INDIANA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
We Protect Hoosiers and Our Environment.

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December 12, 2013

Ms. Susan Hedman
Regional Administrator
U.S. Environmental Protection Agency
Region 5
77 West Jackson Boulevard
Chicago, IL 60604-3950

Dear Ms. Hedman:

Re: Preliminary Recommendations Concerning Air Quality Designations for the Annual Particulate Matter National Ambient Air Quality Standard

This letter is in response to the United States Environmental Protection Agency's (U.S. EPA's) April 16, 2013, guidance memorandum concerning air quality designations for the annual particulate matter ($PM_{2.5}$) National Ambient Air Quality Standard (NAAQS). The guidance indicates U.S. EPA's intention to propose designations by August 14, 2014 and finalize them by December 12, 2014. The guidance also requests that states submit their recommendations for area designations by no later than December 13, 2013.

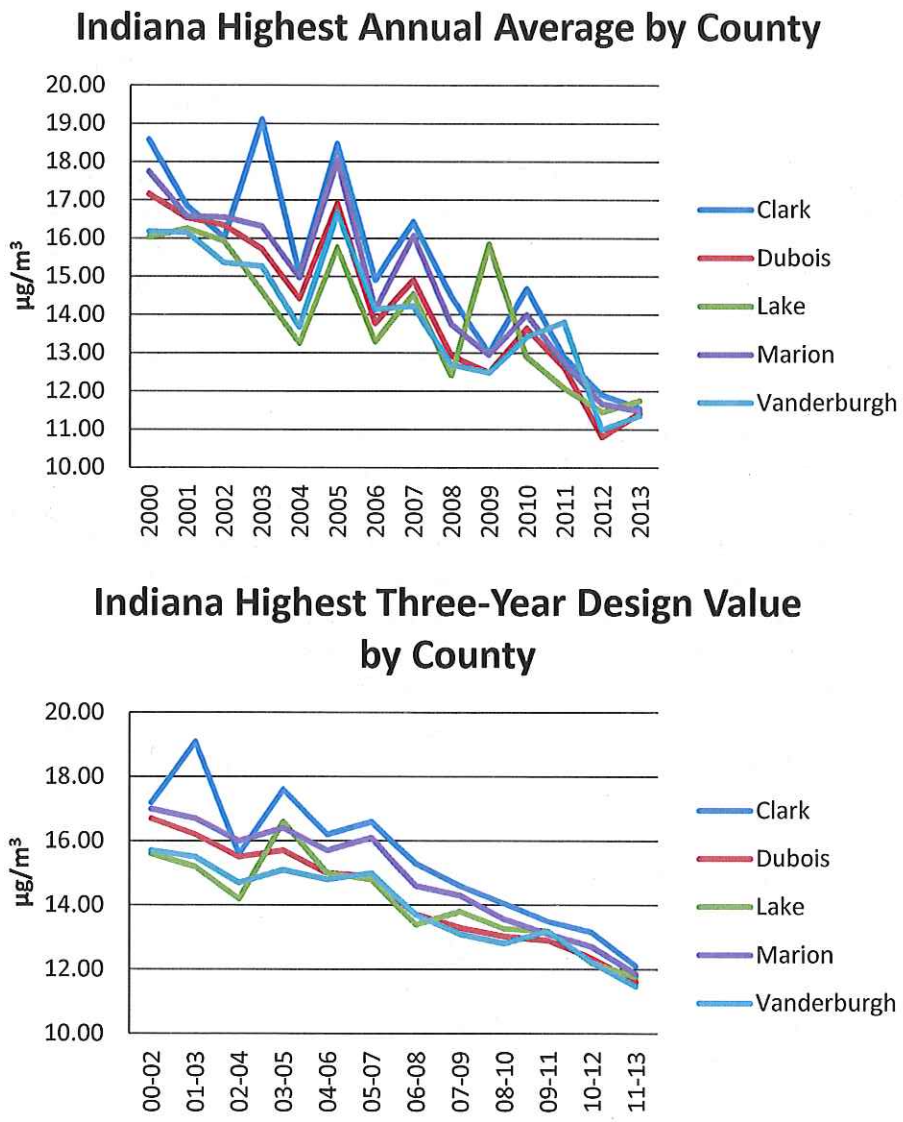
Enclosed you will find quality-assured monitoring data from 2010 through 2012 for Indiana's $PM_{2.5}$ monitoring network, as well as preliminary data through the first three quarters of 2013. Six monitors in five counties within Indiana have $PM_{2.5}$ monitored concentrations above the new annual standard for the period ending 2012. However, $PM_{2.5}$ monitored concentrations have decreased over time and many of the counties with monitored values above the standard are likely to attain prior to the effective date of final designations. Indiana expects monitoring data to decline even further over the next few years with the implementation of federal regulations such as the utility Mercury and Air Toxics Standards (MATS). Because of this, Indiana strongly encourages U.S. EPA to take 2013 and 2014 data into consideration when issuing preliminary and final designations.

The following enclosures are included with this letter:

- Enclosure 1 2010-2012 & 2011-2013 Particulate Matter ($PM_{2.5}$) Monitoring Data for Indiana's Network
- Enclosure 2 Indiana's Preliminary Designation Recommendations
- Enclosure 3 Indiana's Preliminary Designation Recommendations for the 2012 Annual $PM_{2.5}$ Standard
- Enclosure 4 Indiana's Assessment of the Particulate Matter ($PM_{2.5}$) Standard for Nonattainment Designation

Figure 1 illustrates the downward trend in monitored $PM_{2.5}$ concentrations for the five counties that were yet to reach attainment at the close of 2012. Once the $PM_{2.5}$ monitoring data through September 2013 is quality assured and included in the air quality assessment, only one of the five counties (Clark County) with monitored values above the standard at the end of 2012 is likely to remain above the new standard at the close of 2013. The controlling monitor in Clark County will likely be just 0.1 $\mu g/m^3$ above the new standard. However, it is important to note that the three-year design values for that county have been declining by an average of 0.6 $\mu g/m^3$ per year over the past five years. Therefore, IDEM fully expects measured air quality in Clark County to meet the 2012 annual standard before final designations become effective under U.S. EPA's current schedule.

Figure 1: Indiana Highest Annual Average & Three-Year Design Value by County



Based on IDEM's air quality assessment and future year forecast, IDEM recommends all of the monitored counties in Indiana be designated as attainment. Specifically, IDEM recommends that Allen, Clark, Delaware, Dubois, Elkhart, Floyd, Greene, Henry, LaPorte, Lake, Marion, Monroe, Porter, St. Joseph, Spencer, Tippecanoe, Vanderburgh, Vigo, and Whitley counties all be designated as attainment, and all other counties within Indiana be designated as unclassifiable. This recommendation is based on quality assured monitoring data through 2012, preliminary and projected monitoring data for 2013, and a probability forecast for 2014.

The above recommendations are based on the best available information as of the date of this letter, including historical trend information, and how these trends are likely to influence future data. Indiana reserves the right to supplement and/or revise the recommendations contained herein as additional monitoring and technical information become available. Thank you for this opportunity to provide recommendations on this important matter. If you have any questions, please feel free to contact Keith Baugues, Assistant Commissioner, Office of Air Quality, at (317) 232-8222 or by email at kbaugues@idem.in.gov.

Sincerely,

Thomas W. Easterly
Commissioner

TWE/kb

Enclosures:

1. 2010-2012 & 2011-2013 $PM_{2.5}$ Monitoring Data for Indiana's Network
2. Indiana's Preliminary Designation Recommendations
3. Indiana's Preliminary Designation Recommendations for the 2012 Annual $PM_{2.5}$ Standard
4. Indiana's Assessment of the 2012 Annual $PM_{2.5}$ Standard: Technical Support Document

cc: Doug Aburano, U.S. EPA Region 5 (w/ enclosures)
Steve Rosenthal, U.S. EPA Region 5 (no enclosures)
Chris Panos, U.S. EPA Region 5 (no enclosures)
Keith Baugues, IDEM (no enclosures)
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Enclosure 1

2010-2012 & 2011-2013 $PM_{2.5}$ Monitoring Data for Indiana's Network

County	City	Site #	Site Name	2010-2012 Design Value ($\mu g/m^3$)	2011-2013 Design Value ($\mu g/m^3$)
Allen	Fort Wayne	180030004	Fort Wayne-Beacon St.	10.7	10.0
Clark	Jeffersonville	180190006	Jeffersonville-Walnut St.	**13.2**	**12.1****
Clark	Charlestown	180190008	Charlestown State Park	11.0	10.2
Delaware	Muncie	180350006	Muncie-Central HS	11.3	10.3
Dubois	Jasper	180372001	Jasper-Post Office	**12.4**	11.6
Elkhart	Elkhart	180390008	Elkhart-Prarie St.	11.2	10.5
Floyd	New Albany	180431004	New Albany	11.8	10.8
Henry	Mechanicsburg	180650003	Mechanicsburg	10.5	9.8
Lake	East Chicago	180890006	East Chicago-Franklin Sch	11.5	10.8
Lake	Gary	180890031	Gary-Madison St.	**12.2**	11.8
Lake	Hammond	180892004	Hammond-Purdue	11.4	10.9
Lake	Hammond	180892010	Hammond-Clark HS*	11.0	
LaPorte	Michigan City	180910011	Michigan City-Marsh Elem.	10.1	9.7
Marion	Indianapolis	180970078	Washington Park	11.8	11.2
Marion	Indianapolis	180970081	W. 18th St.	**12.7**	11.9
Marion	Indianapolis	180970083	E. Michigan St.	**12.6**	11.6
Monroe	Bloomington	181050003	Bloomington	10.4	10.0
Porter	Ogden Dunes	181270024	Ogden Dunes	10.7	10.1
St. Joseph	South Bend	181410015	South Bend-Shields Dr.	10.6	10.1
Spencer	Dale	181470009	Dale	12.0	11.2
Tippecanoe	Lafayette	181570008	Lafayette-Greenbush St.	10.7	10.1
Vanderburgh	Evansville	181630021	Evansville-Buena Vista	11.8	11.3
Vanderburgh	Evansville	181630016	Evansville-U of E	**12.2**	11.5
Vigo	Terre Haute	181670018	Terre Haute-Lafayette Ave.	11.9	11.2
Whitley	Larwill	181830003	Larwill		9.7***

Red represents monitors with a 2010-2012 or 2011-2013 design value above the annual standard of 12.0$\mu g/m^3$, effective March 18, 2013.

**The Hammond-Clark HS monitor was discontinued on December 29, 2012.*

***IDEM projects this value to be below the standard by close of 2014.*

****The Larwill monitor will have three complete years of data comparable to the standard at the close of 2013.*

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Enclosure 2

Indiana's Preliminary Designation Recommendations*
December 2013

County	Recommendation
Adams	Unclassifiable
Allen	Attainment
Bartholomew	Unclassifiable
Benton	Unclassifiable
Blackford	Unclassifiable
Boone	Unclassifiable
Brown	Unclassifiable
Carroll	Unclassifiable
Cass	Unclassifiable
Clark	Attainment
Clay	Unclassifiable
Clinton	Unclassifiable
Crawford	Unclassifiable
Daviess	Unclassifiable
Dearborn	Unclassifiable
Decatur	Unclassifiable
DeKalb	Unclassifiable
Delaware	Attainment
Dubois	Attainment
Elkhart	Attainment
Fayette	Unclassifiable
Floyd	Attainment
Fountain	Unclassifiable
Franklin	Unclassifiable
Fulton	Unclassifiable
Gibson	Unclassifiable
Grant	Unclassifiable
Greene	Attainment
Hamilton	Unclassifiable
Hancock	Unclassifiable
Harrison	Unclassifiable
Hendricks	Unclassifiable
Henry	Attainment
Howard	Unclassifiable
Huntington	Unclassifiable
Jackson	Unclassifiable
Jasper	Unclassifiable

**Recommendations based on monitoring data available through September 30, 2013.*

County	Recommendation
Jay	Unclassifiable
Jefferson	Unclassifiable
Jennings	Unclassifiable
Johnson	Unclassifiable
Knox	Unclassifiable
Kosciusko	Unclassifiable
LaPorte	Attainment
LaGrange	Unclassifiable
Lake	Attainment
Lawrence	Unclassifiable
Madison	Unclassifiable
Marion	Attainment
Marshall	Unclassifiable
Martin	Unclassifiable
Miami	Unclassifiable
Monroe	Attainment
Montgomery	Unclassifiable
Morgan	Unclassifiable
Newton	Unclassifiable
Noble	Unclassifiable
Ohio	Unclassifiable
Orange	Unclassifiable
Owen	Unclassifiable
Parke	Unclassifiable
Perry	Unclassifiable
Pike	Unclassifiable
Porter	Attainment
Posey	Unclassifiable
Pulaski	Unclassifiable
Putnam	Unclassifiable
Randolph	Unclassifiable
Ripley	Unclassifiable
Rush	Unclassifiable
St. Joseph	Attainment
Scott	Unclassifiable
Shelby	Unclassifiable
Spencer	Attainment
Starke	Unclassifiable
Steuben	Unclassifiable
Sullivan	Unclassifiable
Switzerland	Unclassifiable
Tippecanoe	Attainment

County	Recommendation
Tipton	Unclassifiable
Union	Unclassifiable
Vanderburgh	Attainment
Vermillion	Unclassifiable
Vigo	Attainment
Wabash	Unclassifiable
Warren	Unclassifiable
Warrick	Unclassifiable
Washington	Unclassifiable
Wayne	Unclassifiable
Wells	Unclassifiable
White	Unclassifiable
Whitley	Attainment

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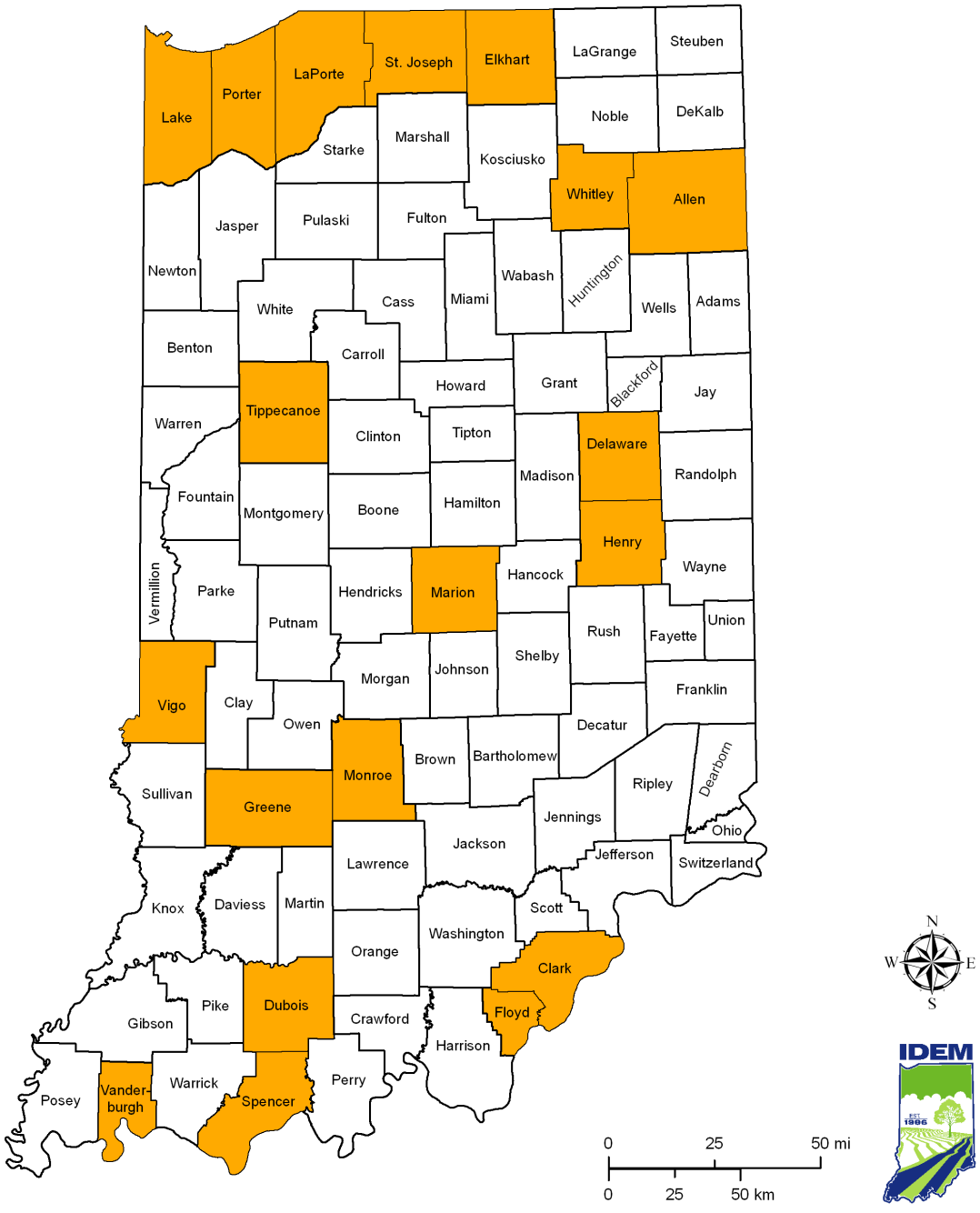
Enclosure 3

Indiana's Preliminary Designation Recommendations for the 2012 Annual $PM_{2.5}$ Standard



This map is intended to serve as an aid in graphic representation only.
This information is not warranted for accuracy or other purposes.

Mapped By: C. Mitchell, OAQ **Date:** 12/04/2013
Source: Office of Air Quality

Map Projection: UTM Zone 16 N **Map Datum:** NAD83

Legend

- **Unclassifiable**
- **County Recommended for Attainment Designation**

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Enclosure 4

Indiana's Assessment of the 2012 Annual $PM_{2.5}$ Standard: Technical Support Document
December 2013

Introduction

On December 14, 2012, the United States Environmental Protection Agency (U.S. EPA) finalized the 2012 annual $PM_{2.5}$ National Ambient Air Quality Standard (NAAQS) of 12 $\mu g/m^3$ averaged over a three-year period. U.S. EPA intends to promulgate final $PM_{2.5}$ area designations by no later than December of 2014. Consistent with U.S. EPA's April 16, 2013 memorandum entitled "Initial Area Designations for the 2012 Revised Primary Annual Fine Particle National Ambient Air Quality Standard," the Indiana Department of Environmental Management (IDEM) has prepared an analysis of potential nonattainment boundaries within Indiana under the 2012 annual $PM_{2.5}$ NAAQS, based on U.S. EPA's recommended five factor analysis:

1. Jurisdictional Boundaries
2. Air Quality Data
3. Emissions and Emissions-Related Data
4. Meteorology
5. Geography/Topography

This evaluation, broken down by potentially affected core-based statistical areas (CBSAs) within Indiana, is based on 2010 through 2012 monitoring data, as well as data on emissions, commuting patterns, vehicle miles traveled, population, and population density. All emissions data derive from the 2011 National Emissions Inventories (NEI). This Technical Support Document is intended to summarize the outcomes of IDEM's analysis and make recommendations to U.S. EPA with regard to $PM_{2.5}$ nonattainment boundaries within the state of Indiana.

At the end of 2012, IDEM operated 31 $PM_{2.5}$ monitors around the state, 24 of which monitored air quality that were compared to the annual standard. Of the 31 total monitors, three monitors did not have three complete years of data and four are intended to reflect air quality within a very small geographic area directly influenced by a specific source of air pollution, and are not compared to the annual standard. Therefore, the evaluation contained herein does not consider data from these sites. IDEM's $PM_{2.5}$ monitoring network, outlined in Enclosure 3, was established in 1999.

This document serves as IDEM's initial recommendations for nonattainment boundaries within the state of Indiana. IDEM reserves the right to update its recommendations as necessary once monitoring data from 2013 and 2014 becomes certified.

IDEM Analysis by Region

Central Indiana

1. Jurisdictional Boundaries

The Central Indiana CBSA consists of Boone, Brown, Hamilton, Hancock, Hendricks, Johnson, Madison, Marion, Morgan, Putnam, and Shelby counties. All of Marion County and portions of Boone, Hamilton, Hancock, Hendricks, Johnson, Morgan, and Shelby counties are part of the Indianapolis Metropolitan Planning Organization (MPO). All of Madison County and portions of Hamilton and Hancock counties are also included within the Madison County Council of Governments (MCCOG). Portions of Johnson and Shelby counties also fall within the boundaries of the Columbus Area Metropolitan Planning Organization (CAMPO).

Hamilton, Hendricks, Marion, Morgan, and Johnson counties were previously designated nonattainment under the 1997 $PM_{2.5}$ annual standard. A Redesignation Request and Maintenance Plan was submitted on October 20, 2009 and became effective on July 11, 2013.

2. Air Quality Data

Monitoring Data

As illustrated in Table 1 below, there are three $PM_{2.5}$ monitors[1] located within the Central Indiana CBSA for which data are compared to the annual standard. Two monitors, at W. 18th St. (180970081) and E. Michigan St. (180970083) in Marion County, have 2010-2012 design values marginally above the 2012 annual $PM_{2.5}$ standard; however, it is anticipated that concentrations measured at both monitors will decrease below the standard well before the effective date of designations. The Indianapolis-Washington Park monitor (180970078) has a 2010-2012 design value below the standard. The School 21 monitor (180970084) is currently a source-oriented monitor, but is scheduled to become a community-oriented monitor as of January 2014. Three years of data will be available to compare to the standard at the close of 2016 for this site. Currently, there are no monitors located in any other county within the Central Indiana CBSA besides Marion County that have three complete years of data to compare to the annual standard.

One additional monitor located within the Central Indiana CBSA is in Madison County (180950011—Anderson-Eastside Elem.) and has been in operation since July 2010. The monitoring site was previously located at W. 5th St. (180950009) from 1999 to 2010. The last complete three-year design value from that site was from 2007-2009 (12.3 $\mu g/m^3$), and like the majority of monitoring sites across Indiana at that point in time, the value would have been above the 2012 annual standard. Since that time, all monitoring sites have measured improved air quality and the majority of Indiana's monitors have fallen below the 2012 annual standard. The Anderson-Eastside Elem. monitor shows a 2010-2011 two-year average of 11.3 $\mu g/m^3$. Though the monitor was not in operation during the first half of 2010, the two and a half year design value is 10.7 $\mu g/m^3$, suggesting the monitor will fall below the annual standard at the close of 2013.

[1] IDEM: http://www.in.gov/idem/airquality/2489.htm

Table 1: 2000-2013 Central Indiana CBSA Monitored Values

County	Monitor ID	Site	Three Year Design Values (µg/m^3)					
			00-02	01-03	02-04	03-05	04-06	05-07
Marion	180970078	Washington Park	17.0	16.2	15.4	15.4	15.0	15.4
Marion	180970081	W. 18th St.	16.1	15.9	15.1	16.4	15.7	16.1
Marion	180970083	E. Michigan St.	16.9	16.7	16.0	16.3	15.6	15.9
Marion	180970084	School 21**						

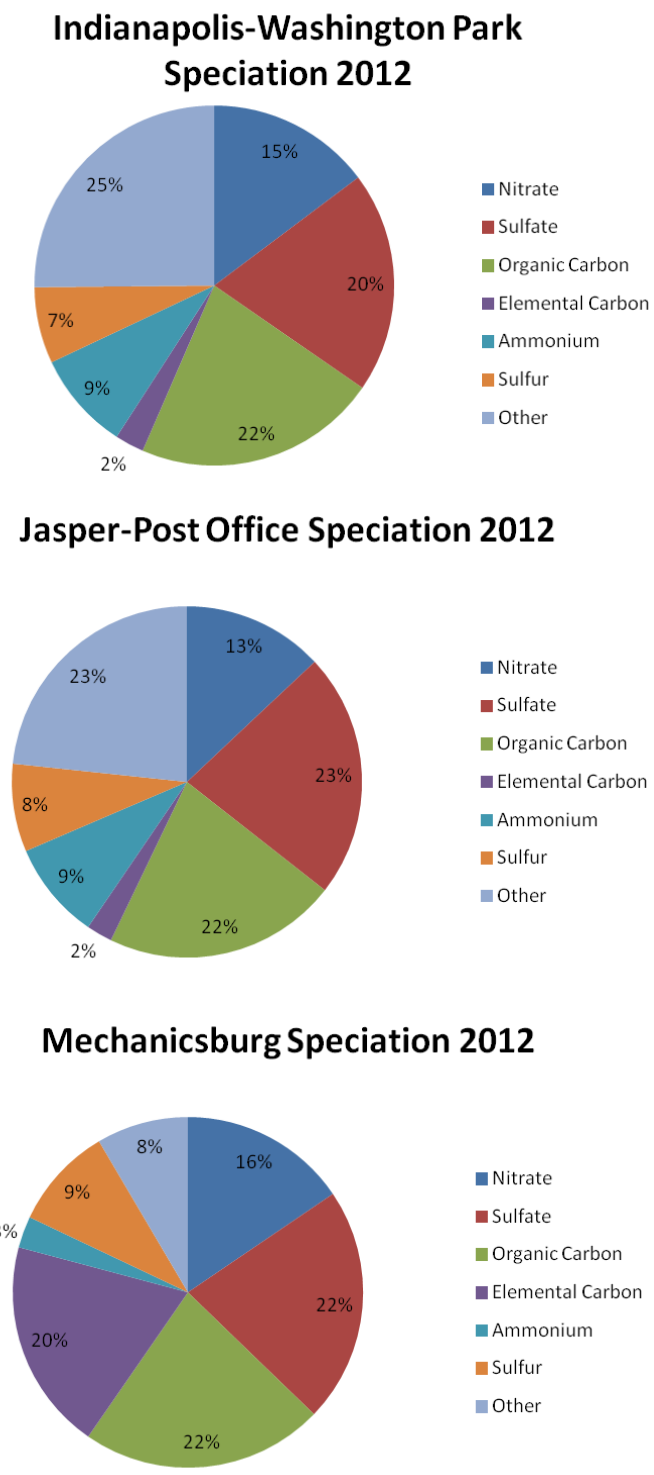
County	Monitor ID	Site	Three Year Design Values (µg/m^3)					
			06-08	07-09	08-10	09-11	10-12	11-13*
Marion	180970078	Washington Park	14.3	13.6	12.7	12.3	11.8	11.2
Marion	180970081	W. 18th St.	14.6	14.3	13.6	13.1	12.7	11.9
Marion	180970083	E. Michigan St.	14.4	13.8	13.2	13.0	12.6	11.6
Marion	180970084	School 21**		11.9	12.9	12.8	12.5	11.7

Highlighted data represents monitors with a 2010-2012 design value above the annual standard of 12.0µg/m^3, effective March 18, 2013.

**2013 monitoring data is only available through September 30, 2013 and has not been certified.*

***The School 21 monitor is a source-oriented monitor through 2013, but is scheduled to become community-oriented as of January 2014. Three years of complete data will be available at the close of 2016 for this site.*

Figure 1: 2012 Speciation

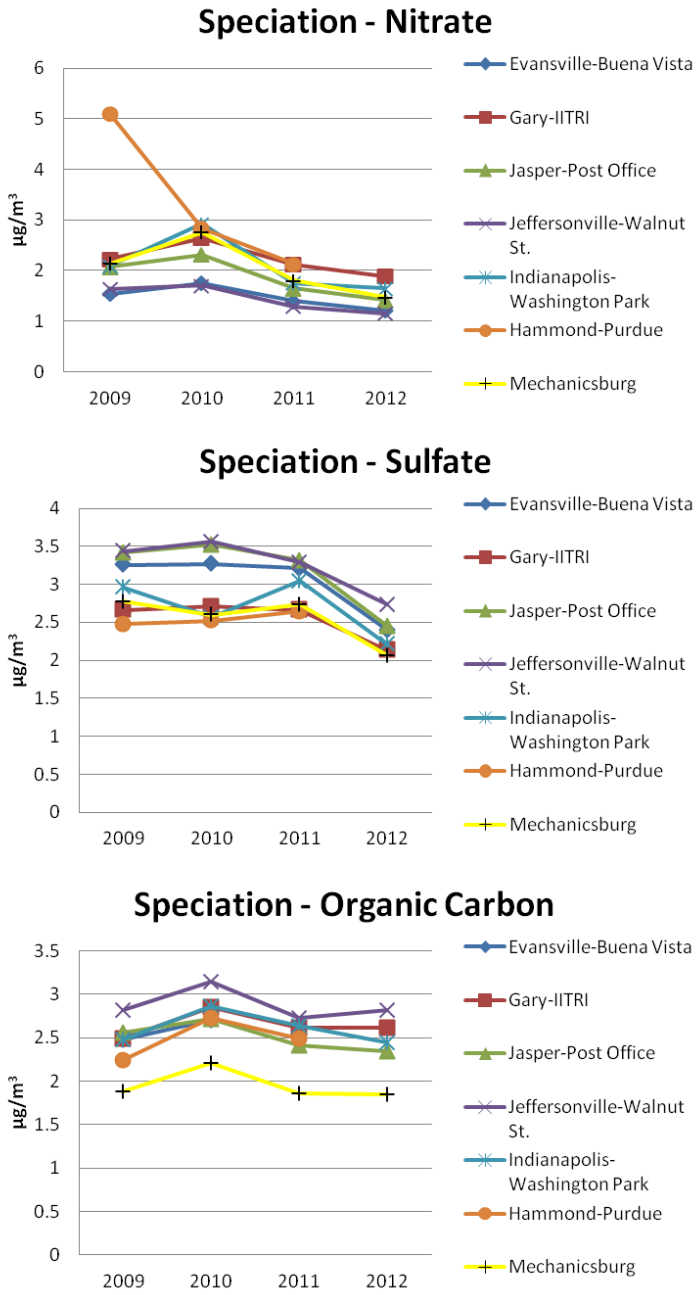


Speciation Data

The Indianapolis-Washington Park monitor is the only monitor in the Central Indiana CBSA that collects speciation data. Figure 1 above shows speciation data from the Indianapolis-Washington Park monitor and illustrates that organic carbon (OC) and sulfate are the largest

components of $PM_{2.5}$ in the area. The difference in total mass between the Indianapolis-Washington Park monitor and the Mechanicsburg monitor is between 1.65 and 1.7 $\mu g/m^3$, while the difference between the Indianapolis-Washington Park monitor and the Jasper-Post Office monitor is between 0.02 and 0.29 $\mu g/m^3$. However, the ratio of each speciated pollutant to total mass is consistent between the three. Because the ratio of pollutants at the Indianapolis-Washington Park monitor is similar to the ratio of pollutants at other speciation monitors in rural portions of the state representative of background concentrations, as seen in Figure 2 below, the counties surrounding Marion County are unlikely to have a significant impact on the violating monitors. It is reasonable to assume that if the counties surrounding Marion County were to have a significant impact on monitored concentrations within Marion County, there would be notable differences in the ratio of specie pollutants to the total mass, notably those influenced by population density (i.e., organic carbon). Figure 2 below illustrates that there is very little difference in the speciation data collected from the Indianapolis-Washington Park, the Jasper-Post Office, and the Mechanicsburg speciation monitors for nitrate, sulfate, and OC.

Figure 2: 2012 Speciation Data with All Monitors



3. Emissions and Emissions-Related Data

Emissions Data

The majority of all anthropogenic (point, area, mobile, and nonroad) emissions[2] produced within the Central Indiana CBSA come from Marion County, illustrated in Figure 3 below. Marion County contributes the largest amount (64%) of sulfur dioxide (SO_2) emissions, almost half (47%) of all nitrogen oxide (NO_x) emissions, 47% of all carbon monoxide (CO) emissions, 44% of all volatile organic compound (VOC) emissions, and 28% of all direct $PM_{2.5}$ emissions within the Central Indiana CBSA. Approximately 30% of all SO_2 emissions are produced by stationary sources located in Morgan County; however, emissions from these sources will be substantially reduced prior to designations under the 2012 $PM_{2.5}$ standard becoming effective. The rest of the counties within the Central Indiana CBSA contribute very small amounts of each precursor pollutant in comparison, with the exception of ammonium (NH_3). It is worth noting that NH_3 emissions are relatively constant among all Indiana counties. In fact, NH_3 emissions tend to be higher in the rural counties outside of the CBSA boundaries. Each county within the Central Indiana CBSA contributes similar amounts of NH_3 and none contribute over 15%. Also, with the exception of Boone, Brown, and Johnson counties, all other counties within the Central Indiana CBSA have large stationary sources that emit 100 tons or more of regulated $PM_{2.5}$ precursor pollutants as seen in Table 3. The vast majority of all major stationary source emissions tied to $PM_{2.5}$ formation originate from Marion County. Individual sources within Marion County are responsible for 67% of all SO_2 emissions, 62% of total NO_x emissions, and 58% of total VOC emissions from stationary sources. Other counties within the Central Indiana CBSA emit very small amounts in comparison.

[2] U.S. EPA $PM_{2.5}$ Mapping Tool Datasets: http://www.epa.gov/pmdesignations/2012standards/techinfo.htm

Figure 3: 2011 Central Indiana CBSA Emissions by Pollutant

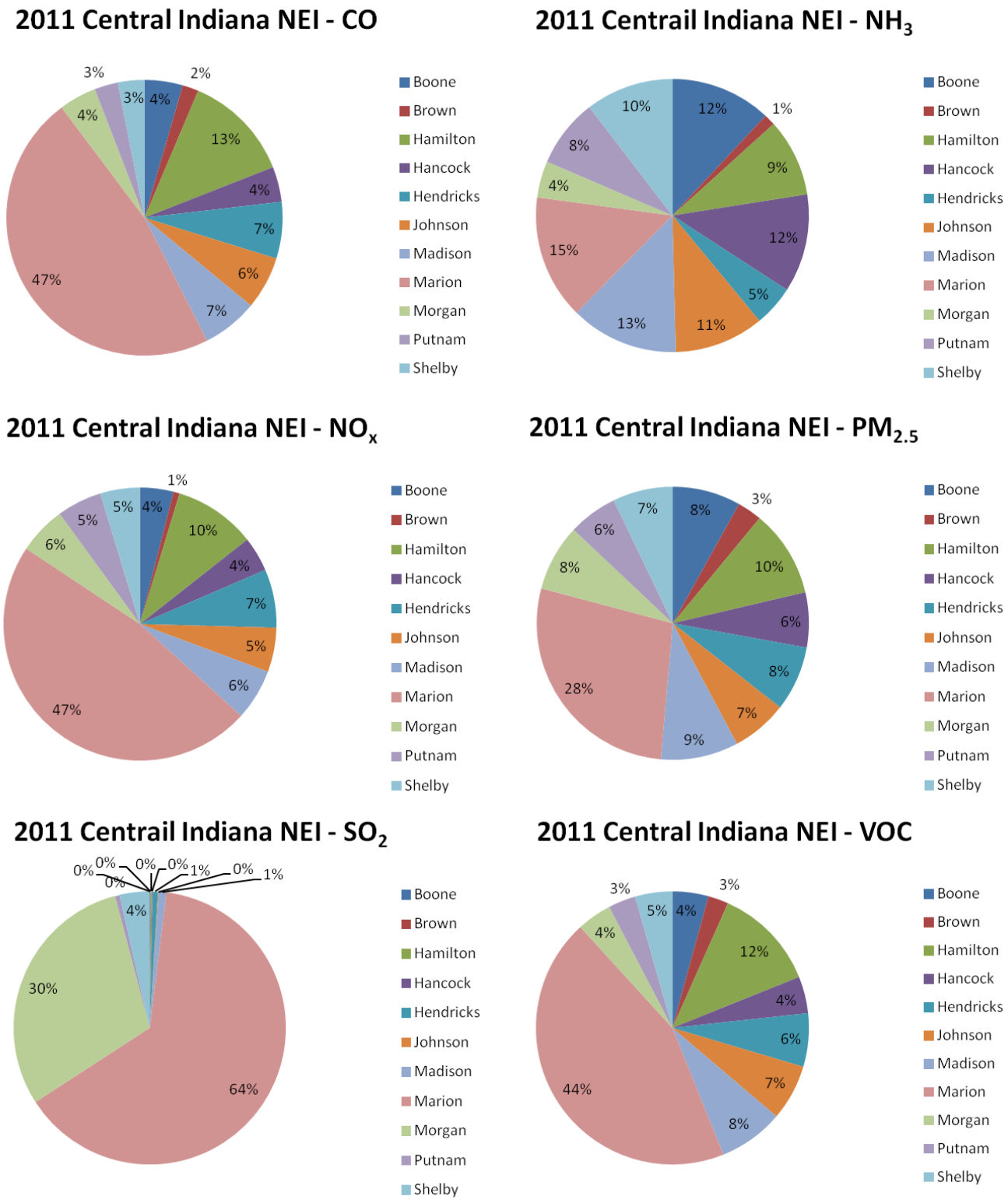


Table 2: 2011 Central Indiana CBSA NEI Source Categories by Pollutant (Tons per Year)[3]

Pollutant	County	Fire	Nonpoint	Nonroad	Onroad	Point
CO	Boone		1,137.1	4,212.9	9,974.9	148.4
	Brown	1,230.6	1,251.5	1,869.3	2,161.4	1.2
	Hamilton	52.6	1,316.2	14,761.9	27,448.7	215.4
	Hancock	104.8	1,367.0	3,086.8	9,477.8	180.6
	Hendricks	105.2	726.1	4,412.5	15,949.6	1,753.5
	Johnson	194.7	646.1	4,753.8	15,767.3	108.0
	Madison		2,015.1	4,964.3	15,493.9	94.6
	Marion		5,621.4	39,012.1	113,664.0	4,996.0
	Morgan	107.1	1,607.1	3,807.4	9,457.1	206.9
	Putnam	150.9	1,197.7	1,311.2	6,154.1	679.2
	Shelby	52.7	1,578.3	1,801.0	6,739.1	576.1
NH_3	Boone		965.7	0.8	38.5	
	Brown	20.1	83.7	0.2	8.7	
	Hamilton	0.9	657.8	3.0	103.9	9.1
	Hancock	1.7	935.4	0.7	37.0	3.2
	Hendricks	1.7	343.8	1.5	60.8	<0.1
	Johnson	3.2	826.2	0.9	60.2	0.7
	Madison		1,015.3	0.9	59.1	0.9
	Marion		412.7	5.4	429.9	389.2
	Morgan	1.8	323.8	0.5	37.2	4.4
	Putnam	2.5	656.1	0.4	24.5	0.1
	Shelby	0.9	791.8	0.4	26.6	55.2
NO_x	Boone		171.2	640.3	2,220.6	2.2
	Brown	13.3	67.9	88.2	383.3	<0.1
	Hamilton	1.2	501.8	2,221.7	4,688.7	28.2
	Hancock	2.4	307.9	545.9	2,273.9	27.9
	Hendricks	2.4	624.7	1,229.2	2,973.6	475.7
	Johnson	2.7	306.6	751.3	2,938.0	28.4
	Madison		667.3	733.1	2,903.7	334.8
	Marion		2,977.6	4,107.1	20,514.6	8,895.7
	Morgan	2.5	175.9	373.1	1,856.9	1,936.3
	Putnam	3.3	373.8	338.0	1,605.8	1,749.7
	Shelby	1.2	612.6	439.9	1,727.6	831.0

[3] U.S. EPA 2011 National Emissions Inventory: http://www.epa.gov/ttnchie1/net/2011inventory.html

Pollutant	County	Fire	Nonpoint	Nonroad	Onroad	Point
$PM_{2.5}$	Boone		1,374.5	59.5	75.9	2.7
	Brown	103.4	410.5	17.7	12.7	<0.1
	Hamilton	4.9	1,546.5	187.9	176.4	24.4
	Hancock	9.8	1,069.0	48.7	82.8	10.3
	Hendricks	9.8	1,131.5	100.5	106.1	97.4
	Johnson	16.8	1,054.2	63.6	105.9	2.4
	Madison		1,487.7	68.7	109.2	54.8
	Marion		2,565.5	334.5	792.8	1,502.0
	Morgan	10.0	1,135.1	35.7	64.5	233.5
	Putnam	13.9	943.2	26.5	51.5	57.4
	Shelby	4.9	1,075.3	34.9	59.1	163.8
SO_2	Boone		13.3	1.7	10.2	0.4
	Brown	8.2	6.6	0.3	2.2	<0.1
	Hamilton	0.5	16.9	6.3	29.2	1.3
	Hancock	1.1	15.8	1.4	10.5	0.8
	Hendricks	1.1	18.9	3.3	16.9	198.0
	Johnson	1.5	6.8	2.1	16.7	0.3
	Madison		26.2	1.9	16.4	296.5
	Marion		90.7	12.1	121.9	23,796.2
	Morgan	1.1	23.2	1.0	9.9	11,262.1
	Putnam	1.5	27.0	0.8	6.6	168.1
	Shelby	0.5	16.0	1.1	7.3	23.0
VOC	Boone		1,030.1	386.6	822.9	72.6
	Brown	289.4	346.7	496.1	180.8	<0.1
	Hamilton	12.6	3,024.7	1,230.7	2,327.5	59.5
	Hancock	25.0	1,138.1	304.7	798.8	103.0
	Hendricks	25.1	1,569.9	427.6	1,360.8	51.5
	Johnson	46.0	1,586.4	518.0	1,343.6	100.0
	Madison		2,132.2	639.6	1,306.1	108.8
	Marion		10,127.4	3,086.7	9,656.4	1,213.9
	Morgan	25.5	1,007.1	344.9	791.6	65.7
	Putnam	35.9	825.0	157.0	516.5	233.4
	Shelby	12.6	1,234.1	142.6	562.8	449.4

Photochemical Modeling

In order to gain a better understanding of potential impacts from surrounding counties on violating monitors in Marion County, a zero-out photochemical modeling analysis was conducted on emissions from Hendricks County, just west of Marion County. Based on numerous factors, including population growth between 2000 and 2010, potential to emit, and prevailing wind direction, Hendricks County was chosen for the zero-out modeling analysis because it is the county with the highest potential to impact monitors in Marion County. The impacts from Hendricks County can be considered representative of the other counties within the Central Indiana CBSA as well. Though Hamilton County has the highest growth rate in the Central Indiana CBSA, it was not chosen over Hendricks County because it is north of Marion County and more likely to be a recipient of transport from Marion County, rather than a contributor to monitored violations within Marion County.

The photochemical modeling performed for the Hendricks County $PM_{2.5}$ zero-out analysis used the Comprehensive Air Quality Model (CAMx) version 5.2, developed by Environ. This model has been accepted by U.S. EPA as an approved air quality model for regulatory analysis and attainment demonstrations. Requirements of 40 CFR 51.112, as well as "Guidance on the Use of Models and Other Analyses in Attainment Demonstrations for the 8-hour Ozone and Fine Particles NAAQS" (EPA-454/R-05-002, Oct. 2005) are satisfied with the use of CAMx.

Several emissions sectors were processed for photochemical modeling, including area emissions sources, low-level point sources, electric generating units (EGUs), non-EGU point sources, motor vehicle emissions, and naturally-occurring biogenic emissions. After running a baseline emissions scenario that included all emissions, a zero-out modeling run analysis was conducted that cut all EGUs, non-EGU point sources, low-level point sources, area, and mobile emissions of NO_x, SO_2, and other precursor emissions by 100% from Hendricks County.

Once the zero-out of emissions was complete through CAMx, the output was run through U.S. EPA's Modeled Attainment Test Software (MATS version 2.5.1) in order to determine the 2005-2009 modeled zero-out design value for the Marion County monitors. As shown in Table 3 below, the difference between the modeled design value and the modeled zero-out design value represents the impacts that emissions from Hendricks County have on the $PM_{2.5}$ monitors in Marion County. The monitor likely to be most impacted by emissions from Hendricks County, W. 18th St. (180970081), showed a difference of 0.37 $\mu g/m^3$.

One important factor to consider is that the zero-out modeling analysis completely eliminates all anthropogenic emissions from Hendricks County, which isn't possible to achieve. In fact, it is unrealistic to even achieve a reduction in emissions greater than 20% through local level emissions controls. Using this rationale and assuming a more realistic 20% cut in emissions from Hendricks County, rather than 100%, the impact of the emissions reduction to $PM_{2.5}$ concentrations would be approximately 0.07 $\mu g/m^3$, which is 0.46% of the modeled baseline concentration of 15.00 $\mu g/m^3$. This is considerably below the threshold that U.S. EPA has historically used when determining significant contribution for regulatory purposes. If the maximum impact we could expect to see from Hendricks County is 0.07 $\mu g/m^3$, and this is reasonably representative of the other surrounding counties in the CBSA, then the inclusion of

Hendricks County or any other surrounding county in the nonattainment area would not aid in addressing the monitored violations in Marion County, nor would it expedite the attainment date.

Table 3: Central Indiana CBSA Annual $PM_{2.5}$ Photochemical Modeling Results ($\mu g/m^3$)

County	Monitor ID	Site	2005-2009 Modeled Design Value	2005-2009 Modeled Zero-Out Design Value	2005-2009 Modeled Difference
Marion	180970078	Washington Park	14.46	14.12	0.34
Marion	180970081	W. 18th St.	15.00	14.63	0.37
Marion	180970083	E. Michigan St.	14.70	14.35	0.35

Major Source Emissions Controls

The Indianapolis Power and Light Company (IPL) - Eagle Valley Generating Station power plant, located in Morgan County and in Table 4 below, is the largest source of direct $PM_{2.5}$ and precursor pollutant outside of Marion County and contains four units. Currently, all units have electrostatic precipitators (ESPs) and Units 3, 4, and 5 also have flue gas conditioning systems to control mercury and PM emissions. All units are equipped with low NO_x burner technology, as well, with separated overfire air (OA) on Units 4 and 5 and closed-coupled OA on Unit 6 to control NO_x emissions. IPL plans to shut down all four of these coal and oil fired electric generating units (EGUs) and replace them with a state-of-the-art, highly efficient combined cycle combustion turbine electric generation facility. The facility will consist of two gas fired combustion turbine units each with a low combustion burner design and Selective Catalytic Reduction (SCR) to control NO_x emissions. This strategy will essentially eliminate PM and SO_2 emissions from the power plant and reduce NO_x emissions by approximately 80%.

Table 4: 2011 Central Indiana CBSA Individual Emissions Sources (Tons per Year)[4]

County	Site	CO	VOC	NO_x	SO_2	$PM_{2.5}$
Hendricks	Steel Dynamics Inc.	1,408.1		246.2	188.4	
Hendricks	Twin Bridges Recycling & Disposal	272.6		128.0		
Madison	Owens Brockway Glass Container, Inc.			332.7	296.3	
Marion	IPL Harding St.	413.8		2,675.6	18,994.2	1,149.3
Marion	C.C. Perry K Steam Plant	243.1		1,422.6	4,348.8	
Marion	Indianapolis Intl.	1,652.5	252.9	1,094.4	107.2	
Marion	PEPL-Zionsville	355.2	117.1	1,583.1		

[4] U.S. EPA 2011 National Emissions Inventory: http://www.epa.gov/ttnchie1/net/2011inventory.html

County	Site	CO	VOC	NO_x	SO_2	$PM_{2.5}$
Marion	Covanta Indianapolis, Inc.			1,076.5		
Marion	Vertellus Agriculture & Nutrition Specialties LLC	945.6		174.8		
Marion	Indianapolis Belmont WWTP	563.2				
Marion	Cryovac, Inc.		344.8			
Marion	Quemetco, Inc.	223.7		263.5	124.4	
Marion	Allison Transmission, Inc. Speedway			142.9		
Marion	Navistar, Inc.	121.7				
Morgan	IPL Eagle Valley Station	136.3		1,801.3	10,875.3	190.4
Morgan	Hydraulic Press Brick Co.			121.0	350.3	
Putnam	Lone Star Industries, Inc.	580.0		1,746.2	167.8	
Putnam	Heartland Automotive, LLC		188.6			
Shelby	ANR Pipeline Co. Shelbyville Station	313.4		797.8		
Shelby	Bunge North America		229.8			
Shelby	Knauf Insulation	150.6	110.3			120.9

Commuting Patterns and Vehicle Miles Traveled

Within the Central Indiana CBSA, a vast majority of residents live and work in the same county[5], as illustrated in Table 5 below. Areas with the highest percentage of out-of-county commuters include Hancock, Hendricks, Morgan, and Boone counties, and a majority of residents in those areas travel to Marion County for work. Though Marion County has the lowest percentage of out-of-county commuters, it has roughly the same amount of out-of-county commuters as Hendricks County. Many counties within Central Indiana have at least one third of residents that are out-of-county commuters. However, the impact on $PM_{2.5}$ levels from out-of-county commuters is not significant enough to warrant consideration when making nonattainment designations because monitored values continue to decrease and the speciation data from the Indianapolis-Washington Park monitor does not suggest that mobile sources have a significant impact on measured concentrations in Marion County. If this were the case, the ratio of organic carbon would likely be much higher in Marion County than in the rural counties.

[5] Stats Indiana: http://www.stats.indiana.edu/dms4/commuting.asp

Table 5: 2011 Central Indiana CBSA Commuting Patterns

County	2011 Total Workforce	Persons Who Live AND Work in County	Persons Who Live in County and Work in Another County	Percent Who Work In County	Percent Who Work Out of County
Boone	39,223	24,294	14,929	61.9%	38.1%
Brown	10,246	6,614	3,632	64.6%	35.4%
Hamilton	186,219	123,537	62,682	66.3%	33.7%
Hancock	47,741	27,813	19,928	58.3%	41.7%
Hendricks	96,171	57,236	38,935	59.5%	40.5%
Johnson	93,792	59,496	34,296	63.4%	36.6%
Madison	79,648	63,664	15,984	79.9%	20.1%
Marion	536,906	496,176	40,730	92.4%	7.6%
Morgan	45,656	28,195	17,461	61.8%	38.2%
Putnam	22,090	16,684	5,406	75.5%	24.5%
Shelby	29,102	21,411	7,691	73.6%	26.4%

In the Central Indiana CBSA, vehicle miles traveled[6] (VMT) hasn't significantly varied from 2000 to 2011, as shown in Table 6. The majority of Central Indiana has seen very small increases, or in some cases, decreases in VMT. Hendricks and Hamilton counties have the highest growth rate over the eleven-year period (71.9% and 56.4%, respectively). Though Hendricks County has the largest growth rate, VMT only increased by roughly 2.04 million miles; in comparison, Marion County, whose growth rate is only 19.9%, experienced an increase of 5.31 million VMT. Marion County stands out as clearly having the highest VMT, while the second highest, Hamilton County, only has 12% of the total VMT for the entire CBSA; therefore, their contribution to monitored violations within Marion County is most likely negligible.

Table 6: 2000 & 2011 Central Indiana CBSA Vehicle Miles Traveled

County	2000 Vehicle Miles Traveled	2011 Vehicle Miles Traveled	Percent Change	Percent of CBSA (2010)
Boone	2,506,084	2,921,000	16.6%	4.5%
Brown	411,760	350,000	-15.0%	0.5%
Hamilton	5,038,772	7,881,000	56.4%	12.2%
Hancock	2,572,506	2,643,000	2.7%	4.1%
Hendricks	2,849,428	4,898,000	71.9%	7.6%
Johnson	2,801,134	4,175,000	49.0%	6.5%
Madison	3,951,125	3,992,000	1.0%	6.2%
Marion	26,691,980	32,005,000	19.9%	49.5%
Morgan	2,187,487	2,410,000	10.2%	3.7%
Putnam	1,724,937	1,522,000	-11.8%	2.4%
Shelby	1,797,192	1,921,000	6.9%	3.0%

[6] Indiana Department of Transportation: http://www.in.gov/indot/2469.htm

Population and Density

As illustrated in Table 7 below, Marion County has the highest population[7] within Central Indiana by a large margin, according to the 2010 census, and makes up almost 50% of the population of the CBSA. Hamilton County remains a distant second most populous county in the area, having over 600,000 less people than Marion. However, Hamilton County has the highest growth rate in the Central Indiana area (50.3%), which accounts for an increase of just over 90,000 people. Brown, Morgan, Putnam, and Shelby counties have modest population growth as compared to the more urban counties surrounding Marion.

Table 7: 2000 & 2010 Central Indiana CBSA Population

County	Population 2000	Population 2010	Percent Change	Percent of CBSA (2010)
Boone	46,107	56,640	22.8%	3.0%
Brown	14,957	15,242	1.9%	0.8%
Hamilton	182,740	274,569	50.3%	14.5%
Hancock	55,391	70,002	26.4%	3.7%
Hendricks	104,093	145,448	39.7%	7.7%
Johnson	115,209	139,654	21.2%	7.4%
Madison	133,358	131,636	-1.3%	7.0%
Marion	860,454	903,391	5.0%	47.9%
Morgan	66,689	68,894	3.3%	3.6%
Putnam	36,019	37,963	5.4%	2.0%
Shelby	43,445	44,436	2.3%	2.4%

Marion County is also the most densely populated[8], while Hamilton County is the second most densely populated, as outlined in Table 8 below. All of the other counties in the Central Indiana CBSA are considerably less dense than either Marion or Hamilton counties. Hamilton County has experienced the largest percent growth (50.3%) from 2000 to 2010, increasing by roughly 233 people per square mile. Hendricks County has the second highest increase in population density (39.7%), which equates to an increase of 102 people per square mile. Other counties within the Central Indiana CBSA only have modest increases in population density.

[7] U.S. Census Bureau: http://www.census.gov/popest/data/index.html

[8] U.S. Census Bureau: http://factfinder2.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=DEC_10_SF1_GCTPH1.ST05&prodType=table

Table 8: 2000 & 2010 Central Indiana CBSA Population Density

(People per Square Mile) County	Population Density 2000	Population Density 2010	Percent Change
Boone	109.0	133.9	22.8%
Brown	47.9	48.9	1.9%
Hamilton	463.5	696.4	50.3%
Hancock	181.0	228.7	26.4%
Hendricks	255.8	357.4	39.7%
Johnson	359.5	435.8	21.2%
Madison	295.1	291.3	-1.3%
Marion	2,171.2	2,279.6	5.0%
Morgan	165.1	170.5	3.3%
Putnam	75.0	79.0	5.4%
Shelby	105.7	108.1	2.3%

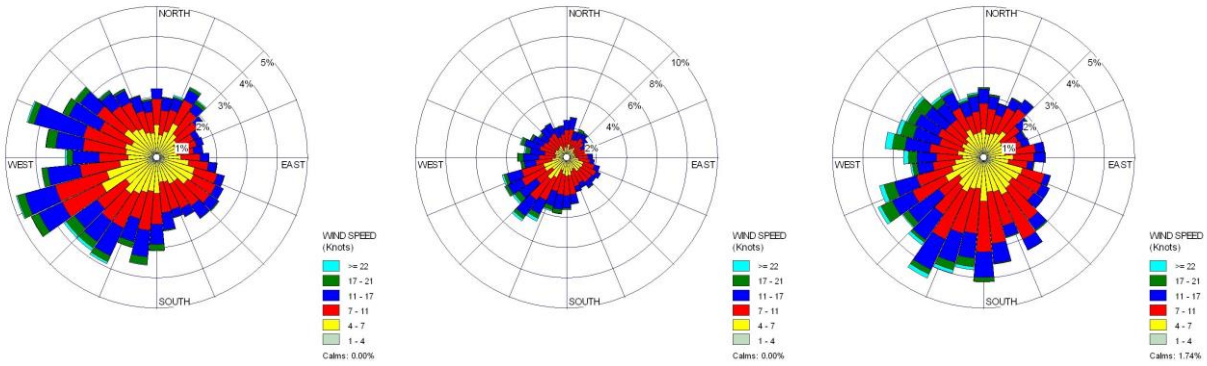
4. Meteorology

Meteorology plays a key role in the development and transport of $PM_{2.5}$. Typically, higher $PM_{2.5}$ daily concentrations occur during episodes of stagnant weather conditions. Light wind speeds provide an environment for $PM_{2.5}$ pre-cursor emissions to react and enhance localized $PM_{2.5}$ development. Also, transport of $PM_{2.5}$ can be aided by higher wind speeds from areas with large industrial sources of emissions or areas with higher background concentrations of $PM_{2.5}$.

The wind roses, below in Figure 4, show the directions from which the winds blew during 2010-2012 at the Indianapolis International Airport, National Weather Service station. Prevailing winds were from the southwest, west, and south. Wind direction data is listed as radial degrees in 10 degree increments. The spike in the north direction is a result of the wind data showing variable or no true wind direction measured during an hour. When this occurs, the wind direction value assigned is 0 radial degrees or a due north direction value.

Figure 4: 2010-2012 Indianapolis Annual Wind Roses

2010 **2011** **2012**



An in-depth analysis on the wind roses on only the days when monitored daily $PM_{2.5}$ concentrations exceeded 30 µg/m^3 was conducted. Cumulative wind roses of all days that recorded higher $PM_{2.5}$ concentrations in Marion County for each year are shown below in Figure 5. Analysis of these wind roses showed more southwest and southeast winds were evident in 2010 while southwest, north, and northwest winds were present on high $PM_{2.5}$ concentration days in 2011. 2012 had more variable wind directions but wind speeds were much lower during the high $PM_{2.5}$ concentration days.

Figure 5: 2010-2012 Indianapolis Cumulative High Concentration Day Wind Roses

2010 **2011** **2012**

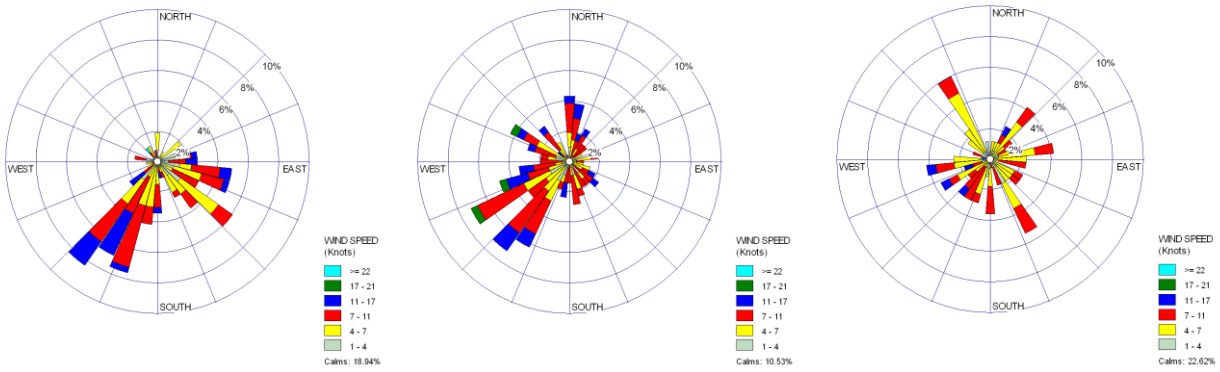


Table 9 shows the frequency of hourly wind directions during 2010-2012 when daily $PM_{2.5}$ concentrations were measured at 30.0 µg/m^3 or above. Winds from the southwest direction were most prevalent, ranging between 12.5% and 27.3% during the three-year period. Southeast winds were evident between 8.6% and 17.0% of the time while winds blew from the south between 8.9% and 15.2%. North and northeast winds were the least prevalent, with those wind direction frequencies ranging between 3.6% and 10.1%.

Table 9: 2010-2012 Indianapolis Most Frequent Wind Directions on High $PM_{2.5}$ Concentration Days

2010		2011		2012	
Direction	**Frequency**	**Direction**	**Frequency**	**Direction**	**Frequency**
SW	20.5%	SW	27.3%	SW	12.5%
SE	17.0%	W	11.5%	SE	11.9%
S	15.2%	N	10.0%	NW	10.7%
E	14.8%	S	10.0%	NE	10.1%
NE	4.5%	NW	10.0%	E	10.1%
W	3.4%	SE	8.6%	W	9.5%
N	3.0%	NE	6.7%	S	8.9%
NW	2.7%	E	5.3%	N	3.6%

It should be noted that data from the wind speed frequencies indicated there were lower wind speeds on the higher daily $PM_{2.5}$ concentration days. Table 10 shows the frequencies of wind speed ranges observed on the high daily $PM_{2.5}$ concentration days. Most days showed wind speed less than 11 knots (13 miles per hour). Also shown are the hours with calm winds, which occurred 8% to 17% of the time during the high daily $PM_{2.5}$ concentration days.

Table 10: 2010-2012 Indianapolis Most Frequent Range of Wind Speeds on High $PM_{2.5}$ Concentration Days

Wind Speed	2010	2011	2012
Calm	17.0%	8.0%	8.0%
1-4 knots	17.8%	12.9%	13.7%
4-7 knots	27.3%	25.8%	38.1%
7-11 knots	26.1%	38.3%	22.0%
11-17 knots	9.5%	11.0%	3.6%
17-22 knots	0.0%	1.4%	0.0%
>22 knots	0.4%	0.0%	0.0%

Results from the wind rose analysis show the high $PM_{2.5}$ concentrations in Marion County could be attributed to more localized emissions within the county due to calm or lower wind speeds observed. Winds blowing from the urban core of Marion County are responsible for a majority of emissions that may impact the $PM_{2.5}$ monitors throughout Marion County.

5. Geography and Topography

There are no geographical or topographical features within the Central Indiana CBSA that would have an impact on air quality or potential transport; therefore, this factor was not significant when making nonattainment recommendations.

6. Conclusion and Recommendation

Based on the above analysis, IDEM recommends that Marion County be designated as attainment and the remaining counties in the Central Indiana CBSA be designated as unclassifiable, as outlined in Table 11 below. The ratio of pollutants at the Indianapolis-Washington Park speciation monitor is very similar to the ratio of specie pollutants measured at other speciation monitors within Indiana, particularly the Jasper-Post Office and Mechanicsburg monitors. This suggests that there is no broad-based urban influence, meaning that population-based activities from the surrounding counties within the Central Indiana CBSA are not impacting the monitors within Marion County. The zero-out modeling analysis further suggests that any potential impacts from the surrounding counties are insignificant. Though there is a 2010-2012 design value above the current standard, IDEM's analysis shows that the monitor is projected to attain the standard at the close of 2013. As shown in Table 4, over 60% of major stationary source emissions of PM2.5 and precursor pollutants come from Marion County. Marion County stands out among the Central Indiana CBSA as having the highest population and population density, as well as VMT. Commuting patterns also show that the vast majority of out-of-county commuters from surrounding counties migrate to Marion County for work. Further, results from the wind roses analysis suggests that higher PM2.5 concentrations are more likely attributed to localized emissions within the urban core of Marion County, rather than surrounding counties. With regard to Madison County, current monitoring data suggests the area will measure attainment at the close of 2013, much like the controlling monitor in Marion County. Though there is not yet three complete years of data to compare to the annual standard, monitored values are declining and there is no evidence to support a designation of nonattainment. Therefore, IDEM recommends a designation of unclassifiable for Madison County. Due to the fact that monitored values continue to decrease in Marion County and IDEM expects the monitor to fall below the current standard by the close of 2013, IDEM recommends a designation of attainment for Marion County, while the remaining counties should be designated as unclassifiable. These recommendations are based on the best available information at the time of this submittal, including a probability evaluation to determine the likelihood of counties to attain the standard by the close of 2013, provided that trends continue downward.

Table 11: IDEM Recommendation for Central Indiana CBSA

County	Recommendation
Boone	Unclassifiable
Brown	Unclassifiable
Hamilton	Unclassifiable
Hancock	Unclassifiable
Hendricks	Unclassifiable
Johnson	Unclassifiable
Madison	Unclassifiable
Marion	Attainment
Morgan	Unclassifiable
Putnam	Unclassifiable
Shelby	Unclassifiable

Chicago CBSA:

1. Jurisdictional Boundaries

Indiana's portion of the Chicago CBSA is comprised of Jasper, Lake, Newton, and Porter counties. Nine counties in Illinois and one county in Wisconsin make up the remainder of the Chicago CBSA. Both Lake and Porter counties are also included in the planning jurisdiction of the Northwest Indiana Regional Planning Commission (NIRPC), the designated MPO for the Northwest Indiana area.

Lake and Porter counties were both designated as nonattainment under the 1997 $PM_{2.5}$ annual standard. After the implementation of the NO_x SIP Call and Tier II engine and fuel standards, both counties reported design values below the 1997 standard of 15 $\mu g/m^3$. A Redesignation and Maintenance Plan was submitted by IDEM and approved by U.S. EPA, effective February 6, 2012.

2. Air Quality Data

Monitoring Data

In Indiana's portion of the Chicago CBSA, five $PM_{2.5}$ monitors[9] are compared to the annual standard, one of which has a design value slightly above the standard, as shown in Table 12 below. Four are located within Lake County and one is located in Porter County. The Gary-Madison St. monitor (180890031) in Lake County has a design value slightly over the standard, but it is anticipated that the concentrations measured at the monitor will decrease below the standard well before the effective date of designations. There are no $PM_{2.5}$ monitors within Jasper or Newton counties. There are multiple large stationary sources in Lake County and both Jasper and Newton counties each contain one large stationary source that all contribute 100 tons or more of regulated $PM_{2.5}$ precursor emissions. Though Porter County has multiple stationary sources, the monitor located within Porter County has a design value well below the 2012 standard.

[9] IDEM: http://www.in.gov/idem/airquality/2489.htm

Table 12: 2000-2013 Indiana Portion of Chicago CBSA Monitored Values

County	Monitor ID	Site	Three Year Design Values (µg/m^3)					
			00-02	01-03	02-04	03-05	04-06	05-07
Lake	180890006	E. Chicago-Franklin Sch.	15.6	15.2	14.2	14.5	14.0	14.5
Lake	180890031	Gary-Madison St.				16.6	15.0	14.8
Lake	180892004	Hammond-Purdue	15.0	14.9	14.2	14.4	13.8	14.0
Lake	180892010	Hammond-Clark HS**	14.9	14.9	13.9	14.1	13.6	14.0
Porter	181270024	Ogden Dunes	14.3	13.8	13.2	13.3	12.9	13.4

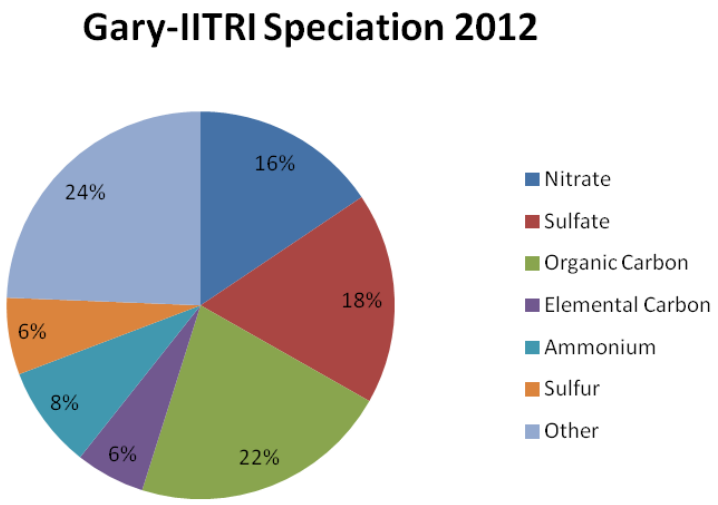
County	Monitor ID	Site	Three Year Design Values (µg/m^3)					
			06-08	07-09	08-10	09-11	10-12	11-13*
Lake	180890006	E. Chicago-Franklin Sch.	13.2	12.6	11.9	11.7	11.5	10.8
Lake	180890031	Gary-Madison St.	13.4	13.0	12.4	12.4	12.2	11.8
Lake	180892004	Hammond-Purdue	12.7	13.8	13.3	13.2	11.4	10.9
Lake	180892010	Hammond-Clark HS**	13.0	12.3	11.7	11.1	11.0	
Porter	181270024	Ogden Dunes	12.2	12.0	11.2	11.1	10.7	10.1

Highlighted data represents monitors with a 2010-2012 design value above the annual standard of 12.0µg/m^3, effective March 18, 2013.

**2013 monitoring data is only available through September 30, 2013 and has not been certified.*

***The Hammond-Clark HS monitor was discontinued on December 29, 2012.*

Figure 6: 2012 Speciation Data



Speciation Data

A source-specific monitor located in Lake County (180890022—Gary-IITRI) is currently the only monitor within Indiana's portion of the Chicago CBSA that collects speciation data. One of the major contributions to $PM_{2.5}$ formation within the area is OC, followed by both sulfate and nitrate, as illustrated above in Figure 6. The Gary-IITRI monitor follows roughly the same trend as other speciation monitors within Indiana, as shown in Figure 2, although it measures higher amounts of nitrate and the second highest amount of organic carbon.

3. Emissions and Emissions-Related Data

Emissions Data

Indiana's portion of the Chicago CBSA accounts for significantly less emissions[10] when compared to the portion from Illinois, as shown in Figure 7. For CO, counties in Illinois emit 70% of total emissions, whereas Lake County produces the largest amount for Indiana's portion (18%). Jasper and Porter counties contribute the largest amount of NH_3 for Indiana's portion of the Chicago CBSA (13%), but the Illinois portion is responsible for 58% of total emissions. For NO_x, Lake County is responsible for 14% of total emissions, whereas counties in Illinois emit 74% of total NO_x. Illinois is also responsible for 74% of all direct $PM_{2.5}$ emissions, while Indiana's portion of the CBSA is responsible for 24%. Lake County contributes 19% of total SO_2 emissions for the area, but Illinois is responsible for 51% of emissions. For VOC, counties in Illinois account for 84% of emissions, whereas the entirety of Indiana's portion of the Chicago CBSA only contributes 14. Overall, despite major stationary sources located in Jasper, Lake, and Porter counties, as outlined in Table 14, Indiana's portion of the Chicago CBSA is overshadowed by the core portion of the area.

[10] U.S. EPA $PM_{2.5}$ Mapping Tool Datasets: http://www.epa.gov/pmdesignations/2012standards/techinfo.htm

Figure 7: 2011 Chicago CBSA Emissions by Pollutant

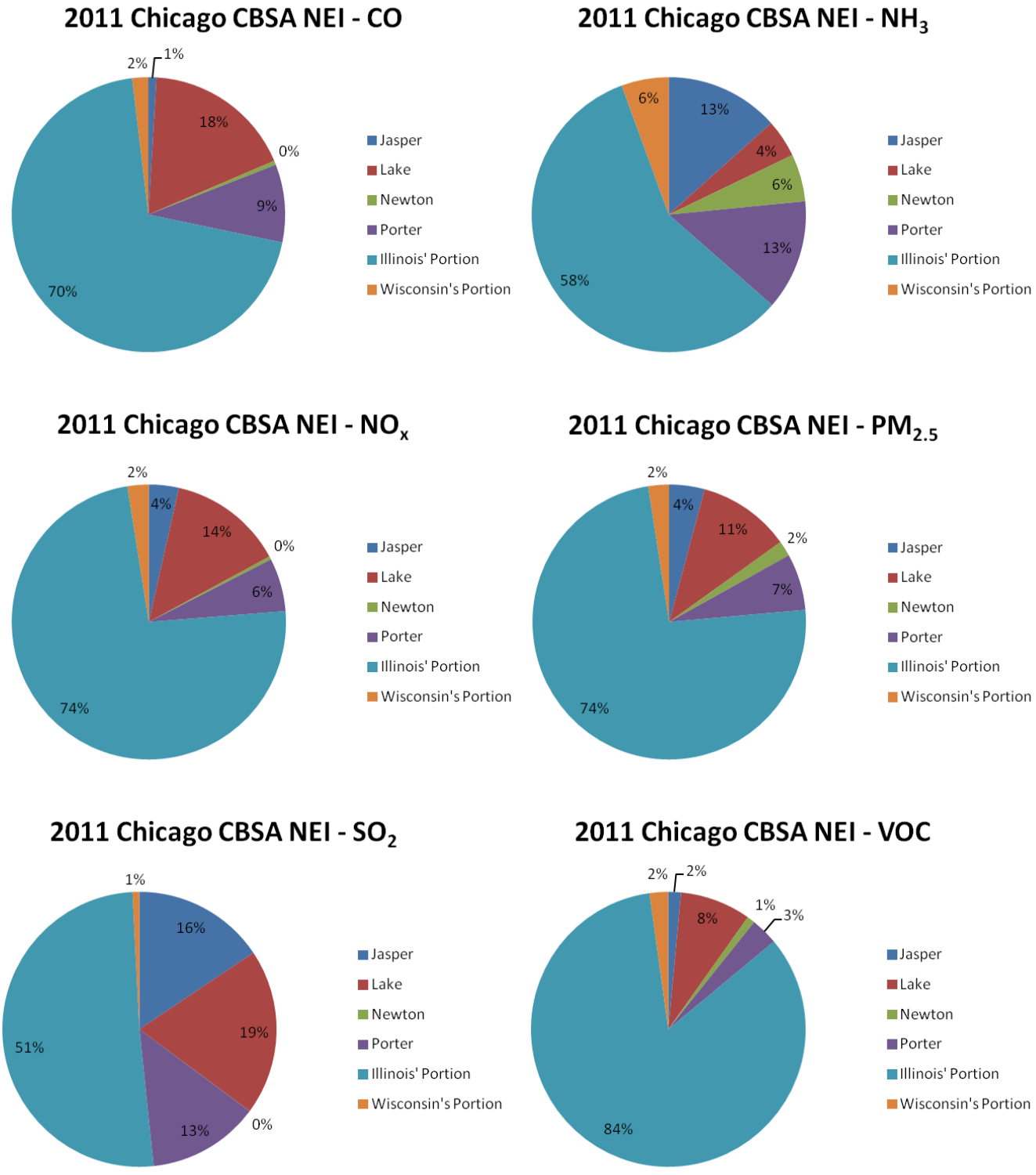


Table 13: 2011 Indiana Portion of Chicago CBSA NEI Source Categories by Pollutant (Tons per Year)[11]

Pollutant	County	Fire	Nonpoint	Nonroad	Onroad	Point
CO	Jasper	126.6	1,117.6	1,944.3	7,239.4	1,166.6
	Lake	172.4	2,324.6	21,664.2	33,902.3	161,628.5
	Newton	267.2	565.6	2,654.7	2,620.3	117.9
	Porter	53.3	1,536.6	13,655.7	13,246.5	85,989.0
NH_3	Jasper	2.1	2,915.0	0.5	28.1	2.0
	Lake	2.9	579.4	3.3	175.2	214.6
	Newton	4.4	1,210.6	0.5	10.5	<0.1
	Porter	0.9	2,716.0	2.0	69.3	64.0
NO_x	Jasper	2.7	160.1	449.2	1,927.3	7,442.1
	Lake	3.5	3,217.0	2,652.0	8,385.6	24,256.2
	Newton	5.4	73.6	312.4	679.7	22.8
	Porter	1.2	2,128.3	1,548.9	3,490.5	10,602.7
$PM_{2.5}$	Jasper	11.6	1,514.0	44.7	60.3	786.6
	Lake	15.7	1,464.0	168.9	378.4	4,335.0
	Newton	24.3	940.5	44.9	25.6	16.6
	Porter	5.0	1,263.1	105.7	155.7	2,350.3
SO_2	Jasper	1.2	9.3	1.1	7.4	19,493.9
	Lake	1.6	51.7	6.9	50.0	24,339.8
	Newton	2.5	5.5	0.9	2.9	5.4
	Porter	0.6	36.9	3.8	19.7	16,458.6
VOC	Jasper	30.1	1,610.6	450.8	598.9	218.5
	Lake	41.0	4,743.4	2,627.0	3,134.3	5,785.6
	Newton	63.5	511.0	921.9	222.8	98.9
	Porter	12.7	2,084.4	2,285.7	1,218.0	686.5

Major Source Emissions Controls

The Northern Indiana Public Service Company (NIPSCO) – R.M. Schahfer Generating Station, outlined in Table 14 and located in Jasper County, contains four units. Currently, all units have ESPs to control PM emissions. NO_x emissions are controlled by OA and a SCR system on Unit 14, while low NO_x burner technology (dry bottom only) and OA control NO_x on Unit 15. Units 17 and 18 have flue gas desulfurization (FGD) systems to control SO_2 emissions. A selective non-catalytic reduction (SNCR) system was approved for construction on Unit 15 in 2011, with operation to begin by 2013, as well as dry sorbent injection (DSI) and FGD systems approved for construction on Units 14 and 15 in 2011 with operation to begin on Unit 14 by 2014 and Unit 15 by 2016. NIPSCO's consent decree agreement calls for the installation of the SNCR system and FGD systems, while the DSI system is proposed as part of the source's control strategy to comply with the new Mercury and Air Toxics Standards (MATS) rule. The installation of these systems will reduce approximately 80% of the source's NO_x emissions and approximately 90% of its SO_2 emissions. In addition, NIPSCO's proposed MATS compliance

[11] U.S. EPA 2011 National Emissions Inventory: http://www.epa.gov/ttnchie1/net/2011inventory.html

plan includes plans to upgrade the ESPs on Units 14, 15, 17, and 18 by retrofitting these systems with transformer rectifier sets to improve performance and increase efficiency.

Table 14: 2011 Indiana Portion of Chicago CBSA Individual Emissions Sources (Tons per Year)[12]

County	Site	CO	VOC	NO_x	SO_2	$PM_{2.5}$
Jasper	NIPSCO- R.M. Schahfer	1,108.7	161.0	7,366.6	19,352.2	746.5
Jasper	St. Joseph's College				141.2	
Lake	US Steel Co. Gary Works	83,741.2	1,167.7	4,313.5	4,201.8	1,528.7
Lake	Indiana Harbor East	60,874.1	1,123.1	4,812.7	2,873.8	526.5
Lake	Mittal Steel (ISG Indiana Harbor West)	12,039.9		1,600.7	860.0	710.8
Lake	State Line Energy LLC	465.2		7,004.7	8,044.0	412.0
Lake	Cokenergy Inc.				4,891.5	
Lake	BP Products North America Inc.	1,291.1	2,117.6	2,547.8	697.3	426.9
Lake	Indiana Harbor Coke Company	368.4		859.4	1,898.0	153.8
Lake	Carmeuse Lime Inc.	1,795.3		1,687.6	313.5	
Lake	ANR Pipeline – St. Johns Station	146.8		481.9		
Lake	Rhodia, Inc.				203.6	
Lake	W.R. Grace & Co.			182.3		
Lake	Citgo Petroleum Corp.		137.2			
Lake	Cargill, Inc.	131.5	130.4			
Lake	Ironside Energy LLC	122.3			118.0	
Lake	Whiting Clean Energy, Inc.			107.7		
Porter	ArcelorMittal Burns Harbor Inc.	85,024.3	496.8	8,289.3	13,842.8	2,065.0
Porter	NIPSCO-Bailly Station	312.2		1,974.5	2,560.4	187.3
Porter	NLMK Indiana	288.0				
Porter	US Steel Midwest Plant			121.9		

Commuting Patterns[13] and Vehicle Miles Traveled

Within Indiana's portion of the Chicago CBSA, the majority of people work in the same county[14] they live in, as shown in Table 15. Because of this, it is safe to assume that cross-county mobile sources (i.e., Porter to Lake) have very little to no impact on violations of the $PM_{2.5}$ standard in this area. Further, the largest percentage of out-of-county commuters can be

[12] U.S. EPA 2011 National Emissions Inventory: http://www.epa.gov/ttnchie1/net/2011inventory.html

[13] Data from this section has been averaged from 2007-2011.

[14] Stats Indiana: http://www.stats.indiana.edu/dms4/commuting.asp

found in Newton County (34.4%). The largest number of out-of-county commuters can be found in Lake County (roughly 54,000), the vast majority of which travel to Illinois for work. Indiana's portion of the Chicago CBSA workforce is particularly small when compared to that of Illinois[15] and only makes up 9.7% of the total workforce for the Chicago CBSA, whereas the Illinois portion makes up 89.3%. Indiana's portion is also responsible for only 8.3% of total out-of-county commuters, whereas counties in Illinois make up 90.2% of all out-of-county commuters, the majority of whom commute to other counties within Illinois.

Table 15: 2007-2011 Chicago CBSA Commuting Patterns

County	2007-2011 Average Total Workforce	Persons Who Live AND Work in County	Persons Who Live in County and Work in Another County	Percent Who Work In County	Percent Who Work Out of County
Jasper	21,601	16,153	5,448	74.8%	25.2%
Lake	297,599	243,601	53,998	81.9%	18.1%
Newton	9,487	6,228	3,259	65.6%	34.4%
Porter	106,985	76,105	30,881	71.1%	28.9%
Illinois' Portion	4,003,909	2,981,956	1,021,953	74.5%	25.5%
Wisconsin's Portion	44,633	26,979	17,654	60.4%	39.6%

There has been little significant change with regard to vehicle miles traveled[16] (VMT) from 2000 to 2011 within Indiana's portion of the Chicago CBSA, as outlined in Table 16. The largest increases have been in Porter County (29.1%) and Lake County (27.6%), by roughly 1.3 million and 3.5 million VMT, respectively. Jasper County has seen a very small increase (14.6%), while Newton County has seen a slight decrease (3.1%) in VMT. When compared to Illinois[17] counties within the Chicago CBSA, Indiana counties only make up roughly 12% of the VMT for the CBSA. Because there has been little change in both commuting patterns and VMT, yet monitored values have decreased, it can be assumed that they do not have a significant impact on monitored violations within the area.

Table 16: 2000 & 2011 Chicago CBSA Vehicle Miles Traveled

County	2000 Vehicle Miles Traveled	2011 Vehicle Miles Traveled	Percent Change	Percent of CBSA (2011)
Jasper	1,778,312	2,038,000	14.6%	1.0%
Lake	12,714,074	16,226,000	27.6%	8.1%
Newton	683,243	662,000	-3.1%	0.3%
Porter	4,586,307	5,920,000	29.1%	2.9%
Illinois' Portion	169,351,794	171,735,138	1.4%	85.6%
Wisconsin's Portion	3,903,300	4,131,658	5.9%	2.1%

[15] Data provided by the Northwestern Indiana Regional Planning Commission (NIRPC)
[16] Indiana Department of Transportation: http://www.in.gov/indot/2469.htm
17 Data provided by the Northwestern Indiana Regional Planning Commission (NIRPC)

Population and Density

In Indiana's portion of the Chicago CBSA, Lake County is the most populous[18], with almost 500,000 residents, as of the 2010 census, as illustrated in Table 17. Porter County, which has roughly one third the population of Lake County, is the next most populous county. Population growth trends from 2000 to 2010 show that Porter County has the largest percent growth (12%), while Jasper County has the second largest percent growth (11.4%). However, the large growth rate in Jasper County only accounts for an increase of roughly 3,000 residents over a ten-year period, and the large growth rate in Porter County accounts for around 17,000 residents. Though the growth rate of Lake County is small when compared to that of Porter or Jasper counties, Lake County gained roughly 11,000 residents over the ten-year period, an approximate 6,000-person difference from that of Porter County's increase and more than three times the size of the population increase in Jasper County. Indiana's portion of the Chicago CBSA makes up approximately 7.5% of the 2010 total Chicago CBSA population, while Illinois' portion is approximately 91% of the 2010 total population.

Table 17: 2000 & 2010 Chicago CBSA Population

County	Population 2000	Population 2010	Percent Change	Percent of CBSA (2010)
Jasper	30,043	33,478	11.4%	0.4%
Lake	484,564	496,005	2.4%	5.2%
Newton	14,566	14,244	-2.2%	0.2%
Porter	146,798	164,343	12.0%	1.7%
Illinois' Portion	8,117,053	8,586,609	5.8%	90.8%
Wisconsin's Portion	145,553	166,426	14.3%	1.8%

Lake County also has the largest population density[19] within Indiana's portion of the Chicago CBSA, at 994 people per square mile, as illustrated in Table 18. Porter County has the second highest population density (393.0), which is roughly 40% of the density in Lake County. Combined, Jasper and Newton counties have a population density (59.8 and 35.5, respectively) less than 10% of the population density of Lake County. Porter County experienced the highest percent growth from 2000 to 2010 (12.0%). Though Jasper County has the second highest percent growth (11.4%), its population density only increased slightly over the 10-year period. When combined, the population densities of Jasper, Porter, and Newton counties make up less than half of the population density of Lake County. Further, when compared to both Illinois and Wisconsin, Indiana's portion of the Chicago CBSA is only around 39% of total 2010 population density.

[18] U.S. Census Bureau: http://www.census.gov/popest/data/index.html

[19] U.S. Census Bureau: http://factfinder2.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=DEC_10_SF1_GCTPH1.ST05&prodType=tale

Table 18: 2000 & 2010 Chicago CBSA Population Density

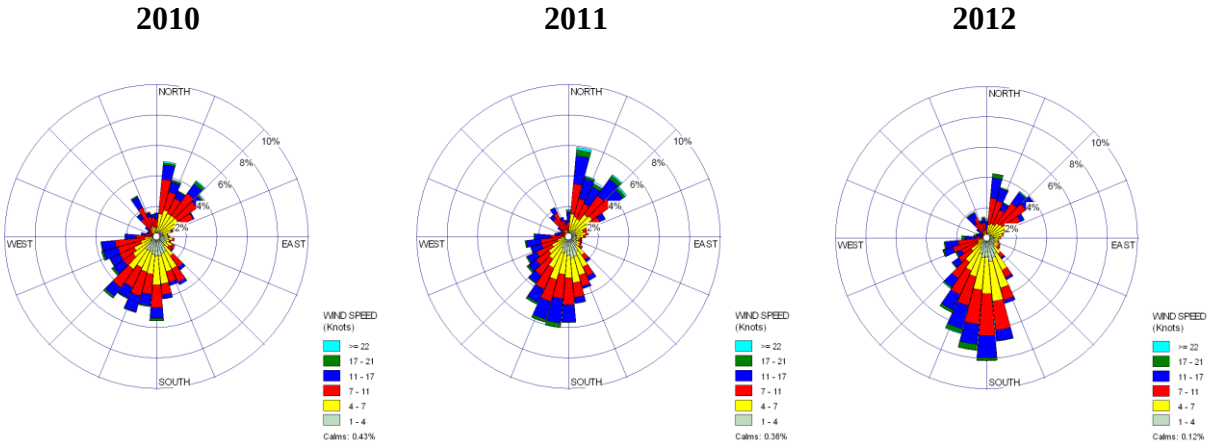
(People per Square Mile) County	Population Density 2000	Population Density 2010	Percent Change
Jasper	53.7	59.8	11.4%
Lake	971.1	994.1	2.4%
Newton	36.3	35.5	-2.2%
Porter	351.1	393.0	12.0%
Illinois' Portion	1,608.5	1,701.6	5.8%
Wisconsin's Portion	535.1	611.9	14.3%

4. Meteorology

Meteorology plays a key role in the development and transport of $PM_{2.5}$. Typically, higher $PM_{2.5}$ daily concentrations occur during episodes of stagnant weather conditions. Light wind speeds provide an environment for $PM_{2.5}$ pre-cursor emissions to react and enhance localized $PM_{2.5}$ development. Transport of $PM_{2.5}$ can also be aided by higher wind speeds from areas with large industrial sources of emissions or areas with higher background concentrations of $PM_{2.5}$.

The wind roses, below in Figure 8, show the directions from which the winds blew during 2010-2012 at the Gary-IITRI meteorological station. Wind direction data is listed as radial degrees in 10 degree increments. Prevailing winds at Gary-IITRI were from the south, northeast and southwest.

Figure 8: 2010-2012 Gary-IITRI Annual Wind Roses



An in-depth analysis on the wind roses on only the days when monitored daily $PM_{2.5}$ concentrations exceeded 30 $\mu g/m^3$ was conducted. Cumulative wind roses of all days that recorded higher $PM_{2.5}$ concentrations in Lake County for each year are shown below in Figure 9. Analysis of these wind roses showed more southeast and south winds were evident in 2010 while south and southwest winds were present on high $PM_{2.5}$ concentration days in 2011. 2012 had northwest, southwest, and southeast winds during the high $PM_{2.5}$ concentration days. A major

industrial source of $PM_{2.5}$ and $PM_{2.5}$ precursor emissions is situated to the northwest of the Gary-IITRI monitor. Therefore, strong northwest winds may cause this emission source to impact the monitor directly. With the proximity of the monitor to Lake Michigan, lake breezes are present, as evident with the increased frequency of winds from the northeast. The lake breezes may be responsible for transport of $PM_{2.5}$ and $PM_{2.5}$ precursor emissions from over the lake to the Gary-IITRI $PM_{2.5}$ monitor.

Figure 9: 2010-2012 Gary-IITRI Cumulative High Concentration Day Wind Roses

2010 **2011** **2012**

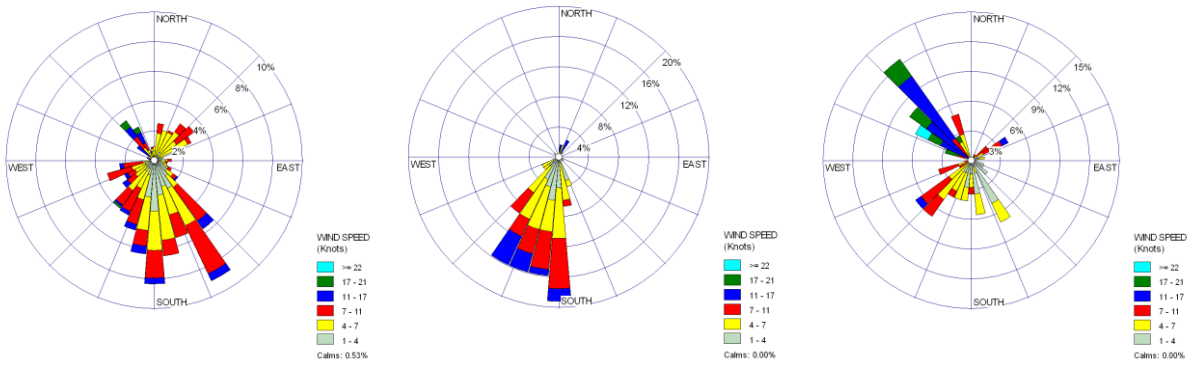


Table 19 shows the frequency of the hourly wind directions during 2010- 2012 when daily $PM_{2.5}$ concentrations were measured at 30.0 $\mu g/m^3$ or above. Wind directions from the south were most prevalent, with frequencies ranging between 17.4% and 56.7% during the three-year period. Southwest winds were evident between 15.2% and 20.8% of the time while winds blew from the northwest between 0.8% and 30.6%. West and east winds were the least prevalent, with those wind direction frequencies ranging between 0.0% and 7.1%.

Table 19: 2010-2012 Gary-IITRI Most Frequent Wind Directions on High $PM_{2.5}$ Concentration Days

2010		2011		2012	
Direction	**Frequency**	**Direction**	**Frequency**	**Direction**	**Frequency**
S	27.9%	S	56.7%	NW	30.6%
SE	20.5%	SW	35.0%	SW	20.8%
SW	15.2%	N	3.3%	S	17.4%
NE	12.6%	NE	3.3%	SE	11.1%
W	7.1%	SE	0.8%	NE	7.6%
NW	6.5%	NW	0.8%	W	5.6%
N	6.1%	E	0.0%	N	4.2%
E	3.7%	W	0.0%	E	2.8%

It should be noted that wind speed frequency data indicated there were lower wind speeds on days with higher daily $PM_{2.5}$ concentrations. Table 20 shows the frequencies of wind speed

ranges observed on the high daily $PM_{2.5}$ concentration days. Most days showed wind speed less than 11 knots (13 miles per hour) with some instances of higher $PM_{2.5}$ concentrations with winds as high as 22 knots (26 miles per hour). These instances may have resulted from impacts from a large emission source near the Gary-IITRI $PM_{2.5}$ monitor.

Table 20: 2010-2012 Gary-IITRI Most Frequent Range of Wind Speeds on High $PM_{2.5}$ Concentration Days

Wind Speed	2010	2011	2012
Calm	0%	0%	0%
1-4 knots	27.9%	26.7%	22.9%
4-7 knots	37.9%	39.2%	28.5%
7-11 knots	25.5%	21.7%	21.5%
11-17 knots	7.1%	12.5%	18.1%
17-22 knots	1.1%	0.0%	7.6%
>22 knots	0.0%	0.0%	1.4%

Results from the wind roses show the high $PM_{2.5}$ concentrations in Lake County could be attributed to more emissions from the industrial areas within the county due to the lower wind speeds observed. The impact on the Gary-IITRI $PM_{2.5}$ monitor from the higher wind speeds blowing from the northwest can be attributed to a major industrial emission source located to the northwest as well as the Chicago metropolitan area. This meteorological analysis does not suggest that emissions from Porter County would have a significant impact on $PM_{2.5}$ concentrations measured in Lake County.

5. Geography and Topography

The most notable geographical or topographical feature within Indiana's portion of the Chicago CBSA is Lake Michigan. This large body of water can potentially influence the formation and distribution of pollutants in the region. One such example is the formation of ozone over the lake and the onshore transport of that ozone-laden air by a circulation known as a "lake breeze." A "lake breeze" is a thermodynamically-driven circulation that is produced when temperature gradients form between warmer air over land and cooler air over the water. The resulting pressure gradient produces an onshore flow of air from the lake. These circulations typically occur during the late spring and summer months and are generally most effective when there is weak synoptic flow. While this phenomenon is typically associated with ozone, and is commonly seen in monitored values across the region, it is not usually associated with particulate matter. As such, Lake Michigan and its effects were not a factor in determining nonattainment boundary recommendations.

6. Conclusion and Recommendation

Based on the above analysis, IDEM recommends that both Lake and Porter counties in Indiana's portion of the Chicago CBSA be recommended as attainment and both Jasper and Newton counties be designated as unclassifiable, as illustrated in Table 21 below. The only

monitored violation within Indiana's portion of the Chicago CBSA can be found in Lake County, and IDEM's analysis shows that, at the date of this enclosure, the area will have a 2011-2013 design value below the 2012 standard. Porter County has a 2010-2012 design value below the standard and that number is expected to continue decreasing. Though Jasper, Lake, and Porter counties have major stationary sources, their emissions are overshadowed by the much larger core portion of the Chicago CBSA. Emissions from Jasper County are expected to be greatly reduced as the major stationary source located there installs control technologies. The wind rose analysis showed a primarily northwest wind direction, meaning that impacts on the violating monitor can largely be attributed to sources in the Chicago metropolitan area. Further, the second most frequent wind direction, a southwest wind, indicates that emissions from Lake and Porter counties would most likely contribute to the monitor in nearby LaPorte County (180910011—Michigan City) rather than monitors in the Chicago area, yet the Michigan City monitor has a 2010-2012 design value below the current standard. Including either Lake or Porter counties in the nonattainment area would not advance the attainment date of the area, because Lake County is projected to attain the standard by the close of 2013 and Porter County does not contribute to the current monitored violation in Lake County, as shown in the wind rose analysis. Both Jasper and Newton counties contribute very little in terms of emissions, commuting patterns, VMT, and population and should not be included in the nonattainment area. Therefore, IDEM recommends that Lake and Porter counties be designated as attainment, while Jasper and Newton counties be designated as unclassifiable. These recommendations are based on the best available information at the time of this submittal, including a probability evaluation to determine the likelihood of counties to attain the standard by the close of 2013, provided that trends continue downward.

Table 21: IDEM Recommendation for Indiana Portion of Chicago CBSA

County	Recommendation
Jasper	Unclassifiable
Lake	Attainment
Newton	Unclassifiable
Porter	Attainment

Cincinnati CBSA:

1. Jurisdictional Boundaries

Dearborn, Ohio, and Union counties make up Indiana's portion of the Cincinnati CBSA, as of the 2013 delineations. Five counties in Ohio and seven counties in Kentucky make up the rest of the Cincinnati CBSA. The Ohio-Kentucky-Indiana Regional Council of Governments (OKI), which functions as the MPO for the Cincinnati area, includes Dearborn County.

Within Indiana's portion of the Cincinnati CBSA, a portion of Dearborn County (Lawrenceburg Township) was designated as nonattainment under the 1997 $PM_{2.5}$ annual standard. A Redesignation and Maintenance Plan was approved by U.S. EPA and became effective on December 23, 2011.

2. Air Quality Data

Monitoring Data

There are no $PM_{2.5}$ monitors located within Indiana's portion of the Cincinnati CBSA.

3. Emissions and Emissions-Related Data

Emissions Data

Within the Cincinnati CBSA, counties in both Ohio and Kentucky produce an overwhelming majority of the $PM_{2.5}$ precursor pollutants[20], as illustrated in Figure 10 below. For CO emissions, Ohio's portion of the CBSA is responsible for the vast majority of all emissions (77%), while counties in Kentucky emit 19%, and counties in Indiana produce 4% of total emissions. Ohio's portion of the Cincinnati CBSA contributes 62% of all NH_3 emissions, while Kentucky emits 23% and Indiana counties are responsible for 15% of emissions. Combined, Ohio and Kentucky's portions of the CBSA are responsible for 92% of all NO_x emissions, while Dearborn County is only responsible for 8% of emissions and both Ohio and Union counties contribute insignificant amounts. Ohio's portion of the CBSA is also responsible for 79% of all direct $PM_{2.5}$ emissions, while Kentucky and Indiana's portions contribute very little in comparison (14% and 7%, respectively). For SO_2, counties in Ohio produce 82% of emissions, while Dearborn County produces 16% of emissions. Counties within Ohio and Kentucky's portion of the Cincinnati CBSA are responsible for 94% of all VOC emissions, while Dearborn County is responsible for 6% of total VOC emissions. Overall, when compared to the rest of the Cincinnati CBSA, counties in Indiana are responsible for significantly less emissions than the contributions from both Ohio and Kentucky.

[20] U.S. EPA $PM_{2.5}$ Mapping Tool Datasets: http://www.epa.gov/pmdesignations/2012standards/techinfo.htm

Figure 10: 2011 Cincinnati CBSA Emissions by Pollutant

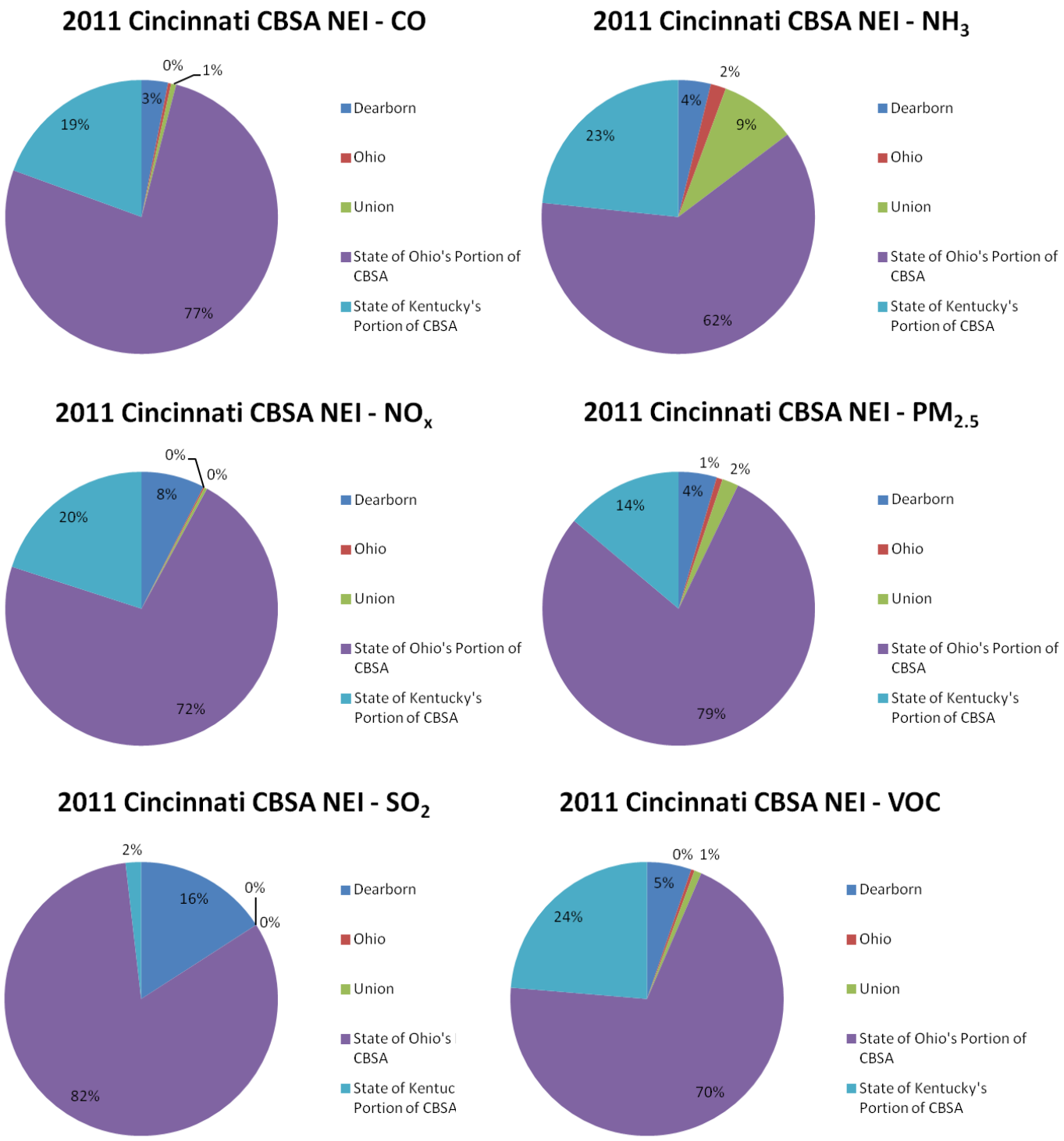


Table 22: 2011 Indiana Portion of Cincinnati CBSA NEI source Categories by Pollutant (Tons per Year)[21]

Pollutant	County	Fire	Nonpoint	Nonroad	Onroad	Point
CO	Dearborn	614.9	1,640.1	1,578.4	6,731.3	873.8
	Ohio	196.2	273.2	223.6	667.8	0.6
	Union		290.5	899.5	999.6	0.6
NH_3	Dearborn	10.1	109.4	0.3	26.6	28.3
	Ohio	3.2	76.6	<0.1	2.7	
	Union		408.2	0.2	4.0	
NO_x	Dearborn	6.6	173.7	196.3	1,461.7	6,530.6
	Ohio	2.8	24.1	28.8	120.8	<0.1
	Union		56.8	135.4	176.6	<0.1
$PM_{2.5}$	Dearborn	51.7	724.4	16.3	48.4	187.1
	Ohio	17.0	139.2	2.5	4.1	<0.1
	Union		423.6	15.2	6.0	<0.1
SO_2	Dearborn	4.1	21.3	0.5	7.1	28,287.1
	Ohio	1.5	3.8	0.1	0.7	<0.1
	Union		8.3	0.3	1.0	<0.1
VOC	Dearborn	144.6	700.1	152.5	570.6	1,573.3
	Ohio	46.3	110.9	30.6	56.1	<0.1
	Union		211.1	218.3	83.6	<0.1

Major Source Emissions Controls

The American Electric Power (AEP) -Tanner's Creek Generating Station power plant, outlined in Table 18 and located in Dearborn County, currently operates four coal-fired units. Currently, the power plant is controlled by ESPs and low NO_x burner technology (dry bottom only) with OA on all four of units. The installation of SNCR systems on three of the four units was agreed to in a consent decree and approved for construction in 2008. However, AEP has announced plans to retire all coal fired units at this facility by mid-2015, eliminating all PM and precursor emissions from the facility.

[21] U.S. EPA 2011 National Emissions Inventory: http://www.epa.gov/ttnchie1/net/2011inventory.html

Table 23: 2011 Indiana Portion of Cincinnati CBSA Individual Emissions Sources (Tons per Year)[22]

County	Site	CO	VOC	NO_x	SO_2	$PM_{2.5}$
Dearborn	AEP-Tanner's Creek	508.8		5,367.4	27,331.5	
Dearborn	Lawrenceburg Distillers Indiana, LLC		961.2	536.4	784.6	
Dearborn	Aurora Casket Company, Inc.		496.5			
Dearborn	Anchor Glass Container Corp.			295.6	162.1	
Dearborn	PSEG Lawrenceburg Energy Company, Inc.	204.4		169.2		
Dearborn	Texas Gas Transmission LLC	132.3		158.4		

Commuting Patterns[23] and Vehicle Miles Traveled

In Indiana's portion of the Cincinnati CBSA, the majority of residents work in the county[24] where they live, as outlined in Table 24. Though the percentage of out-of-county commuters for each county seems substantial, the actual number of people who live in one county and work in another is small. For instance, the highest percentage of out-of-county commuters is in Union County (43.5%), but that consists of fewer than 2,000 people, the majority of whom commute to the state of Ohio. In Ohio County, just over 2,100 residents commute to other counties for work, primarily to Dearborn County. In comparison to both Kentucky and Ohio[25], Indiana counties within the Cincinnati CBSA account for only 4.3% of both the total workforce and total out-of-county commuters for 2007-2011.

Table 24: 2007-2011 Cincinnati CBSA Commuting Patterns

County	2007-2011 Average Total Workforce	Persons Who Live AND Work in County	Persons Who Live in County and Work in Another County	Percent Who Work In County	Percent Who Work Out of County
Dearborn	34,394	20,876	13,518	60.7%	39.3%
Ohio	4,961	2,814	2,147	56.7%	43.3%
Union	4,198	2,372	1,826	56.5%	43.5%
Kentucky's Portion	204,732	87,413	117,319	42.7%	57.3%
Ohio's Portion	758,295	491,512	266,783	64.8%	35.2%

[22] U.S. EPA 2011 National Emissions Inventory: http://www.epa.gov/ttnchie1/net/2011inventory.html
[23] Data from this section has been averaged from 2007-2011.
[24] Stats Indiana: http://www.stats.indiana.edu/dms4/commuting.asp
[25] Data provided by the Ohio Kentucky Indiana Regional Council of Governments (OKI)

Within Indiana's portion of the Cincinnati CBSA, Dearborn County is the only county with an increase in daily vehicle miles traveled[26] (VMT) from 2000 to 2011, as illustrated in Table 25. Both Ohio and Union counties experienced moderate decreases (27.3% and 13.8%, respectively) in VMT. Compared to counties in both Kentucky and Ohio[27] within the Cincinnati CBSA, Indiana's portion has significantly less VMT and only makes up 3.7% of the total VMT for the area. In Indiana's portion of the Cincinnati CBSA, commuting patterns and VMT are very small when compared to portions from Kentucky and Ohio and do not have a significant enough impact on potential monitored violations to be considered when making nonattainment designation determinations.

Table 25: 2000 & 2010 Cincinnati CBSA Vehicle Miles Traveled

County	2000 Vehicle Miles Traveled	2011 Vehicle Miles Traveled	Percent Change	Percent of CBSA (2010)
Dearborn	1,653,577	1,847,000	11.7%	3.2%
Ohio	166,461	121,000	-27.3%	0.2%
Union	237,742	205,000	-13.8%	0.4%
Kentucky's Portion	15,508,863	14,243,357	-8.2%	24.5%
Ohio's Portion	45,564,830	41,802,904	-8.3%	71.8%

Population and Density

Dearborn County remains the most populous[28] within Indiana's portion of the Cincinnati CBSA, with a 2010 population of just over 50,000, as illustrated in Table 26. In comparison, Ohio and Union counties are very small in population and can be considered rural. All three counties experienced modest growth from 2000 to 2010, with Ohio County having the largest percent growth (9%), though it only accounts for roughly 500 people. Dearborn County had the second highest growth rate (8.5%), adding almost 4,000 residents. The population of all three counties combined only makes up roughly 3% of the total population of the Cincinnati CBSA.

Table 26: 2000 & 2010 Cincinnati CBSA Population

County	Population 2000	Population 2010	Percent Change	Percent of CBSA (2010)
Dearborn	46,109	50,047	8.5%	2.4%
Ohio	5,623	6,128	9.0%	0.3%
Union	7,349	7,516	2.3%	0.4%
Kentucky's Portion	373,981	426,366	14.0%	20.1%
Ohio's Portion	1,518,232	1,626,743	7.1%	76.8%

As outlined in Table 27, within Indiana's portion of the Cincinnati CBSA, Dearborn County has the highest population density[29] (164.1 people per square mile). Ohio and Union

[26] Indiana Department of Transportation: http://www.in.gov/indot/2469.htm
[27] Data provided by the Ohio Kentucky Indiana Regional Council of Governments (OKI)
[28] U.S. Census Bureau: http://www.census.gov/popest/data/index.html
[29] U.S. Census Bureau: http://factfinder2.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=DEC_10_SF1_GCTPH1.ST05&prodType=table

counties are very small in comparison, and each has population densities that are less than 50% of Dearborn County. Though Ohio County has the highest percent growth (9.0%), followed closely by Dearborn County (8.5%), the actual increase was roughly 6 people per square mile. Compared to the rest of the Cincinnati CBSA, Indiana's portion is relatively small in both population and density.

Table 27: 2000 & 2010 Cincinnati CBSA Population Density

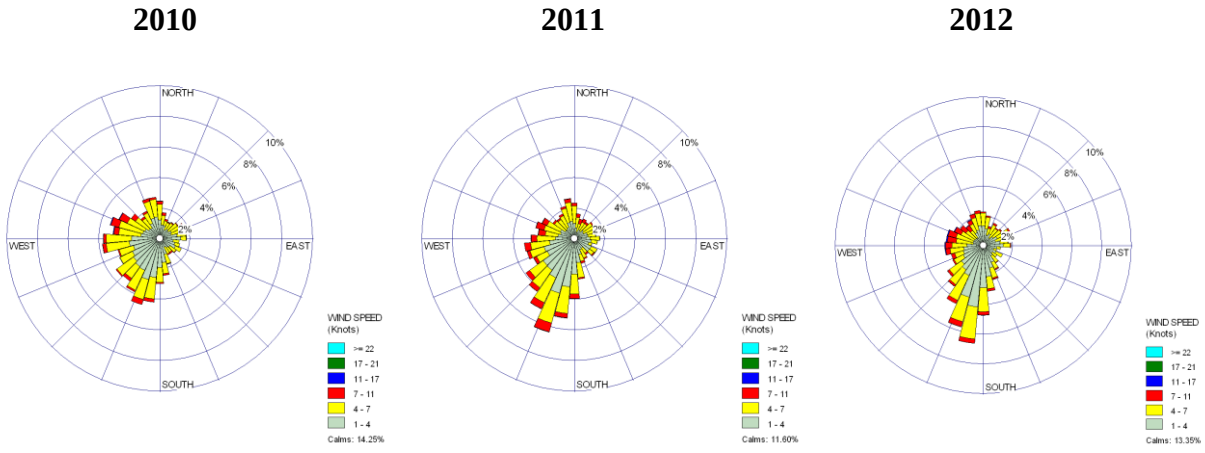
(People per Square Mile) County	Population Density 2000	Population Density 2010	Percent Change
Dearborn	151.2	164.1	8.5%
Ohio	65.3	71.1	9.0%
Union	45.6	46.6	2.3%
Kentucky's Portion	267.2	304.6	14.0%
Ohio's Portion	685.0	734.0	7.1%

4. Meteorology

Meteorology plays a key role in the development and transport of $PM_{2.5}$. Typically, higher $PM_{2.5}$ daily concentrations occur during episodes of stagnant weather conditions. Light wind speeds provide an environment for $PM_{2.5}$ pre-cursor emissions to react and enhance localized $PM_{2.5}$ development. Transport of $PM_{2.5}$ can also be aided by higher wind speeds from areas with large industrial sources of emissions or areas with higher background concentrations of $PM_{2.5}$.

The annual wind rose, below in Figure 11, shows the wind directions as recorded at the Greater Cincinnati Regional Airport. Prevailing winds are from the southwest, west and south.

Figure 11: 2010-2012 Cincinnati Annual Wind Rose



An in-depth analysis at the wind roses on only the days when monitored daily $PM_{2.5}$ concentrations exceeded 30 micrograms per cubic meter ($\mu g/m^3$) was conducted. Cumulative wind roses of all days that recorded higher $PM_{2.5}$ concentrations in the Cincinnati CBSA for 2010 and 2011 are shown below in Figure 12. Analysis of these wind roses showed more

southwest, southeast and south winds were evident. Calm conditions, or hours when there was no recorded wind direction or wind speed was evident over 40% of the time on the high $PM_{2.5}$ concentration days in 2010 and 2011. There were no days that recorded $PM_{2.5}$ concentrations at 30 µg/m^3 or above in 2012.

Figure 12: 2010-2011 Cincinnati Cumulative High Concentration Day Wind Roses

2010 **2011**

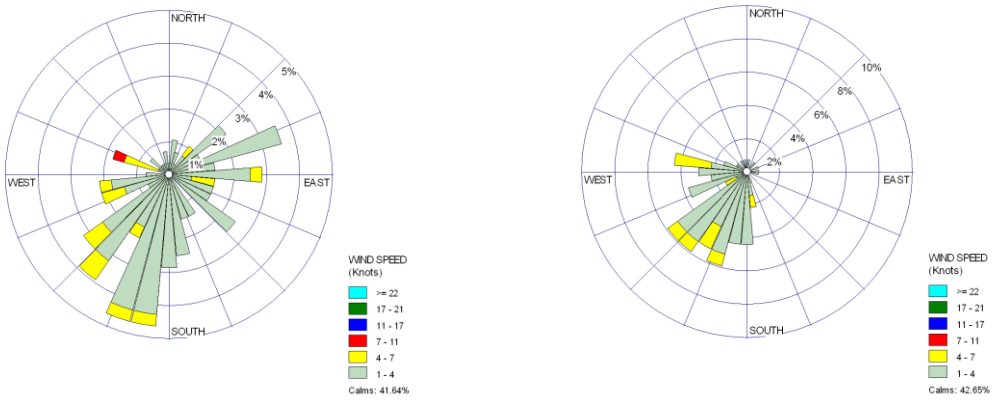


Table 28 shows the frequency of the hourly wind directions during 2010 and 2011 when daily $PM_{2.5}$ concentrations were measured at 30.0 µg/m^3 or above. Wind directions from the southwest were most prevalent, with the frequency between 11.4% and 22.8% during 2010 and 2011. South winds were evident between 14.9% and 15.4% of the time while winds blew from the west 5.7% and 11.8%. Northwest and north winds were the least prevalent, with those wind direction frequencies ranging between 1.5% and 3.2% on the high $PM_{2.5}$ concentration days in 2010 and 2011.

Table 28: Ranking of Most Frequent Wind Directions on High $PM_{2.5}$ Concentration Days

2010		2011	
Direction	**Frequency**	**Direction**	**Frequency**
S	14.9%	SW	22.8%
SW	11.4%	S	15.4%
E	10.3%	W	11.8%
SE	5.7%	E	2.2%
W	5.7%	NW	2.2%
NE	5.0%	N	1.5%
N	3.2%	NE	0.7%
NW	2.1%	SE	0.7%

It should be noted that wind speed frequency data indicated there were lower wind speeds on days with higher daily $PM_{2.5}$ concentrations. Table 29 shows the frequencies of wind speed ranges observed on the high daily $PM_{2.5}$ concentration days in 2010 and 2011. Most days

showed wind speed less than 4 knots (5 miles per hour) with calms conditions present 42% to 43% of the time during the higher $PM_{2.5}$ concentration days. This would indicate more localized impacts on the Cincinnati $PM_{2.5}$ monitors.

Table 29: Ranking of Most Frequent Range of Wind Speeds on High $PM_{2.5}$ Concentration Days

Wind Speed	2010	2011
Calm	42%	43%
1-4 knots	52.0%	50.0%
4-7 knots	6.1%	7.4%
7-11 knots	0.4%	0.0%
11-17 knots	0.0%	0.0%
17-22 knots	0.0%	0.0%
>22 knots	0.0%	0.0%

5. Geography and Topography

There are no geographical or topographical features within Indiana's portion of the Cincinnati CBSA that would have an impact on air quality or potential transport; therefore, this factor was not significant when making nonattainment recommendations.

6. Conclusion and Recommendation

Based on the above analysis, IDEM recommends that all counties within Indiana's portion of the Cincinnati CBSA are designated as unclassifiable, as shown in Table 30 below. There are no monitors within this area, and emissions overwhelmingly come from both Ohio and Kentucky's portions of the CBSA. Emissions from within Indiana's portion of the CBSA mainly come from Dearborn County but overall are very small in comparison to the core portion of the CBSA. In Dearborn County, controls were put into place in 2010 that have resulted in much lower levels of emissions, and AEP has announced plans to close all coal fired units at its Tanner's Creek station by mid-2015, eliminating the vast majority of emissions from the county. Further, as shown in VMT and population data, these counties are growing at such a small rate, and in some instances declining, that they do not warrant consideration for a designation of nonattainment. Also, largely south and southwest wind directions, as well as calmer wind speeds, on days with higher amounts of $PM_{2.5}$ indicate more localized impacts on the Cincinnati $PM_{2.5}$ monitors, as shown in the wind rose analysis. Including any county from Indiana's portion of the Cincinnati CBSA would not advance the attainment date of the CBSA and would only hinder any economic development in the area. Therefore, IDEM recommends that Dearborn, Ohio, and Union counties are all designated as unclassifiable.

Table 30: IDEM Recommendation for Indiana Portion of Cincinnati CBSA

County	Recommendation
Dearborn	Unclassifiable
Ohio	Unclassifiable
Union	Unclassifiable

Louisville CBSA:

1. Jurisdictional Boundaries

Indiana's portion of the Louisville CBSA consists of Clark, Floyd, Harrison, Scott, and Washington counties, in addition to nine counties that make up Kentucky's portion. The Kentuckiana Regional Planning and Development Agency (KIPDA) functions as the MPO for the Louisville area and includes both Clark and Floyd counties.

Clark and Floyd counties, as well as a portion of nearby Jefferson County (Madison Township), were designated as nonattainment under the 1997 annual $PM_{2.5}$ standard. A Redesignation Request and Maintenance Plan for the area has been submitted by IDEM and approval is pending at the time of this submittal. Due to the inclusion of Madison Township within the previous nonattainment boundary, Jefferson County, Indiana, has been included in this analysis.

2. Air Quality Data

Monitoring Data

As illustrated in Table 31 below, there are three $PM_{2.5}$ monitors[30] located within Indiana's portion of the Louisville CBSA—two in Clark County and one in Floyd County. The only monitored violation is at the Jeffersonville – Walnut St. monitor (180190006), in Clark County. The monitor located in Floyd County (180431004—New Albany) has a 2010-2012 design value below the standard. No other area within Indiana's portion of the Louisville CBSA has a $PM_{2.5}$ monitor.

[30] IDEM: http://www.in.gov/idem/airquality/2489.htm

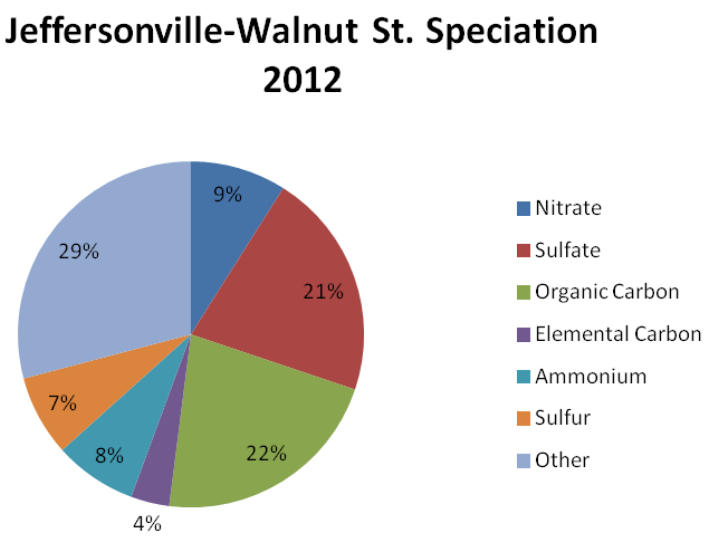
Table 31: 2000-2013 Indiana Portion of Louisville CBSA Monitored Values

County	Monitor ID	Site	Three Year Design Values (µg/m^3) 00-02	01-03	02-04	03-05	04-06	05-07
Clark	180190008	Charlestown St. Park						
Clark	180190005	Jeffersonville-Spring St.	17.2	15.8				
Clark	18019005/6	Jeffersonville Combined (Spring St. & Walnut St.)		16.2	15.6	16.5		
Clark	180190006	Jeffersonville-Walnut St.		19.1	17.1	17.6	16.2	16.6
Floyd	180431004	New Albany	15.5	14.9	14.2	14.9	14.6	14.9

County	Monitor ID	Site	Three Year Design Values (µg/m^3) 06-08	07-09	08-10	09-11	10-12	11-13*
Clark	180190008	Charlestown St. Park	13.4	12.1	12.2	11.4	11.0	10.2
Clark	180190005	Jeffersonville-Spring St.						
Clark	18019005/6	Jeffersonville Combined (Spring St. & Walnut St.)						
Clark	180190006	Jeffersonville-Walnut St.	15.3	14.6	14.1	13.5	13.2	12.1
Floyd	180431004	New Albany	13.6	13.1	12.8	12.3	11.8	10.8

Highlighted data represents monitors with a 2010-2012 design value above the annual standard of 12.0µg/m^3, effective March 18, 2013.
**2013 monitoring data is only available through September 30, 2013 and has not been certified.*

Figure 13: 2012 Speciation



Speciation Data

As shown in Figure 13 above, the Jeffersonville-Walnut St. speciation monitor (180190006) measures higher levels of OC and sulfate, while nitrate and EC levels are all relatively low. In comparison to the other speciation monitors within Indiana, the Jeffersonville-Walnut St. measures higher levels of sulfate, organic carbon, and sulfur, though overall trends are the same as other speciation monitors within Indiana, as shown in Figure 2.

3. Emissions and Emissions-Related Data

Emissions Data

Kentucky's portion of the Louisville CBSA is responsible for the vast majority of emissions[31] of NO_x, VOC, and NH_3, as illustrated in Figure 14 below. For CO, Kentucky's portion of the CBSA is responsible for 72% of all emissions, whereas Clark County emits 9%. Counties within Kentucky produce the majority of NH_3 emissions (47%), while Harrison County is responsible for 19%. For NO_x, counties within Kentucky are responsible for 70% of emissions, whereas the largest amount of NO_x emissions in Indiana comes from Jefferson County (16%). Kentucky's portion of the CBSA also emits the most direct $PM_{2.5}$ for the CBSA (68%), while Clark County is responsible for 8% of emissions. Jefferson County contributes the highest amount of SO_2 emissions (61%), while Kentucky's portion of the CBSA emits 35%. With regard to VOC, Kentucky is again responsible for the largest amount of emissions (81%) while the contribution from Indiana's portion is much smaller (19%). With the exception of SO_2, Kentucky's portion of the CBSA is responsible for the majority of all emissions.

[31] U.S. EPA $PM_{2.5}$ Mapping Tool Datasets: http://www.epa.gov/pmdesignations/2012standards/techinfo.htm

Figure 14: 2011 Louisville CBSA Emissions by Pollutant

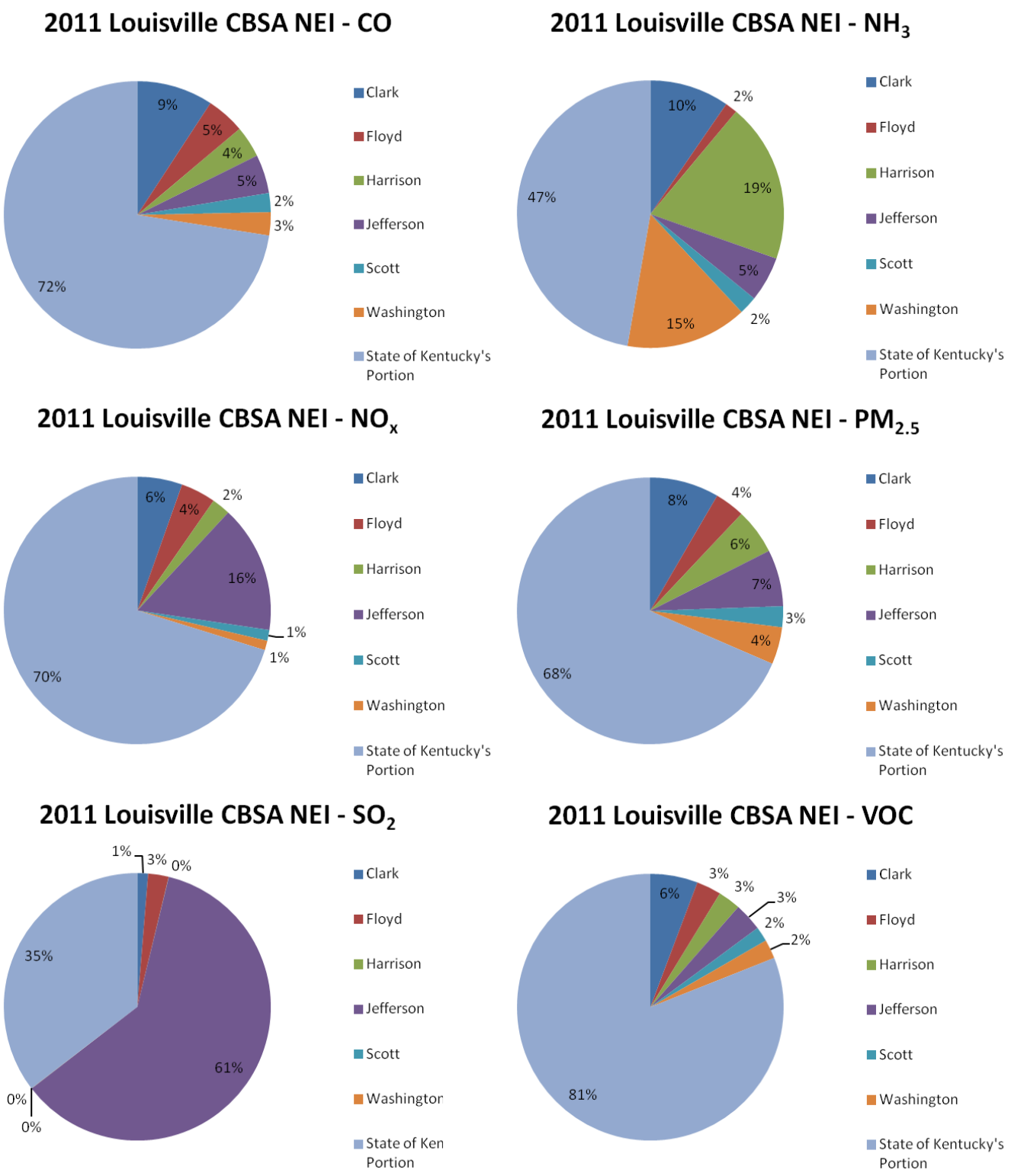


Table 32: 2011 Indiana Portion of Louisville CBSA NEI Source Categories by Pollutant (Tons per Year)[32]

Pollutant	County	Fire	Nonpoint	Nonroad	Onroad	Point
CO	Clark	179.2	2,015.5	3,822.6	9,034.6	4,588.2
	Floyd	120.7	1,393.7	3,164.0	5,109.4	96.7
	Harrison	631.6	1,756.1	1,096.4	4,603.3	9.9
	Jefferson	3,356.0	852.9	1,585.6	3,053.5	1,117.3
	Scott	114.9	672.1	904.4	3,203.6	5.9
	Washington	1,124.8	1,123.5	779.3	2,879.1	34.5
NH_3	Clark	3.0	774.7	0.6	44.6	0.8
	Floyd	2.0	98.4	0.5	25.0	0.5
	Harrison	10.3	1,619.7	0.3	23.0	
	Jefferson	55.2	398.0	0.3	12.1	2.5
	Scott	1.9	174.0	0.2	12.7	0.1
	Washington	18.4	1,229.7	0.2	11.5	<0.1
NO_x	Clark	4.3	340.6	470.0	2,143.3	1,231.1
	Floyd	2.9	289.2	426.8	1,191.0	1,344.4
	Harrison	7.4	408.6	235.5	1,059.4	7.5
	Jefferson	50.6	89.1	227.8	544.9	10,939.2
	Scott	2.6	65.0	140.8	792.9	3.1
	Washington	12.2	129.1	228.2	512.4	3.0
$PM_{2.5}$	Clark	16.9	850.5	40.9	85.4	420.8
	Floyd	11.4	502.5	34.4	49.8	11.8
	Harrison	4.9	1,546.5	187.9	176.4	24.4
	Jefferson	293.0	540.2	20.1	19.4	282.0
	Scott	10.7	373.0	12.9	29.6	0.3
	Washington	94.6	626.5	18.1	17.6	2.2
SO_2	Clark	1.9	15.7	1.3	12.2	1,546.1
	Floyd	1.3	8.2	1.2	7.0	3,009.7
	Harrison	4.4	16.3	0.6	5.8	0.1
	Jefferson	26.7	8.5	0.6	3.3	74,086.1
	Scott	1.2	6.7	0.4	3.6	<0.1
	Washington	7.5	11.8	0.6	3.0	0.3
VOC	Clark	42.8	1,431.7	441.9	755.8	622.9
	Floyd	28.8	995.6	242.9	438.3	11.4
	Harrison	148.7	843.2	132.1	372.8	200.9
	Jefferson	793.1	612.8	202.3	258.0	87.0
	Scott	27.4	454.6	147.2	277.4	124.2
	Washington	264.5	607.0	83.3	242.0	123.7

[32] U.S. EPA 2011 National Emissions Inventory: http://www.epa.gov/ttnchie1/net/2011inventory.html

Major Source Emissions Controls

The only power plant located in Floyd County, as outlined in Table 33, is the Duke Energy Indiana-Gallagher Generating Station, which has operated four coal-fired units. Two of four EGUs, Boiler 2 and Boiler 4, remain in operation at this time. The other two units, Boiler 1 and Boiler 3, were retired as a result of a consent decree. The official retirement date for these units was February 1, 2012. Baghouses are used to control PM emissions and low NO_x burners with OA are used to control NO_x emissions from these units. DSI systems with activated carbon injection (ACI) were installed in 2011. The DSI systems reduced SO_2 emissions over 70%.

Jefferson County also has one power plant. The Clifty Creek Generating Station is owned and operated by the Indiana-Kentucky Electric Corporation. This power plant contains six units, five of which are controlled by ESPs for PM emissions control, OA and SCR systems for NOx emissions control, and DSI (Trona) systems, approved for construction in 2008, for SO_2 emissions control. The sixth unit has an ESP and OA, as well; however, it is not equipped with a SCR system. FGD systems, approved for construction in 2008, were completed and placed into service in the first and second quarters of this year (2013). With the installation of the new DSI and FGD systems complete, NO_x emissions from the power plant will be reduced by approximately 50% and SO_2 emissions will be reduced by approximately 90%.

Table 33: 2011 Indiana Portion of Louisville CBSA Individual Emissions Sources (Tons per Year)[33]

County	Site	CO	VOC	NO_x	SO_2	$PM_{2.5}$
Clark	Essroc Cement Corp.	4,360.2		1,152.5	1,544.6	217.3
Clark	Kitchen Kompact Inc.		362.7			
Clark	Jeffboat LLC		116.3			171.7
Floyd	Duke Energy Indiana-Gallagher			1,344.4	3,009.7	
Harrison	Daramic, LLC		193.5			
Jefferson	IKEC-Clifty Creek Station	1,063.5		10,938.2	74,085.9	280.8
Scott	Genpak LLC		105.4			
Washington	Kimball Office-Salem		123.0			

Commuting Patterns[34] and Vehicle Miles Traveled

In Indiana's portion of the Louisville CBSA, a large majority of residents work in the county[35] where they live, as illustrated in Table 34. The highest percentage of out-of-county commuters is in Floyd County (40.5%) followed by Harrison (37.8%) and Clark (34.7%) counties. The majority of people who work outside of Floyd, Harrison, or Clark counties commute to Kentucky for work. Within the Louisville CBSA, Indiana counties make up 29.7% of the total workforce, whereas Kentucky counties[36] make up the remaining 70.3%. Indiana counties also make up 38.2% of total out-of-county commuters, whereas Kentucky counties

[33] U.S. EPA 2011 National Emissions Inventory: http://www.epa.gov/ttnchie1/net/2011inventory.html
[34] Data from this section has been averaged from 2006-2010.
[35] Stats Indiana: http://www.stats.indiana.edu/dms4/commuting.asp
[36] Data provided by the Kentuckiana Regional Planning & Development Agency (KIPDA)

make up 61.8% of all out-of-county commuters, most of whom travel to other counties within Kentucky.

Table 34: 2006-2010 Louisville CBSA Commuting Patterns

County	2006-2010 Average Total Workforce	Persons Who Live AND Work in County	Persons Who Live in County and Work in Another County	Percent Who Work In County	Percent Who Work Out of County
Clark	69,311	45,229	24,083	65.3%	34.7%
Floyd	49,047	29,159	19,888	59.5%	40.5%
Harrison	25,958	16,157	9,801	62.2%	37.8%
Jefferson	21,129	18,226	2,904	86.3%	13.7%
Scott	15,057	10,938	4,119	72.6%	27.4%
Washington	17,655	11,938	5,717	67.6%	32.4%
Kentucky's Portion	469,058	361,663	107,395	77.1%	22.9%

On the whole, Indiana's portion of the Louisville CBSA has seen very little change from 2000 to 2011 with regard to vehicle miles traveled[37] (VMT), as shown in Table 35. Floyd County remains the only county that has experienced a significant increase (22.5%) of just over 500,000 VMT, yet that still is only 6.1% of total VMT for the entire CBSA. Washington County has seen the largest decrease in VMT (15.5%). Due to the fact that there has been little change in both commuting patterns and VMT, yet monitored values show a downward trend, it can be assumed that both have very little, if any, effect on any monitored violations within the area. As a whole, Indiana counties make up approximately 23.1% of 2011 VMT for the Louisville CBSA, whereas Kentucky[38] counties are responsible for a much larger portion (76.9%). In terms of out-of-county commuters and VMT, Indiana's portion of the Louisville CBSA is much smaller than Kentucky's portion.

Table 35: 2000 & 2011 Louisville CBSA Vehicle Miles Traveled

County	2000 Vehicle Miles Traveled	2011 Vehicle Miles Traveled	Percent Change	Percent of CBSA (2010)
Clark	3,800,574	3,920,000	3.1%	8.6%
Floyd	2,291,900	2,808,000	22.5%	6.1%
Harrison	1,298,585	1,338,000	3.0%	2.9%
Jefferson	836,275	844,000	0.9%	1.8%
Scott	920,611	883,000	-4.1%	1.9%
Washington	893,721	755,000	-15.5%	1.7%
Kentucky's Portion	33,121,000	35,143,000	6.1%	76.9%

[37] Indiana Department of Transportation: http://www.in.gov/indot/2469.htm
[38] Data provided by the Kentuckiana Regional Planning & Development Agency (KIPDA)

Population and Density

In Indiana's portion of the Louisville CBSA, Clark and Floyd counties remain the most populous[39], with a combined population of roughly 185,000, as illustrated in Table 36. Clark County accounts for around 36% of Indiana's portion of the Louisville CBSA while Floyd County has roughly 24% of Indiana's portion. Harrison, Jefferson, Scott, and Washington counties each have populations below 40,000 and are much more representative of rural counties. Though Harrison County had the largest percent growth (14.7%), this only accounts for roughly 5,000 residents, whereas Clark County, which had the second highest growth rate (14.3%), saw an increase of approximately 14,000 residents. All counties within Indiana's portion of the Louisville CBSA displayed a marginal growth rate from 2000 to 2010, and this trend is projected to continue. Further, Indiana's portion of the Louisville CBSA only makes up 23.1% of the total population, whereas counties within Kentucky's portion make up the remaining 76.9%.

Table 36: 2000 & 2010 Louisville CBSA Population

County	Population 2000	Population 2010	Percent Change	Percent of CBSA (2010)
Clark	96,472	110,232	14.3%	8.2%
Floyd	70,823	74,578	5.3%	5.6%
Harrison	34,325	39,364	14.7%	2.9%
Jefferson	31,705	32,428	2.3%	2.4%
Scott	22,960	24,181	5.3%	1.8%
Washington	27,223	28,262	3.8%	2.1%
Kentucky's Portion	913,690	1,031,130	12.9%	76.9%

In Indiana's portion of the Louisville CBSA, Floyd County has the highest population density[40], at 504.1 people per square mile, as outlined in Table 37. Clark County has the second highest population density, at 295.6 people per square mile. Though Floyd County has a higher population density, it is roughly 40% of the size of Clark County, which explains why its population density is higher than that of Clark County. Also, the percent growth in Floyd County (5.3%) is slightly more than one third of the percent growth of Clark County (14.3%). The percent growth of Harrison County (14.7%) also seems big, but only equates to roughly 10 people per square mile. As discussed above, the population of Floyd County is over 30% less than the population of Clark County. In comparison to Clark and Floyd counties, the rest of the counties within Indiana's portion of the Louisville CBSA are nowhere near as developed, which is evident in the counties' populations and densities. Washington County stands out as being the least dense, at 55.0 people per square mile. Clark and Floyd counties have the closest socioeconomic relationship with nearby Louisville, Kentucky, which helps to explain why they are the most populous and dense.

[39] U.S. Census Bureau: http://www.census.gov/popest/data/index.html

[40] U.S. Census Bureau: http://factfinder2.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=DEC_10_SF1_GCTPH1.ST05&prodType=table

Table 37: 2000 & 2010 Louisville CBSA Population Density

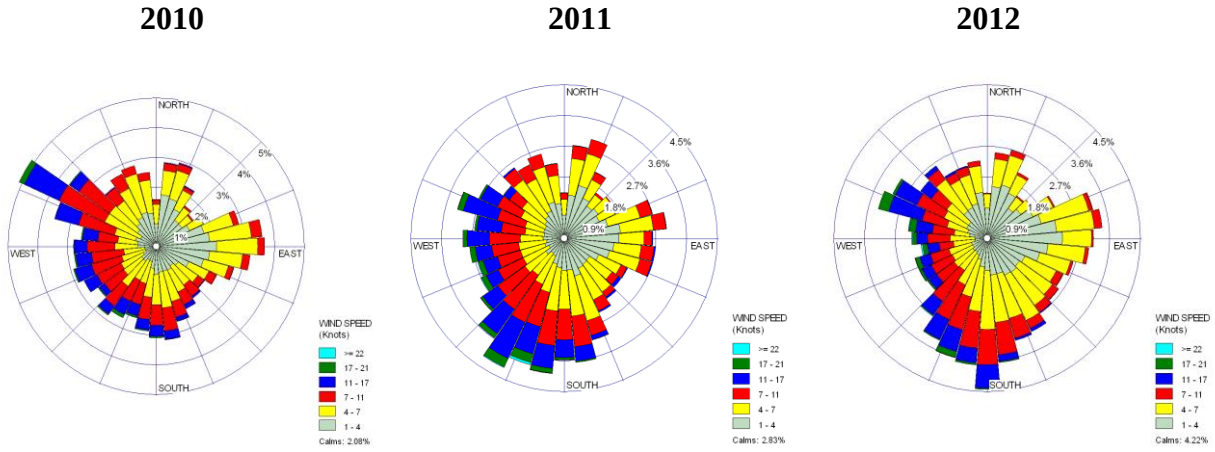
(People per Square Mile) County	Population Density 2000	Population Density 2010	Percent Change
Clark	258.7	295.6	14.3%
Floyd	478.7	504.1	5.3%
Harrison	70.8	81.2	14.7%
Jefferson	87.9	89.9	2.3%
Scott	120.6	127.0	5.3%
Washington	53.0	55.0	3.8%
Kentucky's Portion	352.5	397.8	12.9%

4. Meteorology

Meteorology plays a key role in the development and transport of $PM_{2.5}$. Typically, higher $PM_{2.5}$ daily concentrations occur during episodes of stagnant weather conditions. Light wind speeds provide an environment for $PM_{2.5}$ pre-cursor emissions to react and enhance localized $PM_{2.5}$ development. Transport of $PM_{2.5}$ can also be aided by higher wind speeds from areas with large industrial sources of emissions or areas with higher background concentrations of $PM_{2.5}$.

The wind roses in Figure 15 below show the directions from which the winds blew during 2010-2012 at the Charlestown State Park meteorological station in Clark County. Wind direction data is listed as radial degrees in 10 degree increments. Prevailing winds were from the south, southwest, east, and northwest at the Charlestown State Park monitor.

Figure 15: 2010-2012 Charlestown State Park Annual Wind Roses



An in-depth analysis on the wind roses only on the days when monitored daily $PM_{2.5}$ concentrations exceeded 30 $\mu g/m^3$ was conducted. Cumulative wind roses of all days that recorded higher $PM_{2.5}$ concentrations in southern Indiana for each year are shown below in Figure 16. Analysis of these wind roses showed more southwest, south, west, and east winds were evident in 2010 while south, southwest, and east winds were present on high $PM_{2.5}$

concentration days in 2011. 2012 had only one high $PM_{2.5}$ concentration day (November 21, 2012); wind speeds were very light and wind directions were variable on that day.

Figure 16: 2010-2012 Charlestown State Park Cumulative High Concentration Day Wind Roses

2010 **2011** **2012**

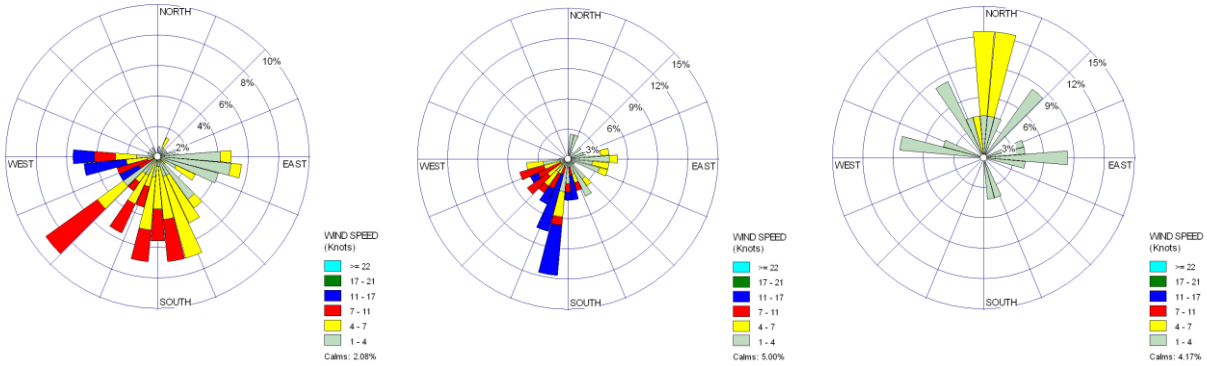


Table 38 shows the frequency of the hourly wind directions during 2010-2012 when daily $PM_{2.5}$ concentrations were measured at 30.0 µg/m^3 or above. Winds from the southwest direction were most prevalent, ranging between 12.5% and 27.3% during the three-year period. Southeast winds were evident between 8.6% and 17.0% of the time while winds blew from the south between 8.9% and 15.2%. North and northeast winds were the least prevalent, with those wind direction frequencies ranging between 3.0% and 10.1%.

Table 38: 2010-2012 Charlestown State Park Most Frequent Wind Directions on High $PM_{2.5}$ Concentration Days

2010		2011		2012	
Direction	**Frequency**	**Direction**	**Frequency**	**Direction**	**Frequency**
SW	20.5%	SW	27.3%	SW	12.5%
SE	17.0%	W	11.5%	SE	11.9%
S	15.2%	N	10.0%	NW	10.7%
E	14.8%	S	10.0%	NE	10.1%
NE	4.5%	NW	10.0%	E	10.1%
W	3.4%	SE	8.6%	W	9.5%
N	3.0%	NE	6.7%	S	8.9%
NW	2.7%	E	5.3%	N	3.6%

Wind speed frequency data indicated lower wind speeds on the days with higher daily $PM_{2.5}$ concentrations. Table 39 shows the frequencies of wind speed ranges observed. A vast majority of high $PM_{2.5}$ concentration days had wind speeds less than 11 knots (13 miles per hour). Also shown are the hours with calm winds, which consisted of 1% to 3% of the high daily $PM_{2.5}$ concentration days.

Table 39: 2010-2012 Charlestown State Park Most Frequent Ranges of Wind Speeds on High $PM_{2.5}$ Concentration Days

Wind Speed	2010	2011	2012
Calm	1%	2%	3%
1-4 knots	38.2%	48.3%	75.0%
4-7 knots	34.0%	15.8%	20.8%
7-11 knots	20.1%	14.2%	0.0%
11-17 knots	5.6%	16.7%	0.0%
17-22 knots	0.0%	0.0%	0.0%
>22 knots	0.0%	0.0%	0.0%

5. Geography and Topography

There are no geographical or topographical features within Indiana's portion of the Louisville CBSA that would have an impact on air quality or potential transport; therefore, this factor was not significant when making nonattainment recommendations.

6. Conclusion and Recommendation

Based on the above analysis, IDEM recommends both Clark and Floyd counties be designated as attainment, while the remaining counties in Indiana's portion of the Louisville CBSA be designated as unclassifiable, as outlined in Table 40 below. Though Clark County contains the only monitored violation for the area, IDEM expects the area to attain the standard before final designations become effective. Kentucky's portion of the CBSA is responsible for the vast majority of emissions for most $PM_{2.5}$ precursor pollutants. Both of the major sources in Jefferson and Floyd counties (IKEC-Clifty Creek and Duke Energy Indiana-Gallagher, respectively) have been fully controlled and though Jefferson County produces the majority of SO_2 emissions, IKEC-Clifty Creek has installed controls and it is expected that emissions will diminish. Therefore, including either Jefferson or Floyd counties in the nonattainment boundary would not advance the attainment date of the area. Clark County is the most populous county in Indiana's portion of the Louisville CBSA and has the highest VMT. Though Floyd County has a higher population density, it is roughly 40% the size of Clark County, and, as shown in IDEM's analysis of the Central Indiana CBSA, population density has little impact on any urban signature of speciation data. Harrison, Scott, and Washington counties are responsible for a relatively small amount of direct $PM_{2.5}$ and $PM_{2.5}$ precursor emissions and have grown at such a small rate that a designation of nonattainment for those counties is unnecessary. Also, the wind rose analysis showed that lower wind speeds were present on high $PM_{2.5}$ concentration days, which suggests that more localized emissions contributed to monitored violations. Based on these reasons, IDEM recommends that Clark and Floyd are designated as attainment, while Harrison, Jefferson, Scott, and Washington counties are designated as unclassifiable. These recommendations are based on the best available information at the time of this submittal, including a probability evaluation to determine the likelihood of counties to attain the standard by the close of 2014, provided that trends continue downward.

Table 40: IDEM Recommendation for Indiana Portion of Louisville CBSA

County	Recommendation
Clark	Attainment
Floyd	Attainment
Harrison	Unclassifiable
Jefferson	Unclassifiable
Scott	Unclassifiable
Washington	Unclassifiable

Southwest Indiana:

1. Jurisdictional Boundaries

For the purpose of this analysis, the Southwest Indiana area is comprised of Dubois, Gibson, Pike, Posey, Spencer, Vanderburgh, and Warrick counties, as well as Henderson County, Kentucky. The area contains both the Evansville, IN-KY, Metropolitan Statistical Area (MSA) and the Jasper, IN, Micropolitan Statistical Area. Vanderburgh and Warrick counties are also part of the Evansville MPO.

IDEM is evaluating these as one area because the areas were treated as one by U.S. EPA during the 1997 annual $PM_{2.5}$ designations. Of those counties, Dubois, Vanderburgh, and Warrick counties, as well as Montgomery Township in Gibson County, Washington Township in Pike County, and Ohio Township in Spencer County, were designated as nonattainment under the 1997 annual $PM_{2.5}$ standard. On October 27, 2011, the Redesignation Request and Maintenance Plan for the Southwest Indiana Area was approved by U.S. EPA.

2. Air Quality Data

Monitoring Data

There are four $PM_{2.5}$ monitors[41] within the Southwest Indiana Area that have three complete years of data to be compared to the standard, as illustrated in Table 41 below. Two monitors are located within Vanderburgh County, one of which has a design value marginally above the 2012 standard (181630016—University of Evansville). The monitor within Dubois County (180372001—Jasper-Post Office) also shows a design value that is marginally above than the standard. Current data suggests that both violating monitors will fall below the standard well before the effective date of designations. The remaining two monitors, located in Spencer and Vanderburgh counties, have design values below the standard. IDEM has installed an additional monitor in Evansville (181630023—E. Walnut St.), which began operation on January 1, 2013. Three years of data to be compared to the standard from the Evansville-E. Walnut St. monitor will not be available until the close of 2015.

[41] IDEM: http://www.in.gov/idem/airquality/2489.htm

Table 41: 2000-2013 Southwest Indiana Area Monitoring Values

			Three Year Design Values (µg/m^3)					
County	**Monitor ID**	**Site**	**00-02**	**01-03**	**02-04**	**03-05**	**04-06**	**05-07**
Dubois	180372001	Jasper-Post Office	16.7	16.2	15.5	15.7	15.0	14.9
Gibson	180510012	Oakland City**						
Spencer	181470009	Dale	15.0	14.4	13.6	14.5	13.9	14.6
Vanderburgh	181630012	Evansville-Mill Rd.	15.5	15.2	14.7	15.0	14.6	14.9
Vanderburgh	181630012/21	Evansville Combined (Mill Rd. & Buena Vista)						
Vanderburgh	181630021	Evansville-Buena Vista						
Vanderburgh	181630016	Evansville-U of E	15.7	15.5	14.7	15.1	14.8	15.0

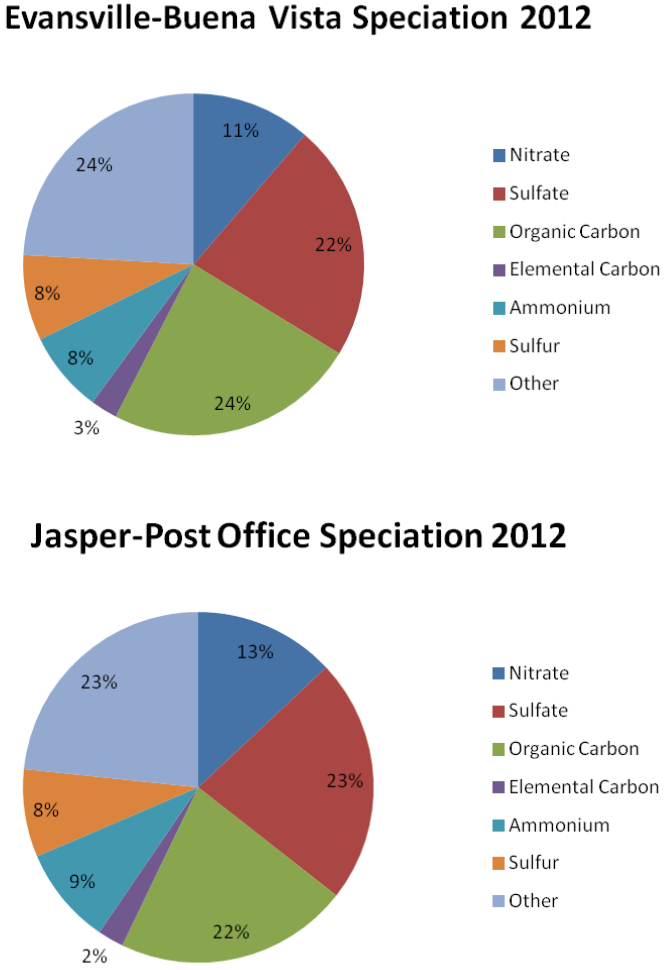
			Three Year Design Values (µg/m^3)					
County	**Monitor ID**	**Site**	**06-08**	**07-09**	**08-10**	**09-11**	**10-12**	**11-13***
Dubois	180372001	Jasper-Post Office	13.3	13.3	13.0	12.9	12.4	11.6
Gibson	180510012	Oakland City**	11.3	11.2	11.5	11.4		
Spencer	181470009	Dale	13.0	12.6	12.3	12.4	12.0	11.2
Vanderburgh	181630012	Evansville-Mill Rd.	13.7	13.0				
Vanderburgh	181630012/21	Evansville Combined (Mill Rd. & Buena Vista)		13.1	12.6	12.3		
Vanderburgh	181630021	Evansville-Buena Vista		12.4	12.6	12.4	11.8	11.3
Vanderburgh	181630016	Evansville-U of E	13.6	13.1	12.8	12.7	12.2	11.5

Highlighted data represents monitors with a 2010-2012 design value above the annual standard of 12.0µg/m^3, effective March 18, 2013.

**2013 monitoring data is only available through September 30, 2013 and has not been certified.*

***The Oakland City monitor was discontinued on December 31, 2011.*

Figure 17: 2012 Speciation



Speciation Data

Within the Southwest Indiana Area, both the Evansville-Buena Vista (181630021) and Jasper-Post Office (180372001) monitors collect speciation data for the Southwest Indiana Area. Both monitors show higher levels of other unmeasured components, organic carbon, and sulfate, as illustrated in Figure 17 above, yet measure similar concentrations of all precursor pollutants when compared to other speciation monitors within Indiana, as shown in Figure 2. All counties within the Southwest Indiana area have large stationary sources that emit 100 tons or more of regulated $PM_{2.5}$ precursor pollutants, as outlined in Table 43 below.

3. Emissions and Emissions-Related Data

Emissions Data

There are no counties that individually contribute 50% or more of emissions[42] within the Southwest Indiana Area, as shown in Figure 18. For CO, Kentucky's portion of the CBSA is responsible for 26% of total emissions, whereas Warrick and Vanderburgh counties contribute 24% and 20%, respectively. Dubois County also contributes the highest amount of NH_3 emissions in the area (44%). For NO_x, Spencer County contributes 27%, while Gibson County contributes 21% of total emissions. For direct $PM_{2.5}$ emissions, Warrick County contributes 24% of total emissions, while Posey County is responsible for 17% of emissions for the area. Spencer County contributes the most SO_2 emissions in the area (31%), followed closely by Pike County (30%). With regard to VOC, Vanderburgh County contributes 18%, while Gibson County is responsible for 18% of total emissions.

[42] U.S. EPA $PM_{2.5}$ Mapping Tool Datasets: http://www.epa.gov/pmdesignations/2012standards/techinfo.htm

Figure 18: 2011 Southwest Indiana Area Emissions by Pollutant

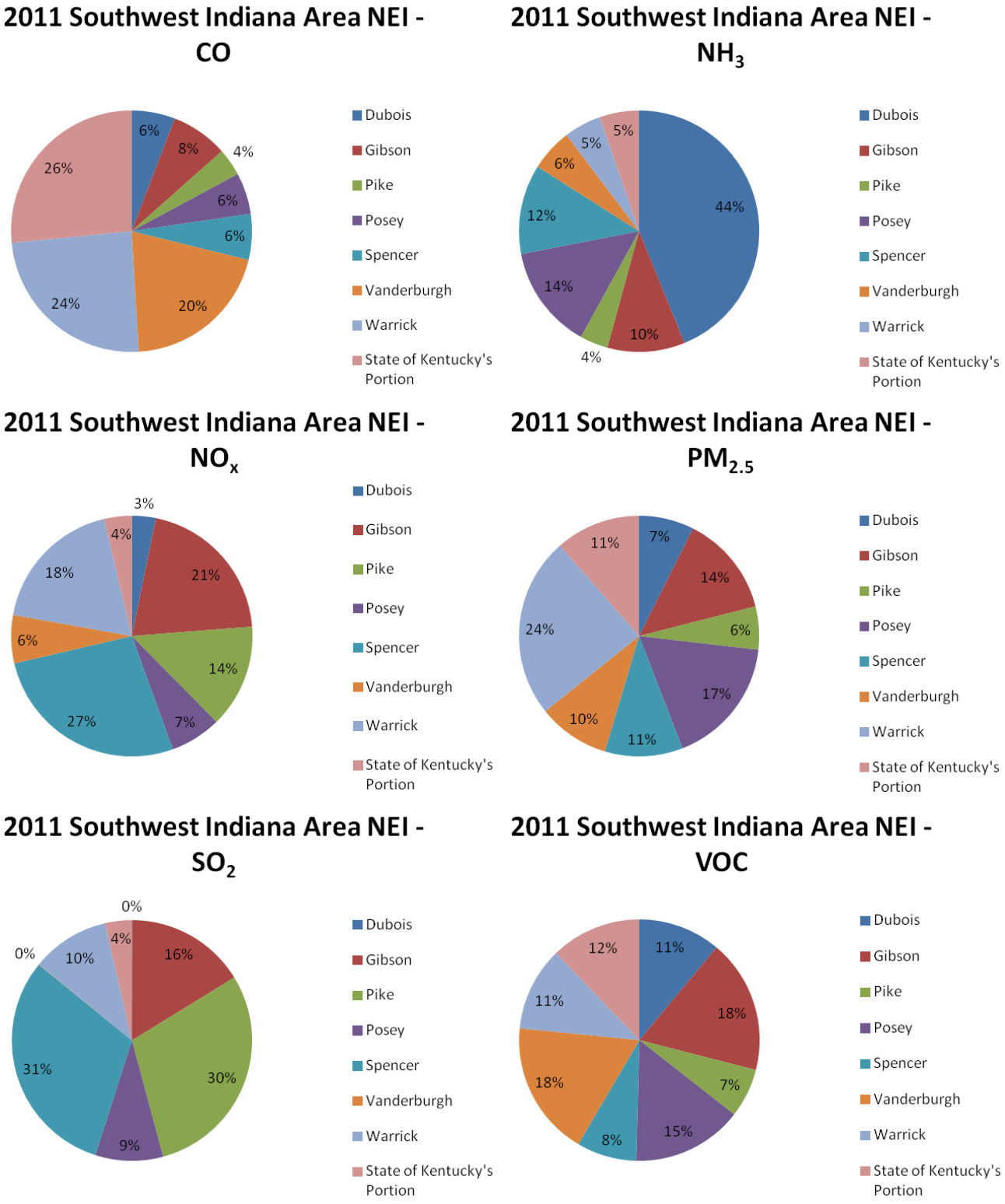


Table 42: 2011 Southwest Indiana Area NEI Source Categories by Pollutant (Tons per Year)[43]

Pollutant	County	Fire	Nonpoint	Nonroad	Onroad	Point
CO	Dubois	79.7	1,563.3	2,112.6	3,953.9	571.2
	Gibson	52.5	1,871.2	2,206.6	4,606.8	2,071.4
	Pike	363.1	1,127.0	599.4	1,749.6	1,376.2
	Posey	51.6	1,808.5	1,214.9	3,771.4	999.9
	Spencer	480.9	1,370.0	1,023.7	3,428.1	2,403.3
	Vanderburgh		1,454.2	7,948.4	18,962.1	309.6
	Warrick	365.0	1,442.9	2,153.9	6,829.2	23,799.4
NH_3	Dubois	1.3	4,815.1	0.4	15.7	0.2
	Gibson	0.9	1,121.7	0.5	18.6	5.1
	Pike	6.0	401.1	0.1	7.1	2.0
	Posey	0.9	1,432.5	0.4	15.2	87.1
	Spencer	7.9	1,295.5	0.3	13.9	9.1
	Vanderburgh		551.5	1.1	73.8	1.5
	Warrick	6.1	508.7	0.4	26.9	9.4
NO_x	Dubois	1.8	448.3	465.2	724.8	1,154.9
	Gibson	1.2	1,358.1	454.2	978.9	15,075.9
	Pike	7.7	505.9	138.3	339.7	11,048.9
	Posey	1.2	912.6	350.7	1,026.3	3,669.1
	Spencer	8.6	408.2	247.2	781.0	21,949.0
	Vanderburgh		1,027.3	875.6	3,479.5	227.7
	Warrick	8.6	208.4	337.0	1,601.0	13,915.9
$PM_{2.5}$	Dubois	7.4	947.2	32.9	24.5	87.4
	Gibson	4.9	1,698.6	41.1	33.5	240.8
	Pike	33.4	612.7	12.3	11.7	186.8
	Posey	4.8	1,347.0	28.1	31.9	1,153.1
	Spencer	43.0	932.8	21.8	24.0	531.8
	Vanderburgh		1,158.9	72.2	126.2	74.0
	Warrick	34.2	912.8	28.6	51.1	2,571.6
SO_2	Dubois	0.8	16.3	1.2	4.2	20.6
	Gibson	0.6	21.0	1.1	5.0	18,986.9
	Pike	3.6	11.6	0.3	1.9	34,731.2
	Posey	0.5	12.6	0.8	4.2	10,686.0
	Spencer	4.2	12.0	0.6	3.7	36,320.6
	Vanderburgh		12.8	2.6	21.0	12.9
	Warrick	3.9	16.3	0.9	7.5	12,277.8

[43] U.S. EPA 2011 National Emissions Inventory: http://www.epa.gov/ttnchie1/net/2011inventory.html

Pollutant	County	Fire	Nonpoint	Nonroad	Onroad	Point
VOC	Dubois	19.0	1,245.5	205.1	337.1	1,205.5
	Gibson	12.5	2,902.2	373.2	395.3	1,202.85
	Pike	86.4	1,267.7	107.8	148.1	185.3
	Posey	12.3	2,434.1	182.0	339.4	1,075.9
	Spencer	114.0	1,233.4	166.3	298.9	374.6
	Vanderburgh		2,318.4	645.0	1,629.7	343.0
	Warrick	87.1	1,083.2	291.7	602.3	1,009.9

Major Source Emissions Controls

The Indianapolis Power and Light Company (IPL) - Petersburg Generating Station power plant, shown in Table 43 and located in Pike County, contains four units. Currently, all units have ESPs to control PM emissions and FGD scrubbers to control SO_2 emissions. Units 1, 2, and 4 have low NO_x burner technology and only Units 2 and 3 have SCR systems to control NO_x emissions. IPL has proposed a number of upgrades to existing control equipment as well as new control systems to be installed as part of a control strategy for compliance with the MATS rule. The company's compliance plan includes the following: 1.) replace ESP on Unit 2 with a baghouse, 2.) keep ESP on Unit 3 and install a polishing baghouse, 3.) enhance ESPs on Units 1 and 4, 4.) upgrade the bypass scrubber system on Units 1 and 2 to minimize bypass time, and 5.) install ACI and DSI systems on all units. PM emissions will be reduced, as a result of the ESP upgrades and baghouse installations, although it is difficult to estimate how much of a reduction in PM emissions will be realized. The FGD upgrades and DSI systems installation will further reduce SO_2 emissions.

The only power plant located in Posey County with coal-fired units is the Southern Indiana Gas and Electric Company, Inc. (SIGECO) - A. B. Brown Generating Station, as seen in Table 43 below. There are two units at this facility, Unit No. 1 and Unit No. 2. Both units are controlled by FGD systems for control of SO_2 and low NO_x combustion (low-excess air and low NO_x burners) and SCR systems for control of NO_x. PM controls, on the other hand, are different for these units. Unit No. 1 is equipped with a fabric filter while Unit No. 2 is equipped with an ESP. All existing controls were included in A. B. Brown Generating Station's initial Title V operating permit issued in 2004; therefore, emissions from this facility are not expected to change.

The Southern Indiana Gas and Electric Company, Inc. (SIGECO) - F. B. Culley power plant located in Warrick County was required to shut down one of three of the EGUs at this facility due to a consent decree agreement in 2003. This agreement also called for Units 2 and 3 to operate at 95% efficiency at all times the units are in operation, which has resulted in a significant reduction in NO_x emissions. Unit 2 is equipped with an electrostatic precipitator for PM emissions control, a low NO_x burner for NO_x emissions control, and a FGD system for SO_2 emissions control. Unit 3 is equipped with a fabric filter to control PM emissions, a low NO_x burner and SCR to control NO_x emissions, and shares the FGD system with Unit 2. All existing controls were included in F.B. Culley Power Plant's initial Title V operating permit issued in 2006; therefore, emissions from this facility are not expected to change.

The ALCOA – Warrick Power Plant is also located in Warrick County. There are four units at this facility: Boiler Nos. 1, 2, 3, and 4. All are configured with ESPs for PM emissions control, low NOx burners and over-fire air, except Unit 4, which has an SCR in place of the OA for NOx emissions control, and FGD systems for SO_2 emissions control. ALCOA installed the FDG systems in 2008 to comply with the requirements of Clean Air Interstate Rule (CAIR). The 2011 NEI, highlighted in Table 43, reflects these reductions and, therefore, emissions from this facility are not expected to change.

The Duke Energy Indiana, Inc. Gibson Generating Station, located in Gibson County, operates five coal-fired units. Currently, all units have ESPs to control PM emissions. NO_x emissions are controlled by low NO_x burner technology with OA and SCR systems, while FGD systems are used to control SO_2 emissions. To comply with the new MATS rule, Duke Energy plans to install mercury re-emission chemical injection systems on Units 1, 2, 3, and 5 by the end of 2014 and an activated carbon injection system on Unit 5 by the beginning of the second quarter in 2015. These systems are designed specifically to reduce mercury emissions, therefore, minimal PM and SO_2 emissions reductions will be realized as a result of implementing this control strategy.

The Indiana Michigan Power d.b.a. American Electric Power (AEP) Rockport Power Plant is located in Spencer County. There are two coal-fired units, MB1 and MB2, at this facility. Both units are equipped with ESPs to control PM emissions and low NO_x burner technology with OA to control NO_x emissions. Only one powdered activated carbon (PAC) injection system, approved for construction in 2008, is used to control mercury emissions from MB1 and MB2 because both units exhaust through a common stack. However, the source plans to reconfigure the exhaust ductwork from these boilers to accommodate another PAC injection system and two new DSI systems, approved for construction in 2013 and scheduled to be online by April 2015. Although the installation of a second PAC injection system will result in minimal PM and SO_2 emissions reductions, the new DSI systems are expected to reduce SO_2 emissions by 30-50%. In addition, a consent decree requires AEP to install SCRs on MB1 by December 2017 and MB2 by December 2019. This will reduce NO_x emissions by approximately 90%.

Hoosier Energy REC, Inc. - Ratts Generating Station, located in Pike County, contains two units. Currently, both units have ESPs to control PM emissions and low NO_x burner technology and a rotating OA system with SNCR to control NO_x emissions. Hoosier Energy entered into a consent decree with U.S. EPA in 2010 for its two Indiana power plants that called for increasingly stringent emission rates per unit and system-wide caps for both NO_x and SO_2 in the coming years. There is also an option to repower one or both units at Ratts starting in 2016. Additionally, Ratts will be required to meet new federal requirements including a transport rule in lieu of CAIR/CSAPR, the utility MATS, and the 1-hour SO2 NAAQS. These requirements will result in substantial reductions in future emissions either way.

Table 43: 2011 Southwest Indiana Area Individual Emissions Sources (Tons per Year)[44]

County	Site	CO	VOC	NO_x	SO_2	$PM_{2.5}$
Dubois	ANR Pipeline-Celestine Station	467.4		1,081.5		
Dubois	Masterbrand Cabinets Plant 4/22		215.9			
Dubois	Masterbrand Plant #3		155.9			
Dubois	OFS Brands, Inc. Plant #3		154.6			
Dubois	Kimball International		111.0			
Dubois	OFS Brands Inc. Plant #1		103.9			
Gibson	Duke Energy Indiana-Gibson	2,023.3	242.4	15,024.4	18,986.6	190.1
Gibson	Toyota Motor Manufacturing Indiana		950.6			
Pike	IPL Petersburg	1,188.7	142.2	9,666.8	25,232.0	161.2
Pike	Hoosier Energy-Ratts Station			1,071.4	9,496.3	
Pike	Texas Gas Transmission-Petersburg			165.0		
Pike	Midwestern Gas Transmission			124.8		
Posey	SIGECO-A.B. Brown	284.1		1,612.5	5,293.9	992.2
Posey	SABIC Innovative Plastics Mt. Vernon LLC	477.7	350.8	1,798.9	4,915.6	

[44] U.S. EPA 2011 National Emissions Inventory: http://www.epa.gov/ttnchie1/net/2011inventory.html

County	Site	CO	VOC	NO_x	SO_2	$PM_{2.5}$
Posey	Consolidated Grain and Barge Co.		463.9			
Posey	Countrymark Refining & Logistics, LLC.	155.3	138.4	137.5	450.5	
Spencer	Indiana Michigan Power-Rockport	2,278.3	272.9	21,840.7	36,319.6	529.5
Spencer	AK Steel Rockport Works	113.6				
Vanderburgh	Guardian Automotive Trim, Inc.		130.1			
Warrick	Alcoa Inc.-Warrick Operations	23,173.4	925.7	331.6	3,897.8	648.3
Warrick	Alcoa APGI-Warrick Power Plant	371.1		11,200.8	4,605.6	1,301.7
Warrick	SIGECO-F.B. Culley	236.8		2,383.4	3,774.4	621.3

Commuting Patterns and Vehicle Miles Traveled

In the Southwest Indiana Area, the majority of residents work in the county[45] where they live, as outlined in Table 44. Warrick County has the highest percent of out-of-county commuters (62.8%), the majority of whom travel to Vanderburgh County for work. Approximately 18,000 residents of Warrick County work outside of the area. Because of the relatively small number of out-of-county commuters within the Southwest Indiana Area as a whole, as well as the downward trend in monitored values, it can be inferred that out-of-county travel for work does not significantly contribute to any monitored violations within the area.

[45] Data provided by the Evansville Metropolitan Planning Organization (MPO)

Table 44: 2007-2011 Southwest Indiana Area Commuting Patterns

County	2007-2011 Total Workforce	Persons Who Live AND Work in County	Persons Who Live in County and Work in Another County	Percent Who Work In County	Percent Who Work Out of County
Dubois	21,500	18,880	2,700	87.4%	12.6%
Gibson	15,481	10,203	5,278	65.9%	34.1%
Pike	5,537	2,217	3,320	40.0%	60.0%
Posey	12,572	5,664	6,908	45.1%	54.9%
Spencer	9,971	4,635	5,336	46.5%	53.5%
Vanderburgh	85,300	74,119	11,181	86.9%	13.1%
Warrick	29,040	10,810	18,230	37.2%	62.8%
Kentucky's Portion	20,472	13,922	6,550	68.0%	32.0%

Within the Southwest Indiana Area, the majority of counties have seen a slight decrease in vehicle miles traveled[46] (VMT), illustrated in Table 45. Vanderburgh County showed the most significant increase (23.5%) of just over 1 million VMT, while Warrick County showed a modest increase (12.8%) from 2000 to 2011. All other counties in the Southwest Indiana Area have seen slight decreases in VMT over the eleven-year period. Overall, the Southwest Indiana Area has not seen any significant changes with regard to VMT from 2000 to 2011.

Table 45: 2000 & 2011 Southwest Indiana Area Vehicle Miles Traveled

County	2000 Vehicle Miles Traveled	2011 Vehicle Miles Traveled	Percent Change	Percent of Area (2011)
Dubois	1,404,270	1,191,000	-15.2%	8.7%
Gibson	1,449,351	1,373,000	-5.3%	10.0%
Pike	571,143	489,000	-14.4%	3.6%
Posey	1,108,067	954,000	-13.9%	7.0%
Spencer	1,019,534	929,000	-8.9%	6.8%
Vanderburgh	4,387,136	5,420,000	23.5%	39.5%
Warrick	1,680,240	1,895,000	12.8%	13.8%
Kentucky's Portion	1,603,000	1,464,000	-8.7%	10.7%

Population and Density

In the Southwest Indiana Area, Vanderburgh County remains the most populous[47], while Warrick County is the second most populous, with roughly one third of the population of Vanderburgh County, as outlined in Table 46 below. With the exception of Vanderburgh and Warrick counties, all other counties in the area remain rural, with populations well below 50,000. Warrick County experienced the largest growth in population (13.9%), but Vanderburgh County, which had the third highest percent growth (4.5%), experienced roughly the same increase in residents (around 7,000). Dubois County, which had the second highest percent growth (5.6%),

[46] Indiana Department of Transportation: http://www.in.gov/indot/2469.htm
[47] U.S. Census Bureau: http://www.census.gov/popest/data/index.html

only added a little over 2,000 residents. On the whole, this area has seen a very modest growth in population.

Table 46: 2000 & 2010 Southwest Indiana Area Population

County	Population 2000	Population 2010	Percent Change	Percent of Area (2010)
Dubois	39,674	41,889	5.6%	11.2%
Gibson	32,500	33,503	3.1%	8.9%
Pike	12,837	12,845	0.1%	3.4%
Posey	27,061	25,910	-4.3%	6.9%
Spencer	20,391	20,952	2.8%	5.6%
Vanderburgh	171,922	179,703	4.5%	48.0%
Warrick	52,383	59,689	13.9%	15.9%
Kentucky's Portion	44,829	46,250	3.2%	11.0%

Within the Southwest Indiana Area, Vanderburgh County stands out as having the highest population density[48], at 769.7 people per square mile, as shown in Table 47 below. The next highest, Warrick County, has a population density of 155.1 people per square mile, significantly less than the population density of Vanderburgh County. The rest of the counties in the area are very rural compared to Warrick and Vanderburgh counties, with most having less than half the population density of Warrick County. Warrick County had the highest percent growth (13.9%), while Dubois County had the second highest (5.6%). All of the rural counties, including Dubois County, tend to have higher percent growth over the 10-year period, but increase by less than 6 people per square mile. The city of Evansville lies entirely within Vanderburgh County, which is represented in both population and density.

Table 47: 2000 & 2010 Southwest Indiana Area Population Density

(Persons per Square Mile) County	Population Density 2000	Population Density 2010	Percent Change
Dubois	92.9	98.0	5.6%
Gibson	66.7	68.7	3.1%
Pike	38.4	38.4	0.1%
Posey	66.1	63.3	-4.3%
Spencer	51.4	52.8	2.8%
Vanderburgh	736.3	769.7	4.5%
Warrick	136.1	155.1	13.9%
Kentucky's Portion	102.7	105.9	3.2%

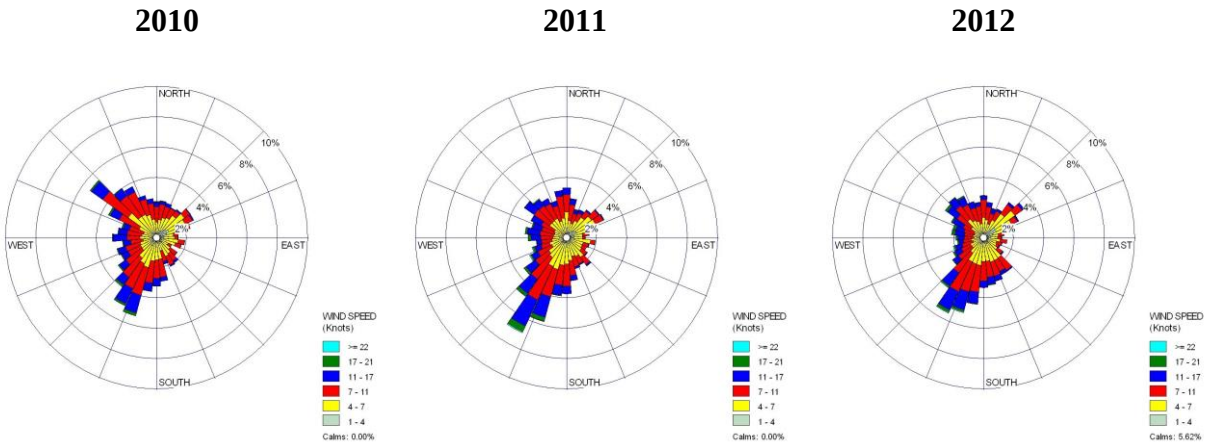
[48] U.S. Census Bureau: http://factfinder2.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=DEC_10_SF1_GCTPH1.ST05&prodType=table

4. Meteorology

Meteorology plays a key role in the development and transport of $PM_{2.5}$. Typically, higher $PM_{2.5}$ daily concentrations occur during episodes of stagnant weather conditions. Light wind speeds provide an environment for $PM_{2.5}$ pre-cursor emissions to react and enhance localized $PM_{2.5}$ development. Transport of $PM_{2.5}$ can also be aided by higher wind speeds from areas with large industrial sources of emissions or areas with higher background concentrations of $PM_{2.5}$.

The wind roses, below in Figure 19, show the directions from which the winds blew during 2010-2012 at the National Weather Service station, located at the Evansville Airport. Wind direction data is listed as radial degrees in 10 degree increments. Prevailing winds were from the southwest and south. The spike in the north direction is a result of the data representing variable wind directions (no true wind direction measured during an hour) being assigned a due north direction value (0 radial degrees in the data set) by the wind direction recording device.

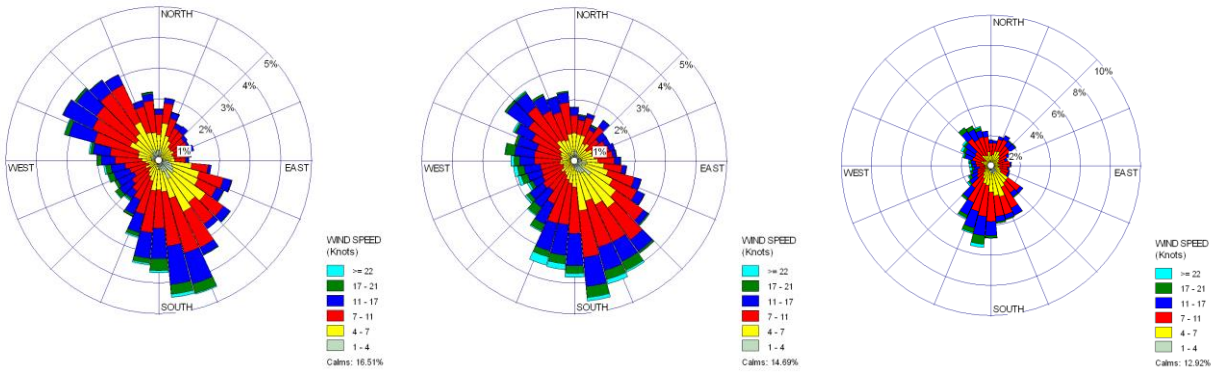
Figure 19: 2010-2012 Evansville Annual Wind Roses



The wind roses, below in Figure 20, show the directions from which the winds blew during 2010-2012 at the Jasper-Post Office meteorological station in Dubois County. Wind direction data is listed as radial degrees in 10 degree increments. Prevailing winds were from the south, southeast, and northwest.

Figure 20: 2010-2012 Jasper-Post Office Annual Wind Roses

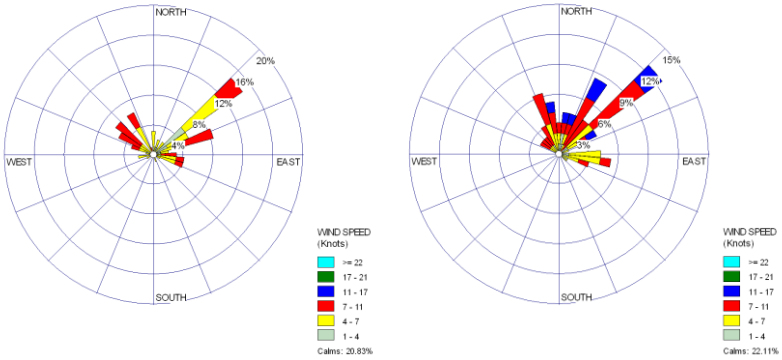
2010 **2011** **2012**



An in-depth analysis on the wind roses on only the days when monitored daily $PM_{2.5}$ concentrations exceeded 30 µg/m^3 narrowed the wind directions and wind speeds that were present. Cumulative wind roses of all days that recorded higher $PM_{2.5}$ concentrations in Vanderburgh County for each year are shown below in Figure 21. Analysis of these wind roses showed more northeast, east, and northwest winds were evident in 2010 while northeast, north, and easterly winds were present on high $PM_{2.5}$ concentration days in 2011. There was only one high $PM_{2.5}$ concentration day in 2012 (November 28, 2012); however there was no meteorological data available from the Evansville Airport NWS station on that day.

Figure 21: 2010 & 2011 Evansville Cumulative High Concentration Day Wind Roses

2010 **2011**



Only one high $PM_{2.5}$ concentration day was identified for the Jasper $PM_{2.5}$ monitor (August 1, 2011). As shown in Figure 22, winds were either calm or very light with wind directions from the west and north.

Figure 22: 2011 Jasper-Post Office Cumulative High Concentration Day Wind Roses
2011

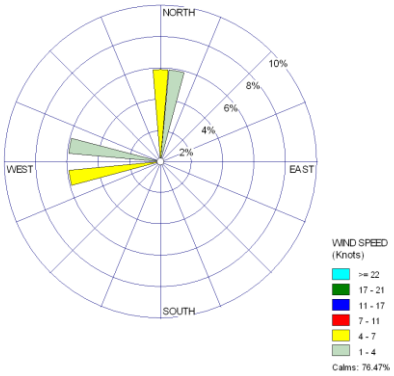


Table 48 shows the frequency of the hourly wind directions during 2010 and 2011 when daily $PM_{2.5}$ concentrations were measured at 30.0 µg/m^3 or above. Winds from the northeast direction were most prevalent, ranging between 26.0% and 31.6% during the three-year period. East winds were evident between 13.7% and 18.8% of the time while winds blew from the northwest between 10.5% and 19.8%. South and southwest winds were the least prevalent, with those wind direction frequencies ranging between 0.0% and 0.5%.

Table 48: 2010 & 2011 Vanderburgh County Most Frequent Wind Directions on High $PM_{2.5}$ Concentration Days

2010		2011	
Direction	**Frequency**	**Direction**	**Frequency**
NE	26.0%	NE	31.6%
NW	19.8%	N	20.0%
E	18.8%	E	13.7%
N	6.3%	NW	10.5%
W	5.2%	SE	2.1%
SE	2.1%	S	0.0%
SW	1.0%	SW	0.0%
S	0.0%	W	0.0%

Wind speed frequency data indicated there were lower wind speeds on the higher daily $PM_{2.5}$ concentration days. Table 49 shows the frequencies of wind speed ranges observed on the high daily $PM_{2.5}$ concentration days. Most days showed wind speed less than 11 knots (13 miles per hour) with the majority of days having wind speeds less than 7 knots (8 miles per hour). Also shown are the hours with calm winds, which consisted of 9% to 15% of the high daily $PM_{2.5}$ concentration days.

Table 49: 2010 & 2011 Vanderburgh County Most Frequent Ranges of Wind Speeds on High $PM_{2.5}$ Concentration Days

Wind Speed	2010	2011
Calm	9.0%	15.0%
1-4 knots	14.6%	10.5%
4-7 knots	41.7%	26.3%
7-11 knots	22.9%	32.6%
11-17 knots	0.0%	8.4%
17-22 knots	0.0%	0.0%
>22 knots	0.0%	0.0%

Results from the wind roses show the high $PM_{2.5}$ concentrations in Vanderburgh and Dubois Counties could be attributed to more localized emissions within each respective county due to the calm winds or lower wind speeds observed. Winds blowing from the northeast and east of Vanderburgh County could be responsible for a majority of emissions that may impact the $PM_{2.5}$ monitors throughout Vanderburgh County.

5. Geography and Topography

There are no geographical or topographical features within the Southwest Indiana Area that would have an impact on air quality or potential transport; therefore, this factor was not significant when making nonattainment recommendations.

6. Conclusion and Recommendation

Based on the analysis of the Southwest Indiana Area, IDEM recommends that Dubois, Spencer, and Vanderburgh counties be designated as attainment, while Gibson, Pike, Posey, and Warrick counties are designated as unclassifiable, as outlined in Table 50 below. Both Dubois and Vanderburgh counties have 2010-2012 monitored violations; however, it is anticipated that these monitors will attain the standard by the close of 2013. The remaining monitors within the Southwest Indiana Area have 2010-2012 design values below the current standard. There is also very little noticeable variation in speciation between monitors in the Southwest Indiana Area and speciation monitors in other urban and rural areas within Indiana, as shown in Figure 2. Many major stationary sources within the Southwest Indiana Area have controls in place, and those that don't will be addressing any potential contribution to $PM_{2.5}$ emissions within the region by complying with regulations at the federal and state levels. Both VMT and population, as well as population density, have either declined over the past decade or experienced small growth, yet monitored values continue to show a downward trend, meaning that these factors do not have an effect on monitors in the area. Compared to Vanderburgh County, every other county in the area has a small population; the closest county in comparison is Warrick County, which has approximately one third the population of Vanderburgh County. Also, the wind rose analysis suggests that high $PM_{2.5}$ concentrations within both Dubois and Vanderburgh counties can be attributed to localized emissions, due to the high prevalence of calm or light winds, though analysis of monitoring data suggests that the violating monitors will attain at the close of 2013.

Therefore, IDEM recommends that Dubois, Spencer, and Vanderburgh counties are designated as attainment, while the remaining counties should be designated as unclassifiable. These recommendations are based on the best available information at the time of this submittal, including a probability evaluation to determine the likelihood of counties to attain the standard by the close of 2014, provided that trends continue downward.

Table 50: IDEM Recommendation for Southwest Indiana Area

County	Recommendation
Dubois	Attainment
Gibson	Unclassifiable
Pike	Unclassifiable
Posey	Unclassifiable
Spencer	Attainment
Vanderburgh	Attainment
Warrick	Unclassifiable