ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

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December 12, 2013

George Czerniak, Director
Office of the Air and Radiation Division
U.S. Environmental Protection Agency, Region V (R18J)
77 West Jackson Boulevard
Chicago, Illinois 60604-3507

Dear Mr. Czerniak:

On behalf of Governor Quinn and pursuant to the U.S. Environmental Protection Agency's December 14, 2012, revision to the National Ambient Air Quality Standards (NAAQS) for the annual PM2.5 standard, I am submitting our recommendations for attainment/nonattainment designations for the State of Illinois. Also included with these recommendations is a support document prepared by the Illinois Environmental Protection Agency (Illinois EPA). The Illinois EPA will also provide this document to your staff in electronic format to facilitate your timely review.

Specifically, the following designations are recommended for Illinois:

County	Designation	Name of Area
Cook	Nonattainment	Chicago
DuPage	Nonattainment	Chicago
Kane	Nonattainment	Chicago
Lake	Nonattainment	Chicago
Will	Nonattainment	Chicago
McHenry	Nonattainment	Chicago
Kendall: Oswego Township All Other Townships	 Nonattainment Attainment/ Unclassifiable	 Chicago
Grundy: Aux Sable Township Goose Lake Township All Other Townships	 Nonattainment Nonattainment Attainment/ Unclassifiable	 Chicago Chicago

Madison	Nonattainment	Metro-East
Monroe	Nonattainment	Metro-East
St. Clair	Nonattainment	Metro-East
Randolph: Baldwin Township (also known as Baldwin Precinct) All Other Townships	 Nonattainment Attainment/ Unclassifiable	 Metro-East
All Other Counties	Attainment/ Unclassifiable	Illinois

We are recommending that portions of the Chicago and Metro-East metropolitan areas be designated as nonattainment for the annual PM2.5 National Ambient Air Quality Standard. These areas are the same areas previously designated nonattainment for the 1997 PM2.5 standard. As violations of the annual PM2.5 standards have been measured in these areas, designating them as nonattainment is appropriate. The remainder of Illinois is attaining the PM2.5 standards and should, therefore, be designated as attainment/unclassifiable.

It should be noted that this recommendation is being made in mid-December, pursuant to USEPA requirements. Current trends indicate there may be a change in some monitor design values when 2013 data is included. Illinois EPA intends to review 2013 monitoring data when it becomes available and, if warranted, will request that USEPA consider 2011-2013 data at that time.

If there are any questions, please feel free to contact me.

Sincerely,

Lisa Bonnett

Lisa Bonnett
Director

Technical Support Document:

Recommended Attainment/Nonattainment Designations in Illinois for the 2012 Revised Primary Annual PM2.5 National Ambient Air Quality Standard

AQPSTR 13-08

December 12, 2013

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Introduction

On December 14, 2012, the U.S. Environmental Protection Agency (U.S. EPA) completed its review of the current National Ambient Air Quality Standards (NAAQS) for particulate matter and revised the primary annual fine particle standard for airborne particles smaller than 2.5 microns in aerodynamic diameter (PM2.5). In this action, U.S. EPA maintained the 24-hour fine particle standard set at a level of 35 micrograms per cubic meter (ug/m^3), and revised the primary annual standard, strengthening it from a level of 15 ug/m^3 to a level of 12 ug/m^3. Following promulgation of a new or revised air quality standard, the Clean Air Act (CAA) requires the Governor to recommend initial designations of the attainment status for all areas in the State. Areas can be classified as ***nonattainment*** (does not meet, or contributes to a nearby area that does not meet the NAAQS), ***attainment/unclassifiable*** (meets the NAAQS or is expected to meet the NAAQS despite a lack of monitoring data), or ***unclassifiable*** (cannot be classified based on available data). Therefore, Illinois is providing recommendations for attainment/nonattainment area boundaries for the annual PM2.5 standard. The U.S. EPA will act on the State's recommendations by affirming and promulgating the recommended designation boundaries, or by promulgating new designation boundaries.

This report provides the basis for recommendations by the Illinois Environmental Protection Agency (IEPA) for attainment/nonattainment designation boundaries for all areas in the State of Illinois for the annual PM2.5 standard**.** Based on the most recent three years of ambient monitoring data (2010-2012), three counties in Illinois are currently violating the annual PM2.5 NAAQS: Cook, Madison, and St. Clair. Based on an analysis of the factors contained in U.S. EPA guidance, the IEPA is recommending that portions of the Chicago and Metro-East metropolitan areas be designated as nonattainment for the annual PM2.5 standard. IEPA's recommended boundaries are consistent with the current annual PM2.5 nonattainment area boundary for the Metro-East, and the current Chicago PM2.5 maintenance area boundary. The recommended boundaries also reflect U.S. EPA guidance to show that boundaries include areas that show a violation of the 2012 annual PM2.5 NAAQS as well as areas that are *contributing* to a violation of the NAAQS in a nearby area. The remaining areas of Illinois should be classified as attainment/unclassifiable areas for the PM2.5 standard.

Federal Guidance

The IEPA relied on guidance identified in a memorandum issued by U.S. EPA on April 16, 2013. U.S. EPA provides states with the ability to evaluate areas on a "case by case basis" and to consider "those counties in the entire metropolitan area, (e.g. Core Based Statistical Area (CBSA) or Combined Statistical Area (CSA)) in which the violating monitor(s) is (are) located." U.S. EPA considers the CBSA or CSA as a "reasonable starting point" for this analysis; however, U.S. EPA does not intend for either of them to be the presumptive nonattainment area (NAA) boundary. States must also evaluate "nearby areas" that contribute to the violations of the NAAQS. States may request NAA boundaries that are smaller than the existing violating county boundaries where counties, or portions of counties, do not contribute to nonattainment based on an examination of five factors. States may also request NAA boundaries that are larger than the current county to include adjacent counties when those counties contain emission sources and other factors that may contribute to the nonattainment problem. This report provides the basis for recommendations by the IEPA for attainment/nonattainment designation boundaries for all areas in the State of Illinois for the revised PM2.5 standard.

Five Factor Analysis

The U.S. EPA recommends that states consider the following five factors in assessing the designated nonattainment area boundary:

1. **Air Quality Data:** An evaluation of the design value calculations for each monitor in the State. This calculation consists of the three-year arithmetic mean of measured annual average PM2.5 concentrations collected at each monitor. Only air quality monitoring data from monitors that are suitable for comparison to the annual PM2.5 NAAQS are considered. U.S. EPA "intends to evaluate areas using the most recent complete three consecutive calendar years of quality-assured, certified air quality data" (2010-2012). However, as indicated in the guidance, certified air quality monitoring data from 2013

may be considered by USEPA before final recommendations are made. Given the proximity of this recommendation to the end of the year, IEPA intends to review 2013 monitoring data when it becomes available and, if a change in our recommendation is warranted based on the 2011-2013 data, will request that USEPA take the 2011-2013 data into account at that time. A detailed discussion of air quality in Illinois is provided in the sections below.

2. **Emissions and Emissions Related Data:** An evaluation of PM2.5 emissions from sources of direct PM2.5 and the major components of direct PM2.5: organic carbon; elemental carbon; crustal material; nitrates and sulfates; and precursor gaseous pollutants known as sulfur dioxide (SO_2), oxides of nitrogen (NO_x), volatile organic compounds (VOC), and ammonia (NH_3) located in and near the violating area which may potentially contribute to observed or modeled violations of the NAAQS. The emissions data used in this analysis are based on actual PM2.5 emissions reported to U.S. EPA by the IEPA for the 2011 National Emissions Inventory (NEI). Due to the fact that air quality is typically the result of a combination of both regional and local emissions, PM2.5 components such as sulfates and nitrates formed through atmospheric processes can be transported hundreds of miles and influence the regional contribution. These emissions may not be considered "nearby" sources and are often referenced as "transported" emissions. Additionally, emissions related data includes emissions coming from transportation and population based emissions. Emission contributions are discussed in detail throughout this document.

3. **Meteorology:** An evaluation of weather conditions, including wind speed and direction that affect the plume of sources contributing to ambient and monitored PM2.5 concentrations. Pollution roses are derived from IEPA sites in the proposed NAAs using first-order National Weather Service (NWS) wind direction measurements paired with daily PM2.5 concentrations. The pollution roses show the frequency of wind directions at the monitor when higher 24-hr concentrations of PM2.5 are occurring. Detailed

meteorology used in IEPA's analysis is discussed in the sections below.

4. **Geography/Topography:** Includes an evaluation of the physical features of the land that might have an effect on the airshed and, therefore, on the distribution of PM2.5 at and near the monitors. Due to the fact that neither of the recommended PM2.5 NAAs in Illinois have any geographical or topographical barriers that significantly limit air pollution transport within the airsheds, the geography/topography factor did not play a significant role in determining the nonattainment boundaries in Illinois.

5. **Jurisdictional Boundaries:** Includes an analysis of areas that provide clearly defined legal boundaries, including landmarks or geographic coordinates, to carry out air quality planning and enforcement functions for the NAA. The Illinois EPA is responsible for air quality regulatory programs for every county in the state. Jurisdictional boundaries considered in this analysis are consistent with recommended geographic boundaries, or definitions, outlined in U.S. EPA's guidance documentation. Sub-county boundaries (townships) in this study reflect 2009 Political Township boundaries provided by Property Tax Division of the Illinois Department of Revenue.

Illinois Air Quality

As recommended by U.S. EPA, the first step in identifying areas that are in violation of the revised annual PM2.5 NAAQS is to evaluate the most recent three years of ambient air monitoring data. Table 1 presents Illinois' certified, quality-assured PM2.5 air monitoring data for 2010 through 2012, including annual design values, for the 31 monitors that are suitable for comparison to the annual NAAQS. The annual PM2.5 design value is defined as the three-year average of the annual mean concentrations collected at each monitor. The trend in annual PM2.5 concentrations across Illinois has been generally downward since 1999, when the statewide PM2.5 monitoring network was first established (Figure 1). Despite the significant improvement in air quality statewide, three monitoring sites still currently violate the revised annual PM2.5 NAAQS: the Washington High School site in Chicago, the Fire Station #1 site in Granite City, and the RAPS Trailer site in East St. Louis. These three sites are located in Cook, Madison, and St. Clair Counties, respectively (Figure 2). The remaining 28 monitoring sites are attaining the revised annual PM2.5 NAAQS, most by a considerable margin.

Due to the location of the three violating monitors and the natural north-south geographical division between the one site in Chicago and the two other sites in Metro-East St. Louis, two separate Five Factor Analyses were conducted by the IEPA. These two areas are referenced as the Chicago Metropolitan Study Area (Chicago Study Area) and the Metro-East St. Louis Study Area (Metro-East Study Area).

Figure 1

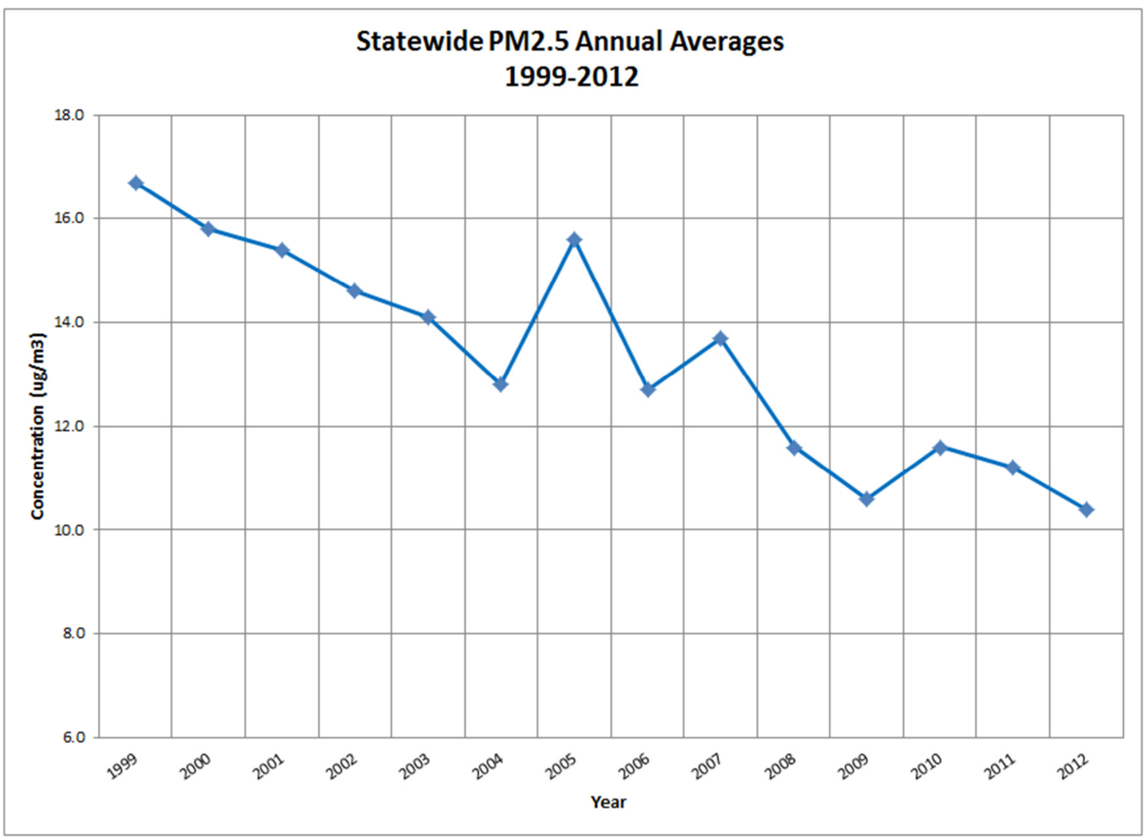
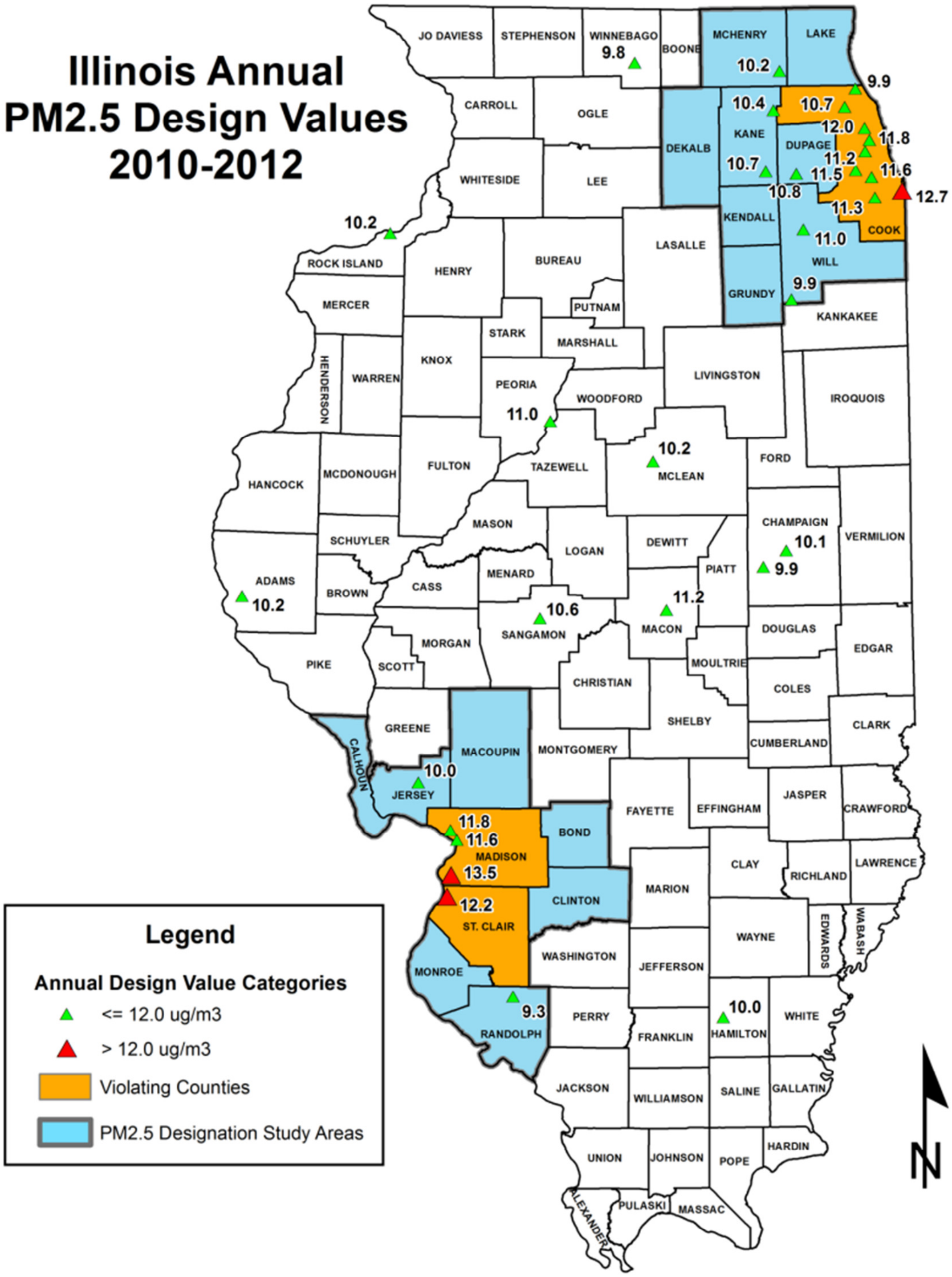


Table 1
2010-2012 Illinois PM2.5 Design Values (ug/m^3)

AQS Code	County	Site	Annual Averages			Design Value
			2010	2011	2012	
170010007	Adams	Quincy	10.5	10.4	*9.7*	10.2
170190006	Champaign	Champaign	n/a	10.6	9.7	10.1
170191001	Champaign	Bondville	10.5	10.2	8.9	9.9
170310022	Cook	Chicago-Washington	14.0	12.6	11.5	**12.7**
170310052	Cook	Chicago-Mayfair	12.6	11.8	11.6	12.0
170310057	Cook	Chicago-Springfield	12.0	*11.5*	11.9	11.8
170310076	Cook	Chicago-ComEd	12.3	11.3	*11.3*	11.6
170312001	Cook	Blue Island	11.6	11.6	10.9	11.3
170313301	Cook	Summit	12.2	11.0	11.3	11.5
170314007	Cook	Des Plaines	10.6	10.6	10.9	10.7
170314201	Cook	Northbrook	9.3	10.2	10.2	9.9
170316005	Cook	Cicero	11.9	11.4	*10.4*	11.2
170434002	DuPage	Naperville	11.7	10.5	10.1	10.8
170650002	Hamilton	Knight Prairie	11.3	10.1	*8.5*	10.0
170831001	Jersey	Jerseyville	11.2	*10.5*	8.4	10.0
170890003	Kane	Elgin	11.3	9.8	10.0	10.4
170890007	Kane	Aurora	11.4	10.8	9.9	10.7
171110001	McHenry	Cary	10.2	10.1	10.1	10.2
171132003	McLean	Normal	10.6	10.7	9.3	10.2
171150013	Macon	Decatur	12.2	11.6	10.0	11.2
171191007	Madison	Granite City-Firestation	14.3	13.3	12.8	**13.5**
171192009	Madison	Alton	13.3	11.5	*10.4*	11.8
171193007	Madison	Wood River	12.0	12.4	10.6	11.6
171430037	Peoria	Peoria	11.5	11.7	9.8	11.0
171570001	Randolph	Houston	10.2	9.5	8.3	9.3
171613002	Rock Island	Rock Island	*9.9*	10.9	9.7	10.2
171630010	St. Clair	East St. Louis	13.0	12.8	10.9	**12.2**
171670012	Sangamon	Springfield	11.5	10.7	9.5	10.6
171971002	Will	Joliet	11.8	10.2	11.1	11.0
171971011	Will	Braidwood	10.0	10.4	9.3	9.9
172010013	Winnebago	Rockford	*10.0*	10.2	9.3	9.8

Note: Annual Averages based on less than four complete quarters of data are indicated with *underlined italics*.

Figure 2



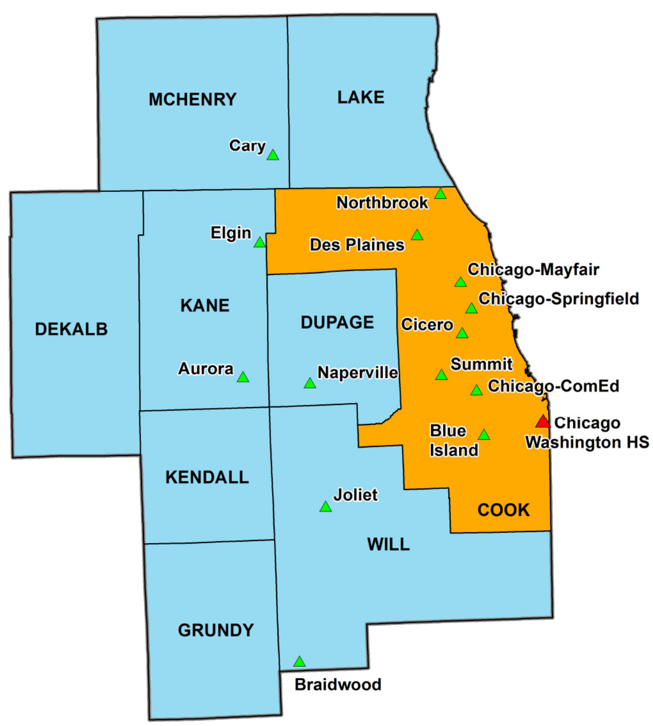
Source: USEPA's AQS PM2.5 Design Value Report for 2012.

Illinois Five Factor Analysis for Chicago Metropolitan Study Area

The U.S. EPA recommends that states consider the following five factors in assessing area-specific analyses to support the designation of nonattainment area boundaries. As previously mentioned, Illinois has three counties where monitored violations of the revised annual PM2.5 NAAQS are occurring. One of these monitors is located in the Chicago Metropolitan Study Area (Chicago Study Area). Figure 3 shows the counties and ambient air monitoring sites included in the Chicago Study Area. The information in the following sections provides boundary recommendations based on the five factors outlined in U.S. EPA guidance for the Chicago Study Area.

Figure 3

Chicago Metropolitan Study Area



Factor 1 – Air Quality Data

Spatial Analysis

The annual PM2.5 design values for the Chicago Study Area are shown below in Figure 4. As can be seen from the map, there are significant west to east and north to south concentration gradients. Design values in the outlying counties range from 9.9 to 11.0 ug/m^3, then gradually increase to peak values above 11.5 ug/m^3 along a southeast-northwest line in eastern Cook County. Along this axis, there are two distinct areas of peak concentration values. The first area is in north central Cook County centered on the Mayfair site, with a peak design value 12.0 ug/m^3. The second, and more important, area is in southeastern Cook County at the Washington High School site, where the design value of 12.7 ug/m^3 currently violates the revised annual PM2.5 NAAQS.

Figure 4

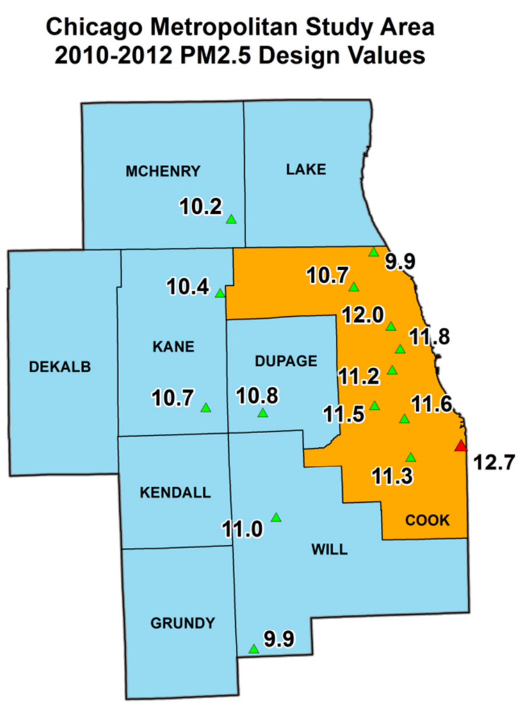
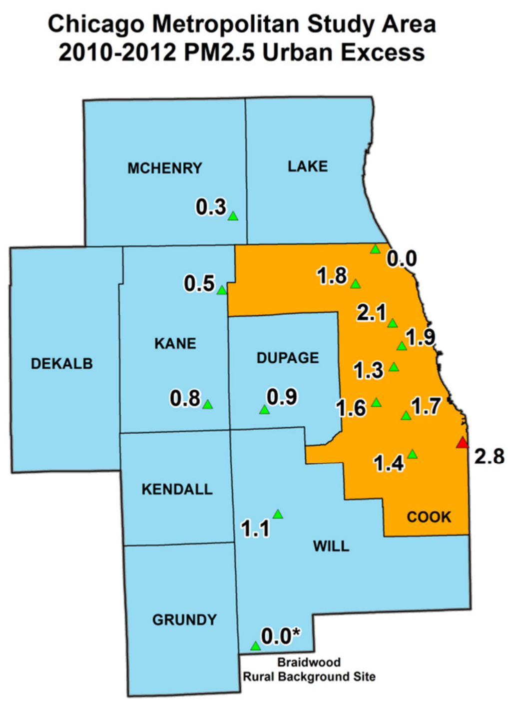


Figure 5 shows the amount of urban excess at the PM2.5 monitoring sites across the Chicago Study Area. These values were calculated by taking the 2010-2012 design values for all of the Chicago area monitoring sites and subtracting out the 9.9 ug/m^3 of PM2.5 recorded at the rural background site in Braidwood, IL. The resulting map of urban excess values shows that, while local emission sources within Cook County appear to generate a large amount of the urban excess measured at the Washington High School site, the outlying portions of the metropolitan area generate significant amounts of PM2.5 as well. The urban excess values at all of the monitoring sites outside of Cook County account for an average of 25.7% (0.72 ug/m^3) of the urban excess at the Washington High School site. This value jumps to 33.3% (0.93 ug/m^3) if data from only the three most proximate, upwind monitors in Will, DuPage, and southern Kane Counties are considered (the Joliet, Naperville, and Aurora sites, respectively). This suggests that the violation at the Washington High School site is not solely due to local emission sources. It appears that there is a significant urban-scale component as well.

Figure 5



Temporal Analysis

Figure 6 presents the annual PM2.5 design value trends for the Chicago Study Area at nine long-term monitoring sites. The graph shows that annual design values across the Chicagoland area have dropped significantly between the periods of 1999-2001 and 2010-2012. Most of this improvement has been due to the large reduction in regional background levels. Design values at the Braidwood background site have dropped from 13.7 ug/m^3 to 9.9 ug/m^3. The amount of locally-generated urban PM2.5 has decreased as well, with the maximum urban excess value dropping from 4.4 ug/m^3 to 2.8 ug/m^3 during the same period. As a result of both regional and local improvements in air quality, only the Washington High School site on the southeast side of Chicago currently violates the revised Annual NAAQS. However, there are still a significant number of sites with design values of 11.5 ug/m^3 or higher, including the Mayfair site which is currently at 12.0 ug/m^3.

Figure 6

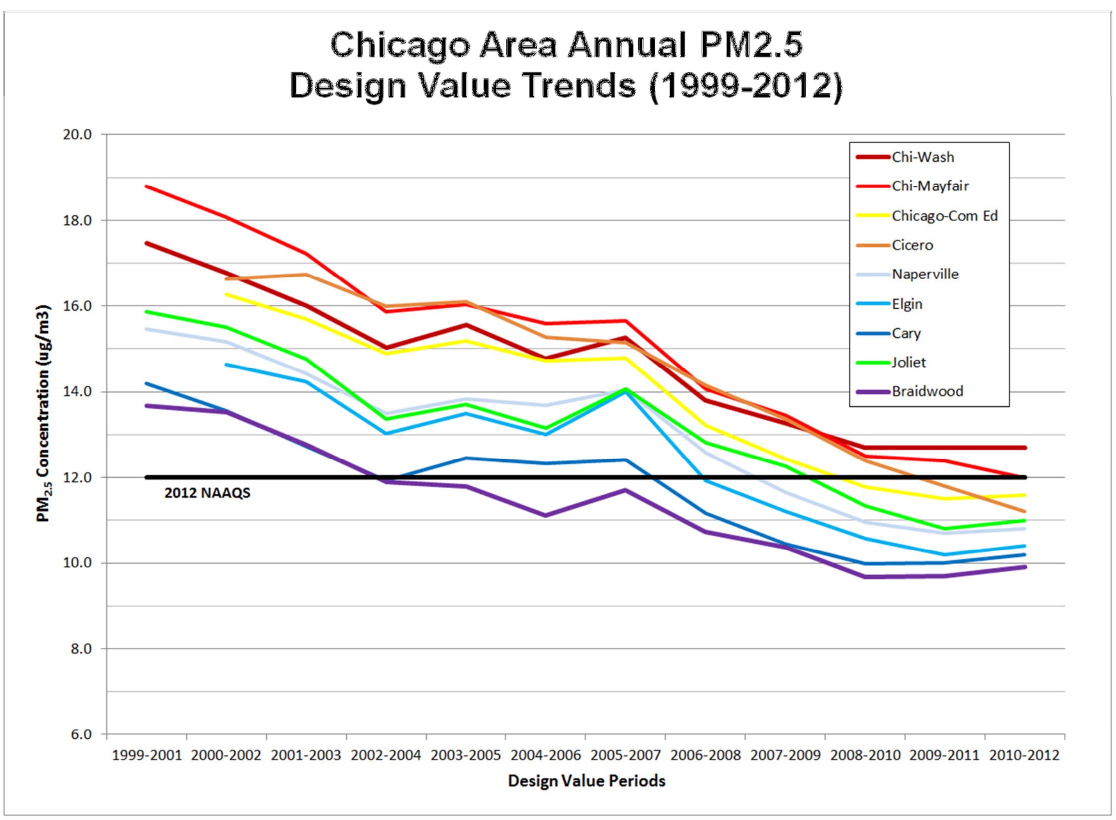


Figure 7 presents the time series trend in seasonal PM2.5 averages for all of the monitors located in the Chicago Study Area between the Winter of 2010 and the Fall of 2012. These values were computed from individual monthly averages that were grouped by meteorological season for each year rather than by calendar quarters (i.e., Winter – December, January, and February; Spring – March, April, and May; Summer – June, July, and August; and Fall – September, October, and November). As can be seen from both Figures 7 and 8, the PM2.5 monitors in the Chicago Study Area are generally winter dominant. As a result, straight calendar quarter averages that split the winter meteorological season into two pieces tend to obscure each site's true meteorologically-driven seasonal patterns.

Figure 7 shows that a large number of sites across the Chicago Study Area have recorded seasonal averages in excess of the level of the revised annual PM2.5 NAAQS. In fact during the Winter of 2011, every single monitor in the Chicago Study Area had a seasonal average above 12.0 ug/m^3. Overall, there is a fairly consistent pattern between all of the sites, with the peak seasonal values occurring during the Winter and Summer periods. The lowest seasonal averages are recorded in both the Spring and Fall. There tends to be a wider range of values among the sites during the Winter and Summer seasons than in either Spring or Fall. The seasonal averages across all sites have been trending downward, especially since the the Winter of 2011, with values in 2012 significantly lower than those recorded in 2010 and 2011. As the seasonal averages have decreased, the Washington High School Site has transitioned from being the most dominant site in the Chicago Study Area to only recording occassional "blips," such as the Summer of 2012.

Figure 8 presents the overall meteorological seasonal averages for the years of 2010, 2011, and 2012 for each monitoring site located in the Chicago Study Area. The monitoring sites are sorted from left to right in descending design value order. The graph clearly shows how Winter-dominant the entire Chicago Study Area is compared to the other three meteorological seasons. Only two sites (Blue Island and Cicero) have Summer averages that even come close to matching their Winter values. With the exception of four sites located in the northern portion of the Chicago Study Area, every monitor, including the Braidwood background site, have Winter seasonal averages for the 2010-2012 period above 12.0 ug/m^3. These high values are due to elevated local and regional nitrate levels combined with the poor meteorological dispersion conditions, such as low mixing heights, that only occur during the Winter. Summer averages at each site, with the two exceptions noted above, are considerably lower than the Winter values. Also, unlike the widespread regional pattern of elevated values seen in the Winter averages, all of the sites with Summer values greater than 12.0 ug/m^3 are confined to Cook County. Spring and Fall seasonal averages across the Study Area are well below 12.0 ug/m^3, with the Spring values being generally higher for the sites the highest design values and the Fall values being higher for the sites with the lowest design values. The Washington High School site has the highest seasonal averages for Winter, Summer, and Spring, indicating that the site is being influenced by local emissions sources. However, the seasonal average data also indicate that highest sites in Cook County are also being impacted by both urban-scale and regional transport from the west-southwest, especially in the Winter.

Figure 7

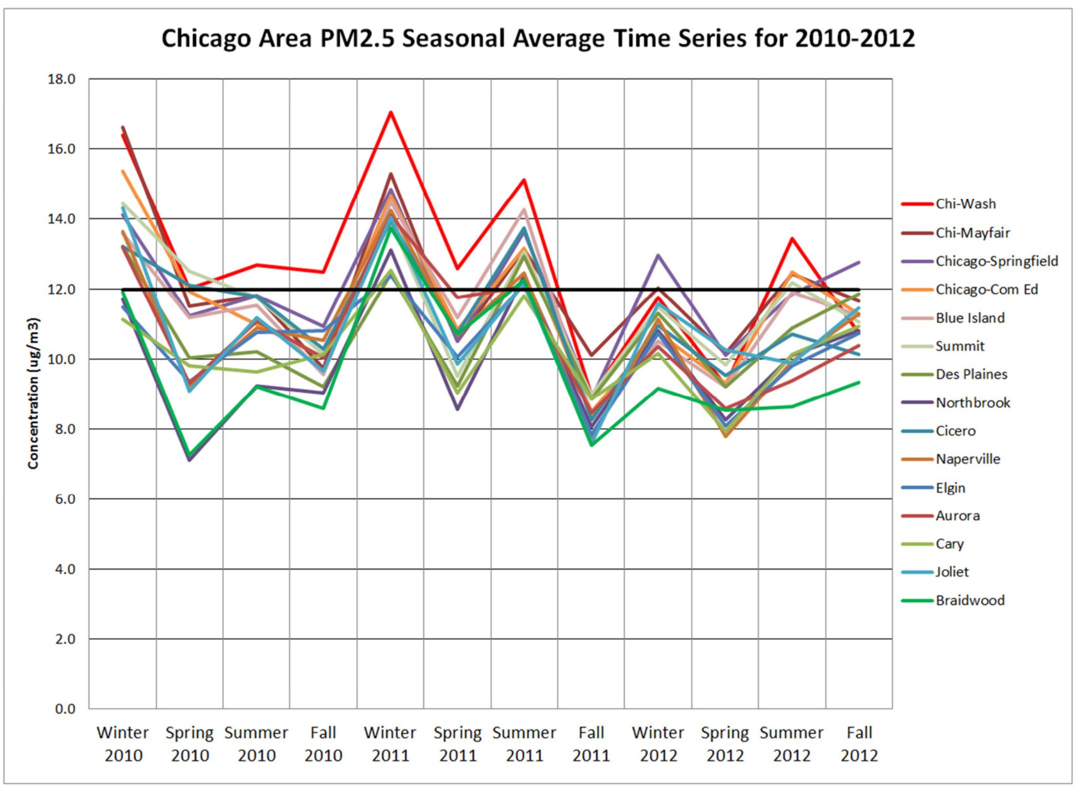
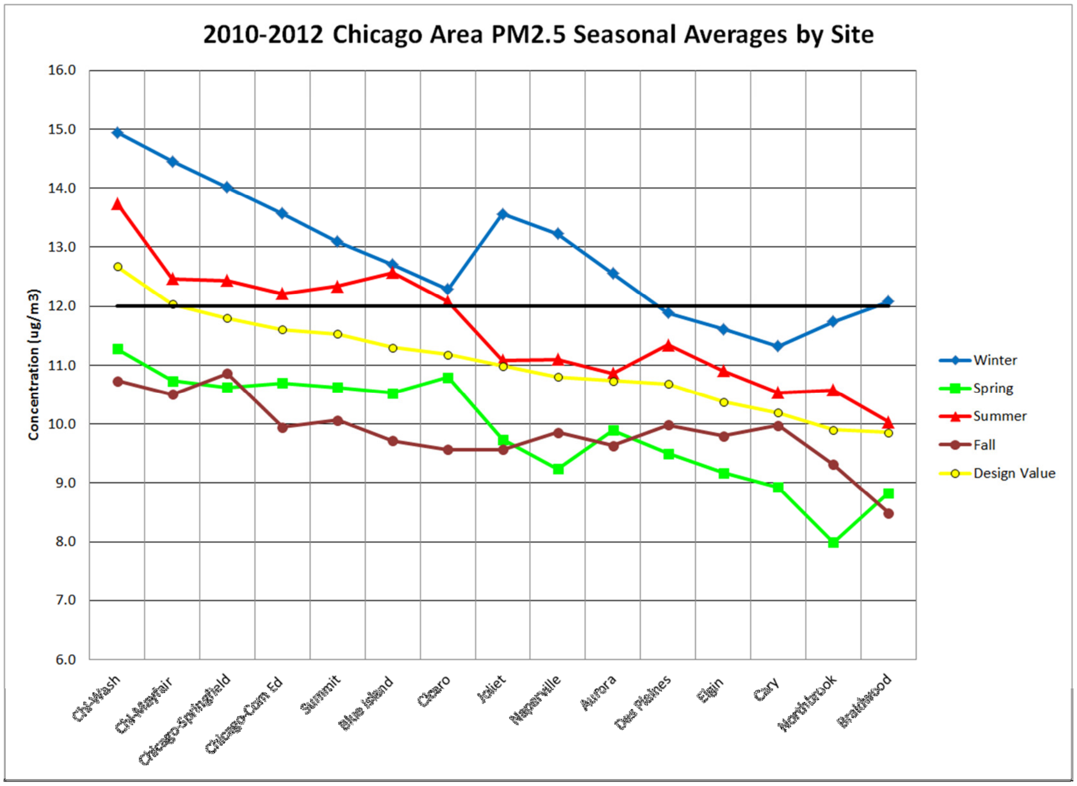


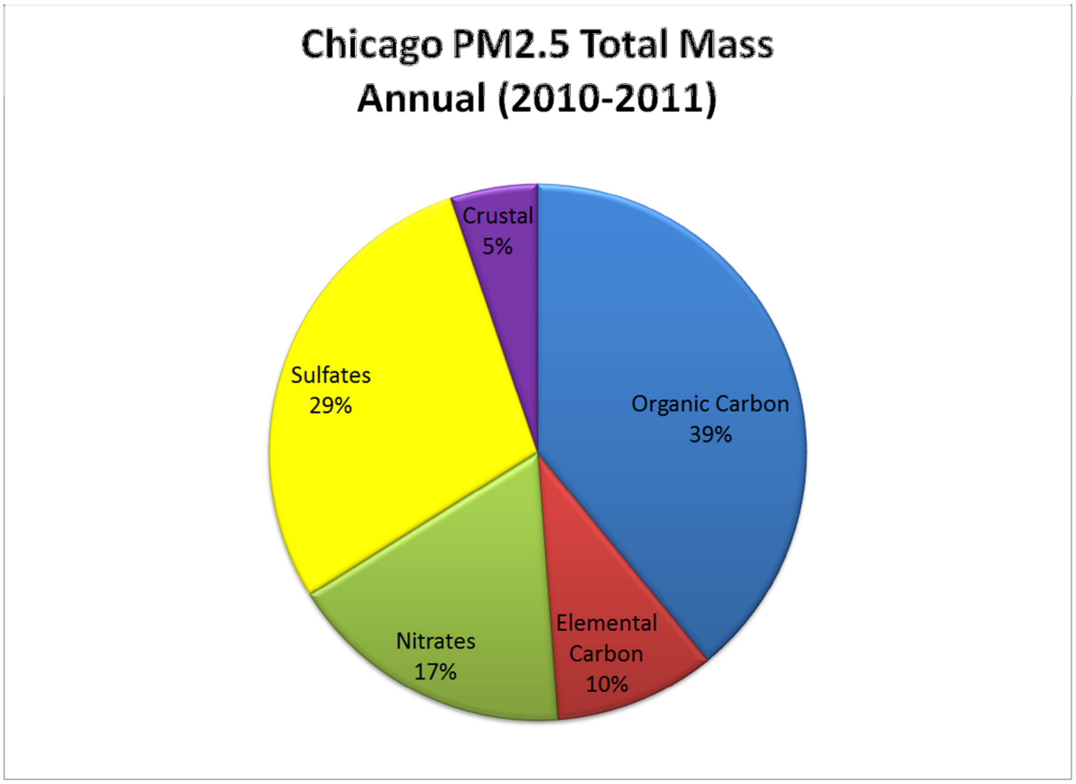
Figure 8



Chemical Speciation Analysis

Unfortunately, there are no PM2.5 chemical speciation data available at the Washington High School site. The closest chemical speciation site is the Com Ed monitor, which is located approximately 10 miles to the northwest. The Com Ed site is not located in as heavily of an industrialized area as the Washington High School site, but it is similarly situated in close proximity to many busy road and rail corridors. The Com Ed site is also located in the southern part of Chicago and is downwind of many of the same major stationary and mobile sources of emissions.

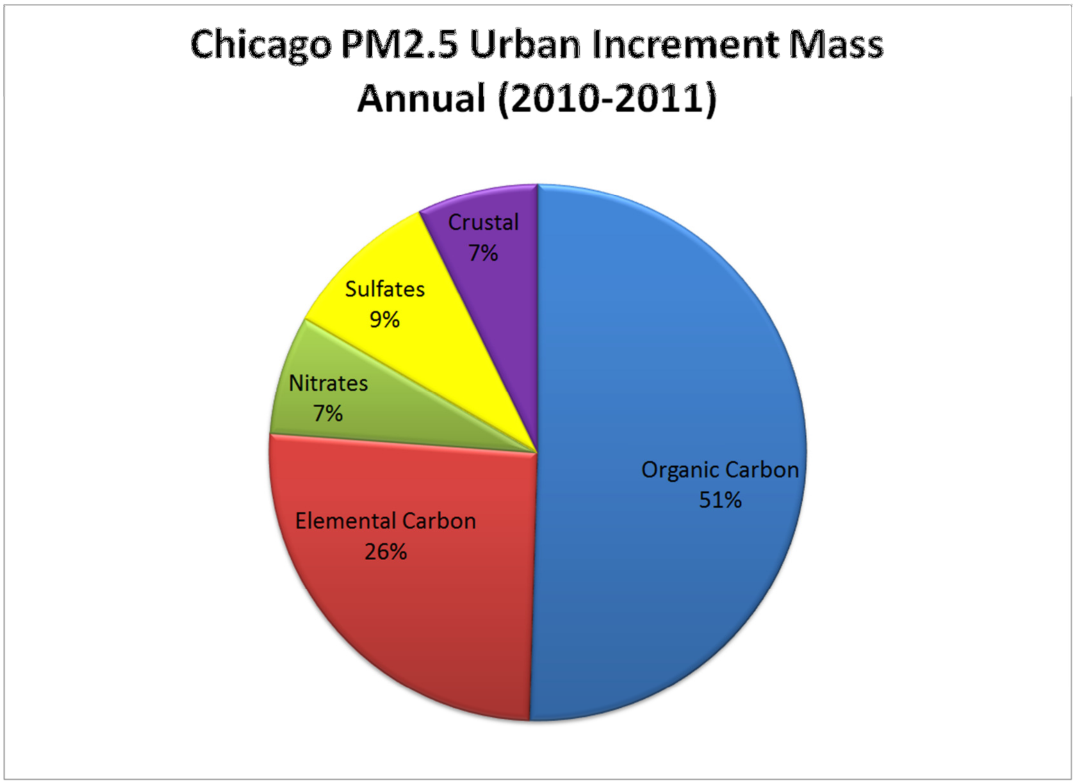
Figure 9



Figures 9 and 10 present the 2010-2011 Annual Total Mass and Urban Increment Mass PM2.5 chemical speciation data for the Com Ed monitor. The patterns shown in both of the pie charts are very similar to many urban speciation sites located across the country. Organic Carbon, Sulfates, and Nitrates dominate the Total Mass pie chart in Figure 9. The high percentages of Sulfates and Nitrates are related primarily to regional transport. When these regional background components are removed, local and urban-scale Elemental Carbon, Organic Carbon, and Crustal Materials dominate the Urban Increment Mass in Figure 10. The increases in Elemental Carbon and Organic Carbon are the most significant and together they make up 77% of the total Urban Increment Mass. These two speciation components point to the large urban-scale emissions from on-road and non-road mobile sources and stationary VOC sources that are found across the Chicago Study Area. Sulfates, Nitrates, and Crustal Materials are all much smaller components, but, when taken together, still represent a significant amount of the Urban

Increment. The Sulfates are most likely associated with the large coal-fired power plants and industrial boilers located within Chicago Study Area. These coal-fired stationary sources also contribute to the Nitrate levels as well, along with the on-road and non-road mobile sources. Lastly, the Crustal Materials are most likely associated with more localized emission sources, such as exposed soils, unpaved roadways, storage piles, and metallurgical-related facilities.

Figure 10



Air Quality Factor Analysis Summary

One monitor currently violates the revised annual PM2.5 NAAQS in the Chicago Study Area. While this site may be impacted by local emission sources, the air quality data for the rest of the Chicago Study Area also points to the impact of regional background and urban-scale emission sources. Almost 78% of the PM2.5 mass measured at the Washington High School site is advecting into the study area at the Braidwood background site due to regional transport. The distribution of the urban excess across the Chicago Study Area shows that significant amounts of additional PM2.5 is being generated within the urban area itself. The existence of urban-scale transport is also clearly evident in the 2010-2012 seasonal time series and the 2010-2012 individual monitoring site seasonal averages. Lastly, the chemical speciation data shows that a very large portion of the Urban Increment Mass is tied to urban-scale Organic Carbon and Elemental Carbon emission sources. The chemical speciation data also indicate that there are significant amounts of Sulfates, Nitrates, and Crustal Materials being generated by urban and local-scale emissions sources as well.

Factor 2 - Emissions and Emissions - Related Data

According to U.S. EPA guidance, source locations as well as the level of emission of PM2.5 related pollutants must also be considered when determining NAA boundaries. PM2.5 is formed through complex atmospheric processes. PM2.5 may be directly emitted to the atmosphere or it can be formed when emissions of NOx, SO_2, VOC, Ammonia (NH_3), and other gases react in the atmosphere. These pollutants are referred to as precursors of PM2.5. The majority of airborne PM2.5 is formed due to precursor emissions. Table 2 shows the ranked PM2.5 and precursor emissions for all of the counties in the Chicago Study Area, based on the 2011 NEI . An evaluation of emissions data shows Cook, Will, Lake, and DuPage Counties as having the greatest level of emissions. Combined they contribute approximately 86% of the total emissions in the area. Kane, McHenry, and DeKalb Counties contribute approximately 11% of the total emissions to the study area and Grundy and Kendall Counties are ranked the lowest with 3.4% of the total emissions.

Table 2
Ranked Chicago Area Emissions by County
Total Tons/Year (TPY)

Illinois Counties	PM2.5	NOx	NH3	SO2	VOC	Total TPY	Percent of Total	Rank
Cook	17,296.29	108,491.22	3445.3	16,507.69	85,360.44	231,100.94	47.9%	1
Will	4,710.46	29,074.20	1,692.42	34,580.37	13,809.04	83,866.49	17.4%	2
Lake	2,591.68	20,734.24	613.89	10,728.58	18,225.48	52,893.87	11.0%	3
DuPage	2,671.13	24,354.39	745.40	551.96	18,291.74	46,614.62	9.7%	4
Kane	2,322.83	12,407.63	985.24	277.86	9,412.35	25,405.91	5.3%	5
McHenry	1,727.77	6,949.17	1,115.43	124.10	5,675.54	15,592.01	3.2%	6
DeKalb	1,641.88	3,566.02	2,821.29	139.36	2,879.8	11,048.35	2.3%	7
Grundy	1,223.46	3,909.37	682.62	148.31	2,125.75	8,089.51	1.7%	8
Kendall	1,044.81	3,158.37	740.79	51.87	3,062.68	8,058.52	1.7%	9
Total Chicago Study Area	**35,230.31**	**212,644.61**	**12,842.38**	**63,110.1**	**158,842.82**	**482,670.22**	**100%**	

IEPA emissions data for PM2.5 and its precursors from the 2011 National Emissions Inventory (NEI) are evaluated and summarized in descending order by county for point, area, non-road and on-road (mobile) source categories in Appendix A, Figures A1 through A5. A point source is defined as a source whose emissions are generally discharged through stacks. Area sources are defined as emissions that are spread over wide areas with no distinct release points (e.g., forest fires), or ones that are comprised of a large number of small sources that are difficult to describe separately (e.g., residential fuel combustion). On-road mobile sources are classified as emissions from cars, trucks, buses, and motorcycles that are used for transportation of goods and passengers on streets and roads. Mobile non-road sources are characterized by emissions from other modes of powered transportation, such as airplanes, trains, ships, and off-highway motor vehicles.

U.S. EPA recommends that proposed nonattainment designations for the PM2.5 NAAQS reflect not only the areas of measured violations, but also the nearby areas that contribute to the measured violations. Figures A1 through A5 (Appendix A), and the accompanying tables, summarize reported emissions from point, area, non-road and on-road/mobile sources in the Chicago Study Area, for the following pollutants: SO_2, NO_x, VOC, NH_3, and direct PM2.5. Metropolitan areas where violations are occurring were evaluated separately based on ranked county level 2011 NEI emissions, as well as on contributions from emissions transported from more distant sources.

For the Chicago Study Area:

- SO_2 emissions are highest in Will, Cook, and Lake Counties, with the greatest emissions coming from point sources. Cook and Will Counties contribute about 81% of the total SO_2 emissions in the area.
- NO_x emissions are highest in Cook County with the greatest emissions from on-road sources. Cook County contributes to about 51% of total NO_x emissions in the Chicago Study Area. NO_x emissions in Will, DuPage, and Lake Counties are also relatively high.
- VOC emissions are highest in Cook County, with the greatest emissions coming from

area sources. VOC emissions from Cook County make up approximately 54% of the total VOC emissions in the area. DuPage and Lake Counties also have relatively high VOC emissions at 23%.

- NH_3 emissions are highest in Cook County, where on-road and area source contributions are greatest. DeKalb contributes the second highest amount of NH_3 emissions. Will, McHenry, and Kane Counties have moderately high emissions of NH_3. The combined emissions from Cook, DeKalb, Will, McHenry, and Kane Counties contribute about 78% of total NH_3 in the Chicago Study Area.
- Direct PM2.5 emissions are highest in Cook and Will Counties with area sources as the greatest contributor. PM2.5 emissions in the both Cook and Will Counties contribute about 63% of total direct PM2.5 emissions in the Chicago Study Area. PM2.5 emissions are relatively high in DuPage Lake, and Kane Counties. When combining emissions from DuPage, Lake, and Kane Counties, the emissions account for approximately 22% of total direct PM2.5 emissions in the area.

Figures A6 through A10 (Appendix A) depict both the locations and facility-reported 2011 emissions for the major point sources (reported emissions over 100 tons per year) in the Chicago Study Area for SO_2, NO_x, VOC, NH_3, and primary PM2.5. As such, sources are shown on these figures as of 2011; some sources may have ceased operation or had other changes since that time, but still appear in these figures. The orange shaded areas in the figures represent the Chicago metropolitan areas that are currently in maintenance status for annual PM2.5 and the blue boundary line represents the study area where emission sources are being evaluated as part of this study as contributing to nonattainment.

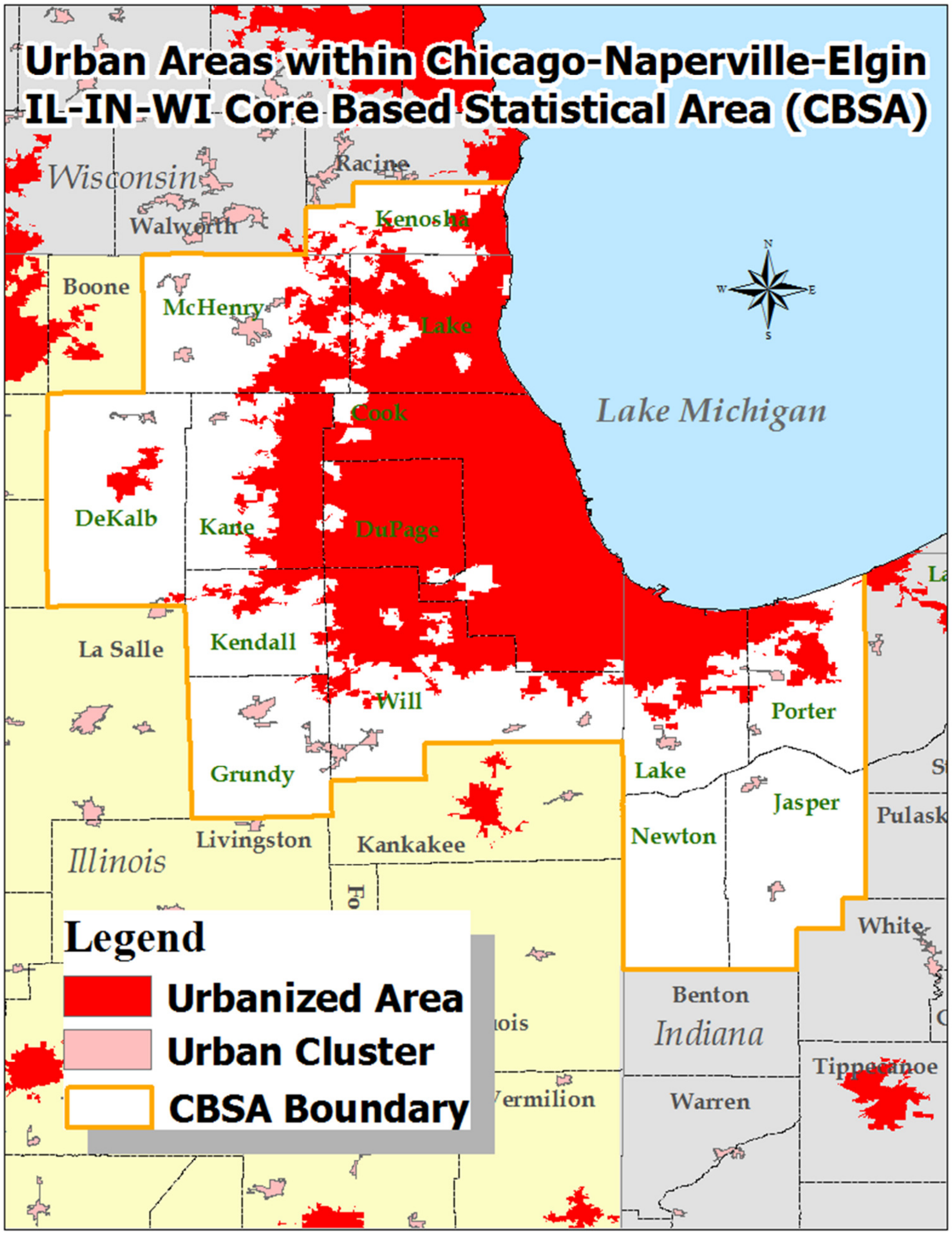
For the Current Chicago Study Area (Figures A6 through A10), the largest SO_2 point sources are located within Will County. Will County also has the largest number of SO_2-emitting point sources. The largest point sources for NO_x are also located in Will County. Cook and Lake Counties also contain major point sources contributing NO_x emissions. Both the largest size and greatest number of VOC point sources occur in Cook, Will, and part of Kane County, followed by Grundy and Kendall Counties. Based on IEPA's 2011 reported emissions inventory, there are few point sources emitting NH_3 in the Chicago area. Only two smaller sources located in Will County area are reporting greater than 100 tons/year of NH_3. Based on IEPA's 2011 reported emissions inventory, the largest and greatest number of emitting point sources of direct PM2.5 are located in Cook and Will Counties.

Emission Related Data – Population and Urbanization

In addition to emissions inventory data, population, urbanization, and transportation-related emissions were also considered as part of the emissions-related data analysis.

Figure 11 illustrates the extent of urbanized area within the Chicago-Naperville-Elgin, IL-IN-WI Core Based Statistical Area (OMB bulletin NO.13-01, February 28, 2013), further referenced here as the Chicago CBSA. According to the U.S. Census Bureau, CBSA boundaries are dependent on a central urbanized area or contiguous area of relatively high population density. Outlying counties are included in CBSAs if they exhibit strong social and economic ties to this core area, often measured by commuting and economic patterns. A pattern of fragmented urban development and commuting toward the urban center is apparent in DeKalb and parts of Kendall and Grundy counties, which supports their inclusion in the Chicago CBSA. Table 3 lists population as well as land areas and population densities based on U.S. Census Bureau estimates for 2010 for each of the counties contained in the Chicago CBSA.

Figure 11


Urban Areas within Chicago-Naperville-Elgin
IL-IN-WI Core Based Statistical Area (CBSA)
Wisconsin
Racine
Walworth
Kenosha
Boone
McHenry
Lake
Cook
Lake Michigan
DeKalb
Kane
DuPage
La Salle
Kendall
Will
Porter
Grundy
Lake
Jasper
Newton
Pulask
Livingston
Kankakee
Illinois
White
Benton
Indiana
Warren
Tippecanoe
Vermilion
Legend
Urbanized Area
Urban Cluster
CBSA Boundary

An evaluation of the population in the CBSA shows that Cook, DuPage, Lake (IL), and Will Counties make up about 79.2% of the total population in the CBSA, with Cook County contributing over half of the total population in the area.

Illinois counties within the CBSA account for 90.7% of the population (see Table 3), while Indiana counties only account for 7.5% of the overall population and Wisconsin's Kenosha County contributes only 1.8 %. Cook, DuPage, and Lake Counties have the highest population densities. Both Will and Kane counties have moderate population density. In comparison, Lake County Indiana also has moderate population density and Jasper and Newton Counties have the lowest population density in the area.

Table 3
Total Population Estimates by County for the Chicago CBSA

State	County	2010 Population	Land Area (Sq. Miles)	Population Density (Persons per sq. mile)	Percent of CBSA	Cumulative Percent
IL	**Cook**	5,194,675	946	5491	54.9%	54.9%
IL	**DuPage**	916,924	334	2745	9.7%	64.6%
IL	**Lake**	703,462	448	1570	7.4%	72.0%
IL	**Will**	677,660	837	810	7.2%	79.2%
IL	**Kane**	515,269	520	991	5.4%	84.6%
IN	Lake	496,005	497	998	5.2%	89.9%
IL	**McHenry**	308,760	604	511	3.3%	93.1%
WI	Kenosha	166,426	273	610	1.8%	94.9%
IN	Porter	164,343	418	393	1.7%	96.6%
IL	**Kendall**	114,736	321	357	1.2%	97.9%
IL	**DeKalb**	105,160	634	166	1.1%	99.0%
IL	**Grundy**	50,063	420	119	0.5%	99.5%
IN	Jasper	33,478	560	60	0.4%	99.8%
IN	Newton	14,244	402	35	0.2%	100.0%

When evaluating the Chicago Study Area by itself (Illinois counties only), based on 2012 U.S. Census Bureau total population estimates, we see a similar rank order in counties (Table 4). Cook, DuPage, Lake, and Will Counties make up a high percentage of the total population. These counties cumulatively account for more than 79% of the total population in the Chicago Study Area, followed by Kane and McHenry Counties having moderate population in comparison.

Table 4
Total Population Estimates by County for the Chicago Study Area

County	2012 Population	Land Area (Sq. Miles)	Population Density (Persons per sq. mile)	Percent of Study Area	Cumulative Percent	**Rank**
Cook	5,231,351	946	5,530	60.5%	60.5%	1
DuPage	927,987	334	2,778	10.7%	71.2%	2
Lake	702,120	448	1,567	8.1%	79.3%	3
Will	682,518	837	815	7.9%	87.2%	4
Kane	522,487	520	1,005	6.0%	93.3%	5
McHenry	308,145	604	510	3.6%	96.8%	6
Kendall	118,105	321	368	1.4%	98.2%	7
DeKalb	104,704	634	165	1.2%	99.4%	8
Grundy	50,281	420	120	0.6%	100.0%	9

Population growth is an important indicator of potential emission increases in an area. Table 5 outlines percent change in population between 2005 and 2012 by county for the Chicago Study Area. This data was provided by the U.S. Census Bureau and is based on estimates dated March 26, 2006. According to the data, Kendall County has experienced the greatest percent increase in population at 48.5%; however its total population is among the smaller counties at 1.4% of the overall study area. Cook County has experienced an estimated 1.4% decrease in population; however, its total population for 2012 represents approximately 61% of the total population within the Chicago Study Area.

Table 5
2005-2012 Population Change by County for the Chicago Study Area

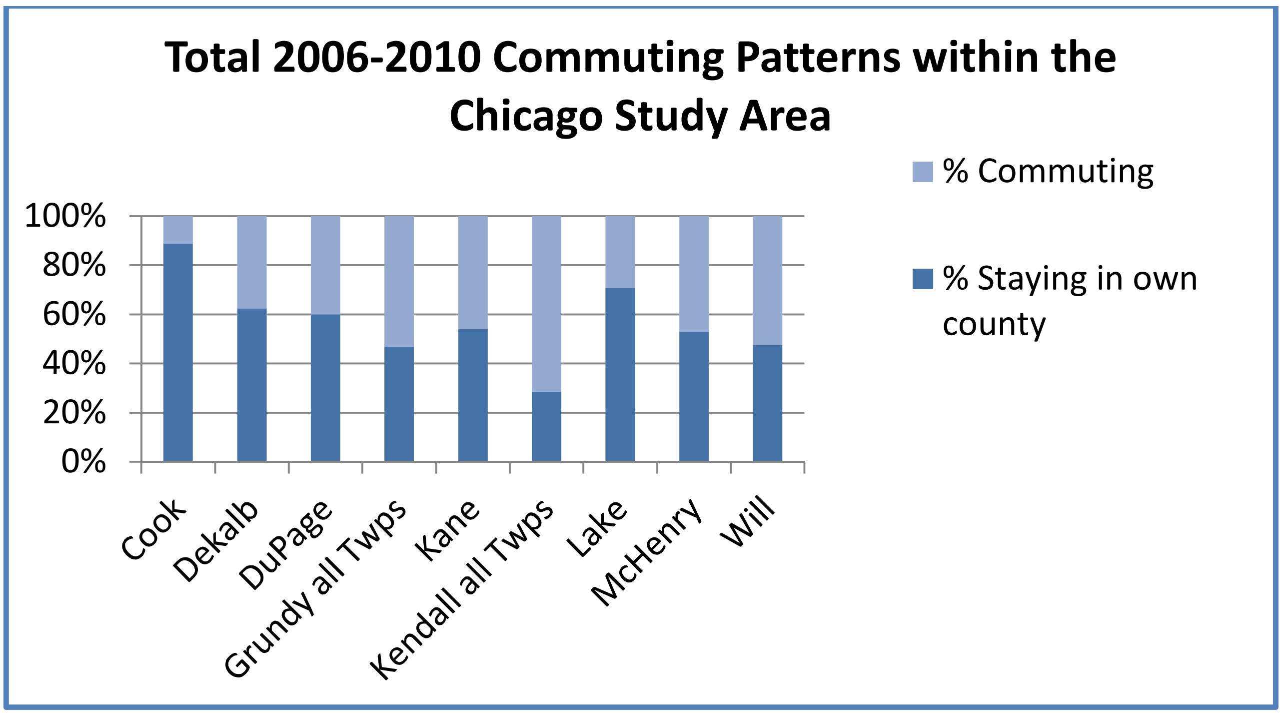
County	2005 Population	2012 Population	Change (%)
Kendall	79,514	118,105	48.5%
Grundy	43,838	50,281	14.7%
Kane	482,113	522,487	8.4%
DeKalb	97,665	104,704	7.2%
Will	642,813	682,518	6.2%
McHenry	303,990	308,145	1.4%
Lake	702,682	702,120	-0.1%
DuPage	929,113	927,987	-0.1%
Cook	5,303,683	5,231,351	-1.4%

The U.S. Census Bureau has compiled statistics from 2006-2010 American Community Survey data that quantify commuting patterns both between counties and in and out of the state. Table 6 and Figure 12 show counties within the Chicago Study area and their respective commuting patterns. Within most of the Chicago Study Area, a higher percentage of people stay in the counties in which they reside for work; however, commuting patterns within Kendall County show a much greater percentage of workers commuting to other counties within the study area at 71.5%. Grundy County statistics also show more than half of working age people commuting to other counties for work. Will County is more evenly weighted with 47.6% of working people who reside in the county staying in the county for work while 52.4% commute.

Table 6
Commuting Patterns in the Chicago Study Area

RESIDENCE COUNTY	% Staying in own County	% Commuting
Cook	88.8%	11.2%
Dekalb	62.5%	37.5%
DuPage	59.9%	40.1%
Grundy all Twps	46.8%	53.2%
Kane	54.0%	46.0%
Kendall all Twps	28.5%	71.5%
Lake	70.6%	29.4%
McHenry	53.1%	46.9%
Will	47.6%	52.4%

Figure 12



Emission Related Data – Traffic and Commuting Patterns

The Illinois Department of Transportation's (IDOT) Office of Planning and Programming publishes an annual report entitled "Illinois Travel Statistics." This report provides detailed information regarding vehicular traffic for each county in Illinois and for different users of traffic data. This includes annual average daily traffic (AADT) volumes and vehicle miles traveled (VMT) data, which are part of the IDOT's Traffic Count Program.

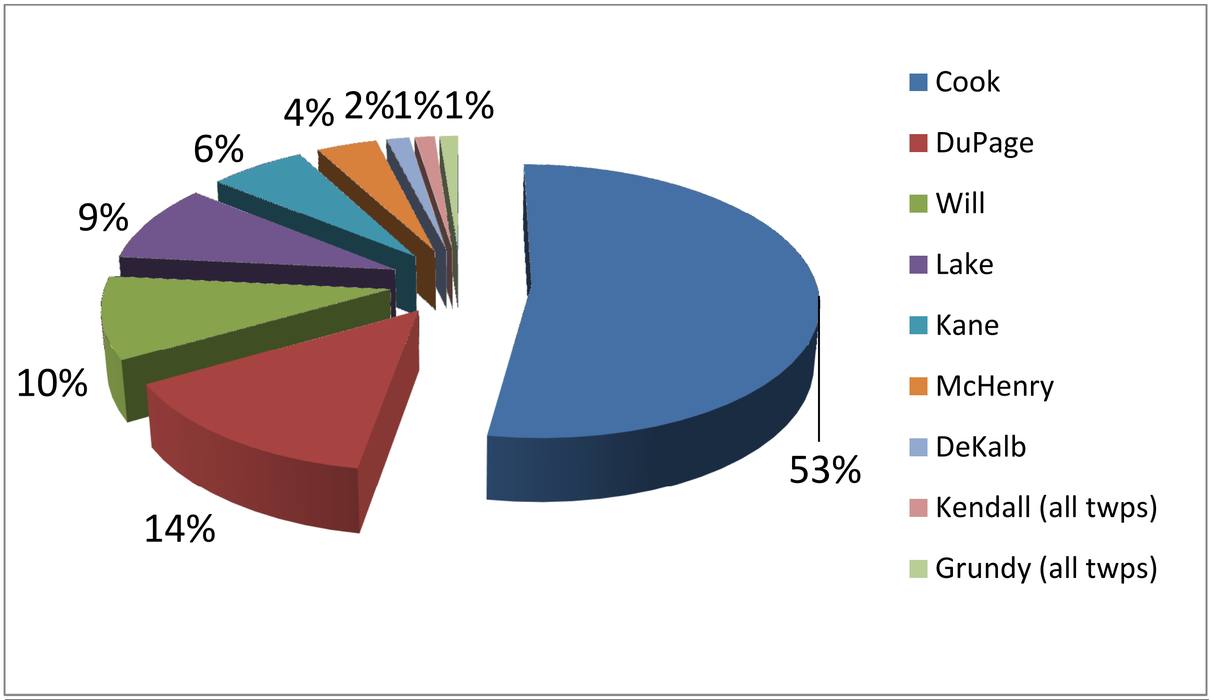
According to IDOT, Average Daily Vehicle Miles Traveled (ADVMT) and Daily Vehicles Miles traveled (DVMT) represent the same number. Annual Vehicle Miles Traveled (AVMT) is calculated as the total for the year, so DVMT * 365 = AVMT. The AVMT on a segment of road is calculated by multiplying the AVMT on the segment by the length of the segment in miles. Table 7 summarizes IDOT's estimates of AVMT for 2012, as calculated by IDOT's Highway Information System for the Chicago Study Area.

Table 7
2012 IDOT Travel Statistics for the Chicago Study Area

Chicago Study Area Counties	**Annual Vehicle Miles Traveled (AVMT)**
Cook	31,469,507,574
DuPage	8,424,261,955
Will	5,836,451,375
Lake	5,535,302,694
Kane	3,768,290,193
McHenry	2,341,490,195
DeKalb	888,587,200
Kendall	777,264,522
Oswego Township	275,398,679
Grundy	710,224,716
Aux Sable Township	160,700,408
Goose Lake Township	18,105,650

In the Chicago area, Cook, DuPage, Will, and Lake Counties have the highest AVMT. In fact, the AVMT in these four counties account for approximately 86% of the total AVMT for the Illinois portion of the Chicago Study Area (see Figure 13).

Figure 13
Percent by County – 2012 AVMT in the Chicago Study Area



Factor 3 – Meteorology

Illinois has a humid, continental climate. Winters are cold and increasingly snowy from south to north, while summers are hot and humid across the state. Spring and fall are transition seasons, sometimes having large temperature changes over short periods of time. Precipitation falls throughout the year, with spring and summer generally having larger precipitation totals than fall and winter. The wind can blow from any direction during any season throughout the state, but south to southwest winds are predominant on an annual basis statewide. Those locations that are in close proximity to Lake Michigan have a higher percentage of generally easterly winds (off of the lake) than do locations in other parts of the state. The distribution of wind directions over the course of a three-year period will look somewhat different depending on where in the state the meteorological station is, and at times, very localized effects, or poor siting and/or maintenance can affect the analysis. Therefore, IEPA has only chosen National Weather Service (NWS) operated sites for wind direction characterization. IEPA has also chosen AERMOD-ready surface meteorological data from which to extract wind speed and direction, since the AERMOD-ready files have been processed with AERMINUTE, a preprocessor that uses averages of one-minute data to produce an hourly wind direction and speed, rather than using an instantaneous wind speed and direction taken once an hour. Use of the AERMINUTE preprocessor greatly reduces the number of calm winds in the data set. The finer temporal resolution data bears out that an essentially calm wind over the course of an hour is quite rare. The resulting meteorological data more accurately represents the wind flow at the station of interest.

A wind rose is a depiction of the frequency of occurrence of wind directions in each of sixteen 22 and a half degree segments around the compass. The primary directions of north, east, south, and west are denoted, and each concentric ring around the center indicates a given percentage increase from the next smallest ring. In other words, the longer the “slice of pie” is, the more frequent the wind is from that wind direction sector. Superimposed on each “slice of pie” is the distribution of wind speeds for all winds within that 22 and a half degree slice. Wind speed is important for determining transport distances, but other tools will be used to better characterize transport. Therefore, only the wind direction distribution will be focused on with the wind roses.

Chicago Meteorology

The NWS meteorological data from Chicago Midway airport is the closest NWS site to the Washington High School monitor. Figure 14 shows a wind rose for Chicago Midway airport for all days in 2010-12. Wind directions are fairly evenly distributed between the northeast, northwest, and southwest quadrants compared to other sites not affected by Lake Michigan, due to the higher percentage occurrence of winds from the northeast quadrant (including due east), which is commonly the direction of a lake breeze.

Figure 14
Wind Rose for Chicago Midway Airport, 2010-2012

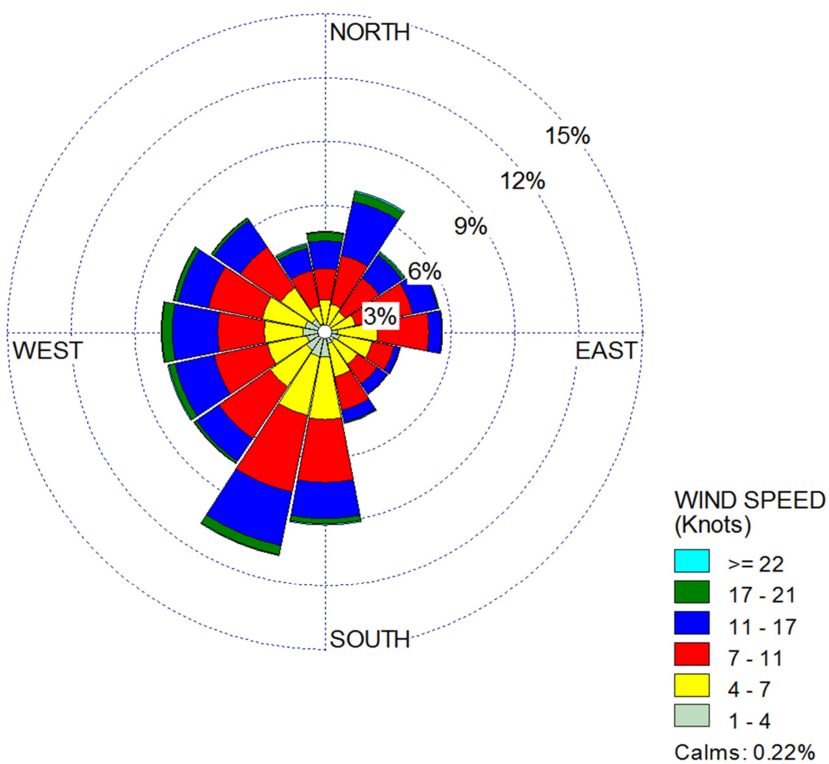


Figure 15 is a representation of hourly wind directions from Chicago Midway that occurred on days in the 2010-12 period when the monitored values at Washington High School were at least 20.0 ug/m^3. This type of a wind rose is called a pollution rose. The Washington High School monitor had been on a one-in-six day sampling schedule during this timeframe (the schedule was changed to one-in-three days in April 2013, after this study period), so the total number of samples over a three-year period is no more than about 180 days. The threshold of 20.0 ug/m^3 was chosen to ensure a large enough sample size to be robust (25 days), while capturing the 24-hour events that are well over the level of the annual standard and are, therefore, contributing the most to the high annual average.

Figure 15 shows that the most frequent wind directions during high PM days are generally southwesterly. However, there is a strong secondary occurrence of west-northwesterly winds not reflected in the wind rose for all days, and an additional small peak in the easterly direction. Note also that, although winds from the southeast quadrant are the least frequent of any quadrant over all days, the frequency increases dramatically for the identified high days. For those sectors where the percent of occurrence in the pollution rose is significantly larger than in the wind rose for all days, these sectors are assumed to be "dirtier" wind directions. Out of the sixteen wind direction sectors, the only four that do not occur at least 3% of the time in the pollution rose are those surrounding due north. This indicates that winds blowing down the lakeshore from the north are most likely to occur on "cleaner" days. On the other hand, high daily concentrations of PM2.5 can occur with winds blowing across a number of different portions of the recommended nonattainment area. However, the distribution of wind directions on the high days does not point to any specific source or group of sources being especially culpable.

Another tool in assessing the transport routes and source regions of air masses that are over a monitor on days of interest is the HYSPLIT trajectory model. The HYSPLIT model uses gridded meteorological data from a prognostic model to produce a trajectory, or path, that the air mass over a location at a given time would have travelled to arrive at the prescribed destination. The type of trajectory that is described here is called a backward trajectory. The trajectories depicted in Figure 16 are from HYSPLIT runs that were performed by USEPA. USEPA ran HYSPLIT for days where monitoring was done for the period 2010-12 for the Washington High School monitor. Four backward trajectories are created on each day of interest, starting from the monitor location at 5 AM. The four trajectories mark different heights above ground for each trajectory. One trajectory always starts at 10 m above ground, while the other three start at 25%, 50%, and 75% of the mixing height at the monitor at the starting time.

Figure 15
Pollution Rose for Washington High School Monitor High Days, 2010-2012

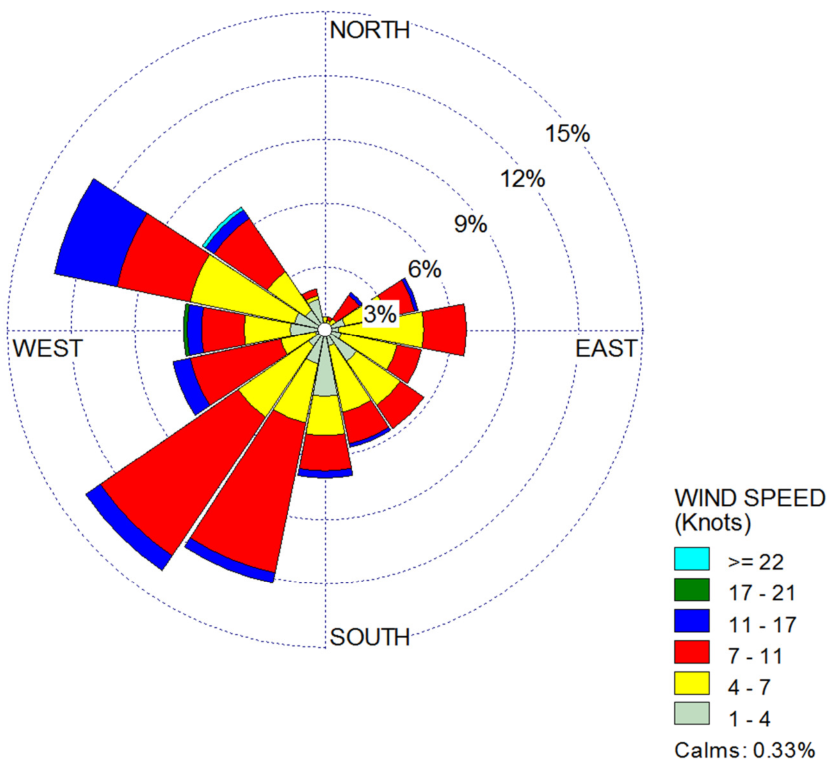
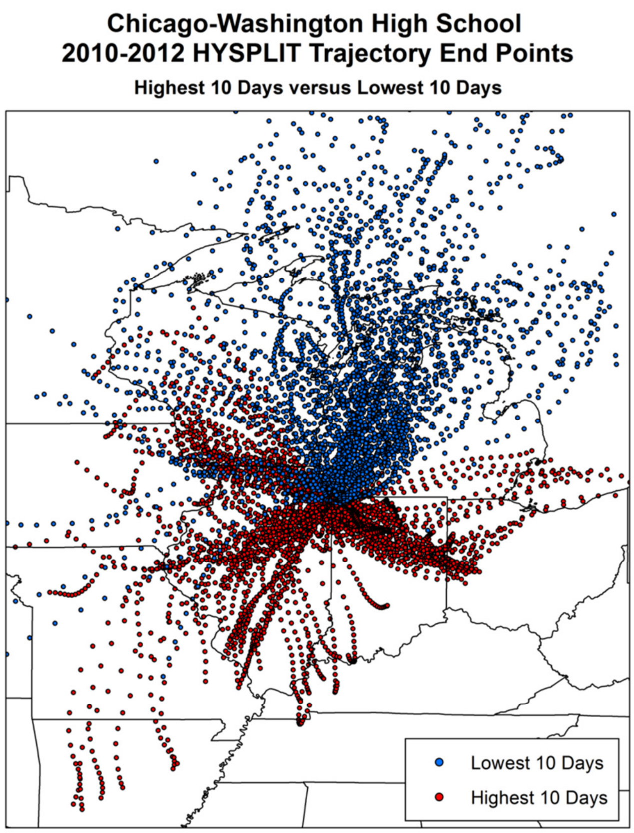


Figure 16 shows the backward trajectories for the ten highest daily concentrations and the ten lowest daily concentrations at the Washington High School monitor over the period 2010-12. Points along the trajectories on the high days are denoted in red, while points along the trajectories on the low days are denoted in blue. Note that the high day trajectories are mainly in three groups: from the southeast, from the southwest, and from the west-northwest. High days with west-northwest winds are less frequent than high days with a southerly component wind, and likely indicate a strong contribution of nitrates during the winter months. High days with southerly component winds also usually have a long trajectory, indicating higher wind speeds and longer transport distances.

Conversely, trajectories on the low days are strongly grouped to the north to northeast. These trajectories are associated with air masses that spent most of their residence time over Lake Michigan, northern lower Michigan, upper Michigan, and into Ontario. These are all areas where emission densities are relatively low. These HYSPLIT trajectories for Washington High School correlate well with the distribution of wind directions on high days previously presented in the pollution rose data.

Figure 16
Trajectories for High and Low Concentration Days at Chicago Washington High School



Factor 4 – Geography/Topography

Illinois is typified by flat to gently rolling terrain, with the exception of the Driftless Area in the northwest corner of the state and the Ozark Plateau in southern portion of the state. Illinois occupies a land mass of approximately 55,584 square miles. The average elevation of the state is approximately 600 feet (183 m) above sea level. Charles Mound, located in Jo Davies County, is the highest point in the state with an elevation of 1,235 feet (376 m) above sea level. The lowest point in the state is 279 feet (85 m) above sea level along the Mississippi River in Alexander County. Total topographic relief across the state is less than 1000 feet, demonstrating the general flatness of the terrain. Therefore, topography is generally not a factor in determining pollutant transport in Illinois, and is not considered a significant issue in defining the boundaries of the annual PM2.5 nonattainment areas.

Factor 5 – Jurisdictional Boundaries

The Illinois EPA is responsible for air quality regulatory programs for every county in the state. Jurisdictional boundaries considered in this analysis are consistent with recommended geographic boundaries definitions, outlined in U.S. EPA's guidance documentation. Township Boundaries in this study reflect the 2009 political township boundaries provided by the Property Tax Division of the Illinois Department of Revenue. Based on the geographic location of the Chicago Study Area and the individual sources, it is expected that the coordination of planning activities required to address the nonattainment designation can be carried out in a cohesive manner.

Five Factor Cumulative Evaluation and Recommendation

An analysis of all the factors discussed above shows the following:

Cook County. Current air quality data (2010-2012) shows that one monitor in Cook County does not meet the annual PM2.5 standard. Cook County has high levels of precursor emissions, and generally has the highest emissions of any of the nine counties in the Chicago Study Area. Demographically, Cook County has the highest population, the highest population density, the largest extent of urban land cover, and the highest level of vehicular traffic (AVMT) of all the counties in the Chicago Study Area. Therefore, Cook County should be included in the Chicago nonattainment area for the annual PM2.5 standard.

DuPage and Will Counties. DuPage and Will Counties have high levels of precursor emissions. DuPage County is second only to Cook County in total population, population density, vehicular traffic, and total urban land cover. Similarly, Will County has a relatively high population, population density, population growth, traffic level, and urban land coverage. The IEPA therefore recommends that DuPage and Will Counties be included in the Chicago nonattainment area for the annual PM2.5 standard.

Lake County. Lake County has high levels of precursor emissions, relatively high total population and population density, a high percentage of urban land cover, and moderately high levels of vehicular traffic. The IEPA therefore recommends that Lake County be included in the Chicago nonattainment area for the annual PM2.5 standard.

Kane and McHenry Counties. Kane and McHenry Counties are on the western fringe of the metropolitan area with the eastern portions of these counties having an urban/suburban character, while the western portions are basically rural. These counties have moderate levels of precursor emissions relative to Cook, DuPage, Lake, and Will Counties, and the total population, population density, and total urban land cover in these counties are also relatively moderate. McHenry and Kane counties are experiencing moderate population growth. The IEPA therefore recommends that McHenry and Kane counties be included in the Chicago nonattainment area for the 24-hour PM2.5 standard.

Kendall and Grundy Counties. Due to their primarily rural character, most of Kendall and Grundy Counties were not included in the 1997 annual PM2.5 nonattainment area. Precursor emission levels in these counties are low, as is the total population, population density, traffic volumes, and total urban land cover. However, due to the presence of emission sources located in parts of the counties and the predominant wind direction in the area, the IEPA recommends that Oswego Township in Kendall County and Goose Lake and Aux Sable Townships in Grundy

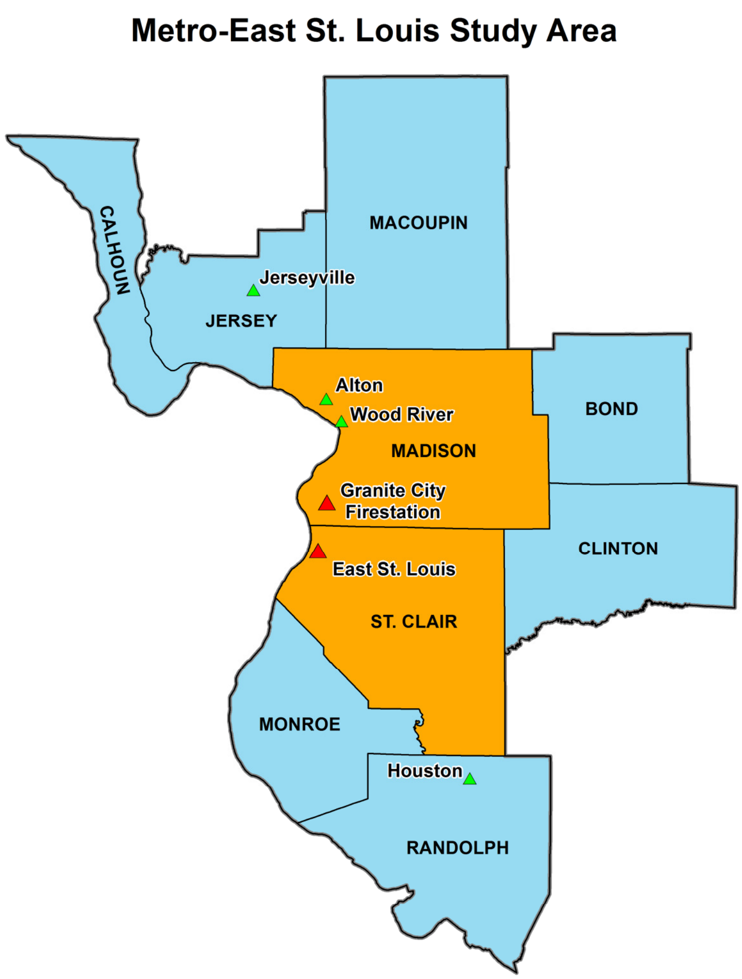
County be included in the Chicago nonattainment area for the NAAQS for annual PM2.5. The remainder of these two counties should retain their current designation as attainment/unclassifiable.

DeKalb County. The U.S. Census Bureau added DeKalb County to the Chicago CBSA in 1998. DeKalb County was not included in the 1997 annual PM2.5 nonattainment area. This county is primarily rural, as shown by its low 2010 population totals and population densities, and the small amount of urban land cover in DeKalb County is not contiguous with the Chicago urbanized area. Current precursor emission levels in these counties are also low, compared to the other counties in the CBSA. For these reasons, the IEPA recommends that DeKalb County not be included in the nonattainment area and that it be designated as attainment/unclassifiable for the NAAQS for annual PM2.5.

Illinois Five Factor Analysis for Metro-East St. Louis Study Area

In the Metro-East St. Louis Study Area (Metro-East Study Area), Illinois has two counties where monitored violations of the revised primary annual PM2.5 NAAQS are occurring. Figure 17 shows the counties and ambient air monitoring sites included in the Metro-East Study Area. The information in the following sections provides boundary recommendations based on the five factors outlined in U.S. EPA guidance for the Metro-East Study Area.

Figure 17



Factor 1 – Air Quality Data

Spatial Analysis

The annual PM2.5 design values for the Metro-East Study Area are shown below in Figure 18. As can be seen from the map, the highest annual PM2.5 design values occur in southwestern Madison and northwestern St. Clair Counties. Design values in northern Madison and Jersey Counties range between 10.0 and 11.8 ug/m^3, while the Houston monitor in Randolph County has the lowest design value at 9.3 ug/m^3. For the 2010-2012 period, there are two monitors that currently violate the revised annual PM2.5 NAAQS: the Granite City-Firestation site in Madison County, with a design value of 13.5 ug/m^3; and the East St. Louis site in St. Clair County, with a design value of 12.2 ug/m^3.

Figure 18

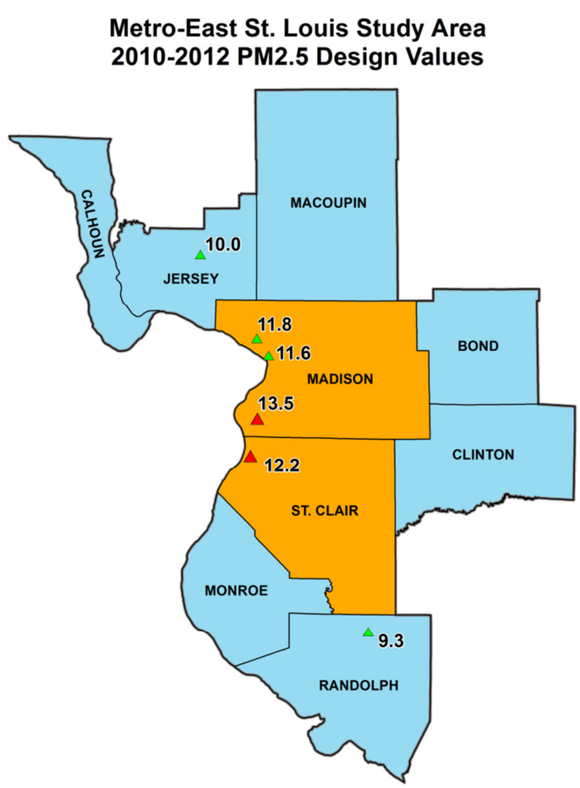
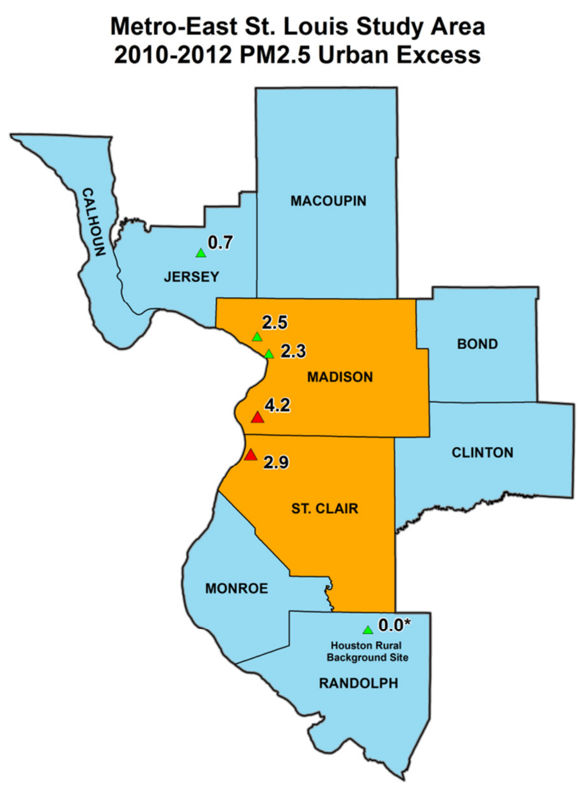


Figure 19 shows the amount of urban excess at the PM2.5 monitoring sites across the Metro-East Study Area. These values were calculated by taking the 2010-2012 design values for all of the Metro-East monitoring sites and subtracting out the 9.3 ug/m^3 of PM2.5 recorded at the rural background site in Houston, IL. The resulting map of urban excess values shows that the peak values occur at the Granite City-Firestation and East St. Louis sites, with a secondary peak located in northwestern Madison County. The urban excess value at the Granite City-Firestation site is significantly higher than all of the other sites in the Metro-East Study Area with a value of 4.2 ug/m^3. This value, which is 31% higher than any of the other sites, is likely due to the close proximity of this particular monitor to the U.S. Steel facility in Granite City, IL. The urban excess values at the East St. Louis, Alton, and Wood River sites are all very similar and range between 2.3 and 2.9 ug/m^3. The Jerseyville monitor has the lowest urban excess value of 0.7 ug/m^3. Due to the lack of significant emission sources in Jersey County, this value most likely represents urban-scale transport downwind of the St. Louis Metropolitan Area.

Figure 19



Temporal Analysis

Figure 20 presents the annual PM2.5 design value trends for the Metro-East Study Area at six long-term monitoring sites. The graph shows that annual design values across the Metro-East Study Area have dropped significantly between the periods of 1999-2001 and 2010-2012. Most of this improvement has been due to the large reduction in regional background levels. Design values at the Houston background site have dropped from 13.9 ug/m^3 to 9.3 ug/m^3. The amount of locally-generated urban PM2.5, however, has fluctuated over time, with the maximum urban excess value actually rising from 3.5 ug/m^3 to 4.2 ug/m^3 over the same period. Due to the significant improvement in regional air quality, only the Granite City-Firestation and East St. Louis sites currently violate the revised Annual NAAQS. However, both the Alton and Wood River sites still have design values greater than 11.5 ug/m^3.

Figure 20

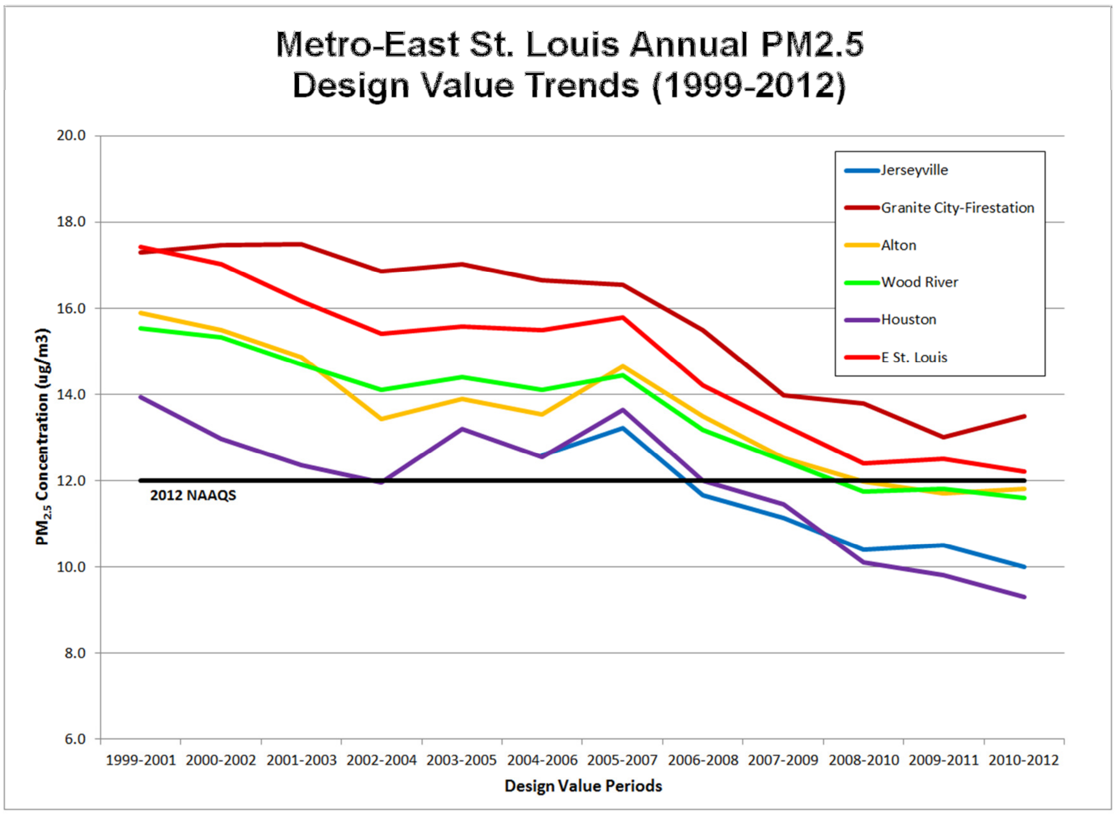


Figure 21 presents the time series trend in seasonal PM2.5 averages for all of the monitors located in the Metro-East Study Area between the Winter of 2010 and the Fall of 2012. These values were computed from individual monthly averages that were grouped by meteorological season for each year rather than by calendar quarters (i.e., Winter – December, January and February; Spring – March, April, and May; Summer – June, July, and August; and Fall – September, October, and November). As can be seen from both Figures 21 and 22, the Metro-East Study Areadoes not exhibit a consistent pattern of either Winter or Summer dominance.

Figure 21 shows that all of the sites in the Metro-East Study Area have recorded seasonal averages in excess of the level of the revised annual PM2.5 NAAQS over the 2010-2012 period. In fact, during the Summer of 2011 every single monitor in the Metro-East Study Area had a seasonal average above 12.0 ug/m^3. Overall, there is a generally consistent pattern between all of the sites, with the peak seasonal values occurring during the Winter and Summer periods. The lowest seasonal averages occur in both the Spring and the Fall. The seasonal averages across all sites have been trending downward, especially since the the Winter of 2011, with overall values in 2012 significantly lower than those recorded in 2010 and 2011. The uptick in seasonal averages during the Summer of 2012 is undoubtedly related to the historic heat wave that affected the St. Louis area. However, despite the extreme heat experienced in the St. Louis area in 2012, the seasonal averages for the Summer of 2012 are significantly lower than the values recorded during the Summer of 2011.

Figure 22 presents the overall meteorological seasonal averages for the years of 2010, 2011, and 2012 for each monitoring site located in the Metro-East Study Area. The monitoring sites are sorted from left to right in descending design value order. The graph clearly shows that the Metro-East Study Area, when taken as a whole, is neither Winter nor Summer dominant. Individual sites such as Granite City-Firestation, Alton, and Houston are summer dominant, while the East St. Louis site is clearly Winter dominant. The Winter and Summer seasonal averages at the Wood River and Jerseyville sites are virtually identical. This lack of consistency across the Metro-East Study Area indicates that there is significant amount of both urban and local scale variability, especially at the Granite City-Firestation and East St. Louis sites. With the exception of the Jerseyville and Houston sites, every monitor in the Metro-East Study Area recorded Winter and Summer seasonal averages for the 2010-2012 period above 12.0 ug/m^3. With the notable exception of the Granite City-Firestation site, Spring and Fall seasonal averages across the area are well below 12.0 ug/m^3, with the Spring values being consistently higher than those in the Fall. The Granite City-Firestation site has the highest seasonal averages for all four seasons, indicating that the site is being strongly influenced by a local source of emissions.

Figure 21

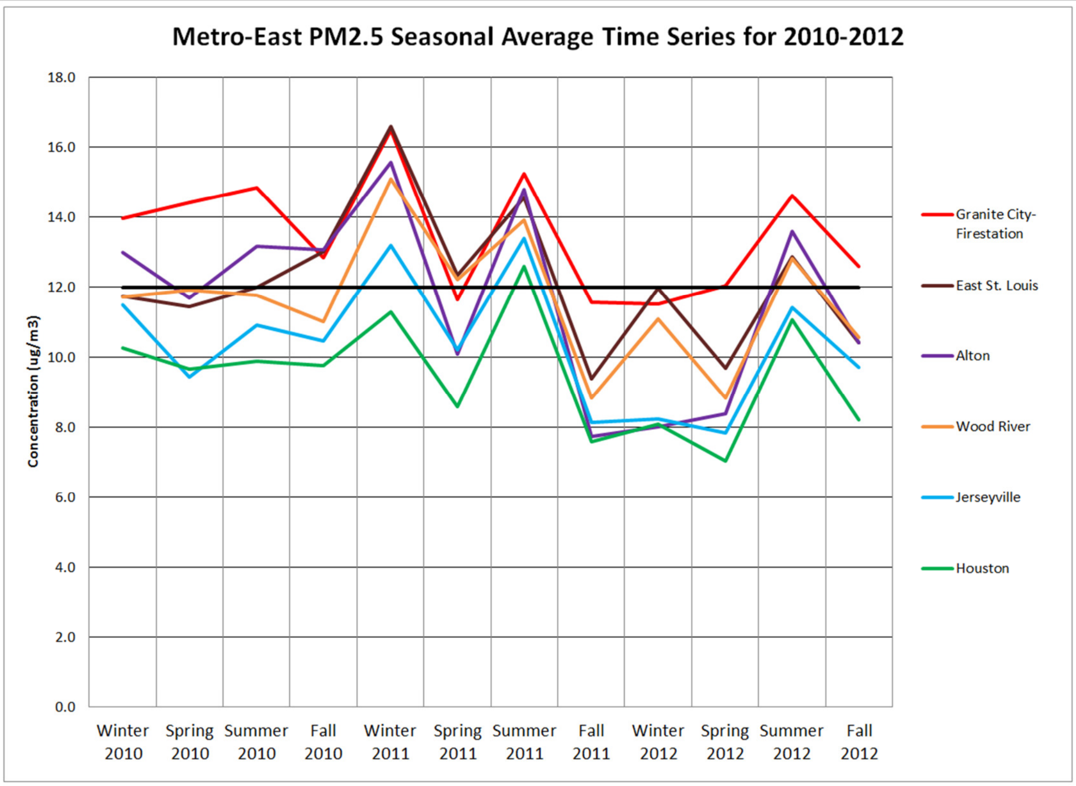
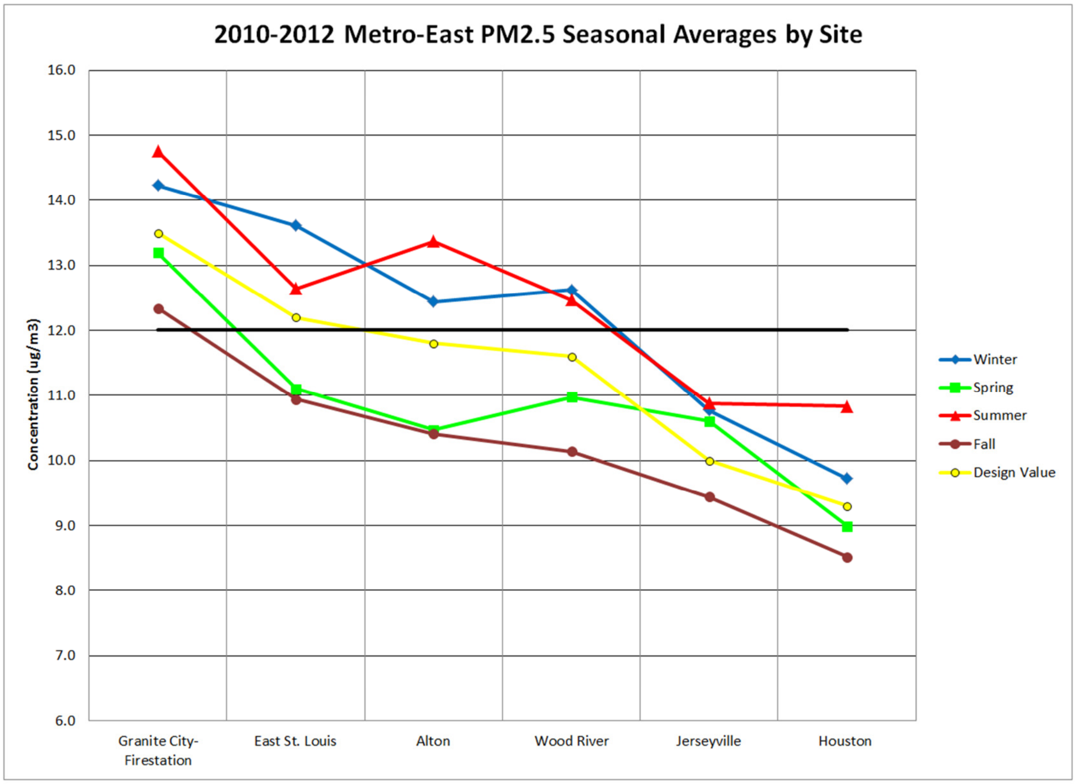


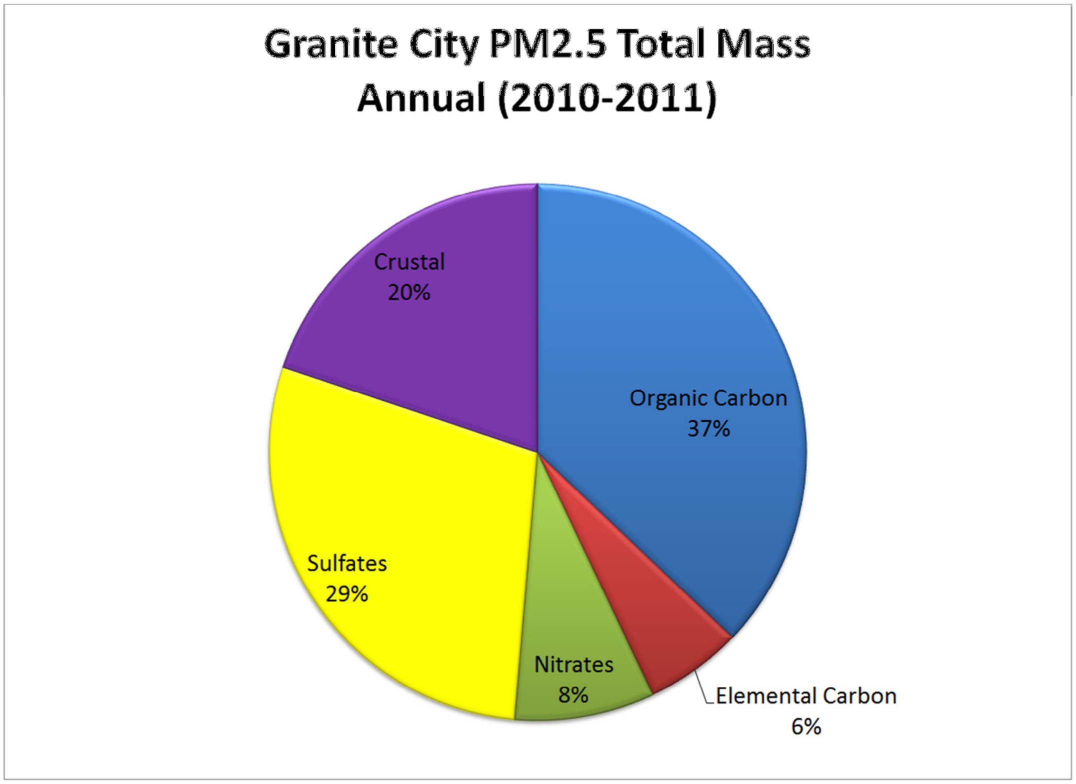
Figure 22



Chemical Speciation Analysis

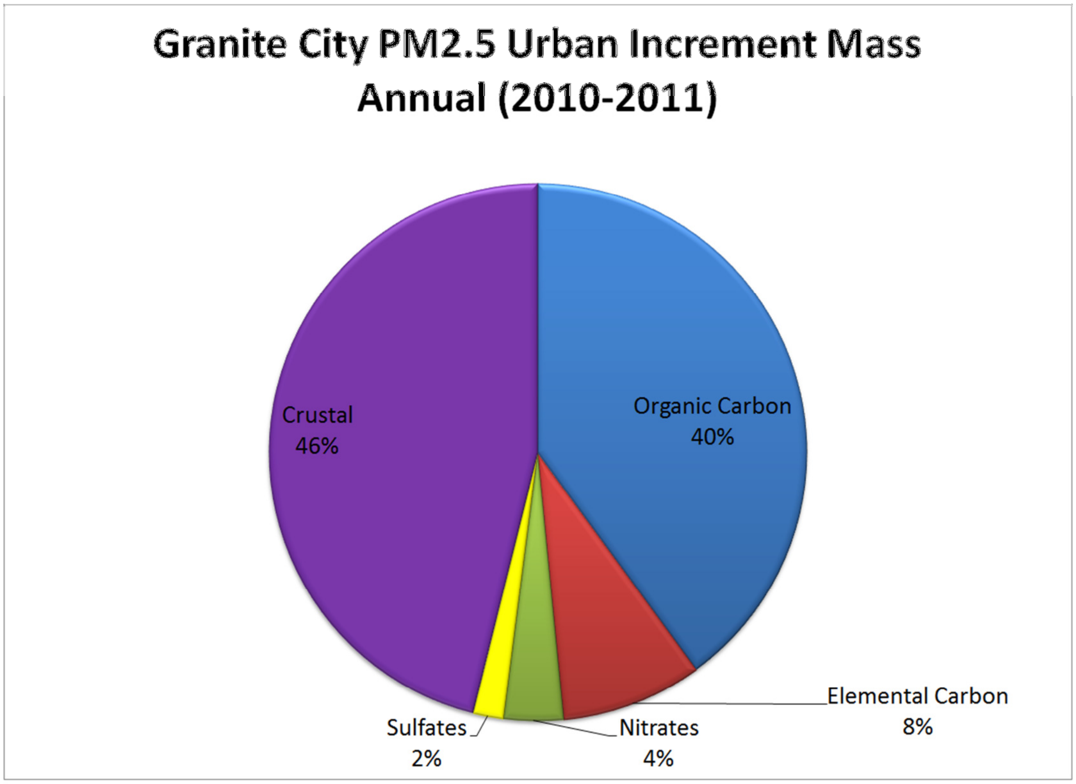
The only chemical speciation site located in the Metro-East Study Area is the Granite City-Firestation monitor. This site is likely impacted by the nearby U.S. Steel facility, as can be seen by the large percentage of Crustal Materials in Figures 23 and 24. Unfortunately, there are no speciation data available for the East St. Louis site. This site would, most likely, exhibit significant differences from the Granite City-Firestation monitor due to the absence of a nearby source of direct PM2.5 emissions.

Figure 23



Figures 23 and 24 present the 2010-2011 Annual Total Mass and Urban Increment Mass PM2.5 chemical speciation data for the Granite City-Firestation monitor. Organic Carbon, Sulfates, and Crustal Materials dominate the Total Mass pie chart in Figure 23. The large percentage of both Sulfates and Nitrates is due primarily to regional transport. When these regional background components are removed, local and urban-scale Crustal Materials, Organic Carbon, and Elemental Carbon dominate the Urban Increment Mass in Figure 24. The increase in Crustal Materials is the most significant and this category alone makes up 46% of the total Urban Increment Mass. It seems likely that a large portion of the Crustal Materials component is coming from the U.S. Steel complex in Granite City. Both Organic Carbon and Elemental Carbon make up 48% of the total Urban Increment Mass. These two components are related to large urban-scale emissions from on-road and non-road mobile sources and stationary VOC sources that are found across the St. Louis Metropolitan Area. The Sulfate and Nitrate components are a surprisingly small portion of the Urban Increment Mass. This indicates that these two components are primarily due to regional transport and that urban-scale Sulfate and Nitrate formation is relatively insignificant.

Figure 24



Air Quality Factor Analysis Summary

Two monitors currently violate the revised annual PM2.5 NAAQS in the Metro-East Study Area. While it is likely that these sites are being impacted by local emission sources, the air quality data for the rest of the Metro-East Study Area also points to the impact of regional background and urban-scale emission sources as well. Approximately 70% of the PM2.5 mass measured at the Granite City-Firestation and East St. Louis sites is advecting into the area due to regional transport. The distribution of the urban excess across the Metro-East Study Area shows that significant amounts of additional PM2.5 is being generated within the urban area itself. In fact, the amount of urban excess has actually increased over the past few years at both the Granite City-Firestation and East St. Louis sites. The existence of urban-scale transport is also clearly evident in the 2010-2012 seasonal time series and the 2010-2012 monitoring site seasonal averages. Lastly, the chemical speciation data shows that nearly 50% of the Urban Increment Mass is related to urban-scale Organic Carbon and Elemental Carbon emission sources, while the contributions from local Sulfate and Nitrate emission sources is very small. Crustal Materials make up 46% of the Urban Increment, but most of this is probably due to local impacts from the nearby U.S. Steel facility.

Factor 2 – Emissions and Emissions – Related Data

Table 8 summarizes emissions in the St. Louis MO-IL Metropolitan Statistical Area (St. Louis MSA) based on 2011 NEI emissions for all counties and pollutants. An evaluation of total tons/year county level emissions in the St. Louis MSA by county shows Missouri counties having the highest percentage of emissions at approximately 77.07 % while Illinois contributes a low 22.93% of overall emissions.

Table 8
St. Louis MO-IL MSA – Percent Emissions by County

Illinois Counties	PM2.5	NOx	NH3	SO2	VOC	Total TPY	Percent of MSA
Madison	3,824.01	16,049.56	1,244.9	13,280.71	9,036.73	43,435.91	10.91%
St. Clair	3,271.48	7,901.27	1,195.97	295.62	5,850.16	18,514.50	4.65%
Clinton	1,153.79	4,596.53	3,010.98	378.14	1,423.65	10,563.09	2.65%
Macoupin	1,613.39	1,865.45	1,716.8	24.3	1,425.22	6,645.16	1.67%
Monroe	775.91	2,223.18	823.57	53.56	945.14	4,821.36	1.21%
Bond	706.46	1,201.65	605.54	13.41	751.52	3,278.58	0.82%
Jersey	603.63	857.42	497.86	27.28	681.49	2,667.68	0.67%
Calhoun	199	599.71	190.05	40.93	318.66	1,348.35	0.34%
Illinois MSA	12,147.67	35,294.77	9,285.67	14,113.95	20,432.57	91,274.63	22.93%
Missouri Counties							
St. Louis	5,538.21	38,672.94	1,761.41	15,810.56	30,568.32	92,351.44	23.20%
Franklin	2,441.27	14,733.98	1,312.84	58,025.06	3,941.06	80,454.21	20.21%
Jefferson	1,737.72	11,464.65	250.34	43,777.64	6,124.25	63,354.60	15.92%
St. Charles	2,059.48	17,937.41	1,020.31	5,441.90	9,921.89	36,380.99	9.14%
St. Louis City	1,716.86	10,301.94	759.53	3,139.73	8,602.42	24,520.48	6.16%
Lincoln	345.16	2063.71	882	39.03	1,914.01	5,243.91	1.32%
Warren	273.93	1,908.80	669.64	23.42	1,549.94	4,425.73	1.11%
Missouri MSA	14,112.63	97,083.43	6,656.07	126,257.34	62,621.89	306,731.36	77.07%
MSA Total	26,260.30	132,378.20	15,941.74	140,371.29	83,054.46	398,005.99	100%

Table 9 shows ranked PM2.5 emissions in the Metro-East Study Area based on total county emissions (tons/year). An evaluation of emissions data shows Madison, Randolph, and St. Clair counties ranked in the top three having the greatest level of emissions. Combined they contribute approximately 76% of the total emissions in the area.

Table 9
Metro-East Study Area - Ranked Emissions by County

Illinois Counties	PM2.5	NOx	NH3	SO2	VOC	Total TPY	Percent of Total	Rank
Madison	3,824.01	16,049.56	1244.90	13,280.71	9,036.73	**43,435.91**	35.82%	1
Randolph	1,408.47	7,031.70	987.39	19,137.10	1,429.31	**29,993.97**	24.73%	2
St. Clair	3,271.48	7,901.27	1195.97	295.62	5,850.16	**18,514.50**	15.27%	3
Clinton	1,153.79	4,596.53	3010.98	378.14	1,423.65	**10,563.09**	8.71%	4
Macoupin	1,613.39	1,865.45	1716.80	24.30	1,425.22	**6,645.16**	5.48%	5
Monroe	775.91	2,223.18	823.57	53.56	945.14	**4,821.36**	3.98%	6
Bond	706.46	1,201.65	605.54	13.41	751.52	**3,278.58**	2.70%	7
Jersey	603.63	857.42	497.86	27.28	681.49	**2,667.68**	2.20%	8
Calhoun	199.00	599.71	190.05	40.93	318.66	**1,348.35**	1.11%	9
Metro-East Study	**13,556.14**	**42,326.47**	**10,273.06**	**33,251.05**	**21,861.88**	**121,268.60**	100.00%	

Figures B1 through B5 (Appendix B) and the accompanying tables, summarize reported emissions from point, area, non-road and on-road mobile sources in the Metro-East Study Area, for the following pollutants: SO_2, NO_x, VOC, NH_3, and direct PM2.5. Metropolitan areas where violations are occurring were evaluated separately based on county level 2011 NEI emissions.

For the Metro-East Study Area (Figures B1 through B5):

- SO_2 emissions are highest in Randolph and Madison Counties, where point sources are the greatest contributors. Combined emissions from Randolph and Madison Counties contribute approximately 97% of total SO_2 emissions in the area.
- NO_x emissions are highest in Madison, St. Clair, and Randolph Counties. Combined NO_x emissions from these counties contribute about 73% of total NO_x emissions within the area. The greatest source contributors to the total NO_x emissions for Madison and

Randolph counties are point sources, whereas the greatest source contributions in St. Clair County comes from on-road mobile sources. Macoupin, Bond, Jersey, and Calhoun counties have relatively low emissions; combined they contribute to less than 11% of total NO_x emissions.

- VOC emissions are highest in Madison and St. Clair Counties, which account for nearly 68% of total VOC emissions. In contrast, Randolph, Macoupin, and Clinton VOC emissions contribute 20% of total VOC emissions for the area. Area sources are the major contributor towards total VOC emissions for 2011.
- NH_3 emissions are highest in Clinton, Macoupin, St. Clair, and Madison Counties, with the greatest emissions arising from animal and area sources. NH_3 emissions in the combined counties of Clinton, Macoupin, Madison, and St. Clair account for approximately 70% of total NH_3 emissions within the Metro-East Study Area. Randolph, Monroe, Bond, Jersey, and Calhoun Counties also have moderately high emissions of NH_3. Calhoun County has the lowest total NH_3 emissions, contributing about 2% of total NH_3 emissions.
- Direct PM2.5 emissions are highest in Madison and St. Clair Counties. Macoupin, Randolph, and Clinton Counties contribute moderately high levels of direct PM2.5 emissions. Direct PM2.5 emissions from Madison and St. Clair Counties contribute to nearly 52% of total direct PM2.5 emissions in the area. The greatest contributor to total direct PM2.5 emissions occurs from area sources. Furthermore, direct PM2.5 emissions are moderate in Monroe, Bond, and Jersey Counties, accounting for nearly 15% of total direct PM2.5 emissions. Calhoun County ranks last, with concentrations of direct PM2.5 below 2% of the total emissions found in the area.

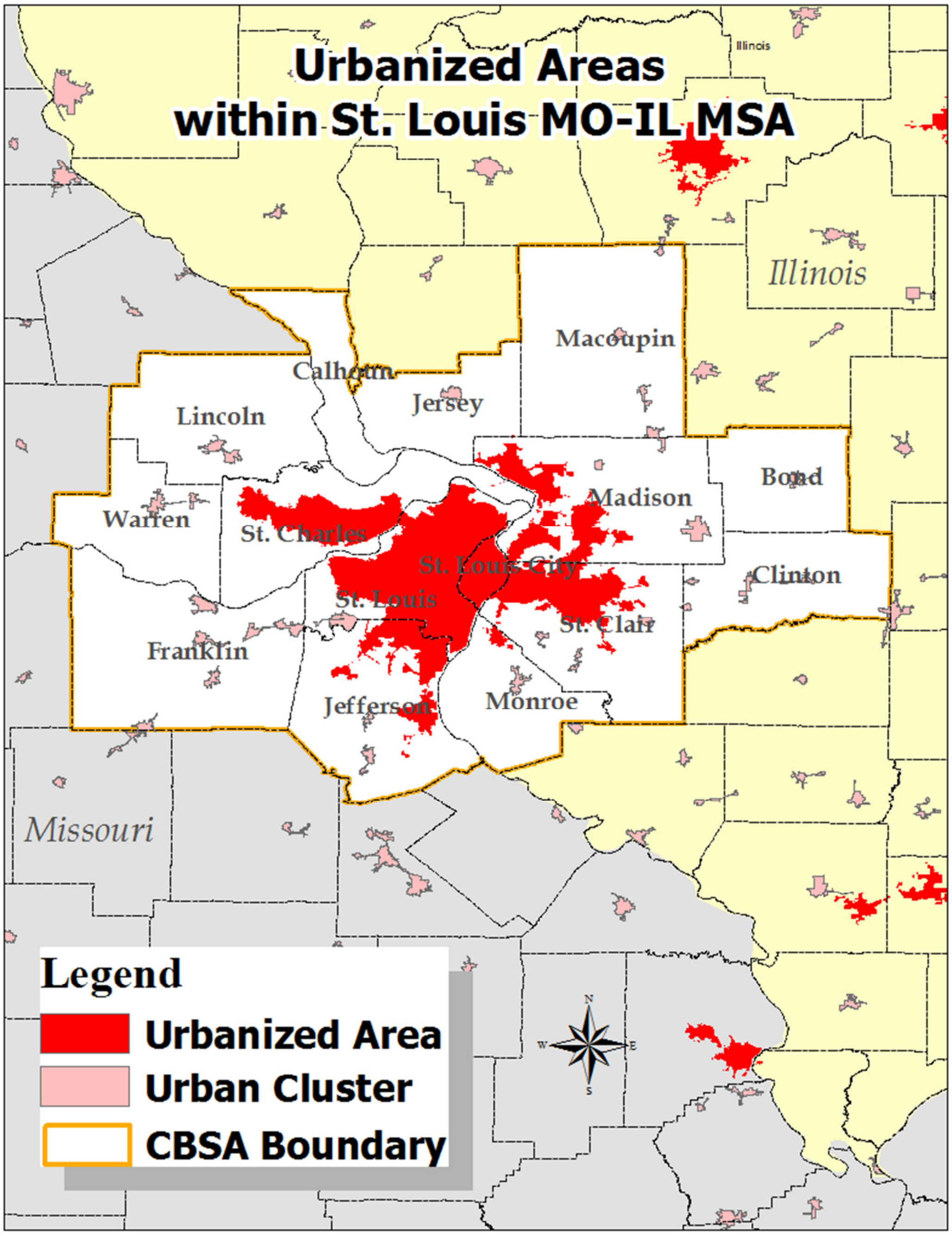
The largest Metro-East Study Area (Figures B6 through B10) point sources for SO_2 are located in Randolph and Madison Counties. Madison and St. Clair Counties have the largest number of SO_2 emitting point sources. Adjacent counties have relatively few point sources emitting SO_2. The largest point sources for NO_x are located in Madison and Randolph Counties. Madison has the largest number of NO_x-emitting point sources emitting greater than 100 tons per year. Adjacent counties have relatively few point sources emitting NO_x. The largest emitting and greatest number of point sources emitting VOCs are located in Madison and Randolph Counties. Adjacent counties have relatively few point sources emitting VOCs. Randolph County contains the only significant point sources of NH_3 based on IEPA's 2011inventory. The largest point sources for direct PM2.5 are located in Madison and Randolph Counties. Madison and Randolph Counties have the largest emitters of direct PM2.5. Adjacent counties have relatively few point sources emitting PM2.5 and none emitting direct PM2.5 at rates greater than 100 tons per year.

Emission Related Data - Population and Urbanization

Urbanization is not as pronounced in the Metro-East Study Area as seen in the Chicago CBSA (see Figure 25). Madison and St. Clair Counties are the most urbanized of the counties in the Metro-East portion of the St. Louis MO-IL MSA. Adjacent counties, such as Washington and Montgomery, are not included in the St. Louis MO-IL MSA due to their fragmented relationship to the population located in the Metro-East urban core. Based on the non-contiguous pattern of urbanization, it is logical to conclude that Washington and Montgomery Counties are not influencing emissions related to social, economic, and population growth in the Metro-East. Madison and St. Clair Counties contain the majority of the Metro-East Study Area population, while Monroe, Macoupin, Jersey, Bond, and Calhoun Counties are considerably less populated.

An evaluation of the population in the St. Louis MO-IL MSA shows that and Madison and St. Clair Counties make up about 20% of the total population in the MSA and the remaining Illinois counties only contribute to 5.7% of the total population in the area.

Figure 25


Urbanized Areas
within St. Louis MO-IL MSA
Illinois
Illinois
Macoupin
Calhoun
Jersey
Lincoln
Madison
Bond
Warren
St. Charles
St. Louis City
Clinton
St. Louis
St. Clair
Franklin
Jefferson
Monroe
Missouri
Legend
Urbanized Area
Urban Cluster
CBSA Boundary
N
W
E
S

Illinois counties within the MSA account for approximately 25% of the population (see Table 10), while Missouri counties account for 75% of the overall population in the MSA. St. Louis City has the highest population density, followed by St. Louis County. Illinois counties also have relatively low population density in comparison to Missouri counties in the MSA.

Table 10
Total Population Estimates by County for the St. Louis MO-IL MSA

State	County	2010 Population	Land Area (Sq. Miles)	Population Density (Persons per sq. mile)	Percent of MSA	Cumulative Percent
MO	St. Louis County	999,026	507.805	1967	35.9%	35.9%
MO	St. Charles	361,745	560.421	645	13.0%	48.9%
MO	St. Louis City	319,102	61.924	5153	11.5%	60.3%
IL	St. Clair	270,380	663.808	407	9.7%	70.0%
IL	Madison	269,282	725.018	371	9.7%	79.7%
MO	Jefferson	219,092	656.796	334	7.9%	87.6%
MO	Franklin	101,535	922.811	110	3.6%	91.2%
MO	Lincoln	52,684	630.49	84	1.9%	93.1%
IL	Macoupin	47,791	863.574	55	1.7%	94.8%
IL	Clinton	37,837	474.233	80	1.4%	96.2%
MO	Warren	32,564	431.314	75	1.2%	97.4%
IL	Monroe	27,619	388.292	71	1.0%	98.4%
IL	Jersey	22,950	369.157	62	0.8%	99.2%
IL	Bond	17,768	380.203	47	0.6%	99.8%
IL	Calhoun	5,089	253.816	20	0.2%	100.0%

When evaluating the Metro-East Study Area by itself (Illinois counties only), based on 2012 U.S Census Bureau total population estimates, we see a similar rank order in counties (Table 11). St. Clair and Madison Counties make up a high percentage of the total population. These counties cumulatively account for more than 73% of the total population in the Metro-East Study Area, followed by Macoupin, Clinton, Monroe, and Randolph Counties having moderate population in comparison (approximately 21%). Jersey, Bond, and Calhoun Counties are considerably less populated and therefore rank the lowest in terms of total population and population density (Table 11).

According to the U.S Census Bureau population change information between 2005 and 2012, the Metro-East county of Monroe has experienced the greatest percent increase in population at 7.5%, followed by Clinton County and St. Clair County. Madison and Jersey Counties have experienced similar percent change in population, however they differ greatly in that Madison County has over eight times the population of Jersey County. According to U.S. Census data, Randolph, Bond, Calhoun, and Macoupin Counties have all experienced negative changes in population between 2005 and 2012.

Table 11
Total Population Estimates by County for the Metro-East Study Area

County	2012 Population	Land Area (Sq. Miles)	Population Density (Persons per sq. mile)	Percent of Study Area	Cumulative Percent	Rank
St. Clair	268,858	664	405	36.6%	36.6%	1
Madison	267,883	725	369	36.5%	73.2%	2
Macoupin	47,231	864	55	6.4%	79.6%	3
Clinton	38,061	474	80	5.2%	84.8%	4
Monroe	33,357	388	86	4.5%	89.3%	5
Randolph	32,956	578	57	4.5%	93.8%	6
Jersey	22,742	369	62	3.1%	96.9%	7
Bond	17,644	380	46	2.4%	99.3%	8
Calhoun	5,014	254	20	0.7%	100.0%	9

Table 12
2005-2012 Population Change by County for the Metro-East Study Area

County	2005 Population	2012 Population	Change (%)
Monroe	31,040	33,357	7.5%
Clinton	36,095	38,061	5.4%
St. Clair	260,067	268,858	3.4%
Madison	264,309	267,883	1.4%
Jersey	22,456	22,742	1.3%
Randolph	33,122	32,956	-0.5%
Bond	18,027	17,644	-2.1%
Calhoun	5,163	5,014	-2.9%
Macoupin	49,111	47,231	-3.8%

Emission Related Data – Traffic and Commuting Patterns

Table 13 summarizes IDOT's estimates of AVMT for 2012, as calculated by IDOT's Highway Information System for the Metro-East Study Area. According to IDOT traffic statistics for 2012, Madison and St. Clair Counties have the highest level of vehicular traffic (AVMT) in the St. Louis Study Area. Both counties together account for approximately 74% of the AVMT in the study area. Macoupin, Clinton, and Monroe Counties have moderate AVMT in comparison and Randolph, Jersey, and Calhoun Counties have the lowest AVMT, with about 7% of the total for the MSA (see Figure 26).

Table 13
2012 IDOT Travel Statistics for the Metro-East Study Area

St. Louis Metropolitan Statistical Area (MSA)	**Average Daily Vehicle Miles Traveled (AVMT)**
Madison	2,871,571,136
St. Clair	2,692,290,691
Macoupin	405,479,774
Clinton	376,916,651
Monroe	359,252,144
Bond	266,809,047
Randolph*	265,392,190
Baldwin Township	15,666,333
Jersey	191,487,505
Calhoun	36,525,557
* Randolph County is not part of the MSA	

Figure 26
Percent by County – 2012 AVMT in Metro-East Study Area

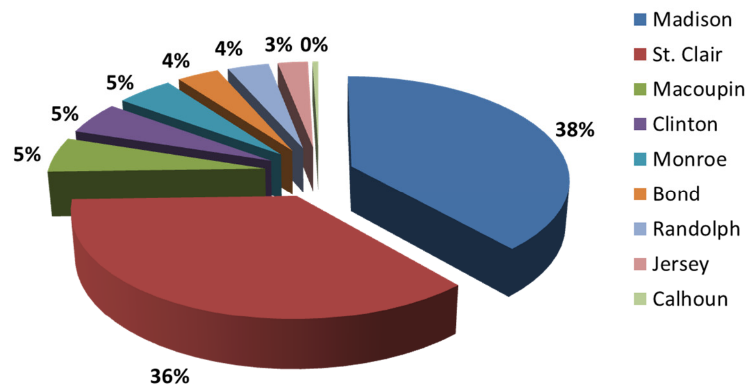
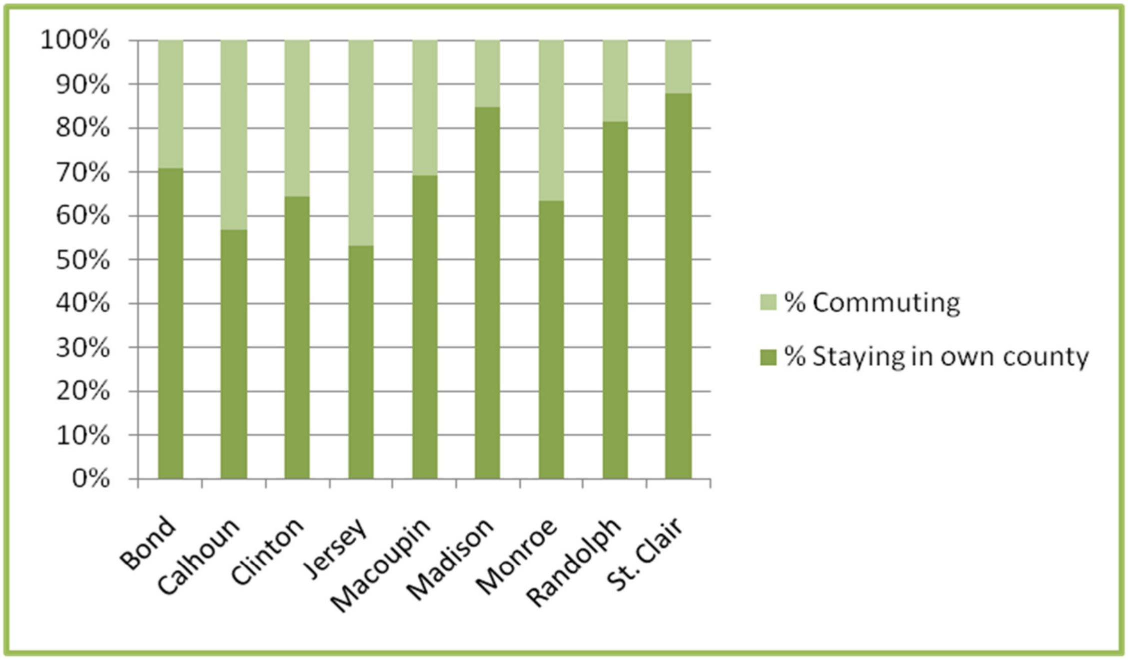


Table 14 and Figure 27 show counties within the Metro-East Study Area and their respective commuting patterns. Within the Metro-East Study Area, a higher percentage of people stay in the counties in which they reside for work with Jersey, Calhoun, and Monroe Counties showing a greater percentage of workers commuting to other counties within the study area.

Table 14
Commuting Patterns in the Metro-East Study Area

RESIDENCE COUNTY	% Staying in own County	% Commuting
Bond	71.0%	29.0%
Calhoun	56.9%	43.1%
Clinton	64.3%	35.7%
Jersey	53.3%	46.7%
Macoupin	69.4%	30.6%
Madison	84.8%	15.2%
Monroe	63.5%	36.5%
Randolph	81.4%	18.6%
St. Clair	88.0%	12.0%

Figure 27
Total 2006-2010 Commuting Patterns within the Metro-East Study Area



Factor 3 - Meteorology

Metro- East Meteorology

Figure 28 shows a wind rose from St. Louis' Lambert International Airport for all days from the period 2010-12. Although the airport is in Missouri, it is in the St. Louis metropolitan area, along with the Metro-East on the Illinois side, and is the NWS surface station that has been used to represent the meteorology of the urban area for many decades. Being an NWS site, it is also under the strict quality control of the NWS, unlike a number of other regional sites in the area, such as Cahokia. Figure 28 shows that the wind direction in St. Louis is fairly evenly distributed around the compass, except for the directions from north clockwise to east, which occur noticeably less frequently. The highest frequencies of winds are from the south and the west-northwest.

Figure 28
Wind Rose for St. Louis Lambert International Airport, 2010-2012

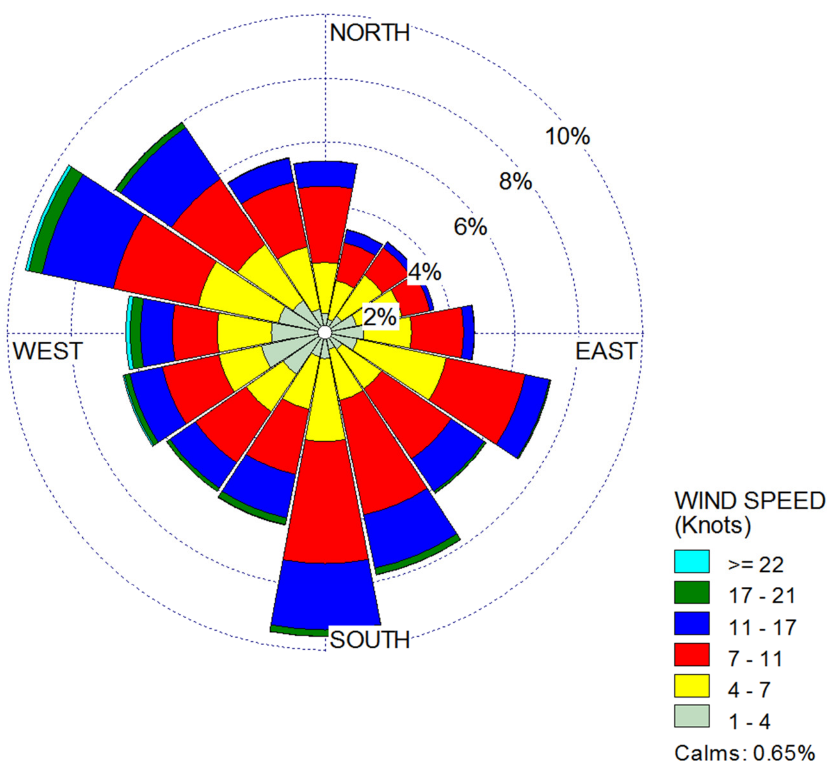


Figure 29 is a representation of hourly wind directions from St. Louis Lambert International Airport that occurred on days when the monitored values at East St. Louis were at least 20.0 ug/m^3. This wind rose looks very different than the wind rose for all days for St. Louis (Figure 28). The largest percentage of occurrence is associated with a wind from the southwest, with secondary peaks associated with east-southeasterly and north-northwesterly winds. These winds point to contributions from different portions of the urban area, including outside of Illinois.

Figure 29
Pollution Rose for East St. Louis Monitor High Days, 2010-2012

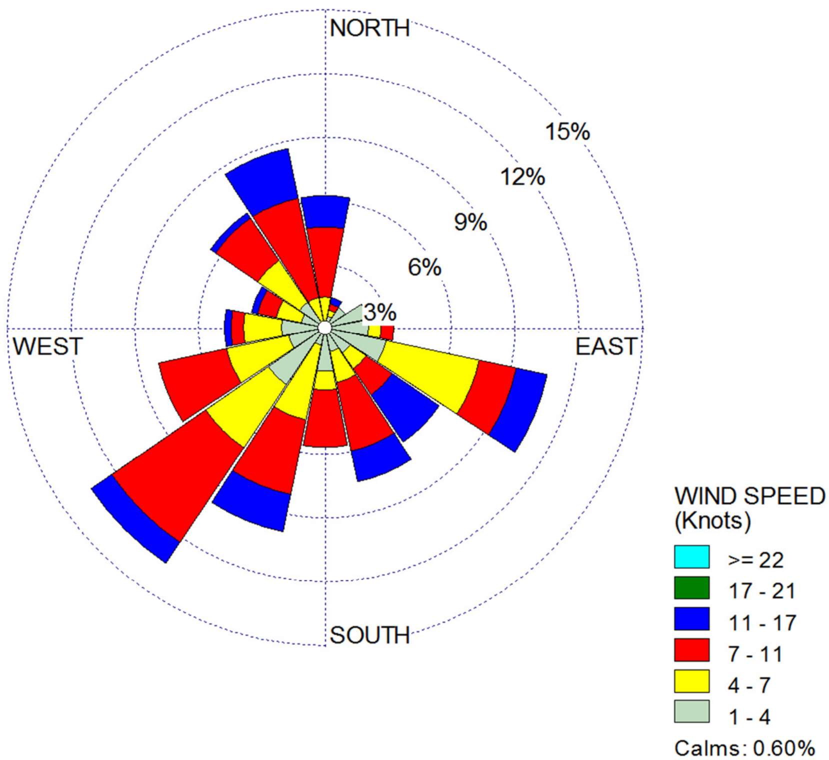
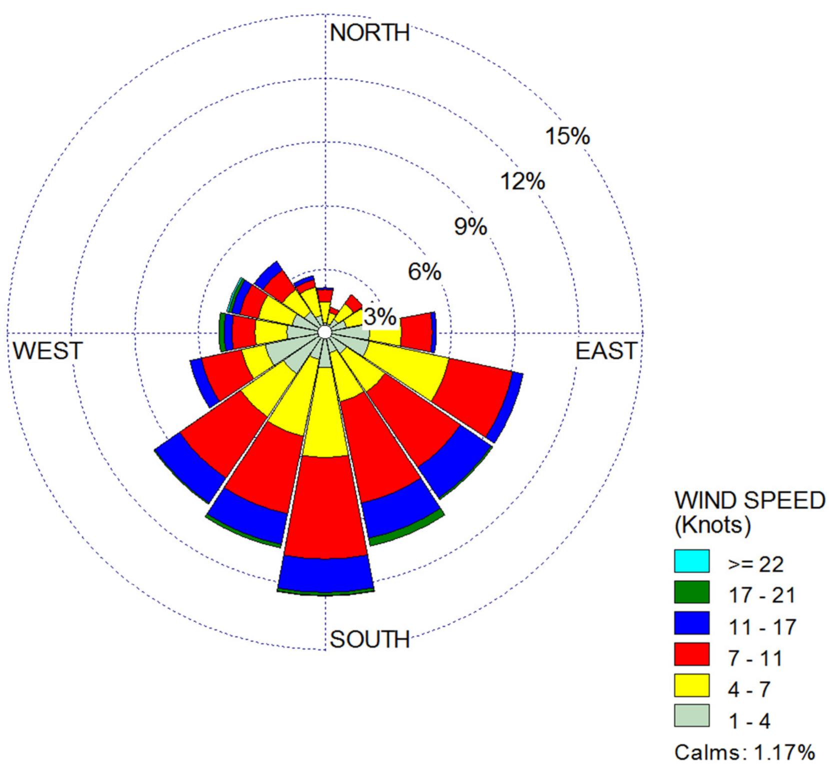


Figure 30 is a representation of hourly wind directions from St. Louis Lambert International Airport that occurred on days when the monitored values at Granite City were at least 20.0 ug/m^3. This pollution rose is significantly different from the pollution rose for the East St. Louis monitor in that there is a very high percentage of occurrences from the south half of the rose. The seven twenty-two and a half degree sectors that are wholly within the south half of the rose account for nearly 70% of the total hours on the identified high $PM_{2.5}$ days. The strong correlation between higher concentrations and generally southerly winds is not surprising considering the close proximity of the monitor to the Granite City Steel/Gateway Coke complex to the southeast through southwest. Of course, these air masses also pass over the broad St. Louis metropolitan area on both sides of the river, and from other urban and industrial areas along the Mississippi and Ohio River valleys. It is equally important to note the very low incidence of higher concentrations when the wind blows from the north through east. The upwind region for the cleanest air masses coming into the Granite City area is northern and central Illinois.

Figure 30
Pollution Rose for Granite City Monitor High Days, 2010-2012



As with the Chicago area analysis, the tool used in assessing the transport routes and source regions of air masses that are over a monitor on days of interest is the HYSPLIT trajectory model. The trajectories in this section (Figures 31 and 32) are from HYSPLIT runs that were performed by USEPA. USEPA ran HYSPLIT for days where monitoring was done for the period 2010-12 for the two violating monitors in the Metro-East. Four backward trajectories are created on each day of interest, starting from the monitor location at 5 AM. The four trajectories mark different heights above ground for each trajectory. One trajectory always starts at 10 m above ground, while the other three start at 25%, 50%, and 75% of the mixing height at the monitor at the starting time.

Figure 31 shows the backward trajectories for the ten highest daily concentrations and the ten lowest daily concentrations at the East St. Louis monitor over the period 2010-12. The trajectories on high days are most concentrated in three different directions: westerly, southerly, and easterly. A significant amount of transport from far beyond the urban area is evident. A majority of the trajectories associated with clean days have a northerly component, often associated with cool, dry air masses that originate over the Canadian prairie and move southeastward across relatively sparsely populated areas of the northern U.S. Great Plains. However, the distribution of trajectories on high and low days is less distinctly separate than is the distribution for Chicago. This is due to the lack of truly high days at the monitor, where only one exceedance occurred in the three year period. There is much more emphasis given to marginally high days, since they comprise some of the highest ten days, and those days will have wind direction characteristics that are similar to “average days,” rather than consistently pointing to an emissions “hot spot.”

Figure 31
Trajectories for High and Low Concentration Days at East St. Louis

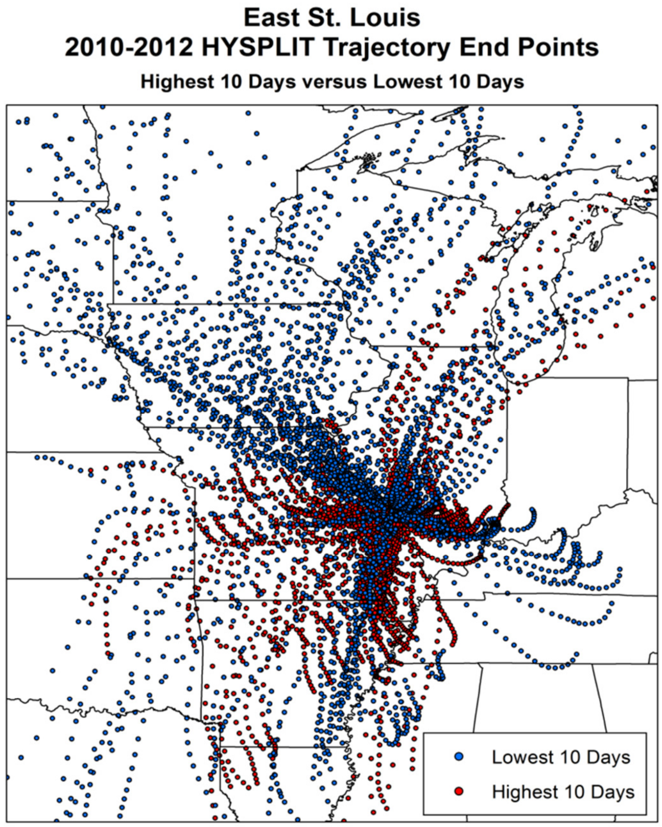
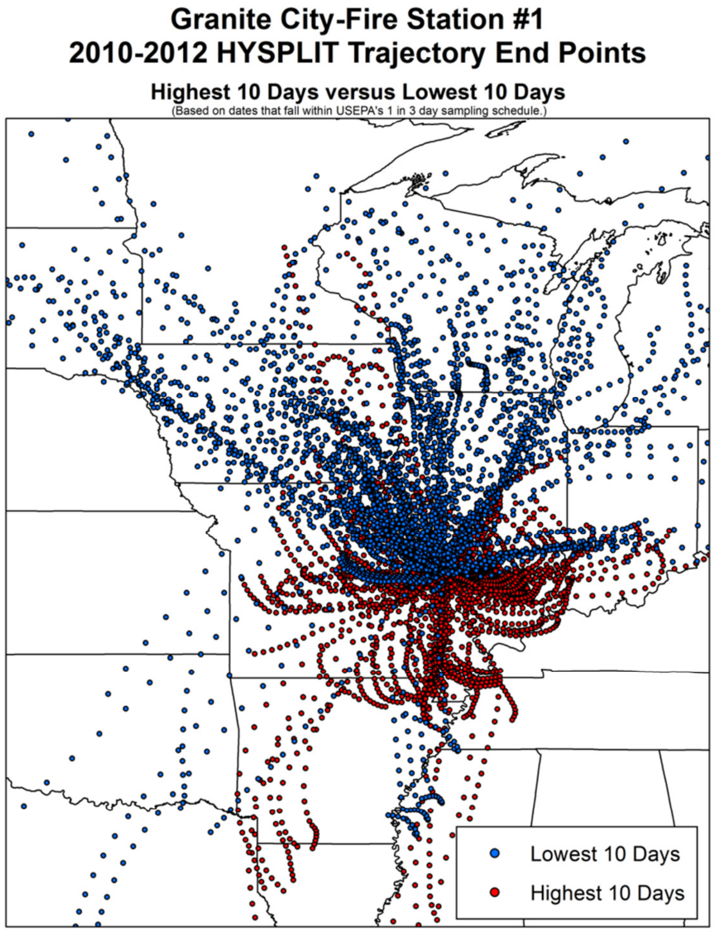


Figure 32 shows the backward trajectories for the ten highest daily concentrations and the ten lowest daily concentrations at the Granite City Fire Station monitor over the period 2010-12. Although this monitor is not considered to be a local-scale monitor, it appears to be strongly influenced by the Granite City Steel/Gateway Coke complex immediately to the southwest through southeast of the monitor. Even so, the trajectories on high days look quite similar to the trajectories on high days at the East St. Louis monitor, with higher frequency of occurrence with west, east, and south winds. This result indicates that higher PM2.5 concentrations occur with similar wind directions, regardless of whether the monitor is north or south of the Granite City Steel complex. Therefore, although the Granite City Steel complex is a contributor to the overall PM loading, all parts of the metropolitan area are also culpable for the annual PM2.5 violations at the Illinois monitors.

Figure 32
Trajectories for High and Low Concentration Days at Granite City



Factor 4 – Geography/Topography

As previously discussed, topography is generally not a factor in determining pollutant transport in Illinois, and is not considered a significant issue in defining the boundaries of the annual PM2.5 nonattainment areas.

Factor 5 – Jurisdictional Boundaries

Based on the geographic location of the Metro-East Study Area and individual sources, it is expected that the coordination of planning activities required to address the nonattainment designation can be carried out in a cohesive manner.

Five Factor Cumulative Evaluation and Recommendation

Madison County. Madison County is currently designated as part of the nonattainment area for the annual PM2.5 standard. Current air quality data (2010-2012) at one monitor in Madison County does not meet the annual PM2.5 standard. In terms of precursor emissions, Madison County has high levels of all precursor emissions, including direct PM2.5. Demographically, Madison County has the second highest population, the second highest population density, and the largest percentage of urban land cover of all the counties in the Metro-East. The IEPA recommends that Madison County be included in the Metro-East nonattainment area for the annual PM2.5 standard.

St. Clair County. St. Clair County is currently designated as nonattainment for the annual PM2.5 standard. Current air quality data (2010-2012) at one monitor in St. Clair County does not meet the annual PM2.5 standard. St. Clair County has relatively high levels of VOC, NO_x, NH_3, and PM2.5 emissions, the highest total population and population density, and a large percentage of urban land cover. St. Clair County is expected to experience moderate population growth in future years. St. Clair County ranks second in AVMT within the study area. The IEPA recommends that St. Clair County be included in the Metro-East nonattainment area for the annual PM2.5 standard.

Monroe County. Monroe County is on the southern fringe of the Metro-East area with the northern portions of the county having an urban/suburban character, while the southern and eastern portions of the county are basically rural. It is currently designated as nonattainment for annual PM2.5 and is immediately adjacent to a county with a violating monitor. Additionally, Monroe County has a relatively high commuting percentage. Due to these reasons, the IEPA recommends that Monroe County be included in the Metro-East nonattainment area for the annual PM2.5 standard.

Jersey County. Jersey County is a rural county located to the north of St. Louis, and is not currently designated as nonattainment for the annual PM2.5 standard. Jersey County has low levels of precursor emissions, low population and population density, low urban land cover, and low total population growth rates. For these reasons, the IEPA recommends that Jersey County be designated as attainment/unclassifiable for the NAAQS.

***Clinton Count*y**. Clinton County was included in the St. Louis MO-IL MSA boundaries established by the U.S. Census Bureau in 2003. This county is primarily rural, with low 2012 population totals and population densities, and small amounts of urban land cover, compared to other counties in the Metro-East study area. Current precursor emission levels in Clinton County are ranked third as a percent of the MSA, expected rates of population growth are moderate as a percentage but total population is relatively low. For these reasons, the IEPA recommends that Clinton County be designated as attainment/unclassifiable for the NAAQS for annual PM2.5.

Randolph County. As defined by the U.S. Census Bureau, Randolph County is not part of the St. Louis MO-IL MSA. A portion of it is, however, included in the current annual PM2.5 nonattainment area. This rural county has low population and population density, low urban land cover, and low population growth rates. However, Randolph County has high levels of PM2.5 and precursor emissions, especially SO_2 and NO_x, virtually all of which are emitted from an existing stationary emission source, the Baldwin Power Station. Figure B11 shows the location of the Baldwin plant in northern Randolph County. Because of the high levels of precursor emissions, and because of the close proximity of the Baldwin facility to the southern edge of St. Clair County, the IEPA recommends that Baldwin Township (Precinct), east of the Kaskaskia River, be designated as nonattainment for the annual PM2.5 standards, and the remainder of Randolph County should be designated as attainment/unclassifiable.

Macoupin, Bond, and Calhoun Counties. Bond, Calhoun, and Macoupin Counties were added to the St. Louis MO-IL MSA as defined by the U.S. Census Bureau in 2003. None of these three counties are included in the current annual PM2.5 nonattainment area. These counties are primarily rural, with low 2012 population totals and population densities, and have small amounts of urban land cover compared to other counties in the MSA. Current precursor emission levels in Macoupin, Bond, and Calhoun Counties are low, as are population and AVMT. For these reasons, the IEPA recommends that Macoupin, Bond, and Calhoun Counties be designated as attainment/unclassifiable for the NAAQS for annual PM2.5.

Montgomery County. Montgomery County is not included in the current annual PM2.5 nonattainment area, nor is it part of the St. Louis MO-IL MSA. The county is not contiguous with the Metro-East urbanized area and was therefore not evaluated based on emissions and emissions related data or other factors for this study. Montgomery County does have a large electric utility source, but it is farther than 46.5 miles away from violating annual PM2.5 monitor and is downwind from the Metro-East area. For these reasons, the IEPA recommends that Montgomery County not be included in the nonattainment area and that it be designated as attainment/unclassifiable for the NAAQS for 24-hour PM2.5.

Washington County. Washington County is not included in the current annual PM2.5 nonattainment area, nor is it part of the St. Louis MO-IL MSA. Washington County is considered adjacent to St. Clair County, however the county is not contiguous with the Metro-East urbanized area and was therefore not evaluated based on emission and emissions related data influences or other factors for this study. For these reasons, the IEPA recommends that Washington County not be included in the nonattainment area and that it be designated as attainment/unclassifiable for the NAAQS for annual PM2.5.

<u>Remainder of Illinois</u>

Areas of the state that are not part of the Chicago or Metro-East metropolitan areas are in attainment with the primary annual PM2.5 NAAQS, and it is recommended that all remaining counties be designated as attainment/unclassifiable.

Recommendations

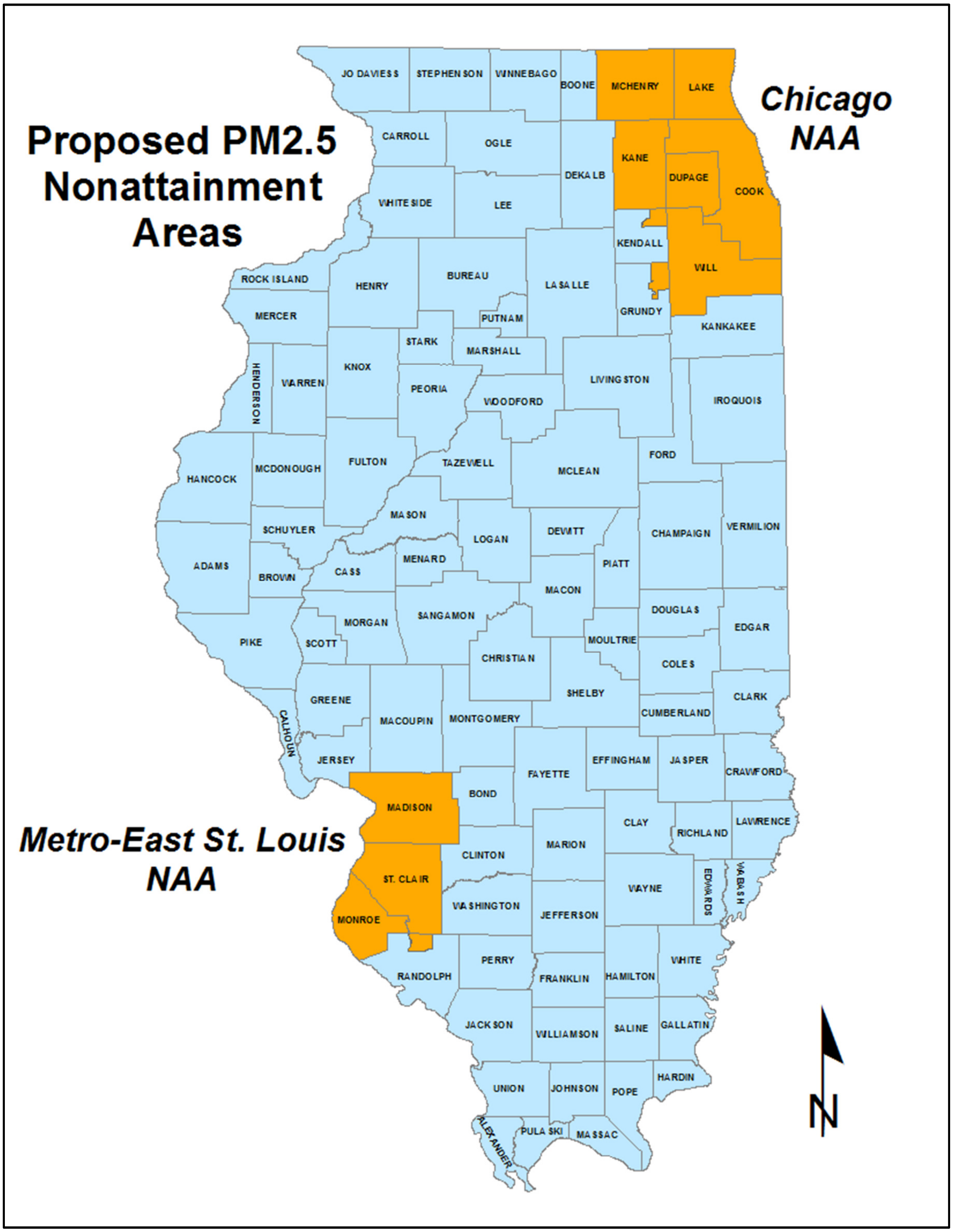
IEPA's recommendations for attainment/nonattainment boundary designations in Illinois for the 2012 revised annual PM2.5 NAAQS are contained in Table 15. The location of IEPA's recommended PM2.5 nonattainment areas for the State of Illinois are shown in Figure 33.

The Clean Air Act does not specify the geographic boundaries, size, or the extent to which source contributions would require that an area be designated as nonattainment for the 2012 revised primary annual PM2.5 standard, nor has U.S. EPA promulgated rules prescribing such. IEPA's recommendations are consistent with the guidance memorandum provided by U.S. EPA and are based on an evaluation of current air quality, the location and magnitude of PM2.5 emission sources, and other factors. The IEPA recognizes that each of the factors considered in this evaluation, when evaluated individually, are not necessarily conclusive. Rather, IEPA's recommendations are based on consideration of all of the factors taken together. It is expected that the coordination of planning activities required to address the nonattainment designations can be carried out in a cohesive manner. The data sources utilized in the preparation of this report are summarized in Table 16.

It should be noted that IEPA presented drafts of these recommendations to the public in October of this year, with a comment period extending into November. Several comments were received from industrial sources or industry groups requesting smaller NAAs (or none at all) and/or asked that the Agency await full 2013 monitoring data prior to making these recommendations. IEPA had previously considered these concepts for the NAA boundaries and thus the recommendations remain unchanged at this time.

However, as noted previously, this recommendation is being made in mid-December, according to USEPA requirements. Current trends indicate there may be a change in monitor design values when 2013 data is included. IEPA intends to review 2013 monitoring data when it becomes available and, if warranted, will request that USEPA consider 2011-2013 data at that time.

Figure 33



Proposed PM2.5 Nonattainment Areas
Chicago NAA
Metro-East St. Louis NAA
JO DAVIESS
STEPHENSON
WINNEBAGO
BOONE
MCHENRY
LAKE
CARROLL
OGLE
DEKALB
KANE
DUPAGE
COOK
WHITESIDE
LEE
KENDALL
WILL
ROCK ISLAND
HENRY
BUREAU
LA SALLE
GRUNDY
KANKAKEE
MERCER
PUTNAM
STARK
MARSHALL
HENDERSON
WARREN
KNOX
PEORIA
WOODFORD
LIVINGSTON
IROQUOIS
FORD
HANCOCK
MCDONOUGH
FULTON
TAZEWELL
MCLEAN
MASON
SCHUYLER
LOGAN
DEWITT
CHAMPAIGN
VERMILION
ADAMS
BROWN
CASS
MENARD
PIATT
MACON
SANGAMON
DOUGLAS
EDGAR
PIKE
SCOTT
MORGAN
MOULTRIE
CHRISTIAN
COLES
SHELBY
CLARK
GREENE
CALHOUN
MACOUPIN
MONTGOMERY
CUMBERLAND
JERSEY
EFFINGHAM
JASPER
CRAWFORD
FAYETTE
MADISON
BOND
CLAY
RICHLAND
LAWRENCE
MARION
CLINTON
ST. CLAIR
EDWARDS
WABASH
WAYNE
WASHINGTON
JEFFERSON
MONROE
PERRY
WHITE
RANDOLPH
FRANKLIN
HAMILTON
JACKSON
WILLIAMSON
SALINE
GALLATIN
HARDIN
UNION
JOHNSON
POPE
ALEXANDER
PULASKI
MASSAC
N

Table 15
Recommended Attainment/Nonattainment Designations in Illinois for the 2012 Revised Primary Annual PM2.5 National Ambient Air Quality Standard

County	Designation	Name of Area
Cook	Nonattainment	Chicago
DuPage	Nonattainment	Chicago
Kane	Nonattainment	Chicago
Lake	Nonattainment	Chicago
Will	Nonattainment	Chicago
McHenry	Nonattainment	Chicago
Kendall:		
Oswego Township	Nonattainment	Chicago
All Other Townships	Attainment/Unclassifiable	
Grundy:		
Aux Sable Township	Nonattainment	Chicago
Goose Lake Township	Nonattainment	
All Other Townships	Attainment/Unclassifiable	
Madison	Nonattainment	Metro-East
Monroe	Nonattainment	Metro-East
St. Clair	Nonattainment	Metro-East
Randolph:		
Baldwin Township/Precinct	Nonattainment	Metro-East
All Other Townships	Attainment/Unclassifiable	
All Other Counties	Attainment/Unclassifiable	

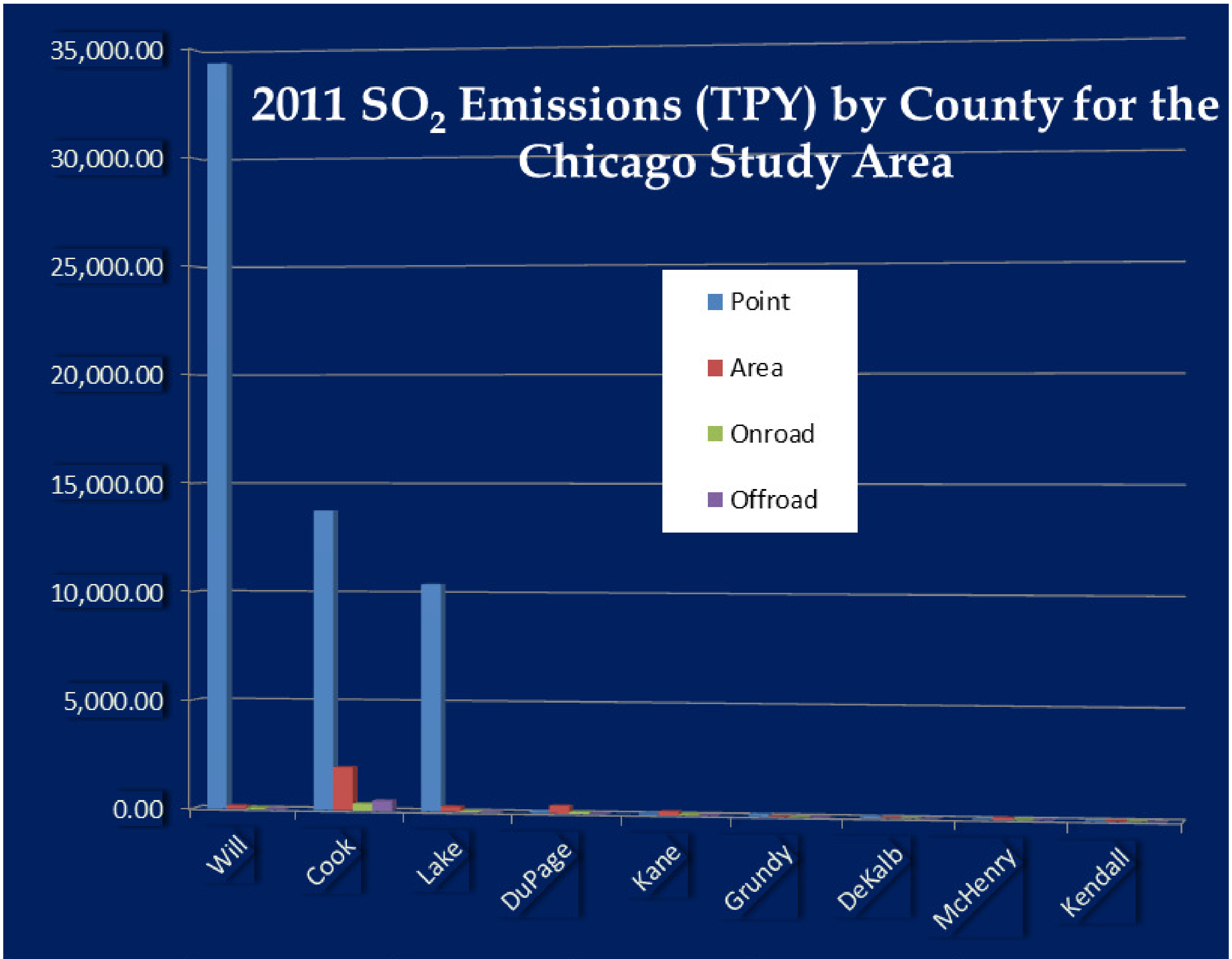
Table 16
PM2.5 NAA Boundary Recommendation Data Sources

Factor	Data Analysis	Data Source	Date of Study
1. Air Quality Data	Annual PM2.5 2010-2012 Design Values	IEPA	2010-2012
	2010 and 2011Annual PM2.5 speciation data for Total Mass and Urban Increment Mass	U.S. EPA Designation and Guidance Section (http://www.epa.gov/pmdesignations/2012standards/techinfo.htm)	2010-2011
2. Emissions	Emission inventory information for pollutants: PM2.5, NH_3, NO_x, SO_2 and VOC within the current annual PM2.5 NAA and adjacent counties. Emission totals (tons/year) are summarized by county for point, area, on-road/mobile, and non-road and animal sectors	IEPA's 2011 submittal to the National Emissions Inventory (NEI)	2011
	Source locations in non-attainment areas and adjacent counties	IEPA	2011
2 Population Density and Urbanization	Annual Estimates of the Population in Illinois. Total population and population density estimates*	Table1:Annual Estimates of the Population for Counties of Illinois and County Rankings:July1,2004 to July1, 2005 (CO-EST2005-03-17) Population Division, U.S. Census Bureau	Release date: March 16, 2006
	Urbanized area boundaries	ESRI Maps and Data	2010
2. Traffic and Commuting Patterns	Annual VMT tables for 2012	Illinois Department of Transportation, Travel Statistics 2012	2012
	Resident County to Workplace County Flows files table	American Community Survey - U.S. Census Bureau	2006-2010
3. Meteorology	Wind speed and wind direction data for the Chicago-Midway and St. Louis-Lambert Airports	National Weather Service	2010-2012
	HYSPLIT Trajectory Endpoint Data for the Washington High School, Granite City-Firestation, and East St. Louis PM2.5 Monitors	U.S. EPA Designation and Guidance Section (http://www.epa.gov/pmdesignations/2012standards/techinfo.htm), HYSPLIT trajectory endpoint data	2010-2012
4. Geography/Topography	The National Elevation Dataset (NED) for Illinois	U.S. Geological Survey	2007
5. Jurisdictional Boundaries	MSA/CBSA/CSA Boundaries	Office of Management and Budget	February 2013
	1997 PM2.5 NAA Boundaries	IEPA BOA	April 2005

Appendix A

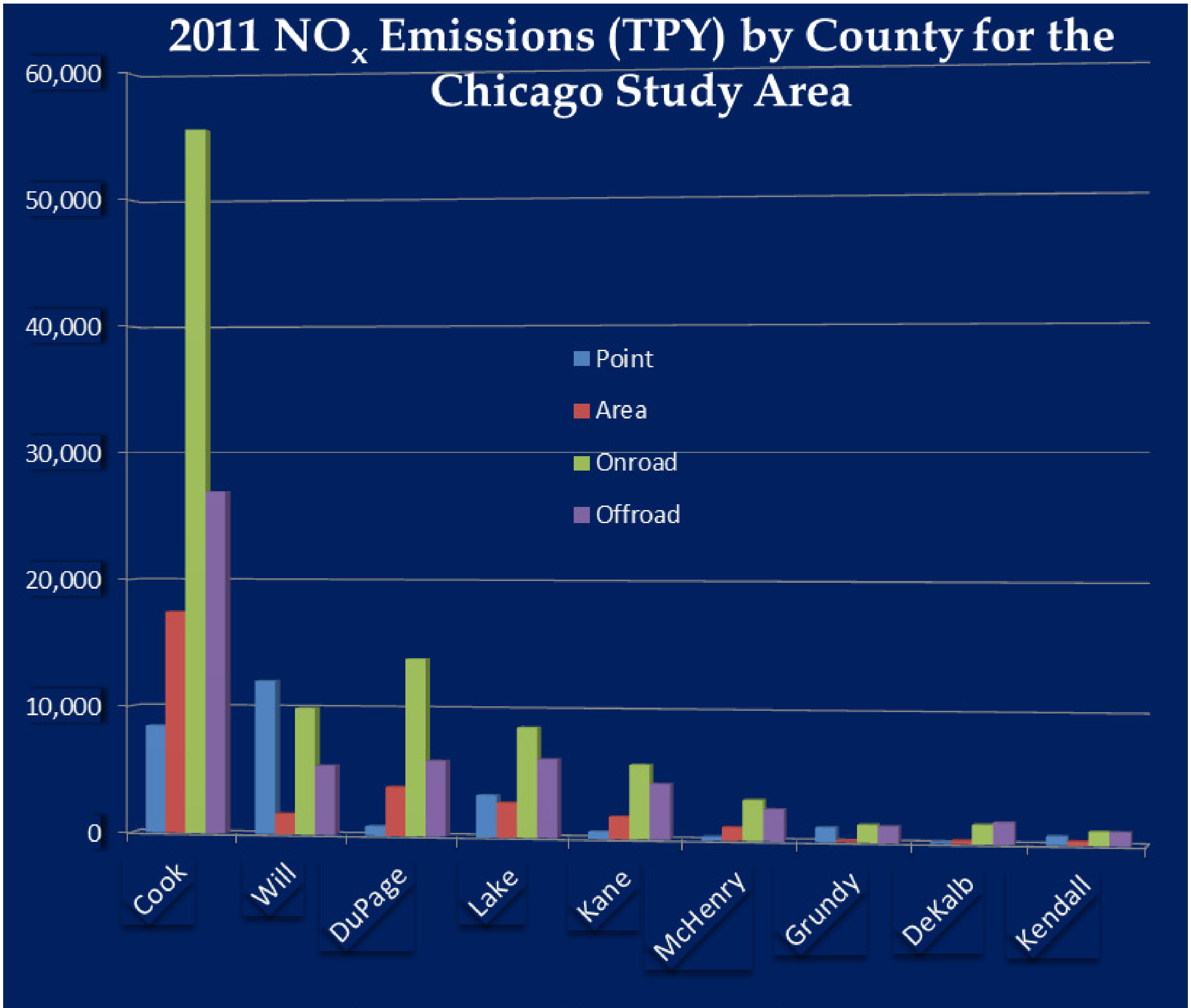
Emission Charts and Maps for the Chicago Metropolitan Study Area

FIGURE A1



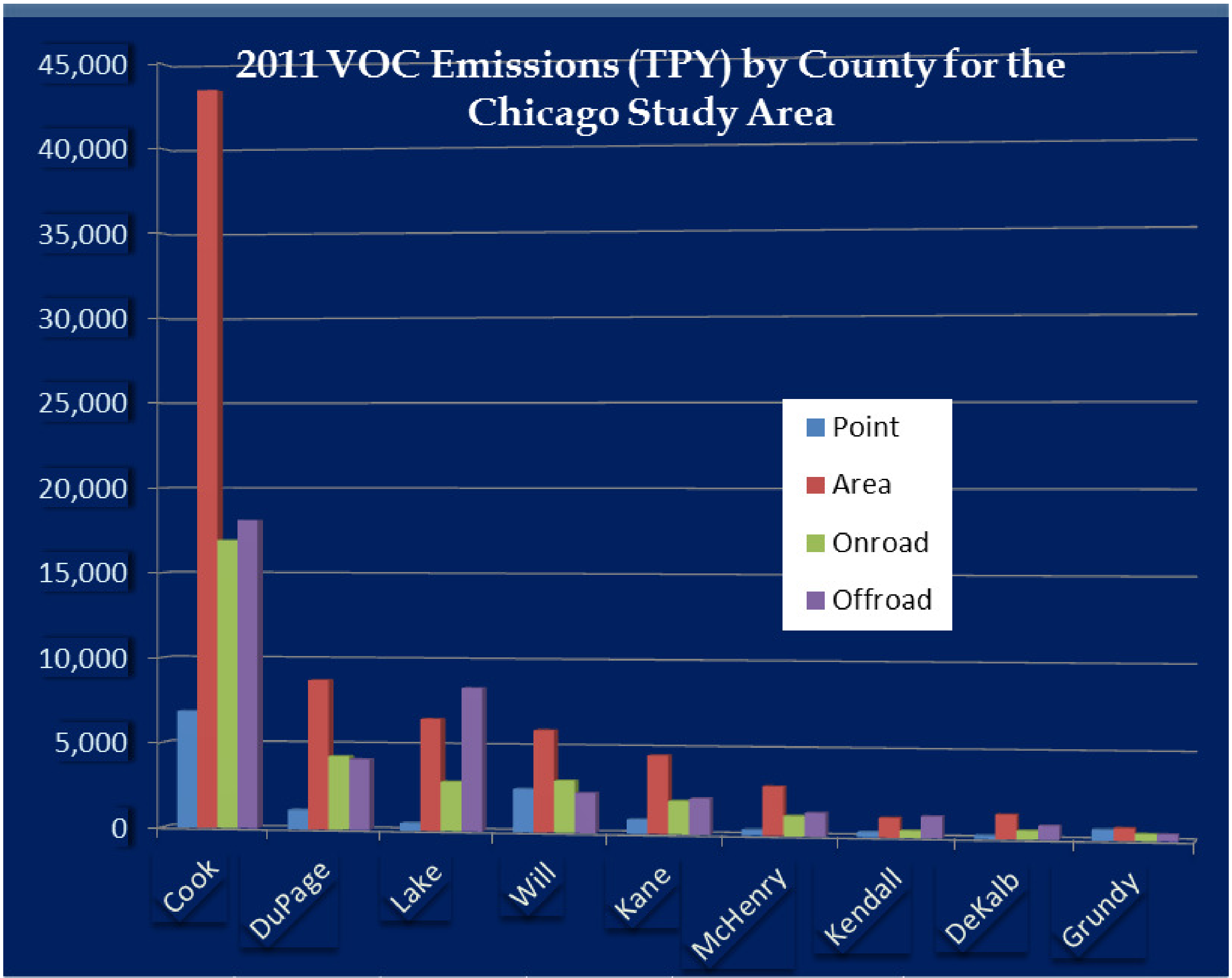
County	Point	Area	Onroad	Offroad	Total TPY
Will	34,355.57	144.75	55.32	24.73	34,580.37
Cook	13,755.87	1,971.47	317.21	463.15	16,507.69
Lake	10,399.29	233.12	53.71	42.46	10,728.58
DuPage	106.95	342.46	80.44	22.10	551.96
Kane	69.09	158.63	35.11	15.04	277.86
Grundy	106.14	12.78	7.03	22.36	148.31
DeKalb	90.25	30.01	8.87	10.23	139.36
McHenry	5.86	91.55	20.63	6.04	124.10
Kendall	12.82	27.97	7.47	3.61	51.87

FIGURE A2



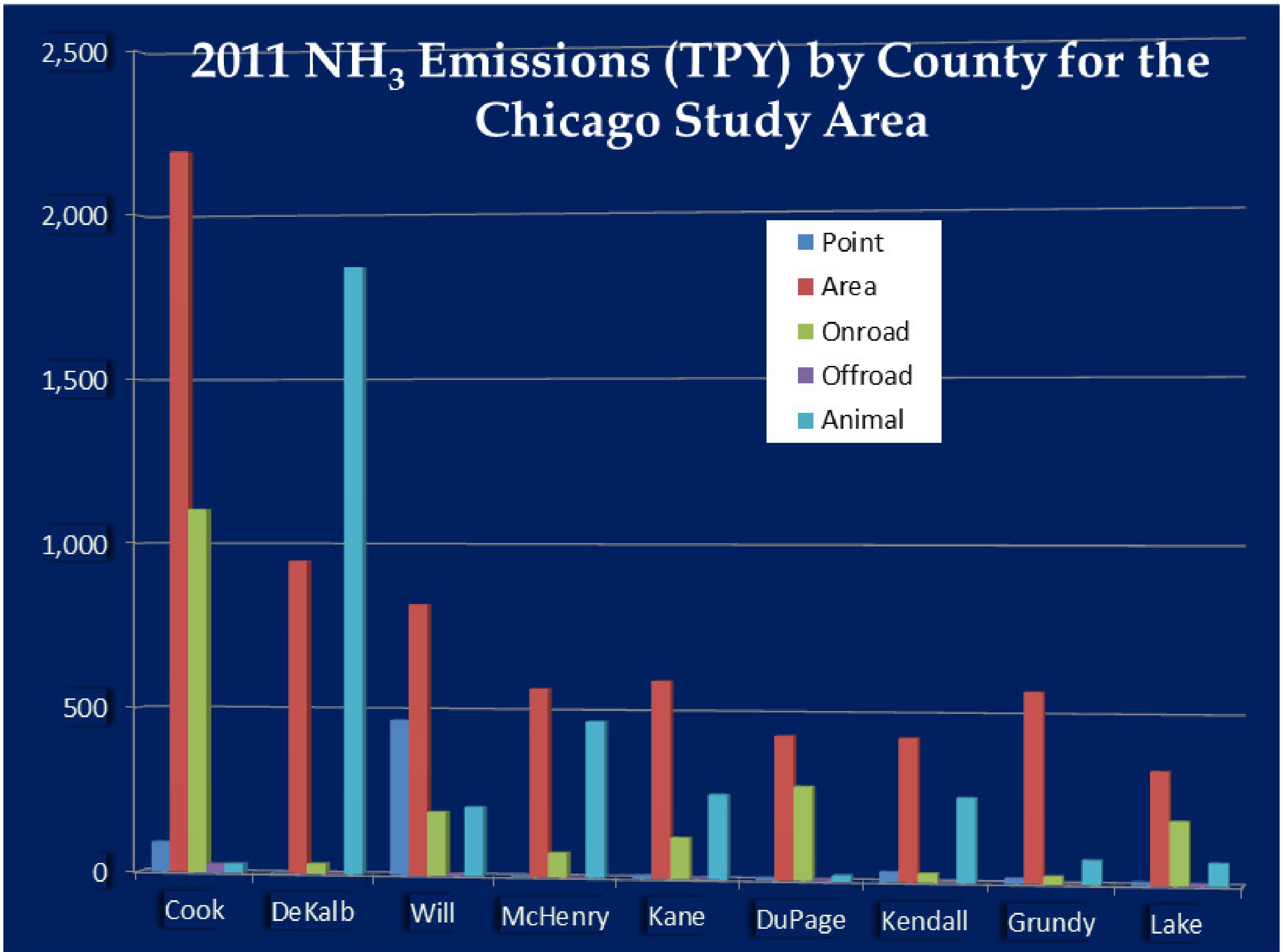
County	Point	Area	Onroad	Offroad	Total TPY
Cook	8,460.56	17,488.93	55,555.13	26,986.59	108,491.22
Will	12,064.39	1,625.83	9,936.91	5,447.06	29,074.20
DuPage	740.46	3,832.41	13,867.30	5,914.23	24,354.39
Lake	3,279.10	2,706.23	8,610.92	6,137.99	20,734.24
Kane	564.01	1,725.76	5,790.27	4,327.60	12,407.63
McHenry	288.67	1,033.07	3,161.54	2,465.88	6,949.17
Grundy	1,123.66	135.70	1,369.44	1,280.58	3,909.37
DeKalb	140.69	259.09	1,490.64	1,675.60	3,566.02
Kendall	695.29	319.95	1,078.86	1,064.27	3,158.37

FIGURE A3



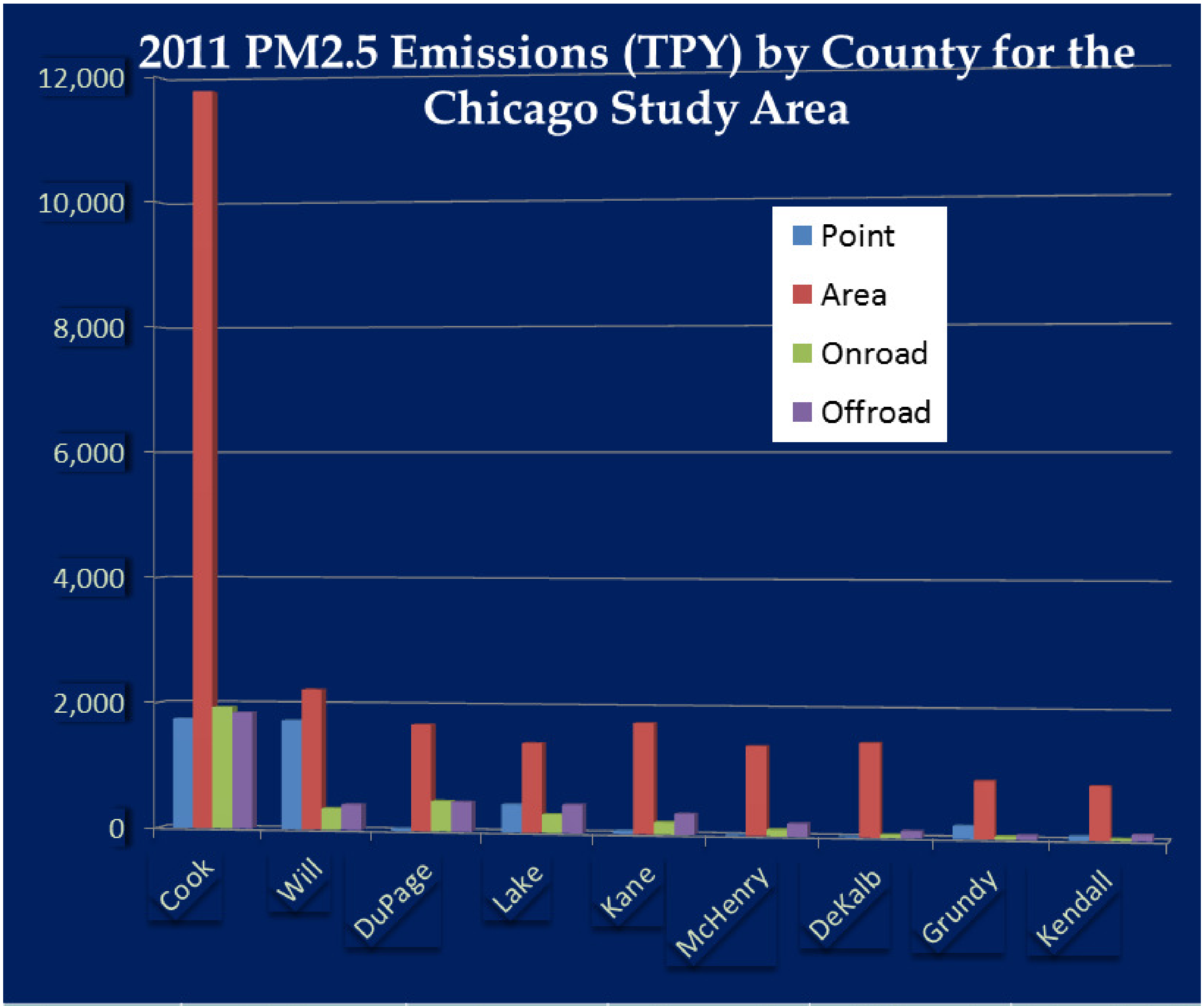
County	Point	Area	Onroad	Offroad	Total TPY
Cook	6,870.21	43,433.11	16,946.52	18,110.61	85,360.44
DuPage	1,115.51	8,749.86	4,300.47	4,125.90	18,291.74
Lake	445.49	6,532.99	2,886.29	8,360.71	18,225.48
Will	2,510.15	5,945.78	3,026.23	2,326.88	13,809.04
Kane	834.68	4,559.20	1,935.77	2,082.71	9,412.35
McHenry	336.06	2,845.07	1,150.48	1,343.94	5,675.54
Kendall	302.04	1,122.74	407.79	1,230.12	3,062.68
DeKalb	188.86	1,393.00	503.26	794.68	2,879.80
Grundy	626.53	715.83	393.92	389.48	2,125.75

FIGURE A4



County	Point	Area	Onroad	Offroad	Animal	Total TPY
Cook	91.08	2,193.46	1,105.33	27.40	28.02	3,445.30
DeKalb	1.57	948.79	31.39	1.42	1,838.13	2,821.29
Will	468.35	817.69	192.34	6.02	208.02	1,692.42
McHenry	3.28	566.33	73.77	2.92	469.13	1,115.43
Kane	10.29	592.26	123.95	4.87	253.86	985.24
DuPage	8.46	431.31	281.09	7.19	17.35	745.40
Kendall	30.50	428.90	26.96	1.33	253.14	740.79
Grundy	16.58	568.39	24.12	0.95	72.59	682.62
Lake	10.02	337.22	190.02	7.88	68.74	613.89

FIGURE A5



County	Point	Area	Onroad	Offroad	Total TPY
Cook	1,743.89	11,769.13	1,934.06	1,849.22	17,296.29
Will	1,735.00	2,228.48	342.26	404.71	4,710.46
DuPage	35.02	1,685.79	481.20	469.12	2,671.13
Lake	440.83	1,409.71	293.47	447.67	2,591.68
Kane	51.65	1,746.12	194.79	330.27	2,322.83
McHenry	16.77	1,406.65	103.58	200.78	1,727.77
DeKalb	15.18	1,470.27	48.23	108.20	1,641.88
Grundy	205.64	902.07	47.23	68.51	1,223.46
Kendall	68.01	841.90	35.12	99.79	1,044.81

Figure A6

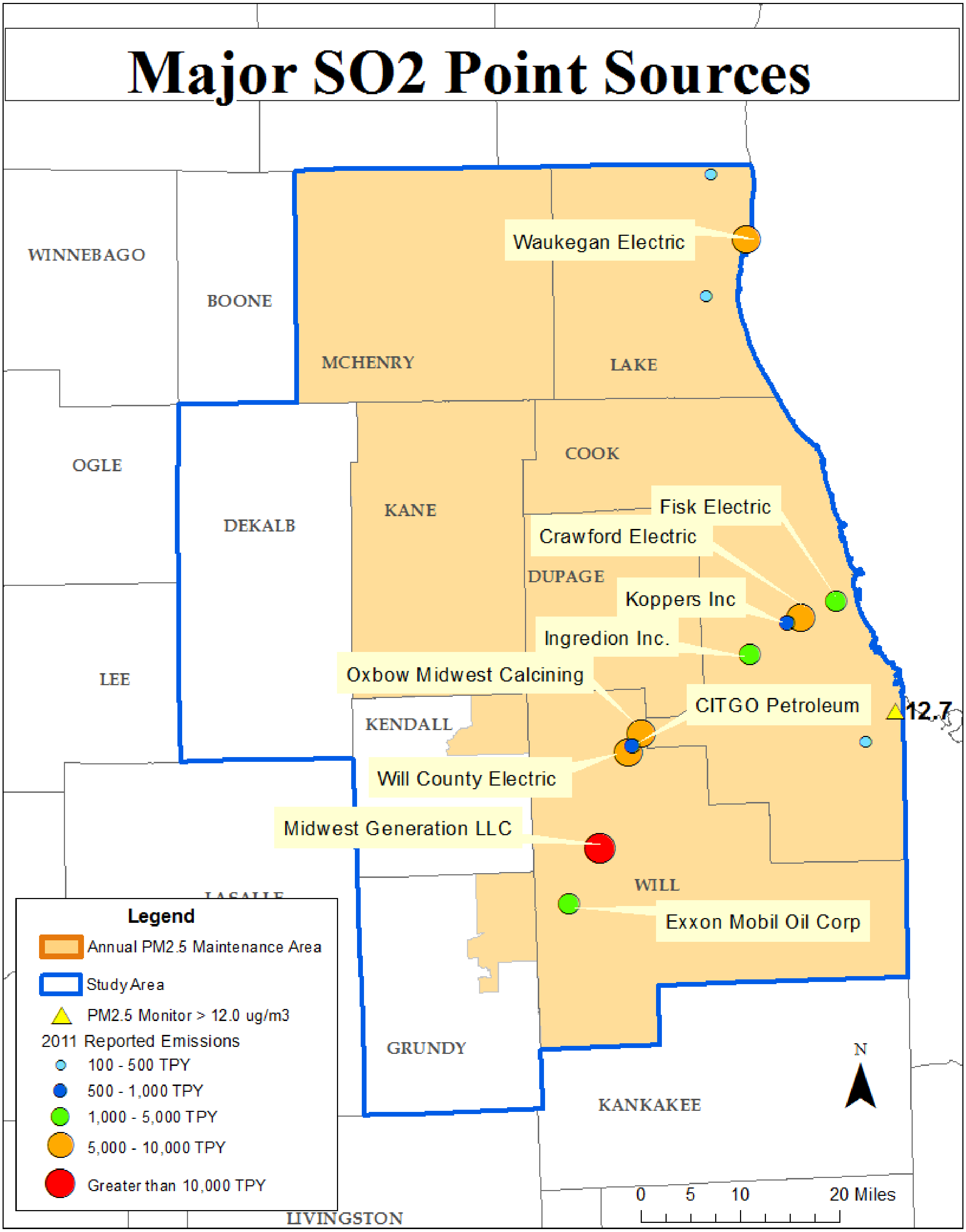

Major SO2 Point Sources
WINNEBAGO
BOONE
MCHENRY
LAKE
OGLE
DEKALB
KANE
COOK
DUPAGE
LEE
KENDALL
LASALLE
WILL
GRUNDY
KANKAKEE
LIVINGSTON
Waukegan Electric
Fisk Electric
Crawford Electric
Koppers Inc
Ingredion Inc.
Oxbow Midwest Calcining
CITGO Petroleum
12.7
Will County Electric
Midwest Generation LLC
Exxon Mobil Oil Corp
Legend
Annual PM2.5 Maintenance Area
Study Area
PM2.5 Monitor > 12.0 ug/m3
2011 Reported Emissions
100 - 500 TPY
500 - 1,000 TPY
1,000 - 5,000 TPY
5,000 - 10,000 TPY
Greater than 10,000 TPY
N
0 5 10 20 Miles

Figure A7

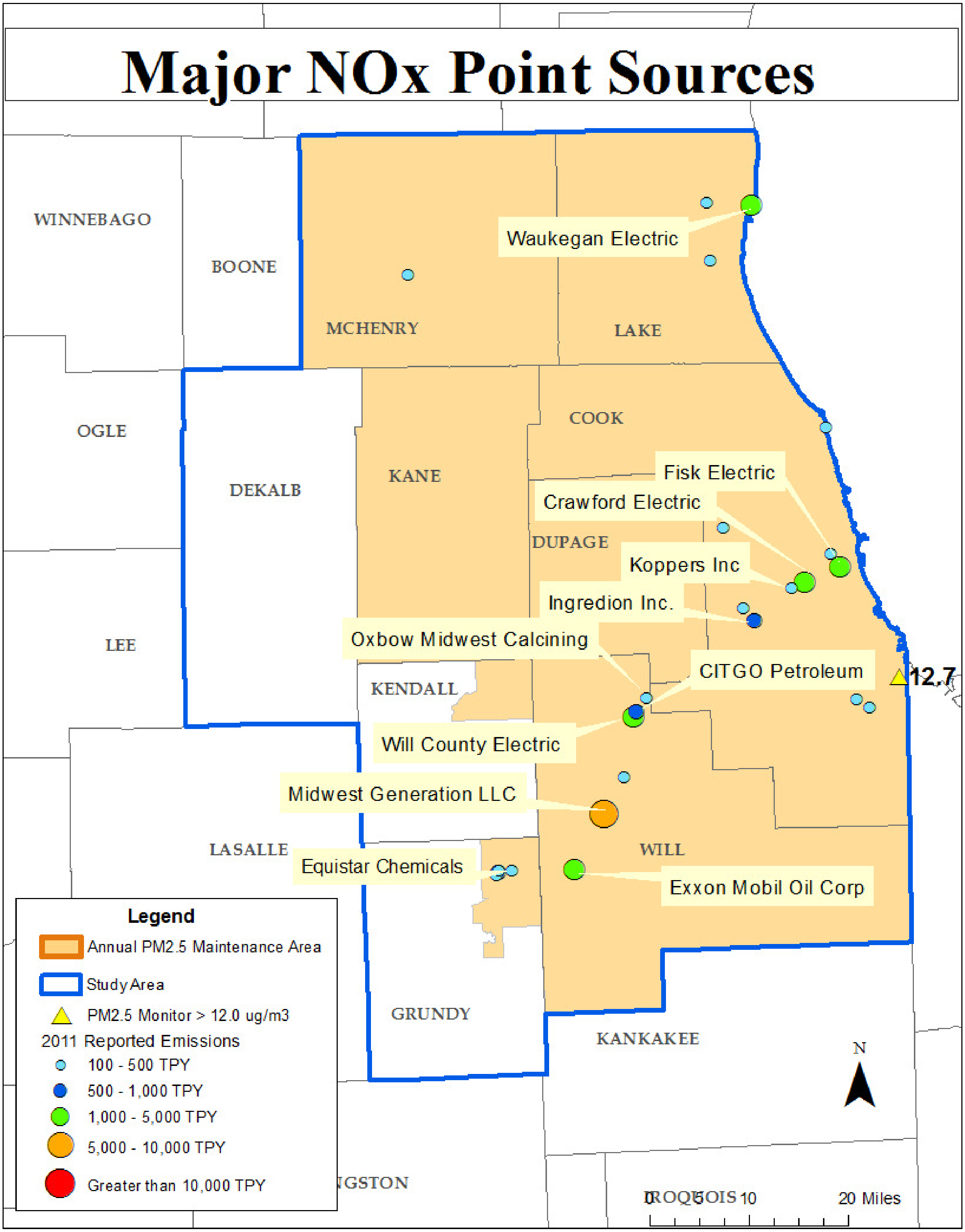

Major NOx Point Sources
WINNEBAGO
BOONE
MCHENRY
LAKE
OGLE
DEKALB
KANE
COOK
DUPAGE
LEE
KENDALL
LASALLE
WILL
GRUNDY
KANKAKEE
IROQUOIS
Waukegan Electric
Fisk Electric
Crawford Electric
Koppers Inc
Ingredion Inc.
Oxbow Midwest Calcining
CITGO Petroleum
12.7
Will County Electric
Midwest Generation LLC
Equistar Chemicals
Exxon Mobil Oil Corp
Legend
Annual PM2.5 Maintenance Area
Study Area
PM2.5 Monitor > 12.0 ug/m3
2011 Reported Emissions
100 - 500 TPY
500 - 1,000 TPY
1,000 - 5,000 TPY
5,000 - 10,000 TPY
Greater than 10,000 TPY
N
0 5 10 20 Miles

Figure A8

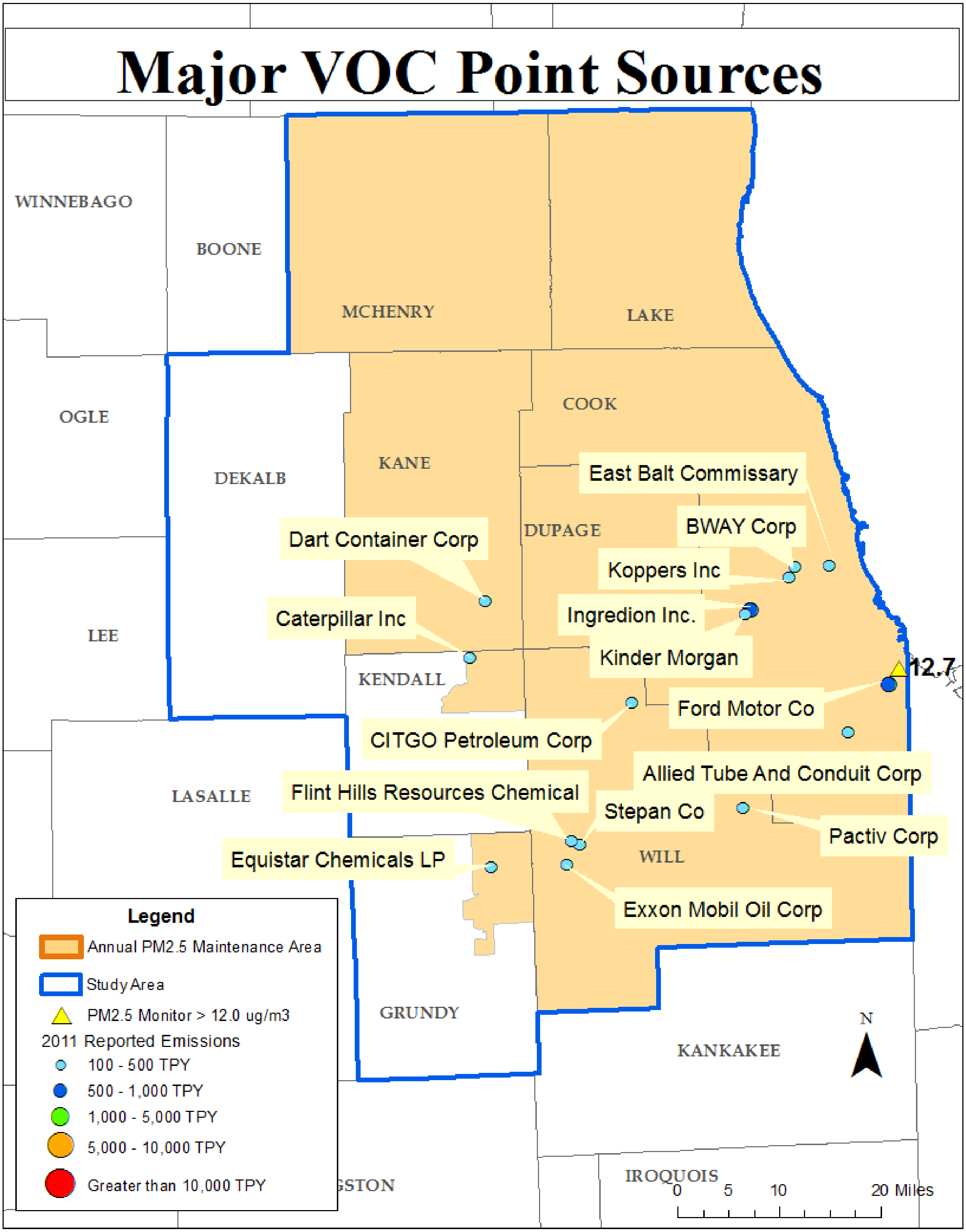

Major VOC Point Sources
WINNEBAGO
BOONE
MCHENRY
LAKE
OGLE
DEKALB
KANE
COOK
DUPAGE
LEE
KENDALL
LASALLE
WILL
GRUNDY
KANKAKEE
IROQUOIS
East Balt Commissary
BWAY Corp
Dart Container Corp
Koppers Inc
Ingredion Inc.
Caterpillar Inc
Kinder Morgan
12.7
Ford Motor Co
CITGO Petroleum Corp
Allied Tube And Conduit Corp
Flint Hills Resources Chemical
Stepan Co
Pactiv Corp
Equistar Chemicals LP
Exxon Mobil Oil Corp
Legend
Annual PM2.5 Maintenance Area
Study Area
PM2.5 Monitor > 12.0 ug/m3
2011 Reported Emissions
100 - 500 TPY
500 - 1,000 TPY
1,000 - 5,000 TPY
5,000 - 10,000 TPY
Greater than 10,000 TPY
N
0 5 10 20 Miles

Figure A9

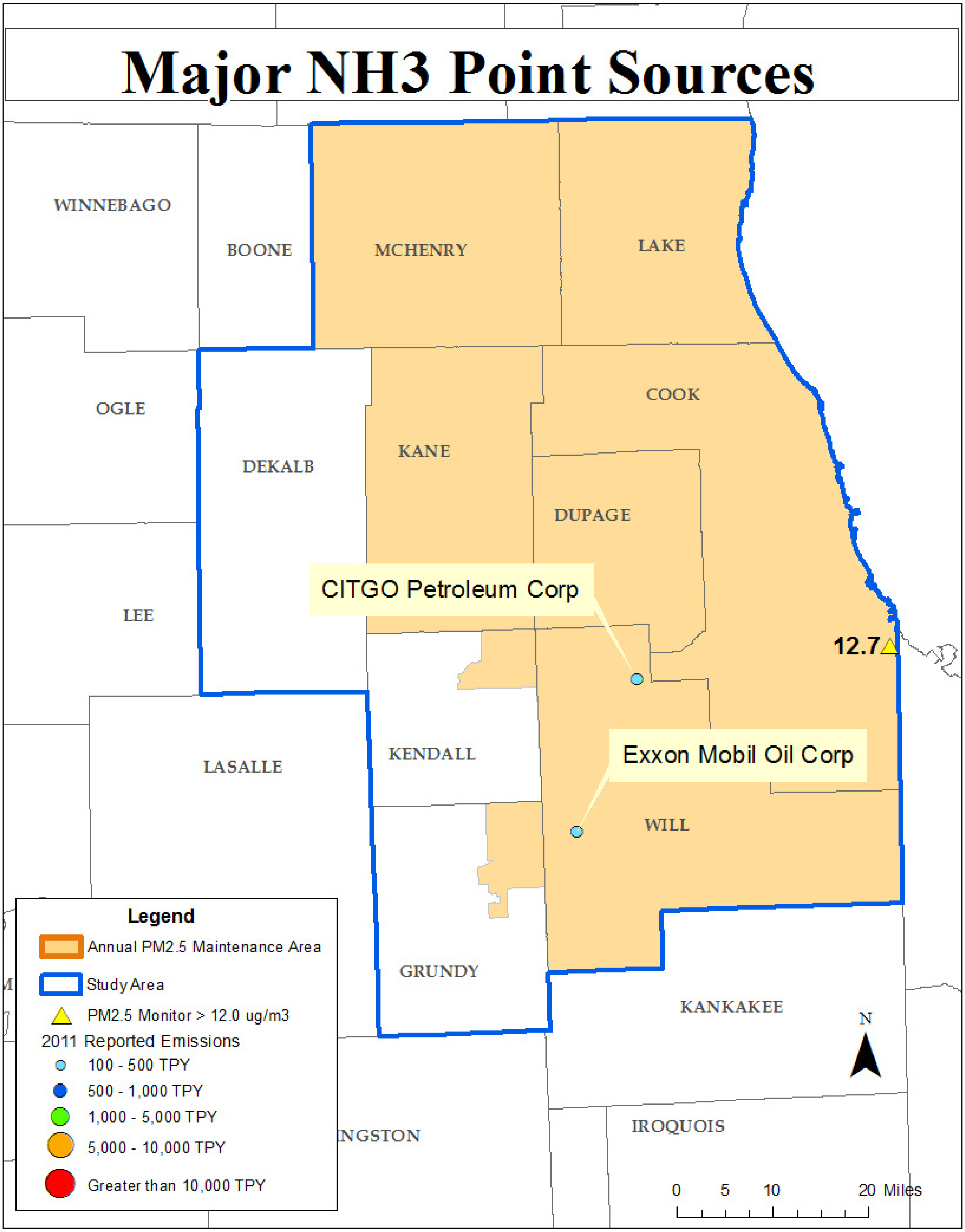
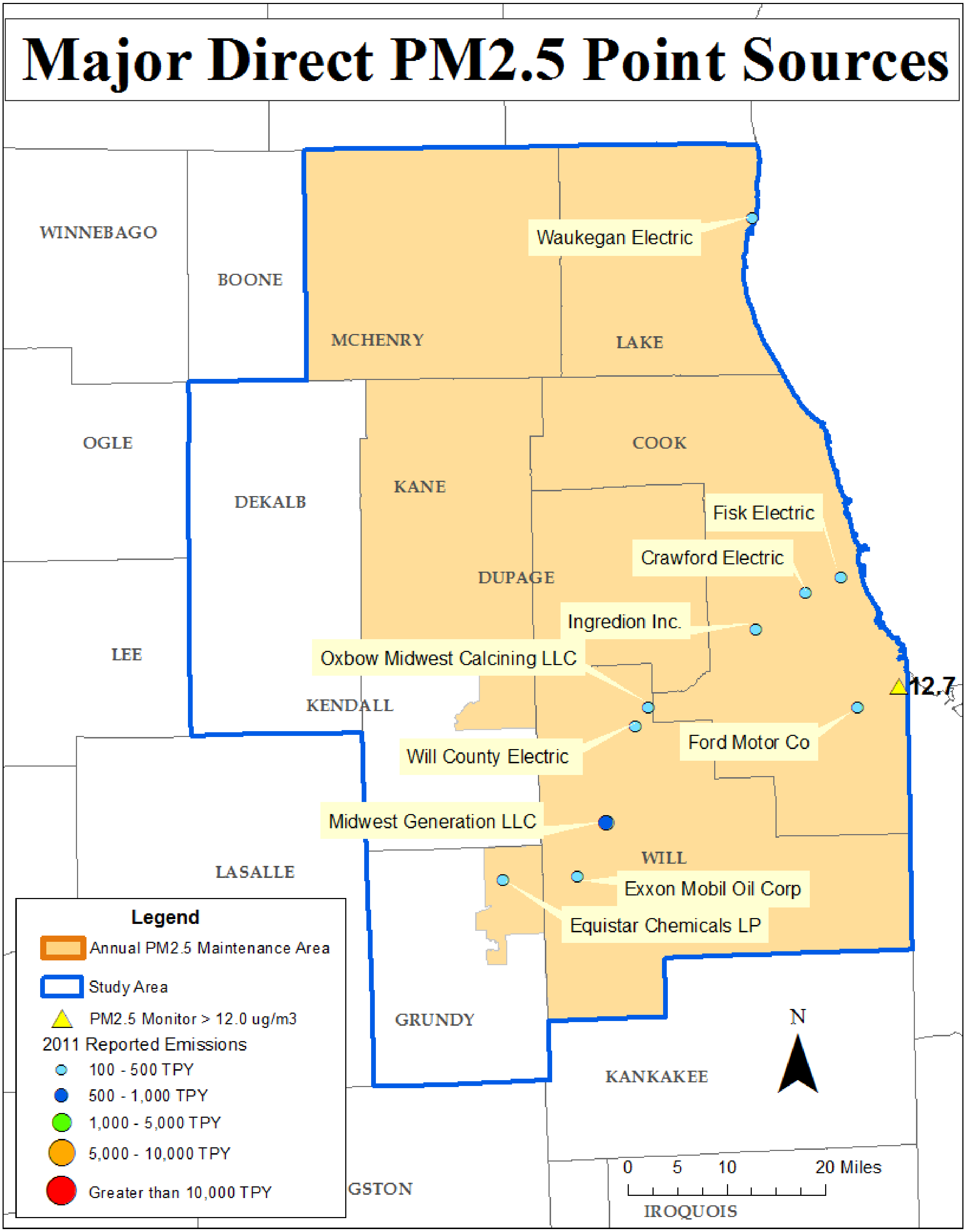

Major NH3 Point Sources
WINNEBAGO
BOONE
MCHENRY
LAKE
OGLE
DEKALB
KANE
COOK
DUPAGE
LEE
CITGO Petroleum Corp
12.7
KENDALL
LASALLE
Exxon Mobil Oil Corp
WILL
GRUNDY
KANKAKEE
N
INGSTON
IROQUOIS
0 5 10 20 Miles
Legend
Annual PM2.5 Maintenance Area
Study Area
PM2.5 Monitor > 12.0 ug/m3
2011 Reported Emissions
100 - 500 TPY
500 - 1,000 TPY
1,000 - 5,000 TPY
5,000 - 10,000 TPY
Greater than 10,000 TPY

Figure A10


Major Direct PM2.5 Point Sources
WINNEBAGO
BOONE
MCHENRY
LAKE
Waukegan Electric
OGLE
DEKALB
KANE
COOK
Fisk Electric
Crawford Electric
DUPAGE
Ingredion Inc.
Oxbow Midwest Calcining LLC
LEE
KENDALL
12.7
Will County Electric
Ford Motor Co
Midwest Generation LLC
WILL
LASALLE
Exxon Mobil Oil Corp
Equistar Chemicals LP
Legend
Annual PM2.5 Maintenance Area
Study Area
PM2.5 Monitor > 12.0 ug/m3
2011 Reported Emissions
100 - 500 TPY
500 - 1,000 TPY
1,000 - 5,000 TPY
5,000 - 10,000 TPY
Greater than 10,000 TPY
GRUNDY
N
KANKAKEE
0 5 10 20 Miles
GSTON
IROQUOIS