index; hotter colors represent higher concentrations, with orange and red representing concentrations above the 8-hour standard.)

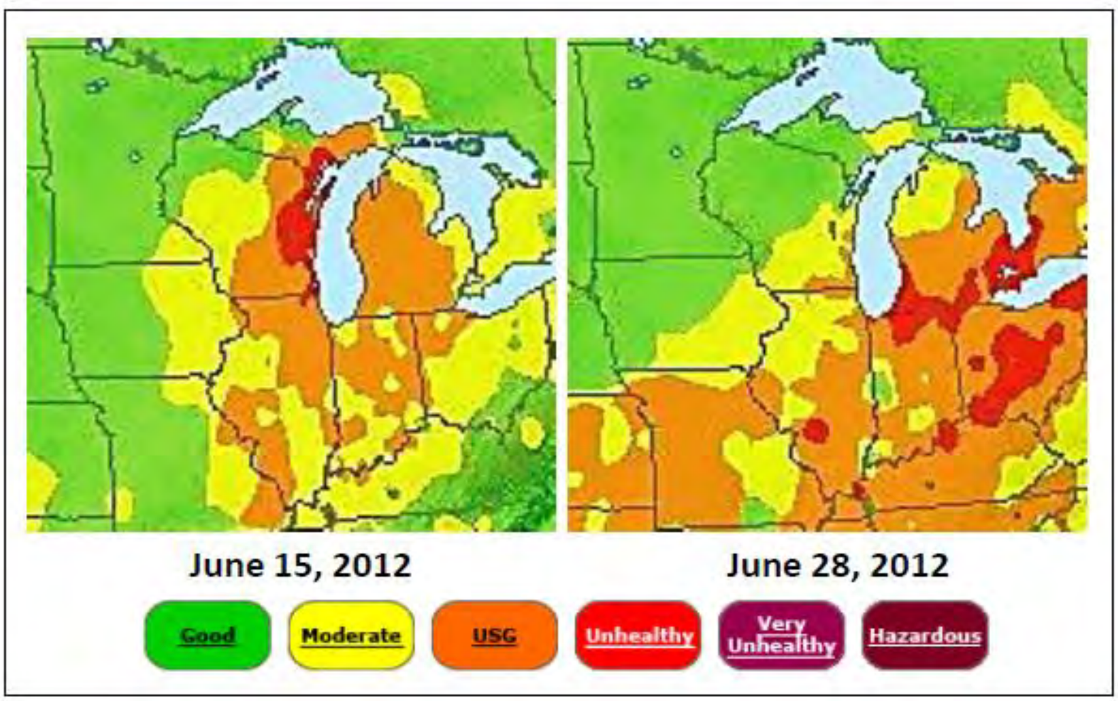

Figure 2.5. Examples of High Ozone Days in the Lake Michigan Area. (Note: data come from AirNow, showing maximum daily ozone Air Quality Index; hotter colors represent higher concentrations, with orange and red representing concentrations above the 8-hour standard.)

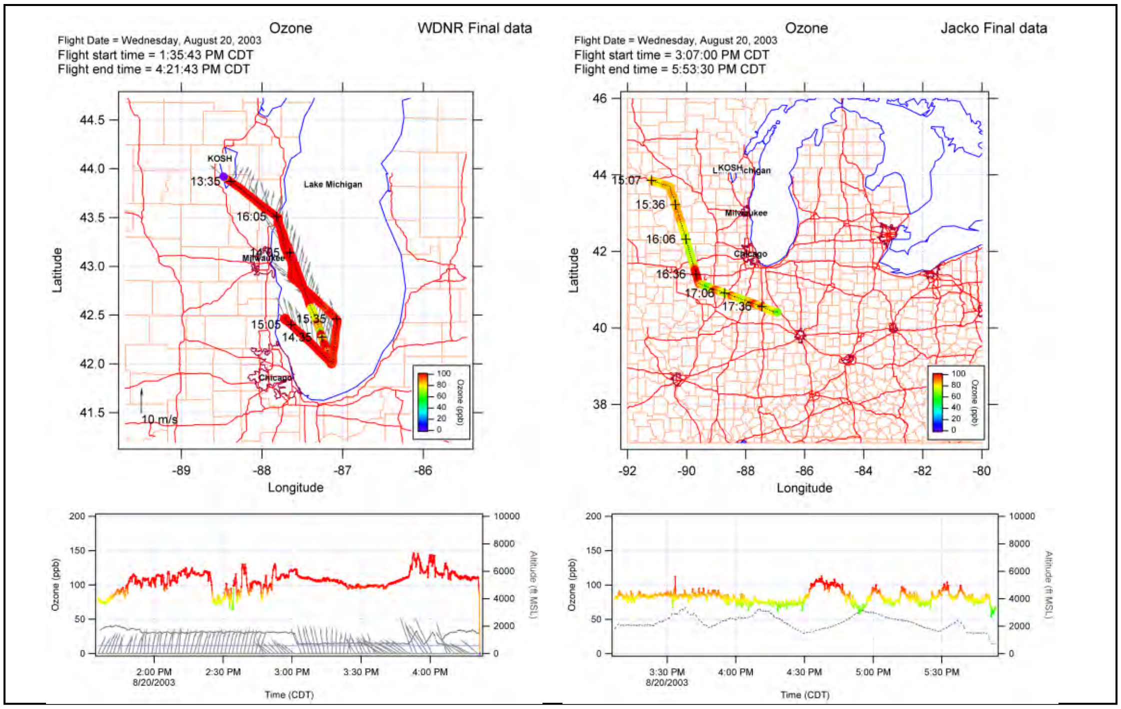

Figure 2.6. Aircraft Ozone Measurements over Lake Michigan (left) and Along Upwind Boundary (right) – August 20, 2003. (Note: aircraft measurements reflect instantaneous values. Flight paths are shown as thick lines, with the color of the lines reflecting ozone concentrations. The wind barbs show southwest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

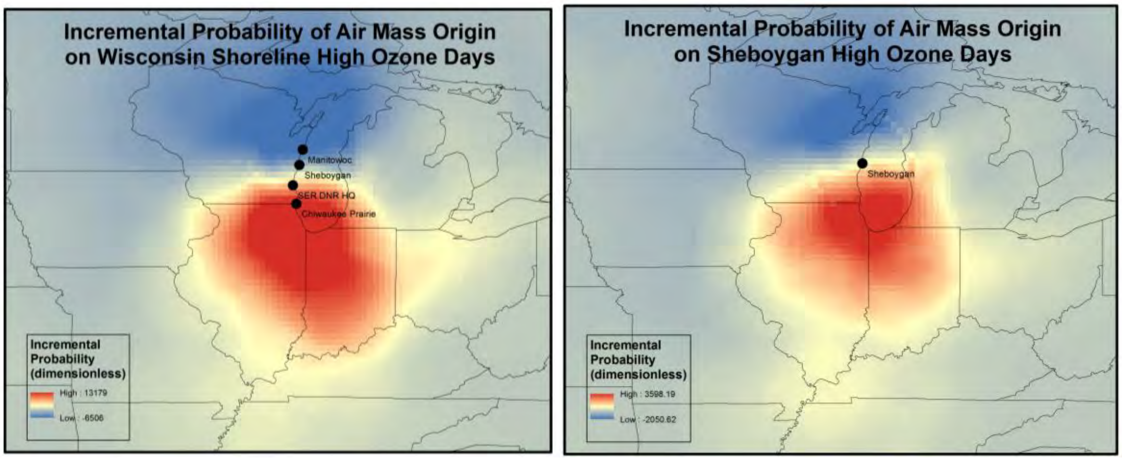

Figure 2.7. Incremental Probability of Air Mass Location in 72 Hours Prior to High Ozone Concentrations at Wisconsin Shoreline Monitors

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

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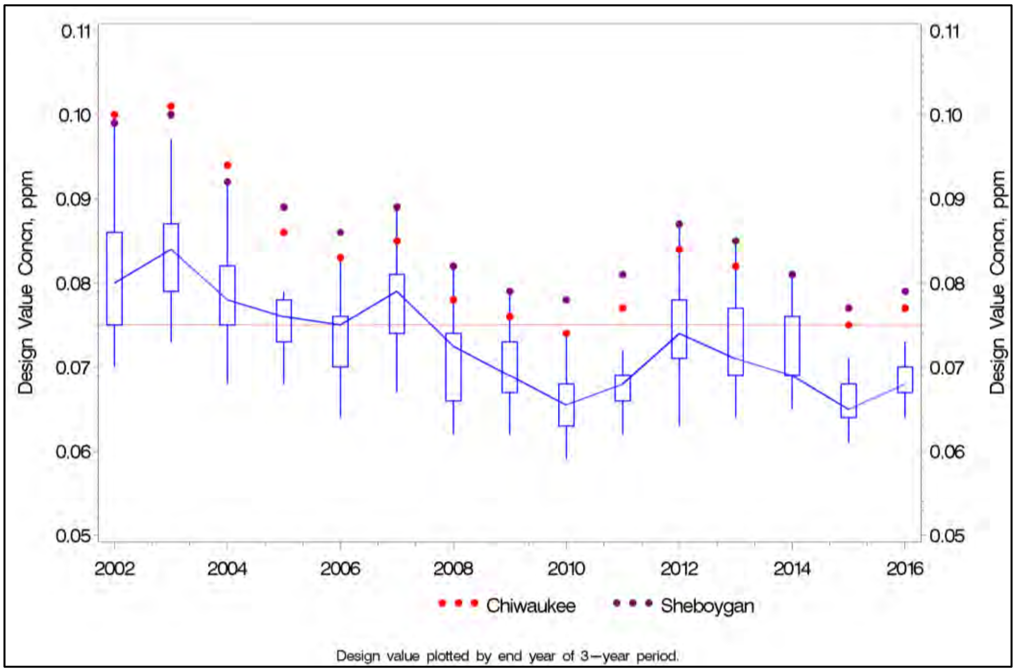


Figure 2.8. Ozone Design Value Trends in the Chicago and Sheboygan Nonattainment Areas

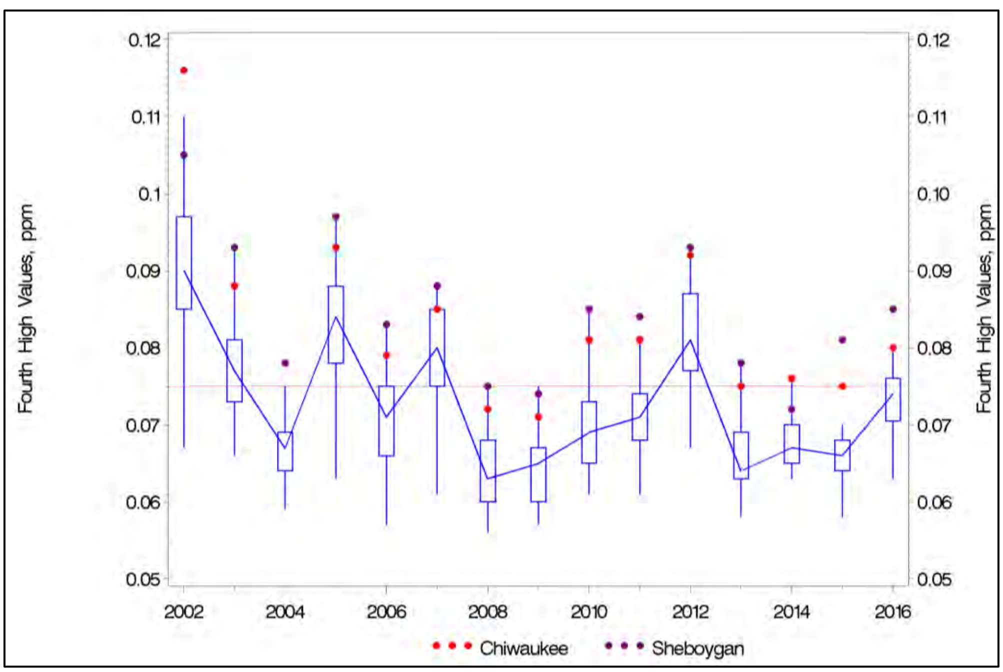


Figure 2.9. Trend in Fourth-High Values in the Chicago and Sheboygan Nonattainment Areas

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.

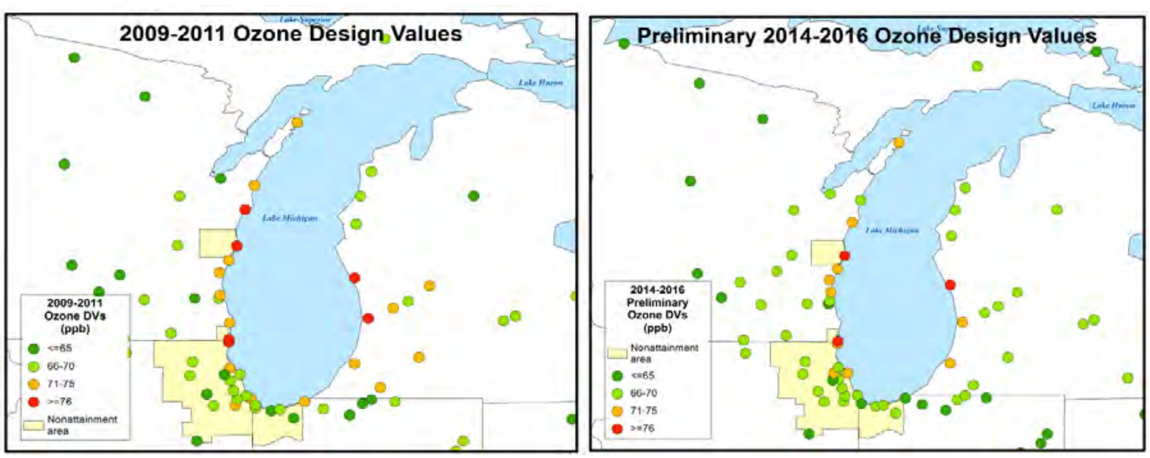


Figure 2.10. Change in Ozone Design Values from 2009-2011 to 2014-2016

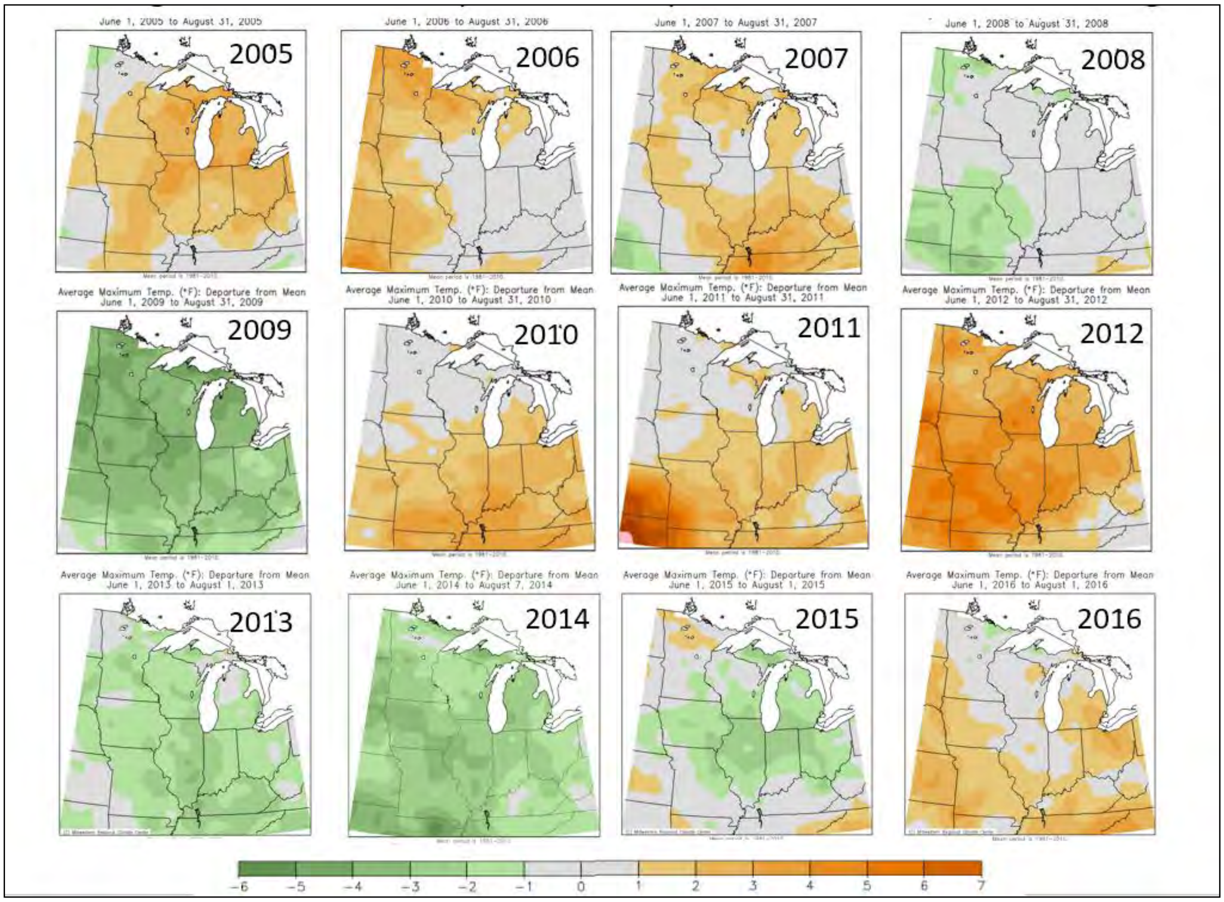


Figure 2.11. Deviation from Long Term Average Temperature, June-August, for 2005-2016

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.

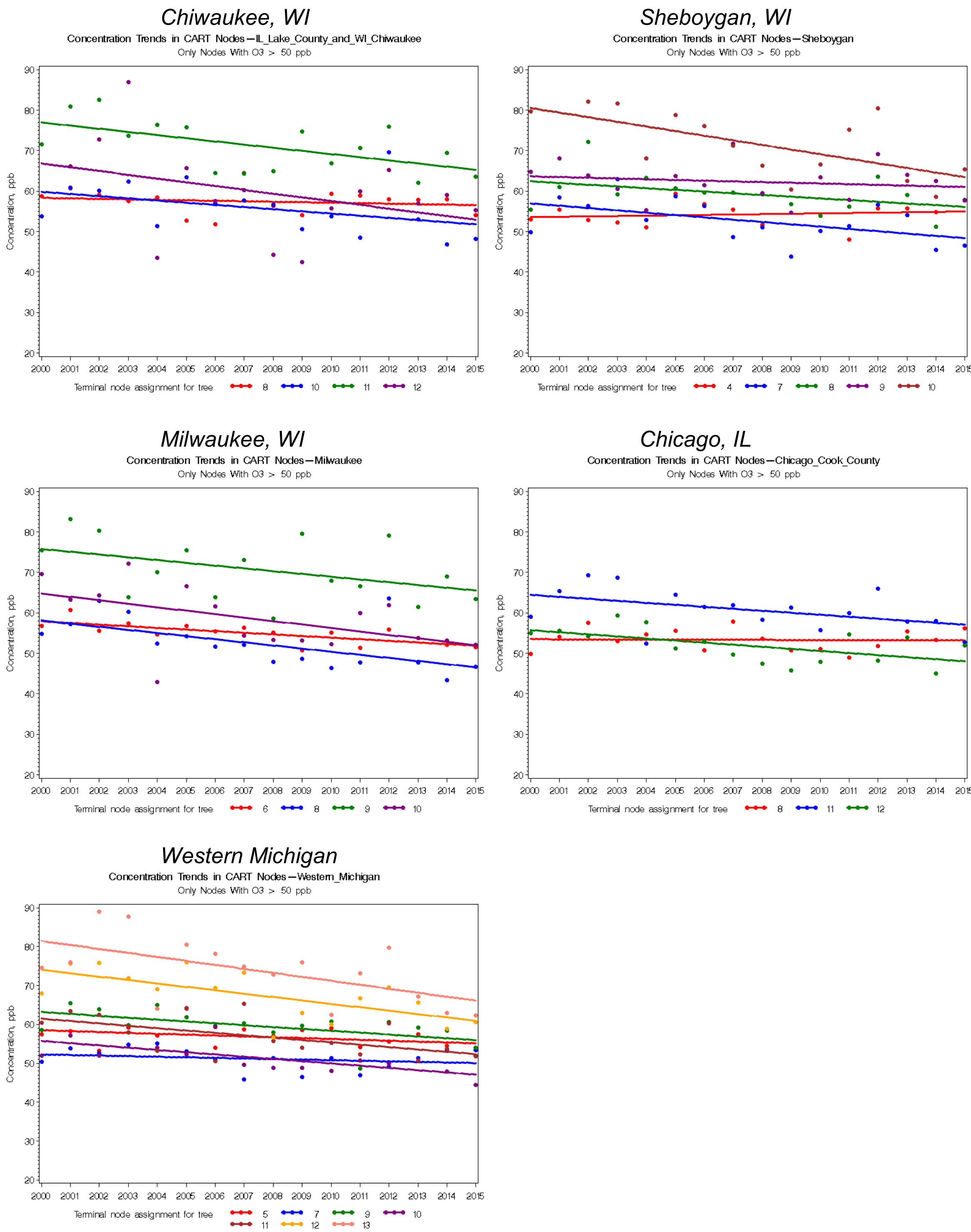


Figure 2.12. Meteorologically Adjusted Ozone Trends Around Lake Michigan

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.

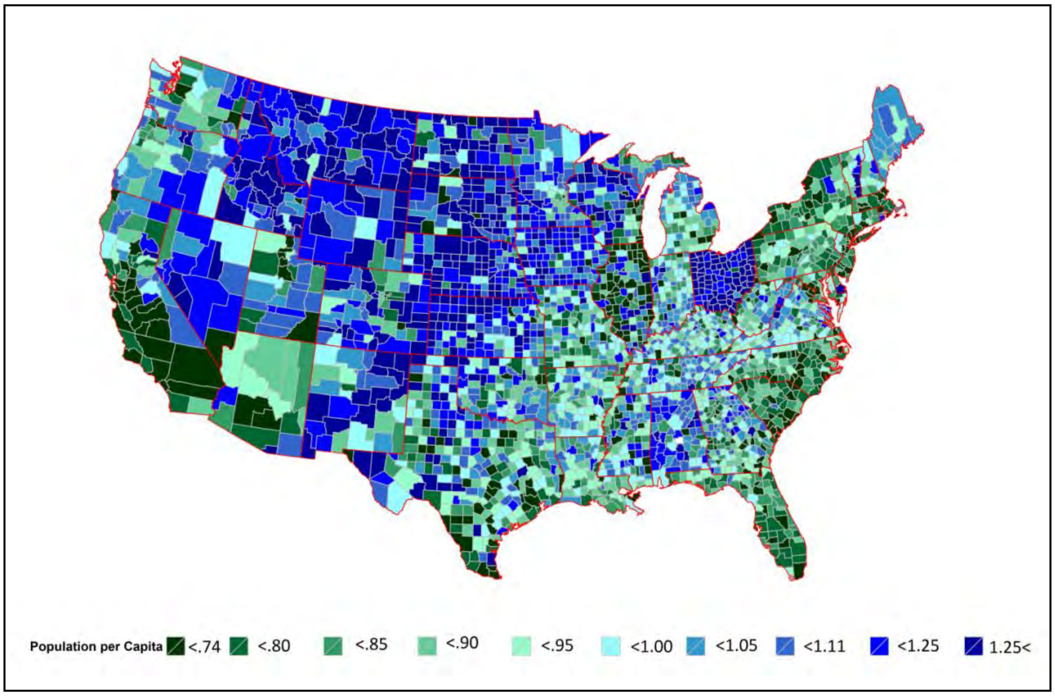


Figure 3.1. Vehicle Population Per Capita Used in the 2011 NEIv2. (Ramboll-Environ, 2014)

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

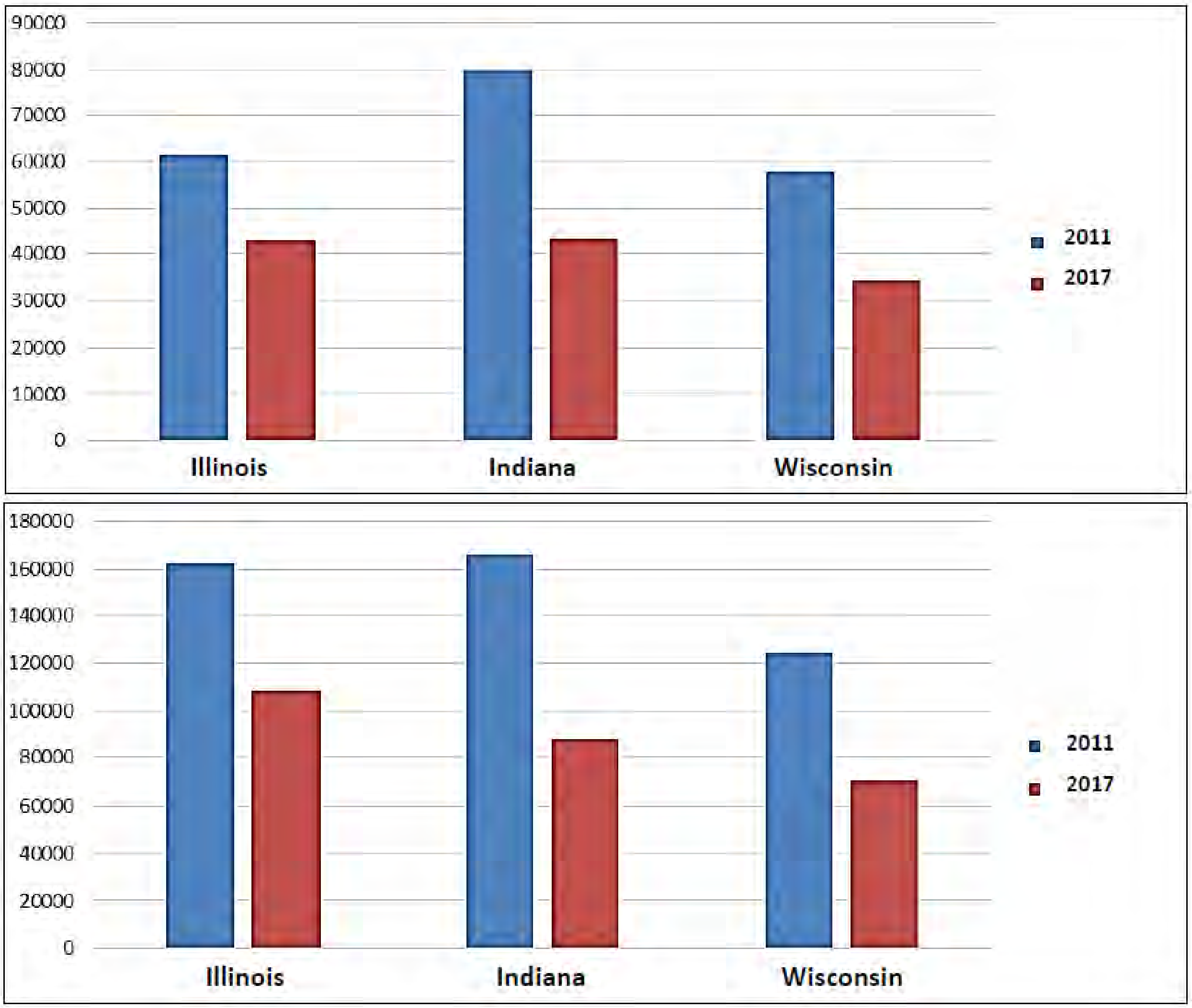


Figure 3.2. Base Year (2011) and Future Year (2017) VOC (top) and NO_X (bottom) Emissions (tons per year) for On-Road Mobile Sources

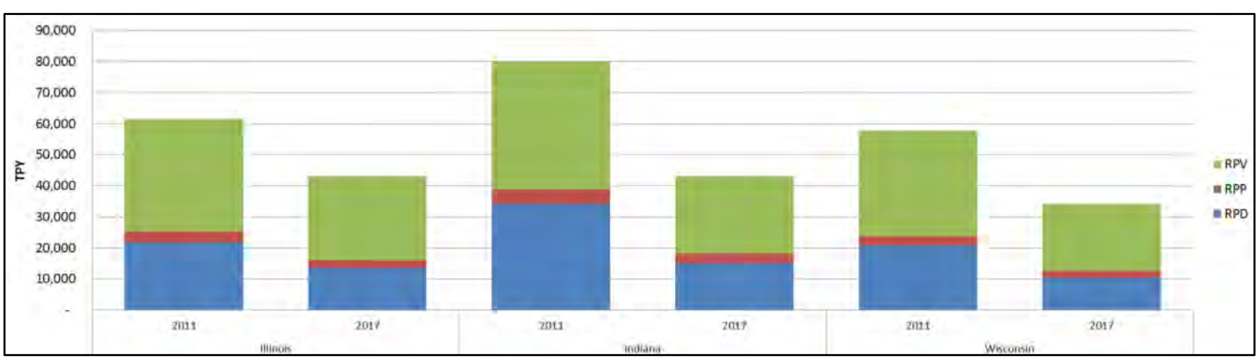
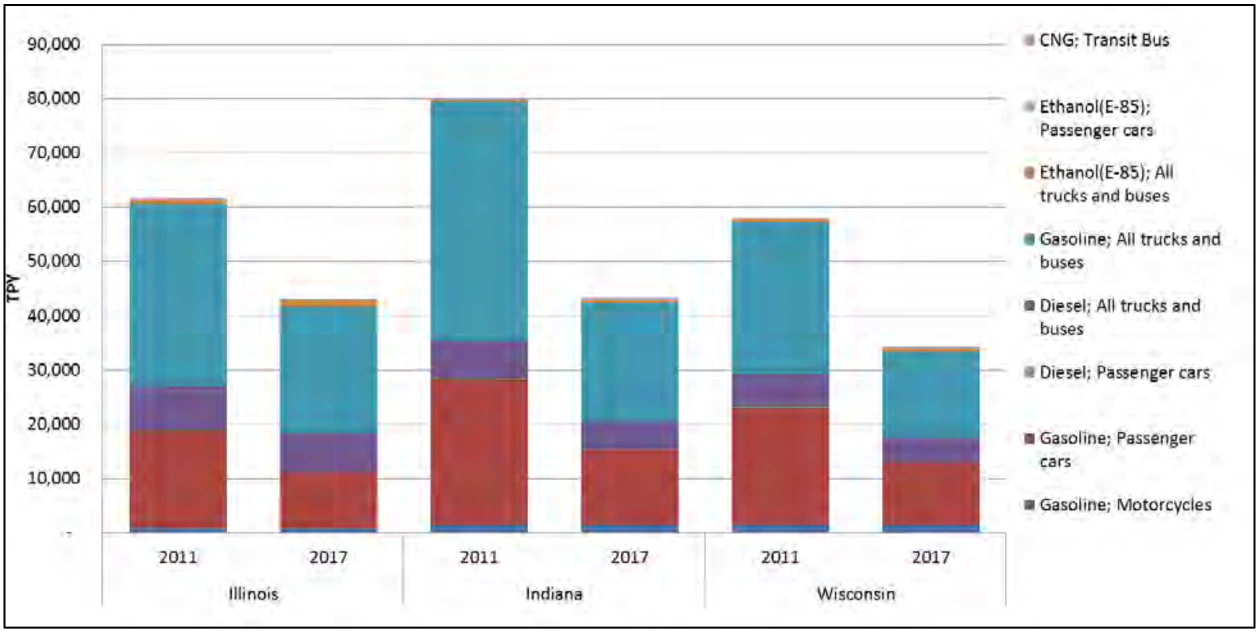


Figure 3.3. VOC Emissions by MOVES Rate Source



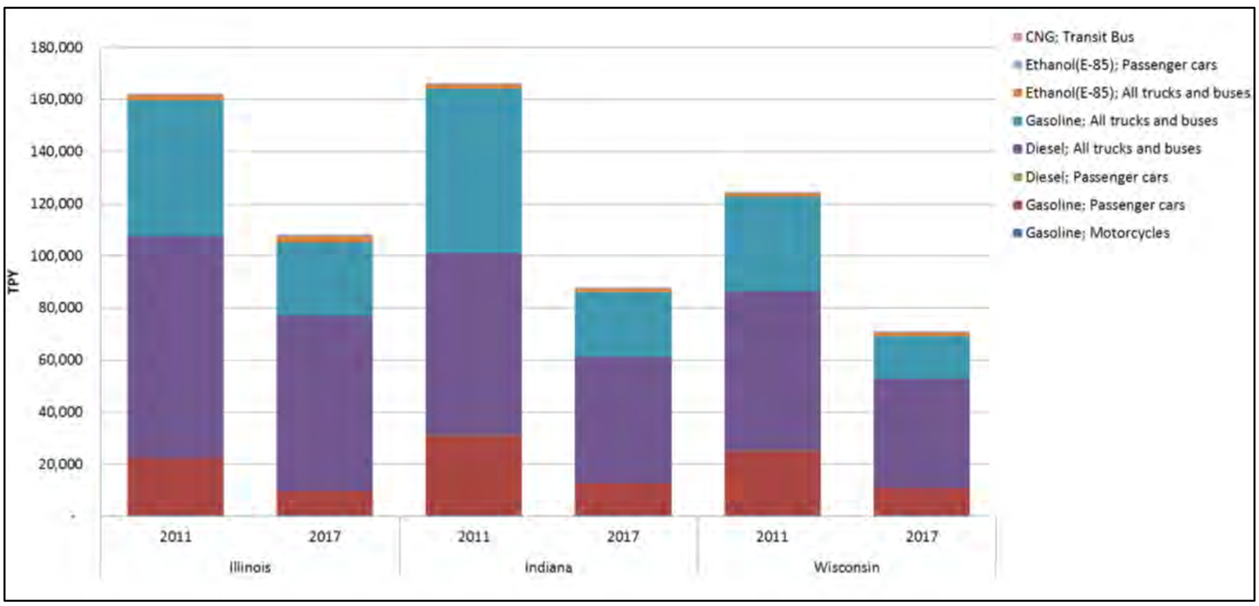


Figure 3.4. Separation of VOC (top) and NOx (bottom) Emissions by MOVES Vehicle Group

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.

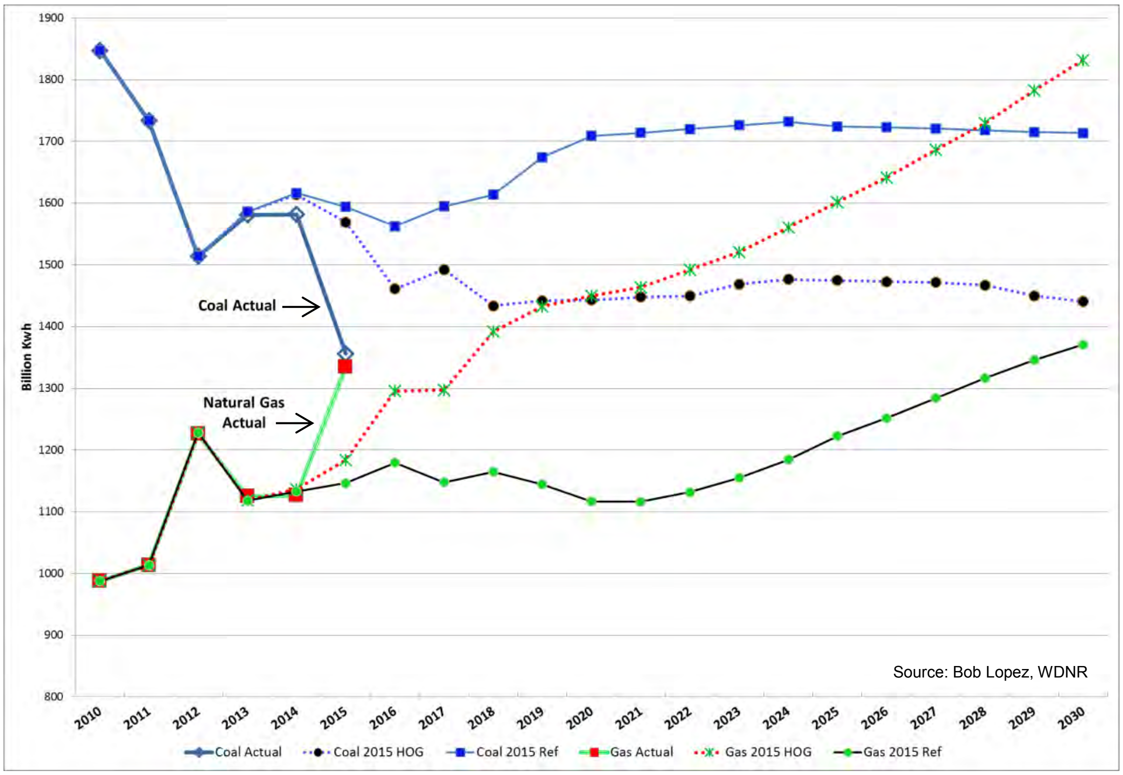


Figure 3.5. 2015 EIA Annual Energy Outlook –
National Forecast of Power Generation for Coal and Natural Gas.
(Note: HOG = high oil and gas, Ref = Reference case.)

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.

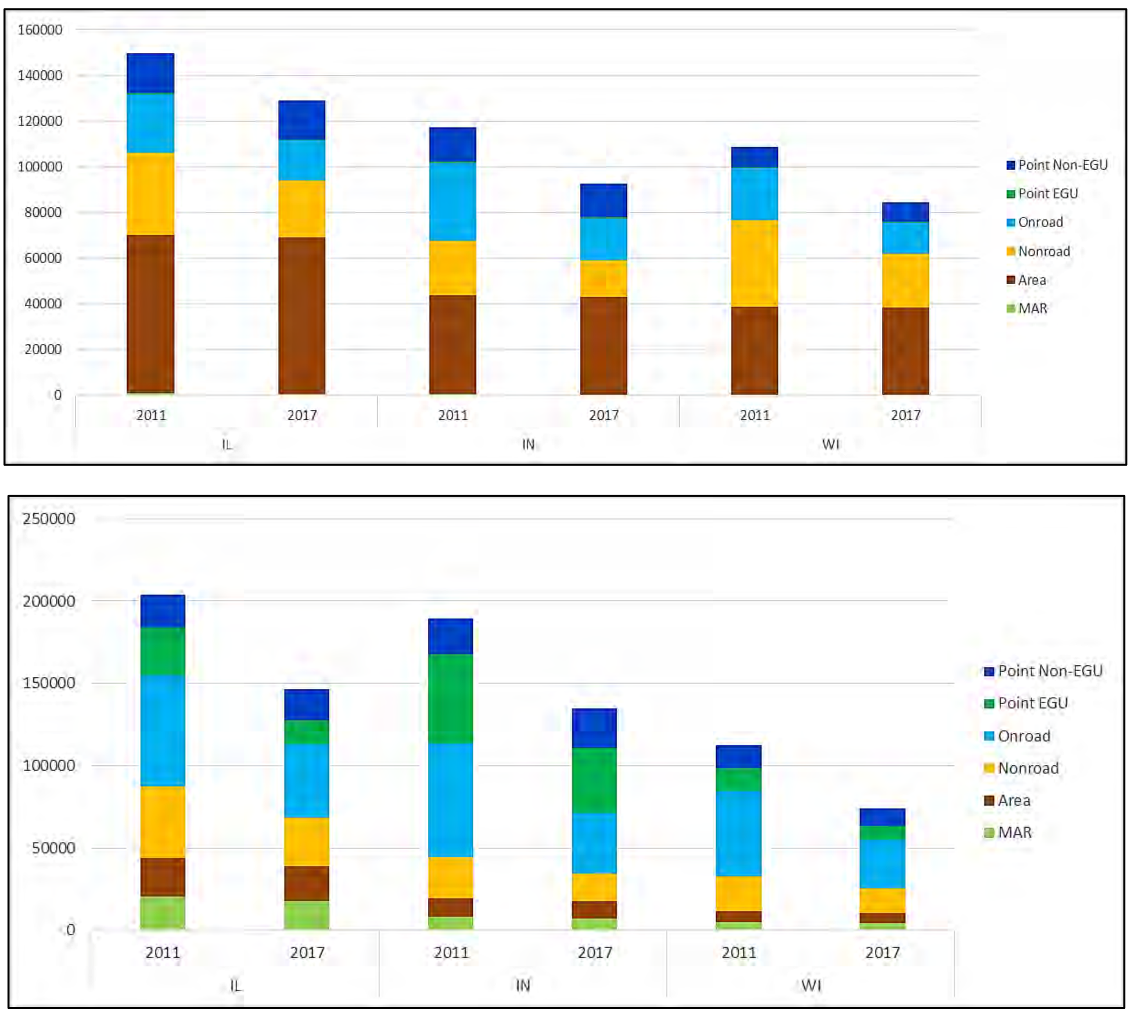


Figure 3.6. Base Year (2011) and Future Year (2017) VOC (top) and NO_X (bottom) Emissions (tons per ozone season).

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).

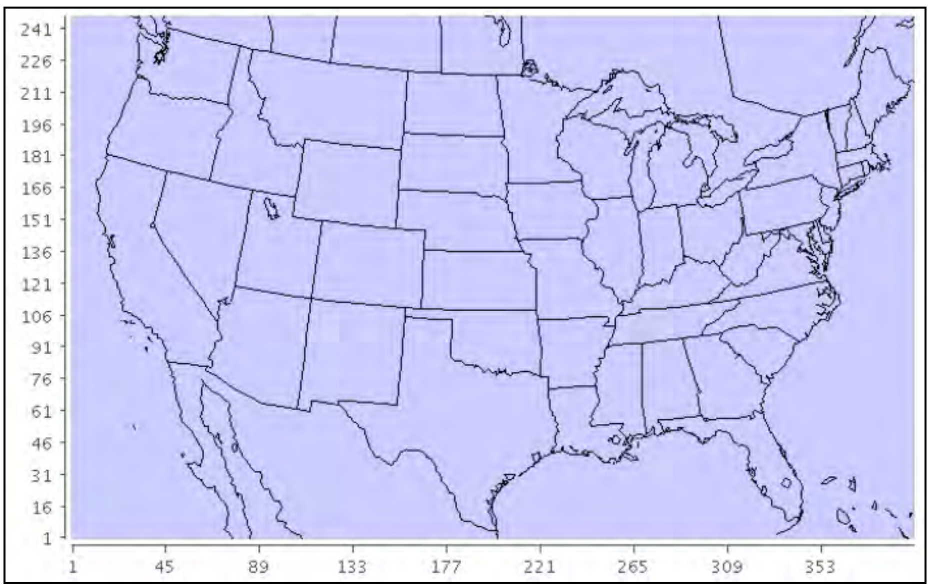


Figure 4.1. Map of WRF Model Domain (U.S. EPA, 2014A)

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.

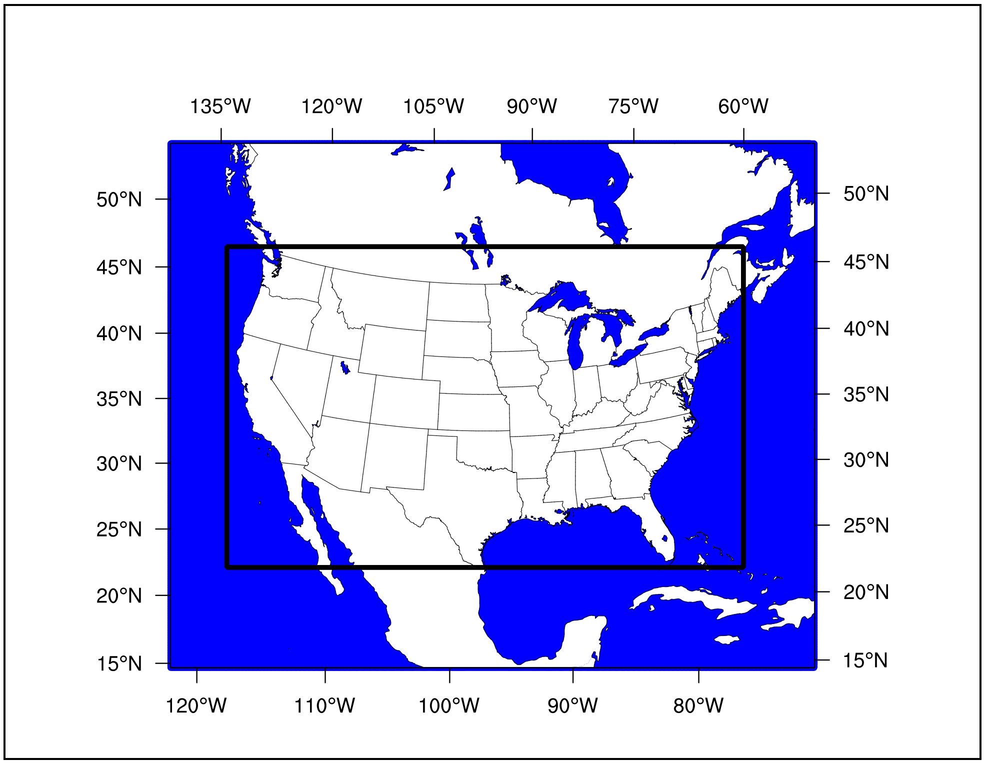


Figure 4.2. Photochemical Modeling Domain (shown in black).

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

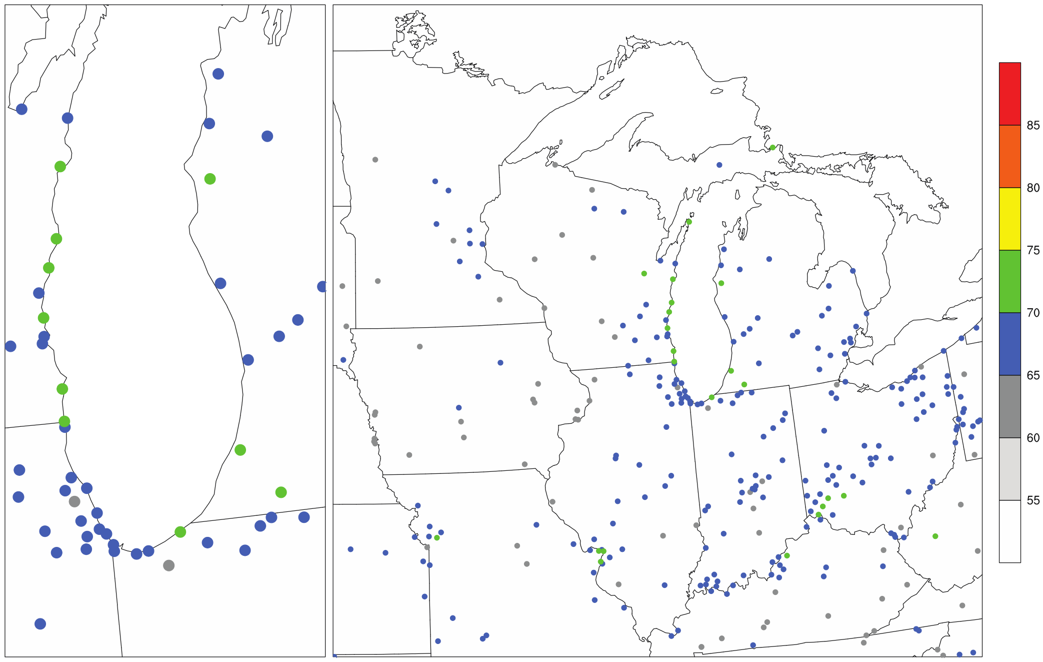


Figure 4.3. 2011 Mean Observed MDA8 Ozone (ppb) with a 60 ppb Ozone Threshold

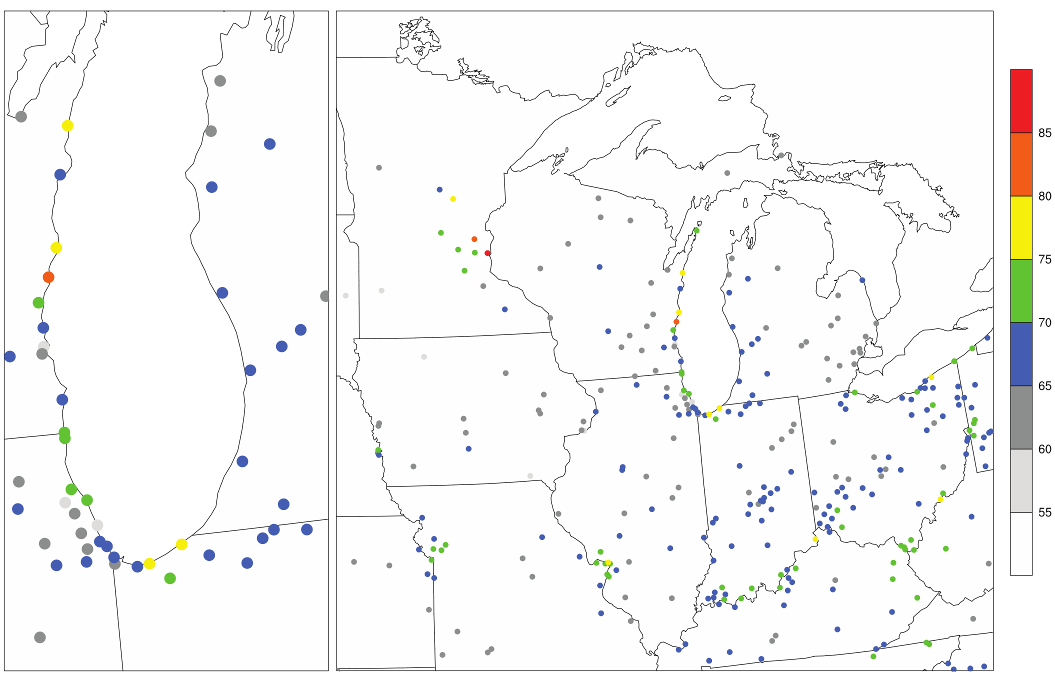


Figure 4.4. 2011 Mean CAMx Predicted MDA8 Ozone (ppb) with a 60 ppb Ozone Threshold.

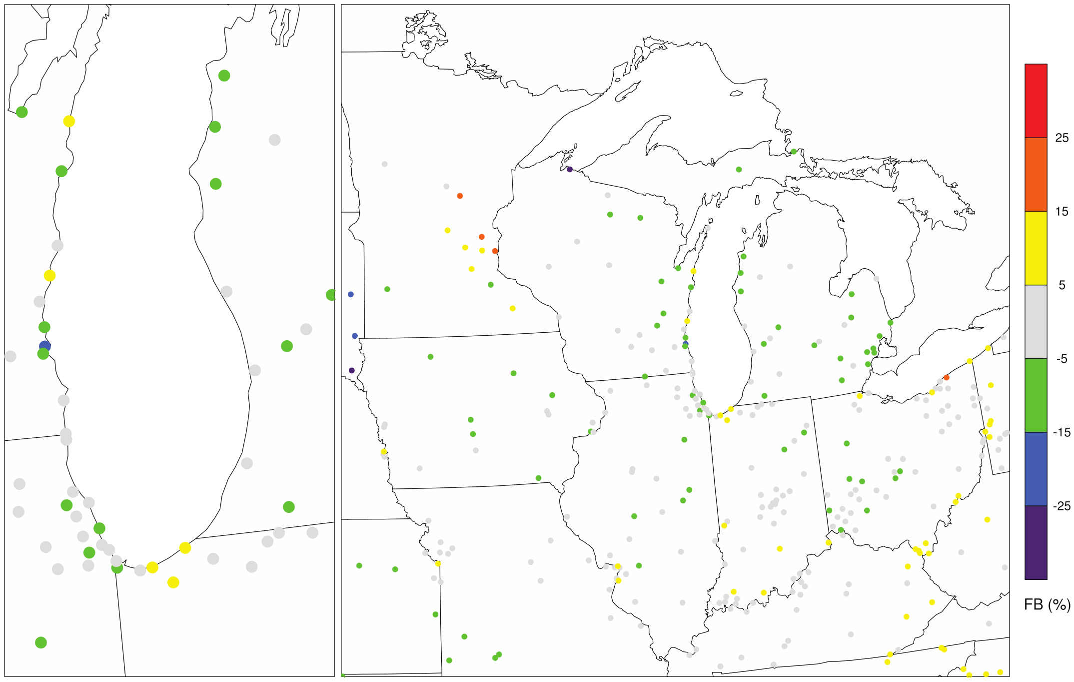


Figure 4.5. 2011 Mean Fractional Bias of MDA8 Ozone (ppb) with a 60 ppb Ozone Threshold

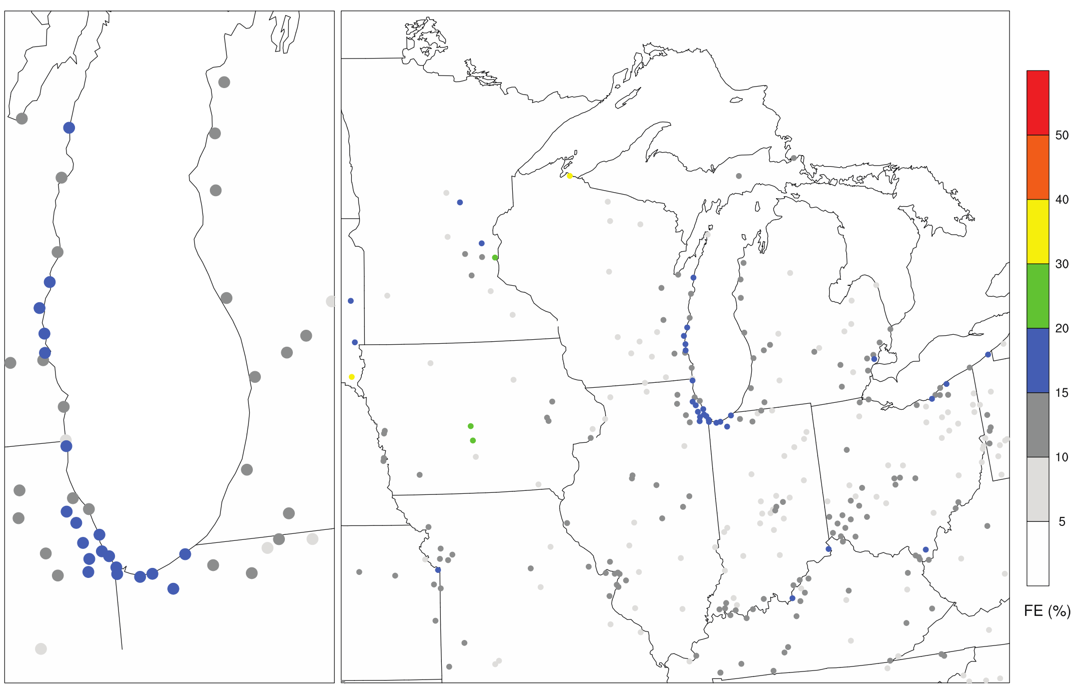


Figure 4.6. 2011 Mean Fractional Error of MDA8 Ozone (ppb) with a 60 ppb Ozone Threshold

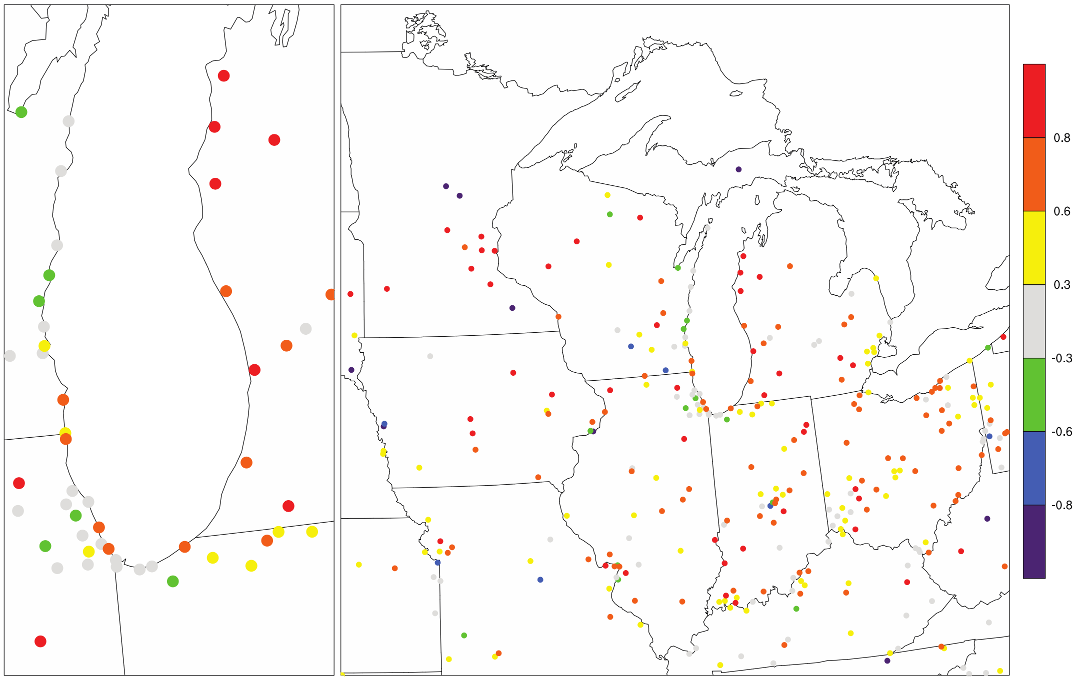


Figure 4.7. 2011 Pearson Correlation Coefficient of MDA8 Ozone (ppb) with a 60 ppb Ozone Threshold

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

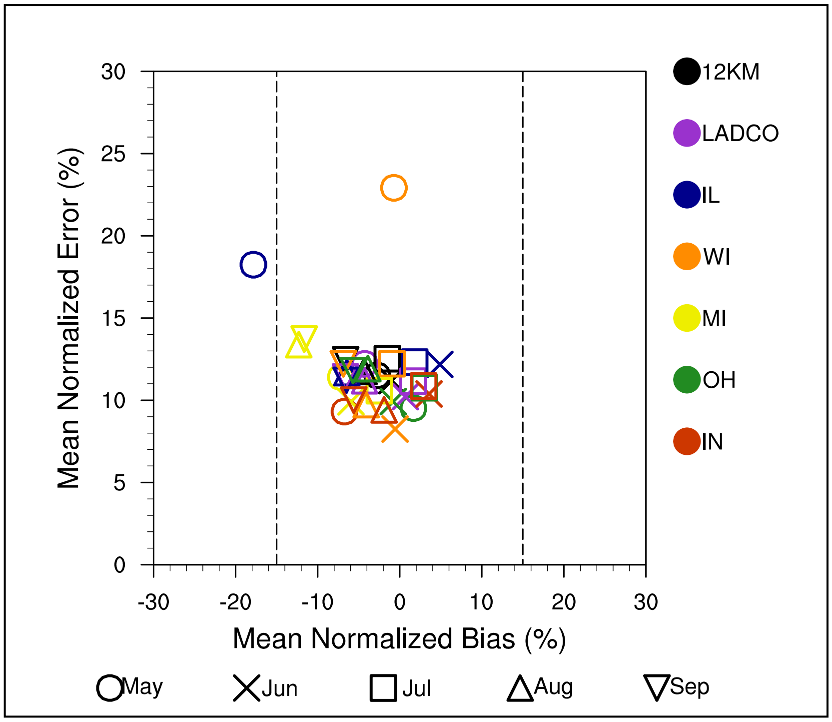


Figure 4.8. MDA8 Ozone Model Performance by Month for the LADCO States, LADCO Aggregated (purple), and National Average (black)

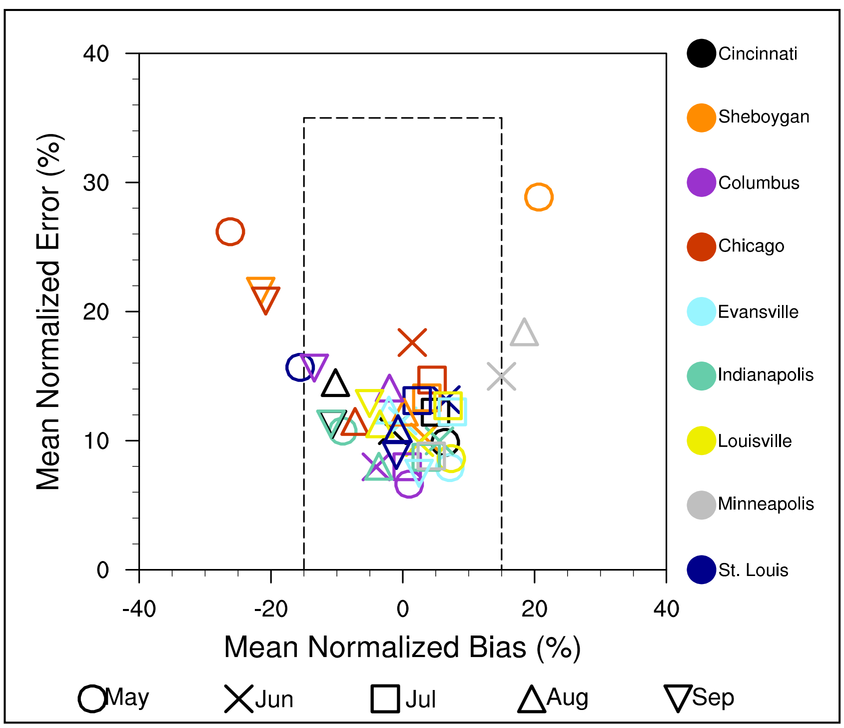


Figure 4.9. MDA8 Ozone Model Performance for Selected Cities in the LADCO Region

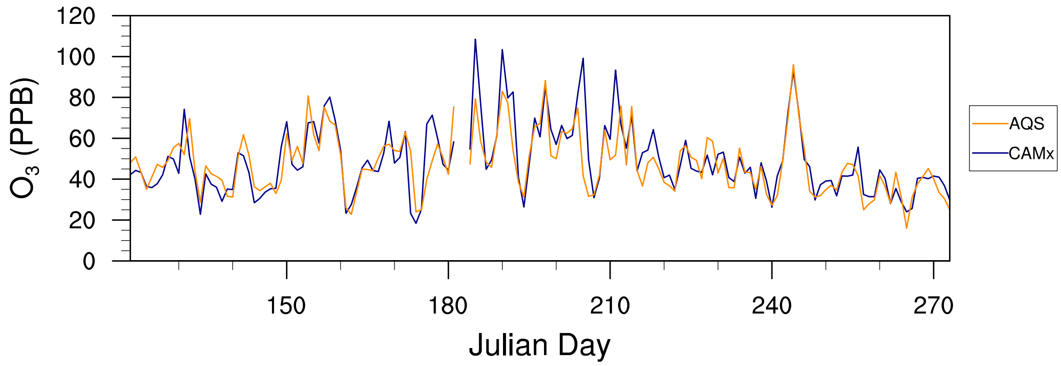


Figure 4.10. MDA8 Ozone Showing Monitoring and Modeling in Chiwaukee Prairie, WI (AQS site ID 550590019)

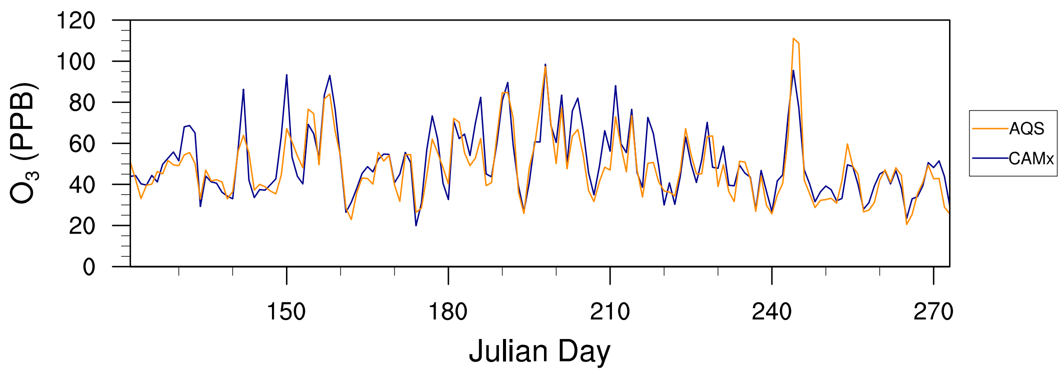


Figure 4.11. Time Series Comparing Observed and Predicted MDA8 Ozone in Sheboygan, WI (AQS site ID 551170006)

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

[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

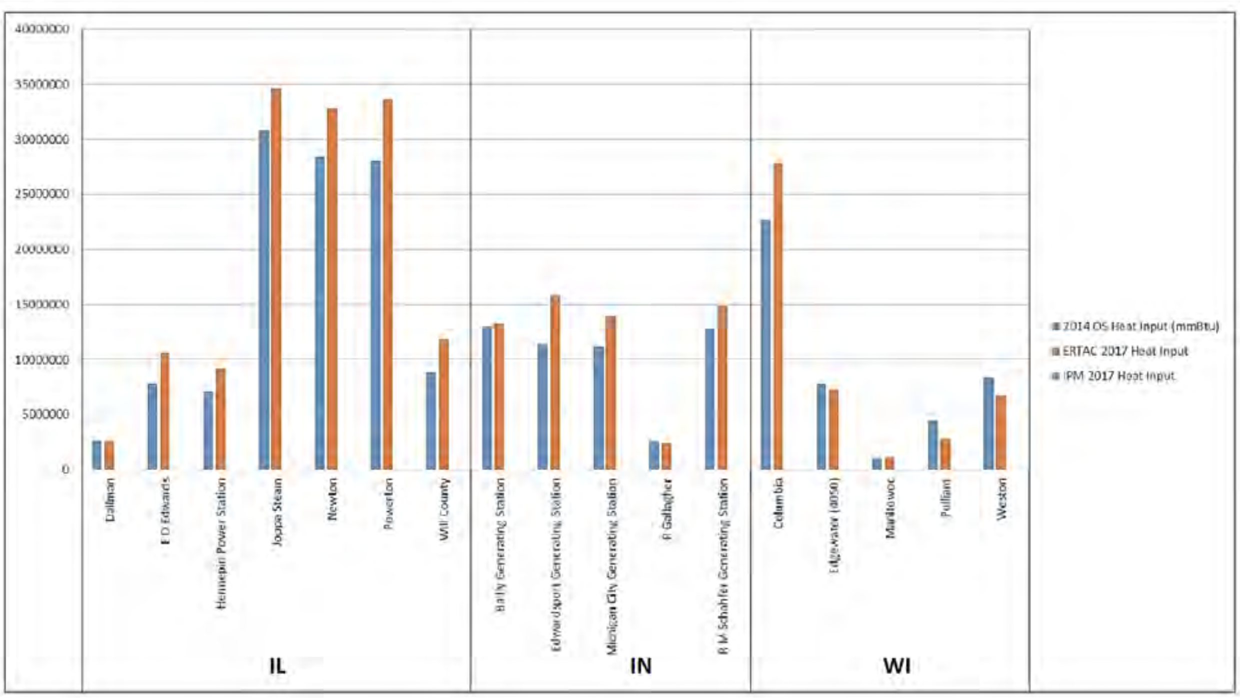


Figure 4.12. Coal Utilization (heat input) Projected by the ERTAC EGU Projection Tool for Power Plants in the LADCO States that IPM Projects to be Shut Down by 2017.

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.

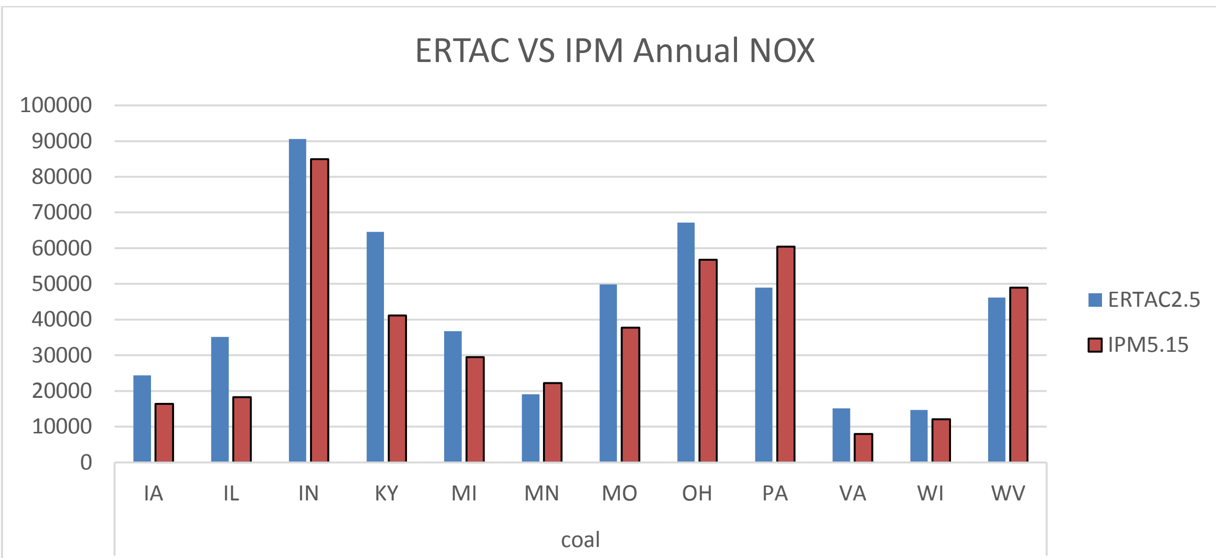


Figure 4.13. Comparison of ERTAC and IPM 2017 NOx Emissions (tons per year)

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.

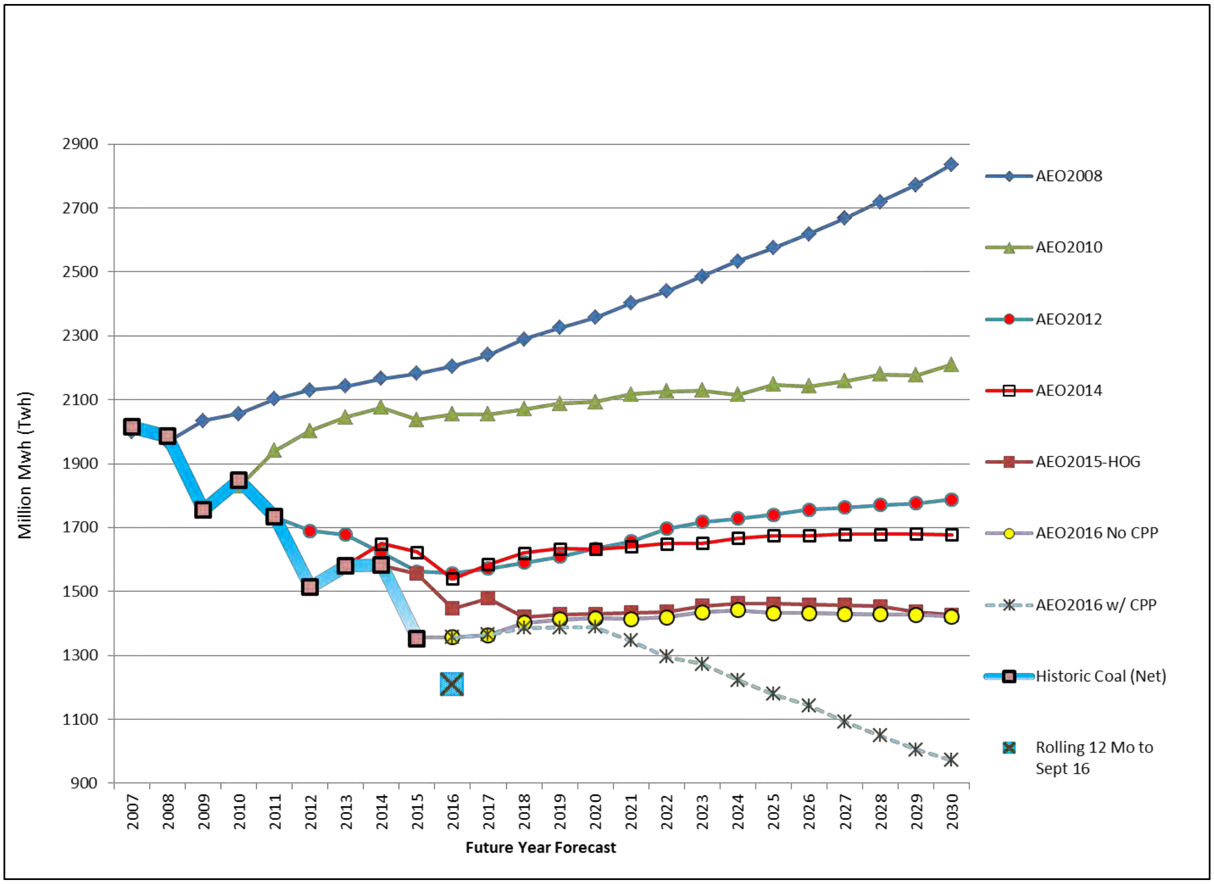


Figure 4.14. Downward Trend in U.S. Coal Net Generation Forecasts from EIA, 2008-2016.

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.

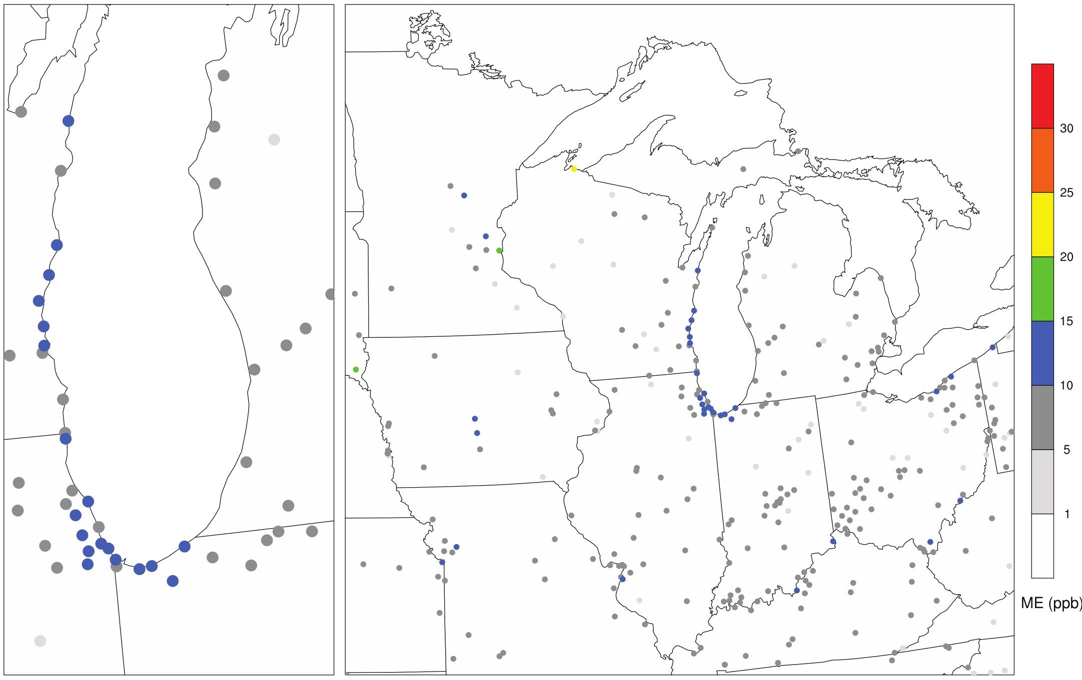


Figure A.1. 2011 mean error of MDA8 ozone (ppb) with a 60 ppb ozone threshold.

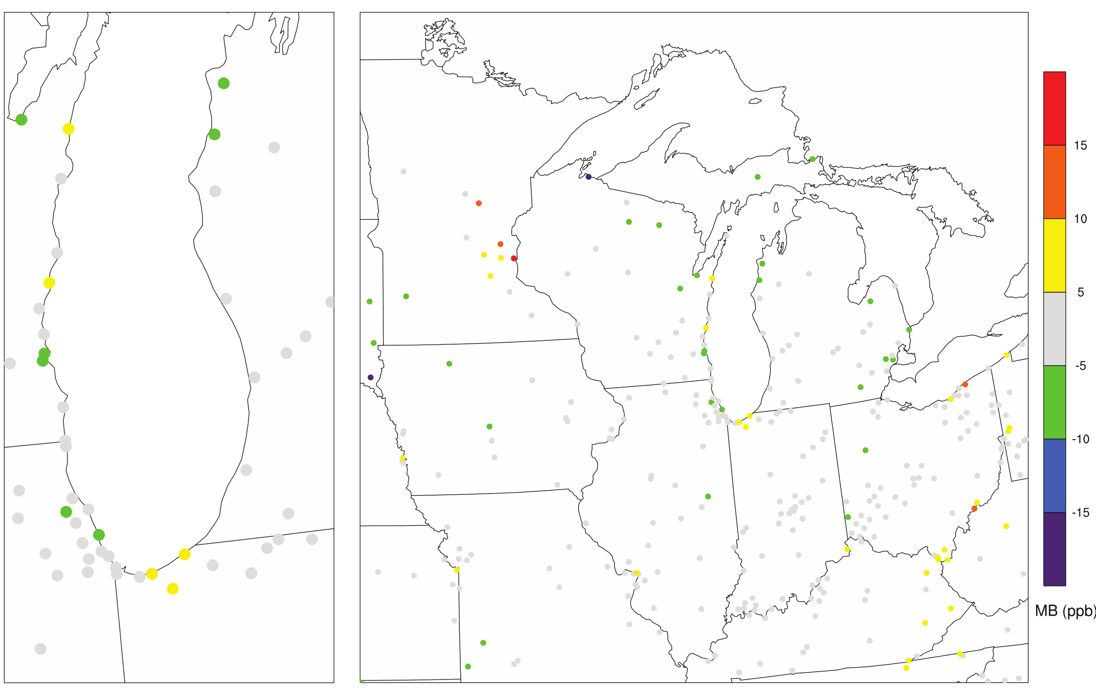


Figure A.2. 2011 mean bias of MDA8 ozone (ppb) with a 60 ppb ozone threshold.

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.

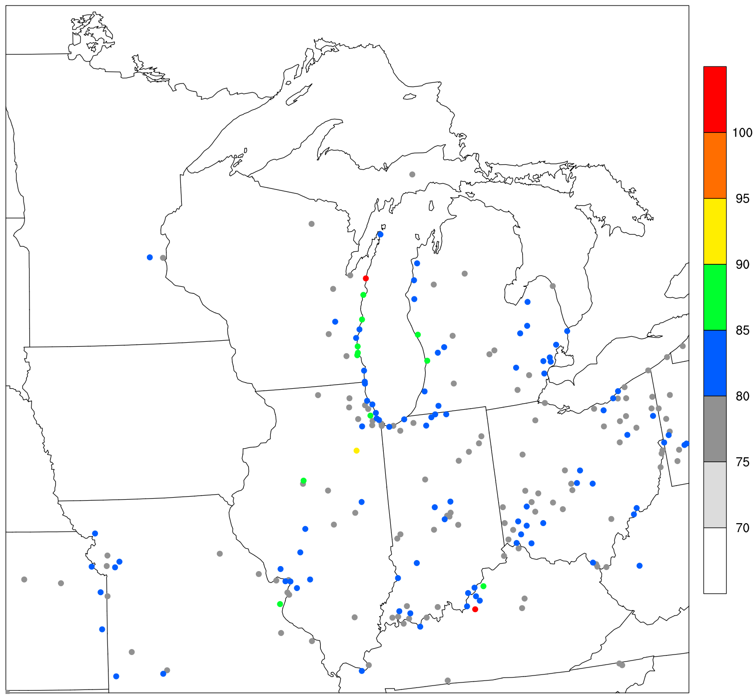


Figure A.3. 2011 mean monitored MDA8 ozone (ppb) with a 75 ppb ozone threshold.

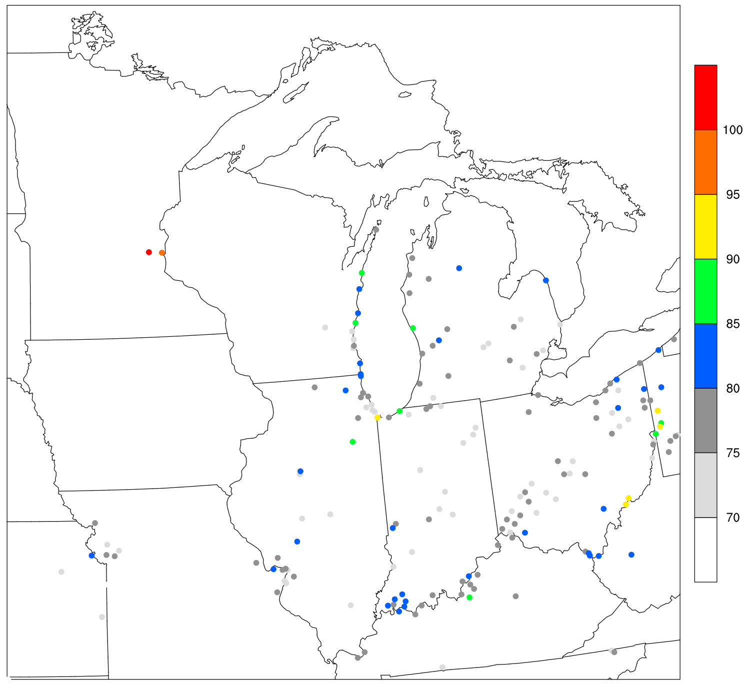


Figure A.4. 2011 mean CAMx predicted MDA8 ozone (ppb) with a 75 ppb ozone threshold.

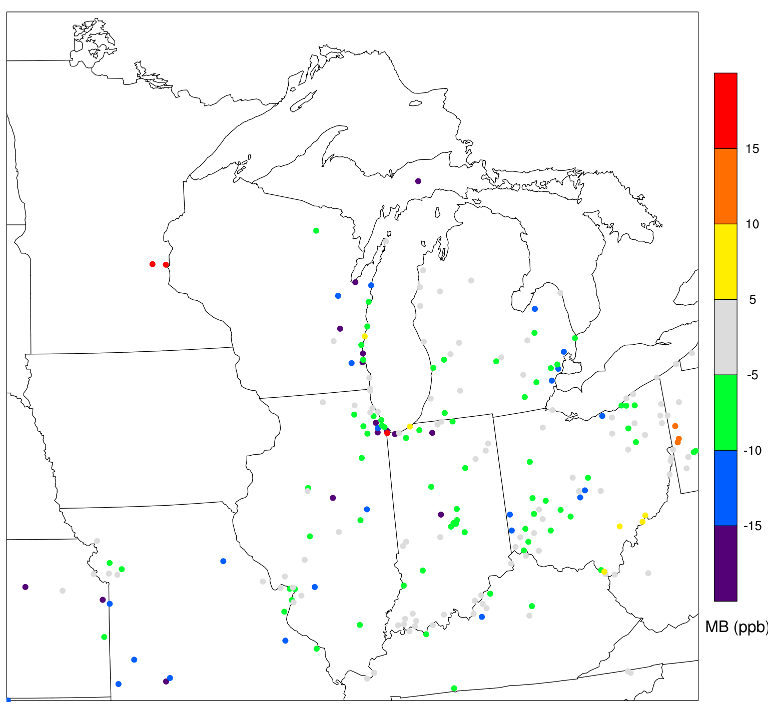


Figure A.5. 2011 mean bias of MDA8 ozone (ppb) with a 75 ppb ozone threshold.

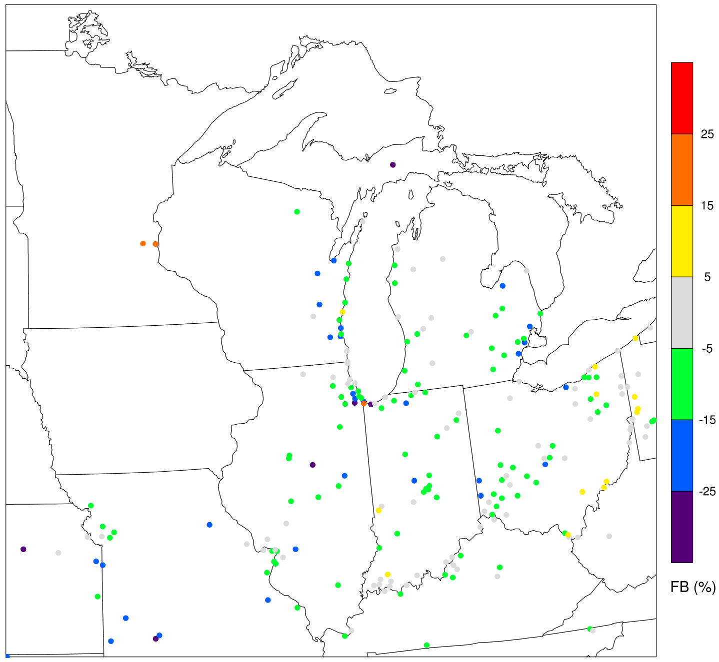


Figure A.6. 2011 mean fractional bias of MDA8 ozone (ppb) with a 75 ppb ozone threshold.

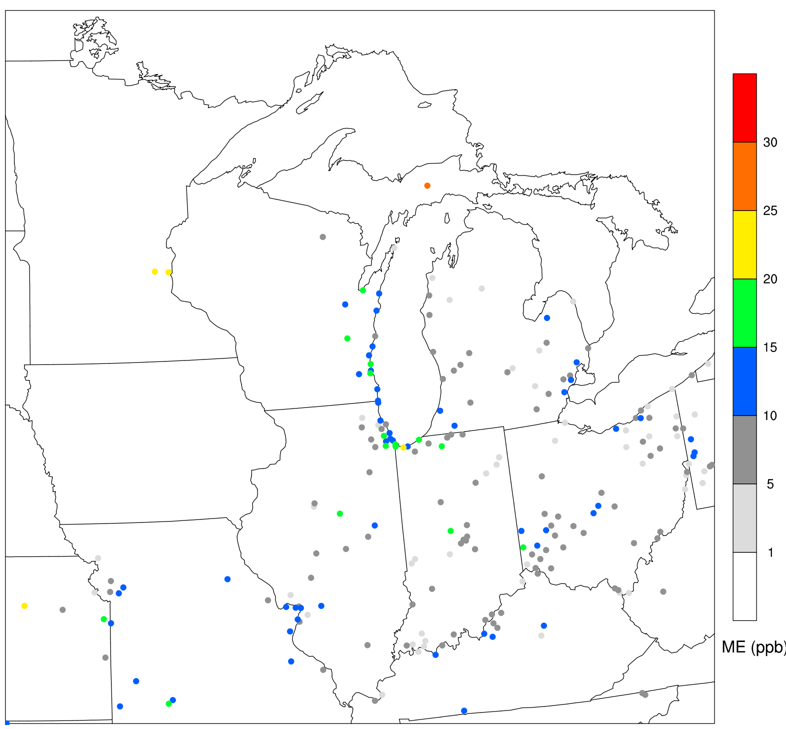


Figure A.7. 2011 mean error of MDA8 ozone (ppb) with a 75 ppb ozone threshold.

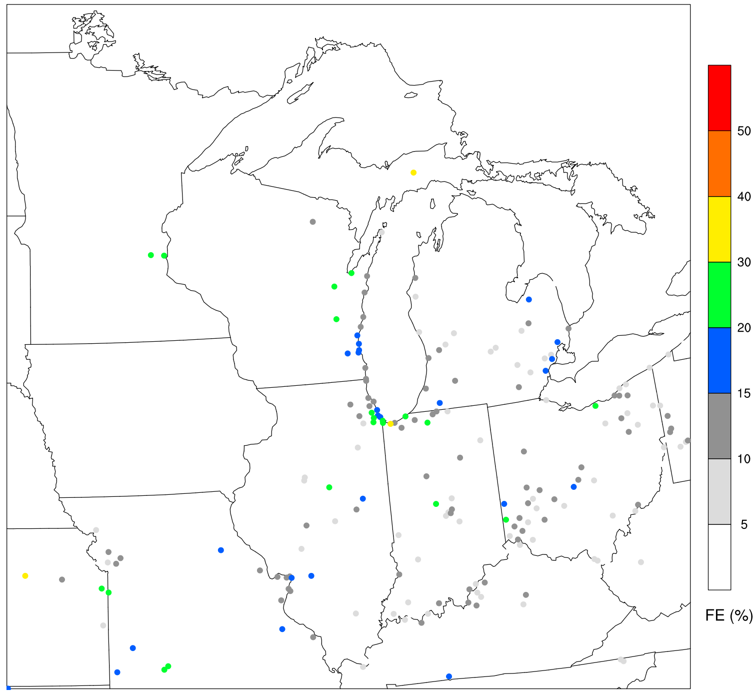


Figure A.8. 2011 mean fractional error of MDA8 ozone (ppb) with a 75 ppb ozone threshold.

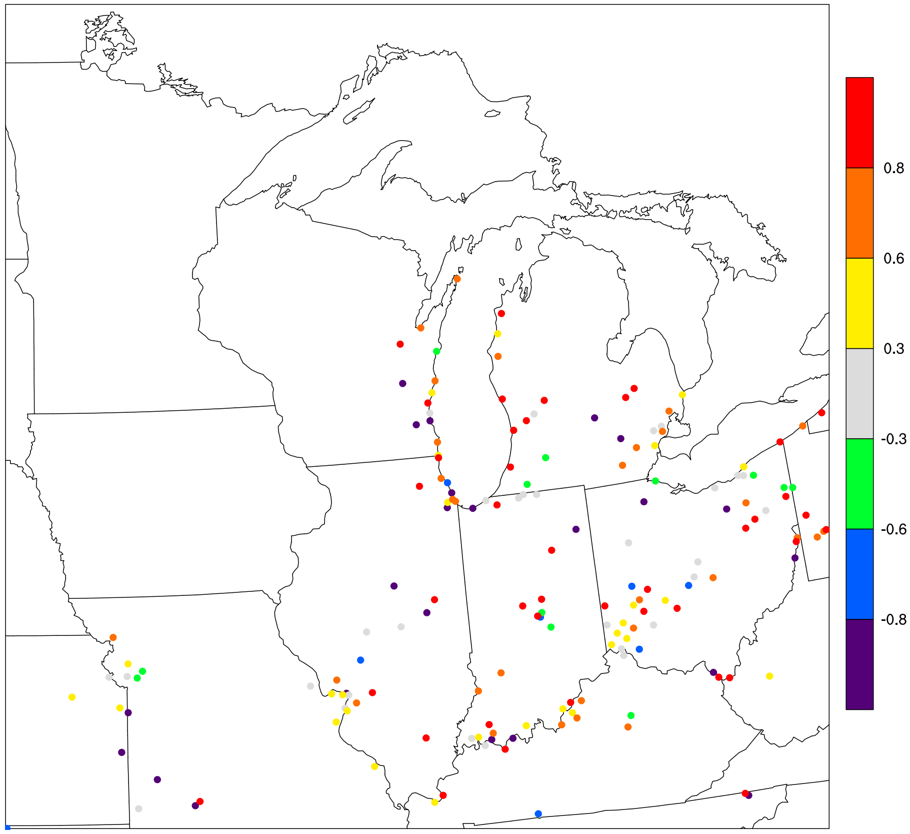


Figure A.9. 2011 Pearson correlation coefficient of MDA8 ozone with a 75 ppb ozone threshold.

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

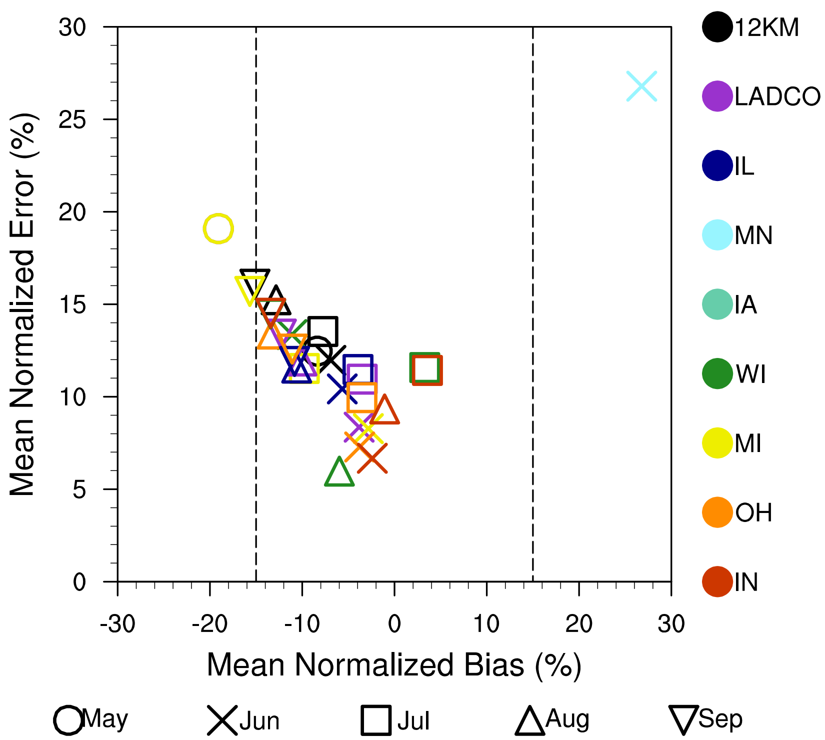


Figure A.10. MDA8 ozone Model Performance by month for the LADCO states, LADCO aggregated (purple), and national average (black) with a 75 ppb ozone threshold.

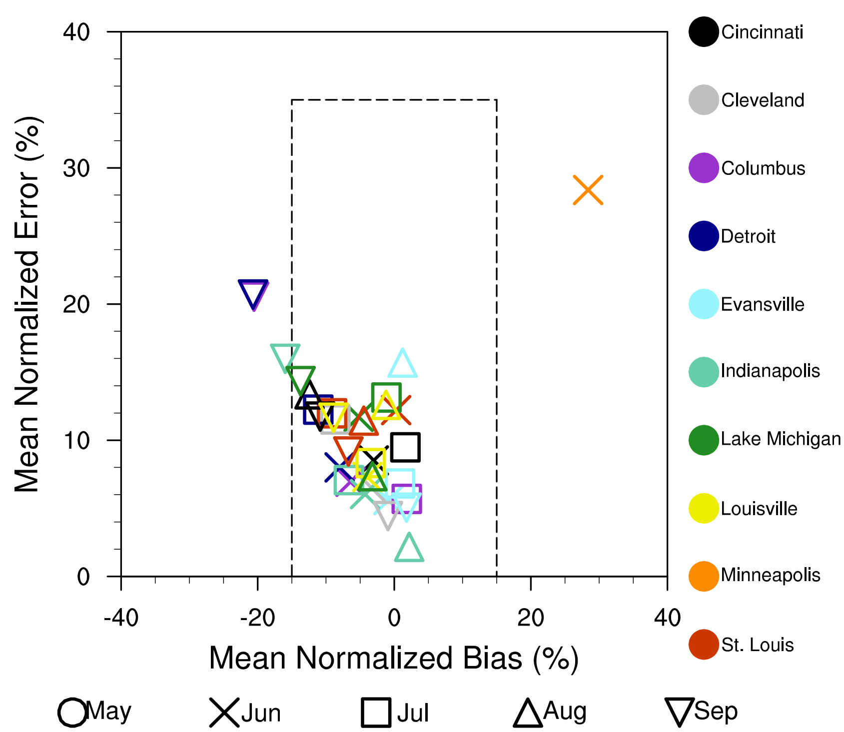


Figure A.11. MDA8 ozone model performance for select LADCO cities with a 75 ppb ozone threshold. Lake Michigan area refers to monitor near the Lake Michigan shoreline.

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.

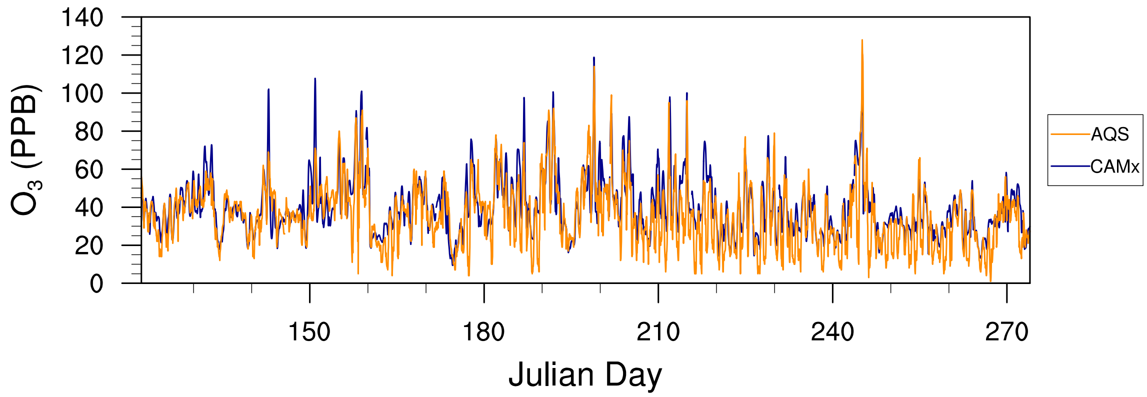


Figure A.12. 1-hour ozone showing monitoring (orange) and modeling (blue) in Sheboygan WI (AQS site ID 551170006).

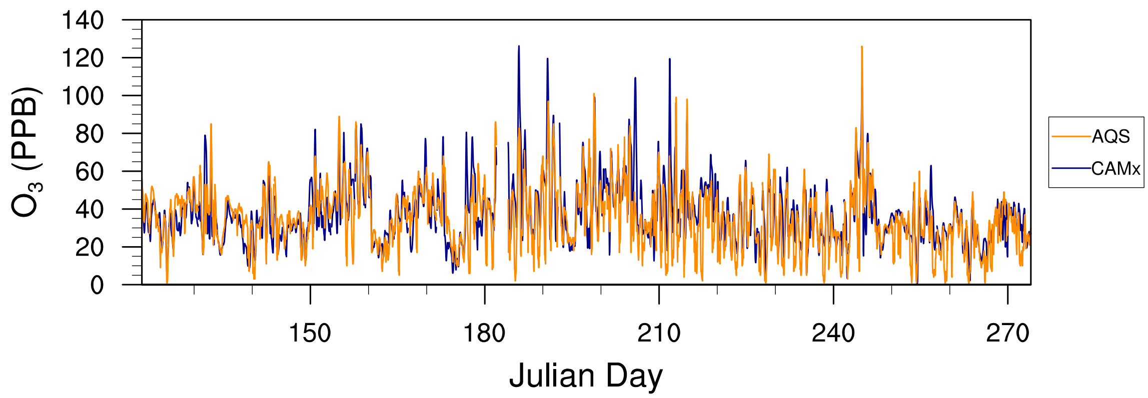


Figure A.13. 1-hour ozone showing monitoring (orange) and modeling (blue) in Chiwaukee Prairie WI (AQS site ID 550590019).

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.

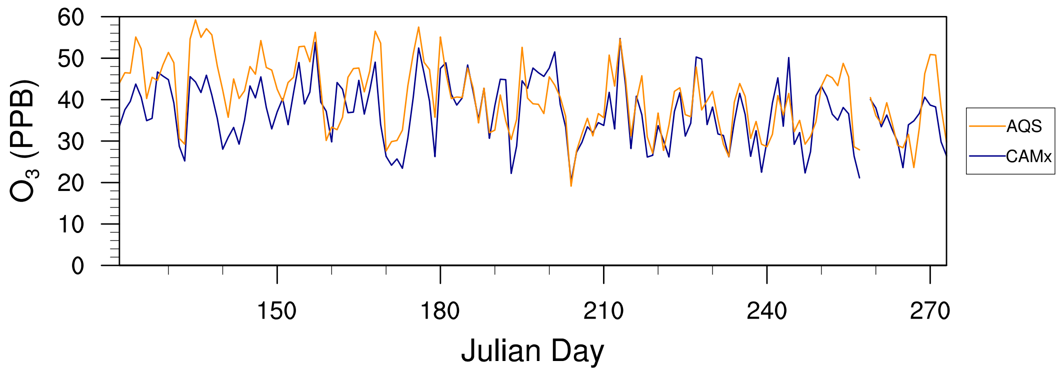


Figure A.14. MDA8 ozone showing monitoring (orange) and modeling (blue) in Voyageurs MN (AQS site ID 271370034).

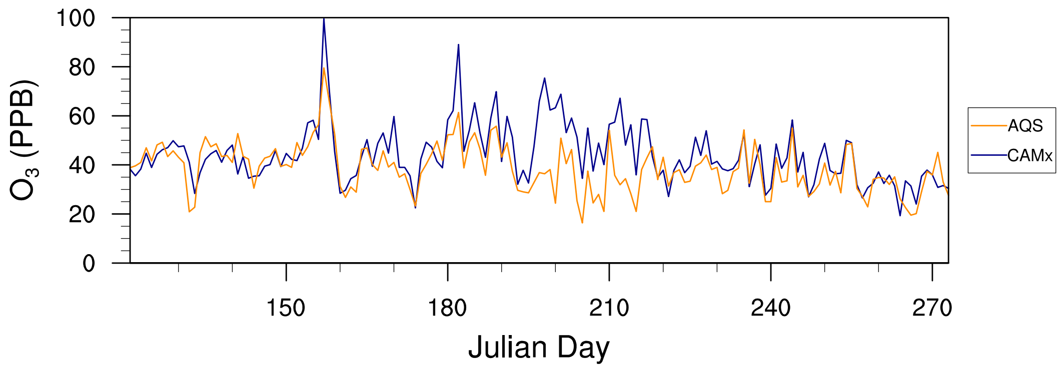


Figure A.15. MDA8 ozone showing monitoring (orange) and modeling (blue) in Stillwater MN (AQS site ID 271636015).

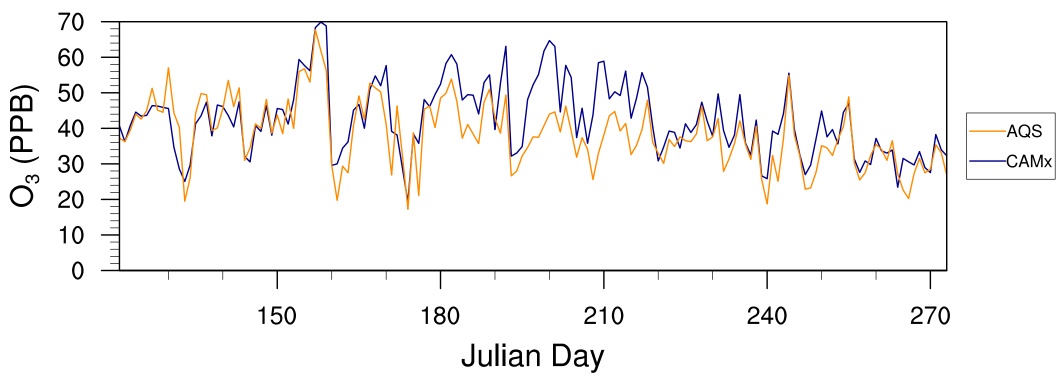


Figure A.16. MDA8 ozone showing monitoring (orange) and modeling (blue) in Rochester MN (AQS site ID 271095008).

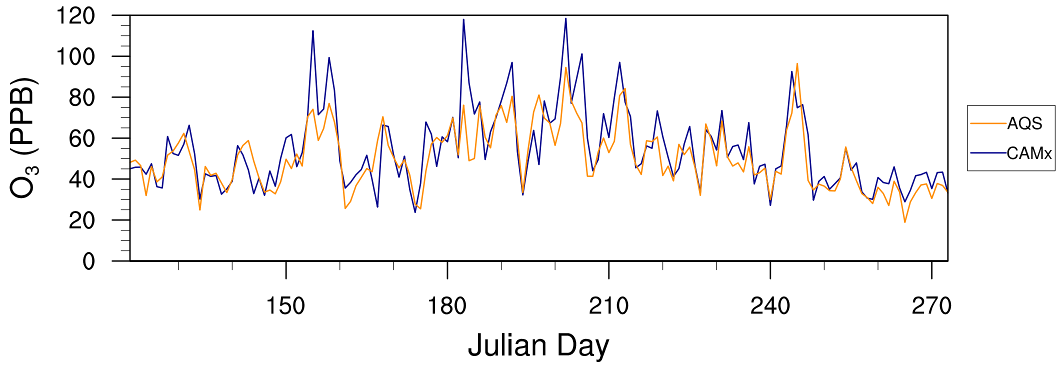


Figure A.17. MDA8 ozone showing monitoring (orange) and modeling (blue) in Michigan City IN (AQS site ID 180910005).

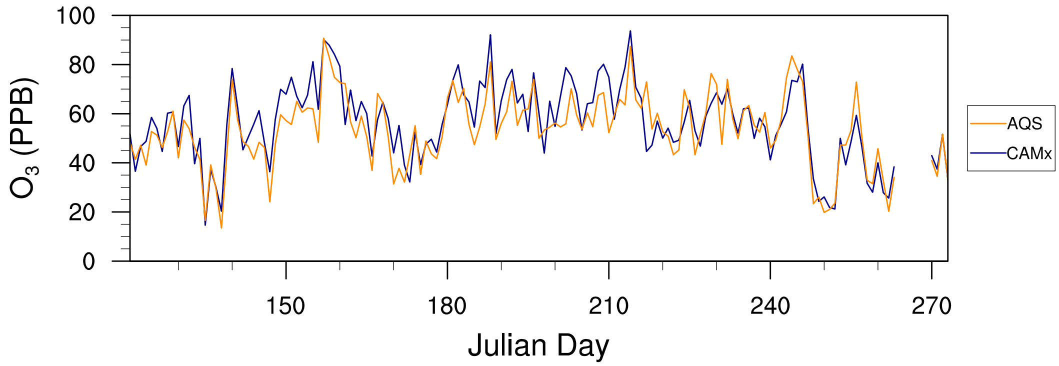


Figure A.18. MDA8 ozone showing monitoring (orange) and modeling (blue) in Charlestown IN (AQS site ID 180190008).

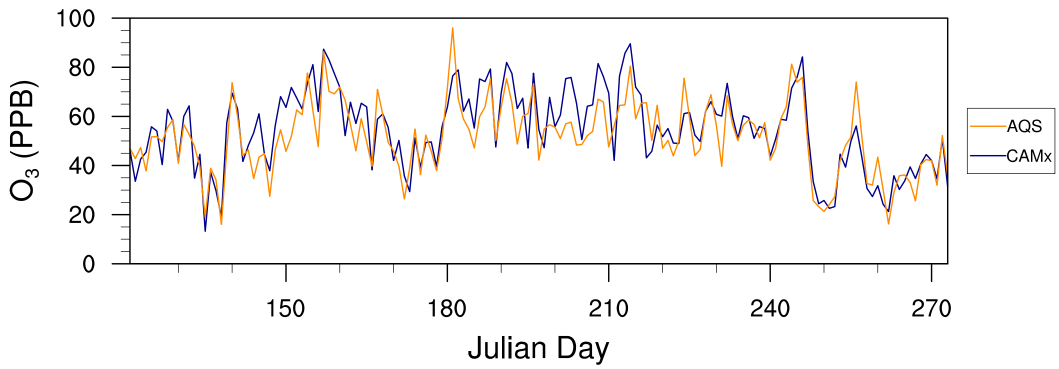


Figure A.19. MDA8 ozone showing monitoring (orange) and modeling (blue) in New Albany IN (AQS site ID 180431004).

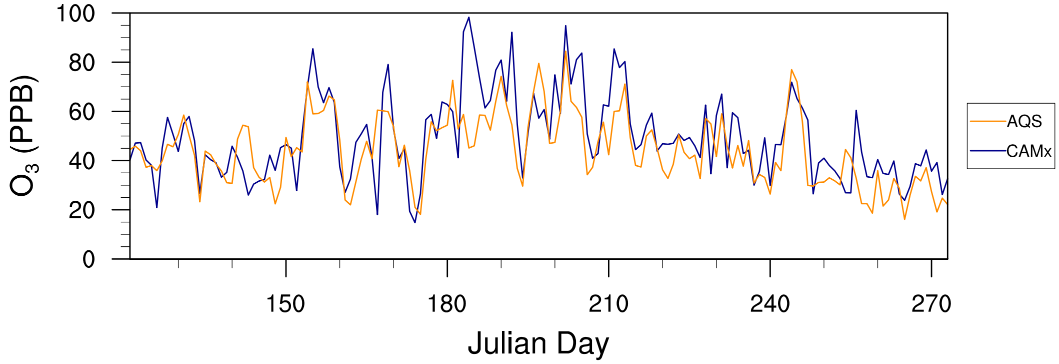


Figure A.19. MDA8 ozone showing monitoring (orange) and modeling (blue) in Chicago IL (AQS site ID 170310063).

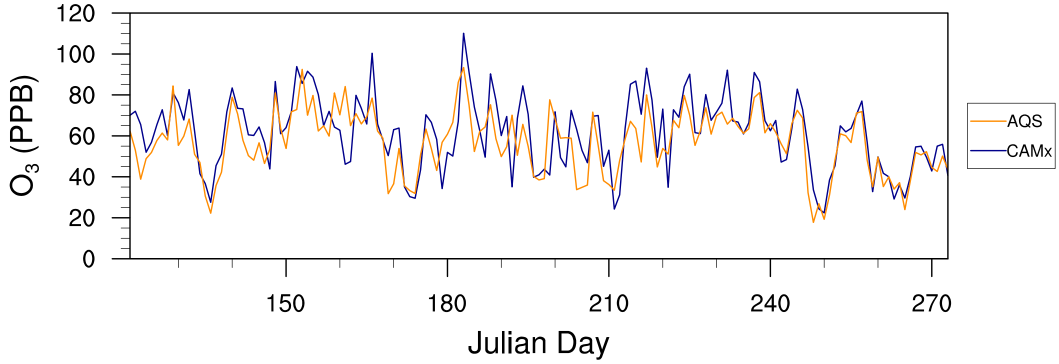


Figure A.19. MDA8 ozone showing monitoring (orange) and modeling (blue) in Atlanta GA (AQS site ID 131210053).

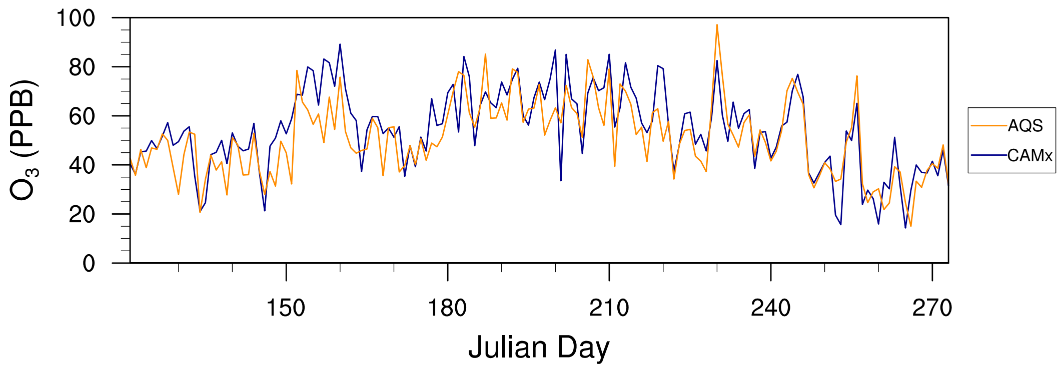


Figure A.20. MDA8 ozone showing monitoring (orange) and modeling (blue) in St. Louis MO (AQS site ID 295100085).

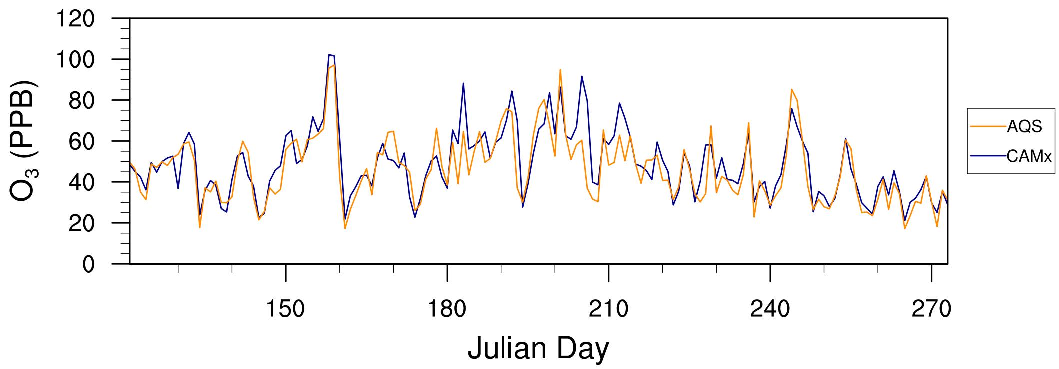


Figure A.21. MDA8 ozone showing monitoring (orange) and modeling (blue) in Holland MI (AQS site ID 260050003).

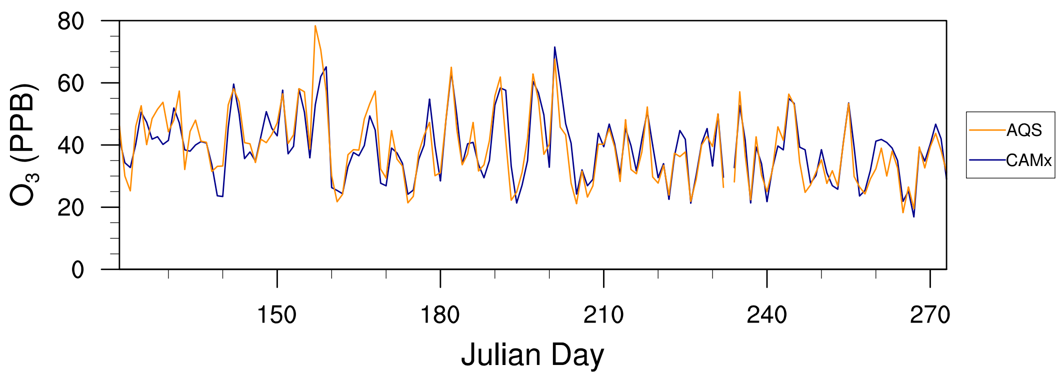


Figure A.22. MDA8 ozone showing monitoring (orange) and modeling (blue) in Seney MI (AQS site ID 261530001).

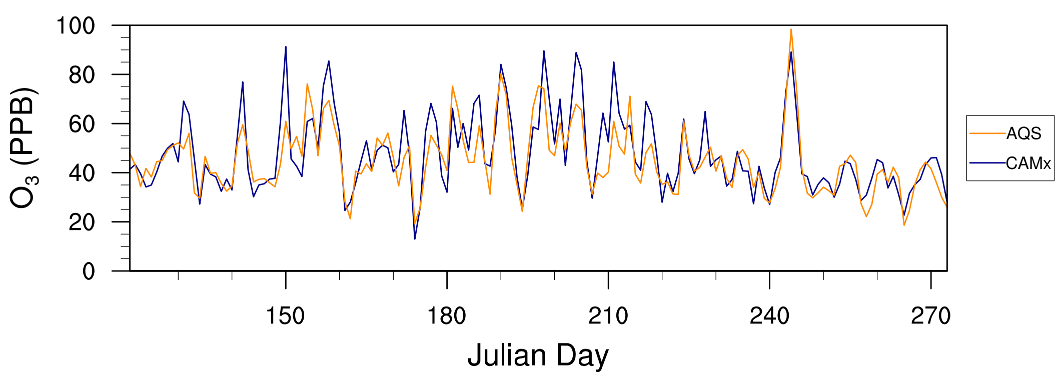


Figure A.23. MDA8 ozone showing monitoring (orange) and modeling (blue) in Ozaukee WI (AQS site ID 550890008).

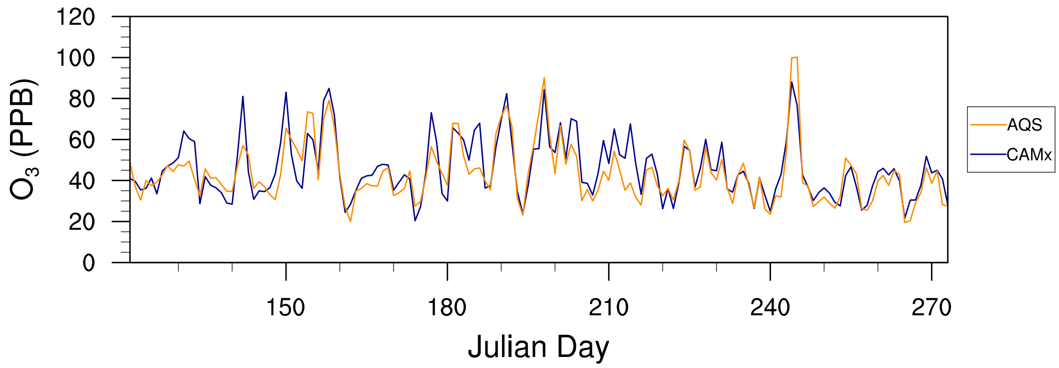


Figure A.23. MDA8 ozone showing monitoring (orange) and modeling (blue) in Manitowoc WI (AQS site ID 550710007).

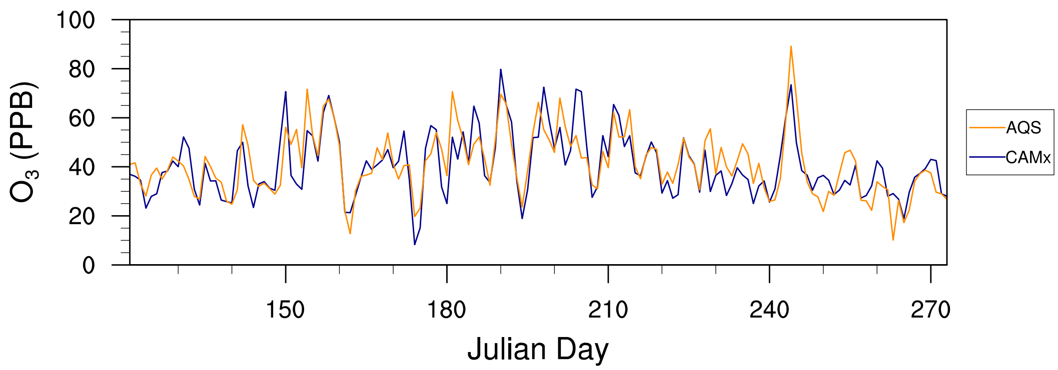


Figure A.23. MDA8 ozone showing monitoring (orange) and modeling (blue) in Milwaukee WI (AQS site ID 550790010).

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.

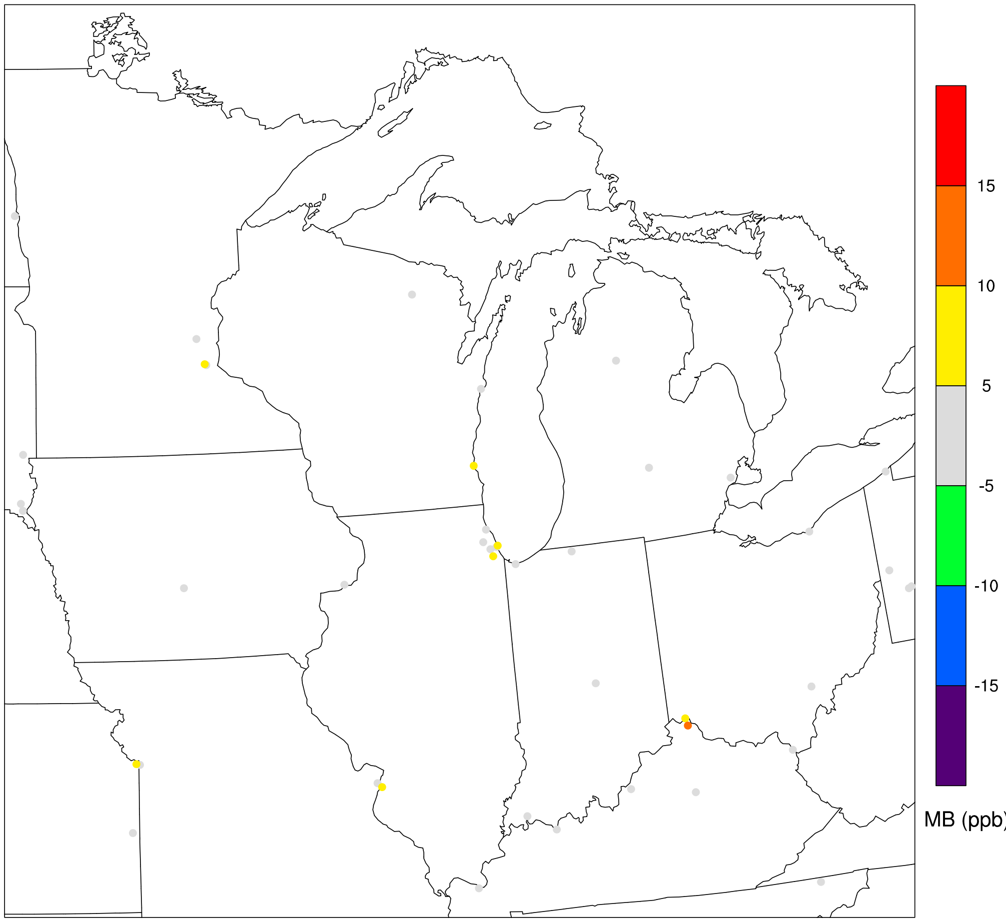


Figure A.24. 2011 mean bias of 1-hour NO_2 (ppb).

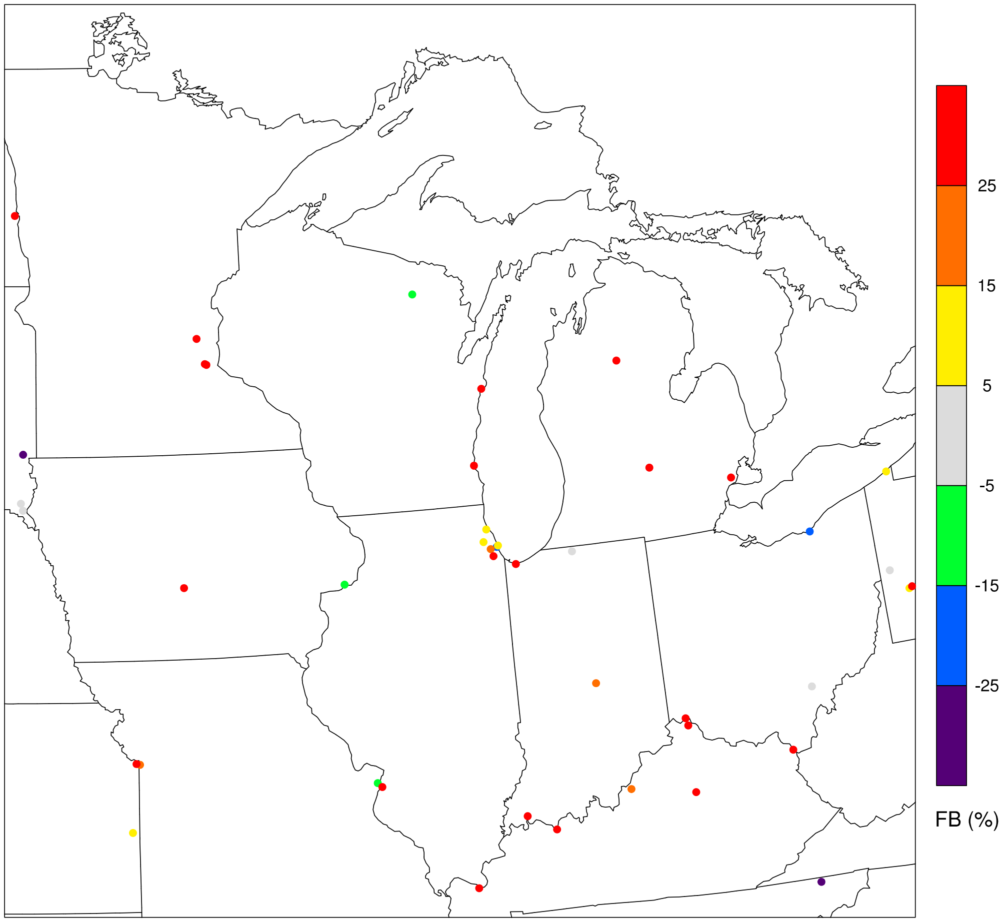


Figure A.25. 2011 fractional bias of 1-hour NO_2 (%).

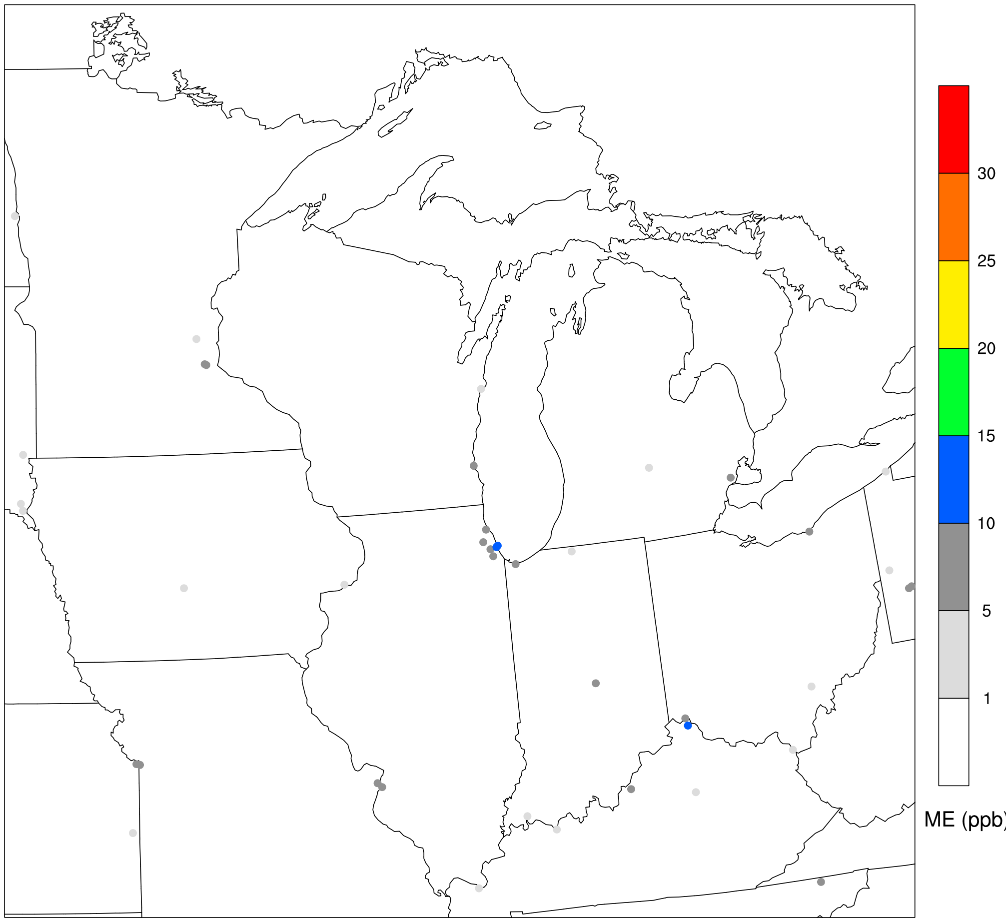


Figure A.26. 2011 mean error of 1-hour NO_2 (ppb).

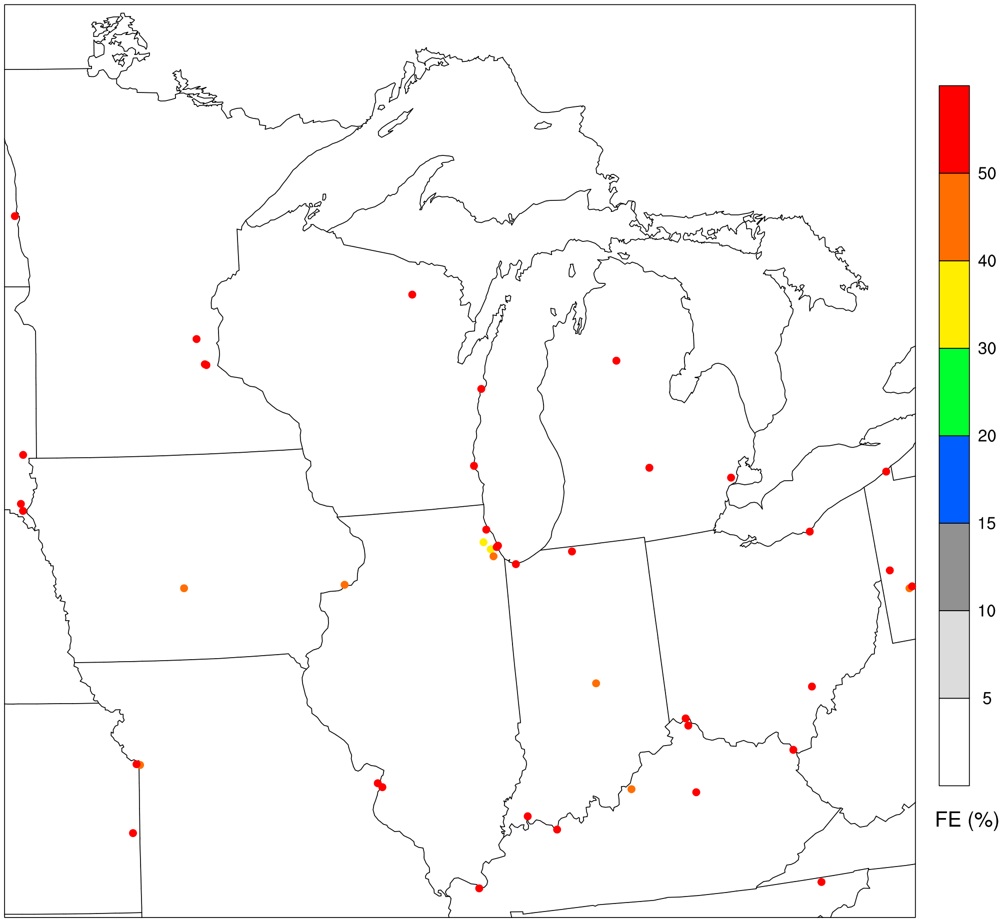


Figure A.27. 2011 fractional error of 1-hour NO_2 (%).

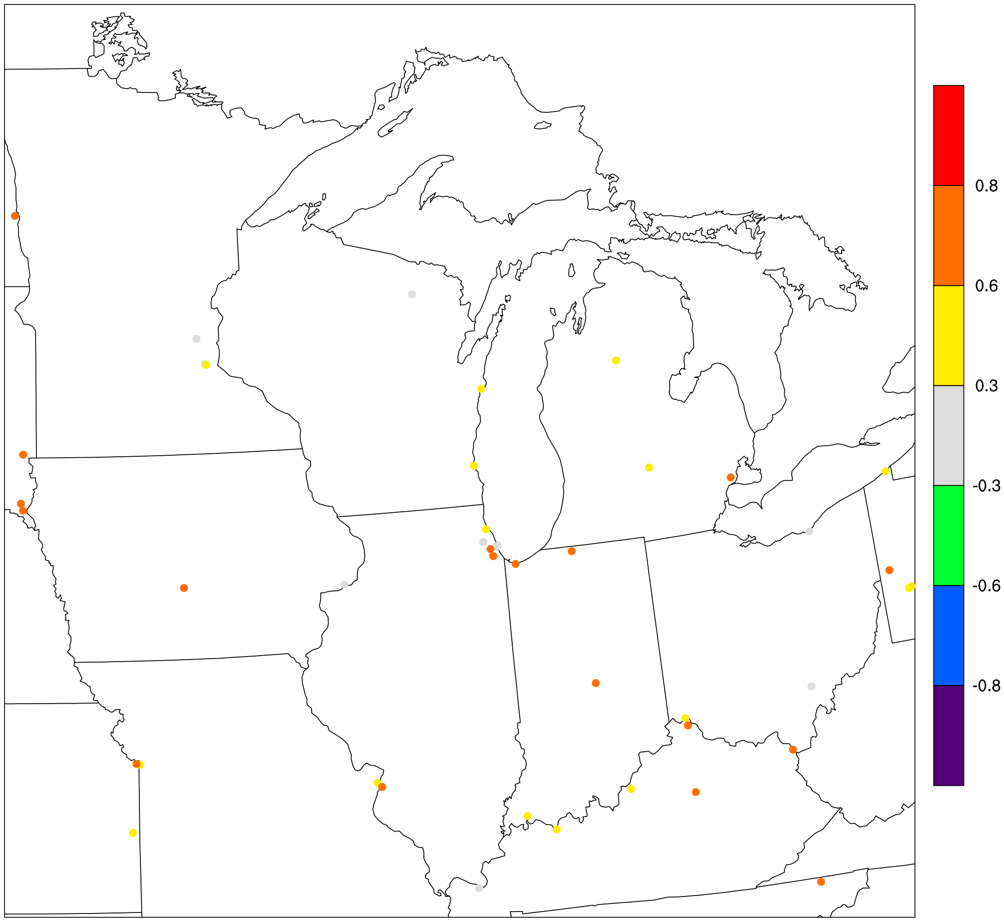


Figure A.28. 2011 Pearson correlation coefficient of 1-hour NO_2.

APPENDIX 10

Supplemental Information for Ozone, NOx and VOC Trends Analysis

Table of Contents

1. SUPPLEMENTAL INFORMATION ON OZONE TRENDS

1.1. Explanation of CART Analysis

Classification and regression tree (CART) analysis is a statistical tool to classify data. Here, it is applied to 8-hour ozone and meteorological data to determine the meteorological conditions most commonly associated with high-ozone days. Once days are classified by their meteorology, ozone concentration trends among days with the same conditions can be developed. By examining trends only on days with similar meteorology, the influence of year-to-year meteorological variability on ozone concentrations is minimized and we assume that any remaining trend is the result of reductions in emissions of ozone precursors and other non-meteorological factors.

A CART analysis was conducted by LADCO using 8-hour ozone monitoring data for Sheboygan's Kohler Andrae monitor The analysis included data from the years 2000-2015, which encompasses many years prior to the promulgation of the 2008 ozone NAAQS. This analysis therefore addresses long-term trends rather than the direct impacts of the 2008 ozone NAAQS. The goal of the analysis was to determine the meteorological conditions associated with high ozone episodes in the Sheboygan airshed and to construct linear trends for the high-ozone days identified as sharing similar meteorological characteristics.

The CART analyses for the Sheboygan area processed multiple meteorological variables for each day to determine which are the most effective at predicting ozone. Meteorological data for the Kohler Andrae monitor were taken from the Manitowoc Airport NWS station and processed by LADCO. Upper air observations were taken from the Green Bay, Wisconsin NWS site. Meteorological variables included maximum and average daily temperature, dew point, relative humidity and air pressure at the surface and different levels of the atmosphere, wind direction and wind speed, change in temperatures and air pressure from the previous day, average wind speed and temperature over a 2 or 3-day period, day of the week, cloud cover, daily precipitation and many other parameters.[1]

Regression trees, in which each branch describes the meteorological conditions associated with different ozone concentrations, were developed to classify each summer day (May – September). Although the exact selection of predictive variables changes from site to site, temperature, wind direction, and relative humidity are common predictors. These are included in the dataset as daily averages and maximums as well as averages at specific times throughout the day (morning 7-10 am, afternoon 1-4 pm, etc.). Similar days were assigned to nodes, which are equivalent to branches of the regression tree. By grouping days with similar meteorology, the influence of meteorological variability on the underlying trend in ozone concentrations is partially removed; the remaining trend is presumed to be due to trends in precursor emissions combined with other non-meteorological influences. Ozone trends in these nodes were then plotted.

The CART analysis for Sheboygan determined that five sets of meteorological conditions had average ozone concentrations above 50 ppb. Table 1 shows the shared meteorological conditions for each high-ozone node along with the frequency and average ozone concentration for each

[1] The original meteorological database used to support this effort, called MetDat, was developed by EPA Office of Air Quality Planning and Standards (OAQPS) and subsequently revised by both Sonoma Technology and LADCO.

node. Most of the high-ozone nodes had high temperatures at 925 millibars pressure (mb) and southerly winds. The highest average ozone concentrations (74.7 ppb) were observed for node 10. This node was characterized by temperatures at 925 mb above 68.4 °F and average afternoon winds of greater than 3.22 m/s from the south.

Figure 5.3 in the main attainment plan document shows the trends in average ozone concentration at the Kohler Andrae monitor for the five primary nodes from the year 2000 through 2015. This analysis demonstrates that ozone concentrations for a given set of high-ozone meteorological conditions have decreased over time. In particular, this analysis shows that ozone concentrations have decreased on days with high temperatures and the right combination of (mostly southerly) winds, along with other characteristics. While maximum temperatures play an important role in the formation of ozone, the CART analysis reveals that other meteorological parameters (such as wind direction, wind speed and morning temperature) also play significant roles in creating conditions conducive for ozone formation. This analysis demonstrates that the observed reductions in ozone concentrations have not been driven solely by favorable meteorological conditions. These results further suggest that progress in reducing ozone precursor emissions was likely an important driver of the observed reductions in 8-hour ozone concentrations in the Sheboygan nonattainment area over this 16 year time period.

Table 1. Meteorological conditions, occurrence and average ozone for the four high-ozone nodes identified by CART from Sheboygan Kohler Andrae monitoring data

<table>
<tr><th rowspan="2">Conditions</th><th colspan="5">Node</th></tr>
<tr><th>4</th><th>7</th><th>8</th><th>9</th><th>10</th></tr>
<tr><td>Temperature at 925 mb, deg F</td><td>≤63.5</td><td colspan="4">>63.5</td></tr>
<tr><td>Southerly component of 24-hr transport vector, km</td><td>>-138.6</td><td colspan="4" rowspan="2"></td></tr>
<tr><td>Afternoon cloud cover, %</td><td>≤55</td></tr>
<tr><td>Southerly component of average afternoon winds, m/s</td><td>>4.86</td><td colspan="2">≤3.22</td><td colspan="2">>3.22</td></tr>
<tr><td>Southerly component of average daily wind, m/s</td><td></td><td colspan="2">>0.07</td><td colspan="2" rowspan="2"></td></tr>
<tr><td>Deviation of morning 700mb surface from 10-yr mean, m</td><td></td><td>≤19.3</td><td>>19.3</td></tr>
<tr><td>Temperature at 925 mb, deg F</td><td></td><td></td><td></td><td>≤68.4</td><td>>68.4</td></tr>
<tr><td>Average ozone, ppb</td><td>54.5</td><td>52.1</td><td>60.2</td><td>62.7</td><td>74.7</td></tr>
<tr><td>Number of days</td><td>176</td><td>155</td><td>170</td><td>204</td><td>201</td></tr>
</table>

1.2. Additional Ozone-Temperature Correlation Plots

Section 5.2.3 of the main attainment plan document presents and discusses trends in monthly averages of two ozone concentration parameters with four temperature parameters. However, that document only incorporates the four plots with the best correlation coefficients comparing ozone at the Kohler Andrae monitor with temperature at the inland Horicon monitor. Figure 1 shows all of the correlations for these locations. This includes plots of three ozone concentration parameters (average maximum daily 8-hour average ozone (MDA8), maximum MDA8, and days with MDA8 above 75 ppb)[2] versus four temperature parameters[3] (number of ozone season days with temperatures above 80 degrees, cooling degree days relative to 70 degrees, mean afternoon temperature, and mean temperature). Figure 2 shows the correlations in the three ozone concentration parameters with two temperature parameters (cooling degree days relative to 65 degrees and days above 90 degrees) measured at the Milwaukee Airport. These figures show that the trends discussed in the main document are representative of all of the ozone-temperature correlations. Namely, ozone concentrations observed for a given temperature level have consistently decreased over each three-year period. The one regular exception to this trend is the recession years (2008-2010), which often had levels of ozone that were similar to or even lower than the most recent set of years (2014-2016), presumably due to lower emissions resulting from reduced economic activity because of the recession. In all of these plots, 2014-2016 had the lowest or near-lowest amounts of ozone for a given temperature level. This analysis supports the conclusion that when adjusted for meteorology, ozone concentrations have decreased consistently through the most recent years.

[2] One of these ozone parameters is a measure of ozone concentrations over the whole month (average MDA8) and includes data from each day in that month. The other two parameters are measures of maximum ozone days only. These parameters only consider extreme days (the highest-ozone day in a month or days with MDA8 ozone above 70 ppb).

[3] Three of these temperature parameters measure temperature over the whole month (cooling degree days, mean afternoon temperatures and mean temperature) and include data from each day in that month. The other parameter (number of days above 80 degrees) is a measure of just the hottest days in that month.

Figure 1. Trends in monthly averages of three ozone concentration parameters (average MDA8, maximum MDA8, and days with MDA8 above 75 ppb) plotted versus four temperature parameters. Temperature data are for the inland Horicon Monitor and ozone data for the Kohler Andrae monitor.

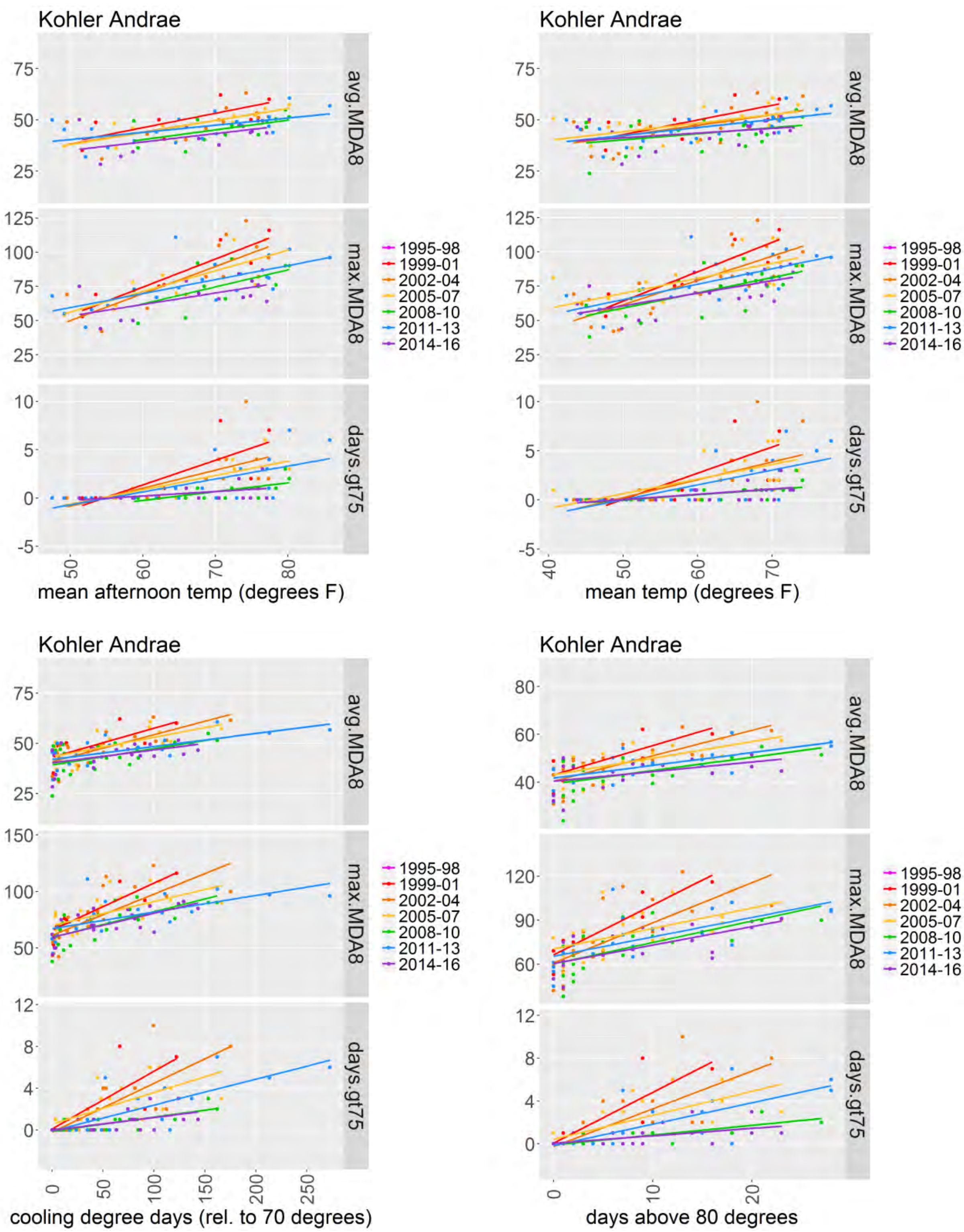
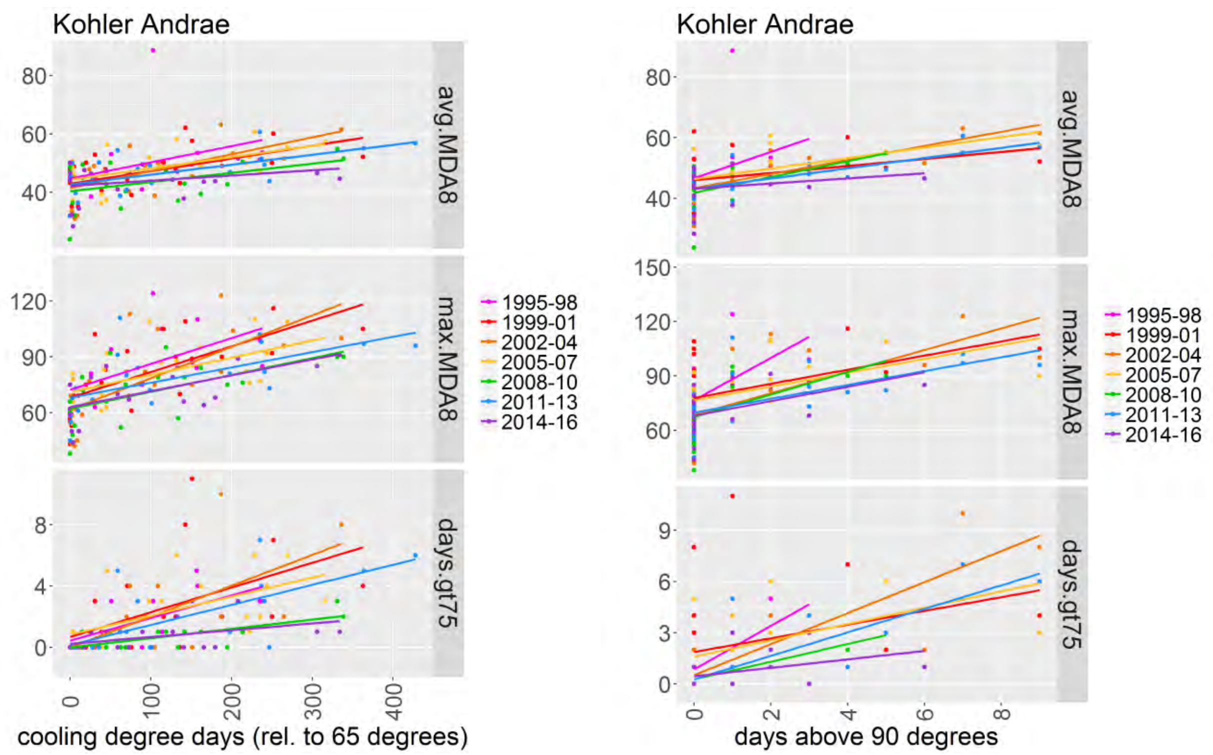


Figure 2. Trends in monthly averages of three ozone concentration parameters (average MDA8, maximum MDA8, and days with MDA8 above 75 ppb) plotted versus two temperature parameters. Temperature data are for the Milwaukee Airport and ozone data for the Kohler Andrae monitor.



2. TRENDS IN NOx CONCENTRATIONS IN WISCONSIN

NOx consists of both nitric oxide (NO) and nitrogen dioxide (NO_2). WDNR measured concentrations of NO, NO_2 and NOx at two sites along Wisconsin's Lake Michigan lakeshore. Monitored concentrations for selected years are shown in Table 2.

Table 2. Concentrations and concentration changes of total NOx at the Milwaukee SER and Manitowoc monitors. Data for 2008 is shown as a midpoint in the record.

Compound	First year monitored	Summer mean			Percent Change		
		First year	2008	2015	First-2008	2008-2015	First-2015
Milwaukee SER							
NO	2000	6.37	2.59	1.77	-59%	-13%	-72%
NO_2	2000	14.29	10.33	7.74	-28%	-18%	-46%
NOx	2000	20.40	12.83	9.44	-37%	-17%	-54%
Manitowoc							
NO	2007	0.08	0.10	0.09	24%	-8%	16%
NO_2	2007	1.90	2.47	1.49	30%	-51%	-22%
NOx	2007	1.95	2.50	1.51	28%	-51%	-23%

3. TRENDS IN VOC CONCENTRATIONS IN WISCONSIN

Concentrations of up to 56 different VOC compounds (listed in Table 3) were measured at Wisconsin monitors. These compounds include both carbonyl (compounds containing carbon-oxygen double bonds) and hydrocarbon (which contain only carbon and hydrogen) VOCs. The hydrocarbons can be further grouped into four classes based on their chemical properties. These compound classes include branched and cyclic hydrocarbons, aromatic hydrocarbons, n-alkanes, and unsaturated hydrocarbons. In addition, isoprene is a hydrocarbon that comes from biogenic (not anthropogenic) sources. These different compound classes often have different origins.

Concentrations of all of the sub-classes of anthropogenic hydrocarbons also decreased during this time period (Figure 3 and Table 3), with the largest decrease from branched and cyclic hydrocarbons (62%) and the smallest decrease from aromatic hydrocarbons (31%). Concentrations of isoprene were variable but did not show any apparent trend during this time period. Figure 5.8 in the main document shows plots for total hydrocarbons and carbonyls.

Figure 3. Trends in sums of compound classes of hydrocarbons. Note that trends for most compound classes are only shown for the Milwaukee SER monitor because the other monitors either did not measure any of these compounds or only measured a few.

Table 3. Concentrations and concentration changes of VOC compounds at Wisconsin monitoring sites. Data for 2008 are shown as a midpoint in the record.

Compound Class & Name	First year monitored	Summer Mean (ppb)			Change (%)		
		First year	2008	2015	First-2008	2008-2015	First-2015
Milwaukee SER DNR							
Carbonyls (mg/m^3)							
Acetaldehyde	2004	1.65	1.83	1.41	11%	-23%	-15%
Acetone	2004	2.45	2.42	2.03	-1%	-16%	-17%
Formaldehyde	2004	2.96	3.43	2.75	16%	-20%	-7%
Total Carbonyls		**7.06**	**7.67**	**6.19**	**9%**	**-19%**	**-12%**
Isoprene (ppb)							
Isoprene	2000	0.09	0.08	0.09	-12%	10%	-3%
Aromatic Hydrocarbons (ppb)							
Benzene	2000	0.37	0.24	0.15	-34%	-40%	-60%
Toluene	2000	0.97	0.52	0.31	-47%	-40%	-68%
o-Xylene	2000	0.14	0.09	0.02	-36%	-78%	-86%
m/*p* Xylene	2000	0.35	0.24	0.11	-33%	-54%	-69%
Ethylbenzene	2000	0.11	0.09	0.02	-23%	-82%	-86%
Styrene	2000	0.04		0.07			71%
1,2,3-Trimethylbenzene	2000	0.08	0.04	0	-46%	-100%	-100%
1,2,4-Trimethylbenzene	2000	0.15	0.09	1.07	-39%	1058%	607%
1,3,5-Trimethylbenzene	2000	0.06	0.04	0	-31%	-90%	-93%
N-Propylbenzene	2000	0.03	0.02	0	-34%	-100%	-100%
Isopropylbenzene	2000	0.01	0.01	0	-50%	-100%	-100%
O-Ethyltoluene	2000	0.04	0.04	0	-5%	-100%	-100%
M-Ethyltoluene	2000	0.09		0.01			-85%
P-Ethyltoluene	2000	0.05	0.03	0	-36%	-100%	-100%
M-Diethylbenzene	2000	0.04		0			-100%
P-Diethylbenzene	2000	0.03		0			-88%
Total Aromatic HCs		**2.56**	**1.44**	**1.76**	**-44%**	**22%**	**-31%**
Normal Alkanes (*n*-Alkanes; ppb)							
Ethane	2000	3.38	2.35	2.25	-30%	-5%	-34%
Propane	2000	1.20	1.12	0.90	-7%	-19%	-25%
n-Butane	2000	0.59	0.51	0.39	-13%	-25%	-34%
n-Pentane	2000	0.47	0.43	0.30	-8%	-29%	-35%
n-Hexane	2000	0.36	0.25	0.10	-30%	-60%	-72%
n-Heptane	2000	0.18	0.09	0.03	-49%	-62%	-81%
n-Octane	2000	0.07	0.04	0	-41%	-100%	-100%
n-Nonane	2000	0.05	0.04	0.02	-12%	-48%	-54%
n-Decane	2000	0.06	0.06	0.01	-7%	-75%	-77%
n-Undecane	2000	0.05		0			-100%
Total *n*-Alkanes		**6.41**	**4.90**	**4.01**	**-24%**	**-18%**	**-37%**

Table 3. (continued)

Compound Class & Name	First year monitored	Summer Mean (ppb) First year	Summer Mean (ppb) 2008	Summer Mean (ppb) 2015	Change (%) First-2008	Change (%) 2008-2015	Change (%) First-2015
Milwaukee SER DNR							
Branched & Cyclic Hydrocarbons (ppb)							
Isobutane	2000	0.36	0.31	0.18	-14%	-41%	-49%
Isopentane	2000	1.01	0.75	0.57	-26%	-25%	-44%
Cyclopentane	2000	0.03	0.04	0	7%	-100%	-100%
Cyclohexane	2000	0.09	0.05	0	-45%	-100%	-100%
2,2-Dimethylbutane	2000	0.03	0.04	0	39%	-100%	-100%
2,3-Dimethylbutane	2000	0.14	0.09	0.03	-34%	-65%	-77%
2-Methylpentane	2000	0.29	0.23	0.31	-22%	33%	4%
3-Methylpentane	2000	0.20	0.16	0.07	-23%	-57%	-67%
Methylcyclopentane	2000	0.19	0.14	0.05	-25%	-65%	-74%
2,3-Dimethylpentane	2000	0.27	0.15	0.04	-45%	-72%	-85%
2,4-Dimethylpentane	2000	0.18	0.09	0.03	-50%	-72%	-86%
2,2,4-Trimethylpentane	2000	0.55	0.30	0.14	-46%	-54%	-75%
2,3,4-Trimethylpentane	2000	0.20	0.09	0.03	-56%	-67%	-85%
2-Methylhexane	2000	0.14	0.09	0.06	-39%	-30%	-57%
3-Methylhexane	2000	0.18	0.14	0.06	-25%	-57%	-68%
Methylcyclohexane	2000	0.11	0.06	0.01	-43%	-84%	-91%
2-Methylheptane	2000	0.05	0.04	0	-11%	-100%	-100%
3-Methylheptane	2000	0.06	0.04	0	-36%	-100%	-100%
Total B & C HCs		**4.08**	**2.80**	**1.57**	**-31%**	**-44%**	**-62%**
Unsaturated Hydrocarbons (ppb)							
Ethylene	2000	1.75	1.06	0.84	-39%	-21%	-52%
Acetylene	2000	0.68		0.54			-21%
Propylene	2000	0.55	0.36	0.16	-35%	-55%	-71%
Cis-2-Butene	2000	0.04		0			-100%
Trans-2-Butene	2000	0.10		0			-100%
1-Pentene	2000	0.02	0.04	0	98%	-100%	-100%
Cis-2-Pentene	2000	0.01	0.02	0	89%	-100%	-100%
Trans-2-Pentene	2000	0.03	0.04	0.01	64%	-79%	-65%
Total Unsaturated HCs		**3.18**	**1.52**	**1.54**	**-52%**	**1%**	**-51%**
Totals							
Total Non-Methane Organic Carbon (NMOC; ppb C)	2000	95.30	95.77	63.10	0%	-34%	-34%
Total of 53 Hydrocarbons (listed above; ppb)	**2000**	**16.32**	**10.74**	**8.97**	**-34%**	**-16%**	**-45%**

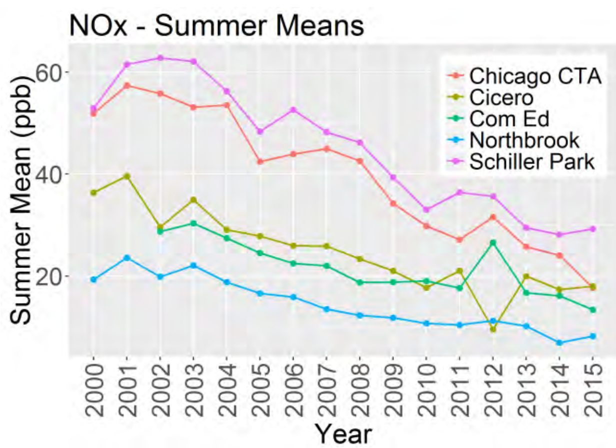
Table 3. (continued)

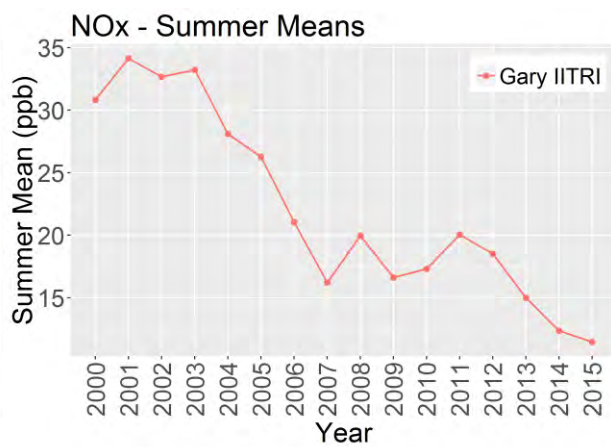
Compound Class & Name	First year monitored	Summer Mean (ppb) First year	2008	2015	Change (%) First-2008	2008-2015	First-2015
Milwaukee Health Center							
Carbonyls (mg/m^3)							
Acetaldehyde	2000	2.06	2.18	1.55	6%	-29%	-25%
Acetone	2000	2.20	2.48	1.80	13%	-27%	-18%
Formaldehyde	2000	2.87	4.90	2.70	71%	-45%	-6%
Total Carbonyls		**7.13**	**9.56**	**6.05**	**34%**	**-37%**	**-15%**
Aromatic Hydrocarbons (ppb)							
Benzene	2000	0.52	0.37	0.21	-29%	-43%	-60%
Toluene	2000	1.48	0.87	0.42	-41%	-52%	-72%
o-Xylene	2000	0.24	0.17	0.12	-27%	-28%	-48%
m/*p* Xylene	2000	0.68	0.47	0.37	-31%	-21%	-46%
Ethylbenzene	2000	0.18	0.21	0.05	19%	-78%	-74%
Styrene	2000	0.06	0.06	0	3%	-100%	-100%
Total Aromatic HCs		**3.14**	**2.15**	**1.16**	**-32%**	**-46%**	**-63%**
Unsaturated Hydrocarbons (ppb)							
Propylene	2000	0.80	0.52	0.37	-35%	-28%	-54%
Horicon/Mayville							
Carbonyls (mg/m^3)							
Acetaldehyde	2004	0.99	1.52	0.91	54%	-40%	-8%
Acetone	2004	1.70	2.44	1.67	43%	-31%	-2%
Formaldehyde	2004	2.01	3.40	2.03	69%	-40%	1%
Total Carbonyls		**4.70**	**7.36**	**4.62**	**56%**	**-37%**	**-2%**
Aromatic Hydrocarbons (ppb)							
Benzene	2004	0.04	0.02	0.07	-50%	237%	68%
Toluene	2004	0.08	0.16	0.08	106%	-49%	5%
o-Xylene	2004	0.01	0.00	0.01	-50%	22%	-39%
m/*p* Xylene	2004	0.05	0.01	0.01	-87%	29%	-83%
Ethylbenzene	2004	0.01	0.00	0.01	-73%	43%	-61%
Styrene	2004	0	0.00	0.15			
Total Aromatic HCs		**0.20**	**0.20**	**0.33**	**1%**	**64%**	**66%**
Unsaturated Hydrocarbons (ppb)							
Propylene	2004	0.00	0.06				

4. TRENDS IN NOx IN THE CHICAGO AREA (ILLINOIS AND INDIANA)

Figure 4 shows the monitored NOx concentrations[4] in the upwind Illinois and Indiana portions of the Chicago area. VOC trends in these areas are also shown and discussed in the main document.

Figure 4. Trends in mean summer NOx concentrations for monitors in the (left) Illinois and (right) Indiana portions of the Chicago nonattainment area.





[4] NOx and VOC data were downloaded from EPA's Air Quality Systems database.

APPENDIX 11

EPA Approval of Wisconsin's Emission Statement Program

Federal Register / Vol. 58, No. 232 / Monday, December 6, 1993 / Rules and Regulations 64155

37 CFR Parts 1, 5 and 10

[Docket No. 920779–3226]

RIN 0651–AA34

Miscellaneous Changes in Patent Practice; Correction

AGENCY: Patent and Trademark Office, Commerce.

ACTION: Final rule; correction.

SUMMARY: The Patent and Trademark Office (Office) is correcting errors in the final rule which appeared in the **Federal Register** on Friday, October 22, 1993 (58 FR 54504). The regulations related to miscellaneous changes in patent practice contained in parts 1, 5 and 10.

EFFECTIVE DATE: January 3, 1994.

FOR FURTHER INFORMATION CONTACT: Abraham Hershkovitz by telephone at (703) 305–9282, or by facsimile transmission at (703) 305–8825, or by mail marked to his attention and addressed to: Office of the Assistant Commissioner for Patents, Box DAC, Washington, DC 20231.

SUPPLEMENTARY INFORMATION:

Background

The final regulations that are the subject of these corrections, make miscellaneous changes to the rules of practice in patent cases.

Need for Correction

As published, the final regulations contain errors, including the effective date, which may be misleading and are in need of clarification.

Correction of Publication

Accordingly, the publication on October 22, 1993, of the final regulations (Docket No. 920779–3226), which were the subject of FR Doc. 93–25865, is corrected as follows:

1. On page 54504, in the second column, the Effective Date: should read "January 3, 1994."

2. On page 54505, first column, the second to last line of the first full paragraph, the "§ 029" should be removed.

Dated: November 29, 1993.

Bruce A. Lehman,

Assistant Secretary of Commerce and Commissioner of Patents and Trademarks.

[FR Doc. 93–29599 Filed 12–3–93; 8:45 am]

BILLING CODE 3510–16–M

ENVIRONMENTAL PROTECTION AGENCY

40 CFR Part 52

[WI38–01–6031; FRL–4809–5]

Approval and Promulgation of Wisconsin Implementation Plan; Emission Statements

AGENCY: Environmental Protection Agency (EPA).

ACTION: Final rule.

SUMMARY: The U.S. EPA is approving a revision to Wisconsin's State Implementation Plan (SIP) submitted by the State of Wisconsin to implement an emission statement program for stationary sources throughout the State. The implementation plan was submitted by the State to satisfy the Federal requirements for an emission statement program in ozone nonattainment areas.

EFFECTIVE DATE: This action will be effective February 4, 1994, unless notice is received on or before January 5, 1994, that someone wishes to submit adverse comments. If the effective date is delayed, timely notice will be published in the **Federal Register**.

ADDRESSES: Written comments should be sent to: Carlton T. Nash, Chief, Regulation Development Section, Air Toxics and Radiation Branch (AT–18J), U.S. Environmental Protection Agency, 77 West Jackson Boulevard, Chicago, Illinois 60604.

Copies of the SIP revision and U.S. EPA's analysis are available for inspection at the U.S. Environmental Protection Agency, Region 5, Air and Radiation Division, 77 West Jackson Boulevard, Chicago, Illinois 60604. (It is recommended that you telephone Megan Beardsley at (312) 886–0669 before visiting the Region 5 Office.)

A copy of this Wisconsin section 182 SIP revision is available for inspection from Jerry Kurtzweg (ANR–443), U.S. Environmental Protection Agency, 401 M Street SW., Washington, DC 20460.

FOR FURTHER INFORMATION CONTACT: Megan Beardsley, Air Toxics and Radiation Branch, Regulation Development Section (AT–18J), U.S. Environmental Protection Agency, Region 5, Chicago, Illinois 60604, (312) 353–6680.

SUPPLEMENTARY INFORMATION:

I. Background

The SIP requirements for ozone nonattainment areas are set out in subparts I and II of part D of title I of the Clean Air Act, as amended by the Clean Air Act Amendments of 1990 ("the Act").

Section 182 of the Act sets out a graduated control program for ozone nonattainment areas. Paragraph 182(a) sets out requirements applicable in marginal nonattainment areas, which are also made applicable in paragraphs (b), (c), (d), and (e) to all other ozone nonattainment areas.

Paragraph 182(a)(3) requires that States implement rules that require stationary sources to submit to the State annual emission statements showing actual emissions of volatile organic compounds (VOC) and nitrogen oxides (NO_x). These rules were to be submitted as a revision to the SIP by November 15, 1992. When Wisconsin failed to submit complete rules by this deadline, U.S. EPA began a sanctions process against the State. On July 2, 1993, Wisconsin submitted the current emission statement SIP revision. On August 4, 1993, U.S. EPA sent Wisconsin a letter notifying the State that this submittal was complete and that the completeness finding ended the sanctions process for the emission statement SIP revision.

II. Evaluation of State Submission

A. Procedural Background

The Act requires States to observe certain procedural requirements in developing its SIP, of which the emission statement program will become a part. Section 110(a)(2) of the Act provides that each implementation plan submitted by a State must be adopted after reasonable notice and public hearing.[1] Section 110(l) similarly provides that each revision to an implementation plan submitted by a State under the Act must have been adopted by such State after reasonable notice and public hearing.

The State of Wisconsin held public hearings on December 8, 10 and 11, 1992, to solicit public comment on the emission statement rule, "Air Contaminant Emission Inventory Reporting Requirements," chapter NR 438 of the Wisconsin Administrative Code. Following the public hearing, the rule was adopted by the State and became effective June 1, 1993. The rule was submitted to U.S. EPA on July 2, 1993, as a proposed revision to the SIP.

The proposed SIP revision was reviewed by the U.S. EPA to determine completeness shortly after its submittal, in accordance with the completeness the criteria set out at 40 CFR part 51, appendix V (1991), as amended by 57 FR 42216 (August 26, 1991). The submittal was found to be complete, and a letter indicating the completeness of

[1] Also, section 172(c)(7) of the Act requires that plan provisions for nonattainment areas meet the applicable provisions of section 110(a)(2).

the submittal was sent to the governor's delegate on August 4, 1993.

B. Components of the Emission Statement Program

The U.S EPA has published a "General Preamble" describing the U.S. EPA's preliminary views on how the U.S. EPA intends to review SIP's and SIP revisions submitted under title I of the Act (see 57 FR 13498 (April 16, 1992) ("SIP: General Preamble for the Implementation of Title I of the Clean Air Act Amendments of 1990"), 57 FR 18070 (April 28, 1992) ("Appendices to the General Preamble"), and 57 FR 55620 (November 25, 1992) ("SIP: NO_x Supplement to the General Preamble")).

The U.S. EPA has also issued draft "Guidance on the Implementation of an Emission Statement Program" (July 1992). It should be noted that this guidance has not been finalized,[1] but does provide the best available guidance on the content and use of emission statements. Further revisions to this draft guidance were not available prior to final rulemaking on the Wisconsin SIP revision. Therefore, it is appropriate to use the July 1992 draft guidance in evaluating Wisconsin's emission statement submittal.

The draft guidance contains the following criteria for evaluating State emission statement programs.

1. Applicability

The State program must include provisions covering applicability of the regulations. The State may exempt individual sources emitting less than 25 tons per year of actual NO_x or VOC if the State provides an inventory of emissions from such class or category of sources, based on the use of emission factors established by the Administrator or other methods acceptable to the Administrator. However, if either NO_x or VOC is emitted at a rate equal to or greater than 25 tons per year, the source shall not be exempt.

Wisconsin's NR 438 is applicable to any person owning or operating a facility that emits an air contaminant is quantities above the minima listed in NR 438. In particular, sources must report annual, actual emissions of NO_x exceeding 5 tons per year (tpy) and annual, actual emissions of VOC exceeding 3 tpy.

2. Definitions

The State program must include definitions for key terms used in the regulations. Wisconsin's NR 438 includes specific definitions for "facility," and "source classification code." Other relevant definitions are established in NR 400, which is applicable to terms used in NR 400 to 499.

3. Compliance Schedule

The State program must include a compliance schedule for sources covered by the regulations. In particular, the State shall require sources emitting NO_x or VOC in ozone nonattainment areas to submit emission statement data before November 15, 1993, and annually thereafter. The U.S. EPA, however, strongly encourages a submittal date of April 15.

Wisconsin's regulation requires that sources report emissions by March 1 of each year. Beginning June 1993, sources must certify their emissions by June 30 of each year.

4. Source Information

When requesting an emission statement from sources of NO_x or VOC, the State shall require the following information from the source:

a. Source identification information;
b. Operating schedule;
c. Emissions information;
d. Control equipment information;
e. Process data; and
f. Certification of data accuracy.

Wisconsin fulfills the criteria for source information. In particular:

a. Source Identification. Wisconsin requires that sources reporting emissions provide their name, location, mailing address, and Standard Industrial Classification code, as well as additional information not addressed in the Federal guidance.

b. Operating Schedule. Wisconsin requires that sources provide their normal operating schedule in hours per day, days per week, days per year and percentage production per quarter.

c. Emissions Information. Wisconsin requires that facilities with emissions exceeding 5 tons per year of NO_x or 3 tons per year of VOC submit an emission inventory report of annual, actual emissions or supply sufficient information for Wisconsin Department of Natural Resources (WDNR) to calculate these emissions. Wisconsin also requires sources to report annual, actual emissions for several hundred other pollutants if emissions of these pollutants exceed the quantities listed in NR 438.

d. Control Equipment. Wisconsin requires that sources report control equipment and control equipment efficiency for the following types of emissions: Fugitive emissions, emissions from fuel combustion units, emissions from manufacturing processes, and emissions from incinerator equipment.

e. Process Data. Wisconsin requires process data for fuel combustion equipment, manufacturing processes and incineration equipment. The WDNR will compute the peak ozone season daily process rate based on the reported percentage production per quarter for the third quarter (July, August and September).

f. Certification. Wisconsin requires that, by June 30 of each year, the owner or operator of a facility that emits VOC or NO_x in a nonattainment area or is required to obtain an air pollutant control permit shall send written certification to WDNR that the WDNR's summary of the facility's emissions is correct.

Wisconsin has developed a series of forms for the emission reporting and certification described above.

5. State Reporting

In addition to the required SIP revision, the U.S. EPA guidance requests that the State enter the source data elements into the Aerometric Information Retrieval System (AIRS) and provide U.S. EPA with quarterly emission statement status reports beginning July 1, 1993.

Wisconsin has submitted its first quarterly report and has agreed to continue submitting these reports. Wisconsin also has agreed to continue working to load its emission inventory information into the AIRS database.

C. Enforceability Issues

All measures and other elements in the SIP must be enforceable by the State and the U.S. EPA. Wisconsin's emission statement rule includes a schedule for source submittal of emission statements and details the data to be included in the statements. Under NR 494 of the Wisconsin Administrative Code, "Enforcement and Penalties for Violation of Air Control Provisions," any person who violates NR 438 is subject to the penalties provided under § 144.426 of the Wisconsin Statute.

D. Conclusion

U.S. EPA has reviewed Wisconsin's emission requirements set forward in the Clean Air Act and in the guidance discussed above. Hence, the U.S. EPA approves the emission statement SIP revision submitted to the U.S. EPA by Wisconsin on July 2, 1993.

Because the U.S. EPA considers this action noncontroversial and routine, we are approving it today without prior proposal. The action will become effective on February 4, 1994. However,

[1] The EPA is presently conducting a rulemaking process to modify title 40 of the CFR to reflect the requirements of the emission statement program.

if we receive notice by January 5, 1994, that someone wishes to submit adverse comments, then U.S. EPA will publish: (1) A notice that withdraws the action, and (2) a notice that begins a new rulemaking by proposing the action and establishing a comment period.

Nothing in this action should be construed as permitting, allowing or establishing a precedent for any future request for revision to any SIP. The U.S. EPA shall consider each request for revision to the SIP in light of specific technical, economic, and environmental factors and in relation to relevant statutory and regulatory requirements.

IV. Administrative Requirements

A. Executive Order 12866

This action has been classified as a Table 2 action by the Regional Administrator under the procedures published in the **Federal Register** on January 19, 1989 (54 FR 2214–2225). On January 6, 1989, the Office of Management and Budget (OMB) waived Table 2 and 3 SIP revisions (54 FR 2222) from the requirements of section 3 of Executive Order 12291 for a period of 2 years. The U.S. EPA has submitted a request for a permanent waiver for Table 2 and Table 3 SIP revisions. The OMB has agreed to continue the temporary waiver until such time as it rules on the U.S. EPA's request. This request is still applicable under Executive Order 12866.

B. Regulatory Flexibility

Under the Regulatory Flexibility Act, 5 U.S.C. 600 *et seq.*, U.S. EPA must prepare a regulatory flexibility analysis assessing the impact of any proposed or final rule on small entities (5 U.S.C. 603 and 604). Alternatively, U.S. EPA may certify that the rule will not have a significant impact on a substantial number of small entities. Small entities include small businesses, small not-for-profit enterprises, and government entities with jurisdiction over populations of less than 50,000.

Approvals of SIP's under section 110 and subchapter I, part D, of the Act do not create any new requirements, but simply approve requirements that the State is already imposing. Therefore, because the Federal SIP approval does not impose any new requirements, I certify that it does not have a significant impact on any small entities affected. Moreover, due to the nature of the Federal-State relationship under the Act, preparation of the regulatory flexibility analysis would constitute Federal inquiry into the economic reasonableness of the State action. The Act forbids U.S. EPA to base its actions concerning SIPs on such grounds (*Union Electric Co.* v. *U.S. E.P.A.*, 427 U.S. 246, 256–66 (1976)).

C. Judicial Review

Under section 307(b)(1) of the Act, petitions for judicial review of this action must be filed in the United States Court of Appeals for the appropriate circuit by February 4, 1994. Filing a petition for reconsideration by the Administrator of this final rule does not affect the finality of this rule for the purposes of judicial review nor does it extend the time within which a petition for judicial review may be filed, and shall not postpone the effectiveness of such rule or action. This action may not be challenged later in proceedings to enforce its requirements. (See section 307(b)(2).)

List of Subjects in 40 CFR Part 52

Environmental protection, Emission statements, Hydrocarbons, Incorporation by reference, Intergovernmental relations, Nitrogen dioxide, Oxides of nitrogen, Reporting and recordkeeping requirements, Volatile organic compounds.

Dated: November 17, 1993.

Dale S. Bryson,

Acting Regional Administrator.

For the reasons stated in the preamble, part 52, chapter I, title 40 of the Code of Federal Regulations is amended as follows:

PART 52—[AMENDED]

1. The authority citation for part 52 continues to read as follows:

Authority: 42 U.S.C. 7401–7671q.

Subpart YY—Wisconsin

2. Section 52.2570 is amended by adding paragraph (c)(70) to read as follows:

§ 52.2570 Identification of plan.

* * * * *

(c) * * *

(70) On July 2, 1993, the State of Wisconsin submitted a requested revision to the Wisconsin State Implementation Plan (SIP) intended to satisfy the requirements of section 182 (a)(3)(B) of the Clean Air Act as amended in 1990. Included were State rules establishing procedures for stationary sources throughout the state to report annual emissions of volatile organic compounds (VOC) and oxides of nitrogen (NO_x) as well as other pollutants.

(i) *Incorporation by reference.* Wisconsin Administrative Code, Chapter NR 438, Air Contaminant Emission Reporting Requirements, published in the Wisconsin Register, May 1993, effective June 1, 1993.

[FR Doc. 93–29721 Filed 12–3–93; 8:45 am]

BILLING CODE 6560–50–P

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40 CFR Part 52

[CA 15–1–6084; FRL–4801–4]

Approval and Promulgation of Implementation Plans California State Implementation Plan Revision Ventura County Air Pollution Control District

AGENCY: Environmental Protection Agency (EPA).

ACTION: Final rulemaking.

SUMMARY: EPA is finalizing the approval of a revision to the California State Implementation Plan (SIP) proposed in the **Federal Register** on January 17, 1991. The revision concerns Ventura County Air Pollution Control District (VCAPCD) Rule 71.2, Storage of Reactive Organic Compound Liquids. This approval action will incorporate the rule into the federally approved SIP. The intended effect of approving this rule is to regulate emissions of volatile organic compounds (VOCs) in accordance with the requirements of the Clean Air Act, as amended in 1990 (CAA or the Act). The revised rule controls VOC emissions from the storage of reactive organic compound (ROC) liquids. Thus, EPA is finalizing the approval of this revision into the California SIP under provisions of the CAA regarding EPA action on SIP submittals, SIPs for national primary and secondary ambient air quality standards and plan requirements for nonattainment areas.

EFFECTIVE DATE: This action is effective on January 5, 1994.

ADDRESSES: Copies of the rule revisions and EPA's evaluation report for each rule are available for public inspection at EPA's Region IX office during normal business hours. Copies of the submitted rule revisions are available for inspection at the following locations:

Rulemaking Section II (A–5–3), Air and Toxics Division, U.S. Environmental Protection Agency, Region IX, 75 Hawthorne Street, San Francisco, CA 94105.

Environmental Protection Agency, Jerry Kurtzweg ANR 443, 401 "M" Street, SW., Washington, DC 20460.

California Air Resources Board, Stationary Source Division, Rule Evaluation Section, 2020 "L" Street, Sacramento, CA 95814.

Ventura County Air Pollution Control District, 702 County Square Drive, Ventura, California 93003.

APPENDIX 12

Response to Public Comments

The Wisconsin Department of Natural Resources (WDNR) solicited public comment on a draft version of the Attainment Plan for the Sheboygan County, Wisconsin 2008 8-Hour Ozone Nonattainment Area, to be submitted to the U.S. Environmental Protection Agency (EPA). The comment period was noticed on June 23, 2017 and closed July 26, 2017, and a public hearing was held in Sheboygan on July 24, 2017.

WDNR received one written public comment from the Sheboygan County Chamber of Commerce/Sheboygan County Nonattainment Task Force ("Sheboygan Chamber"). Two comments were made at the public hearing by representatives of Plymouth Foam, Inc. and Congressman Glenn Grothman's office. No other parties submitted comments. This document summarizes the comments received, WDNR's response to the comments, and modifications made to the document in response to these comments. WDNR also made several minor clarifications and corrections in the final document.

<u>General Comments</u>

Comment: The Sheboygan Chamber requested that DNR more thoroughly describe the seriousness of the regulatory issue facing Sheboygan County.

Response: A thorough description of the regulatory burden faced by Sheboygan County is beyond the scope of this attainment plan, the goal of which is to fulfill the state's Clean Air Act State Implementation Plan requirements. However, the plan describes the inability of Sheboygan County to reduce the ozone values measured at the Kohler-Andrae monitor in several places; in addition, DNR has described the regulatory burden facing Sheboygan County in multiple other communications with EPA, most recently in submittals made to the EPA relative to 2015 ozone standard initial area designations. No changes were made to the document in response to this comment.

<u>Use of the Sheboygan Haven and Kohler Andrae monitors</u>

Comment: The Sheboygan Chamber requested that WDNR base attainment projections primarily on data from the Haven ozone monitor. The representative from Plymouth Foam made a similar comment.

Response: The implementation rule for the 2008 ozone NAAQS states that "The attainment test is applied at each monitor location within or near a designated nonattainment area." (80 FR 12270) It is not possible to apply the attainment test to the Sheboygan Haven monitor because it was not operating during the years 2009 through 2013, and the test is based on projections from the weighted design value for those years. WDNR was therefore required to make attainment projections for the Kohler Andrae monitor and unable to make them for the Sheboygan Haven monitor. No changes were made to the document in response to this comment.

Comment: The Sheboygan Chamber requested that WDNR note that the Kohler Andrae monitor is a "regional transport" monitor whereas the Haven monitor is placed to demonstrate "population exposure".
Response: A sentence was added on page 36 of the attainment plan to address this comment.

Comment: The Sheboygan Chamber requested that WDNR place more emphasis on comparing the data from the Kohler Andrae and Haven monitors and add wind direction data to provide further support for claims of transport.

Response: WDNR moved text in Section 5 that compared monitoring data at the two monitors from a footnote into the main body text to give this issue more emphasis. In addition, Figure 5.1 and Table 5.1 compare fourth-high maximum daily 8-hour average ozone concentrations and design values for the two sites; these clearly show the concentration differences between the two monitors. In addition, Figure 5.11 shows wind direction data for hours with high ozone concentrations, and Section 5.4.1 discusses how this wind direction data supports the important role of transport of ozone to this site. No further changes were made to the document in response to this comment.

Comment: The Sheboygan Chamber commented that WDNR should submit a clean data finding and redesignation request based on data from the Haven monitor.

Response: Clean data findings and redesignation requests are beyond the scope of the attainment plan that was out for public comment. However, WDNR is concurrently submitting a supplement to its 2013 request for EPA to reconsider the boundaries of the Sheboygan County nonattainment area for the 2008 ozone NAAQS. If granted by EPA, such a reconsideration would remove most of Sheboygan County from the nonattainment area based on clean data monitored at the Sheboygan Haven monitor.

Comment: The representative from Plymouth Foam stated that this is a transport issue and that EPA in 1996 put more emphasis on the role of transport to the Kohler Andrae monitor. He also asked when we could “deregulate” the Kohler Andrae monitor to show that air quality at that monitor is not affected by local emissions.

Response: The issue of discontinuing air quality monitors is beyond the scope of the attainment plan. Section 5.4.1 addresses the overwhelming role of transport at this monitor, and Section 5.6 demonstrates that ozone levels at this monitor are not affected by local emissions. No changes were made to the document in response to this comment.

<u>The Role of Transport</u>

Comment: The Sheboygan Chamber asked WDNR to more clearly explain what little impact local regulations can have on ozone concentrations at the Kohler Andrae monitor.

Response: WDNR devoted three pages of the attainment plan to photochemical modeling that demonstrated that completely eliminating all anthropogenic emissions from Sheboygan County would not reduce ozone design values at the Kohler Andrae monitor (Section 5.6). The attainment plan furthermore highlights this conclusion on pages 2, 61-62, and 71. The document adequately addresses this comment and no changes were made to the document in response to this comment.

Comment: The Sheboygan Chamber requested that WDNR work with LADCO to do source apportionment modeling to estimate the contribution solely from Sheboygan County emission sources to the Kohler Andrae monitor.

Response: The photochemical modeling mentioned in the previous response already demonstrates that Sheboygan County does not contribute significantly to ozone levels at the Kohler Andrae monitor, which makes additional contribution modeling unnecessary. No changes were made to the document in response to this comment.

Comment: The representative from Congressman Glenn Grothman's office stated that this is a transport issue, and that EPA has acknowledged that. He also talked about the work the congressman's office is doing to raise this issue at the federal level. He did not request any revisions to the attainment plan.

Response: No response is needed.