Technical Support Document: Recommended Initial Attainment/Nonattainment Designations in Illinois for the 2024 Revised Primary Annual $PM_{2.5}$ National Ambient Air Quality Standard

AQPSTR 25-01

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Introduction

On May 6, 2024, the United States Environmental Protection Agency ("USEPA") published its final rule for the reconsideration of the current National Ambient Air Quality Standards ("NAAQS") for particulate matter ("$PM_{2.5}$") (89 FR 16202). USEPA maintained the primary 24-hour $PM_{2.5}$ standard at 35 micrograms per cubic meter ($\mu g/m^3$), maintained the primary 24-hour PM_{10} standard at 150 $\mu g/m^3$, and strengthened the primary annual $PM_{2.5}$ standard from 12 $\mu g/m^3$ to 9.0 $\mu g/m^3$. Following promulgation of a new or revised air quality standard, Section 107(d) of the Clean Air Act ("CAA") requires the Governor of each State to recommend initial designations of the attainment status for all areas in that State.

Areas can be classified as ***nonattainment*** (not meeting or contributing to a nearby area that does not meet the NAAQS), ***attainment/unclassifiable*** (meeting the NAAQS or expected to meet the NAAQS despite a lack of monitoring data), or ***unclassifiable*** (cannot be classified based on available data). Illinois is providing recommendations for attainment/nonattainment area boundaries for the annual $PM_{2.5}$ standard. The USEPA will then 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 the recommendations by the Illinois Environmental Protection Agency (Illinois EPA) for the Chicago metropolitan area and the Metro-East St. Louis ("Metro-East") metropolitan area to be classified as nonattainment for the 2024 $PM_{2.5}$ NAAQS. Based on the most recent three years of ambient monitoring data (2021-2023), the counties of Cook, DuPage, Kane, and Will in the Chicago metropolitan area and Madison and St. Clair in the Metro-East metropolitan area are currently violating the 2024 $PM_{2.5}$ NAAQS. The surrounding counties of Lake, McHenry, and portions of Kendall and Grundy County are significantly contributing to the violating counties in the Chicago area. The additional county of Monroe and a portion of Randolph County are contributing to the violating counties in the Metro-East area**.** Illinois EPA's recommended boundaries are consistent with previous Chicago and Metro-East $PM_{2.5}$ nonattainment area boundaries when the areas were designated nonattainment for the 1997 $PM_{2.5}$ standard. The boundaries are based on the 2021-2023 ambient monitoring data. And the boundaries reflect USEPA guidance. The remaining areas of Illinois should be classified as attainment/unclassifiable areas for the $PM_{2.5}$ standard.

Federal Guidance

The Illinois EPA relied on guidance identified in a memorandum[1] issued by USEPA that

[1] "Initial Area Designations for the 2024 Revised Primary Annual Fine Particle National Ambient Air Quality Standard", Office of Air and Radiation, February 7, 2024, available at: https://www.epa.gov/system/files/documents/2024-02/pm-naaqs-designations-memo_2.7.2024-_-jg-signed.pdf

provided 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." (pg. 5).

USEPA considers the CBSA or CSA as a "reasonable starting point" for this analysis; however, USEPA 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 Illinois EPA for attainment/nonattainment designation boundaries for all areas in the State of Illinois for the revised primary annual $PM_{2.5}$ standard.

FIVE FACTOR ANALYSIS

USEPA 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 $PM_{2.5}$ concentrations collected at each monitor. Only air quality monitoring data from monitors that are suitable for comparison to the annual $PM_{2.5}$ NAAQS have been considered. USEPA "intends to evaluate areas using the most recent complete three consecutive calendar years of quality-assured, certified air quality data" (2021-2023). However, as indicated in the guidance, certified air quality monitoring data from 2024 may be considered by USEPA before final recommendations are made. Given the proximity of this recommendation to the end of the year, Illinois EPA intends to review 2024 monitoring data when it becomes available and, if a change in our recommendation is warranted based on the 2022-2024 data, will request that USEPA take the 2022-2024 data into account at that time.

2. **Emissions and Emissions Related Data:** An evaluation of $PM_{2.5}$ emissions from sources of direct $PM_{2.5}$ and the major components of direct $PM_{2.5}$: organic carbon; elemental carbon; crustal material; nitrates and sulfates; and precursor gaseous pollutants known as sulfur dioxide (SO_2), oxides of nitrogen (NOx), 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 $PM_{2.5}$ emissions reported to USEPA by the Illinois EPA for the 2023 National Emissions Inventory (NEI). Because air quality is typically the result of a combination of both regional and local emissions, $PM_{2.5}$ 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. https://www.epa.gov/particle-pollution-designations/particle-pollution-designations-memorandum-and-data-2024-revised 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 $PM_{2.5}$ concentrations. Pollution roses are derived from Illinois EPA sites in the proposed NAAs using first-order National Weather Service (NWS) wind direction measurements paired with daily $PM_{2.5}$ concentrations. The pollution roses show the frequency of wind directions at the monitor when higher 24-hr concentrations of $PM_{2.5}$ are occurring. Detailed meteorology used in Illinois EPA's analysis is discussed in the sections below.

4. **Geography/Topography:** Includes an evaluation of the physical features of the land that might influence the airshed and, therefore, the distribution of $PM_{2.5}$ at and near the monitors. Since neither of the recommended $PM_{2.5}$ 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 USEPA's guidance documentation. Sub-county boundaries (townships) in this study reflect Political Township boundaries provided by Property Tax Division of the Illinois Department of Revenue

Illinois Air Quality

As recommended by USEPA, the first step in identifying areas that are in violation of the revised annual $PM_{2.5}$ NAAQS is to evaluate the most recent three years of ambient air monitoring data. Table 1 presents Illinois certified, quality assured $PM_{2.5}$ air monitoring data for 2021 through 2023, including annual design values, for the 32 monitors that are suitable for comparison to the annual NAAQS. Table 1 also includes 2 source orientated $PM_{2.5}$ site monitors, Granite City Medical Center and Village Hall (also referred to as Granite City Gateway and Lyons Township in Illinois EPA's approved 2024 and proposed 2025 Annual Network Plans, ANP's) for informational purposes for a total of 34 monitors. Granite City Medical Center is a middle scale site situated in an industrial area with multiple sources. Another $PM_{2.5}$ site not far away at 23rd and Madison in Granite City is sited for neighborhood scale to help satisfy area monitoring requirements. The Village Hall site is also a middle scale site that is adjacent to industrial areas and an active quarry. Neighborhood scale monitoring takes place at a nearby Summit monitoring site. No changes are anticipated for these source designations given the intended purpose of these sites. Although included in this report for informational purposes, these sites shall only be used for their design intent and not as part of the annual $PM_{2.5}$ attainment demonstration.

The annual $PM_{2.5}$ design value is defined as the three-year average of the annual mean concentrations collected at each monitor. The trend in annual $PM_{2.5}$ concentrations across Illinois has been generally downward since 1999, when the statewide $PM_{2.5}$ monitoring network was first established. Despite the significant improvement in air quality statewide, with the annual $PM_{2.5}$ NAAQS being lowered from 12 to 9 $\mu g/m^3$, 14 area and 1 source oriented monitoring sites in the Chicago area and 3 area and 1 source oriented in the Metro-East area currently violate the revised annual $PM_{2.5}$ NAAQS. These nineteen sites are all located in six counties: Cook, DuPage, Kane, Will, Madison, and St. Clair Counties (Figure 2). The remaining 15 monitoring sites are either attaining the revised annual $PM_{2.5}$ NAAQS or are unclassifiable. Prior to the revision, all 34 sites throughout the state were either attaining or unclassifiable.

Due to the location of the nineteen violating monitors and the natural north-south geographical division between the fifteen sites in Chicago and the four other sites in Metro-East St. Louis, two separate Five Factor Analyses were conducted by the Illinois EPA. 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).

Table 1 2021-2023 Illinois $PM_{2.5}$ Design Values ($\mu g/m^3$)

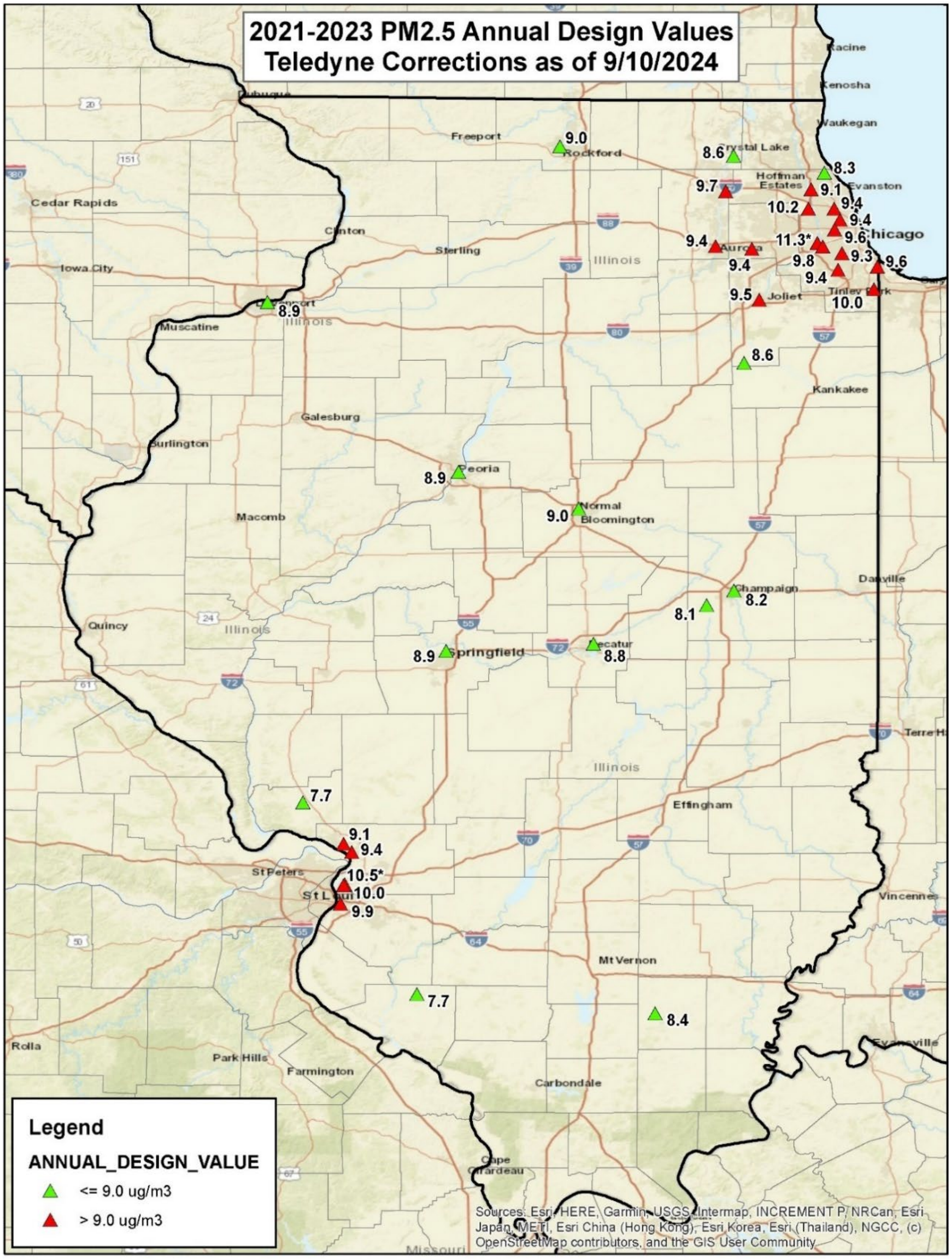
AQS Code	County	Site	Annual Averages 2021	Annual Averages 2022	Annual Averages 2023	Design Value
170190006	Champaign	Champaign	8.5	7.4	8.6	8.2
170191001*	Champaign	Bondville	8.2	7.4	8.7	8.1
170310001	Cook	Village Garage	9.1	8.6	10.6	9.4
170310022	Cook	Chicago-Washington	9.4	9.0	10.3	9.6
170310052	Cook	Chicago-Mayfair	9.5	8.6	10.0	9.4
170310057*	Cook	Chicago-Springfield	9.1	8.7	10.5	9.4
170310076*	Cook	Chicago-ComEd Lawndale	8.7	8.8	10.4	9.3
170310119	Cook	Kingery Exp. & Torrence	10.1	8.6	11.2	10.0
170311016‡	Cook	Village Hall	11.9	11.3	10.8	11.3
170313103	Cook	IEPA Trailer	10.5	9.6	10.4	10.2
170313301	Cook	Summit	9.8	9.2	10.4	9.8
170314007	Cook	Des Plaines	9.7	7.5	10.2	9.1
170314201*	Cook	Northbrook	8.1	7.0	9.8	8.3
170316005	Cook	Cicero	8.7	9.1	11.1	9.6
170434002	DuPage	Naperville	9.5	8.0	10.7	9.4
170650002	Hamilton	Knight Prairie	9.3	7.3	8.6	8.4
170830117	Jersey	Jerseyville Water Treatment Plant	7.9	6.9	8.3	7.7
170890003	Kane	Elgin	9.0	9.7	10.2	9.7
170890007	Kane	Aurora	9.6	9.1	9.4	9.4
171110001	McHenry	Cary	8.6	7.8	9.5	8.6
171132003	McLean	Normal	8.9	7.9	10.2	9.0
171150013	Macon	Decatur	9.6	7.3	9.7	8.8
171190024*‡	Madison	Gateway Medical Center	10.2	10.3	11.0	10.5
171190120	Madison	Alton Horace Mann Elementary School	9.3	8.9	9.2	9.1
171191007	Madison	Granite City-Fire station	10.0	9.9	10.2	10.0
171193007	Madison	Wood River	9.7	9.6	9.0	9.4
171430037†	Peoria	Peoria	9.6	8.3	8.6	8.9
171570001	Randolph	Houston	8.1	6.9	8.0	7.7
171613002	Rock Island	Rock Island	8.8	7.6	10.1	8.9
171630010	St. Clair	East St. Louis	10.0	9.0	10.6	9.9
171670012	Sangamon	Springfield	8.7	8.4	9.6	8.9
171971002	Will	Joliet	9.7	7.9	10.8	**9.5**
171971011	Will	Braidwood	8.6	7.5	9.7	8.6
172010118	Winnebago	Rockford Fire Department	9.4	7.1	10.5	9.0

*Site with speciated data from which Figures 8, 9, 22, and 23 were developed.

†Annual Averages based on less than four complete quarters of data.

‡Source oriented $PM_{2.5}$ monitors designed to capture the 24 hour, not neighborhood scale monitors used to help satisfy area monitoring requirements for the annual standard.

Figure 1 **2021-2023 $PM_{2.5}$ Annual Design Values Teledyne Corrections as of 9/10/2024**

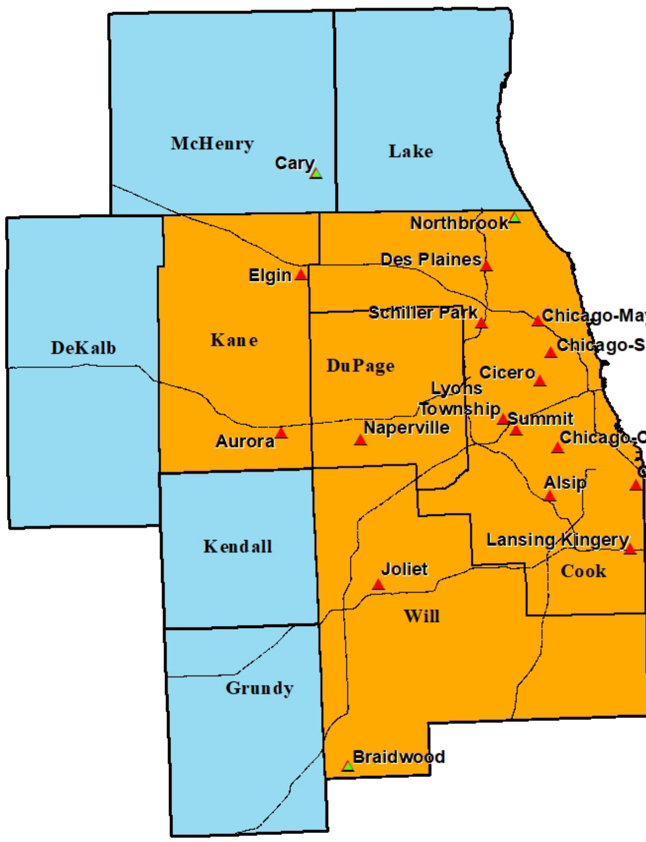


Illinois Five Factor Analysis for Chicago Metropolitan Study Area

The USEPA recommends that states consider the following five factors in assessing area-specific analyses to support the designation of nonattainment area boundaries. As previously noted, Illinois has six counties with monitored violations of the revised annual $PM_{2.5}$ NAAQS. Fifteen of these monitors are located in the Chicago Metropolitan Study Area (Chicago Study Area). Figure 2 shows the counties and ambient air monitoring sites included in the Chicago Study Area.

Figure 2 Chicago Metropolitan Study Area

Factor 1 – Air Quality Data



Spatial Analysis

The annual $PM_{2.5}$ design values for the Chicago Study Area are shown below in Figure 3. As can be seen from this map, Figure 3 (annual design values), and Figure 10 (urban areas within the Chicago core based statistical area) there are concentration gradients running along most major interstates as they approach cook county urban areas, reaching a peak within Cook County generally in proximity to other major traffic arteries or areas of high traffic and urban concentrations. Conversely, this pattern reverses and concentrations drop off quickly, even along the major traffic arteries, as distance is increased from Cook County and major population areas. Design values in the outlying counties range from 8.6 to 9.7 µg/m^3, then gradually increase to a peak value of 11.3 µg/m^3 at the Village Hall monitor. There are three distinct areas of peak concentration values, all coinciding with major interstates within urban population areas. The first area is in north-western Cook County centered on the Illinois EPA Trailer site in Schiller Park, with a design value 10.2 µg/m^3. The second area, which also has the highest design value, is in west central Cook County at the Village Hall site, where the States design values peak at 11.3 µg/m^3. The third area is at the Kingery Expressway & Torrence site, with a design value of 10.0 µg/m^3.

Figure 3 Chicago Metropolitan Study Area 2021-2023 $PM_{2.5}$ Design Values

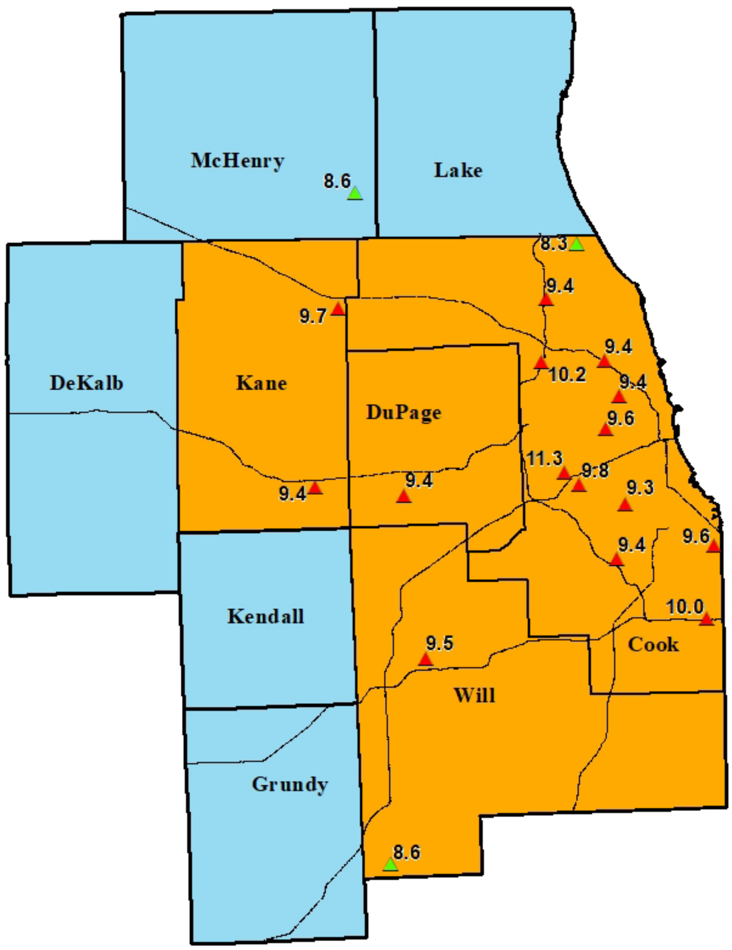
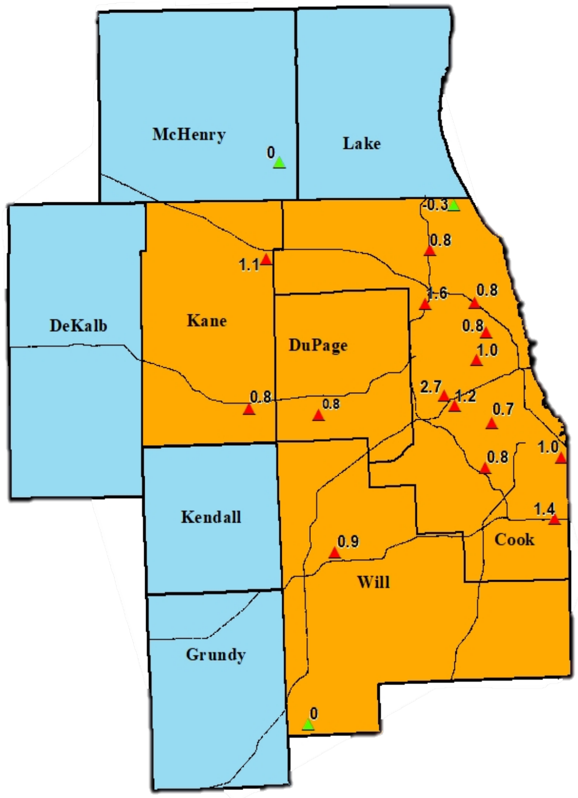


Figure 4 shows the urban excess values at the $PM_{2.5}$ monitoring sites across the Chicago Study Area. These values were calculated by taking the 2021-2023 design values for all the Chicago area monitoring sites and subtracting out the 8.6 µg/m^3 of $PM_{2.5}$ recorded at the rural background site in Braidwood, IL. Local emission sources within Cook County appear to generate a large amount of the urban excess measured, focused along an arc generally following interstate 294, starting at Schiller Park, running down to Lyons Township and Summit, continuing and ending in Lansing at the Kingery site. The outlying portions of the metropolitan area also generate significant amounts of $PM_{2.5}$ which appear to also be concentrated along the major traffic arteries and urban population centers, decreasing at a moderate rate as distance from Cook County increases and decreasing rapidly as major population areas decrease (see also Figure 10 depicting urban areas within the Chicago core based statistical area). The urban excess values at all the monitoring sites outside of Cook County account for an average of 22.2% (0.6 $\mu g/m^3$) of the urban excess at the Village Hall site. This value increases to 30.9% (0.83 $\mu g/m^3$) 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 Village Hall site is not solely due to local emission sources. It appears that there is a significant urban-scale component as well, again, concentrated along the major traffic arteries within the major urban population centers.

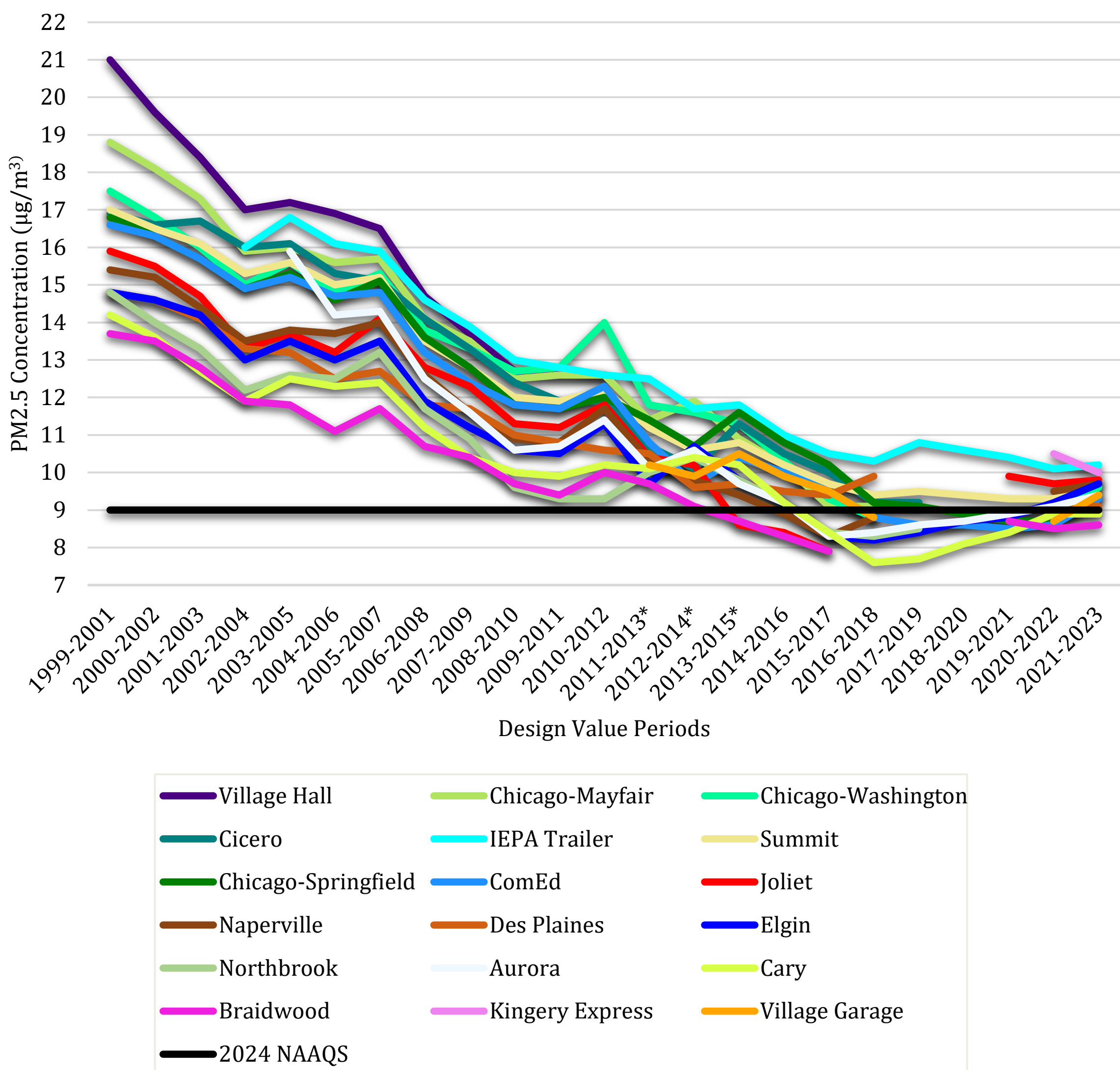
Figure 4 Chicago Metropolitan Study Area 2021-2023 $PM_{2.5}$ Urban Excess



Temporal Analysis

Figure 5 presents the annual $PM_{2.5}$ design value trends for the Chicago Study Area at eighteen long-term monitoring sites. The graph shows that annual design values across the Chicagoland area have dropped significantly between the periods of 1999-2018 and leveling out from 2018-2023. Most of this improvement has been due to the large reduction in regional background levels and the reduction of coal consumption at point sources in and around the CSA. Design values at the Braidwood background site have dropped from 13.7 $\mu g/m^3$ to 8.6 $\mu g/m^3$. The amount of locally generated urban $PM_{2.5}$ has decreased as well, with the maximum urban excess value dropping from 4.4 μg/m³ to 2.7 μg/m³ during the same period. Despite significant regional and local improvements in air quality, the strengthening of the $PM_{2.5}$ NAAQS has resulted in all but one monitor within Cook County, and four monitors in the immediately surrounding counties, to be violating the revised annual NAAQS. It should be noted that a significant number of these sites have design values of 9.4 μg/m³ or less, and that those monitors, along with some monitors with design values as high as 9.7 μg/m³ may be in attainment of the NAAQS if some exceptional events were excluded from design value calculations. However, even if these exceptional events were considered, it would not change the status of approximately seven of the monitors which would still exceed the revised annual NAAQS (see Figure 7). Hence, Illinois EPA has not pursued an Exceptional Events Demonstration for the area as such a demonstration would not be regulatorily significant.

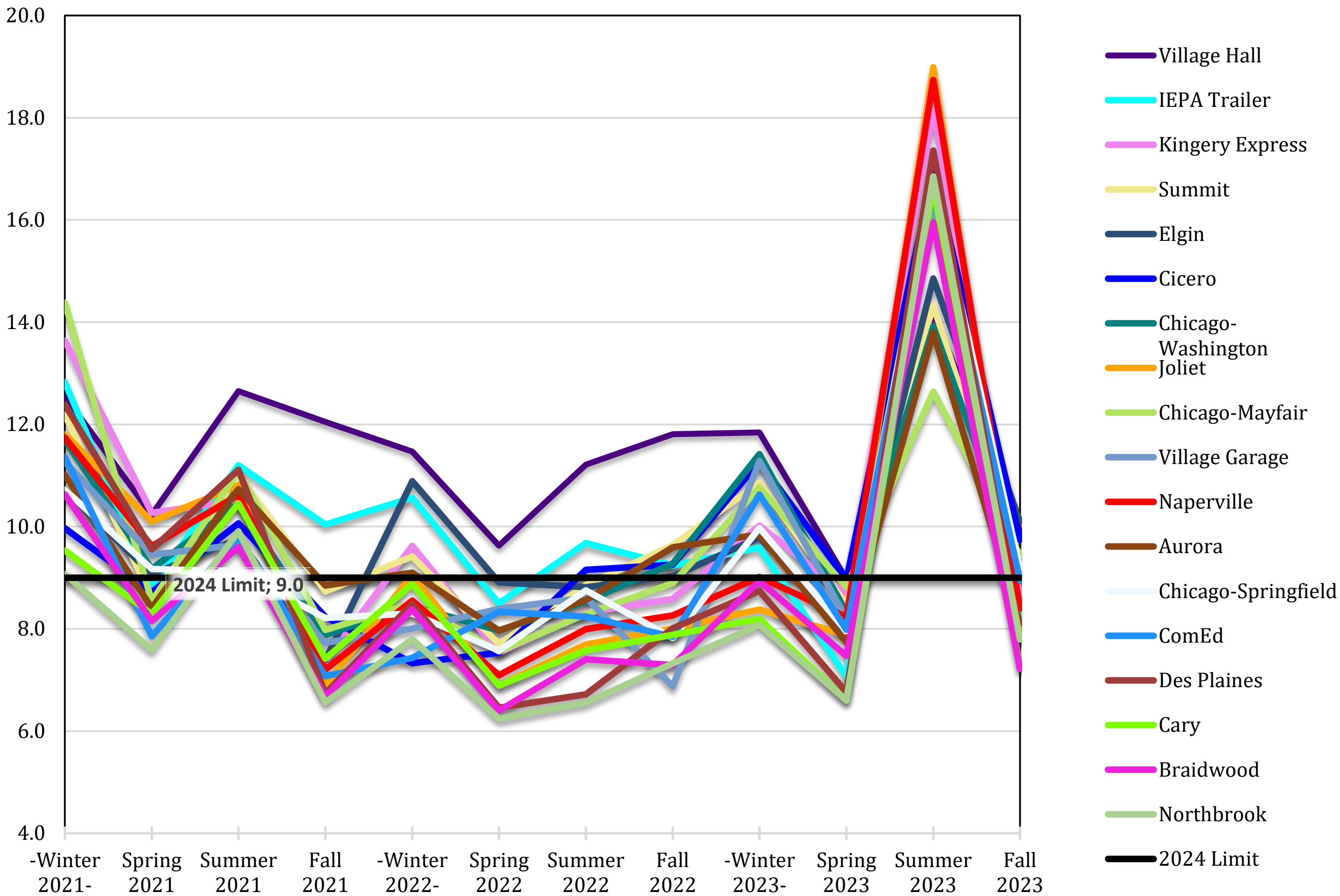
Figure 5 Chicago Area Annual PM2.5 Design Value Trends (1999-2023)



*Data was decertified by USEPA

Figure 6 presents the time series trend in seasonal $PM_{2.5}$ averages for all monitors located in the Chicago Study Area between the winter of 2021 and the fall of 2023. These values were computed from individual daily 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 6 and 7, the $PM_{2.5}$ 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 6 Chicago Area PM2.5 Seasonal Average Time Series for 2021-2023

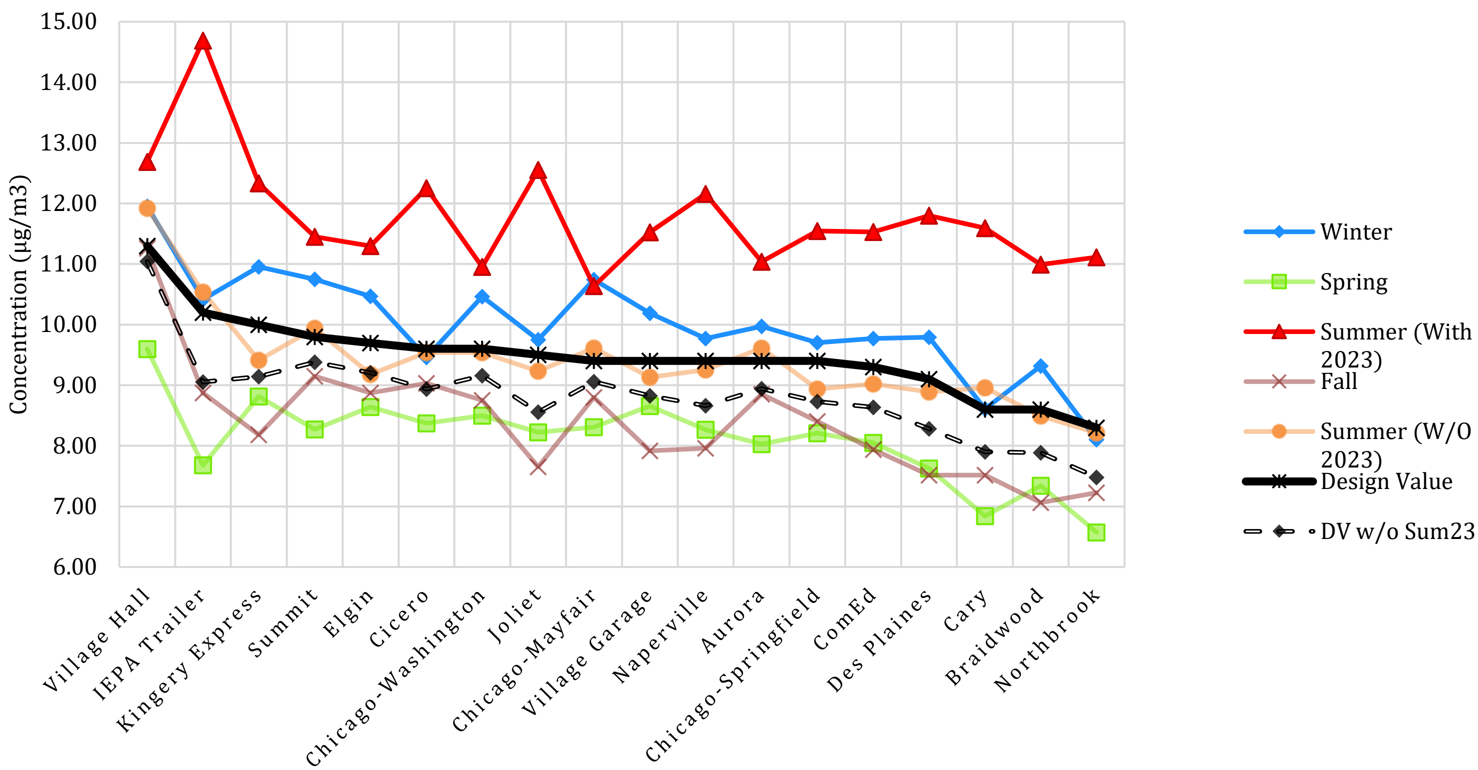


*Note: Because the numbers in Figure 6 include seasonal data which include December of 2020, the values, and subsequent order (highest to lowest) of the monitors design values may vary from those in Table 1. However, this does not affect the overall emissions patterns or analyses.

Figure 6 shows that many sites across the Chicago Study Area have recorded seasonal averages in excess of the level of the revised annual $PM_{2.5}$ NAAQS. Generally during the winter season, about half of the monitors in the Chicago Study Area had a seasonal average above 9.0 $\mu g/m^3$. 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 concentration averages across all sites had been trending downward, leveling out around 2022, showing a slight increase in winter of 2023 and then a significant spike caused by the summer 2023 Canadian wildfires, followed by concentrations decreasing back to pre-2023 values in the fall of that same year. The distance from the Village Hall monitor to the center of the main fires on June 27, 2023, is approximately 910 miles. Taking into account distance, magnitude, timing, long-term averaging, and the downwind direction of the monitoring site, demonstrates that regional pollution and transported pollutant can cause significant contribution to the nonattainment areas annual design values despite the time limited event. As the seasonal averages have decreased since 2010, (see also Figure 5 above), the Washington High School Site has transitioned from being the dominant site in the Chicago Study Area to being the 6th highest design values.

Figure 7 presents the overall meteorological seasonal averages for the years of 2021, 2022, and 2023 for each monitoring site located in the Chicago Study Area. The monitoring sites are sorted from left to right in descending design value order. Since 2010, the winter season has consistently demonstrated the highest seasonal $PM_{2.5}$ averages for the Chicago Study Area, with the exception of the 2023 summer season that included the Canadian wildfires. This one-time, nonrepeatable event, substantially affected the entire seasonal analysis, potentially invalidating it as a tool. To account for the wildfire, two lines of data were added to Figure 7 that show the summer seasonal and design values which have had the data for summer of 2023 removed. This was accomplished by only using the average of the 2021-2022 summer seasons in their summer data sets. This gives us a clearer picture as to the relevant magnitude and extent of the nonattainment area and the subsequent reductions needed to achieve attainment not considering exceptional events that may happen moving forward. Once adjusting for the exceptional event influence of the Canadian wildfires of 2023, the graph shows, once again, how winter-dominant the entire Chicago Study Area is compared to the other three meteorological seasons. Only four sites (Village Hall, Illinois EPA Trailer, Cicero, and Cary) have summer averages that are near to matching their winter values. With the exception of two sites, Cary and Northbrook, every monitor, including the Braidwood background site, have winter seasonal averages for the 2021-2023 period that are greater than 9.0 $\mu g/m^3$. 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, adjusting for the 2023 wildfires, and the exceptions noted above, are lower than the winter values. Spring and fall seasonal averages across the Study Area are generally well below 9.0 $\mu g/m^3$; the exceptions being, Village Hall, and Illinois EPA Trailer, Summit, and Cicero monitors which exceed in fall. The Village Hall site has the highest seasonal averages for winter, summer, spring, and fall, 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 impacted by both urban-scale and regional transport from the west-southwest, especially in the winter. Additionally, with the wildfire events excluded, only seven, instead of 15 monitors, would violate the 2024 revised $PM_{2.5}$ NAAQS.

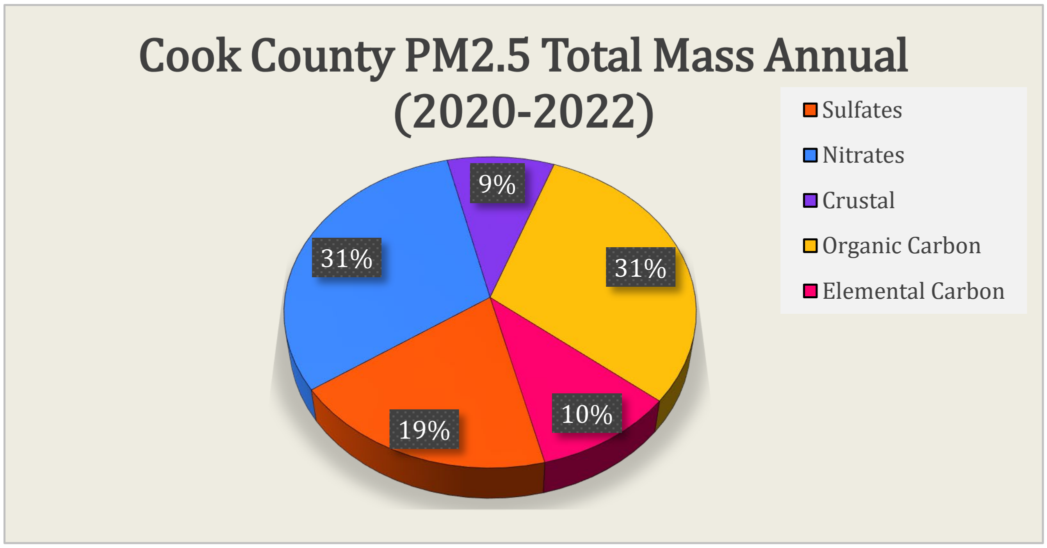
Figure 7 2021-2023 Chicago Area PM2.5 Seasonal Averages by Site



Chemical Speciation Analysis

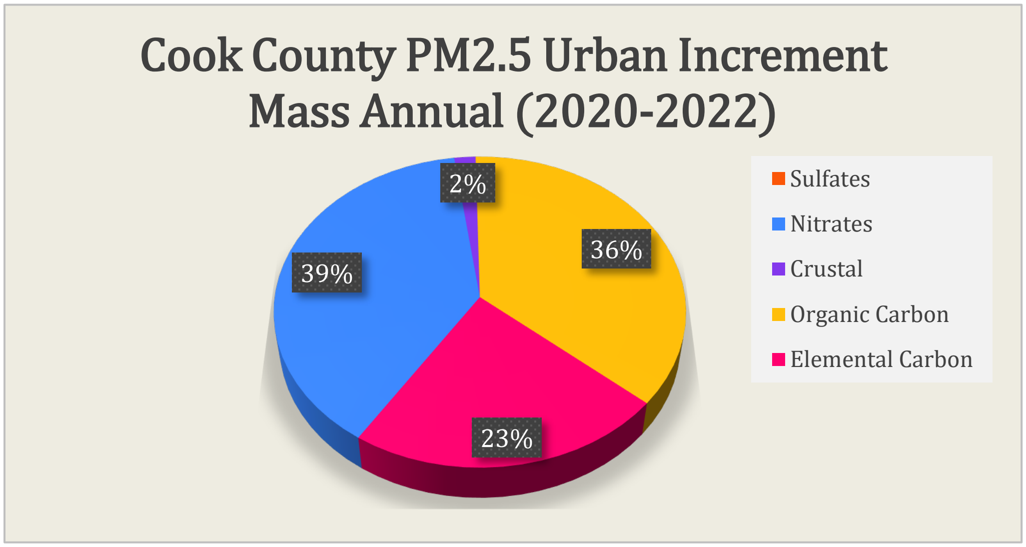
There are no $PM_{2.5}$ chemical speciation data available at the Village Hall, Illinois EPA Trailer, Kingery Expressway & Torrence, or Summit sites. The closest sites with chemical speciation are the Com Ed, Chicago-Springfield, and Northbrook monitors, which are located North, East, and South of the sites with the highest annual $PM_{2.5}$ readings. The Com Ed and Chicago-Springfield sites are 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 source emissions.

Figure 8 Cook County $PM_{2.5}$ Total Mass Annual (2020-2022)



Figures 8 and 9 present the 2020-2022 Annual Total Mass and Urban Increment Mass $PM_{2.5}$ chemical speciation data for the Com Ed, Chicago-Springfield, and Northbrook monitors combined. The 2020–2022 timeframe was used because it was the most recent three-year period for which speciated data was available at the time of analysis. The patterns shown in both 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 8. 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 Nitrates dominate the Urban Increment Mass in Figure 9. The increase in the percent represented by Elemental Carbon is the most significant, and although Elemental Carbon, Organic Carbon, and Nitrates make up 98% of the total Urban Increment Mass. As can be seen in Table 2 below, from 2011 through 2020, total NOx emissions have decreased by 54.3% and SO_2 emissions have nearly disappeared from the speciated data, dropping 92.5%. These three speciation components, Elemental Carbon, Organic Carbon, and Nitrates, 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, and Crustal Materials are all much smaller components, and when taken together, represent only 2% 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. The sulfate makeup has decreased significantly, by over 92% in the past ten years, likely due to the decrease in emissions from and shutdowns of coal fired units in that same period. These coal-fired stationary sources also contribute to the Nitrate levels as well, as do the on-road and non-road mobile sources. Although the urban increment for Nitrates, as a percentage, has not decreased, its actual emissions have decreased by 54.3%, an actual decrease of 115,452 Tons annually. This is likely tied to the decrease in the sulfate makeup and is also due to the decrease in emissions from coal fired units. Lastly, the Crustal Materials are most likely associated with more localized emission sources, such as exposed soils, unpaved roadways, storage piles, quarries, and metallurgical-related facilities.

Figure 9 **Cook County PM2.5 Urban Increment Mass Annual (2020-2022)**



Air Quality Factor Analysis Summary

Fourteen area and one source-oriented monitors currently violate the revised annual $PM_{2.5}$ NAAQS in the Chicago Study Area. While these sites 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 76% of the $PM_{2.5}$ mass measured at the Village Hall site is advecting into the study area as regional transport. However, the distribution of the urban excess across the Chicago Study Area shows that additional $PM_{2.5}$ is being generated within the urban area itself. The chemical speciation data shows that a very large portion of the Urban Increment Mass is tied to urban-scale Organic Carbon, Elemental Carbon, and Nitrate emission sources. Lastly a dominate winter season is clearly evident in the 2021-2023 seasonal time series and the 2021-2023 monitoring site seasonal averages.

FACTOR 2 - EMISSIONS AND EMISSIONS - RELATED DATA

According to USEPA guidance, source locations, as well as the level of emission of $PM_{2.5}$ related pollutants, must also be considered when determining NAA boundaries. $PM_{2.5}$ is formed through complex atmospheric processes. $PM_{2.5}$ 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 $PM_{2.5}$. The majority of airborne $PM_{2.5}$ is formed due to precursor emissions. Table 2 shows the ranked $PM_{2.5}$ and precursor emissions for all the counties in the Chicago Study Area, based on the 2020 National Emissions Inventory (NEI). An evaluation of emissions data shows Cook, Will, DuPage, and Lake Counties as having the greatest level of emissions. Combined they contribute approximately 77.6% of the total emissions in the study area. Kane, McHenry, and DeKalb Counties contribute approximately 16.8% of the total emissions to the study area and Grundy and Kendall Counties are ranked the lowest with 5.7% of the total emissions.

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

Illinois Counties	Year	PM2.5	NOx	NH3	SO2	VOC	Total TPY	Percent of Total	Rank
Cook	2020	10,526.46	49,356.49	3,124.10	2,533.41	71,323.73	136,865.19	46.1%	1
Will	2020	3,300.23	11,426.30	1,346.79	1,183.62	17,886.82	35,143.76	11.8%	2
DuPage	2020	2,692.61	11,095.12	669.40	83.72	17,278.29	31,819.14	10.7%	3
Lake	2020	2,187.75	8,354.58	862.50	687.50	14,849.35	26,941.68	9.0%	4
Kane	2020	2,106.95	5,869.98	1,123.89	56.71	12,101.44	22,258.97	7.5%	5
McHenry	2020	1,944.77	3,837.56	934.53	42.14	8,913.28	15,672.28	5.2%	6
DeKalb	2020	1,563.45	2,534.64	3,145.19	42.55	5,011.16	12,296.54	4.1%	7
Grundy	2020	737.64	2,842.95	625.76	47.73	4,986.13	9,240.21	3.1%	8
Kendall	2020	990.96	1,874.61	717.50	30.76	4,077.03	7,690.86	2.6%	9
Total: Chicago Study Area	2020	26,050.81	97,192.24	12,549.63	4709.15	156,427.23	296,929.06	100%	

Illinois EPA emissions data for $PM_{2.5}$ and its precursors from the 2020 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 (nonpoint) 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.

USEPA recommends that proposed nonattainment designations for the $PM_{2.5}$ 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, NOx, VOC, NH_3, and direct $PM_{2.5}$. Metropolitan areas where violations are occurring were evaluated separately based on ranked county level 2020 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 Cook, Will, and Lake Counties, with the greatest emissions coming from point sources. Cook and Will Counties contribute about 79% of the total SO_2 emissions in the area.
- NOx emissions are highest in Cook County with the greatest emissions from non-point(area) sources. Cook County contributes to about 51% of total NOx emissions in the Chicago Study Area. NOx emissions in Will, DuPage, and Lake Counties are also relatively high accounting for about 32% of the total NOx emissions.
- VOC emissions are highest in Cook County, with the greatest emissions coming from Nonpoint (Area) sources. VOC emissions from Cook County make up approximately 46% of the total VOC emissions in the area. Will and DuPage Counties also have relatively high VOC emissions at 22%.
- NH_3 emissions are highest in DeKalb County, where Nonpoint (Area) source contributions are greatest. Cook 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 77% of total NH_3 in the Chicago Study Area.
- Direct $PM_{2.5}$ emissions are highest in Cook and Will Counties with Nonpoint (Area) sources as the greatest contributor. $PM_{2.5}$ emissions in both Cook and Will Counties contribute about 53% of total direct $PM_{2.5}$ emissions in the Chicago Study Area. $PM_{2.5}$ emissions are relatively high in DuPage Lake, and Kane Counties. When combining emissions from DuPage, Lake, and Kane Counties, the emissions account for approximately 26.8% of total direct $PM_{2.5}$ emissions in the area.

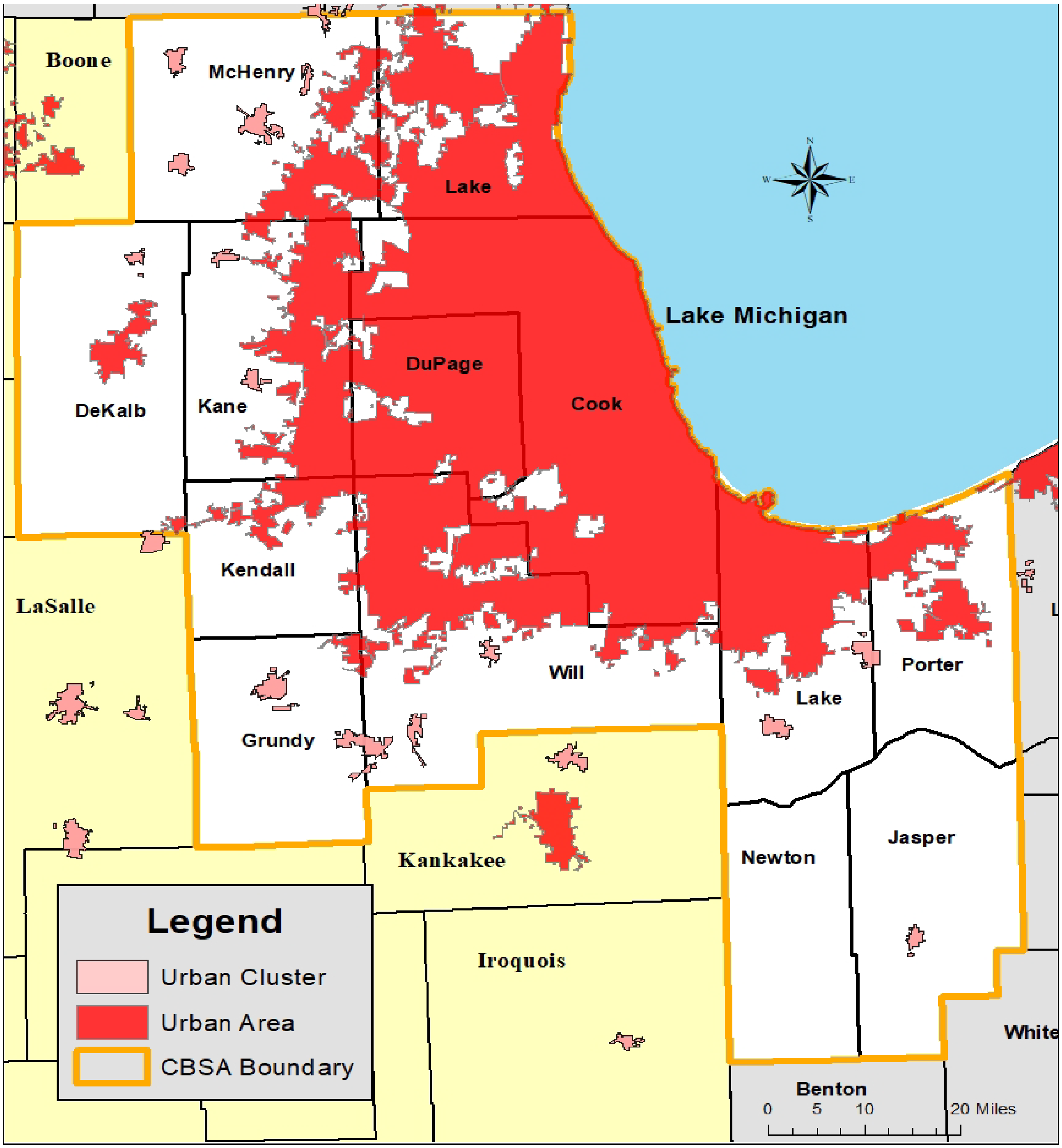
Figures A6 through A10 in Appendix A depict both the locations and facility-reported 2023 emissions for the major point sources (reported emissions over 100 tons per year) in the Chicago Study Area for SO_2, NOx, VOC, NH_3, and primary $PM_{2.5}$. USEPA has stated that they intend to initially designate all $PM_{2.5}$ NAA's as moderate, which places the major source threshold at 100tpy. If an area were reclassified as serious nonattainment, then the major source threshold would be 70tpy for $PM_{2.5}$. Due to the low number of 100tpy major sources in the study area and to include potentially affected sources in the future, sources with emissions of 70tpy or more have been included in the figures in Appendix A and B. Additionally, for some pollutants in some areas the largest emitters were included even if their annual emissions were significantly under the moderate or serious major source threshold limits in order to give a better and more consistent graphical demonstration of type, amount, and source of emissions in an area. As such, sources are shown on these figures as of 2023; 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 $PM_{2.5}$ 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 Cook County. Cook County also has the largest number of SO_2-emitting point sources. The largest point sources for NOx are located in Will County. Cook, Grundy, DuPage and Lake Counties also contain major point sources contributing NOx emissions. Both the largest size and greatest number of VOC point sources occur in Cook, Will, and part of Grundy County, followed by Kane and DuPage Counties. Based on Illinois EPA's 2023 reported emissions inventory, there are no point sources emitting NH_3 in excess of 20 tons annually in Cook County. Of the largest NH_3 emitters in the Chicagoland area, only three sources located in the Will-Kendall-Grundy County corridor area are reporting greater than 20 tons/year. Based on Illinois EPA's 2023 reported emissions inventory, the largest and greatest number of emitting point sources of direct $PM_{2.5}$ are located in Cook and Will Counties.

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 10 illustrates the extent of urbanized area within the Chicago-Naperville-Elgin, IL-IN-WI Core Based Statistical Area, 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 parts of Kendall and Grundy counties, and to a lesser extent DeKalb due to its distance and no obvious urban area connecting commuting pattern into the urban center, which supports considering 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 2023 for each of the counties contained in the Chicago CBSA.

Figure 10 Urban Areas within Chicago-Naperville-Elgin IL-IN-WI Core Based Statistical Area



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 90.8% 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	2020 Population	Land Area (Sq. Miles)	Population Density (Persons per sq. mile)	Percent of CBSA	Cumulative Percent
IL	Cook	5,275,541	946	5577	54.8%	54.8%
IL	DuPage	932,877	334	2793	9.7%	64.5%
IL	Lake	714,342	448	1595	7.4%	72.0%
IL	Will	696,355	837	832	7.2%	79.2%
IL	Kane	516,522	520	993	5.4%	84.6%
IN	Lake	498,700	497	1003	5.2%	89.8%
IL	McHenry	310,229	604	514	3.2%	93.0%
WI	Kenosha	169,151	273	620	1.8%	94.8%
IN	Porter	173,215	418	414	1.8%	96.6%
IL	Kendall	131,869	321	411	1.4%	97.9%
IL	DeKalb	100,420	634	158	1.0%	99.0%
IL	Grundy	52,533	420	125	0.5%	99.5%
IN	Jasper	32,918	560	59	0.3%	99.9%
IN	Newton	13,830	402	34	0.1%	100.0%

When evaluating the Chicago Study Area by itself (Illinois counties only), based on 2023 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 86.9% 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	2023 Population	Land Area (Sq. Miles)	Population Density (Persons per sq. mile)	Percent of Study Area	Cumulative Percent	Rank
Cook	5,087,072	946	5,377	59.6%	59.6%	1
DuPage	921,213	334	2,758	10.8%	70.4%	2
Lake	708,760	448	1,582	8.3%	78.7%	3
Will	700,728	837	837	8.2%	86.9%	4
Kane	514,982	520	990	6.0%	92.9%	5
McHenry	312,800	604	518	3.7%	96.6%	6
Kendall	139,976	321	436	1.6%	98.2%	7
DeKalb	100,288	634	158	1.2%	99.4%	8
Grundy	53,578	420	128	0.6%	100.0%	9

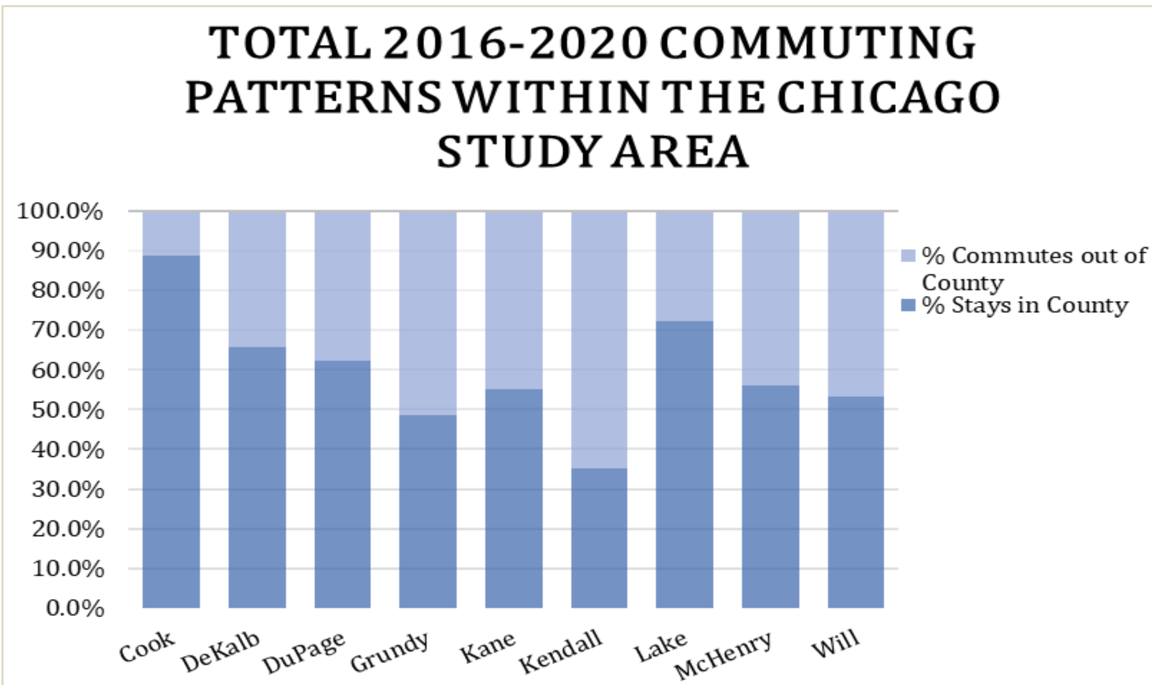
Population growth is an important indicator of potential emission increases in an area. Table 5 outlines percent change in population between 2005 and 2023 by county for the Chicago Study Area. This data was provided by the U.S. Census Bureau and is based on estimates dated March 26, 2006, and January 1, 2023, for the 2005-2012 and 2020-2023 time periods respectively. According to the data, Kendall County has experienced the greatest percent increase in population at 76%; however, its total population is among the smaller counties at 1.6% of the overall study area. Cook County has experienced an estimated 4.1% decrease in population; however, its total population for 2023 represents approximately 59.6% of the total population within the Chicago Study Area.

Table 5 2005-2023 Population Change by County for the Chicago Study Area

County	2005 Population	2023 Population	Change (%)
Kendall	79,514	139,976	76.04%
Grundy	43,838	53,578	22.22%
Will	642,813	700,728	9.01%
Kane	482,113	514,982	6.82%
McHenry	303,990	312,800	2.9%
DeKalb	97,665	100,288	2.69%
Lake	702,682	708,760	0.86%
DuPage	929,113	921,213	-0.85%
Cook	5,303,683	5,087,072	-4.08%

The U.S. Census Bureau has compiled statistics from 2016-2020 American Community Survey 2016-2020 5-Year ACS Commuting Flows[2] data that quantify commuting patterns both between counties and in and out of the state. Table 6 and Figure 11 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 64.9%. 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 53.4% of working people who reside in the county staying in the county for work while 46.6% commute.

Figure 11 Total 2016-2020 Commuting Patterns Within the Chicago Study Area



[2] https://www.census.gov/data/tables/2020/demo/metro-micro/commuting-flows-2020.html

Table 6 Commuting Patterns within the Chicago Study Area

RESIDENCE COUNTY	% Staying in own County	% Commuting
Cook	88.8%	11.2%
Dekalb	65.7%	34.3%
DuPage	62.4%	37.6%
Grundy all Townships	48.7%	51.3%
Kane	55.0%	45.0%
Kendall all Twps	35.1%	64.9%
Lake	72.1%	27.9%
McHenry	56.1%	43.9%
Will	53.4%	46.6%

Traffic and Commuting Patterns

The Illinois Department of Transportation's (IDOT) Office of Planning and Programming publishes an annual report entitled "Illinois Travel Statistics."[3] This report provides detailed information regarding vehicular traffic for each county. 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 2023, as calculated by IDOT's Highway Information System for the Chicago Study Area.

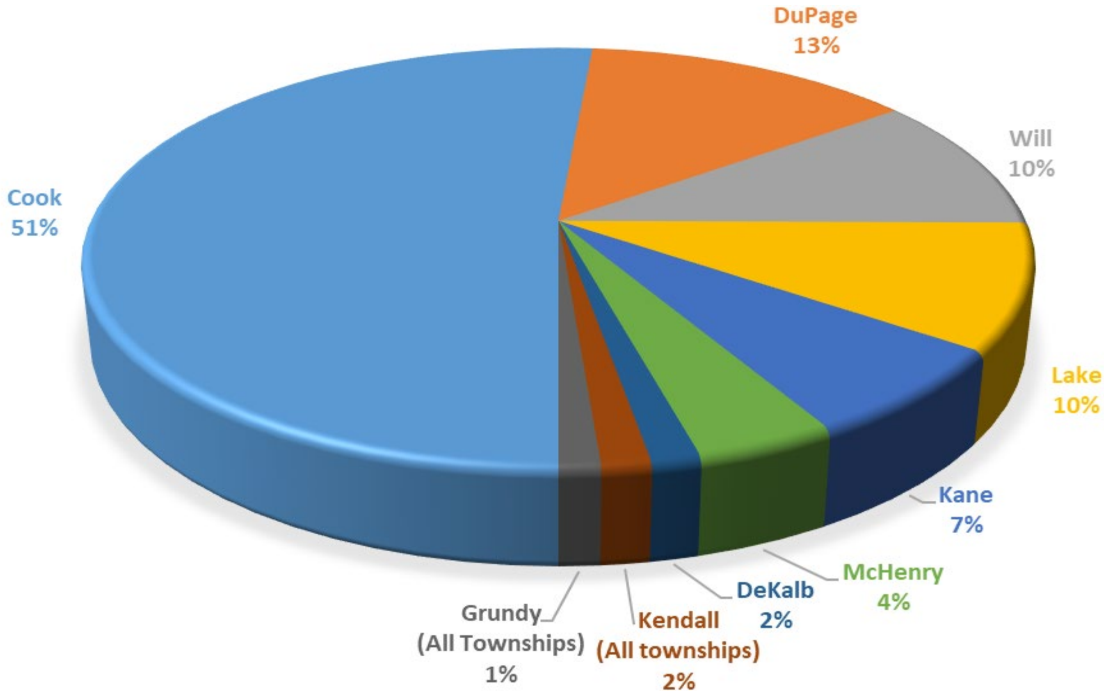
Table 7 2023 IDOT Travel Statistics for the Chicago Study Area

Chicago Study Area Counties	Annual Vehicle Miles Traveled (AVMT)
Cook	30,281,081,462
DuPage	7,883,353,359
Will	6,122,902,386
Lake	5,713,079,357
Subtotal	*50,000,416,564*
Kane	4,107,057,672
McHenry	2,421,598,585
DeKalb	851,058,046
Kendall Oswego Township	852,521,130 293,476,768
Grundy Aux Sable Township Goose Lake Township	714,383,176 164,918,070 15,859,122
TOTAL	*58,947,035,173*

In the Chicago area, Cook, DuPage, Will, and Lake Counties have the highest AVMT, accounting for approximately 84% of the total AVMT for the Illinois portion of the Chicago Study Area (see Figure 12).

[3] https://idot.illinois.gov/content/dam/soi/en/web/idot/documents/transportation-system/reports/opp/travel-stats/2023/02%20-%202023_ITS_Original_Website.pdf

Figure 12 Percent by County – 2023 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, Illinois EPA has only chosen National Weather Service (NWS) operated sites for wind direction characterization. Illinois EPA chose AERMOD-ready surface meteorological data to extract wind speed and direction since the AERMOD-ready files have been processed with AERMINUTE. AERMINUTE is 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 22.5-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 22.5-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 Village Hall monitor and is most central to the three monitors with the highest readings in the Chicagoland area. Figure 13a shows a wind rose for Chicago Midway airport for all days in 2021-2023. 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 13a Wind Rose for Chicago Midway Airport, 2021-2023

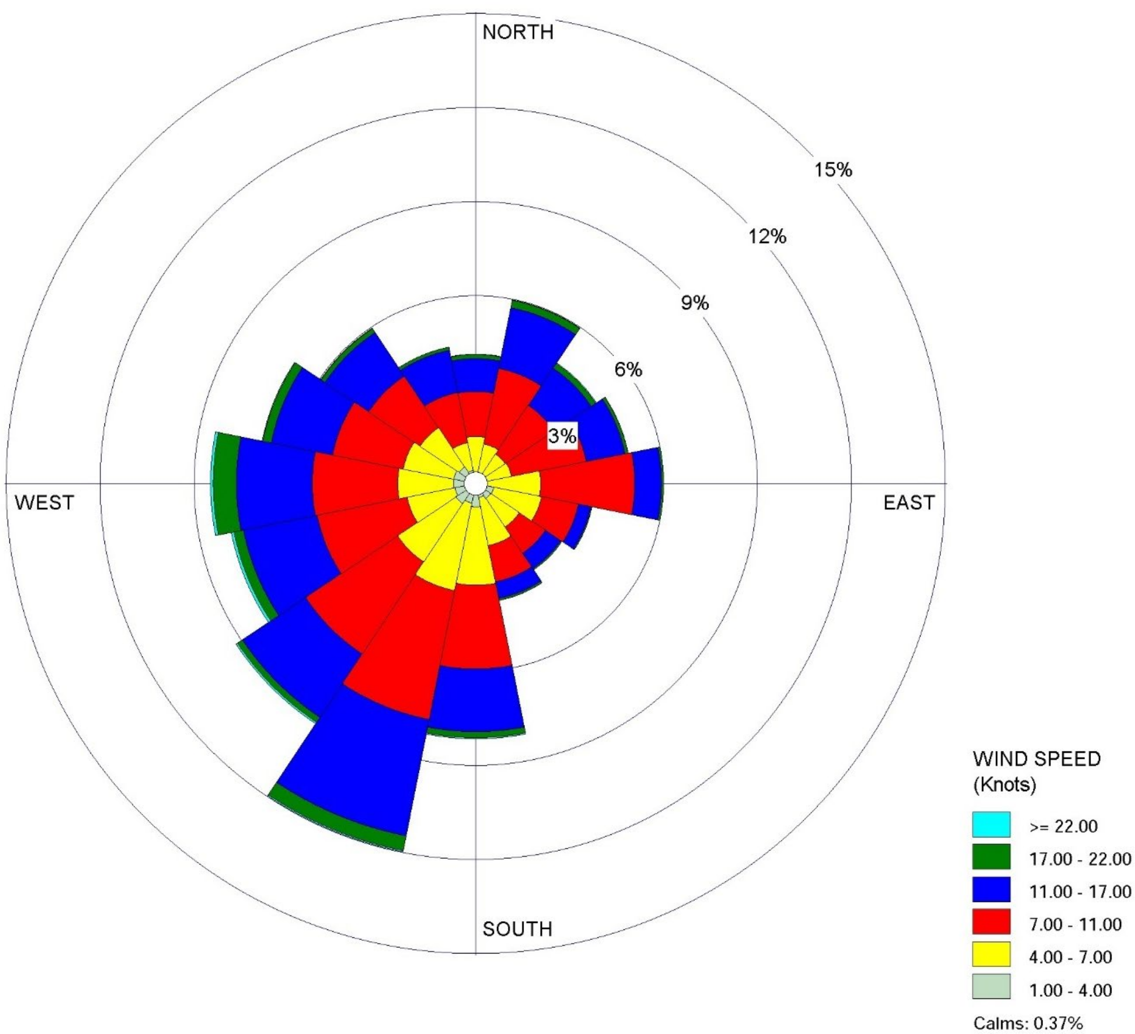
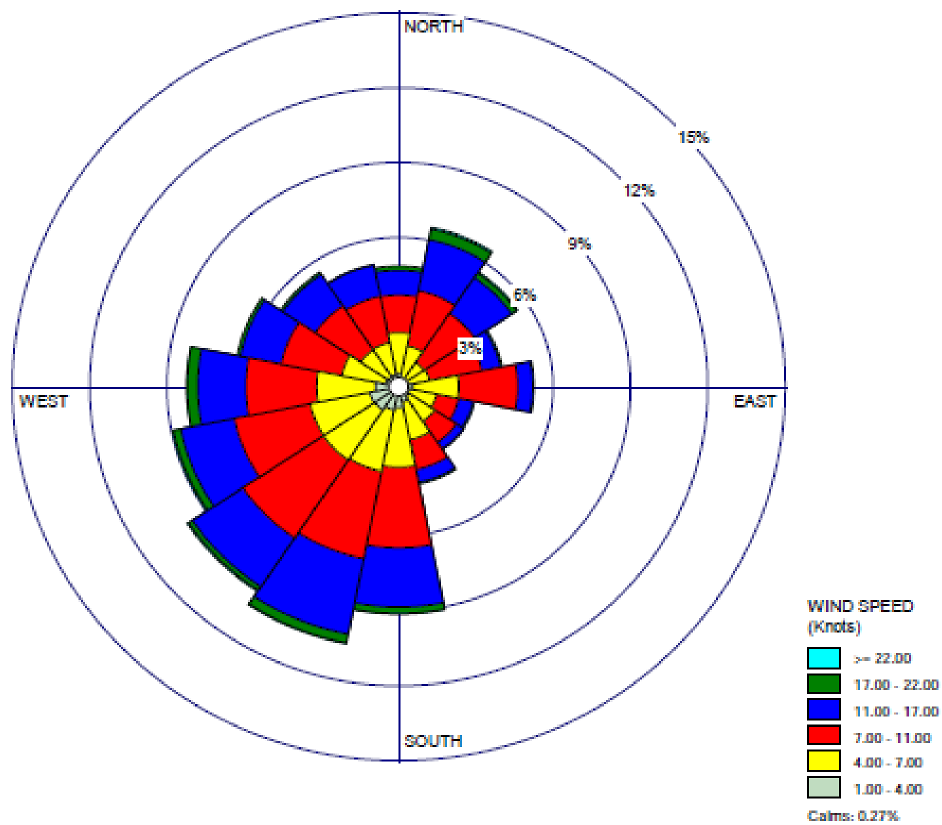


Figure 13b **Chicago O'Hare Windrose 2021-2023**

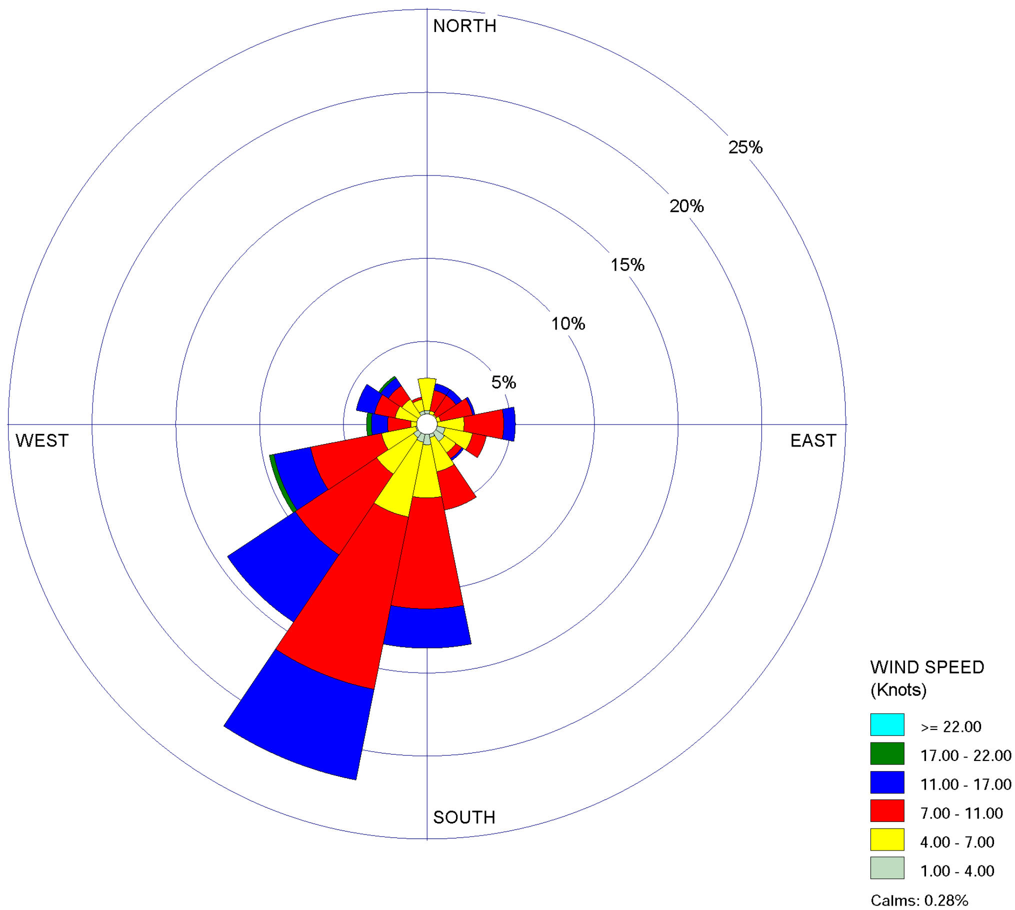


Chicago O'Hare, Figure 13b, was also looked at and found to be similar to the Midway data. However, since the winds are predominately out of the South-west heading toward Chicago in the direction of Cook County, Midway, and the monitors with the highest readings, Midway was selected as a more representative data point.

Figure 14 is a representation of hourly wind directions from Chicago Midway that occurred on days in the 2021-23 period when the monitored values at Village Hall were at least 20.0 $\mu g/m^3$. This type of a wind rose is called a pollution rose. The threshold of 20.0 $\mu g/m^3$ was chosen to ensure a large enough sample size to be robust (30 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 14 shows that the most frequent wind directions during high PM days are generally southwesterly, which is in correlation with its proximity to the McCook quarry and the monitors sited purpose. However, there is 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, see Figure 15. 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 overwhelming majority of those occurring less than 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. Although high daily concentrations of $PM_{2.5}$ can occur with winds blowing across a number of different portions of the recommended nonattainment area the distribution of wind directions on the high days are almost exclusively from the South and Southwest, pointing directly at the McCook quarry as the most likely source of $PM_{2.5}$ emissions. Further supporting the Village Hall Monitors design purpose and designation as a source orientated $PM_{2.5}$ site monitor.

Figure 14 Pollution Rose for Village Hall Monitor High Days, 2021-2023

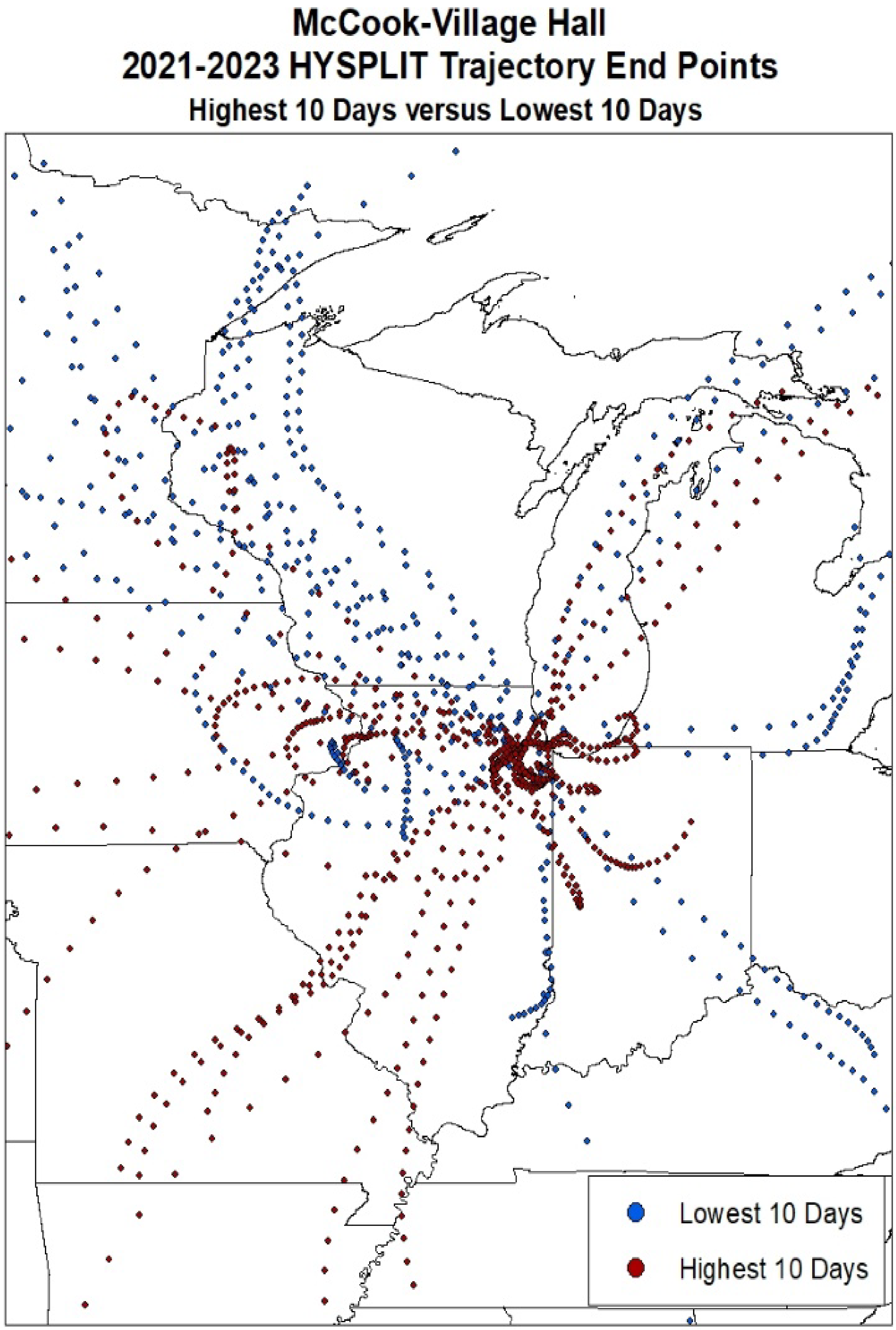


Another tool in assessing the transport routes and source regions of air masses that are over a monitor on days of interest is the HYSPLIT trajectory model. The HYSPLIT model uses gridded meteorological data from a prognostic model to produce a trajectory, or path, that the air mass over a location at 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 15 are from HYSPLIT runs. Illinois EPA ran HYSPLIT for days where monitoring was done for the period 2021-23 for the Village Hall monitor. Three backward trajectories are created on each day of interest, starting from the monitor's location at midnight the days of at heights of 200, 500, and 1,000 meters above ground.

Figure 15 shows the backward trajectories for the ten highest daily concentrations and the ten lowest daily concentrations at the Village Hall monitor over the period 2021-23. 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 southwest, and from the west-northwest and from the northeast. 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 and northeasterly component winds also usually have a long trajectory, indicating higher wind speeds and longer transport distances. The northeast trajectories are associated with air masses that passed through the Ontario area of Canada and coincide with the fires of June 2023.

Conversely, trajectories on the low days are predominately from the northwest portion of the United States. These are all areas where emission densities are relatively low. These HYSPLIT trajectories for Village Hall correlate well with the distribution of wind directions on high days previously presented in the pollution rose data.

Figure 15 **McCook-Village Hall 2021-2023 HYSPLIT Trajectory End Points**



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 $PM_{2.5}$ 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 USEPA's guidance documentation. Township Boundaries in this study reflect the 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 (2021-2023) shows that eleven monitors in Cook County do not meet the annual $PM_{2.5}$ 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 $PM_{2.5}$ 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 Illinois EPA therefore recommends that DuPage and Will Counties be included in the Chicago nonattainment area for the annual $PM_{2.5}$ 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 Illinois EPA therefore recommends that Lake County be included in the Chicago nonattainment area for the annual $PM_{2.5}$ 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 overall population growth, although it has fluctuated over the study's time period. The Illinois EPA therefore recommends that McHenry and Kane counties be included in the Chicago nonattainment area for the annual $PM_{2.5}$ standard.

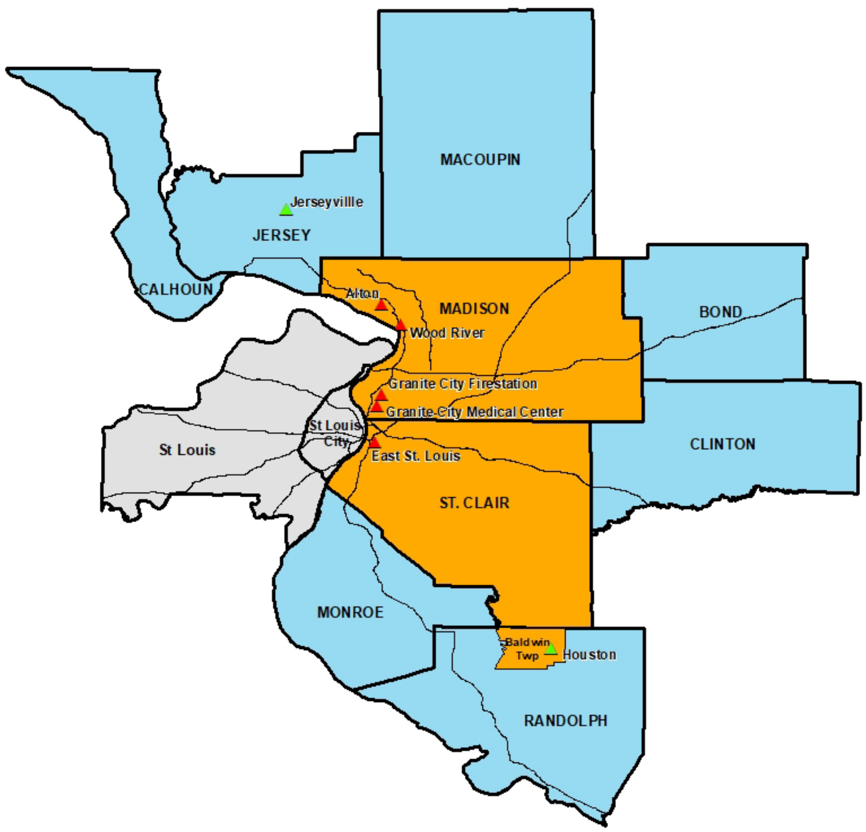
- ***Kendall and Grundy Counties.*** Due to their primarily rural character, most of Kendall and Grundy Counties were not included in the 1997 annual $PM_{2.5}$ nonattainment area. Precursor emission levels in these counties are low, as is the total population, population density, traffic volumes, and 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 Illinois EPA 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 $PM_{2.5}$. 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 $PM_{2.5}$ nonattainment area. This county is primarily rural, as shown by its low 2020 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 Illinois EPA recommends that DeKalb County not be included in the nonattainment area and that it be designated as attainment/unclassifiable for the NAAQS for annual $PM_{2.5}$.

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 with monitored violations of the revised primary annual $PM_{2.5}$ NAAQS. Figure 16 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 USEPA guidance for the Metro-East Study Area.

Figure 16 Metro-East St. Louis Study Area



FACTOR 1 – AIR QUALITY DATA

Spatial Analysis

The annual $PM_{2.5}$ design values for the Metro-East Study Area are shown below in Figure 17. As can be seen from the map in Figure 17, Figure 1 (annual design values), and Figure 24 (urban areas within the St. Louis, MO-IL core based statistical area), there are concentration gradients running along most major interstates as they approach Madison and St. Clair counties urban areas. The concentrations reach a peak within Madison County near other major traffic arteries or areas of high traffic coinciding in regions with high industrial concentrations. High industrial areas are concentrated before crossing into Missouri St. Louis metropolitan area running along a curving path generally following the Mississippi river along Illinois 3 and bounded by IL67 to the North and Interstate 255 to the South.

Conversely, concentrations drop off quickly as distance is increased from Southwest Madison County, specifically the region around Granite City and the major population areas, even along the major traffic arteries. For the 2021-2023 period, there are five monitors that violate the revised annual $PM_{2.5}$ NAAQS. The monitors that violated in Madison County are the Gateway Medical Center, Granite City-Fire station, Wood River, and Alton Horace-Mann Elementary School sites, with design values of 10.5, 10.0, 9.4, and 9.1$\mu g/m^3$ respectively. The monitor that violated in St. Clair County is the East St. Louis site with a design value of 9.9 $\mu g/m^3$. The highest annual $PM_{2.5}$ design values occur in southwestern Madison and northwestern St. Clair Counties. Design values in northern Madison and Jersey Counties range between 7.7 and 9.4 $\mu g/m^3$, while the Houston monitor in Randolph County and the Jerseyville Water Treatment Plant monitor in Jersey County are tied for the lowest design value at 7.7$\mu g/m^3$.

Figure 17 Metro-East St. Louis Study Area 2021-2023 PM2.5 Design Values

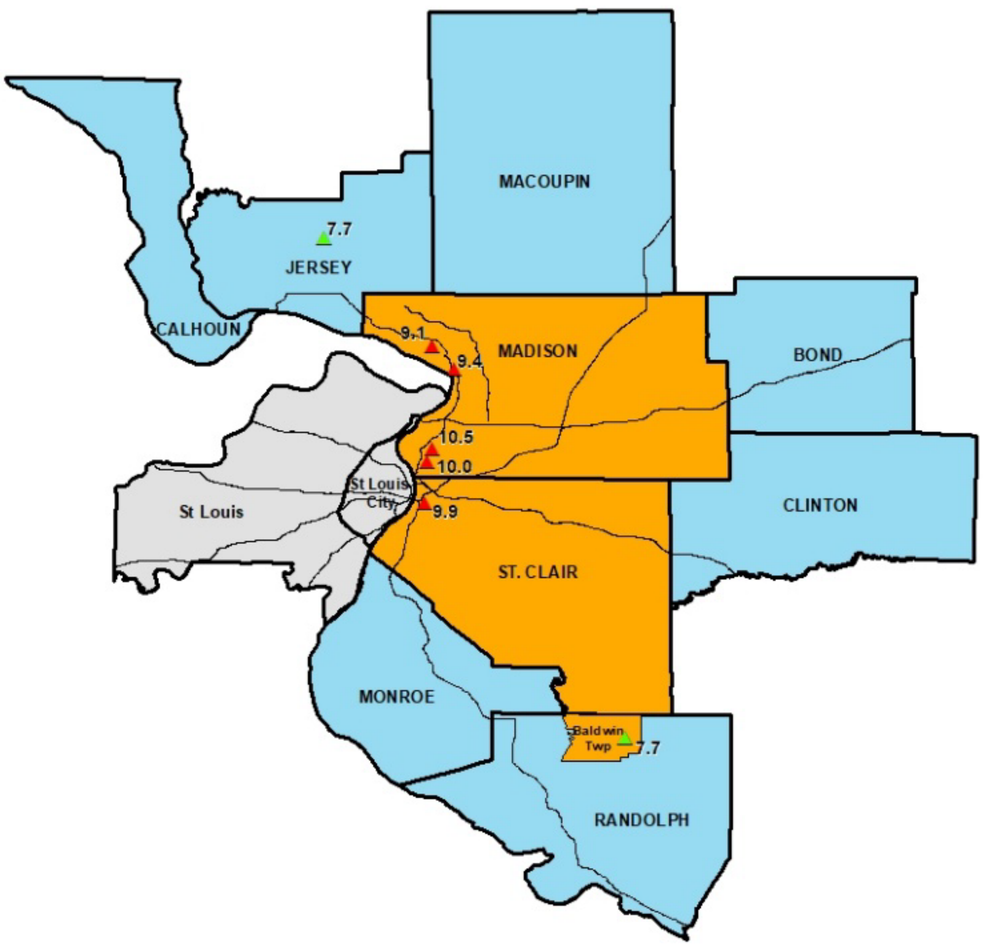
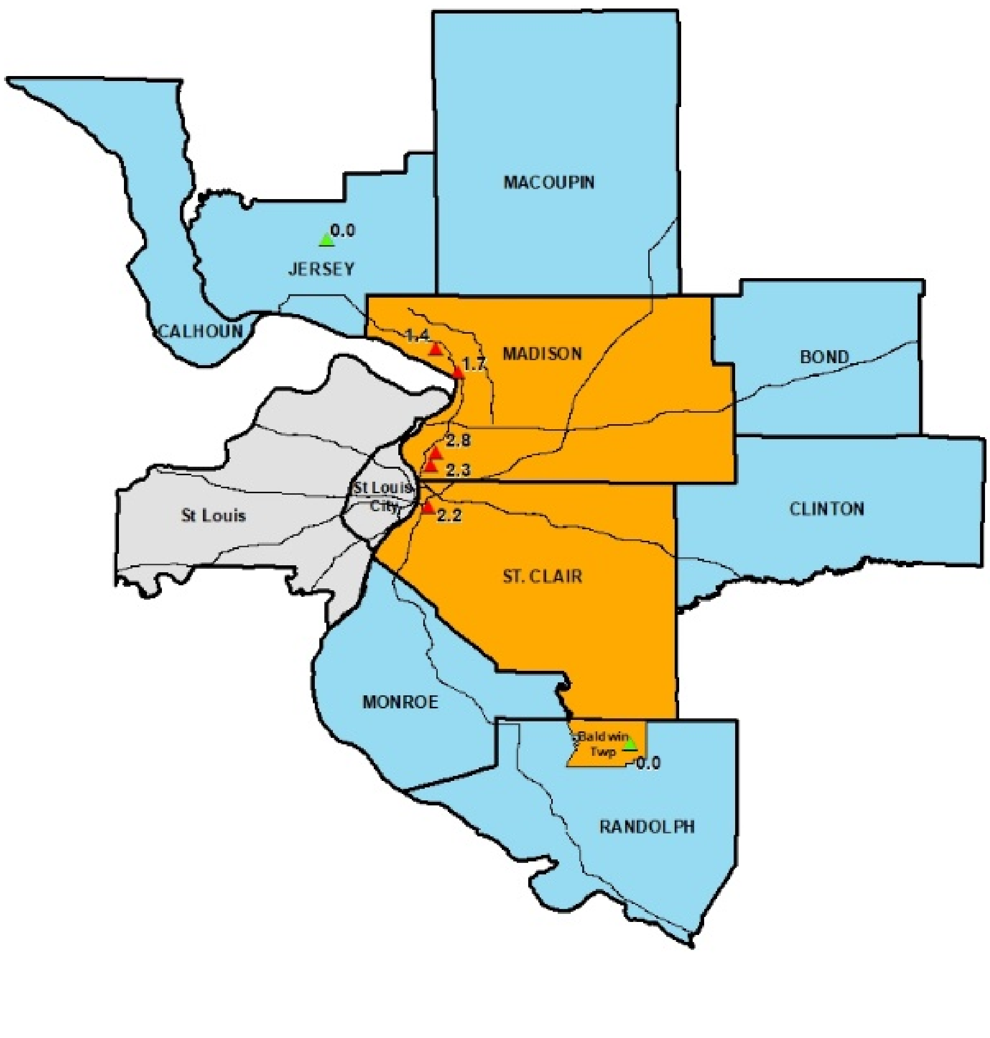


Figure 18 shows the amount of urban excess at the $PM_{2.5}$ monitoring sites across the Metro-East Study Area. These values were calculated by taking the 2021-2023 design values for all the Metro-East monitoring sites and subtracting out the 7.7 µg/m^3 of $PM_{2.5}$ recorded at the rural background site in Houston, IL. The resulting map of urban excess values shows that the peak values occur at the Gateway Medical Center and East St. Louis sites. The urban excess value at the Gateway Medical Center site is significantly higher, 27%, than all the other sites in the Metro-East Study Area, with a value of 2.8 µg/m^3. This is likely due to its proximity to major industrial sites located in Granite City and its immediate area. The urban excess values at the Granite City-Fire station and East St. Louis sites are all very similar and range between 2.2 and 2.3 µg/m^3; the Alton Horace Mann Elementary School and Wood River sites are also similar to each other and range between 1.4 and 1.7 µg/m^3. The Jerseyville monitor has the lowest urban excess value of 0.0 µg/m^3. Due to the lack of significant emission sources in Jersey County, and this value most likely represents urban-scale transport downwind of the St. Louis Metropolitan Area.

Figure 18 Metro-East St. Louis Study Area 2021-2023 PM2.5 Urban Excess



Temporal Analysis

Figure 19 presents the annual $PM_{2.5}$ design value trends for the Metro-East Study Area at seven long-term monitoring sites. The graph shows that annual design values across the Metro-East Study Area have dropped significantly between the periods of 1999-2017. 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 μg/m^3 to 7.7 μg/m^3. The amount of locally generated urban $PM_{2.5}$, however, has fluctuated over time, with the maximum urban excess value decreasing from 4.2 μg/m^3 to 2.8 μg/m^3 over the same period. Although there has been significant improvement in regional air quality, due to the strengthening of the NAAQS, the Gateway Medical Center, Granite City-Fire station, Wood River, Alton Horace-Mann Elementary School, and East St Louis sites currently violate the revised Annual NAAQS.

Figure 19 Metro-East St. Louis Annual PM2.5 Design Value Trends (1999-2023)

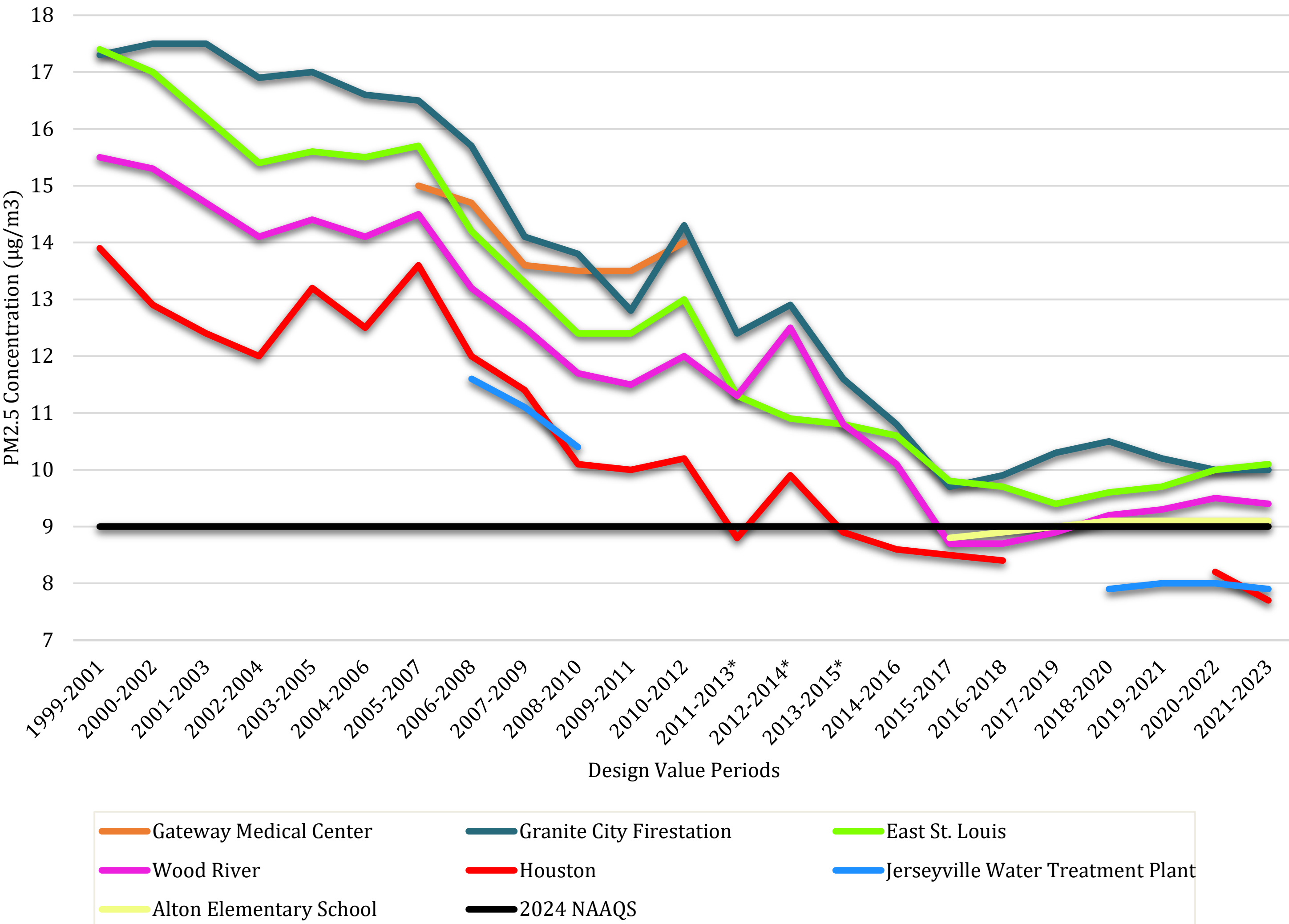


Figure 20 presents the time series trend in seasonal $PM_{2.5}$ averages for all monitors located in the Metro-East Study Area between the winter of 2021 and the fall of 2023. These values were computed from individual monthly averages that were grouped by meteorological season for each year rather than 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 20 and 21, the $PM_{2.5}$ monitors in the Metro- East Study Area generally are summer dominant.

Figure 20 Metro-East $PM_{2.5}$ Seasonal Average Time Series for 2021-2023

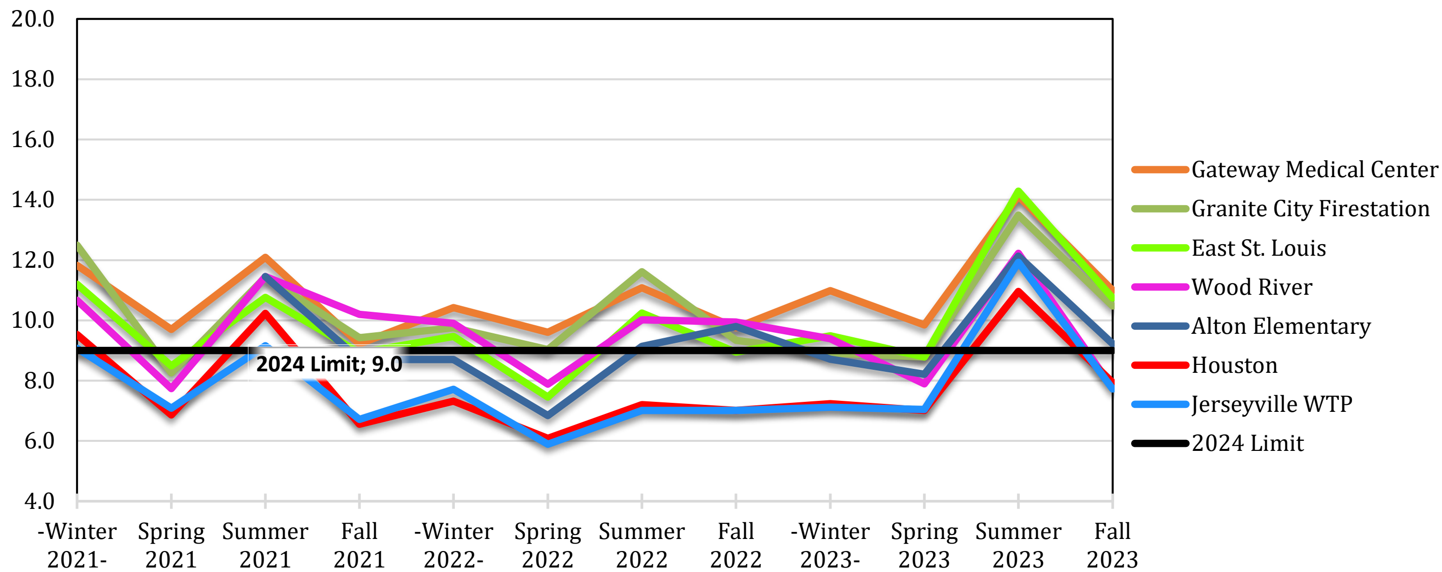
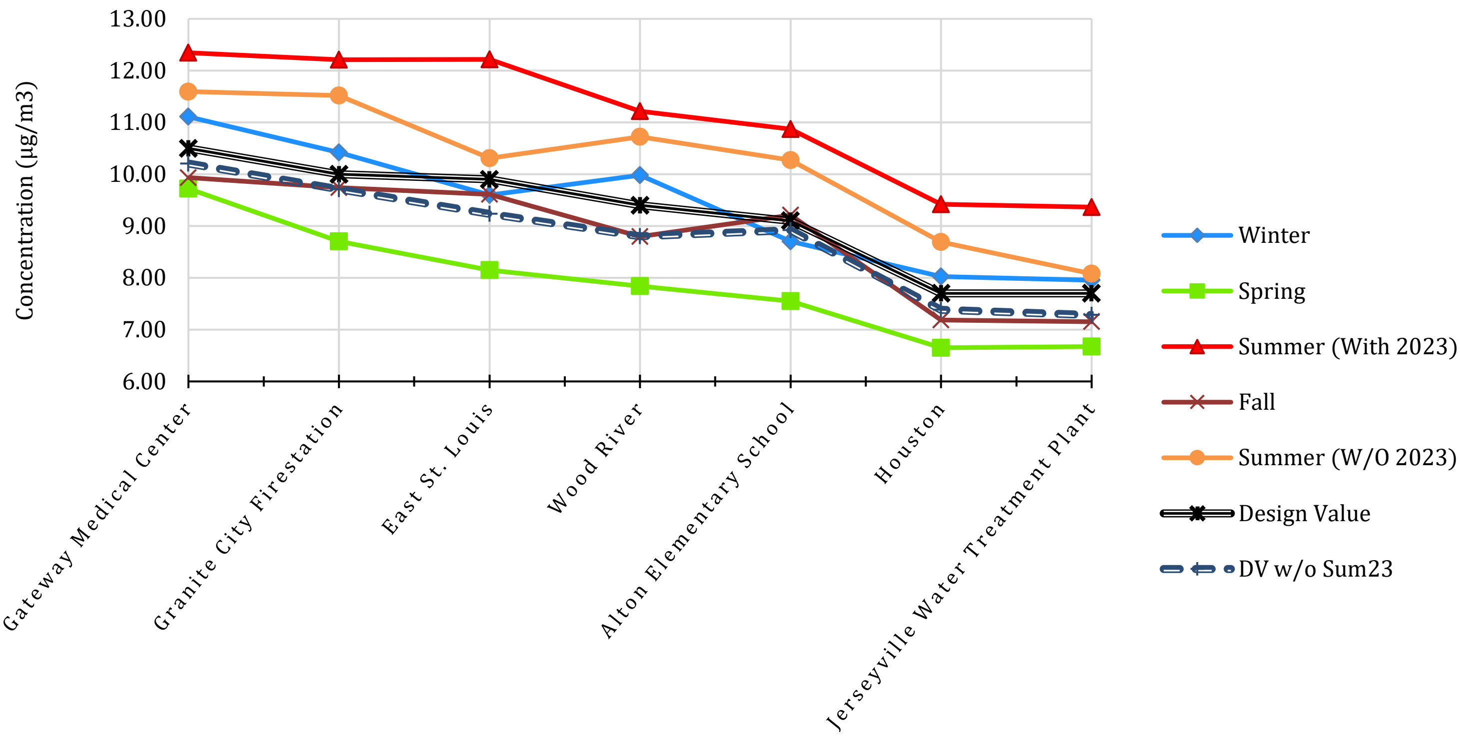


Figure 20 shows that most of the sites in the Metro-East Study Area have recorded seasonal averages in excess of the level of the revised annual $PM_{2.5}$ NAAQS over the 2021-2023 period. Overall, there is a generally consistent pattern between all the sites, with the peak seasonal values occurring during the summer and winter periods. The lowest seasonal averages occur in both the spring and the fall. The seasonal averages across all sites have been trending gradually downward, but not significantly. However, a significant spike occurred in summer of 2023, caused by the Canadian wildfires, followed by a drop back down to pre-summer 2023 numbers in the fall of that same year.

Figure 21 presents the overall meteorological seasonal averages for the years of 2021, 2022, and 2023, 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 shows that the Metro-East Study Area is summer dominant. 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 2021-2023 period above 9.0 µg/m^3.

With the notable exception of the Gateway Medical Center site, spring seasonal averages across the area are below 9.0 µg/m^3. The Gateway Medical Center site has the highest seasonal averages for all four seasons, indicating that the site is being strongly influenced by a local source of emissions.

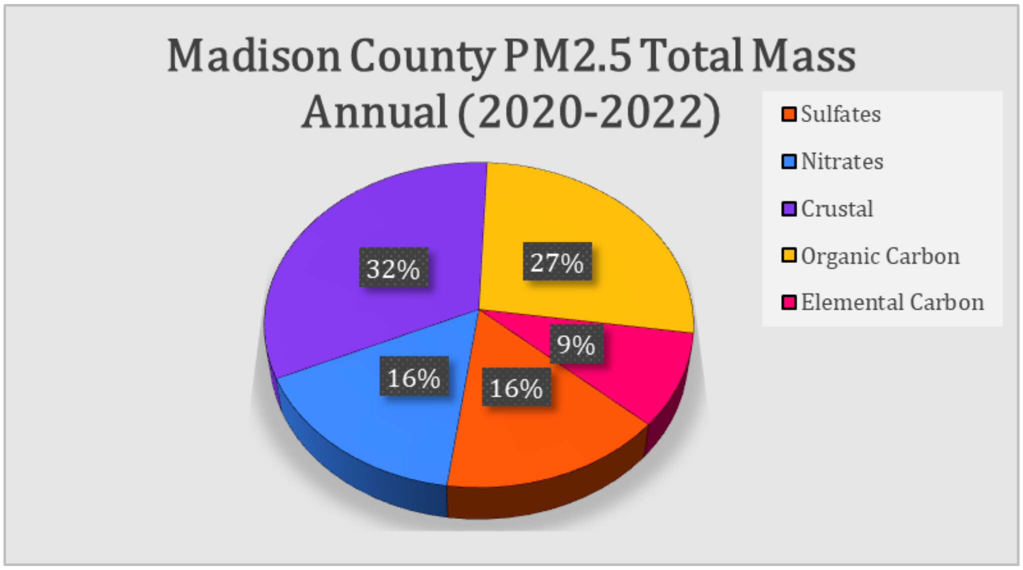
Figure 21 2021-2023 Metro-East $PM_{2.5}$ Seasonal Averages by Site (Additional DV)



Chemical Speciation Analysis

The only chemical speciation site located in the Metro-East Study Area is the Gateway Medical Center monitor. This site is likely impacted by the nearby major industrial sites located in Granite City and its immediate area, as can be seen by the large percentage of Crustal Materials in Figures 22 and 23. There is no speciation data available for the East St. Louis site. This site would, most likely, exhibit significant differences from the Gateway Medical Center monitor due to the absence of a nearby source of direct $PM_{2.5}$ emissions.

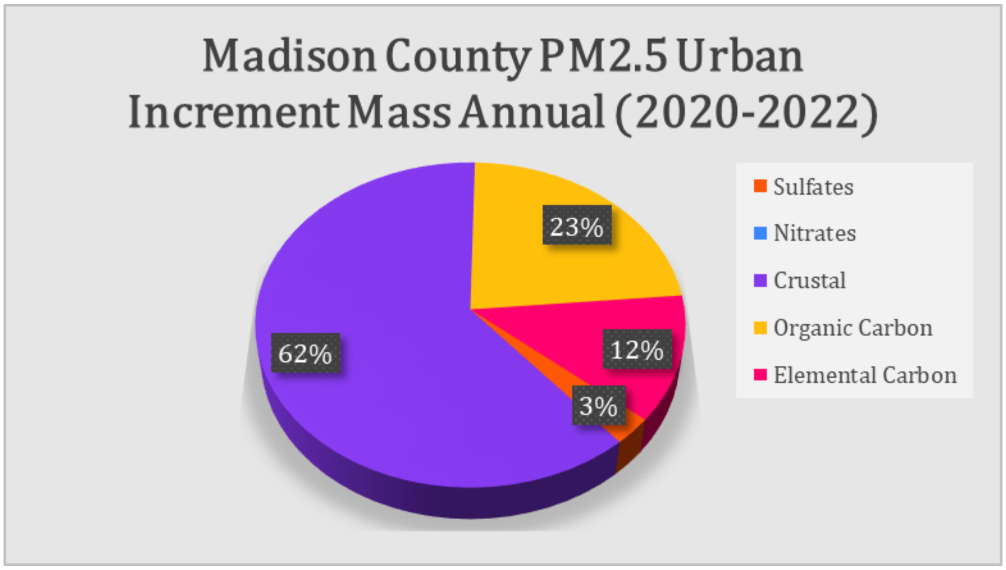
Figure 22 Madison County $PM_{2.5}$ Total Mass Annual (2020-2022)



Figures 22 and 23 present the 2020-2022 Annual Total Mass and Urban Increment Mass $PM_{2.5}$ chemical speciation data for the Gateway Medical Center monitor. Organic Carbon, Sulfates, Nitrates, and Crustal Materials dominate the Total Mass pie chart in Figure 22. 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 23. The increase in Crustal Materials is the most significant, this category alone makes up 62% of the total Urban Increment Mass. Both Organic Carbon and Elemental Carbon make up 35% of the total Urban Increment Mass. These three components combined make up 97% of the Urban increment, all of which tend to originate from large urban-scale local emission sources of on-road and non-road mobile sources, localized combustion sources, and stationary VOC sources that are found across the St. Louis Metropolitan Area. Based on this, it is likely that a large portion of the Crustal Materials component is coming from major traffic arteries or areas of high traffic concentrations in the region combined with major industrial sites located in Granite City and its immediate area. This further supports the Gateway Medical Center Monitor's design purpose and designation as a source orientated $PM_{2.5}$ site monitor.

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 23 Madison County $PM_{2.5}$ Urban Increment Mass Annual (2020-2022)



Air Quality Factor Analysis Summary

Four area and one source-oriented monitors currently violate the revised annual $PM_{2.5}$ 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 73% of the $PM_{2.5}$ mass measured at the Gateway Medical Center site is advecting into the area due to regional transport. The distribution of the urban excess across the Metro-East Study Area shows that additional $PM_{2.5}$ is being generated within the urban area itself. A dominate winter season is also clearly evident in the 2021-2023 seasonal time series and the 2021-2023 monitoring site seasonal averages. Lastly, the chemical speciation data shows that nearly 97% of the Urban Increment Mass is related to urban-scale Crustal Materials, Organic Carbon, and Elemental Carbon emission sources, 62% of which is Crustal and probably due to local impacts from the nearby major industrial sites located in Granite City and its immediate area and related facilities. While the contributions from local Sulfate and Nitrate emission sources is statistically insignificant at approximately 3% combined.

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 2020 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 69.7%, more than twice what Illinois counties contribute, 30.3%, of overall emissions.

Table 8 St. Louis MO-IL MSA – Ranked Emissions by County (2011 & 2020 NEI data)

Illinois Counties/Sources	Year	PM2.5	NOx	NH3	SO2	VOC	Total TPY	Percent of MSA
Madison	2011	3,824.01	16,049.56	1,244.9	13,280.71	9,036.73	43,435.91	10.27%
	2020	2,644.09	7,857.68	1,076.92	2,441.47	15,313.72	29,333.88	7.60%
Clinton	2011	1,153.79	4,596.53	3,010.98	378.14	1,423.65	10,563.09	2.49%
	2020	1,348.87	2,273.17	2,348.41	317.19	8,355.25	14,642.89	3.79%
St. Clair	2011	3,271.48	7,901.27	1,195.97	295.62	5,850.16	18,514.50	4.37%
	2020	1,820.99	4,342.68	1,503.28	161.83	12,887.67	20,716.46	5.37%
Monroe	2011	775.91	2,223.18	823.57	53.56	945.14	4,821.36	1.14%
	2020	746.90	1,195.84	729.12	13.18	7,581.25	10,266.29	2.66%
Macoupin	2011	1,613.39	1,865.45	1,716.8	24.3	1,425.22	6,645.16	1.57%
	2020	1,494.45	1,905.94	1,346.32	18.08	11,465.18	16,229.974	4.21%
Bond	2011	706.46	1,201.65	605.54	13.41	751.52	3,278.58	0.75%
	2020	576.25	1,097.66	424.43	6.53	6,470.06	8,574.93	2.22%
Calhoun	2011	199	599.71	190.05	40.93	318.66	1,348.35	0.31%
	2020	241.41	516.75	463.48	7.17	6,203.19	7,431.99	1.92%
Jersey	2011	603.63	857.42	497.86	27.28	681.49	2,667.68	0.63%
	2020	689.44	739.07	397.29	12.17	6,966.12	8,804.08	2.28%
Dynegy Midwest Generation, Baldwin Facility	2011	505.2	4,771.5	129.26	19,066	354.17	24,826.13	5.87%
	2020	14.38	1,787	6.38	1,475	136.67	3,419.43	0.88%
Illinois MSA Totals	2011	12,652.87	40,066.27	9,414.93	33,178.95	20,786.74	116,100.76	27.45%
	2020	9,576.78	21,715.79	8,295.63	4,452.62	75,379.11	119,419.93	30.97%

Missouri Counties	Year	PM2.5	NOx	NH3	SO2	VOC	Total TPY	Percent of MSA
St. Louis	2011	5,538.21	38,672.94	1,761.41	15,810.56	30,568.32	92,351.44	21.84%
	2020	10,293.7	13,366.6	2,201.57	614.37	29,471.8	55,948.02	14.5%
Franklin	2011	2,441.27	14,733.98	1,312.84	58,025.06	3,941.06	80,454.21	19.02%
	2020	5,692.73	10,584.9	1,913.19	39,480.9	20,849.7	78,521.45	20.36%
Jefferson	2011	1,737.72	11,464.65	250.34	43,777.64	6,124.25	63,354.60	14.98%
	2020	5,471.56	8,942.96	901.37	17,904.5	19,229.4	52,449.87	13.6%
St. Charles	2011	2,059.48	17,937.41	1,020.31	5,441.90	9,921.89	36,380.99	8.60%
	2020	5,642.27	8,277.98	1,283.08	1,301.76	16,712.2	33,217.27	8.61%
St. Louis City	2011	1,716.86	10,301.94	759.53	3,139.73	8,602.42	24,520.48	5.8%
	2020	1,255.31	5,324.48	749.97	203.51	6,821.1	14,354.37	3.72%
Lincoln	2011	345.16	2063.71	882	39.03	1,914.01	5,243.91	1.24%
	2020	2327.15	1571.64	1100.61	45.49	12,624.3	17,669.15	4.58%
Warren	2011	273.93	1,908.80	669.64	23.42	1,549.94	4,425.73	1.04%
	2020	1,537.19	1,224.47	694.3	35.38	10,578.7	14,070.1	3.64%
Missouri MSA	2011	14,112.63	97,083.43	6,656.07	126,257.34	62,621.89	306,731.36	72.55%
	2020	32,219.9	49,293	8,844.1	59,586	116,287	266,230.195	69.03%
MSA Total	2011	26,765.50	137,149.70	16,071.00	159,436.29	83,408.63	422,832.12	100%
	2020	41,796.68	71,008.79	17,139.73	64,038.62	191,666.11	385,650.13	100%

Note: Red indicates an increase and Green a decrease from 2011 numbers.

Table 9 shows ranked $PM_{2.5}$ emissions in the Metro-East Study Area based on total county emissions (tons/year). An evaluation of emissions data shows Madison, St. Clair, and Randolph counties ranked in the top three having the greatest level of emissions. Combined they contribute approximately 50% of the total emissions in the area.

Table 9 Metro-East Study Area - Ranked Emissions by County (Based on 2020 NEI data)

Illinois Counties	PM2.5	NOx	NH3	SO2	VOC	Total TPY	Percent of Total	Rank
Madison	2,644.09	7,857.68	1,076.92	2,441.47	15,313.72	29,333.88	22.08%	1
St. Clair	1,820.99	4,342.68	1,503.28	161.83	12,887.67	20,716.45	15.59%	2
Randolph	1,110.55	3,347.89	1,066.98	1,487.93	9,863.47	16,876.82	12.7%	3
Macoupin	1,494.45	1,905.94	1,346.32	18.08	11,465.18	16,229.97	12.21%	4
Clinton	1,348.87	2,273.17	2,348.41	317.19	8,355.25	14,642.89	11.02%	5
Monroe	746.90	1,195.84	729.12	13.18	7,581.25	10,266.29	7.73%	6
Jersey	689.44	739.07	397.29	12.17	6,966.12	8,804.09	6.63%	7
Bond	576.25	1,097.66	424.43	6.53	6,470.06	8,574.93	6.45%	8
Calhoun	241.41	516.75	463.48	7.17	6,203.19	7,432.00	5.59%	9

Totals:	10,672.95	23,276.68	9,356.23	4,465.55	85,105.91	132,877.32	100.0%	

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, NOx, VOC, NH_3, and direct $PM_{2.5}$. Metropolitan areas where violations are occurring were evaluated separately based on county level 2020 NEI emissions. For the Metro-East Study Area (Figures B1 through B5):

- SO_2 emissions are highest in Madison and Randolph Counties, where point sources are the greatest contributors. Combined emissions from Randolph and Madison Counties contribute approximately 88% of total SO_2 emissions in the area.
- NOx emissions are highest in Madison, St. Clair, and Randolph Counties. Combined NOx emissions from these counties contribute about 66.8% of total NOx emissions within the area. The greatest source contributors to the total NOx emissions for Madison and Randolph counties are point sources, whereas the greatest source contributions in St. Clair County comes from Nonpoint (area) and on-road mobile sources. Monroe, Bond, Jersey, and Calhoun counties have relatively low emissions - combined they contribute to less than 15.3% of total NOx emissions.
- VOC emissions are highest in Madison and St. Clair Counties, which account for 33% of total VOC emissions. In contrast, Jersey, Bond, and Calhoun VOC emissions contribute 23% of total VOC emissions for the area. Area sources are the major contributor towards total VOC accounting for 83.4% of total VOC emissions for 2023.
- NH_3 emissions are highest in Clinton, St. Clair, Macoupin, and Madison Counties, with the greatest emissions arising from organic, biomass, and area sources. NH_3 emissions in the combined counties of Clinton, St. Clair, Macoupin, and Madison account for approximately 67% of total NH_3 emissions within the Metro-East Study Area. Randolph, Monroe, Calhoun, Bond, and Jersey Counties also have moderately high emissions of NH_3. Jersey County has the lowest total NH_3 emissions, contributing about 4% of total NH_3 emissions.
- Direct $PM_{2.5}$ emissions are highest in Madison and St. Clair Counties. Macoupin, Randolph, and Clinton Counties contribute moderately high levels of direct $PM_{2.5}$ emissions. Direct $PM_{2.5}$ emissions from Madison and St. Clair Counties contribute to nearly 41.8% of total direct $PM_{2.5}$ emissions in the area. The greatest contributor to total direct $PM_{2.5}$ emissions occurs from area sources. Furthermore, direct $PM_{2.5}$ emissions are moderate in Monroe, Bond, and Jersey Counties, accounting for nearly 18.9% of total direct $PM_{2.5}$ emissions. Calhoun County ranks last, with concentrations of direct $PM_{2.5}$ below 2.3% 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 County has the largest number of SO_2 emitting point sources. Adjacent counties have relatively few point sources emitting SO_2. The largest point sources for NOx are located in Madison and Randolph Counties. Madison has the largest number of NOx-emitting point sources emitting greater than 100 tons per year.

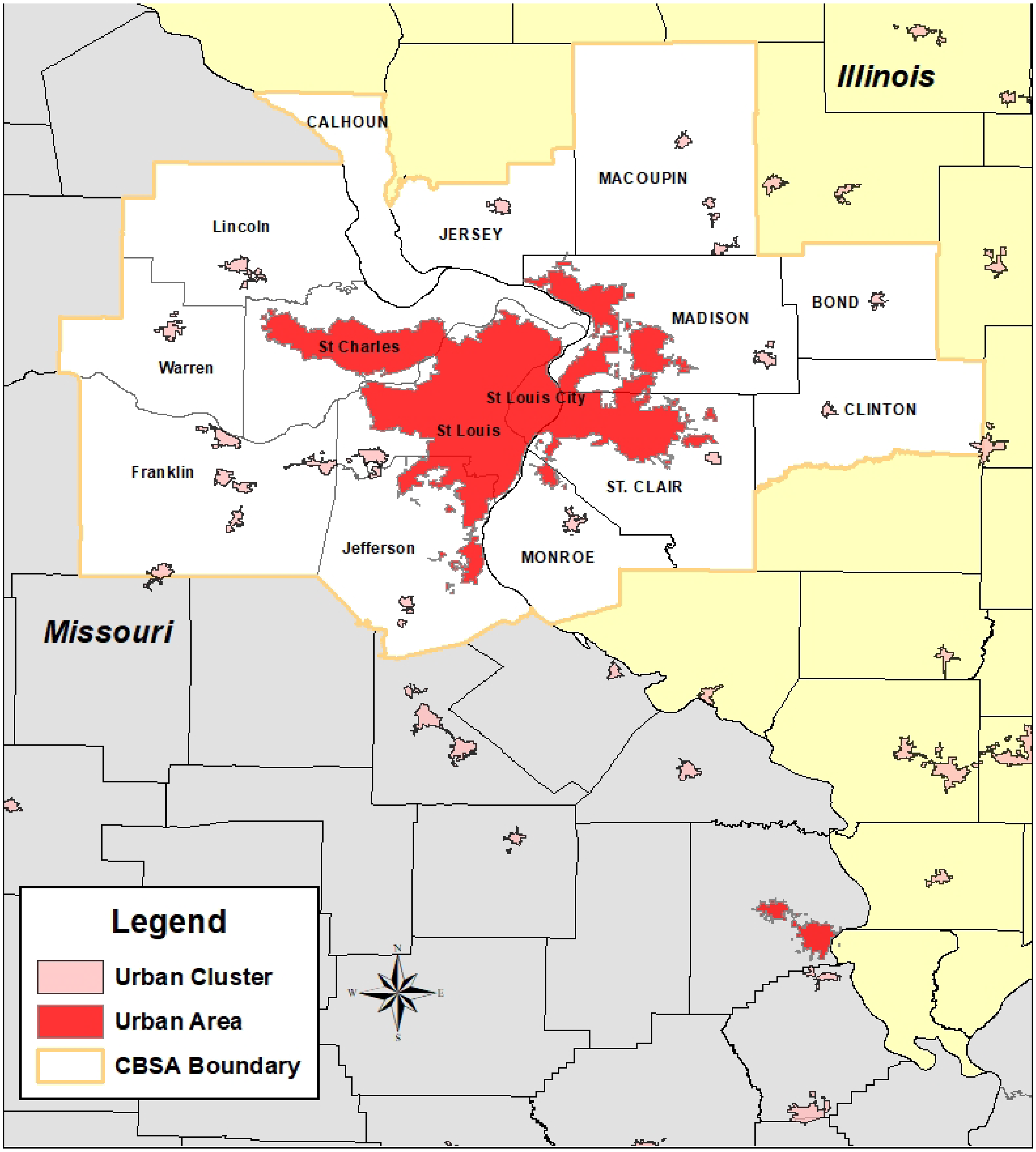
Adjacent counties have relatively few point sources emitting NOx. The largest emitting and greatest number of point sources emitting VOCs are located in Madison and Randolph Counties. Adjacent counties have relatively few point sources emitting VOCs. There are no significant point sources of NH_3 based on Illinois EPA's 2023 inventory within the MSA. The largest point sources for direct $PM_{2.5}$ are located in Madison County. Madison County has the largest emitters of direct $PM_{2.5}$. Adjacent counties have relatively few point sources emitting $PM_{2.5}$ and none emitting direct $PM_{2.5}$ at rates greater than 100 tons per year.

Population and Urbanization

Urbanization is not as pronounced in the Metro-East Study Area as seen in the Chicago CBSA (see Figure 24). Madison and St. Clair Counties are the most urbanized of the counties in the Metro-East portion of the St. Louis MSA. Adjacent counties, such as Washington and Montgomery, are not included in the St. Louis 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 MSA shows that Madison and St. Clair Counties make up about 18.4% of the total population in the MSA and the remaining Illinois counties only contribute to 6.7% of the total population in the area.

Figure 24 **Urban Areas within St. Louis, MO-IL Core Based Statistical Area**



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

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

State	County	2020 Population	Land Area (Sq. Miles)	Population Density (Persons per sq. mile)	Percent of MSA	Cumulative Percent
MO	St. Louis County	1,004,125	532.2	1,919	35.23%	35.2%
MO	St. Charles County	405,262	592.4	684	14.22%	49.4%
MO	St. Louis City	301,578	66.2	4,556	10.58%	60.0%
IL	Madison County	265,859	740.0	359	9.33%	69.4%
IL	St. Clair County	257,400	673.9	382	9.03%	78.4%
MO	Jefferson County	226,739	664.3	341	7.95%	86.3%
MO	Franklin County	104,682	930.7	112	3.67%	90.0%
MO	Lincoln County	59,574	640.5	93	2.09%	92.1%
IL	Macoupin County	44,967	867.7	52	1.58%	93.7%
IL	Clinton County	36,899	503.1	73	1.29%	95.0%
MO	Warren County	35,532	437.8	81	1.25%	96.2%
IL	Monroe County	34,962	398.4	88	1.23%	97.4%
IL	Randolph County	30,163	597.1	51	1.06%	98.5%
IL	Jersey County	21,512	377.5	57	0.75%	99.3%
IL	Bond County	16,725	382.8	44	0.59%	99.8%
IL	Calhoun County	4,437	383.6	16	0.16%	100.0%

When evaluating the Metro-East Study Area by itself (Illinois counties only), based on 2023 U.S Census Bureau total population estimates, we see a similar rank order of population in counties (Table 11). Madison and St. Clair 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 2023, the Metro-East county of Monroe has experienced the greatest percent increase in population at 12.6%, followed by Clinton County, which although experienced net population growth, has been shrinking since at least 2012. According to U.S. Census data, all other counties in the study area have experienced negative changes in population over the same period, with Calhoun County losing the greatest percentage at 16.4%. However, Calhoun County had the lowest number of actual people lost at -864 and accounts for the smallest land area in the study with only 0.6%.

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

County	2023 Population	Land Area (Sq. Miles)	Population Density (Persons per sq. mile)	Percent of Study Area	Cumulative Percent	Rank
Madison	262,752	725	362	37.4%	37.4%	1
St. Clair	251,018	664	378	35.7%	73.1%	2
Macoupin	44,018	864	51	6.4%	79.5%	3
Clinton	36,785	474	78	5.2%	84.7%	4
Monroe	34,957	388	90	5.0%	89.7%	5
Randolph	29,815	578	56	4.3%	94%	6
Jersey	21,091	369	57	3.0%	97%	7
Bond	16,450	380	43	2.3%	99.3%	8
Calhoun	4,317	254	17	0.6%	99.9%	9
Totals:	701,203	4,696	-	-	-	-

Table 12 2005 - 2023 Population Change by County for the Metro-East Study Area

County	Population in Year:			Population Change		Change (%) for Year Range:	
	2005	2012	2023	2005-2023	2005-12	2012-23	2005-23
Monroe	31,040	33,357	34,957	3,917	7.5%	4.80	12.62
Clinton	36,095	38,061	36,785	690	5.4%	-3.35	1.91
Madison	264,309	267,883	262,752	-1,557	1.4%	-1.92	-0.59
St. Clair	260,067	268,858	251,018	-9,049	3.4%	-6.64	-3.48
Jersey	22,456	22,742	21,091	-1,365	1.3%	-7.26	-6.08
Bond	18,027	17,644	16,450	-1,577	-2.1%	-6.77	-8.75
Randolph	33,122	32,956	29,815	-3,307	-0.5%	-9.53	-9.98
Macoupin	49,111	47,231	44,018	-5,093	-3.8%	-6.80	-10.37
Calhoun	5,163	5,014	4,317	-864	-2.9%	-13.90	-16.39

Traffic and Commuting Patterns

Table 13 summarizes IDOT's estimates of AVMT for 2023, as calculated by IDOT's Highway Information System for the Metro-East Study Area. According to IDOT traffic statistics for 2023, Madison and St. Clair Counties have the highest level of AVMT in the St. Louis Study Area. Both counties together account for approximately 73.5% of the AVMT in the study area. Clinton, Macoupin, and Monroe Counties have moderate AVMT in comparison and Randolph, Jersey, and Calhoun Counties have the lowest AVMT, with about 6.7% of the total for the MSA (see Figure 25).

Table 13 2023 IDOT Travel Statistics for the Metro-East Study Area

St. Louis Metropolitan Statistical Area (MSA)	Average Daily Vehicle Miles Traveled (AVMT)
Madison	2,807,669,191
St. Clair	2,640,570,480
Clinton	409,881,378
Macoupin	395,521,457
Monroe	357,743,913
Bond	308,201,912
Randolph* Baldwin Township	265,637,032 14,617,757
Jersey	197,795,245
Calhoun	34,348,924
Total	*7,166,350,257*

* Randolph County is not part of the MSA; however, Baldwin Township is

Figure 25 Percent by County – 2023 AVMT in Metro-East Study Area

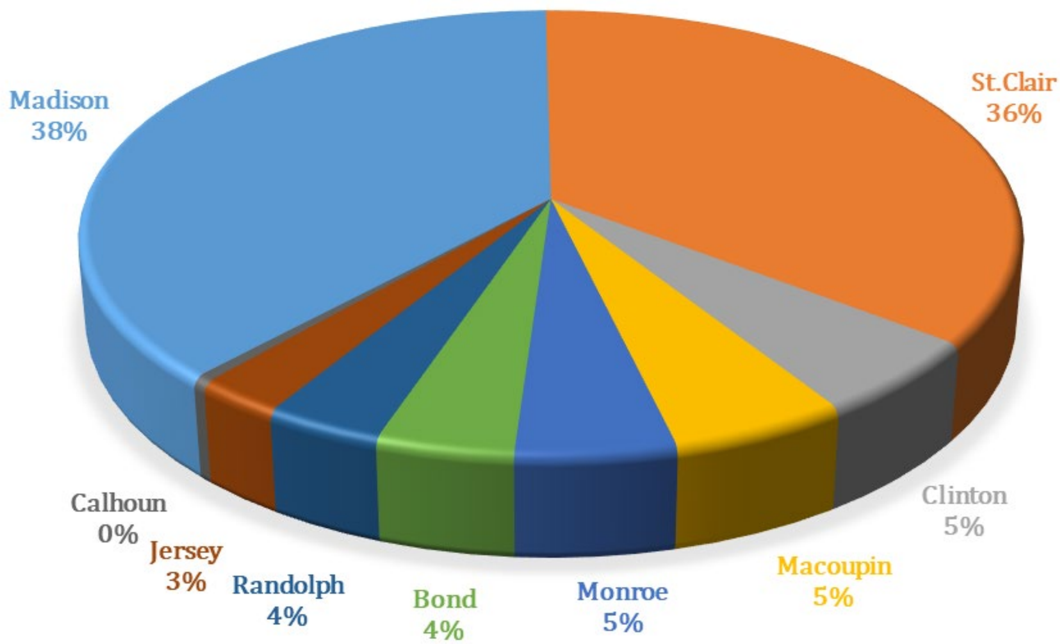
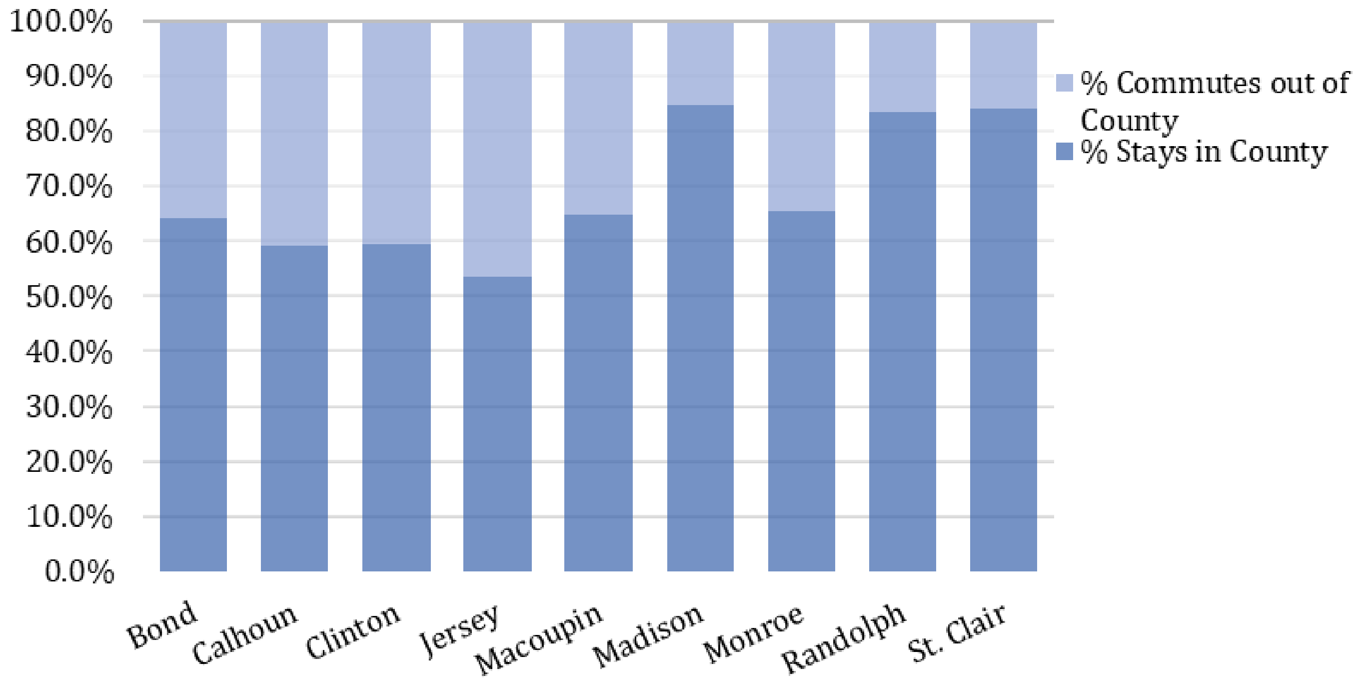


Table 14 and Figure 26 show counties within the Metro-East Study Area and their respective commuting patterns. Within the Metro-East Study Area, a higher percentage of people stay in the counties in which they reside for work, with Jersey, Calhoun, and Clinton Counties showing a greater percentage of 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	64.1%	35.9%
Calhoun	59.0%	41.0%
Clinton	59.4%	40.6%
Jersey	53.5%	46.5%
Macoupin	64.7%	35.3%
Madison	84.6%	15.4%
Monroe	65.5%	34.5%
Randolph	83.4%	16.6%
St. Clair	84.2%	15.8%

Figure 26 Total 2016-2020 Commuting Patterns Within the Metro-East Study Area



FACTOR 3 – METEOROLOGY

Metro- East Meteorology

Figure 27 shows a wind rose from St. Louis' Lambert International Airport for all days from the period 2021-23. 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 27 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 27 Wind Rose for St. Louis Lambert International Airport, 2021-2023

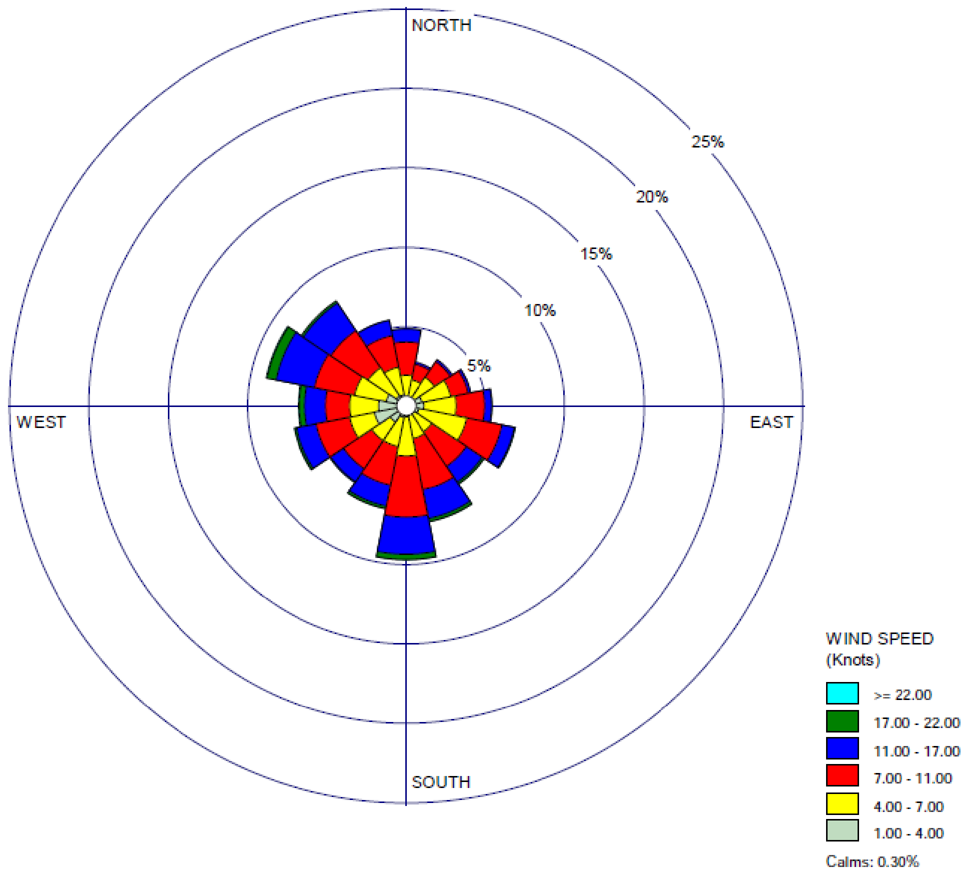


Figure 28 is a representation of hourly wind directions from St. Louis Lambert International Airport that occurred on days when the monitored values at East St. Louis were at least 20.0 µg/m^3. The threshold of 20.0 µg/m^3 was chosen to ensure a large enough sample size to be robust (35 days), while 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. This wind rose looks similar to the wind rose for all days for St. Louis (Figure 27). The largest percentage of occurrence is associated with a wind from the east-southeast, with secondary peaks associated with the west-southwesterly winds; the main difference between the two being the substantial decrease in winds from the west-northwesterly direction. These winds point to contributions from different portions of the urban area, including outside of Illinois.

Figure 28 Pollution Rose for East St. Louis Monitor High Days, 2021-2023

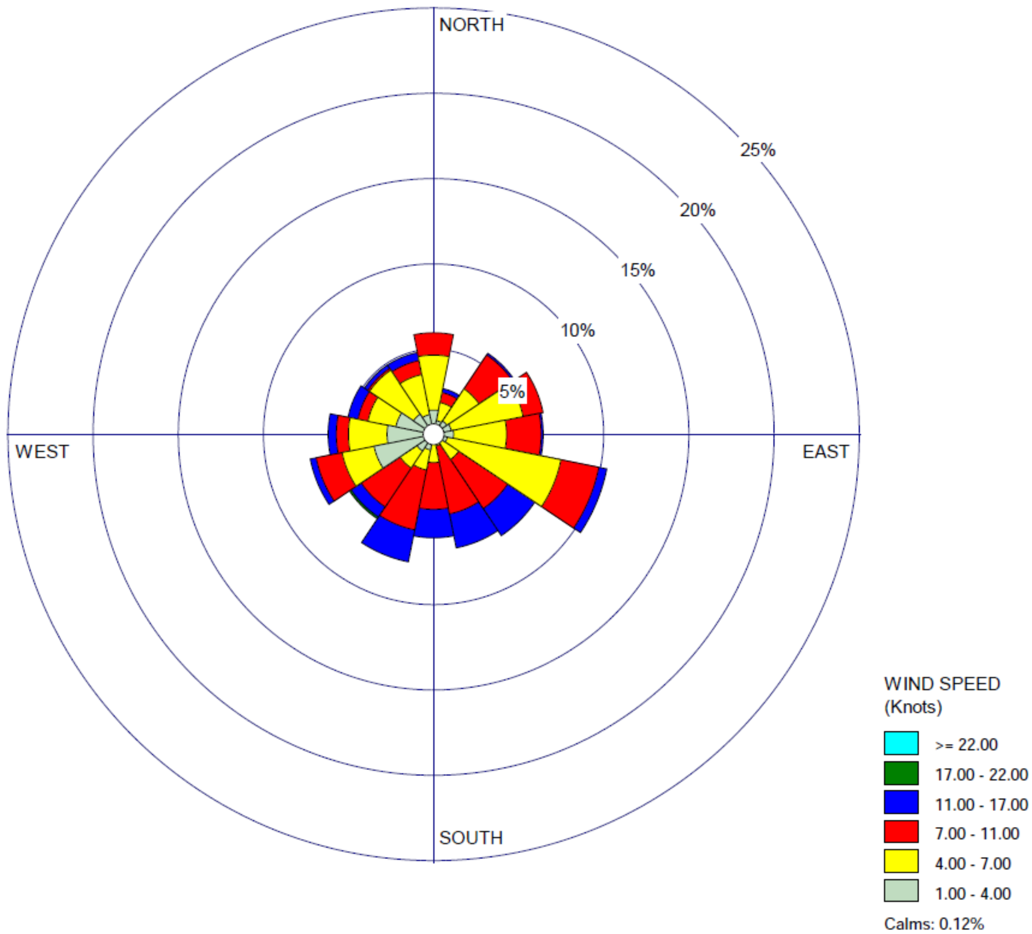
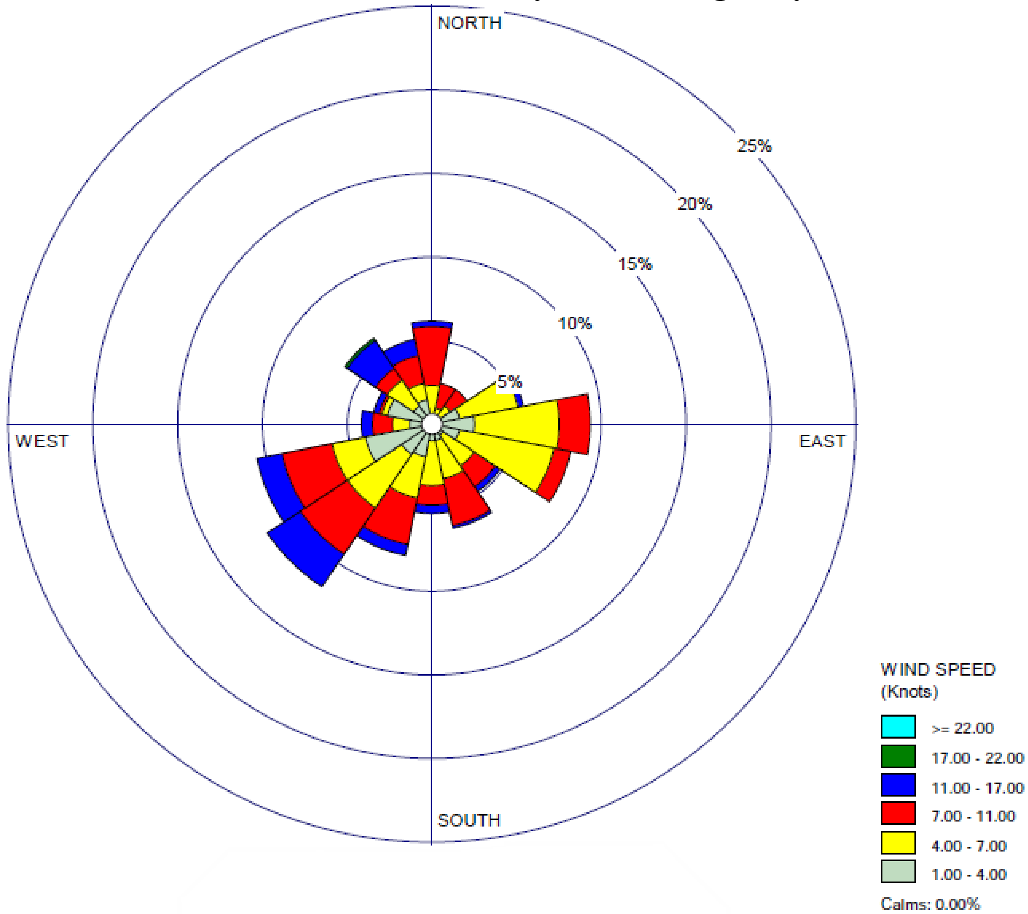


Figure 29 is a representation of hourly wind directions from St. Louis Lambert International Airport that occurred on days when the monitored values at Granite City were at least 15.0 µg/m^3. The threshold of 15.0 µg/m^3 was chosen to ensure a large enough sample size to be robust and similar (25 days) to the East St. Louis monitoring site sample size. This pollution rose varies from the pollution rose for both the East St. Louis monitor and for all days in St. Louis, depicted in Figures 27 and 28 above, in that it is dominated by winds out of the west-southwest and east, coupled with a spike out of the north-northwest.

The strong correlation between higher concentrations and generally southerly winds is not surprising considering the close proximity of the monitor to the major industrial sites located in Granite City and its immediate area 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, which is consistent through all three wind roses.

Figure 29 Pollution Rose for Granite City Monitor High Days, 2021-2023



The trajectories depicted in Figures 30 and 31 are from HYSPLIT runs. Illinois EPA ran HYSPLIT for days where monitoring was done for the period 2021-23 for the violating monitors in the Metro-East. Three backward trajectories are created on each day of interest at two sites, starting from the monitor's location at midnight at heights of 200, 500, and 1,000 meters above ground.

Figure 30 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 2021-2023. The trajectories on high days are most concentrated in three different directions: North, North-East, and Southwest. A significant amount of transport from far beyond the urban area is evident, including high concentration days from the North-East due to the Canadian wildfires. A majority of the trajectories associated with clean days have a West-Northwesterly component swinging around to the southwest, often associated with cool, dry air masses that originate over north-western North America and move southeastward across relatively sparsely populated areas of the northern U.S. Great Plains. The distribution of trajectories on high and low days are distinctly separate with the higher concentrations of $PM_{2.5}$ advecting into the area from the East and Northeast, having higher population density areas in those regions of the U.S. The lower concentrations days are primarily flowing in from the west, which is less densely populated and correspondingly has lower concentrations of air pollutants, including PM2.5 and its precursors, therefore contributing less to high days in Figure 30.

Figure 30 Trajectories for High and Low Concentration Days at East St. Louis

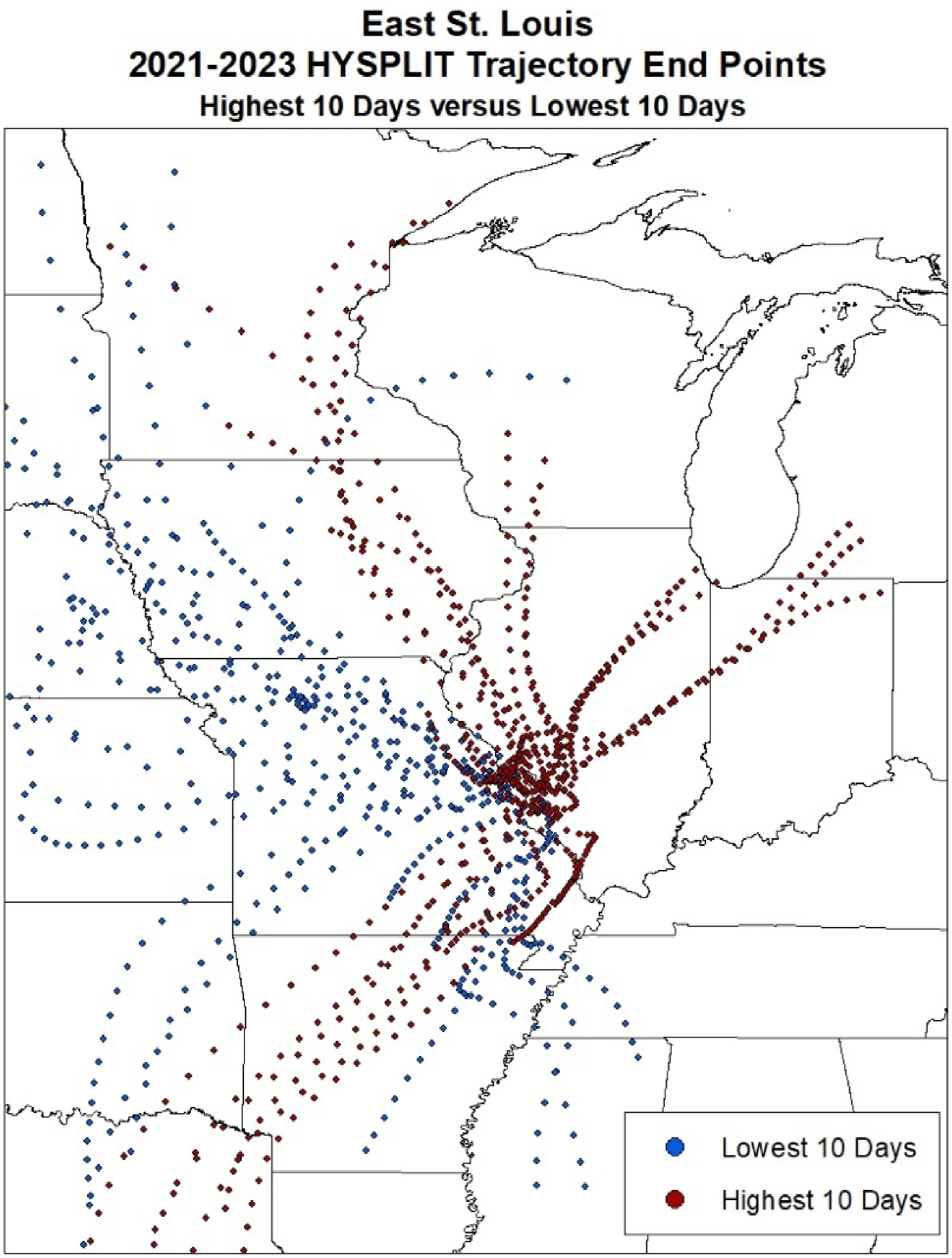
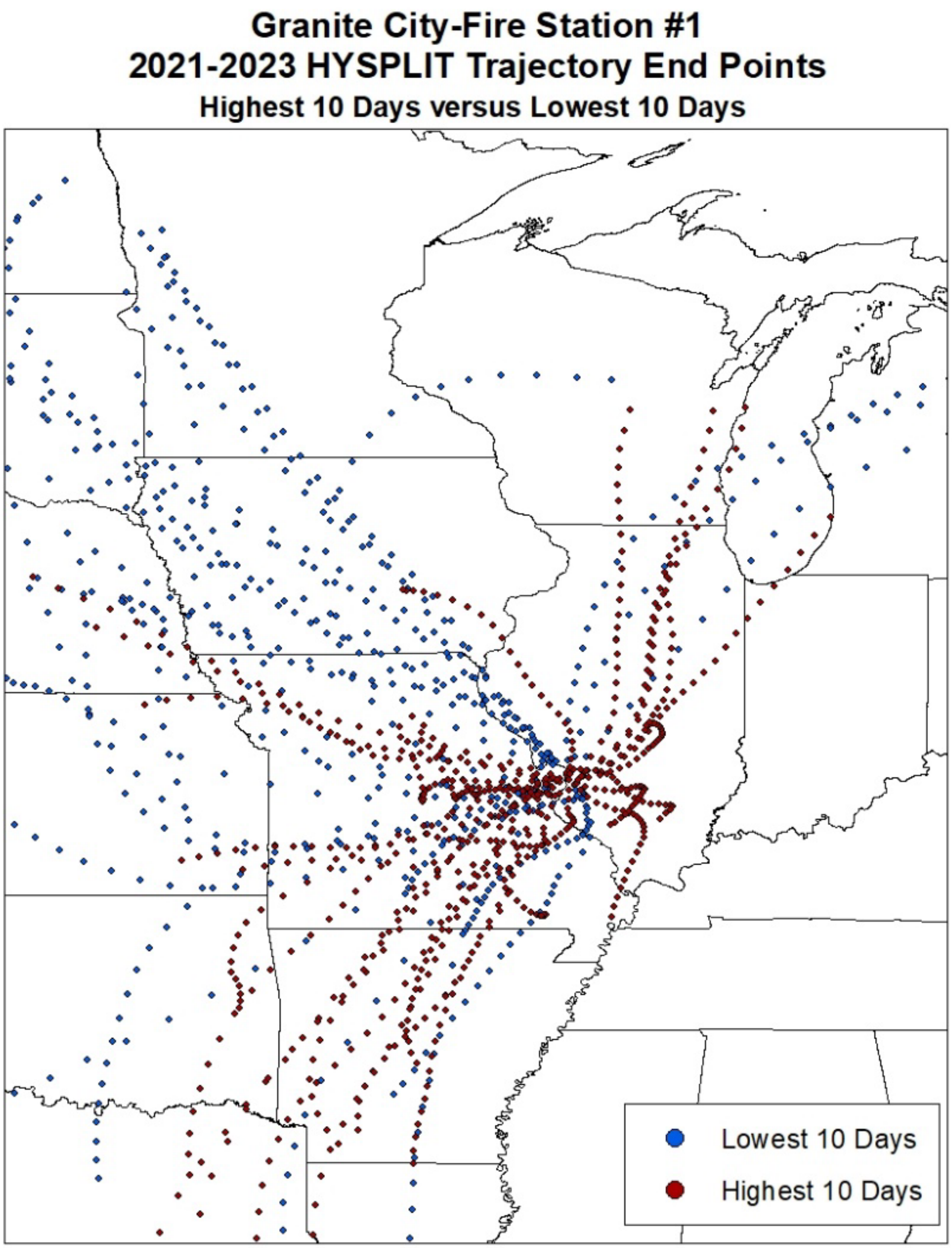


Figure 31 shows the backward trajectories for the ten highest daily concentrations and the ten lowest daily concentrations at the Granite City Fire Station monitor over the period 2021-2023. The trajectories on high days are concentrated in two directions: west Southwest, and North-East. Although this monitor is not considered to be a local-scale monitor, it appears to be strongly influenced by the nearby major industrial sites located in Granite City and its immediate area to the southwest of the monitor. A significant amount of transport from outside the urban area is evident from the high concentration days from the North-East, attributable to the Canadian wildfires. The resulting map reflects those of the urban excess values shown in Figure 18 with peak values occurring at the Gateway Medical Center and East St. Louis sites. These urban excess values are significantly higher, 27%, than all the other sites in the Metro-East Study Area. Again, this is likely due to its proximity to nearby major industrial sites located in Granite City and its immediate area. Therefore, although the urban excess that is attributable to the Granite City Illinois facilities is appreciable, the majority of the contribution to the overall PM loading is from transport from outside the urban area. The lower concentrations days are weakly affected by the urban excess and more strongly reflect those for the East St. Louis monitor for the same reasons i.e. regional cool dry air masses moving in from sparsely populated areas to the West-Northwest.

Figure 31 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 $PM_{2.5}$ 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's current air quality data (2021-2023) at four monitors does not meet the 2024 annual $PM_{2.5}$ standard. In terms of precursor emissions, Madison County has relatively high levels of all precursor emissions, including direct $PM_{2.5}$. However, $PM_{2.5}$ and all precursor emission levels, except for VOC's, have decreased since 2012 - in the cases of NOx and SO_2 by 51% and 81% respectively. Demographically, Madison County has the highest population, the second highest population density, and the largest percentage of urban land cover of all the counties in the Metro-East. The Illinois EPA recommends that Madison County be included in the Metro-East nonattainment area for the annual $PM_{2.5}$ standard.
- ***St. Clair County***. St. Clair County's current air quality data (2021-2023) at one monitor does not meet the 2024 annual $PM_{2.5}$ standard. St. Clair County has relatively high levels of VOC, NOx, NH_3, and $PM_{2.5}$ emissions, the second highest total population and highest population density, and a large percentage of urban land cover. St. Clair County has been experiencing an accelerating population decline which is expected to continue into the near future. St. Clair County ranks second in AVMT within the study area. The Illinois EPA recommends that St. Clair County be included in the Metro-East nonattainment area for the annual $PM_{2.5}$ 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. Monroe has moderate levels of $PM_{2.5}$ and VOCs, and relatively low levels of all other $PM_{2.5}$ precursors, accounting for only 7.7% of emissions in the Metro-East study area. It is currently designated as nonattainment for annual $PM_{2.5}$ and is immediately adjacent to a county with a violating monitor. Additionally, Monroe County has a relatively high commuting percentage, and although total AVMT accounts for less than 5% of the total AVMT within the study area, 34.5% of that portion commutes outside of the county. Due to these reasons, the Illinois EPA recommends that Monroe County be included in the Metro-East nonattainment area for the annual $PM_{2.5}$ 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 $PM_{2.5}$ standard. Jersey County has low levels of precursor emissions, low population and population density, low urban land cover, and a negative population growth rate. For these reasons, the Illinois EPA recommends that Jersey County be designated as attainment/unclassifiable for the NAAQS.

- ***Clinton Count*y**. Clinton County was included in the St. Louis MSA boundaries established by the U.S. Census Bureau in 2003. This county is primarily rural, with low 2023 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 fourth as a percent of the MSA. Expected rates of population growth have been moderate since 2005 and are slowing, with total population being relatively low at 5.2%. For these reasons, the Illinois EPA recommends that Clinton County be designated as attainment/unclassifiable for the NAAQS for annual $PM_{2.5}$.
- ***Randolph County*.** As defined by the U.S. Census Bureau, Randolph County is not part of the St. Louis MSA. A portion of it, Baldwin Township is, however, included in the current annual $PM_{2.5}$ nonattainment area recommendation. This rural county has low population and population density, low urban land cover, and a negative population growth rate. Randolph County has a slowly decreasing moderate level of $PM_{2.5}$ and precursor emissions (except for VOC, which is increasing, like it is in the rest of the MSA), especially SO_2 and NOx, which have dropped by 92% and 52% respectively since 2012 However, virtually all the County's emissions originate in Baldwin Township. and due to its close proximity to the southern edge of St. Clair County, the Illinois EPA recommends that Baldwin Township (Precinct), east of the Kaskaskia River, be designated as nonattainment for the annual $PM_{2.5}$ 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 MSA as defined by the U.S. Census Bureau in 2003. None of these three counties are included in the current annual $PM_{2.5}$ nonattainment area. These counties are primarily rural, with low 2023 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 Illinois EPA recommends that Macoupin, Bond, and Calhoun Counties be designated as attainment/unclassifiable for the NAAQS for annual $PM_{2.5}$.
- **Montgomery County.** Montgomery County is not included in the current annual $PM_{2.5}$ nonattainment area, nor is it part of the St. Louis 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 did have a large electric utility source, Coffeen, however, it ceased operations on 1/1/2020 and was more than 45 miles away from violating annual $PM_{2.5}$ monitor in addition to being downwind from the Metro-East area. For these reasons, the Illinois EPA recommends that Montgomery County not be included in the nonattainment area and that it be designated as attainment/unclassifiable for the NAAQS for annual $PM_{2.5}$.

- **Washington County.** Washington County is not included in the current annual $PM_{2.5}$ 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 Illinois EPA recommends that Washington County not be included in the nonattainment area and that it be designated as attainment/unclassifiable for the NAAQS for annual $PM_{2.5}$.

Remainder of Illinois

Areas of the state that are not part of the Chicago or Metro-East metropolitan areas are in attainment with the primary annual $PM_{2.5}$ NAAQS, and it is recommended that all remaining counties be designated as attainment/unclassifiable.

Recommendations

Illinois EPA's recommendations for attainment/nonattainment boundary designations in Illinois for the 2024 revised annual $PM_{2.5}$ NAAQS are contained in Table 15. The location of Illinois EPA's recommended $PM_{2.5}$ nonattainment areas for the State of Illinois are shown in Figure 32.

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 2024 revised primary annual $PM_{2.5}$ standard, nor has USEPA promulgated rules prescribing such. Illinois EPA's recommendations are consistent with the guidance memorandum provided by USEPA and are based on an evaluation of current air quality, the location and magnitude of $PM_{2.5}$ emission sources, and other factors. The Illinois EPA recognizes that each of the factors considered in this evaluation, when evaluated individually, are not necessarily conclusive. Rather, Illinois EPA's recommendations are based on consideration of all 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.

Public Outreach

Illinois EPA presented drafts of these recommendations to the public in February 2025, and accepted comments on the recommendations for a period of 30 days. Below is a summary of those comments.

Consideration of More Recent Data

As noted previously, this recommendation is being made in February 2025, according to USEPA requirements. Current trends indicate there may be a change in monitor design values when 2024 data is included. Illinois EPA intends to review 2024 monitoring data when it becomes available and, if warranted, will request that USEPA consider 2022-2024 data at that time.

Figure 32 Proposed Nonattainment Areas

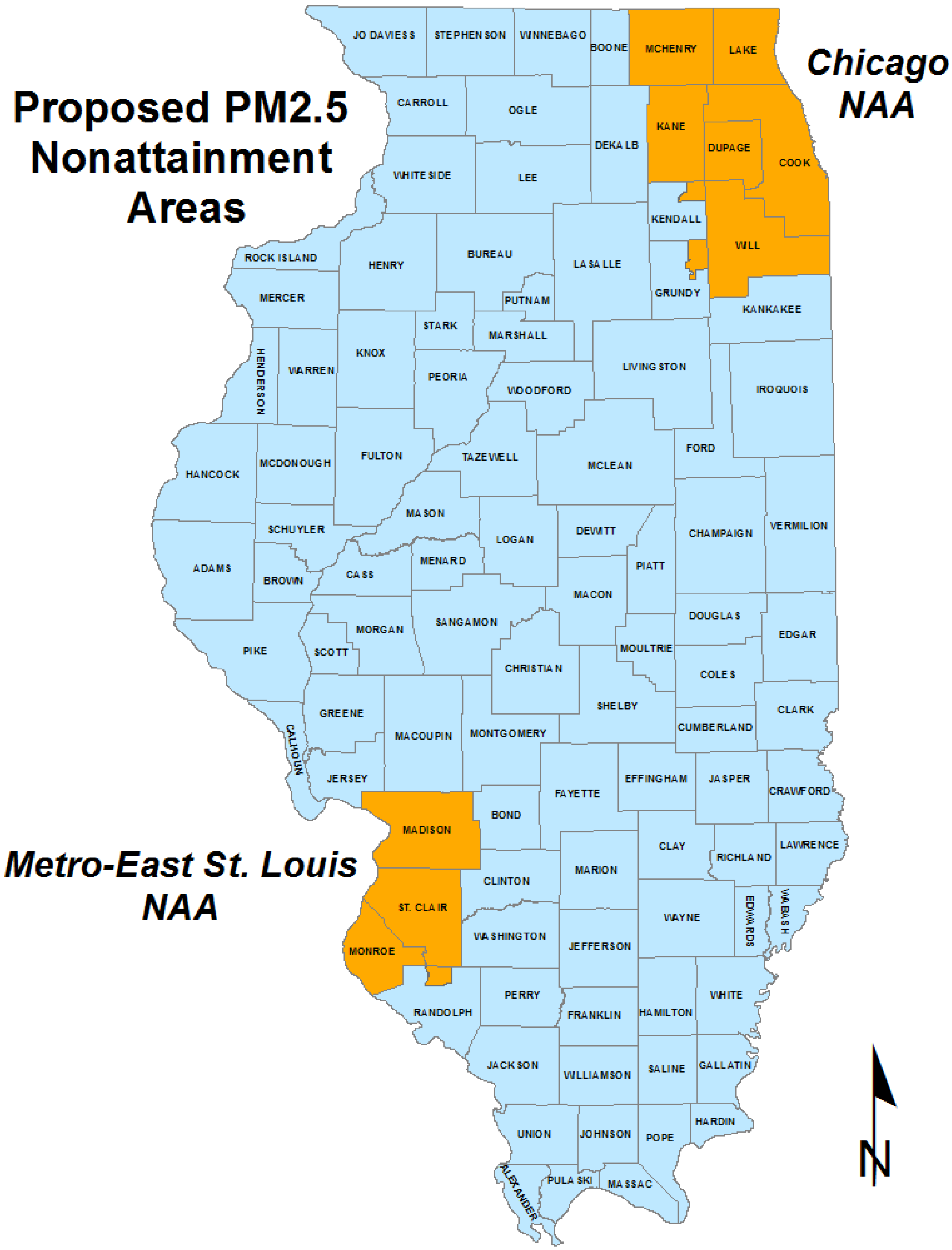


Table 15 Recommended Attainment/Nonattainment Designations in Illinois for the 2024 Revised Primary Annual $PM_{2.5}$ National Ambient Air Quality Standard

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 All Other Townships	Nonattainment Attainment/Unclassifiable	Chicago
Grundy: Aux Sable Township Goose Lake Township All Other Townships	Nonattainment Nonattainment Attainment/Unclassifiable	Chicago
Madison	Nonattainment	Metro-East
Monroe	Nonattainment	Metro-East
St. Clair	Nonattainment	Metro-East
Randolph: Baldwin Township/Precinct All Other Townships	Nonattainment Attainment/Unclassifiable	Metro-East
All Other Counties	Attainment/Unclassifiable	

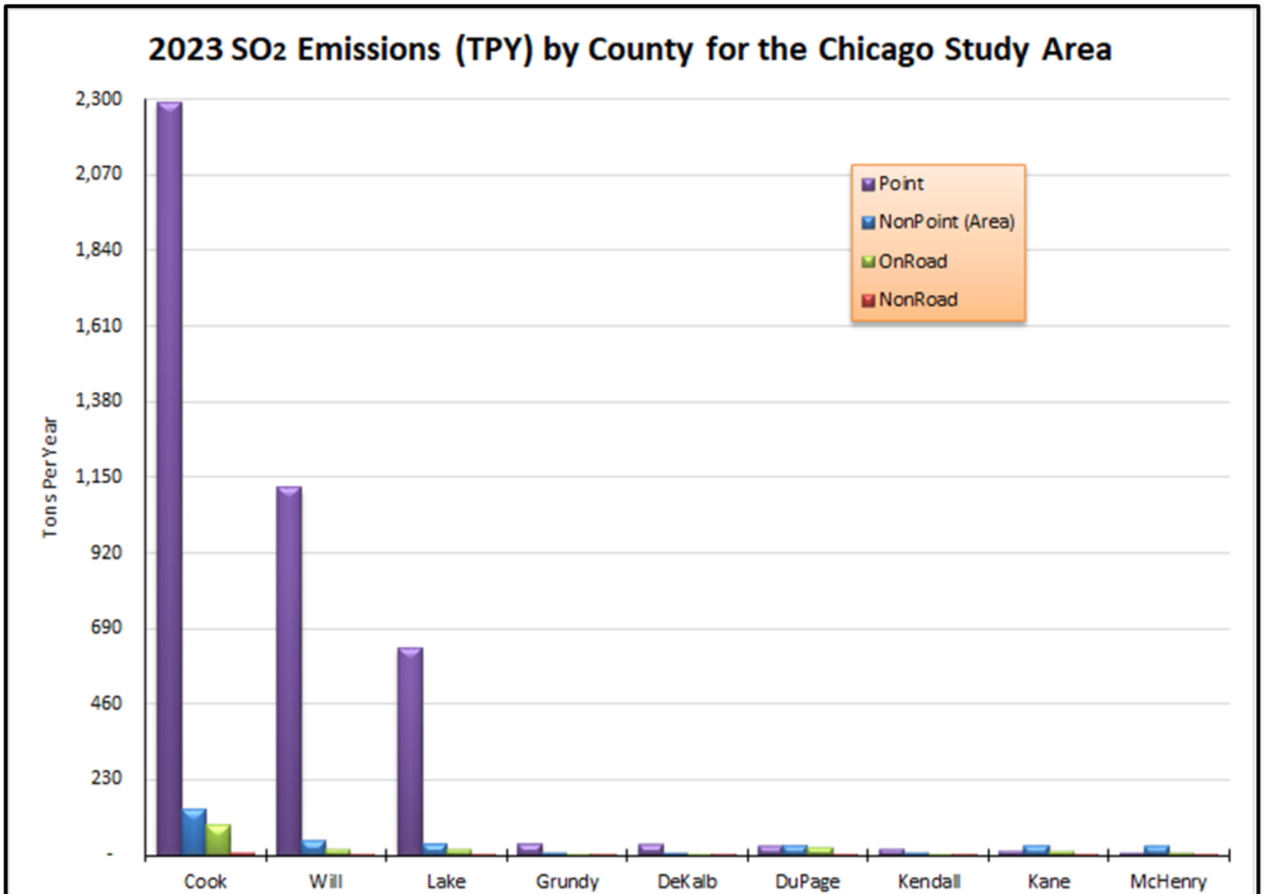
Table 16 PM2.5 NAA Boundary Recommendation Data Sources

5 Factors	Data Analysis	Data Source	Date of Study
1. Air Quality Data	Annual PM2.5 1999-2023 Design Values	https://www.epa.gov/air-trends/air-quality-design-values#dvtool	1999-2023
	2020-2022 Annual PM2.5 speciation data for Total Mass and Urban Increment Mass	USEPA Designation and Guidance Section Current Website Data per individual monitors in nonattainment areas	2021-2023
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 sources.	National Emissions Inventory (NEI) NEI is updated every three years. 2012 (previous document) used the 2011, 2023 (this document) used 2020. The NEI is updated every three years and the next NEI is due to be posted in 2026 according to the USEPA website. 2020 data can be found here: *"N:\BOA\aqp\PM2.5\2024 PM2.5\Data used\2020-national-emissions-inventory-nei-for-county-emissions.xlsx"*	2020
	Source locations in non-attainment areas and adjacent counties	Point source data collected from ICEMAN. Plotting data into map: ArcGIS	2023
2 Population Density and Urbanization	Annual Estimates of the Population in Illinois. Total population and population density estimates	Tables 3,4,5, & 10,11,12 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 From April 1, 2020, to July 1, 2023: https://www.census.gov/data/tables/time-series/demo/popest/2020s-counties-total.html	2011-2012 2020-2023
	Urbanized area boundaries	Compiled by Illinois EPA's GIS unit	2024
2. Traffic and Commuting Patterns	Annual VMT tables for 2023	2023 Travel statistics: https://idot.illinois.gov/transportation-system/network-overview/highway-system/reports/illinois-travel-statistics.html, Contacted Barb.Clauser@Illinois.gov and Michael.Miller@Illinois.gov at IDOT to get individual townships.	2023
	Resident County to Workplace County Flows files table	American Community Survey - U.S. Census Bureau Current Site	2016-2020
3. Meteorology	Wind speed and wind direction data for the Chicago-Midway, Chicago O'Hare, and St. Louis-Lambert Airport and East St. Louis Monitor.	National Weather Service info used to create wind roses. Illinois EPA's modelling unit	2021-2023
	HYSPLIT Trajectory Endpoint Data for Village Hall, Gateway Medical, and East St. Louis PM2.5 Monitors	http://www.epa.gov/pmdesignations/2012standards/techinfo.htm Modelling and GIS unit collaboration	
4. Geography/ Topography	The National Elevation Dataset (NED) for Illinois	U.S. Geological Survey For example: https://www.illinois-map.org/topo-map.htm#:~:text=Illinois%20Topographical%20Features,hills%20and%20shallow%20river%20valleys	
5. Jurisdictional Boundaries	MSA/CBSA/CSA Boundaries	Office of Management and Budget Maps of Boundary Areas Political township boundaries provided by the Property Tax Division of the Illinois Department of Revenue	2020
	1997 PM2.5 NAA Boundaries	Illinois EPA BOA	

Appendix A

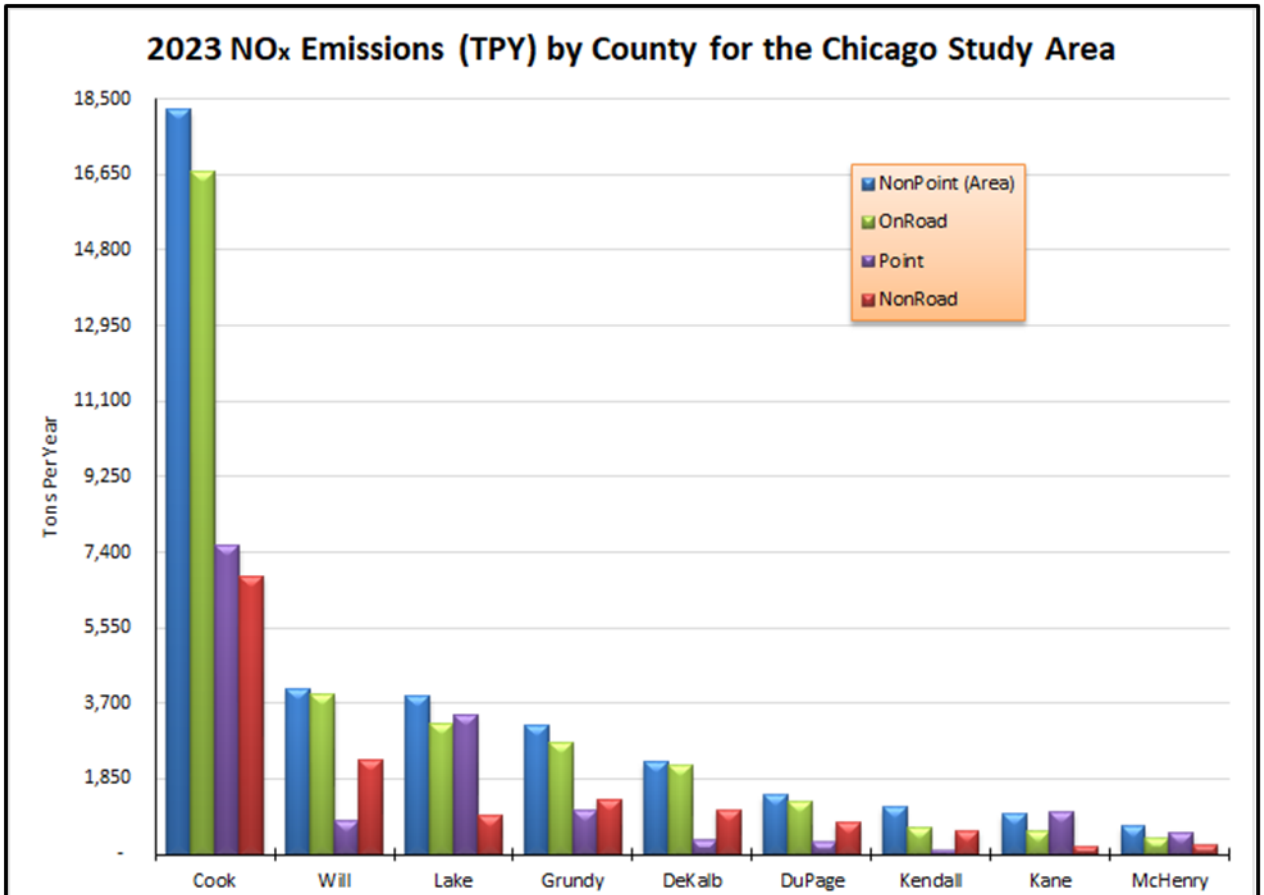
Emission Charts and Maps for the 2023 Chicago Metropolitan Study Area

FIGURE A1



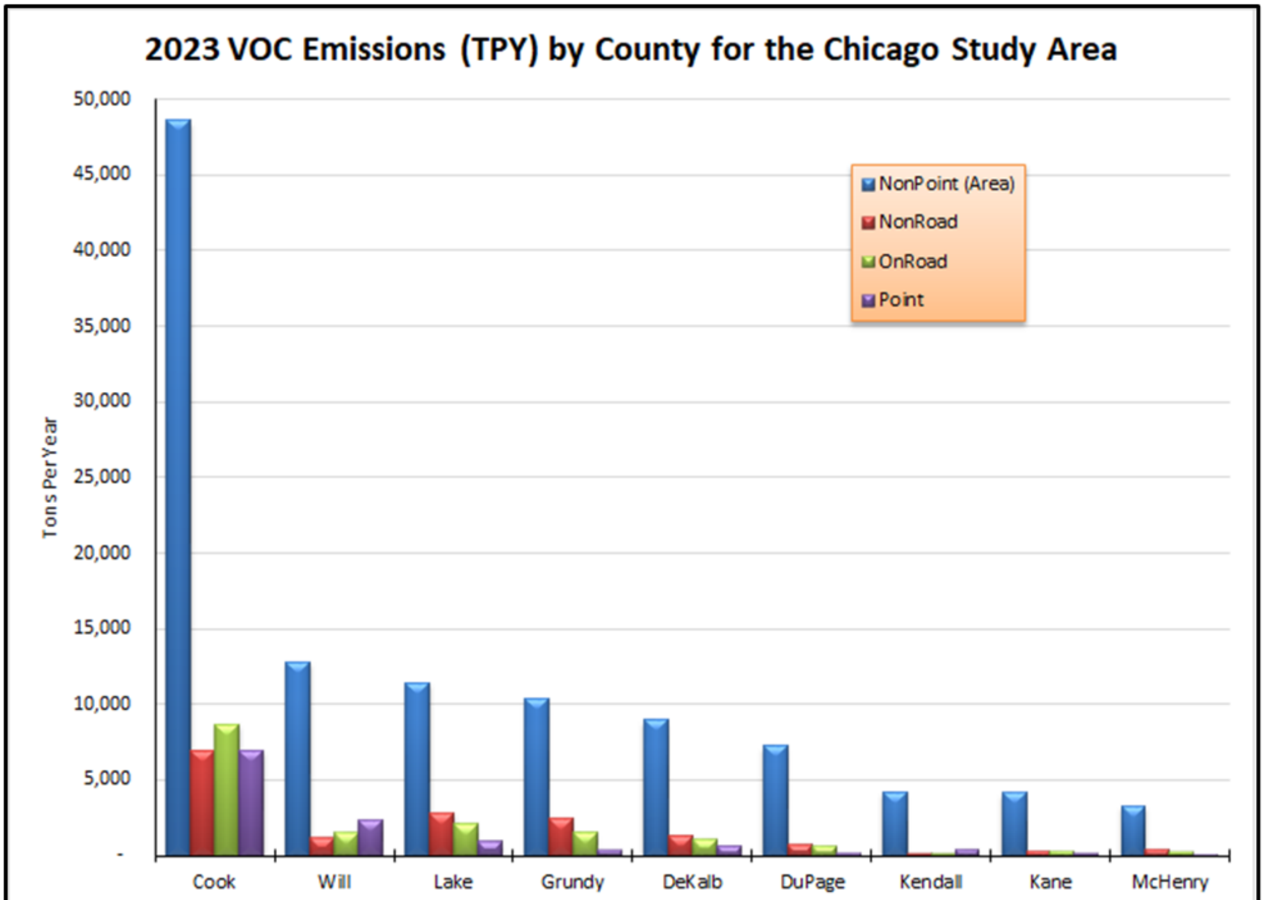
County	Nonpoint (Area)	Nonroad	Onroad	Point	Total
Cook	142	9	93	2,291	2,534
Will	45	1	17	1,120	1,184
Lake	37	2	16	633	687
Grundy	9	0	2	37	48
DeKalb	7	0	2	32	43
DuPage	30	3	22	28	84
Kendall	9	0	2	19	31
Kane	31	1	11	13	57
McHenry	28	1	7	7	42

FIGURE A2



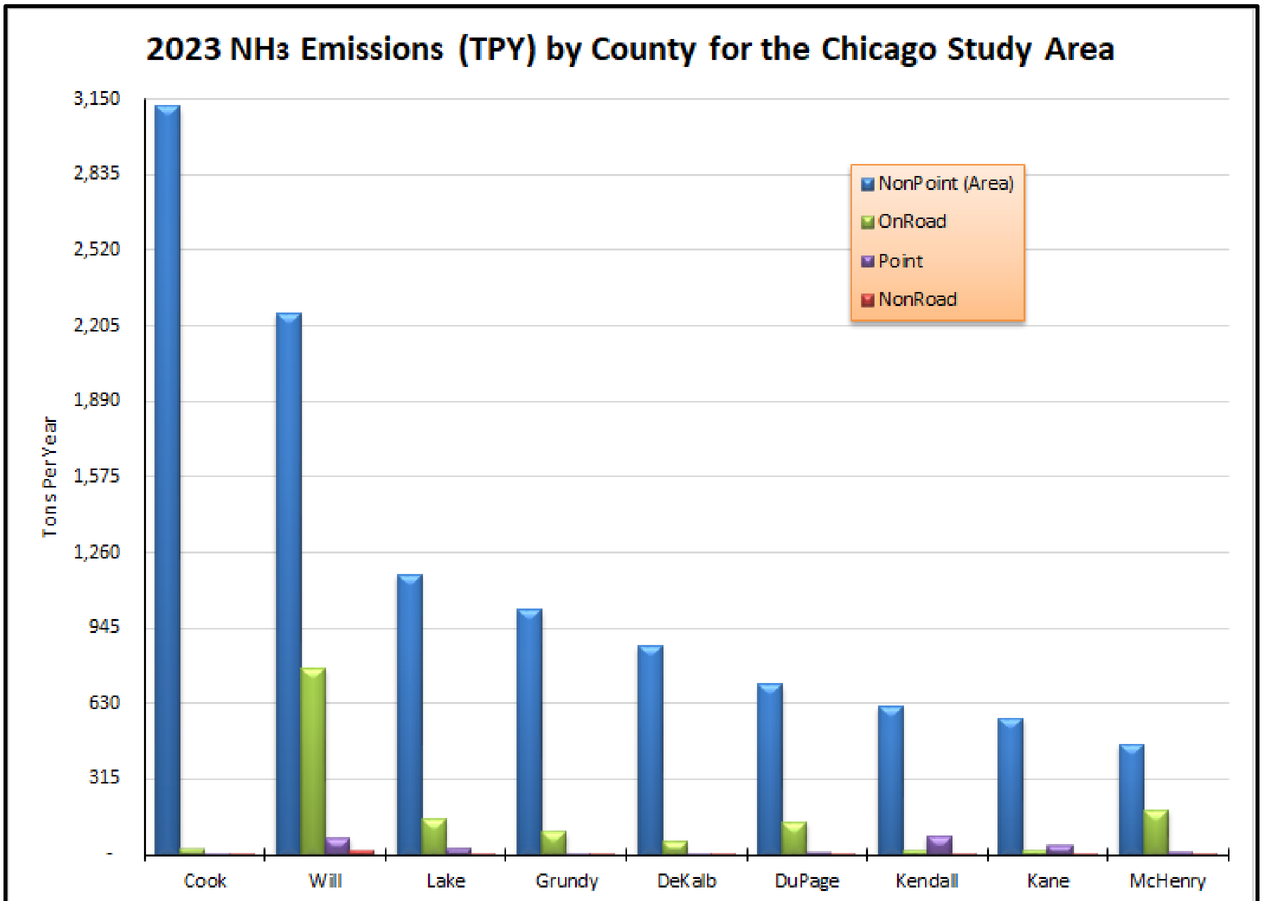
County	Nonpoint (Area)	Nonroad	Onroad	Point	Total
Cook	18,254	6,825	16,710	7,567	49,356
DuPage	4,053	2,309	3,905	829	11,095
Will	3,874	954	3,197	3,402	11,426
Lake	3,166	1,355	2,755	1,078	8,355
Kane	2,267	1,086	2,167	350	5,870
McHenry	1,448	784	1,299	307	3,838
DeKalb	1,163	595	664	113	2,535
Grundy	998	215	577	1,053	2,843
Kendall	696	237	411	530	1,875

FIGURE A3



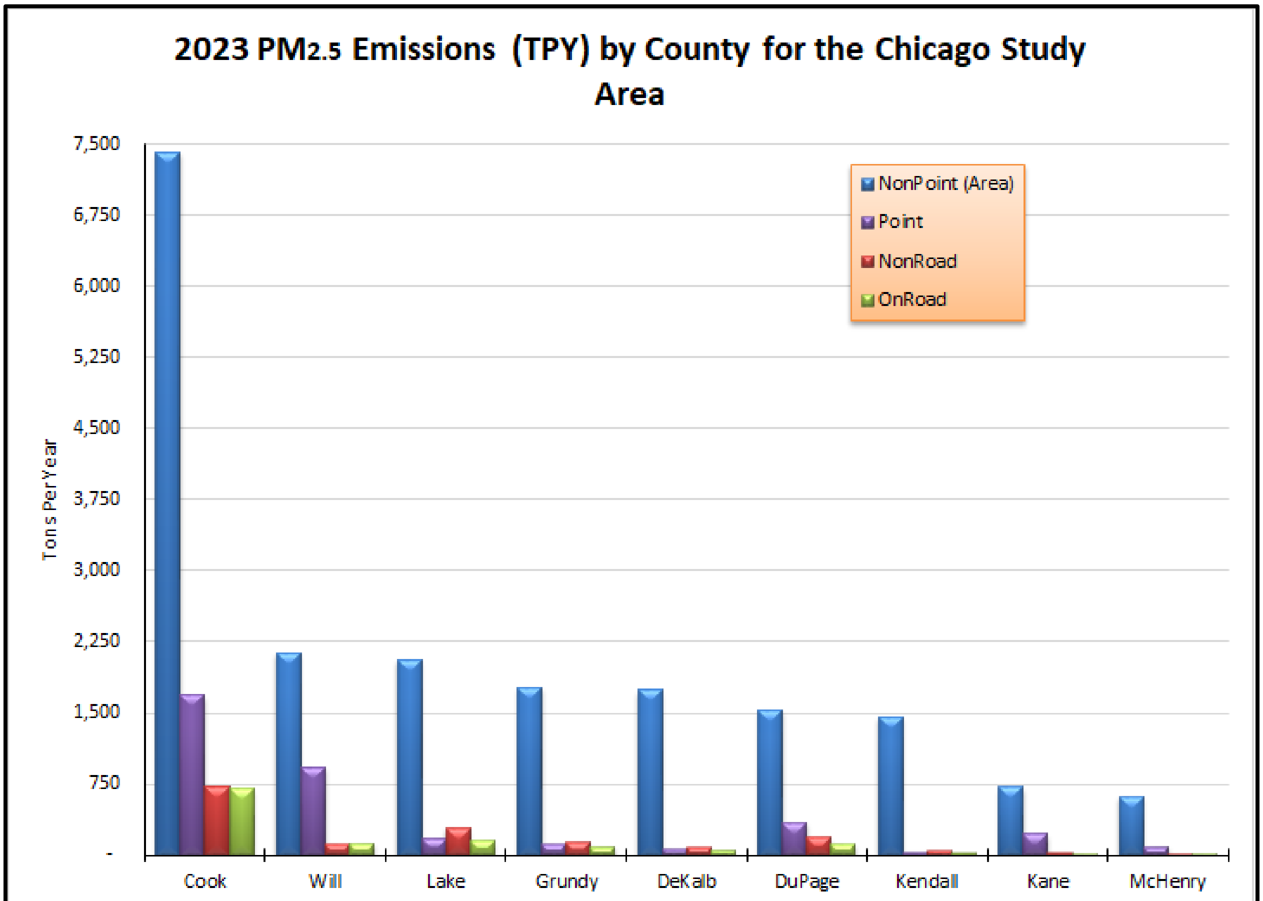
County	Nonpoint	Nonroad	Onroad	Point	Total
Cook	48,626	6,992	8,712	6,994	71,324
Will	12,799	1,180	1,505	2,403	17,887
DuPage	11,427	2,841	2,078	933	17,278
Lake	10,425	2,474	1,583	366	14,849
Kane	8,962	1,347	1,097	695	12,101
McHenry	7,245	749	689	230	8,913
Grundy	4,218	157	162	449	4,986
DeKalb	4,173	347	315	175	5,011
Kendall	3,289	465	254	70	4,077

FIGURE A4



County	Nonpoint (Area)	Nonroad	Onroad	Point	Total
DeKalb	3,120	1	23	1	3,145
Cook	2,257	18	778	70	3,124
Will	1,167	3	149	27	1,347
Kane	1,021	3	95	5	1,124
McHenry	873	2	57	2	935
Lake	711	4	137	10	863
Kendall	620	1	19	78	718
Grundy	568	0	19	38	626
DuPage	462	7	186	15	669

FIGURE A5



County	Nonpoint	Nonroad	Onroad	Point	Total
Cook	7,418	726	699	1,684	10,526
Will	2,135	114	123	929	3,300
DuPage	2,066	291	156	179	2,693
Kane	1,769	138	87	113	2,107
McHenry	1,745	83	54	63	1,945
Lake	1,536	193	113	345	2,188
DeKalb	1,458	49	23	34	1,563
Kendall	716	29	18	228	991
Grundy	616	17	18	87	738

FIGURE A6

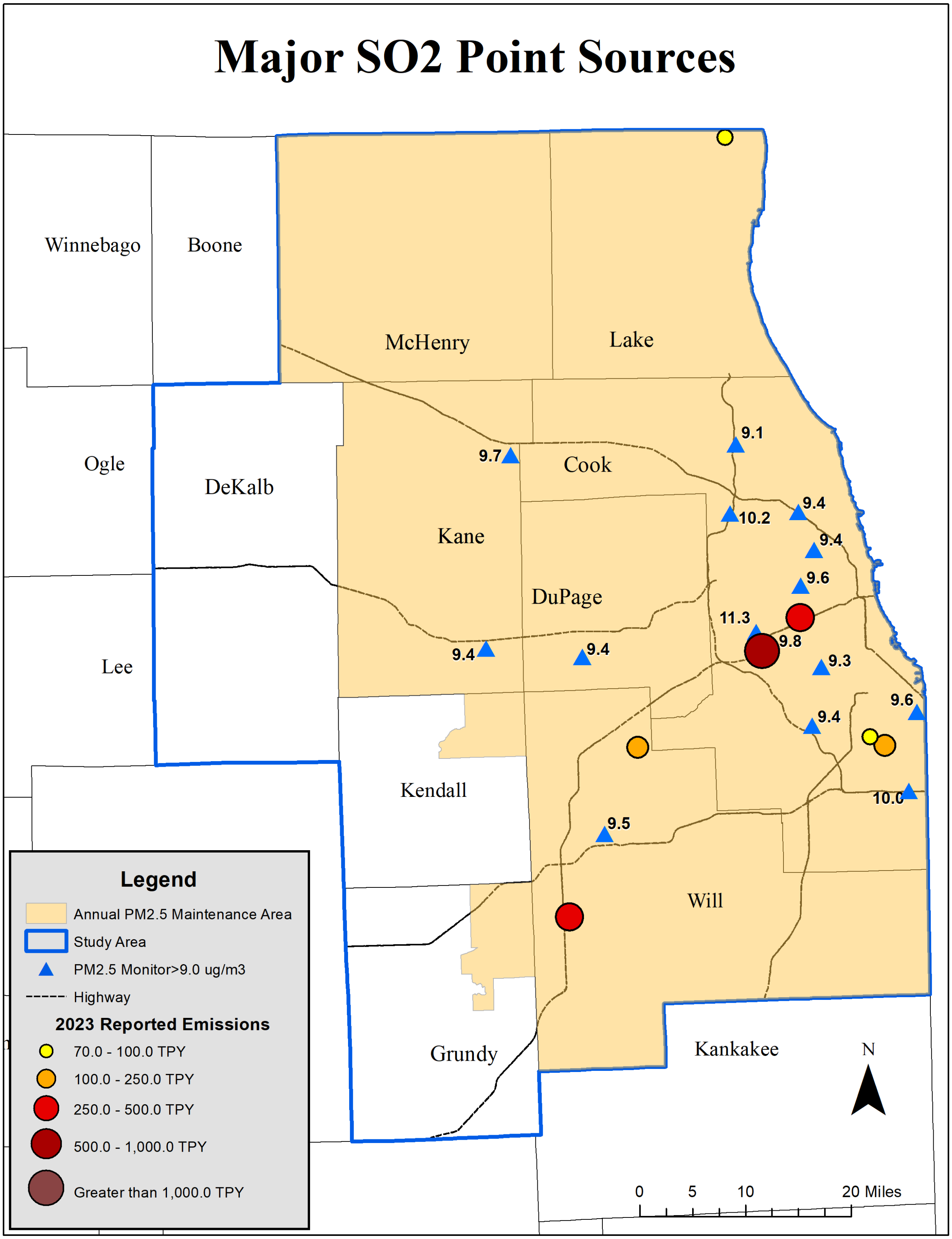

Major SO2 Point Sources
Winnebago
Boone
McHenry
Lake
Ogle
DeKalb
Cook
Kane
DuPage
Lee
Kendall
Will
Grundy
Kankakee
9.1
9.7
9.4
10.2
9.4
9.6
11.3
9.8
9.4
9.4
9.3
9.6
9.4
10.0
9.5
Legend
Annual PM2.5 Maintenance Area
Study Area
PM2.5 Monitor>9.0 ug/m3
Highway
2023 Reported Emissions
70.0 - 100.0 TPY
100.0 - 250.0 TPY
250.0 - 500.0 TPY
500.0 - 1,000.0 TPY
Greater than 1,000.0 TPY
N
0 5 10 20 Miles

FIGURE A7

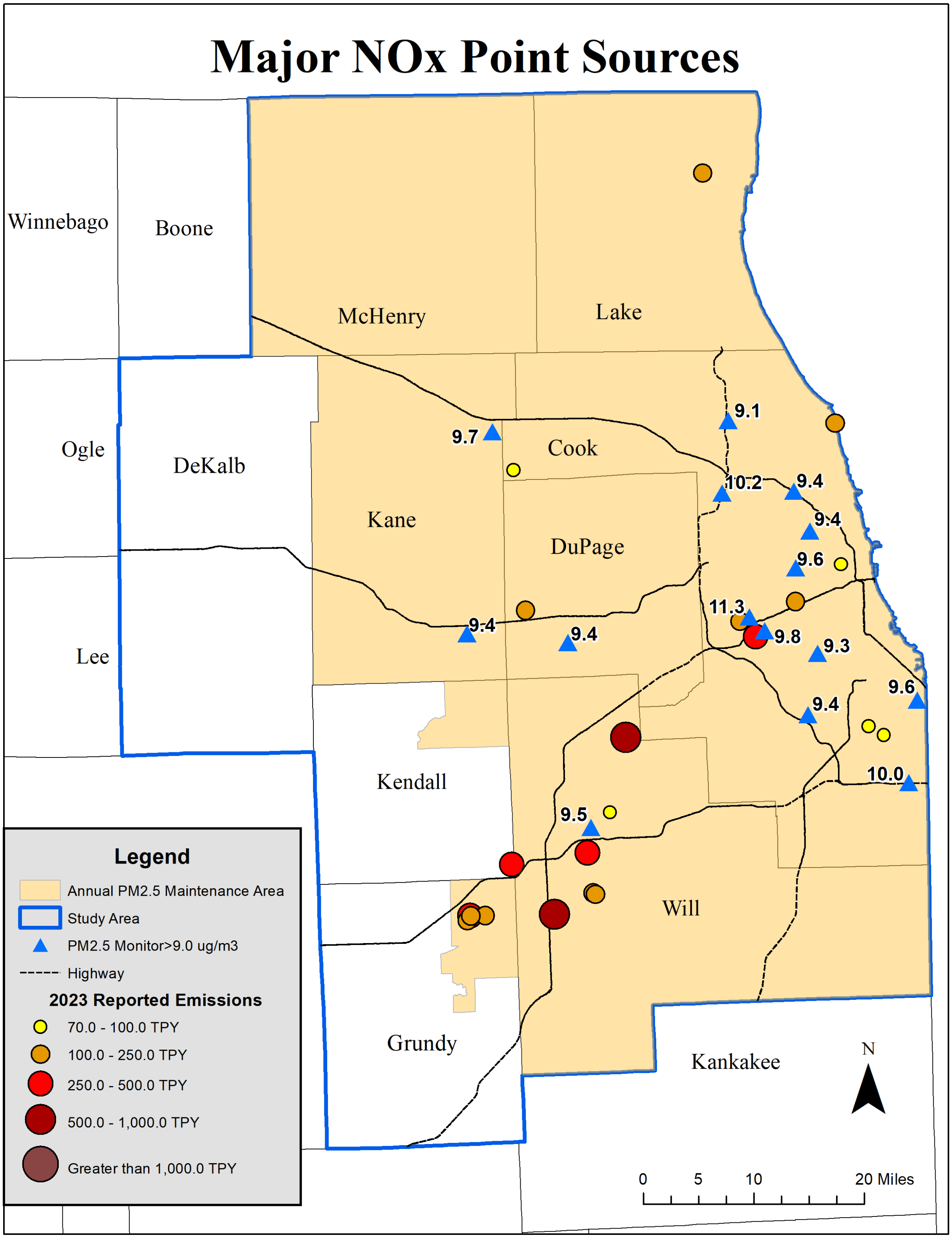

Major NOx Point Sources
Winnebago
Boone
McHenry
Lake
Ogle
DeKalb
Kane
Cook
DuPage
Lee
Kendall
Will
Grundy
Kankakee
9.7
9.1
10.2
9.4
9.4
9.6
11.3
9.8
9.3
9.4
9.4
9.4
9.6
9.4
10.0
9.5
Legend
Annual PM2.5 Maintenance Area
Study Area
PM2.5 Monitor>9.0 ug/m3
Highway
2023 Reported Emissions
70.0 - 100.0 TPY
100.0 - 250.0 TPY
250.0 - 500.0 TPY
500.0 - 1,000.0 TPY
Greater than 1,000.0 TPY
N
0 5 10 20 Miles

FIGURE A8

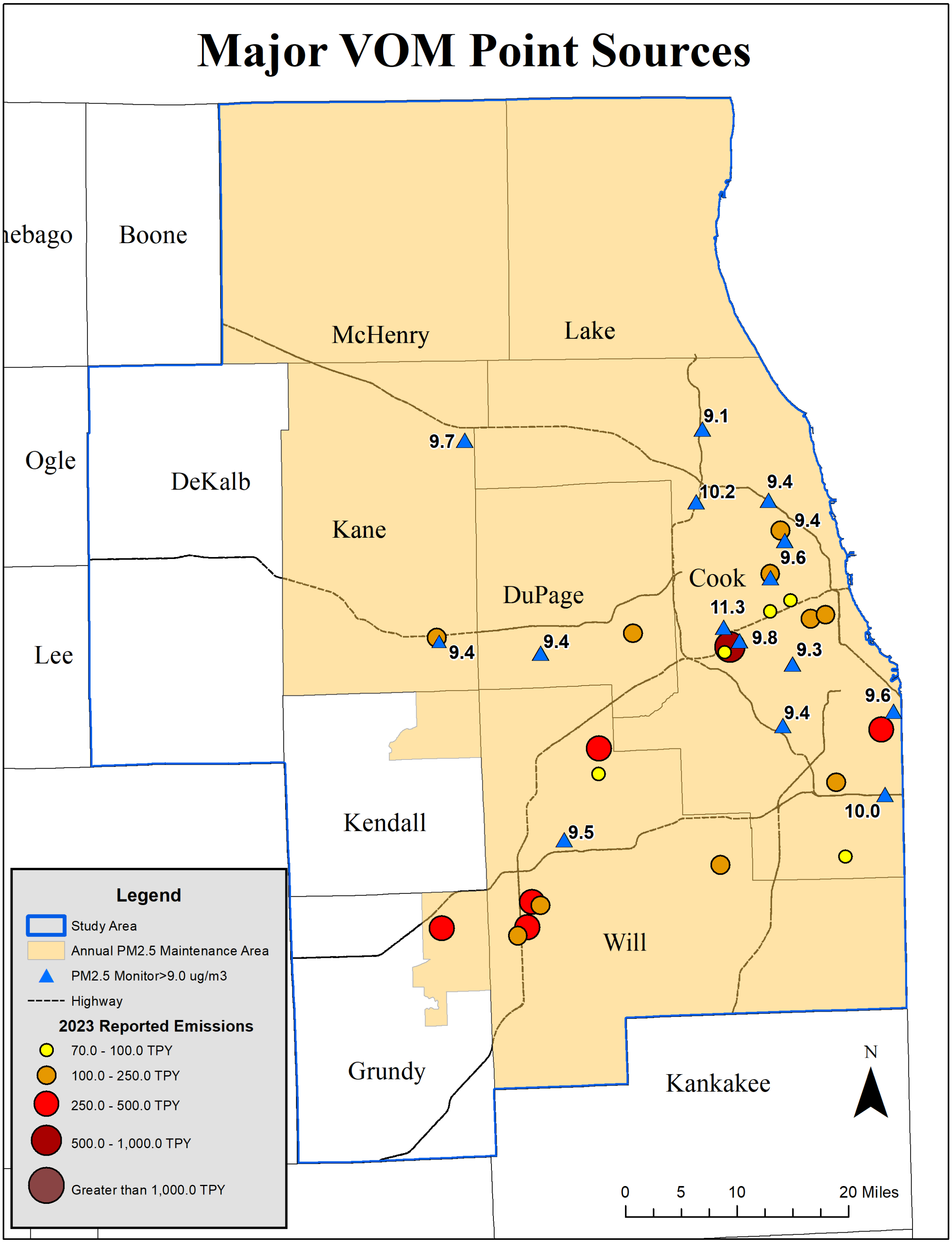

Major VOM Point Sources
nebago
Boone
McHenry
Lake
Ogle
DeKalb
Kane
DuPage
Cook
Lee
Kendall
Will
Grundy
Kankakee
9.1
9.7
10.2
9.4
9.4
9.6
11.3
9.8
9.3
9.4
9.4
9.6
9.4
9.5
10.0
Legend
Study Area
Annual PM2.5 Maintenance Area
PM2.5 Monitor>9.0 ug/m3
Highway
2023 Reported Emissions
70.0 - 100.0 TPY
100.0 - 250.0 TPY
250.0 - 500.0 TPY
500.0 - 1,000.0 TPY
Greater than 1,000.0 TPY
N
0
5
10
20 Miles

FIGURE A9

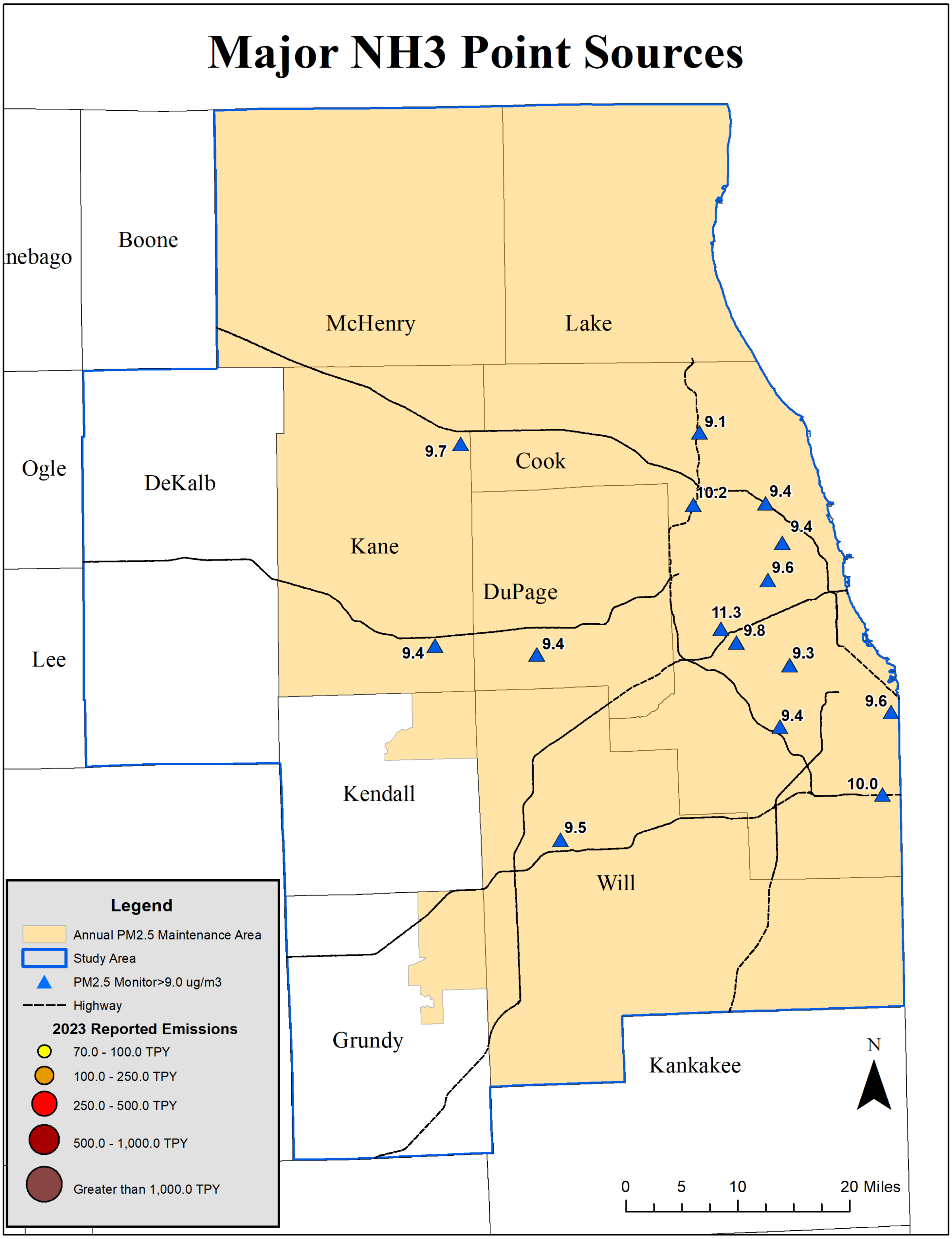
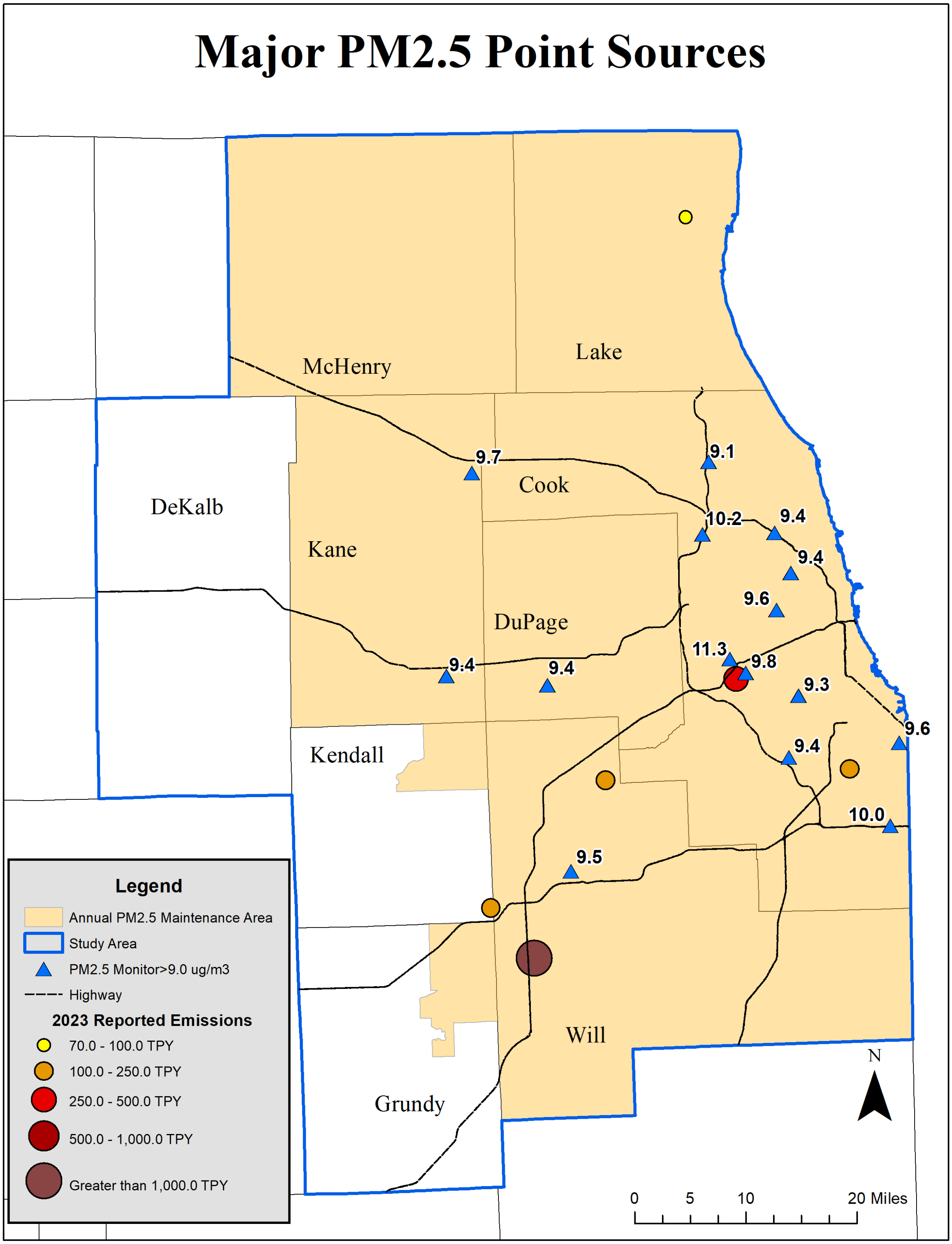

Major NH3 Point Sources
nebago
Boone
McHenry
Lake
Ogle
DeKalb
Cook
Kane
DuPage
Lee
Kendall
Will
Grundy
Kankakee
9.1
9.7
10.2
9.4
9.4
9.6
11.3
9.8
9.4
9.4
9.3
9.6
9.4
10.0
9.5
Legend
Annual PM2.5 Maintenance Area
Study Area
PM2.5 Monitor>9.0 ug/m3
Highway
2023 Reported Emissions
70.0 - 100.0 TPY
100.0 - 250.0 TPY
250.0 - 500.0 TPY
500.0 - 1,000.0 TPY
Greater than 1,000.0 TPY
N
0
5
10
20 Miles

FIGURE A10

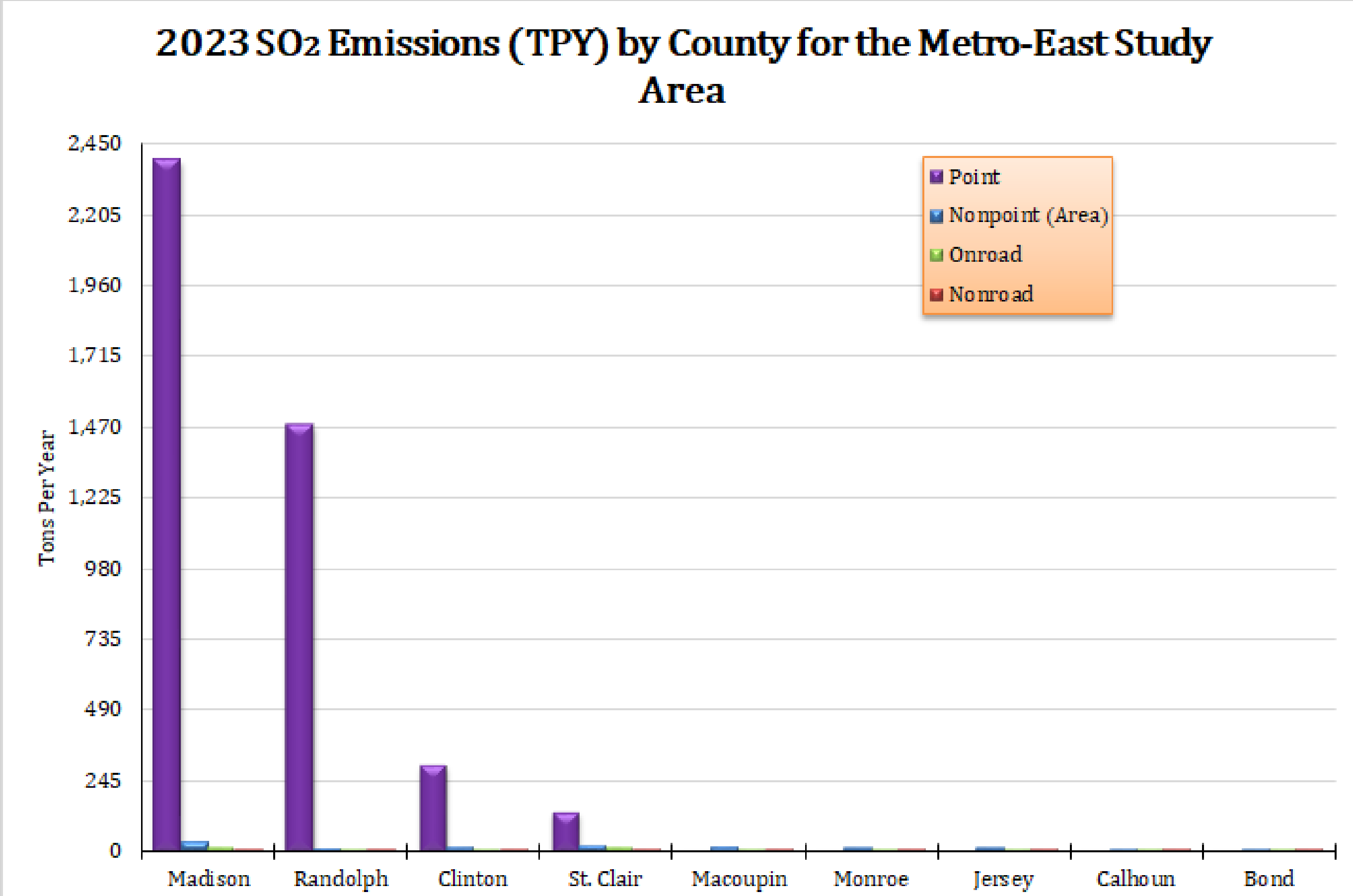


Major PM2.5 Point Sources
McHenry
Lake
DeKalb
Kane
Cook
DuPage
Kendall
Will
Grundy
9.7
9.1
10.2
9.4
9.4
9.6
11.3
9.8
9.3
9.4
9.4
9.6
9.4
10.0
9.5
Legend
Annual PM2.5 Maintenance Area
Study Area
PM2.5 Monitor>9.0 ug/m3
Highway
2023 Reported Emissions
70.0 - 100.0 TPY
100.0 - 250.0 TPY
250.0 - 500.0 TPY
500.0 - 1,000.0 TPY
Greater than 1,000.0 TPY
N
0
5
10
20 Miles

Appendix B

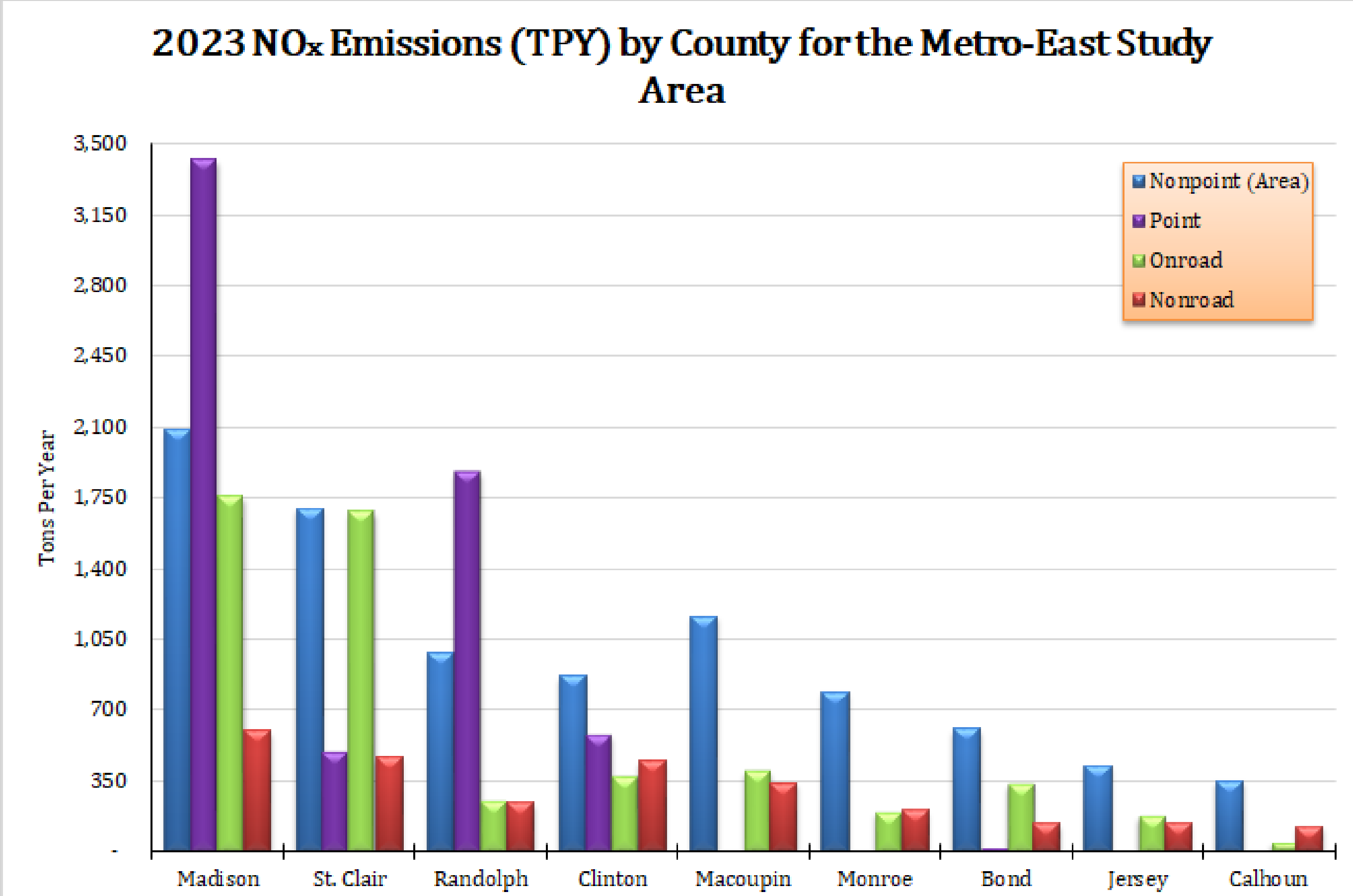
Emission Charts and Maps for the 2023 Metro-East St. Louis Study Area

FIGURE B1



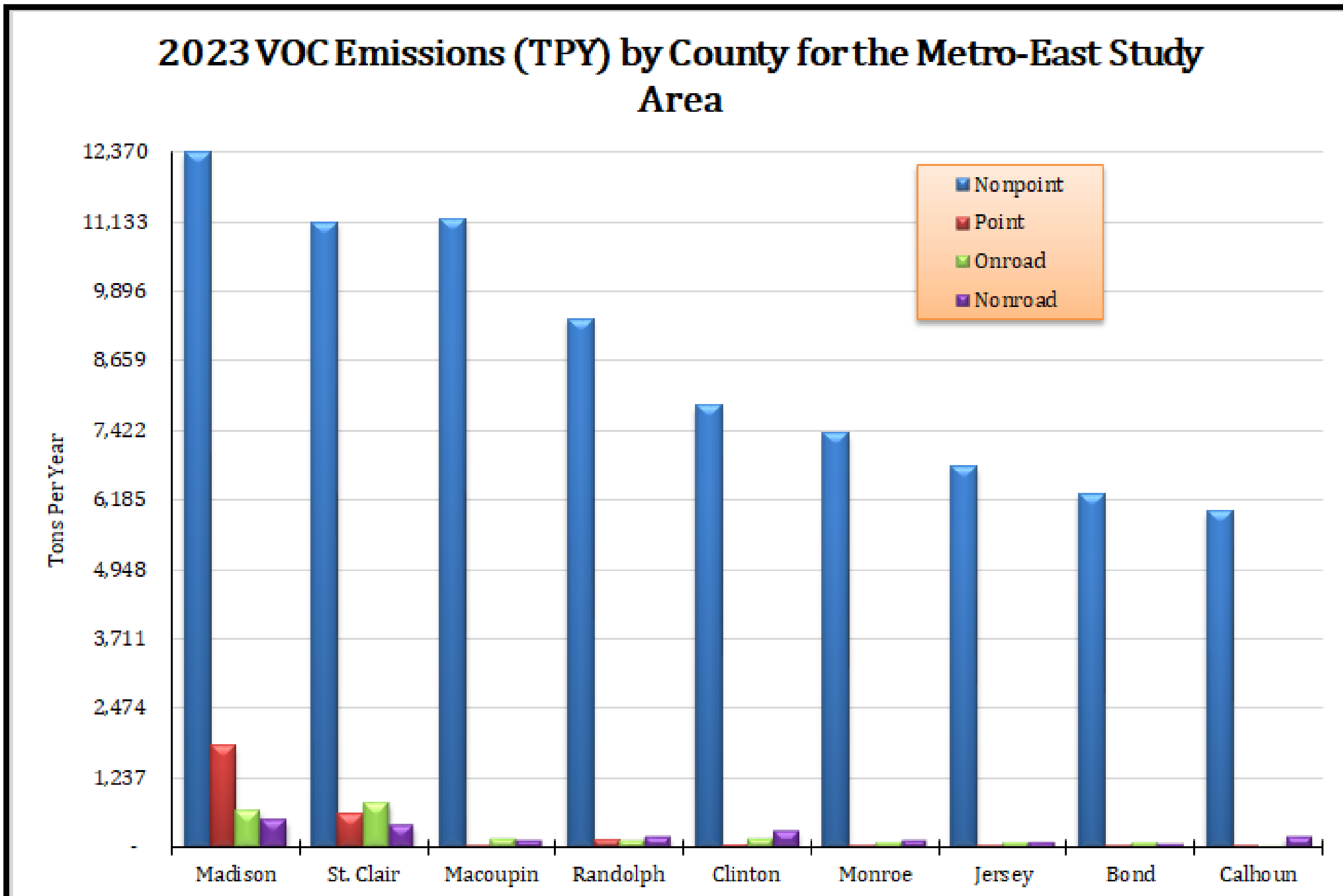
County	Point	Nonpoint (Area)	Onroad	Nonroad	Total
Madison	2,398.58	33.84	8.41	0.63	2,441.47
Randolph	1,476.94	10.01	0.79	0.19	1,487.93
Clinton	300.08	15.47	1.29	0.36	317.19
St. Clair	134.82	18.62	7.91	0.47	161.83
Macoupin	0.09	16.49	1.26	0.23	18.08
Monroe	0.08	11.89	1.06	0.16	13.18
Jersey	-	11.47	0.59	0.11	12.17
Calhoun	0.00	6.94	0.12	0.10	7.17
Bond	1.09	4.48	0.86	0.10	6.53

FIGURE B2



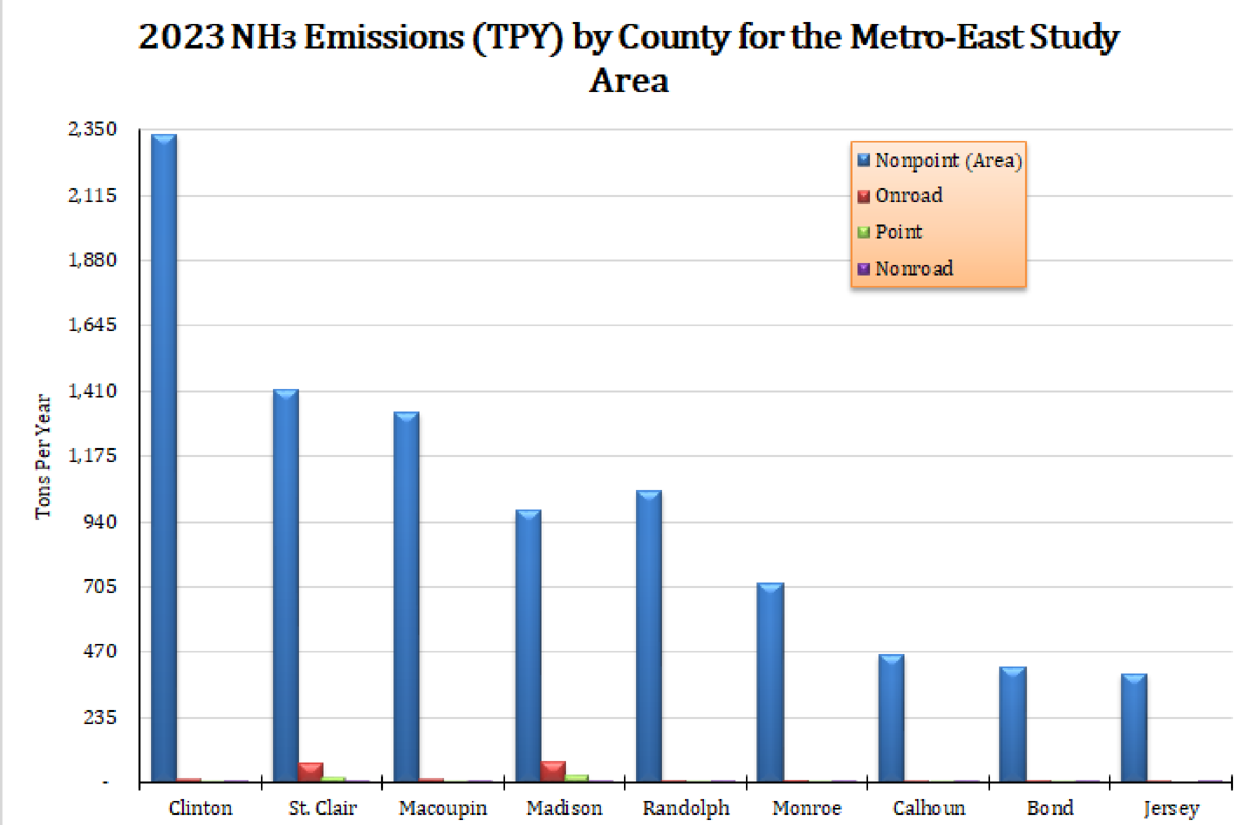
County	Nonpoint (Area)	Point	Onroad	Nonroad	Total
Madison	2,085	3,420	1,753	600	7,858
St. Clair	1,696	495	1,685	467	4,343
Randolph	980	1,878	249	241	3,348
Clinton	869	581	375	448	2,273
Macoupin	1,164	8	395	339	1,906
Monroe	788	5	197	206	1,196
Bond	609	12	335	142	1,098
Jersey	426	-	170	143	739
Calhoun	352	1	40	124	517

FIGURE B3



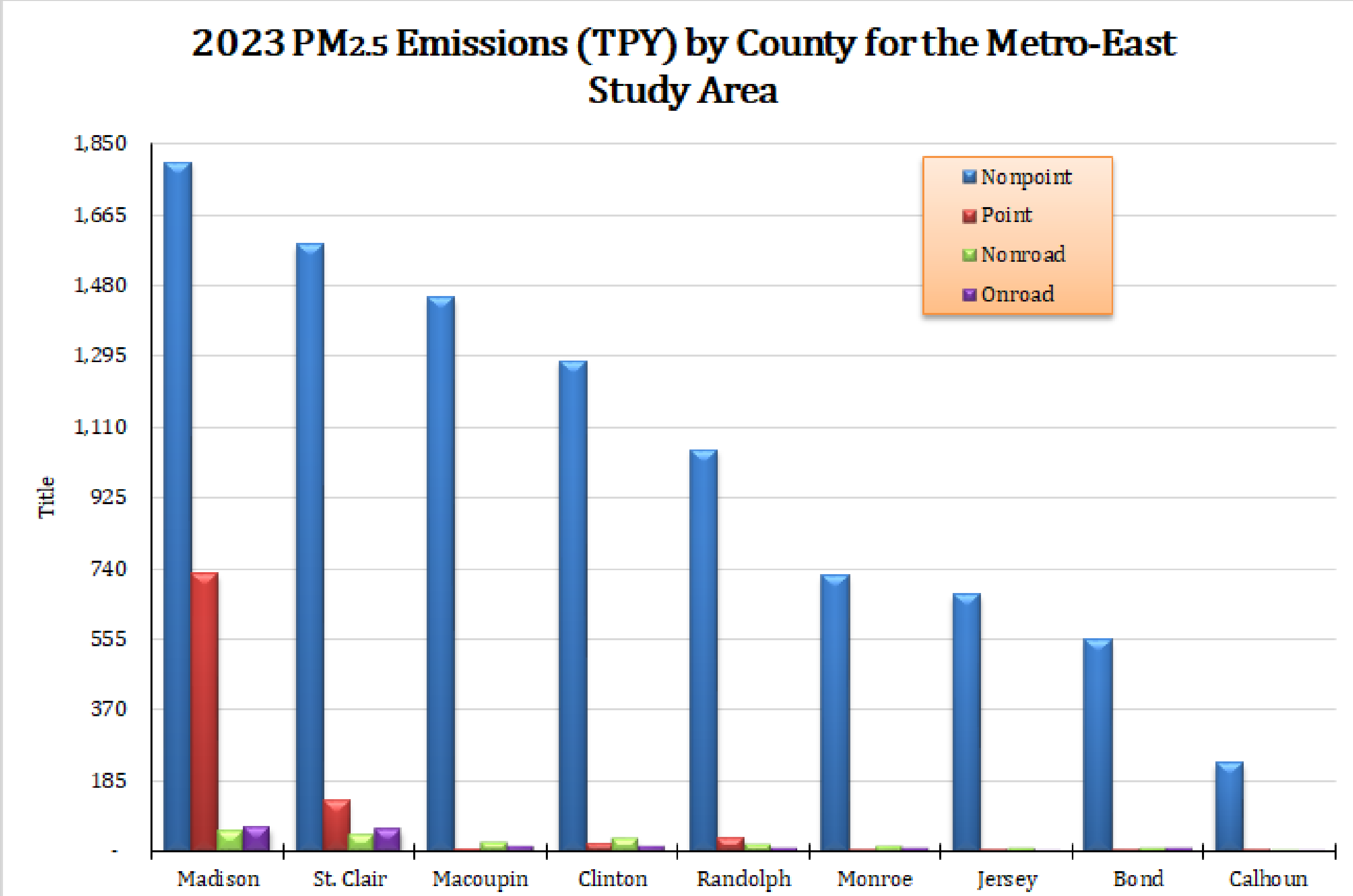
County	Nonpoint	Point	Onroad	Nonroad	Total
Madison	12,366	1,816	635	496	15,314
St. Clair	11,130.61	613.71	767.20	376.15	12,887.67
Macoupin	11,189	5	165	105	11,465
Randolph	9,406	153	124	181	9,863
Clinton	7,872	52	143	289	8,355
Monroe	7,374	5	88	114	7,581
Jersey	6,778	10	87	90	6,966
Bond	6,301	22	90	57	6,470
Calhoun	5,987	0	21	194	6,203

FIGURE B4



County	Nonpoint (Area)	Onroad	Point	Nonroad	Total
Clinton	2,335	12	0	1	2,348
St. Clair	1,413.55	73.25	15.42	1.07	1,503.28
Macoupin	1,334	12	0	1	1,346
Madison	979	75	22	1	1,077
Randolph	1,052	8	7	0	1,067
Monroe	719	9	0	0	729
Calhoun	462	1	0	0	463
Bond	415	9	0	0	424
Jersey	391	6	-	0	397

FIGURE B5



County	Nonpoint	Point	Nonroad	Onroad	Total
Madison	1,802	728	54	61	2,644
St. Clair	1,587	132	43	58	1,821
Macoupin	1,450	8	25	12	1,494
Clinton	1,283	22	32	11	1,349
Randolph	1,050	37	16	8	1,111
Monroe	721	4	15	7	747
Jersey	673	1	10	5	689
Bond	553	4	10	9	576
Calhoun	233	1	6	1	241

FIGURE B6

Major SO2 Point Sources

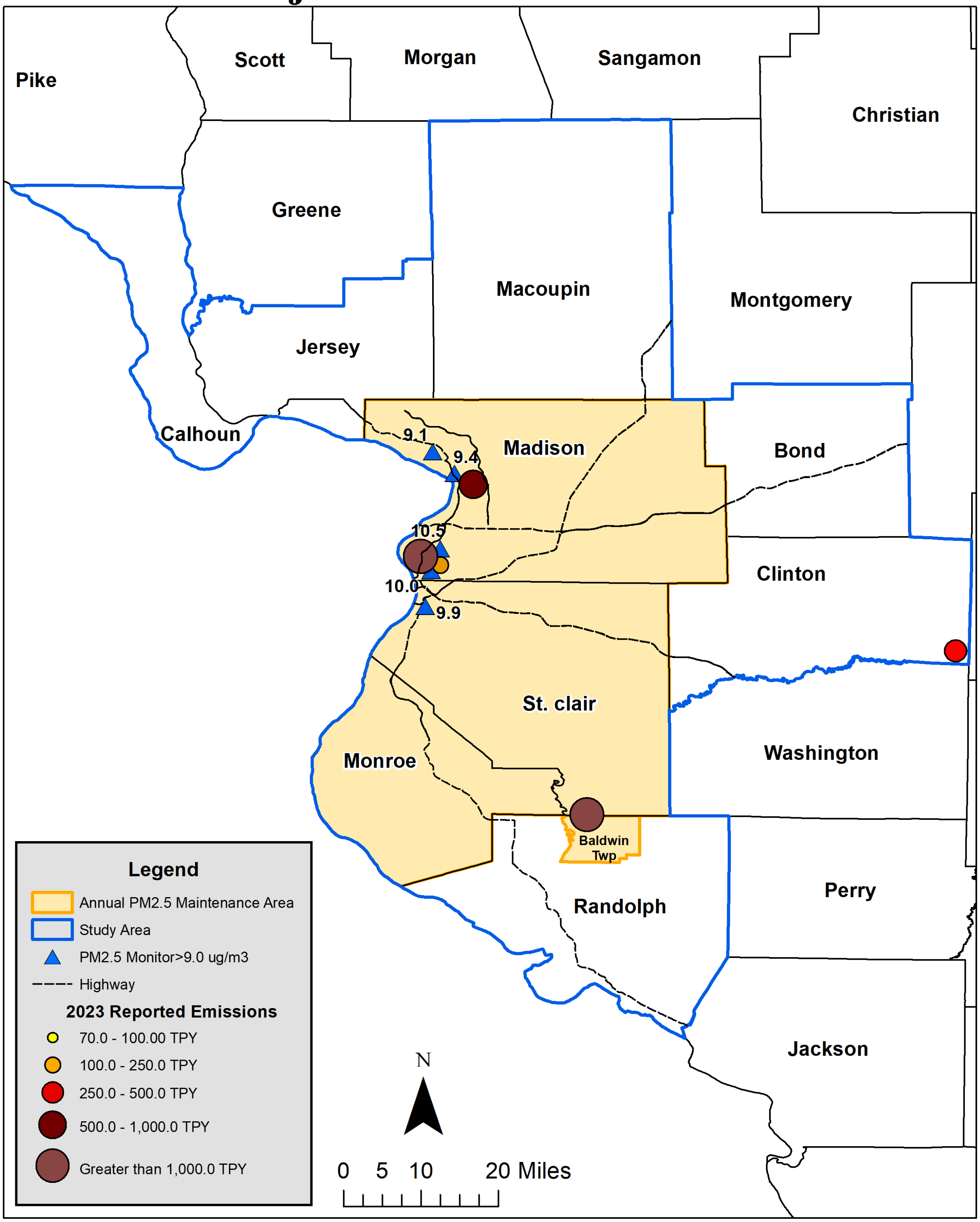


FIGURE B7

Major NOx Point Sources

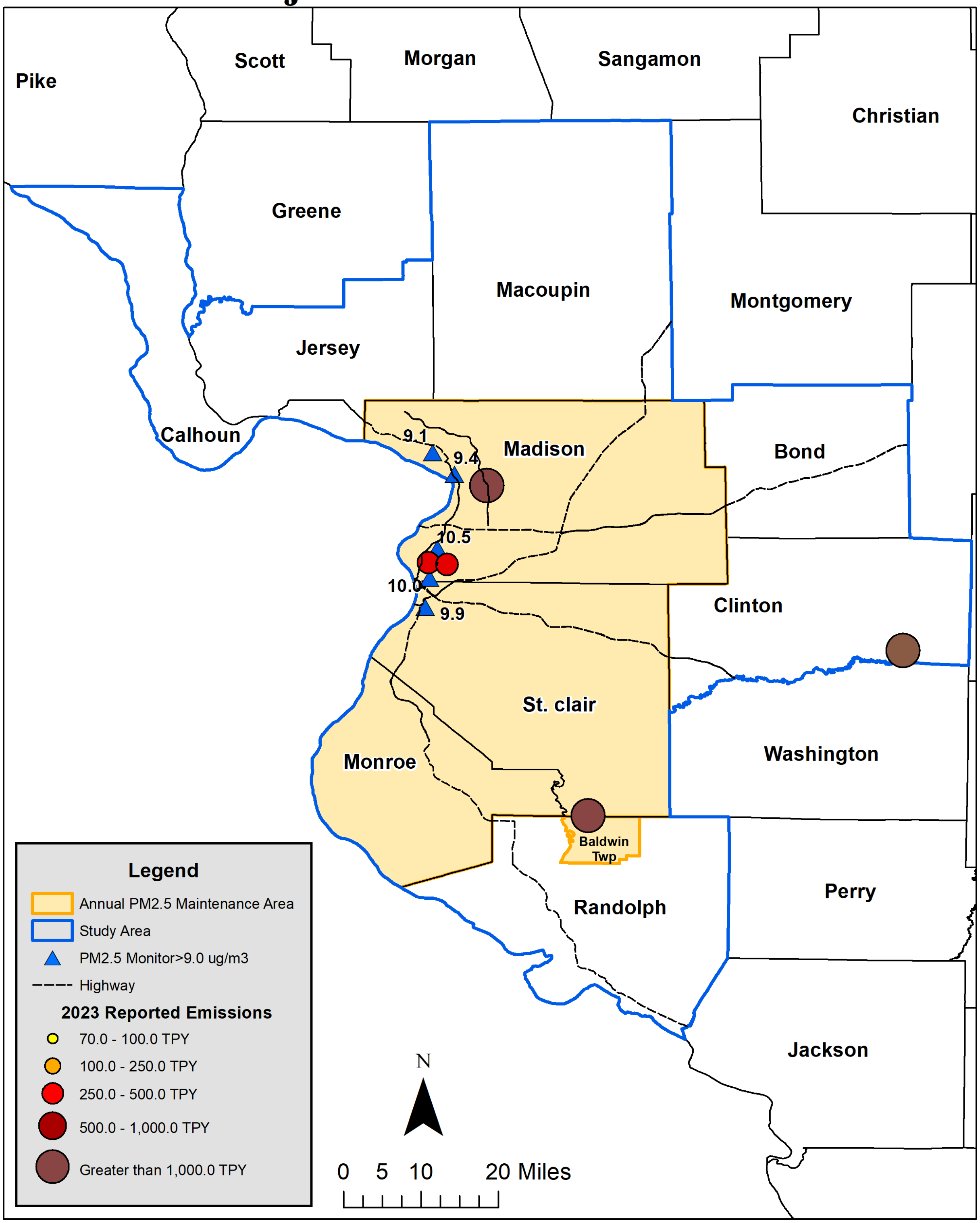


FIGURE B8

Major VOM Point Sources

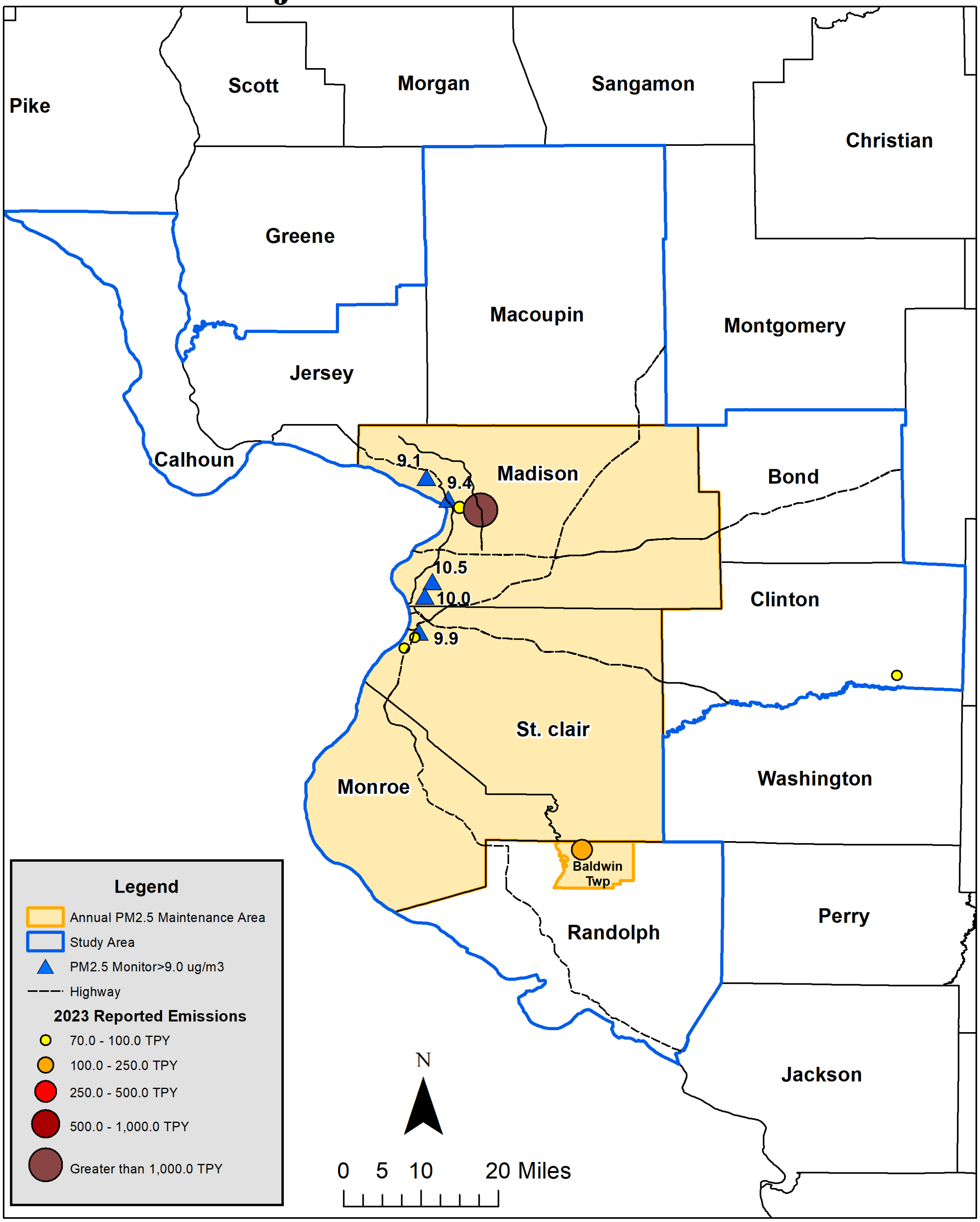


FIGURE B9

Major NH3 Point Sources

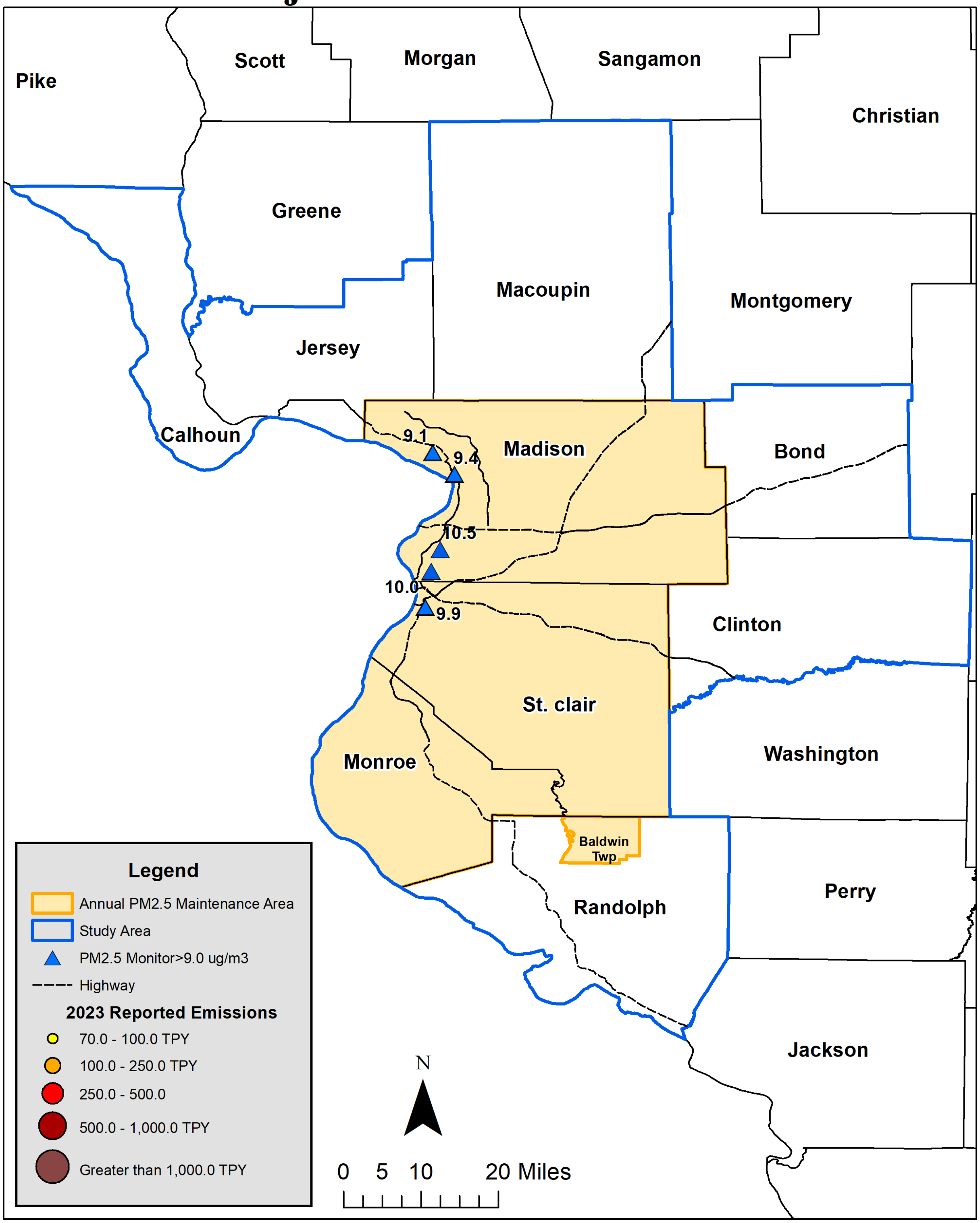


FIGURE B10

Major PM2.5 Point Sources