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GOVERNOR

STATE OF MICHIGAN
DEPARTMENT OF
ENVIRONMENT, GREAT LAKES, AND ENERGY
EXECUTIVE OFFICE



PHILLIP D. ROOS
DIRECTOR

February 6, 2025

VIA ELECTRONIC SUBMISSION

Cheryl L. Newton, Acting Regional Administrator
United States Environmental Protection Agency
Region 5
77 West Jackson Boulevard (R-19J)
Chicago, Illinois 60604-3507

Dear Acting Regional Administrator Newton:

SUBJECT: Michigan's Recommended Area Designations for the 2024 Annual PM_{2.5}
National Ambient Air Quality Standard

By way of this letter, the Michigan Department of Environment, Great Lakes, and Energy (EGLE), herein referred to as Michigan, submits the enclosed recommendation entitled, "Michigan's Recommended Area Designations for the 2024 Annual PM_{2.5} National Ambient Air Quality Standard," as allowed under Section 107(d)(1)(A) of the federal Clean Air Act.

The designation recommendations are based on the most current PM_{2.5} monitoring data, including ambient PM_{2.5} data for the period 2021-2023 from all monitoring stations within Michigan, and preliminary 2024 ambient data in the case of Missaukee and Washtenaw Counties (see below).

To determine the attainment status of areas within Michigan based on the revised standard, Michigan consulted the United States Environmental Protection Agency's (USEPA) guidance, "Initial Area Designations for the 2024 Revised Primary Annual Fine Particle National Ambient Air Quality Standard" (February 7, 2024). This guidance states that the USEPA will make final designations based on a five-factor analysis, taking into consideration the Core Based Statistical Area (CBSA), Combined Statistical Area (CSA), which includes two or more adjacent CBSAs, and adjacent counties to the CBSA or CSA that have the potential to contribute to the violating monitor(s). Under this guidance, these areas would serve as the starting point or "presumptive" boundary for evaluating each nonattainment area. Michigan has used this approach in developing its recommendations. The enclosed documentation, including emissions and air quality data, population density and degree of urbanization, traffic and commuting patterns, and wind rose and HYSPLIT analyses, supports the recommended designation for each particular area.

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For Missaukee and Washtenaw Counties, Michigan evaluated nonattainment status based on quality-assured 2021-2023 ambient monitoring data, as well as preliminary 2024 ambient data for the exceeding monitors. The 2024 data utilized for this document were complete through quarter 3, whereas preliminary data were utilized for quarter 4. Michigan believes the data predictions laid out in this document will closely align with the final certified 2024 ambient data and will not change significantly enough to affect Michigan's recommendations. However, if final certified data indicates those areas exceed the new standard, Michigan will expeditiously prepare and submit an exceptional events demonstration for the USEPA's consideration prior to the announcement of its proposed final designations.

Several counties within and adjacent to previous nonattainment boundaries were evaluated to determine what, if any, adjustments need to be made to the recommendations. Below are the Area of Analysis counties Michigan evaluated in this document, the historical nonattainment areas for PM_{2.5}, and the specific counties which Michigan believes should be included in the area designations under this newly revised PM_{2.5} standard:

County of Violating Monitors	Counties in the Area of Analysis	Historical Nonattainment Counties	Recommended Nonattainment County
<i>Kalamazoo</i>	Allegan, Barry, Branch, Calhoun, Cass, Kalamazoo, and Van Buren	None	Kalamazoo
<i>Kent</i>	N/A (see exceptional events demonstration)	None	None
<i>Missaukee</i>	Missaukee	None	None
<i>Washtenaw</i>	Washtenaw	1997 and 2006 standards: Detroit-Ann Arbor, MI (Livingston, Macomb, Monroe, Oakland, St. Clair, Washtenaw, and Wayne)	None
<i>Wayne</i>	Lapeer, St. Clair, Macomb, Monroe, Oakland, Livingston, Washtenaw, and Wayne	1997 and 2006 standards: Detroit-Ann Arbor, MI (Livingston, Macomb, Monroe, Oakland, St. Clair, Washtenaw, and Wayne)	Wayne

Michigan appreciates the opportunity to provide these initial recommendations and will work cooperatively with USEPA Region 5 staff to review new ambient data. Michigan looks forward to commenting on the USEPA's own proposed designations, which, if different from Michigan's, are expected 120 days prior to promulgation of the final designations.

Cheryl L. Newton, Acting Regional Administrator

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An electronic version of the submittal, in PDF format, has been submitted to the USEPA's Region 5 office using the State Planning Electronic Collaboration System.

Questions on this submittal may be directed to Robert Irvine, Supervisor, SIP Development Unit, Air Quality Division, at 517-648-7367; IrvineR@Michigan.gov; or EGLE, P.O. Box 30260, Lansing, Michigan 48909-7760; or you may contact me.

Sincerely,



Phillip D. Roos
Director
517-284-6700

Enclosure

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Michigan's Recommended Area Designations
for the
2024 Annual PM_{2.5} National Ambient Air Quality Standard



MICHIGAN DEPARTMENT OF
ENVIRONMENT, GREAT LAKES, AND ENERGY

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1.0 Introduction

On February 7, 2024, the United States Environmental Protection Agency (USEPA) strengthened the 2012 primary annual National Ambient Air Quality Standard (NAAQS) for particulate matter with a diameter of 2.5 micrometer or smaller (PM_{2.5}) from 12.0 µg/m³ to 9.0 µg/m³ (89 Federal Register [FR] 16202). The USEPA also retained the existing 24-hour PM_{2.5} standard of 35 µg/m³.

Under the federal Clean Air Act Section 107(d), the USEPA is required to make PM_{2.5} attainment, nonattainment, and unclassifiable designations after a state submits recommendations based on the analysis of air monitoring data. These recommendations are due to the USEPA by February 7, 2025. This document provides Michigan's designation recommendations for the 2024 annual PM_{2.5} standard based on air monitoring data for 2021-2023, the three most recent years of quality-assured data currently available. It also considers the preliminary data available for 2024. Following this recommendation the USEPA will finalize designations based on the quality-assured data for the years 2022-2024, after a public comment period.

Based on the air quality data and the five-factor analysis discussed below, the Michigan Department of Environment, Great Lakes, and Energy (herein referred to as Michigan) is recommending designations of attainment, unclassifiable/attainment, and nonattainment. The remainder of this document discusses the analyses and results Michigan used to arrive at recommendations of attainment and nonattainment for the counties equipped with PM_{2.5} monitoring stations. Michigan is recommending all other counties in the state be designated as unclassifiable/attainment. The USEPA has historically used the "unclassifiable/attainment" category for areas that do not have monitors and where there is no reason to believe they are in nonattainment or contributing to nearby violations.

Historical Nonattainment Areas

Prior to 1997, particulate standards had been based on total suspended particulates and then particles less than 10 micrometers in diameter (PM₁₀). In 1997, the USEPA revised the NAAQS to reflect the growing body of scientific knowledge that links serious health effects to fine particles. On July 18, 1997, the USEPA promulgated two new PM_{2.5} standards – an annual average of 15 µg/m³, and a 24-hour daily average of 65 µg/m³ (62 FR 38652). On October 17, 2006, the USEPA published a revised 24-hour standard for PM_{2.5}, lowering the standard from 65 µg/m³ to 35 µg/m³ (71 FR 61144). The USEPA retained the annual standard for PM_{2.5} of 15 µg/m³. The USEPA also retained the daily standard for PM₁₀ of 150 µg/m³ but revoked the annual standard of 50 µg/m³. On December 14, 2012, the USEPA strengthened the 1997 primary annual PM_{2.5} standard, lowering it from 15.0 µg/m³ to 12.0 µg/m³, and retained the existing 2006 24-hour PM_{2.5} standard of 35 µg/m³ (78 FR 30860).

Table 1 below documents the historical PM_{2.5} nonattainment areas (NAA) and the recommended nonattainment counties for the 2024 PM_{2.5} NAAQS. Historically, Michigan had one NAA in the Detroit area for the 1997 and 2006 PM_{2.5} NAAQS. Redesignation was granted for this NAA in 2013 for the 1997 and 2006 PM_{2.5} NAAQS, respectively. These historical NAAs were taken into consideration during Michigan's analysis for designation recommendations.

Table 1. Historical Nonattainment Areas and Recommended Nonattainment Counties for 2024 PM_{2.5} NAAQS

Core Based Statistical Area (CBSA)	Counties in the CBSA	Historical 1997 Nonattainment Counties	Historical 2006 Nonattainment Counties	Historical 2012 Nonattainment Counties	Recommended Nonattainment Counties for 2024 NAAQS
Detroit-Warren-Dearborn	Lapeer, St. Clair, Macomb, Oakland, Livingston, and Wayne	Livingston, Macomb, Monroe, Oakland, St. Clair, Washtenaw, and Wayne	Livingston, Macomb, Monroe, Oakland, St. Clair, Washtenaw, and Wayne	None	Wayne
Kalamazoo-Portage	Kalamazoo	None	None	None	Kalamazoo

2.0 Monitoring Data Adjustments

Following the strengthening of the PM_{2.5} NAAQS, the USEPA provided an opportunity for public comment in the Federal Register on February 15, 2024, on their plan to apply the approved modification of the Federal Equivalent Method (FEM) for the Teledyne T640 particulate matter (PM) mass monitor, including the T640X. This revised all the PM_{2.5} concentration data for the T640 and T640X in the USEPA's Air Quality System (AQS) that was reported prior to the monitor's firmware modification (89 FR 11832). This modification aligned the T640 and T640X monitoring data with that of the Federal Reference Method (FRM) and other FEMs in order for states and the USEPA to review the three-year design value (DV) and make designation recommendations consistently across states and various types of monitors for the 2024 PM_{2.5} standard. The monitoring data utilized in this designation reflects adjustments made for the T640 and T640X monitors.

3.0 Five Factor Analysis

The USEPA's memorandum "Initial Area Designations for the 2024 Revised Primary Annual Fine Particle National Ambient Air Quality Standard" (February 7, 2024) (herein referred to as the "Designation Guidance"), stated that each area evaluated for nonattainment should be assessed on a case-by-case basis considering the specific facts and circumstances unique to the area.¹ A NAA must include not only the area that is violating the standard but also nearby areas that contribute to the violation. This analysis began with an evaluation of the 2023 Core Based Statistical Area/Combined Statistical Area (CBSA/CSA) that contains the violating monitor(s). Michigan's CBSA/CSA areas are shown in Attachment 1. Boundary recommendations were based on an evaluation of the five factors discussed in the Designation Guidance, as well as other relevant factors or circumstances specific to particular areas.

¹ (2024, February 7). Memorandum: Initial Area Designations for the 2024 Revised Primary Annual Fine Particle National Ambient Air Quality Standard [Review of Memorandum: Initial Area Designations for the 2024 Revised Primary Annual Fine Particle National Ambient Air Quality Standard]. USEPA.
https://www.epa.gov/system/files/documents/2024-02/pm-naaqs-designations-memo_2.7.2024_-ig-signed.pdf

The five designation factors used to analyze potential nonattainment boundaries were:

1. Air quality data;
2. Emissions and emissions-related data;
3. Meteorology;
4. Geography/topography; and
5. Jurisdictional boundaries.

The analysis methods for each factor are described below and the individual analysis for each NAA is provided in Section 4.0, “Recommendation Analysis for Areas with Exceeding Monitors.”

The Designation Guidance recommended the USEPA’s PM_{2.5} Designation Mapping Tool to identify disadvantaged communities for outreach efforts. Additionally, Michigan reviewed environmental justice (EJ) data to provide additional information to inform this recommendation. While this data did not influence the recommendation Michigan presents in this document, it is an important consideration when addressing updated NAAQS. Information on EJ data reviewed and community outreach completed is further discussed in the following sections. Additional governmental departments, associations, and conferences where outreach was conducted that does not specifically align with specific geographic areas were Michigan Environmental Compliance Conference, ESC Spectrum Corporation, Michigan Department of Transportation (MDOT), the Air Advisory Council, Michigan Aggregates Association, and Michigan Manufactures Association.

3.1 Factor 1: Air Quality Data

The annual revised standard is 9.0 µg/m³. Michigan operates a large network of PM_{2.5} monitors that measure using three techniques: filter-based FRM, continuous methods, and chemical speciation methods (e.g., sulfate, nitrate, organic carbon, elemental carbon, and crustal or other). The PM_{2.5} FRM filter-based monitors are deployed to characterize background or regional PM_{2.5} transport collectively from upwind sources and population-oriented sites. These monitors are located primarily in the expected high PM_{2.5} concentration areas, with additional attention given to more highly populated areas. Figure 1 shows the location of PM_{2.5} monitors across Michigan and the controlling monitors’ DVs based on the 3-year average for 2021-2023. Table 2 provides the 2023 DVs and CBSA area classifications for each PM_{2.5} monitor in Michigan.

Figure 1. Michigan PM_{2.5} Monitor Locations and 2023 Design Values

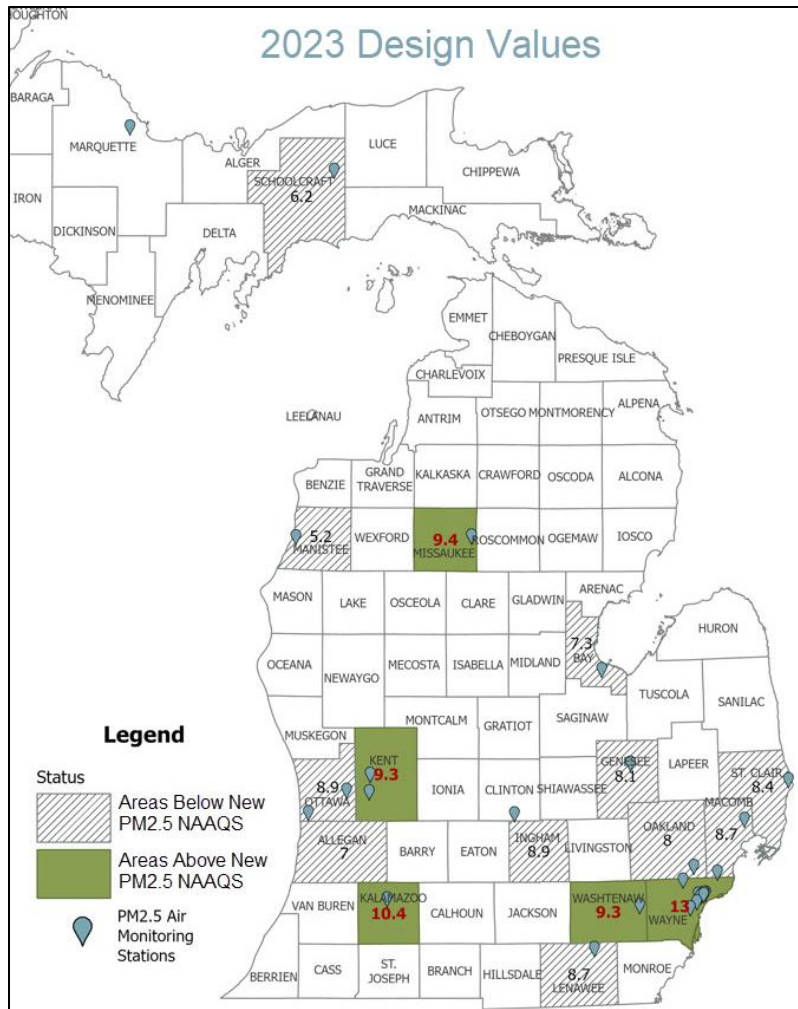


Table 2. Michigan Air Quality Monitors and 2023 Design Values.

County	Monitoring Site (AQS ID)	USEPA Final 2021-2023 Design Value (µg/m ³)	CSBA Name
Lenawee	Tecumseh (260910007)	8.7 ¹	Adrian, MI
Macomb	New Haven (260990009)	8.7	Detroit-Warren-Dearborn, MI
Oakland	Oak Park (261250001)	8.0 ¹	Detroit-Warren-Dearborn, MI
St. Clair	Port Huron – Dove St. (261470005)	8.4	Detroit-Warren-Dearborn, MI
Washtenaw	Ypsilanti (261610008)	9.3	Ann Arbor, MI
Wayne	Allen Park (261630001)	9.1	Detroit-Warren-Dearborn, MI
Wayne	Detroit - E7 Mile (261630019)	8.0	Detroit-Warren-Dearborn, MI
Wayne	Detroit - SW (261630015)	10.4	Detroit-Warren-Dearborn, MI
Wayne	Dearborn (261630033)	10.6	Detroit-Warren-Dearborn, MI
Wayne	Eliza Howell Near Road (261630093)	11.6	Detroit-Warren-Dearborn, MI
Wayne	NMH 48217 (261630097)	10.1 ¹	Detroit-Warren-Dearborn, MI
Wayne	DP4th (261630098)	10.8	Detroit-Warren-Dearborn, MI
Wayne	Trinity (261630099)	12.1	Detroit-Warren-Dearborn, MI
Wayne	Military Park (261630100)	13.0	Detroit-Warren-Dearborn, MI
Genesee	Flint (260490021)	8.1	Flint, MI
Ottawa	Jenison (261390005)	8.9 ¹	Grand Rapids – Wyoming – Kentwood, MI
Kent	Grand Rapids – Monroe St. (260810020)	9.3	Grand Rapids – Wyoming – Kentwood, MI
Allegan	Holland (260050003)	7.0 ¹	Holland, MI
Kalamazoo	Kalamazoo (260770008)	10.4	Kalamazoo-Portage Area
Ingham	Lansing / Filley Street (260650018)	8.9	Lansing-East Lansing, MI
Bay	Bay City (260170014)	7.3	Bay City, MI
Missaukee	Houghton Lake (261130001)	9.4	Cadillac, MI
Manistee	Manistee (261010922)	5.2 ¹	None
Schoolcraft	Seney (261530001)	6.2 ¹	None

¹ Invalid 2021-2023 Design Value due to incomplete quarter(s).

The air quality monitoring sites identified in Table 2 as Tecumseh, New Haven, Oak Park, Port Huron – Dove Street, Detroit – E7 Mile, Flint, Jenison, Holland, Lansing/Filley Street, Bay City, Manistee, and Seney are all below the 2024 PM_{2.5} NAAQS.

Air quality in the Grand Rapids-Wyoming CBSA was impacted in June and July 2023 by smoke entering the region from wildfires in Canada. Due to this influence, Michigan’s Air Quality Division (AQD) anticipates submitting an Exceptional Events Demonstration for the Grand Rapids-Wyoming CBSA by the submittal deadline of February 7, 2025. The days included in the Exceptional Event Demonstration are Tier 1 category days according to the USEPA’s PM_{2.5} Tiering Tool. If the USEPA grants the exclusion of the

days from the Grand Rapids monitor, PM_{2.5} DV calculations for the Grand Rapids 2021-2023 DV will be below the 2024 annual PM_{2.5} NAAQS. Based on this information, Michigan has not included a detailed analysis for the Grand Rapids-Wyoming CBSA.

The air quality data analysis completed consists of a review of air quality monitoring data, including annual DVs for PM_{2.5} based on the 3-year average of the annual mean concentrations from the 2021 to 2023 timeframe, quarterly mean concentrations from 2021 to 2023, and a 10-year historical PM_{2.5} DV trends analysis. Additionally, Michigan considered the PM_{2.5} speciated data by completing an urban increment analysis and review of recent scientifically peer-reviewed PM_{2.5} compositional analysis for the Detroit area.

3.2 Factor 2: Emissions and Emissions-related Data

The analysis for factor 2 looks at PM_{2.5}-related emissions from areas near an exceeding monitor to determine their contribution. Emissions data was derived from the USEPA 2022v1 emissions modeling platform (EMP) and the 2022 Michigan State and Local Emissions Inventory System (SLEIS) data. Emissions reductions that may occur and affect these inventories that are due to permanent and enforceable emissions controls and that will be in place in the attainment timeframe were also evaluated and are covered later in this document.

This portion of the analysis looks at sources and source categories, based on data from direct PM_{2.5} emissions, PM_{2.5} precursor emissions (nitrogen oxides (NO_x), sulfur dioxide (SO₂), volatile organic compounds (VOCs), and ammonia (NH₃)), and speciated components of direct PM_{2.5} (organic carbon, elemental carbon, crustal material). These emissions were also analyzed for any potential seasonal fluctuations. Analyzing the magnitude and extent of emissions can further inform the urban/rural air monitoring analysis, as described below. Considering meteorological data additionally informs the contributions from nearby areas versus regional contributions.

In addition to emissions data from point sources, analyses were completed reviewing mobile source emissions from the 2022v1 EMP in tandem with current and historic population, population density, degree of urbanization, and traffic and commuting patterns for areas surrounding violating monitors. Local trends in population growth and commuting patterns may indicate the probable location and magnitude of emissions sources that contribute to nonattainment. Traffic and commuting pattern data can help assess the influence of mobile source emissions in a given area.

Lastly, as stated in the USEPA's *Final Regulatory Impact Analysis for the Reconsideration of the National Ambient Air Quality Standards for Particulate Matter*, released in January 2024, nationally it has been found that among the PM_{2.5} precursors, the largest emission reductions have occurred for SO₂ and NO_x, (84% and 60%, respectively) from 2002 to 2017.² These reductions have been attributed to emission reductions at stationary sources such as electrical generating units (EGUs) for SO₂ and reduced emissions from mobile sources and EGUs for NO_x in the eastern United States. These large SO₂ and NO_x reductions in recent decades have been found to reduce regional background concentrations and increase the importance of urban influences for PM_{2.5} emissions. Furthermore, the USEPA's 2032 projections show additional large reductions in SO₂ and NO_x emissions, which further support the need

² Final Regulatory Impact Analysis for the Reconsideration of the National Ambient Air Quality Standards for Particulate Matter. (n.d.). https://www.epa.gov/system/files/documents/2024-02/naags_pm_reconsideration_ria_final.pdf

for control of local primary PM_{2.5} sources to address the highest PM_{2.5} concentrations in urban areas. Michigan has taken this into consideration when assessing and recommending nonattainment boundaries. Further discussion in relation to local SO₂ and NO_x emission reductions are discussed in the sections below to relate this national finding to the State of Michigan.

3.3 Factor 3: Meteorology

The meteorological analysis looks at the transport of emissions contributing to PM_{2.5}, which helps to identify areas contributing to elevated PM_{2.5} concentrations. This analysis includes the creation and review of wind and pollution roses, as well as Hybrid Single-Particle Lagrangian Integrated Trajectory (HYSPLIT) modeling. Wind roses depict the wind speed and direction at a singular location. Wind roses in this report were generated by Michigan staff using meteorological data from PM_{2.5} air quality monitors and nearby airports. The generated wind roses for monitoring locations and airports were then added to the USEPA PM_{2.5} Designation Mapping Tool. Michigan staff compared the wind roses generated by the USEPA and determined they were comparable to the wind roses generated by Michigan staff. The main difference between the USEPA wind roses and AQS wind roses was the number of quadrants (the USEPA having more quadrants than Michigan) and the USEPA documenting wind speed in meters per second (m/s) while Michigan documented wind speed in miles per hour (mph). Pollution roses depict concentrations of PM_{2.5} and wind direction. Pollution roses included in this report were generated by Michigan staff using pollutant concentrations and wind direction data from PM_{2.5} air quality monitors. Daily HYSPLIT data for 2021-2023 for each violating monitor were produced by the USEPA as outlined in the Designation Guidance and analyzed by Michigan. This modeling analysis produces trajectories illustrating how air masses likely traveled to reach the exceeding monitor locations for days that were representative of high concentrations of PM_{2.5}.

3.4 Factor 4: Geography and Topography

The geography and topography analysis looks at physical features that might have an effect on the distribution of particulate matter within an area. Michigan does not have significant topographic features that substantially influence the regional transport and formation of PM_{2.5}.

3.5 Factor 5: Jurisdictional Boundaries

The analysis of jurisdictional boundaries looks at the planning and organizational structure of an area to determine if the implementation of controls in a potential NAA can be carried out in a cohesive manner. This analysis considered data from the counties with exceeding monitors as well as respective CBSA and adjacent counties. The CSA for Kalamazoo was also considered.

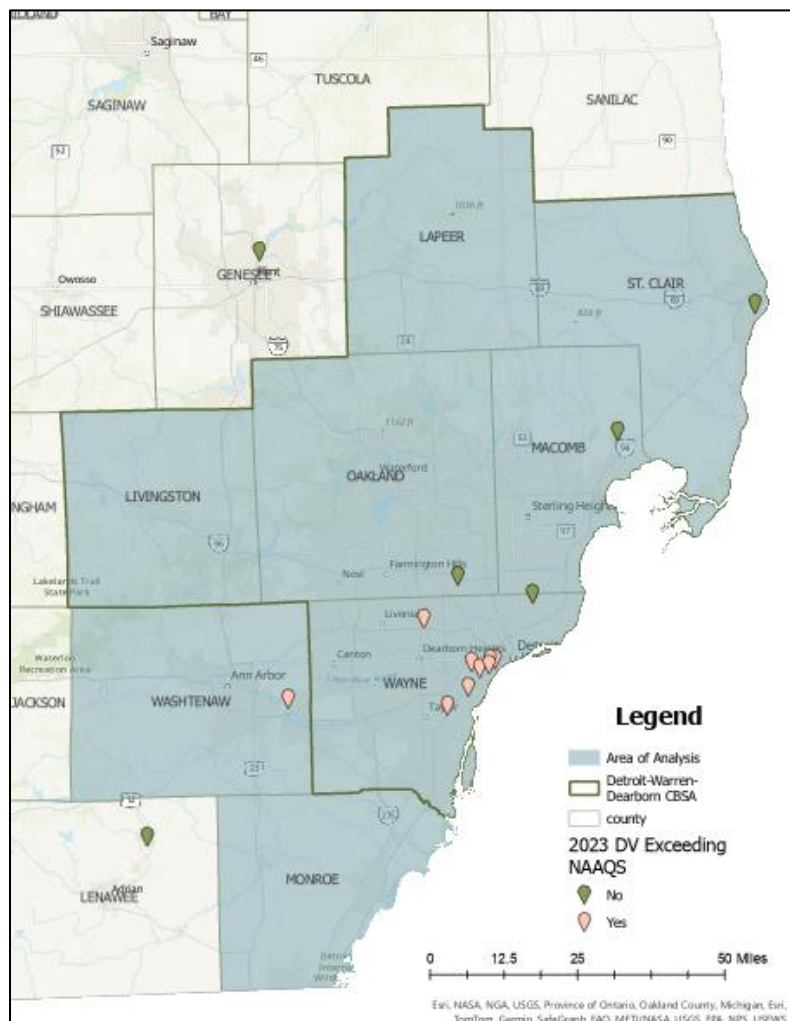
4.0 Recommendation Analysis for Areas with Exceeding Monitors

The areas discussed in Section 4.0 are areas Michigan evaluated because they have a monitor exceeding the 2024 PM_{2.5} NAAQS. Michigan made determinations of attainment and nonattainment based on these analyses. In general, areas that were evaluated had air monitor sites with 2021-2023 DVs violating the 2024 PM_{2.5} NAAQS. For additional information on Michigan's analysis, refer to the sections below.

4.1.0 Wayne County Area of Analysis

The Wayne County Area of Analysis (AoA) was evaluated because several air monitoring sites in this area exceed the 2021-2023 DV. Refer to Section 4.1.1 Wayne County AoA – Air Quality Data for additional information. Michigan analyzed the CBSA identified as the Detroit-Warren-Dearborn, Michigan Area as well as adjoining Washtenaw and Monroe counties in evaluating the Detroit area. The Detroit-Warren-Dearborn CBSA includes Lapeer, Livingston, Macomb, Oakland, St. Clair, and Wayne counties. Included as Figure 2 is the Wayne County AoA for the Detroit-Warren-Dearborn, Michigan Area. The red markers depicted in Figure 2 are air quality monitor locations with 2021-2023 DV above the revised PM_{2.5} NAAQS; the green markers depict air quality monitor locations with 2021-2023 DV below the revised PM_{2.5} NAAQS. Historical PM_{2.5} NAA for the Wayne County AoA is discussed earlier in Section 1.0. The sections included below summarize the analyses Michigan completed for this area.

Figure 2. Area of Analysis for the Detroit-Warren-Dearborn, Michigan Area



4.1.1 Wayne County AoA - Air Quality Data

Air Quality Data

The Wayne County AoA consists of 13 Michigan monitoring sites. These sites are identified in Table 2 and are depicted in Figure 2 as red and green markers. Of the 13 monitoring sites, 9 are exceeding the NAAQS. As documented in Table 3 below, 8 of the monitoring sites are in Wayne County and one site is in eastern Washtenaw County.

Table 3. Detroit Area Violating Michigan Air Quality Monitors and 2023 Design Values

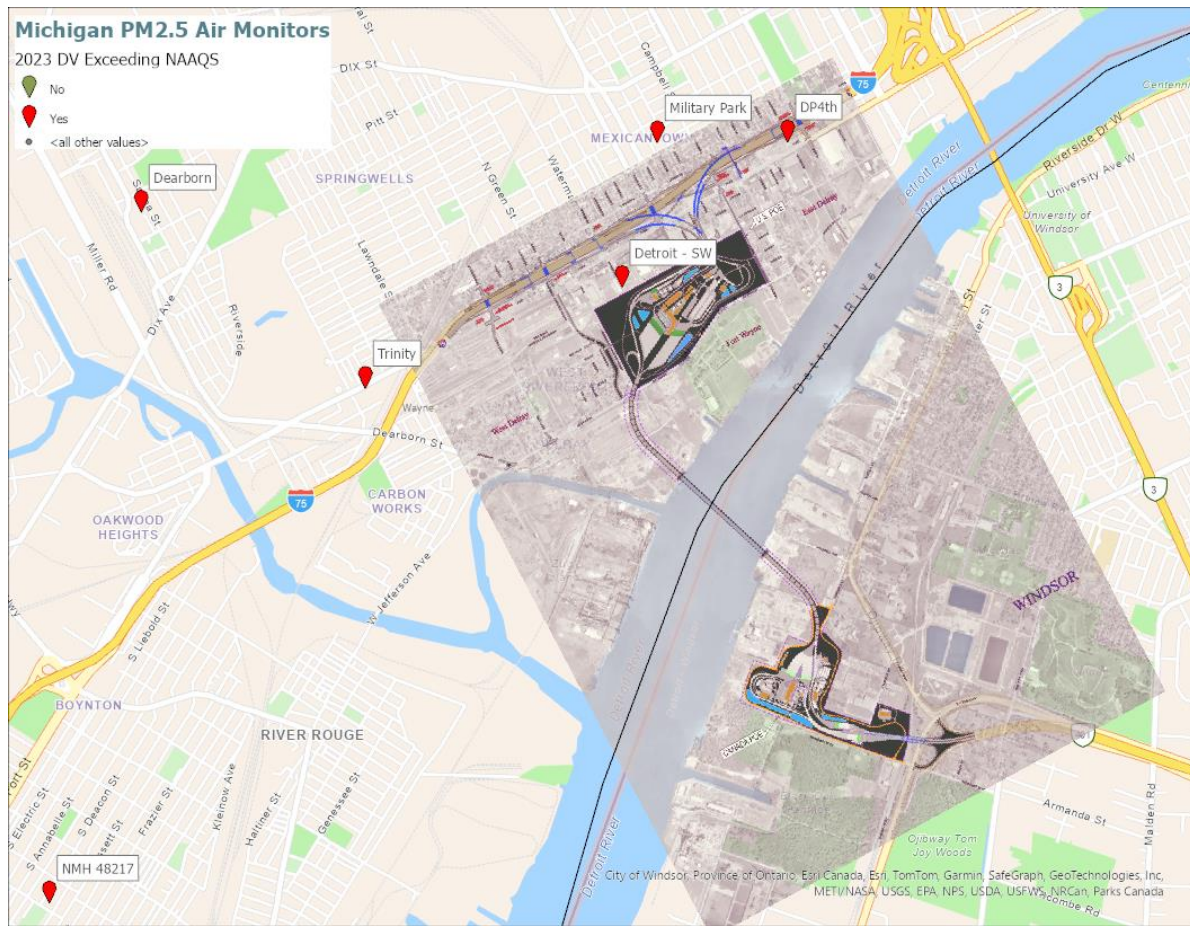
County	Monitoring Site (AQ5 ID)	USEPA Final 2021-2023 Design Value (µg/m ³)
Washtenaw	Ypsilanti (261610008)	9.3
Wayne	Allen Park (261630001)	9.1
Wayne	Detroit - SW (261630015)	10.4
Wayne	Dearborn (261630033)	10.6
Wayne	Eliza Howell Near Road (261630093)	11.6
Wayne	NMH 48217 (261630097)	10.1 ¹
Wayne	DP4th (261630098)	10.8
Wayne	Trinity (261630099)	12.1
Wayne	Military Park (261630100)	13.0

¹ Invalid 2021-2023 Design Value due to incomplete quarter(s).

Michigan considers it important to acknowledge the construction of the Gordie Howe International Bridge (GHIB) in Wayne County when evaluating the 2021-2023 DV period. The GHIB commenced in 2018, and several air quality monitors were placed near this construction project. The GHIB is a \$6.4 billion dollar project, adding a 6-lane and 1.5-mile cable-stayed design bridge, 167-acre U.S. Port of Entry, and updates to the Michigan interchange. These interchange improvements include: four new road bridges, five new pedestrian bridges, widening of roads at key intersections, connecting ramps to and from the US Port of Entry by adding four bridges crossing the railways and connecting Interstate 75 (I-75) to the US Port of Entry, and reconfiguration of the I-75 interchange ramps and service drives.³ Michigan has monitored the air quality near the GHIB with the Detroit-SW, DP4th, Trinity, and Military Park monitoring sites. Michigan added DP4th, Trinity, and Military Park monitoring sites in 2017 and 2018. The three new sites were added to monitor air pollutants before, during, and after construction of the bridge. In addition, a continuous PM_{2.5} monitor was added to the existing Detroit-SW monitoring site for this project. Construction is still ongoing near these sites with an expected opening date of the bridge in early fall of 2025. Figure 3 shows a map of the GHIB project overlaying the Michigan PM_{2.5} air quality monitoring sites.⁴

³ Project Overview | Gordie Howe International Bridge. (n.d.). [www.gordiehoweinternationalbridge.com](https://www.gordiehoweinternationalbridge.com/en/project-overview).
<https://www.gordiehoweinternationalbridge.com/en/project-overview>

⁴ Gallery. Gordie Howe International Bridge. (n.d.).
<https://www.gordiehoweinternationalbridge.com/en/gallery#!nav-maps>

Figure 3. GHB Project and Location of Michigan PM_{2.5} Air Quality Monitoring Sites.

As mentioned in Section 3.1 Factor 1, a trends analysis was completed by looking at quarterly mean concentrations of PM_{2.5} from 2021 to 2023. Figures 4 and 5 show the trend of the quarterly mean concentrations from 2021-2023. A high quarter can increase the mean for a year, and therefore can increase the DV. Review of the quarterly means at exceeding monitors in the Wayne County AoA shows a slight uptick in PM_{2.5} concentrations in the first quarters of 2021 and 2022, and the fourth quarter of 2022, associated with the fall and winter months when PM_{2.5} concentrations are generally higher. Additionally, a large peak of PM_{2.5} concentrations in the second quarter of 2023 shown in these figures may be associated with the Canadian wildfires that occurred during that period. This high PM_{2.5} concentration in the second quarter of 2023, and in some cases also the third quarter of 2023 (DP4th and Trinity monitors), increased the overall DV for 2021-2023. Additionally, the Military Park monitor experienced a higher percentage of invalidated clean data during this quarter which, when coupled with the wildfire smoke, showed an increased second quarter PM_{2.5} mean concentration.

Figure 4. Area of Analysis for the Detroit-Warren-Dearborn, Michigan Area

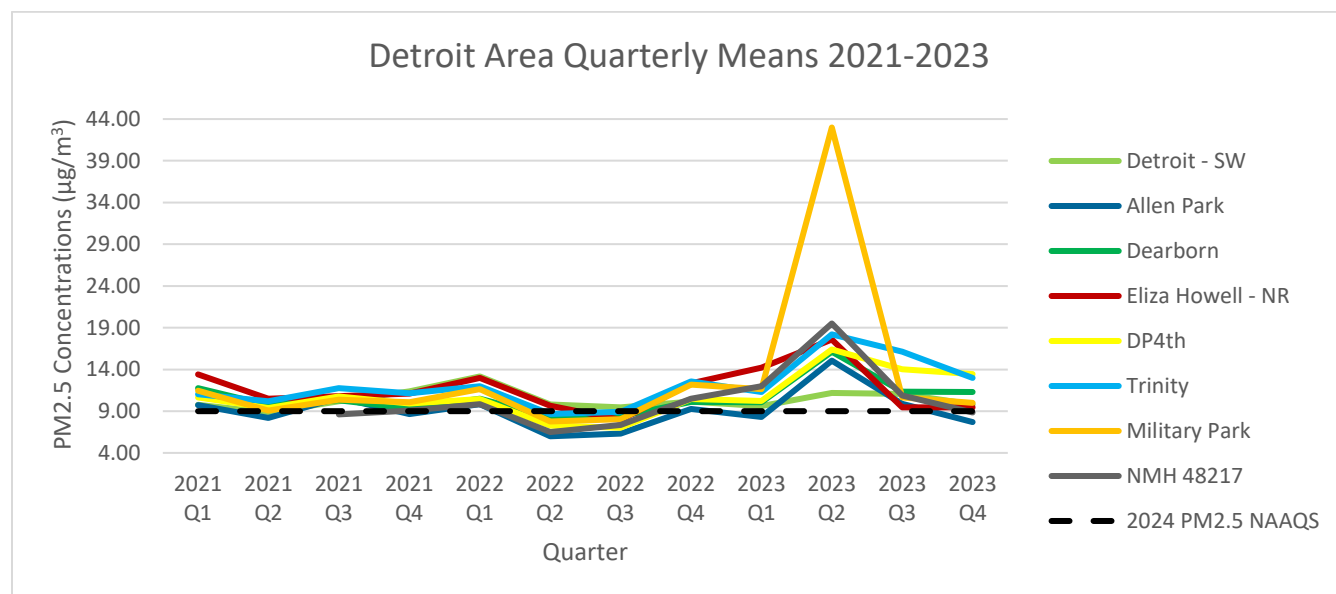
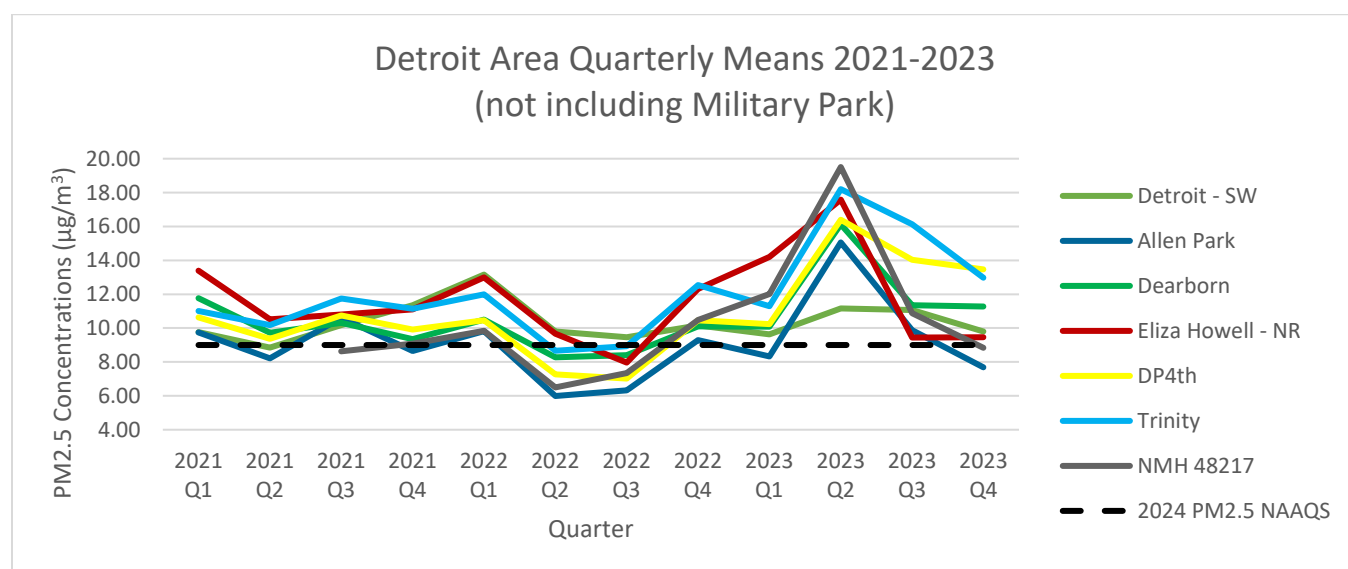


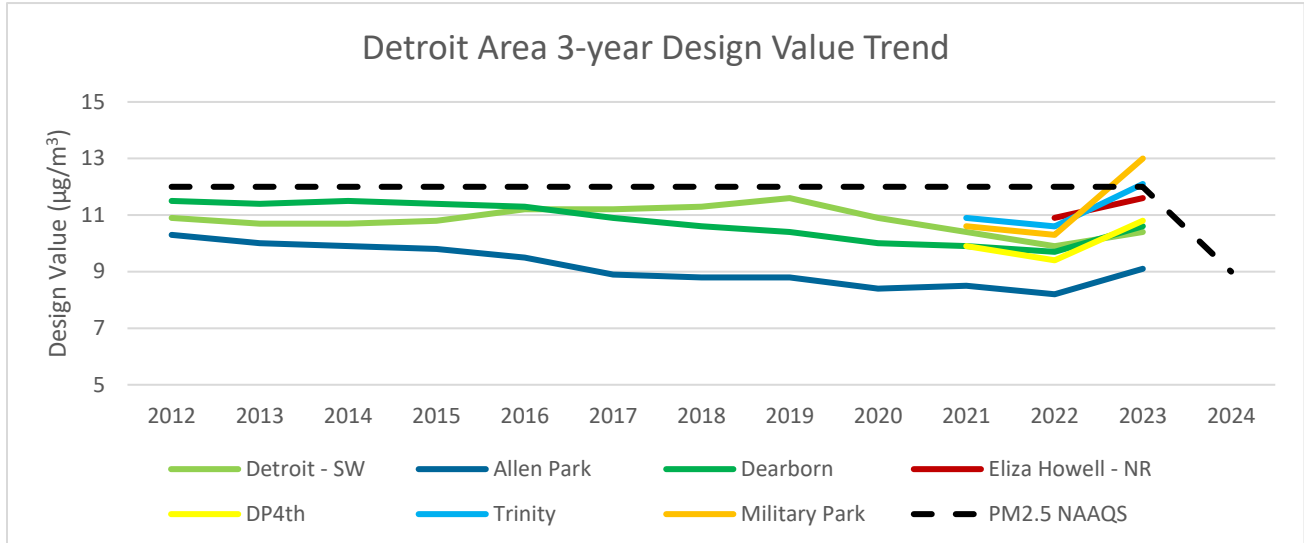
Figure 5. Area of Analysis for the Detroit-Warren-Dearborn, Michigan Area – not including Military Park



Michigan compiled 10 years of PM_{2.5} DVs for a historical analysis, which is included below as Figure 6. Review of this figure indicates the Allen Park and Dearborn monitoring sites were trending down from 2012 to 2022; however, from 2022 to 2023 both locations show an upward peak. The Detroit-SW monitoring site shows a slight decrease from 2012 to 2013, then remains relatively consistent from 2013 to 2014, and then begins to trend upward from 2014 to 2019. From 2019 to 2022 the monitoring site trends back downward and then begins trending upward again from 2022 to 2023. The remaining monitoring sites included in the figure show a slight downward trend (except Eliza Howell-NR) from 2021 to 2022 and then begin an upward trend from 2022 to 2023. It is likely that the upward trend in 2023 for all monitoring sites depicted on Figure 6 is associated with the Canadian wildfire impact seen

earlier in the second and third quarters of 2023. It is notable that even with the substantial wildfire smoke the upper Midwest experienced in the summer of 2023, the annual average and DVs still remain well below values observed at the monitoring locations in the mid to late 2010s.

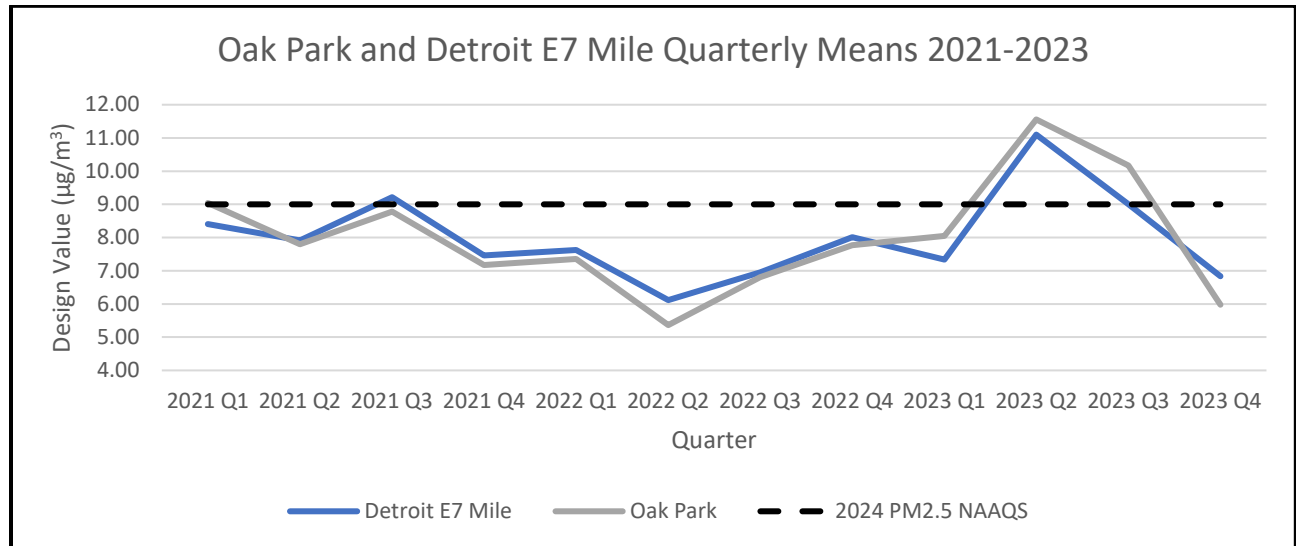
Figure 6. Detroit Area 3-year Design Value Trend



Lastly, Michigan compiled data from PM_{2.5} air monitors along the northern boundary of Wayne County and the southern boundaries of Oakland and Macomb counties to analyze PM_{2.5} trends further from the controlling monitor (Military Park). A trends analysis was completed by looking at quarterly mean concentrations of PM_{2.5} from 2021 to 2023 for the Oak Park and Detroit E7 Mile PM_{2.5} air monitors. Figure 7 shows the trend of the quarterly mean concentrations from 2021-2023 for Oak Park and Detroit E7 Mile. Review of the quarterly means data for both monitors shows a slight uptick in PM_{2.5} concentrations in the first quarters of 2021 and 2022, the fourth quarter of 2022, and the first quarter of 2023 (Oak Park only), associated with the fall and winter months when PM_{2.5} concentrations are generally higher. A slight uptick in PM_{2.5} concentrations was also seen in the third quarters of 2021 and 2022. Additionally, a large peak of PM_{2.5} concentrations in the second quarter of 2023 is shown in the figure, which is associated with the Canadian wildfires that occurred during that period.

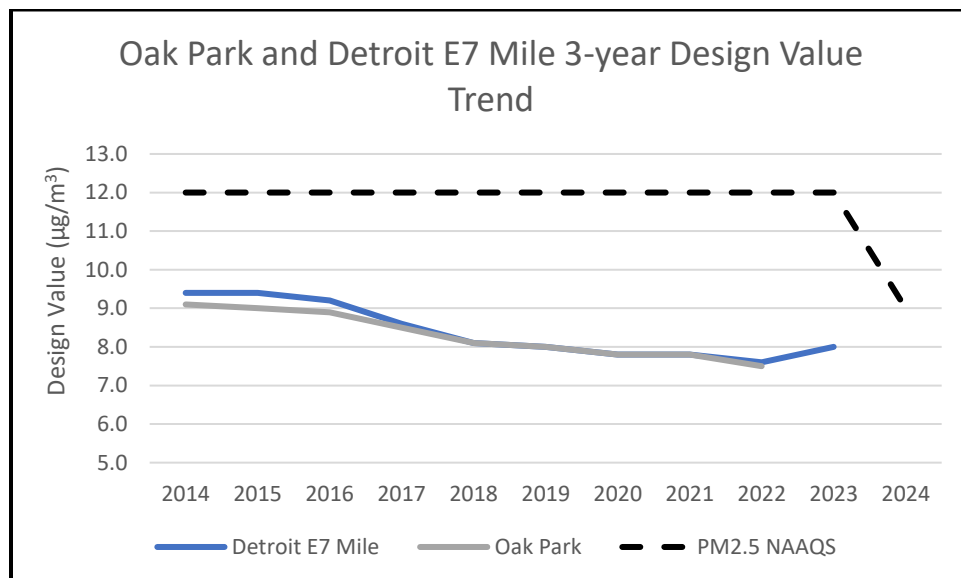
It should be noted that the third and fourth quarters of 2023 for Oak Park are considered by the USEPA to be invalid. The third and fourth quarters were only 65% and 50% complete, respectively. Although there were more than 11 creditable sample counts, because the DV was calculated to be below the 2024 PM_{2.5} NAAQS, the DV is considered invalid per Title 40 of the Code of Federal Regulations, Appendix N to Part-50 4.04.1(c). The quarterly means data shown in Figure 7 below depict Oak Park and Detroit E7 Mile as generally mirroring each other. Although two quarters of Oak Park's data were invalid, Figure 7 shows that for both monitors those two quarters appeared to be trending downward. For the most part, the quarterly means data was below the 2024 NAAQS with the exception of the third quarter in 2021 (Detroit E7 Mile, 9.21 µg/m³) and the second and third quarters of 2023, which were impacted by wildfire smoke.

Figure 7. Area of Analysis for the Oak Park and Detroit E7 Mile PM_{2.5} Monitors



Michigan compiled 10 years of PM_{2.5} DVs for the Oak Park and Detroit E7 Mile monitors for a historical analysis, which is included as Figure 8. Review of this figure indicates the Oak Park and Detroit E7 Mile monitors have been trending downward from 2012 to 2022; however, from 2022 to 2023 they show an upward peak. It is likely that the upward trend in 2023 depicted on Figure 8 is associated with the Canadian wildfire impact seen earlier in the second and third quarters of 2023. Although an upward peak is observed from 2022 to 2023, it should be noted that the DV has been below the 2024 PM_{2.5} NAAQS since 2017 for the Detroit E7 Mile monitor. The Oak Park monitor DV has been at or below the 2024 PM_{2.5} NAAQS since 2015. While not depicted in Figure 8, it should be noted that Oak Park's invalid DV for 2023 is 8.0 as documented in Table 2.

Figure 8. Oak Park and Detroit E7 Mile 3-year Design Value Trend



PM_{2.5} Compositional Analysis

Michigan was not able to conduct a PM_{2.5} Compositional Analysis; however, recent related work has been performed by the University of Michigan in an open access article titled “Apportionment of PM_{2.5} Sources across Sites and Time Periods: An Application and Update for Detroit, Michigan.”⁵ Michigan finds this study relevant for the purposes of understanding the PM_{2.5} composition for the Wayne County AoA and making a designation recommendation. This study retrieved data from the three Chemical Speciation Network (CSN) monitors in Wayne County: Allen Park, AQS ID: 26-163-0001; Dearborn, AQS ID: 26-163-0033; and Southwestern High School – now referred to as Detroit Southwest (Detroit-SW), AQS ID: 26-163-0015. Data was reviewed for the years of 2016-2021. PM_{2.5} at all three sites was apportioned using positive matrix factorization (PMF). The USEPA Designation Guidance recommends this type of analysis be done to better understand contributing influences on air quality. The University of Michigan utilized two approaches with this PMF modeling. The first approach developed separate PMF model source profiles for each site over the 6-year period; and the second approach consolidated all three sites and developed one single PMF model source profile over the 6-year period. Further methodology parameters can be found within the publication.

Results of this study found several pollutants had strong seasonal variation with both winter and summer peaks, especially at Detroit-SW, which had the highest PM_{2.5}, ammonia, nitrate, sulfate, sulfur, elemental carbon, and organic carbon (NH₄⁺, NO₃⁻, SO₄²⁻, S, EC, and OC) concentrations, potentially reflecting industry, fugitive dust, and construction activity. Additionally, this study found that mobile sources (onroad and nonroad) were the largest single contributor to PM_{2.5} levels at each site, accounting for 34-42% of PM_{2.5} depending on the site and PMF approach. It is noted that mobile source contributions at the Detroit-SW site may be influenced by the large GHIB construction site and associated nonroad sources (see Figure 3). This is further supported by seasonal trends showing the highest contributions occurring in summer and fall which are typical construction seasons. Other significant emissions were found to have come from ferrous (steel and coke) metals, soils/dust (construction, paved road, unpaved road), and other sources.

Urban Increment Analysis

To better understand and differentiate the influence of more distant emissions sources from the influence of closer emissions sources, Michigan conducted an urban increment analysis. For this analysis Michigan utilized two different methodologies. The first method compared speciation data from the closest CSN monitors in urban areas with that of Interagency Monitoring of Protected Visual Environments (IMPROVE)⁶ sites within 150 miles of the exceeding monitoring site. The IMPROVE sites are meant to represent rural background PM_{2.5} concentrations. The second methodology utilized satellite-derived global and regional PM_{2.5} data for 2022 developed by the Atmospheric Composition and Analysis Group at Washington University⁷. Urban and suburban census tract areas were then removed to determine rural and urban mean concentrations. A complete description of the process used for these methodologies can be found in Attachments 3 and 4. The findings of both methodologies for the Wayne County AoA are discussed below.

⁵ Yang, Z., Islam, M. K., Xia, T., & Batterman, S. (2023). Apportionment of PM_{2.5} Sources across Sites and Time Periods: An Application and Update for Detroit, Michigan. *Atmosphere*, 14(3), 592. <https://doi.org/10.3390/atmos14030592>

⁶ [Improve – Interagency Monitoring of Protected Visual Environments](#)

⁷ Satellite-derived PM_{2.5}. Atmospheric Composition Analysis Group. (n.d.). <https://sites.wustl.edu/acag/datasets/surface-pm2-5/>

USEPA Urban Increment Methodology

As described in the Designations Guidance, “the basic approach for the urban increment analysis is to calculate the difference between the ambient PM_{2.5} speciation levels at an urban area monitoring site and the ambient PM_{2.5} speciation levels at a nearby rural monitoring site(s).” To calculate the rural background, the USEPA recommends averaging the data from all IMPROVE monitors located within 150 miles of the violating AQS site, and if no IMPROVE monitors are within 150 miles, then data from the next closest IMPROVE site should be used. Based on this methodology, Michigan used annual/quarterly PM_{2.5} speciation data from the St. John’s Road – Quaker City, Ohio IMPROVE monitor located in southeast Ohio to represent the PM_{2.5} rural background concentration for Wayne County since no other IMPROVE monitors were within the 150-mile radius from the Wayne County monitoring sites. Table 4 shows which CSN and IMPROVE sites were utilized as part of this analysis, and the respective distances from the IMPROVE monitor for each exceeding PM_{2.5} monitoring site in Wayne County.

Table 4. Violating Detroit Area AQS Monitors – CSN/IMPROVE Monitor Pairing for Urban Increment

County Name	AQS Site ID	Local Site Name	Valid 2021-2023 Annual Design Value (µg/m ³)	Nearest CSN Site Name	Nearest IMPROVE Site Name	Nearest IMPROVE Site Distance (mi) from AQS Site
Wayne	261630100	Military Park (GHIB)	13	Detroit-Southwest (DET-SW)	ST JOHNS ROAD QUAKER CITY, OH	188
Wayne	261630099	Trinity St Marks – (GHIB)	12.1	Property Owned by Dearborn Public Schools	ST JOHNS ROAD QUAKER CITY, OH	188
Wayne	261630093	Eliza-NR	11.6	Property Owned by Dearborn Public Schools	ST JOHNS ROAD QUAKER CITY, OH	197
Wayne	261630098	DP4th - Detroit Police 4th Precinct (GHIB)	10.8	Detroit-Southwest (DET-SW)	ST JOHNS ROAD QUAKER CITY, OH	188
Wayne	261630033	Property Owned by Dearborn Public Schools	10.6	Property Owned by Dearborn Public Schools	ST JOHNS ROAD QUAKER CITY, OH	189
Wayne	261630015	Detroit-Southwest (DET-SW)	10.4	Detroit-Southwest (DET-SW)	ST JOHNS ROAD QUAKER CITY, OH	187
Wayne	261630001	Allen Park	9.1	Allen Park	ST JOHNS ROAD QUAKER CITY, OH	186

Michigan continued to adhere to the USEPA’s recommendations for conducting an urban increment analysis, as outlined in the *Designations Guidance* Memorandum – and calculated three-year average (2021-2023) quarterly and annual urban increments for each of the different measured components of the PM_{2.5} mass (ammonium sulfate, ammonium nitrate, organic matter, elemental carbon, and crustal). Similarly, Michigan calculated three-year average quarterly and annual urban increments for total PM_{2.5} (which combines all five components of the PM_{2.5} mass). Michigan accessed the speciated urban and rural background concentrations from the PM_{2.5} Speciation Network (2021-2023) layer within the USEPA’s PM_{2.5} Designations Mapping Tool. These calculations are shown below in Tables 5 through 7 and Figures 9 through 11.

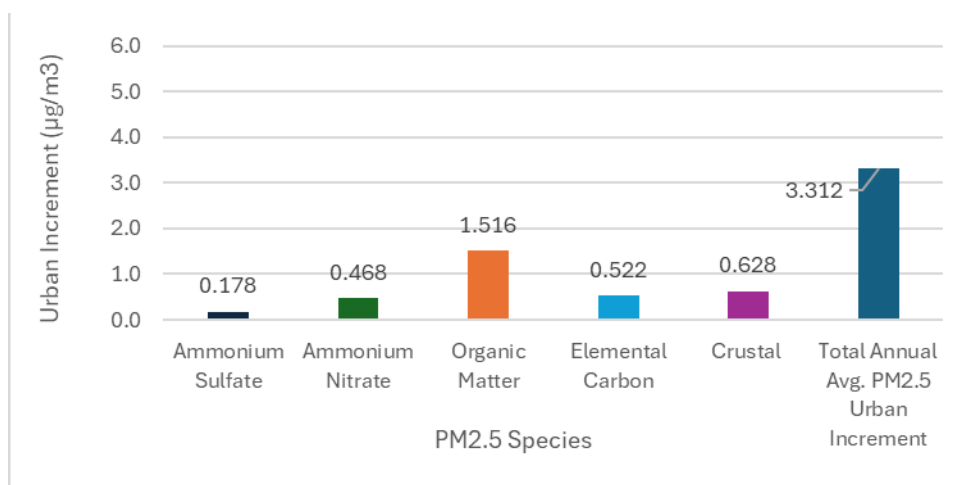
In Table 5, Michigan depicts the results of its computations for the speciated and total annual average PM_{2.5} urban increments for Michigan’s Military Park, DP4th, and Detroit-SW monitors using quarterly speciated PM_{2.5} concentration data from the Detroit-SW CSN monitor and the St. John’s Road – Quaker City, Ohio IMPROVE monitor. The quarterly speciated data that was used to produce these calculations

can be found in Attachment 3 - Urban Increment USEPA Methodology. As shown in Table 5 and Figure 9, the PM_{2.5} component that contributed the most to the total PM_{2.5} urban increment on an average annual basis is the organic matter portion of PM_{2.5} (1.516 µg/m³).

Table 5. Military Park, DP4th, and DET-SW Monitors – 2021-2023 Annual Average Urban Increment by PM_{2.5} Species

Local Site Name [Site ID]	Annual Avg. Ammonium Sulfate Increment	Annual Avg. Ammonium Nitrate Increment	Annual Avg. OM Increment	Annual Avg. EC Increment	Annual Avg. Crustal Increment	Total Annual Avg. PM _{2.5} Urban Increment	Units
Military Park [261630100], DP4th [261630098], DET-SW [261630015]	0.178	0.468	1.516	0.522	0.628	3.312	µg/m ³

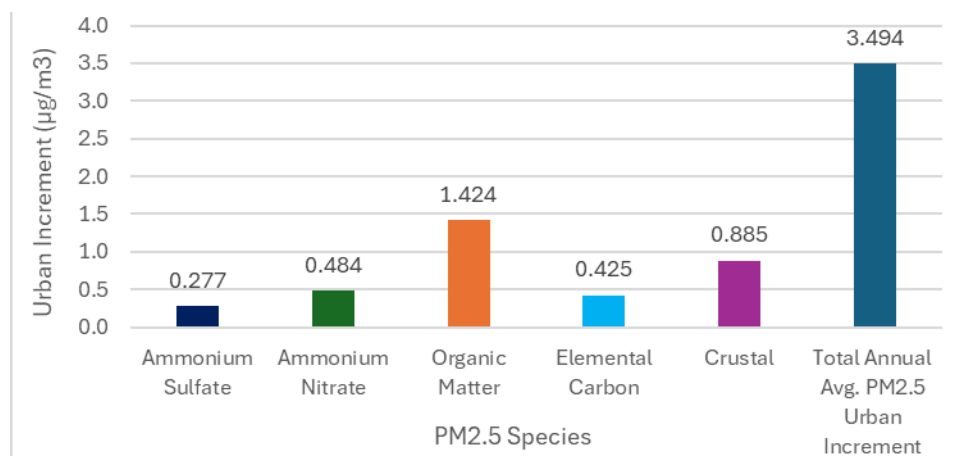
Figure 9. Military Park, DP4th, and DET-SW Monitors – 2021-2023 Annual Average Urban Increment by PM_{2.5} Species



In Table 6, below, Michigan depicts the results of its computations for the speciated and total annual average PM_{2.5} urban increments for Michigan's Trinity St. Marks, Eliza-NR, and Dearborn Public Schools monitors using quarterly speciated PM_{2.5} concentration data from the Dearborn Public Schools CSN monitor and the St. John's Road – Quaker City, Ohio IMPROVE monitor. The quarterly speciated data that was used to produce these calculations can be found in Attachment 3. As shown in Table 6 and Figure 10, the PM_{2.5} component that contributed the most to the total PM_{2.5} urban increment on an average annual basis is the organic matter portion of PM_{2.5} (1.424 µg/m³).

Table 6. Trinity St. Marks, Eliza-NR, and Dearborn Public Schools Monitors – 2021-2023 Annual Average Urban Increment by PM_{2.5} Species

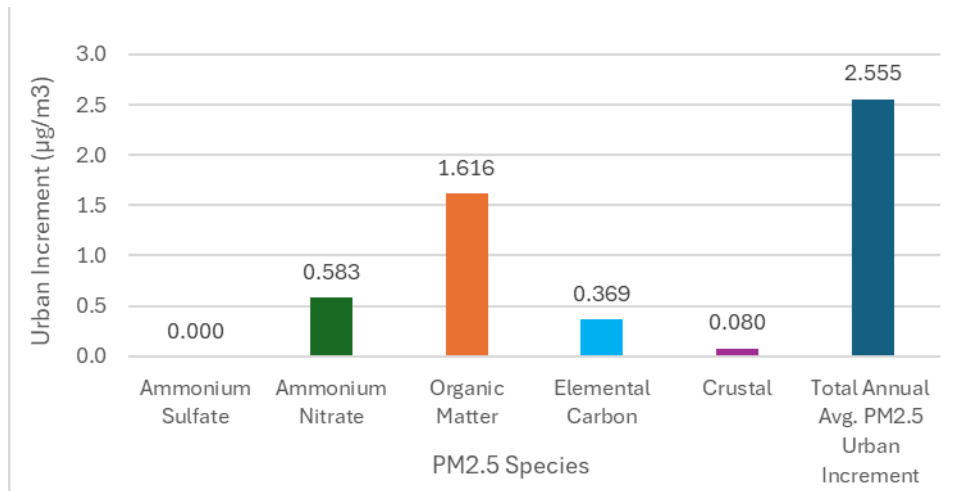
Local Site Name [Site ID]	Annual Avg. Ammonium Sulfate Increment	Annual Avg. Ammonium Nitrate Increment	Annual Avg. OM Increment	Annual Avg. EC Increment	Annual Avg. Crustal Increment	Total Annual Avg. PM _{2.5} Urban Increment	Units
Trinity St. Marks [261630099], Eliza-NR [261630093], Dearborn Public Schools [261630033]	0.277	0.484	1.424	0.425	0.885	3.494	µg/m ³

Figure 10. Trinity St. Marks, Eliza-NR, and Dearborn Public Schools Monitors – 2021-2023 Annual Average Urban Increment by PM_{2.5} Species

In Table 7, Michigan depicts the results of its computations for the speciated and total annual average PM_{2.5} urban increments for Michigan's Allen Park monitor using quarterly speciated PM_{2.5} concentration data from the Allen Park CSN monitor and the St. John's Road – Quaker City, Ohio IMPROVE monitor. The quarterly speciated data that was used to produce these calculations can be found in Attachment 3, Urban Increment USEPA Methodology. As shown within Table 7 and Figure 11, the PM_{2.5} component that contributed the most to the total PM_{2.5} urban increment on an average annual basis is the organic matter portion of PM_{2.5} (1.616 (µg/m³)).

Table 7. Allen Park Monitor – 2021-2023 Annual Average Urban Increment by PM_{2.5} Species

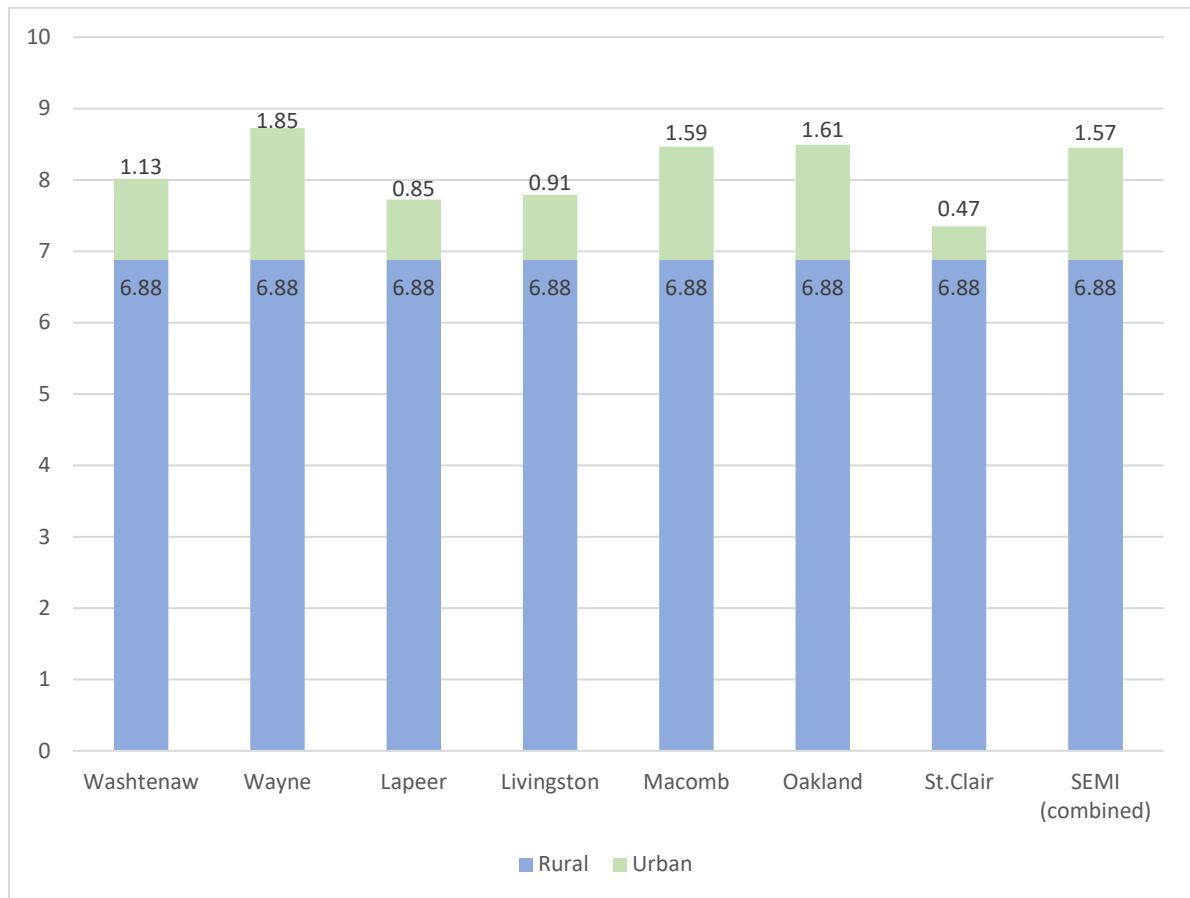
Local Site Name [Site ID]	Annual Avg. Ammonium Sulfate Increment	Annual Avg. Ammonium Nitrate Increment	Annual Avg. OM Increment	Annual Avg. EC Increment	Annual Avg. Crustal Increment	Total Annual Avg. PM _{2.5} Urban Increment	Units
Allen Park [261630001]	0.000	0.583	1.616	0.369	0.080	2.555	µg/m ³

Figure 11. Allen Park Monitor – 2021-2023 Annual Average Urban Increment by PM_{2.5} Species

Satellite-derived Urban Increment Methodology

As previously stated, Michigan conducted a secondary approach to calculating the urban increment, this approach is outlined in Attachment 4. The findings of this satellite-derived urban increment analysis for the Wayne County AoA are shown in Figure 12. This analysis showed a rural background of 6.88 µg/m³ for the southern portion of Michigan and urban increments ranging from 1.85 µg/m³ to 0.47 µg/m³. The highest urban increments were found to be in Wayne County (1.85 µg/m³) followed by Oakland (1.61 µg/m³) and Macomb (1.59 µg/m³) counties.

Figure 12. Satellite-derived Urban Increments for Wayne County AoA.



There are some differences and limitations between the two methodologies. With the USEPA Designations Guidance methodology Michigan is able to better understand the speciated breakdown across the entire three-year period (2021-2023), while the satellite data the analysis is limited to 2022 PM_{2.5} data. Conversely, the USEPA approach looks only at exceeding monitoring sites, and not surrounding areas or attaining monitors and is limited by the use of CSN monitors that are located within one area in Wayne County. The satellite-derived approach is able to show potential urban increments for the surrounding counties in the AoA. With both approaches the totals found at each monitor or county do not align directly with the formal monitoring DVs. This is again due to the constraints of these methodologies relying on CSN monitors and IMPROVE monitors. The Wayne County DV is based on the controlling monitor, Military Park, which is not a CSN monitor. Wayne County has three CSN monitors at the Allen Park, SW Detroit, and Dearborn monitoring sites. CSN monitors are a component of national PM_{2.5} monitoring, and their purpose is not to establish if the NAAQS are being attained. Instead, they are intended to provide expanded gravimetric PM_{2.5} measurements to support assessment of trends, development of effective State Implementation Plans (SIP) and determination of regulatory compliance, development of control strategies, interpretation of health studies on effects of PM_{2.5} constituents, characterization of annual and seasonal spatial variation of aerosols, and comparison to the IMPROVE network.

Michigan has factored in these limitations for determining influence of the final nonattainment boundaries. Due to the constraints of this analysis, Michigan did not heavily weigh the findings but

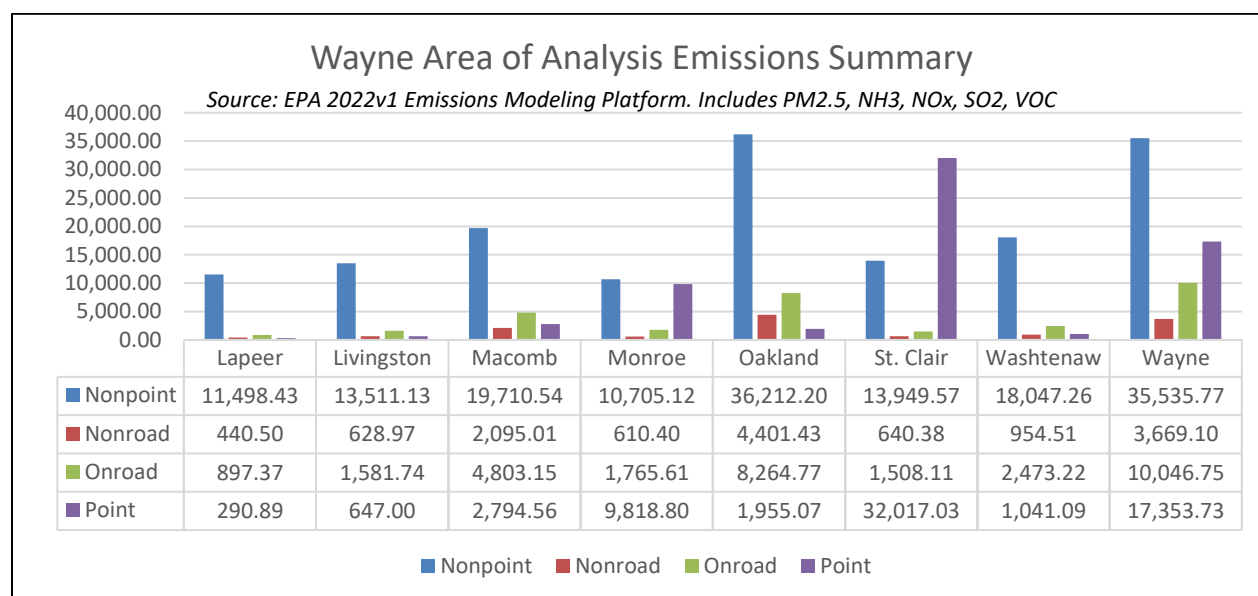
rather utilized the broad conclusions to help better understand the overall analysis of the Wayne County AoA. From this analysis, main conclusions were drawn from the overall trends shown through these two methodologies. Michigan concludes that organic matter, followed by crustal matter, and to a lesser extent ammonium nitrate and elemental carbon are contributing most to the PM_{2.5} urban increments. The overall urban increments from the USEPA method attribute almost 3.5 µg/m³ to urban influence, whereas the satellite-derived approach results in less than 2 µg/m³ in counties through the AoA, with the most in Wayne County.

4.1.2 Wayne County AoA - Emissions Data

Emissions Trends

Figure 13 presents PM_{2.5}, NO_x, SO_x, VOC, and NH₃ (PM_{2.5} and precursors) emissions data for the Wayne County AoA⁸. The most significant emissions in the Wayne County AoA are from nonpoint (59%) followed by point (24%), onroad (12%), and lastly nonroad (5%). To assist in determining potential influence of adjacent county emissions on the exceeding monitors within Wayne County, Michigan additionally reviewed emissions trends from a subset of the AoA, which included Wayne, Oakland, and Macomb (WOM subset). When looking at the WOM subset the distribution of sector contributions shifts. Nonpoint is still the dominant contributor at 62%, but point is lowered to 15% and onroad is higher at 16% (Figure 14). Below, the sector and county contributions are discussed further.

Figure 13. PM_{2.5} and Precursor Emissions Data for the Wayne County AoA.



⁸ USEPA 2022v1 EMP <https://www.epa.gov/particle-pollution-designations/particle-pollution-designations-memorandum-and-data-2024-revised#C>

Figure 14. PM_{2.5} and Precursor Emissions Distribution for Wayne County AoA and WOM Subset.

The top 10 PM_{2.5} nonpoint sector categories are listed in Table 8 for the Wayne County AoA and Table 9 for the WOM subset. Since many of the nonpoint source sectors are correlated with population, it is reasonable to expect more nonpoint emissions are originating from areas with higher population densities. Later in this section there is a discussion of the population density within the Wayne County AoA (see Figure 17). Michigan took into consideration population density when assessing the nonpoint source county level inventory. Fuel combustion from residential wood is highest for both areas, followed by commercial cooking. The Wayne County AoA has higher overall emissions coming from dust for both paved and unpaved roads, waste disposal and fuel combustion (from industrial boilers, internal combustion engines – biomass) than that of the WOM subset. For the WOM subset fuel combustion (from industrial boilers, internal combustion engines – biomass) is higher, followed by dust from paved and unpaved roads, and then dust from construction.

Table 8. Top 10 Nonpoint Sector Categories for the Wayne County AoA in tons per year (tpy) for Combined PM_{2.5}.

Nonpoint Sector Category	PM _{2.5} (tpy)	Overall Percentage
Fuel Comb - Residential - Wood	6,490.13	33.7
Commercial Cooking	2,850.35	14.8
Dust - Unpaved Road Dust	1,874.59	9.7
Dust - Paved Road Dust	1,669.57	8.7
Waste Disposal	1,661.34	8.6
Fuel Comb - Industrial Boilers, ICEs – Biomass	1,553.49	8.1
Dust - Construction Dust	946.83	4.9
Agriculture - Crops & Livestock Dust	764.43	4.0
Fuel Comb - Comm/Institutional – Biomass	604.57	3.1
Industrial Processes - Mining	355.39	1.8

Table 9. Top 10 Nonpoint Sector Categories for the WOM Subset in tons per year for Combined PM_{2.5}.

Nonpoint Sector Category	PM _{2.5} (tpy)	Overall Percentage
Fuel Comb - Residential - Wood	4,034.27	32.2
Commercial Cooking	2,370.52	18.9
Fuel Comb - Industrial Boilers, ICEs - Biomass	1,273.28	10.2
Dust - Paved Road Dust	1,212.14	9.7
Dust - Unpaved Road Dust	880.34	7.0
Dust - Construction Dust	837.90	6.7
Waste Disposal	745.07	5.9
Fuel Comb - Comm/Institutional - Biomass	514.79	4.1
Industrial Processes - Mining	258.41	2.1
Miscellaneous Non-Industrial Not Elsewhere Classified	175.90	1.4

For the PM_{2.5} and precursor point source contributions based on Figure 13, St. Clair County has the highest point contribution, followed by Wayne County. Michigan also looked at individual pollutant contributions based on the data provided by the USEPA for 2022 County and Facility level⁹ (see Table 10). Wayne County is highest for Total PM_{2.5} primary, NH₃, and VOC. St. Clair County is highest for NO_x and SO₂. Additionally, Table 11a through 11e show the top 20 facilities with highest emissions for each pollutant, what county they reside in, and their NAICS code and description.

Table 10. Wayne County AoA County-level PM_{2.5} and Precursor Point Source Emissions Breakdown in tpy (see Footnote 8).

County	PM _{2.5} Primary	NH ₃	NO _x	SO ₂	VOC
Lapeer	3.60	0.40	17.90	188.30	80.60
Livingston	9.10	0.20	495.00	1.50	141.10
Macomb	214.30	16.60	847.40	96.00	1,620.20
Monroe	117.00	1.30	5,680.40	3,808.40	211.60
Oakland	144.50	13.30	928.60	118.70	749.90
St. Clair	139.80	18.40	10,020.20	26,892.70	1,186.80
Washtenaw	81.70	11.80	590.80	127.60	229.20
Wayne	1,414.00	46.20	7,271.80	7,967.50	3,602.00

⁹ USEPA 2022 County and Facility Emissions for PM_{2.5} Designations spreadsheet, <https://www.epa.gov/particle-pollution-designations/particle-pollution-designations-memorandum-and-data-2024-revised#C>

Table 11a. Top 20 Facility Level PM_{2.5} Emissions for the Wayne County AoA (see Footnote 8).

County	Facility Name	NAICS Code	NAICS Description	PM _{2.5} (tpy)
Wayne	EES Coke Battery LLC	324199	All Other Petroleum and Coal Products Manufacturing	172.95
Wayne	Cleveland-Cliffs Steel Corporation Dearborn Works	331110	Iron and Steel Mills and Ferroalloy Manufacturing	154.51
Wayne	Z Technologies Corp.	325510	Paint and Coating Manufacturing	75.15
Wayne	Marathon Petroleum Company LP	324110	Petroleum Refineries	52.86
Monroe	DTE Electric Company - Monroe Power Plant	221112	Fossil Fuel Electric Power Generation	40.87
Macomb	Pine Tree Acres, Inc.	562212	Solid Waste Landfill	34.89
Wayne	Dearborn Industrial Generation	221112	Fossil Fuel Electric Power Generation	31.80
St. Clair	Cargill Salt - St. Clair	311942	Spice and Extract Manufacturing	31.53
Wayne	Carmeuse Lime Inc., River Rouge Operation	327410	Lime Manufacturing	27.46
St. Clair	St. Clair / Belle River Power Plant	221112	Fossil Fuel Electric Power Generation	23.95
Washtenaw	Arbor Hills Landfill, Inc.	562212	Solid Waste Landfill	21.85
Wayne	Crown Group, Lynch Road Plant	332812	Metal Coating, Engraving (except Jewelry and Silverware), and Allied Services to Manufacturers	17.57
Monroe	Gerdau MacSteel Monroe Mill	331110	Iron and Steel Mills and Ferroalloy Manufacturing	16.44
Wayne	Ford Motor Co./ Livonia Transmission	336350	Motor Vehicle Transmission and Power Train Parts Manufacturing	16.01
Wayne	GLWA Water Resource Recovery Facility	221320	Sewage Treatment Facilities	15.12
Wayne	FCA US LLC - Jefferson North Assembly Plant	336110	Automobile and Light-duty Motor Vehicle Manufacturing	13.91
Wayne	Ajax Materials Corporation	324121	Asphalt Paving Mixture and Block Manufacturing	13.44
Wayne	Woodland Meadows RDF	562212	Solid Waste Landfill	12.91
Wayne	Ford Motor Co. Rouge Complex	336110	Automobile and Light-duty Motor Vehicle Manufacturing	12.54
Wayne	St Marys Cement	327310	Cement Manufacturing	11.65

Table 11b. Top 20 Facility Level NH₃ Emissions for the Wayne County AoA (see Footnote 8).

County	Facility Name	NAICS Code	NAICS Description	NH ₃ (tpy)
Wayne	Marathon Petroleum Company LP	324110	Petroleum Refineries	14.27
Wayne	Cooper Heat Treating LLC	332811	Metal Heat Treating	12.00
Macomb	FCA US LLC Sterling Heights Assembly plant	336110	Automobile and Light-duty Motor Vehicle Manufacturing	9.76
Oakland	Engineered Heat Treat, Inc.	332811	Metal Heat Treating	9.25
Wayne	EES Coke Battery LLC	324199	All Other Petroleum and Coal Products Manufacturing	8.22
Washtenaw	University of Michigan	611310	Colleges, Universities, and Professional Schools	6.06
St. Clair	DTE Electric Company - Greenwood Energy Center	221112	Fossil Fuel Electric Power Generation	5.50
St. Clair	St. Clair/Belle River Power Plant	221112	Fossil Fuel Electric Power Generation	4.92
Washtenaw	DAPCO Industries	332911	Industrial Valve Manufacturing	3.72
Wayne	U S Steel Great Lakes Works	331110	Iron and Steel Mills and Ferroalloy Manufacturing	2.71
St. Clair	Marysville Ethanol, LLC	325193	Ethyl Alcohol Manufacturing	2.47
St. Clair	Cargill Salt - St. Clair	311942	Spice and Extract Manufacturing	2.05
Macomb	Consumers Energy - Ray Compressor Station	486210	Pipeline Transportation of Natural Gas	1.61
Macomb	Specialty Steel Treating Inc.	332811	Metal Heat Treating	1.56
Macomb	GM Technical Center	541380	Testing Laboratories and Services	1.31
Wayne	Cleveland-Cliffs Steel Corporation Dearborn Works	331110	Iron and Steel Mills and Ferroalloy Manufacturing	1.22
Oakland	FCA US LLC - Chrysler Technology Center	336110	Automobile and Light-duty Motor Vehicle Manufacturing	1.17
St. Clair	Consumers Energy - St. Clair Compressor Station	486210	Pipeline Transportation of Natural Gas	1.06
Wayne	BASF Corporation - Chemical Plants	325199	All Other Basic Organic Chemical Manufacturing	0.92
Wayne	Ford Motor Co. Elm Street Boilerhouse	221330	Steam and Air-Conditioning Supply	0.89

Table 11c. Top 20 Facility Level NO_x Emissions for the Wayne County AoA (see Footnote 8).

County	Facility Name	NAICS Code	NAICS Description	NO _x (tpy)
St. Clair	St. Clair/Belle River Power Plant	221112	Fossil Fuel Electric Power Generation	9,224.04
Monroe	DTE Electric Company - Monroe Power Plant	221112	Fossil Fuel Electric Power Generation	4,969.71
Wayne	EES Coke Battery LLC	324199	All Other Petroleum and Coal Products Manufacturing	1,542.05
Wayne	Detroit Metropolitan Wayne County	48811	Airport OperationsT	1,203.07
Wayne	Dearborn Industrial Generation	221112	Fossil Fuel Electric Power Generation	598.89
Wayne	Carmeuse Lime Inc., River Rouge Operation	327410	Lime Manufacturing	521.20
Wayne	DTE Electric Company - Trenton Channel Power Plant	221112	Fossil Fuel Electric Power Generation	509.43
Monroe	Guardian Industries-Carleton	327211	Flat Glass Manufacturing	488.15
Livingston	Howell Compressor Station	486210	Pipeline Transportation of Natural Gas	471.91
Wayne	Marathon Petroleum Company LP	324110	Petroleum Refineries	360.16
Washtenaw	University of Michigan	611310	Colleges, Universities, and Professional Schools	295.64
Wayne	Cleveland-Cliffs Steel Corporation Dearborn Works	331110	Iron and Steel Mills and Ferroalloy Manufacturing	280.19
St. Clair	DTE Electric Company - Greenwood Energy Center	221112	Fossil Fuel Electric Power Generation	243.64
St. Clair	DTE Gas Co. - Belle River Mills Compressor Station	221210	Natural Gas Distribution	231.62
Macomb	Selfridge ANGB	48811	Airport OperationsT	207.70
Wayne	GLWA Water Resource Recovery Facility	221320	Sewage Treatment Facilities	191.09
Wayne	Detroit Thermal Beacon Heating Plant	221330	Steam and Air-Conditioning Supply	177.42
Wayne	Oakwood	488210	Support Activities for Rail Transportation	169.36
Wayne	Consumers Energy - Northville Compressor Station	486210	Pipeline Transportation of Natural Gas	154.50
Wayne	U S Steel Great Lakes Works	331110	Iron and Steel Mills and Ferroalloy Manufacturing	147.97

Table 11d. Top 20 Facility Level SO₂ Emissions for the Wayne County AoA (see Footnote 8).

County	Facility Name	NAICS Code	NAICS Description	SO ₂ (tpy)
St. Clair	St. Clair/Belle River Power Plant	221112	Fossil Fuel Electric Power Generation	26,862.73
Monroe	DTE Electric Company - Monroe Power Plant	221112	Fossil Fuel Electric Power Generation	3,583.73
Wayne	EES Coke Battery LLC	324199	All Other Petroleum and Coal Products Manufacturing	2,957.98
Wayne	DTE Electric Company - Trenton Channel Power Plant	221112	Fossil Fuel Electric Power Generation	2,428.52
Wayne	Dearborn Industrial Generation	221112	Fossil Fuel Electric Power Generation	914.23
Wayne	Cleveland-Cliffs Steel Corporation Dearborn Works	331110	Iron and Steel Mills and Ferroalloy Manufacturing	481.19
Wayne	U S Steel Great Lakes Works	331110	Iron and Steel Mills and Ferroalloy Manufacturing	389.52
Wayne	Carmeuse Lime Inc., River Rouge Operation	327410	Lime Manufacturing	233.90
Lapeer	Tuscola Energy - Richfield Gas Plant	211130	Natural Gas Extraction	187.90
Wayne	Marathon Petroleum Company LP	324110	Petroleum Refineries	169.25
Wayne	Detroit Metropolitan Wayne County	48811	Airport OperationsT	128.51
Washtenaw	Arbor Hills Landfill, Inc.	562212	Solid Waste Landfill	120.88
Monroe	Gerdau MacSteel Monroe Mill	331110	Iron and Steel Mills and Ferroalloy Manufacturing	113.81
Wayne	Carleton Farms Landfill	562212	Solid Waste Landfill	112.09
Monroe	Guardian Industries-Carleton	327211	Flat Glass Manufacturing	104.48
Macomb	Pine Tree Acres, Inc.	562212	Solid Waste Landfill	68.08
Oakland	Oakland Heights Development, Inc.	562212	Solid Waste Landfill	39.17
Oakland	Eagle Valley Landfill	562212	Solid Waste Landfill	38.98
Wayne	Ameresco Woodland Meadows Romulus LLC	486990	All Other Pipeline Transportation	37.67
Wayne	Riverview Land Preserve	562212	Solid Waste Landfill	30.30

Table 11e. Top 20 Facility Level VOC Emissions for the Wayne County AoA (see Footnote 8).

County	Facility Name	NAICS Code	NAICS Description	VOC (tpy)
Macomb	FCA US LLC Sterling Heights Assembly plant	336110	Automobile and Light-duty Motor Vehicle Manufacturing	665.35
Wayne	Ford Motor Co. Rouge Complex	336110	Automobile and Light-duty Motor Vehicle Manufacturing	626.52
Wayne	FCA US LLC - Jefferson North Assembly Plant	336110	Automobile and Light-duty Motor Vehicle Manufacturing	626.34
St. Clair	St. Clair / Belle River Power Plant	221112	Fossil Fuel Electric Power Generation	399.25
St. Clair	Intertape Polymer Group	322220	Paper Bag and Coated and Treated Paper Manufacturing	350.59
Wayne	Marathon Petroleum Company LP	324110	Petroleum Refineries	300.19
Wayne	EES Coke Battery LLC	324199	All Other Petroleum and Coal Products Manufacturing	267.64
Wayne	Ford Motor Co./ Wayne Complex	336110	Automobile and Light-duty Motor Vehicle Manufacturing	227.80
Macomb	FCA US LLC Warren Truck Assembly Plant	336110	Automobile and Light-duty Motor Vehicle Manufacturing	178.36
Macomb	Pine Tree Acres, Inc.	562212	Solid Waste Landfill	159.36
Wayne	Detroit Metropolitan Wayne County	48811	Airport OperationsT	155.14
St. Clair	Pregis	326150	Urethane and Other Foam Product (except Polystyrene) Manufacturing	138.20
Wayne	Ford Motor Company - Flat Rock Assembly	336110	Automobile and Light-duty Motor Vehicle Manufacturing	118.87
Macomb	Selfridge ANGB	48811	Airport OperationsT	101.05
Livingston	Ventra Fowlerville LLC	336390	Other Motor Vehicle Parts Manufacturing	87.33
Macomb	Shelby Foam Systems, a Division of Magna Seating	326150	Urethane and Other Foam Product (except Polystyrene) Manufacturing	65.51
Oakland	Eagle Industries, INC.	326150	Urethane and Other Foam Product (except Polystyrene) Manufacturing	65.39
Washtenaw	Arbor Hills Landfill, Inc.	562212	Solid Waste Landfill	64.49
Wayne	Riverview Land Preserve	562212	Solid Waste Landfill	60.58
Lapeer	Albar Industries, Inc.	326199	All Other Plastics Product Manufacturing	59.43

As stated in Section 3.2, the USEPA has acknowledged that SO₂ and NO_x emissions in the last decade, as well as predicted reductions, make PM_{2.5} exceedances more of a localized issue with more emphasis on direct PM_{2.5} emissions than has been found in the past. The point source data provided above shows the highest PM_{2.5} emissions are from within Wayne County (1,414 tpy), with the next highest county at only 15% of Wayne County's total PM_{2.5} emissions, Macomb County with 214 tpy. When looking at the facility level PM_{2.5} emissions the highest contributors are over 50 tpy and are in Wayne County. The

surrounding counties all have facility level PM_{2.5} emissions under 50 tpy. When addressing the NO_x and SO₂ emissions, the highest emissions come from two sources within the Wayne County AoA: the St. Clair / Belle River Power Plant (B2796) and the DTE Electric Company - Monroe Power Plant (B2816).

While the county level emissions for SO₂ are significantly higher in St. Clair County, as shown in Table 10, when the facility level emissions were reviewed there was one source contributing to 99.7% of the total SO₂, the St. Clair / Belle River Power Plant (B2796). Michigan reviewed the emission units at this facility based on the 2022 SLEIS reporting which showed that two coal boilers at Belle River make up over 20,000 tpy of the overall 26,862.73 tpy SO₂ emissions in the county. According to DTE Electric Company's most recent 2022 Integrated Resource Plan (IRP),¹⁰ the Belle River plant is slated for conversion from baseload coal to a natural gas peaker plant, only operating in times of high customer demand. The conversion will occur in two phases, with the first unit conversion happening in 2025 and the second unit in 2026. Additionally, DTE has indicated it plans to retire the Belle River natural gas peaking resource by the year 2040. The St. Clair coal-fired power plant retired in May 2022. IRPs are not federally enforceable and are resubmitted and updated on a set schedule every three to five years; however, there are ongoing public and customer pressures to utilize more sustainable and cleaner forms of energy generation. This provides an incentive for utilities not to stray too much from what they've incorporated into their IRPs.

In addition, DTE Electric has another power plant located in the Wayne County AoA, the Monroe Power Plant, that is contributing to the higher point source emissions from that county, specifically for NO_x and SO₂ (see Tables 11c and 11d). Similar to the St. Clair / Belle River Power Plant, based on DTE Electric's most recent IRP (see Footnote 9) this coal-fired power plant is slated to be retired in mid-2030, with retirements of two units in 2028. The energy currently generated by the two coal units is proposed to be replaced with renewable energy and energy storage. In addition, a low or zero carbon dispatchable resource may be considered for the mid-2030s timeframe to support the final retirement of all coal units. Tables 11f and 11g represent facility level data from the USEPA 2022v1 emissions modeling platform (see Footnote 7) and model projected emissions for PM_{2.5} and precursors for the DTE Electric St. Clair/Belle River and Monroe Power Plant facilities. Projected emissions show significant reductions from these two DTE facilities for both NO_x and SO₂ emissions with between 20 to 60% reductions by 2026, and 98%+ reductions by 2032 from their 2022 base levels.

Due to the retirement of the St. Clair coal-fired power plant, proposed conversions at the Belle River power plant, and planned retirements of coal units at the Monroe power plant, Michigan expects the NO_x and SO₂ contributions will be reduced significantly over the next few years. Thus, in combination with other emission data and factors addressed in this recommendation, Michigan does not view the NO_x and SO₂ emissions coming from St. Clair or Monroe counties to be contributing to the PM_{2.5} exceedances in Wayne County.

¹⁰ Case U-21193. Michigan LARA. (2022, February 7). <https://mi-psc.my.site.com/s/case/5008y000002yQhVAAU/in-the-matter-of-the-application-of-dte-electric-company-for-approval-of-power-purchase-agreements-and-other-relief>

Table 11f. NO_x and SO₂ Emissions Projections for DTE Electric St. Clair/Belle River.

Pollutant (tpy)	NO_x	SO₂
2022	9,224.04	26,862.73
2026	5,291.95	8,849.35
2032	219.46	0.08

Table 11g. NO_x and SO₂ Emissions Projections for DTE Electric Monroe Power Plant.

Pollutant (tpy)	NO_x	SO₂
2022	4,969.71	3,583.73
2026	3,897.77	2,839.56
2032	71.49	3.62

Lastly, to better understand the overall distribution of PM_{2.5} and precursors at point sources in the Wayne County AoA, Michigan utilized the PM_{2.5} facility level data from the 2022v1 EMP provided by the USEPA and completed a weighted overlay analysis to determine where there were areas of high PM_{2.5} and precursor emissions and high facility count at a city/township level. This helped better refine the county level data discussed earlier. To complete this analysis the data from the 2022v1 EMP were converted to a raster and totals for total PM_{2.5} and precursor emissions and facility count were summarized for each city and township area. This data was then rasterized and scored on a scale from 0 to 1. Both layers, the emissions and count layers, were then multiplied against each other with equal weight (i.e., 50% each). The final output, Figure 15, shows areas with high emissions (PM_{2.5} and precursors) and facility count in red, and areas with fewer emissions and fewer facilities in progressively darker green. This same process was completed just for PM_{2.5} emissions and facility count, with the results shown in Figure 16.

Figure 15. Wayne County AoA Point Distribution Weighted Overlay Analysis for PM_{2.5} and Precursor Emissions.

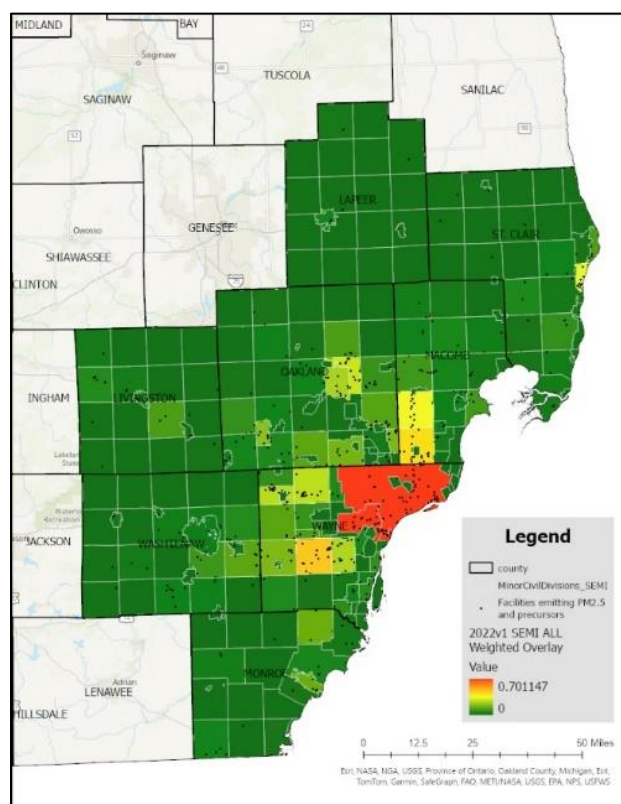
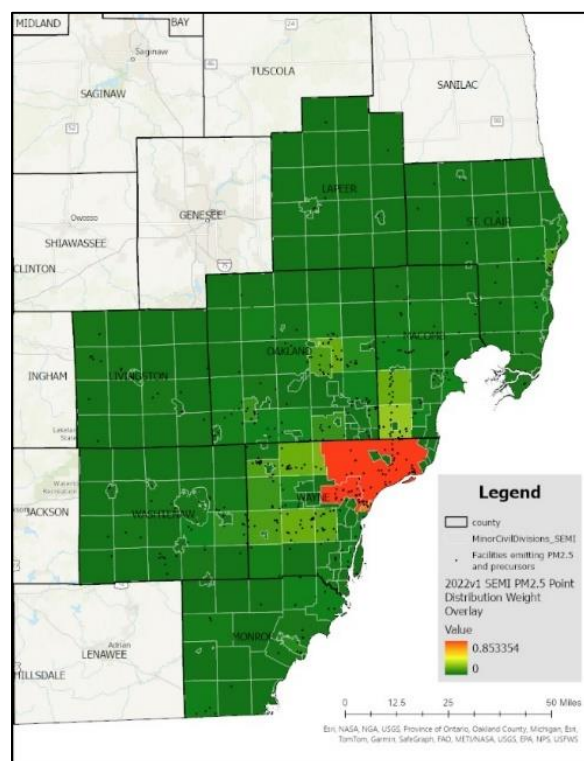


Figure 16. Wayne County AoA Point Distribution Weighted Overlay Analysis for PM_{2.5} Emissions.

The results of this analysis show a large PM_{2.5} (and precursor) facility and emissions distribution in the northeastern region of Wayne County, and some higher precursor contributions in mid-Wayne County and the southern portions of Oakland and Macomb counties. When reviewing the facility level data correlated with the higher values shown in Figure 15 in the southern portions of Oakland and Macomb counties, we see that there are many facilities within each township; however, they have low overall emissions. The majority of larger facility level PM_{2.5} emissions come from Wayne County facilities, with large SO₂ and NO_x facility level emissions from the St. Clair and Monroe power plants, which are anticipated to drastically reduce emissions in the coming years.

Population Density

Michigan looked at the population density and degree of urbanization for the Wayne County AoA using the U.S. Census Bureau's 2020 Census Demographic and Housing Characteristics.¹¹ Review of Figure 17 shows that Wayne, Macomb, and Oakland counties have the highest population density in the Wayne County AoA and therefore the highest degree of urbanization. The areas of highest population density are in northern, central, and eastern Wayne County; southern and central Macomb County; and southern and southeastern Oakland County. Michigan gathered 2023 total county-level population data for each county in the Wayne County AoA from the U.S. Census Bureau. Percentages were calculated representing the contribution of each county's total population to the total population of the Wayne County AoA, as shown in Table 12.¹² In 2023, the largest counties in the Wayne County AoA by

¹¹ (2024). ArcGIS.com. <https://www.arcgis.com/home/item.html?id=a1926cb43e844c3f82275917d6eab47a>

¹² Bureau, U. C. (2022). County Population Totals: 2020-2021. Census.gov. <https://www.census.gov/data/tables/time-series/demo/popest/2020s-counties-total.html>

population were Wayne County (approximately 1.8 million), Oakland County (1.3 million), and Macomb County (0.9 million).

Figure 17. Population Density Map for the Wayne County Area of Analysis

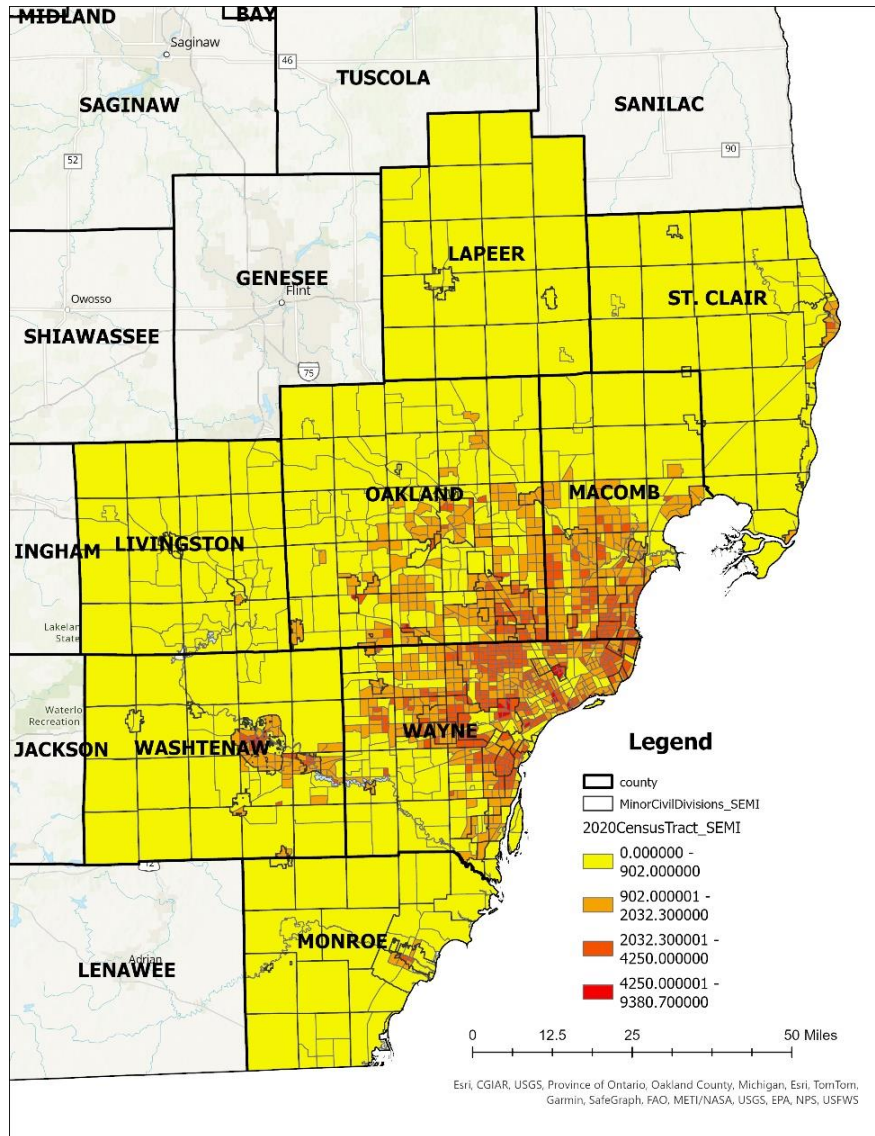


Table 12. Annual Estimate of the Resident Population for Each County in the Wayne County AoA in 2023.

County	Total County Population	Percentage of Total Wayne County AoA Population (4,862,885 people)
Lapeer	88,977	1.8
Livingston	196,757	4.0
Macomb	875,101	18.0
Monroe	155,045	3.2
Oakland	1,270,426	26.1
St. Clair	159,874	3.3
Washtenaw	365,536	7.5
Wayne	1,751,169	36.0

Traffic and Commuting patterns

The Designations Guidance recommends conducting analyses related to traffic and commuting patterns by examining the location of major transportation arteries, traffic volume, and commuting in and around violating monitors. Michigan conducted the following analyses to evaluate mobile patterns and emissions for the Wayne County AoA.

For the Wayne County AoA, Michigan looked at average daily person miles traveled (PMT) data from 2019-2024 at the county level for Wayne, Macomb, Oakland, Washtenaw, Livingston, Monroe, and St. Clair counties, and similarly evaluated daily expanded truck movements data from 2023, in the form of vehicle miles traveled (VMT), for the same counties. This information was accessed using the LOCUS tool developed through a partnership between the Southeast Michigan Council of Governments (SEMCOG) and LOCUS Inc. - a wholly owned subsidiary of Cambridge Systematics.¹³

In regard to average daily motorized PMT we consider both: 1) trips that originated in Wayne County and end in another county of the Wayne County AoA (excluding Lapeer County), and 2) trips that originate in one of the counties in the Wayne County AoA (excluding Lapeer County) and end in Wayne County. Wayne County represents the highest proportion, approximately 60%, of the total daily PMT for these trips across all counties in the AoA, as shown in Tables 14a and 14b. The second highest county for trips both to and from Wayne County was Oakland County at about 18%.

Considering that heavy, medium, and light-duty trucks have higher emission rates of PM_{2.5} and its precursors than passenger vehicles, Michigan utilized the 2023 SEMCOG Truck Movements dataset within the LOCUS tool to determine which counties in the Wayne County AoA (excluding Lapeer) harbor the greatest amount of trucking activity on an average daily basis. In regard to average daily extended VMT for trucking trips that originated in Wayne County and end in another county of the Wayne County AoA (excluding Lapeer County), and trips that originate in one of the counties in the Wayne County AoA (excluding Lapeer County) and end in Wayne County, Wayne County represents the highest proportion, approximately 65%, of the total average daily extended VMT for all vehicle class categories (heavy-duty, medium-duty, and light-duty) across all counties in the AoA – as shown in Tables 14c and 14d. The next

¹³ (2025). LOCUS. <https://locusdata.io/>

highest county was Oakland County at 16.7%, which is significantly less than Wayne County. The Wayne County heavy- and light-duty vehicle class categories accounted for approximately 27% and 33% of the total average daily extended VMT across all counties, which was also higher than all other counties. Additionally, Tables 14c and 14d showed that within all counties generally the light-duty vehicles made up between 67% to 88% of county level VMT and heavy-duty vehicles made up 2% to 14% of the county level VMT. However, in Wayne County there is a significant shift in this pattern; light-duty vehicles represent 51.7% of county level VMT and heavy-duty vehicles represent 42.4%. These data show that more heavy-duty vehicle traffic occurs within Wayne County than traffic to or from Wayne County to or from other counties in the area.

In Table 14e, Michigan used the LOCUS tool data to analyze the county-level average daily expanded VMT for trucking trips to Wayne County from origin counties in the Wayne County AoA (except Lapeer County) by industry class for all truck vehicle types. It was determined that the Wayne County Retail Trade and Transportation/Warehousing industry classes represent the highest portion of the total daily VMT across all counties in the AoA, approximately 36%. Analogous results were also found for county-level average daily expanded VMT for trucking trips originating in Wayne County and ending in counties in the Wayne County AoA (excluding Lapeer) – as shown in Table 14f.

Table 14a. Average Daily PMT to Wayne (destination) County from Origin County in the Wayne County AoA (2019-2024)

Origin County	Daily PMT	Percentage of Total PMT (%)
Wayne	7,445,331	59.6
Oakland	2,297,487	18.4
Macomb	1,192,271	9.5
Washtenaw	766,967	6.1
Monroe	349,451	2.8
Livingston	292,049	2.3
St. Clair	152,928	1.2
<i>Total PMT</i>	<i>12,496,484</i>	<i>100.0</i>

Table 14b. Average Daily PMT from Wayne (origin) County to Destination County in the Wayne County AoA (2019-2024)

Destination County	Daily PMT	Percent of Total PMT (%)
Wayne	7,445,331	59.7
Oakland	2,310,498	18.5
Macomb	1,152,476	9.2
Washtenaw	738,587	5.9
Monroe	349,692	2.8
Livingston	308,046	2.5
St. Clair	158,013	1.3
<i>Total PMT</i>	<i>12,462,643</i>	<i>100.0</i>

Table 14c. Average Daily Expanded VMT to Wayne (destination) County from Origin County in Wayne County AoA by Vehicle Class (2023)

Origin County	Sum of Daily Expanded VMT	Percentage of County-wide Total VMT (%)	Percentage of Wayne County AoA VMT (%)
Livingston	3,296		1.5
Heavy-duty Trucks	74	2.2	0.0
Light-duty Trucks	2,914	88.4	1.4
Medium-duty Trucks	308	9.3	0.1
Macomb	20,777		9.7
Heavy-duty Trucks	1,170	5.6	0.5
Light-duty Trucks	17,256	83.1	8.1
Medium-duty Trucks	2,351	11.3	1.1
Monroe	3,499		1.6
Heavy-duty Trucks	489	14.0	0.2
Light-duty Trucks	2,380	68.0	1.1
Medium-duty Trucks	630	18.0	0.3
Oakland	35,820		16.7
Heavy-duty Trucks	1,715	4.8	0.8
Light-duty Trucks	29,995	83.7	14.0
Medium-duty Trucks	4,110	11.5	1.9
St. Clair	1,310		0.6
Heavy-duty Trucks	28	2.1	0.0
Light-duty Trucks	1,047	80.0	0.5
Medium-duty Trucks	235	17.9	0.1
Washtenaw	11,213		5.2
Heavy-duty Trucks	1,527	13.6	0.7
Light-duty Trucks	7,545	67.3	3.5
Medium-duty Trucks	2,141	19.1	1.0
Wayne	138,128		64.5
Heavy-duty Trucks	58,515	42.4	27.3
Light-duty Trucks	71,412	51.7	33.4
Medium-duty Trucks	8,201	5.9	3.8
Grand Total	214,043		100.0

Table 14d. Average Daily Expanded VMT from Wayne (origin) County to Destination County in Wayne County AoA by Vehicle Class (2023)

Destination County	Sum of Daily Expanded VMT	Percentage of County-wide Total VMT (%)	Percentage of Wayne County AoA VMT (%)
Livingston	3,666		1.7
Heavy-duty Trucks	265	7.2	0.1
Light-duty Trucks	3,135	85.5	1.5
Medium-duty Trucks	266	7.3	0.1
Macomb	19,178		9.0
Heavy-duty Trucks	1,828	9.5	0.9
Light-duty Trucks	15,592	81.3	7.3
Medium-duty Trucks	1,758	9.2	0.8
Monroe	3,413		1.6
Heavy-duty Trucks	516	15.1	0.2
Light-duty Trucks	2,515	73.7	1.2
Medium-duty Trucks	382	11.2	0.2
Oakland	38,250		17.9
Heavy-duty Trucks	5,432	14.2	2.5
Light-duty Trucks	29,787	77.9	13.9
Medium-duty Trucks	3,031	7.9	1.4
St. Clair	1,228		0.6
Heavy-duty Trucks	191	15.6	0.1
Light-duty Trucks	935	76.1	0.4
Medium-duty Trucks	102	8.3	0.0
Washtenaw	10,332		4.8
Heavy-duty Trucks	1,201	11.6	0.6
Light-duty Trucks	7,354	71.2	3.4
Medium-duty Trucks	1,777	17.2	0.8
Wayne	138,128		64.5
Heavy-duty Trucks	58,515	42.4	27.3
Light-duty Trucks	71,412	51.7	33.3
Medium-duty Trucks	8,201	5.9	3.8
Grand Total	214,194		100.0

Table 14e. Average Daily Expanded VMT to Wayne (destination) County from Origin County in Wayne County AoA by Industry Class for Heavy, Medium, and Light-duty Trucks (2023)

Origin County	Sum of Daily Expanded VMT	Percentage of County-wide Total VMT (%)	Percentage of Wayne County AoA VMT (%)
Livingston	3,295		1.5
Administrative and Support and Waste Management and Remediation Services	484	14.7	0.2
Construction	346	10.5	0.2
Manufacturing	519	15.8	0.2
Other Services	1,045	31.7	0.5
Retail Trade	148	4.5	0.1
Transportation and Warehousing	421	12.8	0.2
Unknown	26	0.8	0.0
Wholesale Trade	306	9.3	0.1
Macomb	20,777		9.7
Administrative and Support and Waste Management and Remediation Services	3,663	17.6	1.7
Construction	2,966	14.3	1.4
Manufacturing	2,256	10.9	1.1
Other Services	4,158	20.0	1.9
Retail Trade	1,473	7.1	0.7
Transportation and Warehousing	3,838	18.5	1.8
Unknown	237	1.1	0.1
Wholesale Trade	2,186	10.5	1.0
Monroe	3,499		1.6
Administrative and Support and Waste Management and Remediation Services	282	8.1	0.1
Construction	608	17.4	0.3
Manufacturing	299	8.5	0.1
Other Services	701	20.0	0.3
Retail Trade	283	8.1	0.1
Transportation and Warehousing	769	22.0	0.4
Unknown	81	2.3	0.0
Wholesale Trade	476	13.6	0.2
Oakland	35,820		16.7
Administrative and Support and Waste Management and Remediation Services	4,386	12.2	2.0
Construction	4,120	11.5	1.9
Manufacturing	3,003	8.4	1.4

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Other Services	9,223	25.7	4.3
Retail Trade	2,307	6.4	1.1
Transportation and Warehousing	8,255	23.0	3.9
Unknown	532	1.5	0.2
Wholesale Trade	3,994	11.2	1.9
St. Clair	1,310		0.6
Administrative and Support and Waste Management and Remediation Services	150	11.4	0.1
Construction	602	46.0	0.3
Manufacturing	114	8.7	0.1
Other Services	181	13.8	0.1
Retail Trade	26	2.0	0.0
Transportation and Warehousing	119	9.1	0.1
Unknown	14	1.1	0.0
Wholesale Trade	104	8.0	0.0
Washtenaw	11,212		5.2
Administrative and Support and Waste Management and Remediation Services	1,198	10.7	0.6
Construction	909	8.1	0.4
Manufacturing	900	8.0	0.4
Other Services	1,934	17.3	0.9
Retail Trade	860	7.7	0.4
Transportation and Warehousing	3,531	31.5	1.6
Unknown	167	1.5	0.1
Wholesale Trade	1,713	15.3	0.8
Wayne	138,128		64.5
Administrative and Support and Waste Management and Remediation Services	10,141	7.3	4.7
Construction	6,481	4.7	3.0
Manufacturing	5,686	4.1	2.7
Other Services	22,363	16.2	10.4
Retail Trade	46,270	33.5	21.6
Transportation and Warehousing	31,223	22.6	14.6
Unknown	1,522	1.1	0.7
Wholesale Trade	14,442	10.5	6.7
Grand Total	214,042		100.0

Table 14f. Average Daily Expanded VMT from Wayne (origin) County to Destination County in Wayne County AoA by Industry Class for Heavy, Medium, and Light-duty Trucks (2023)

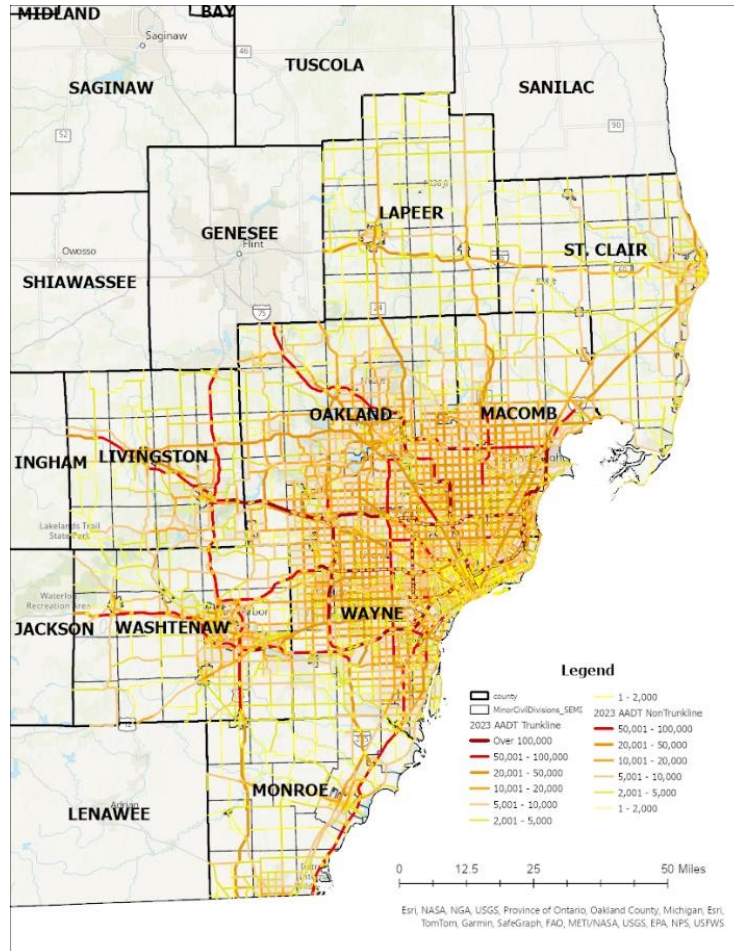
Destination County	Sum of Daily Expanded VMT	Percentage of County-wide Total VMT (%)	Percentage of Wayne County AoA VMT (%)
Livingston	3,666		1.7
Administrative and Support and Waste Management and Remediation Services	463	12.6	0.2
Construction	575	15.7	0.3
Manufacturing	424	11.6	0.2
Other Services	831	22.7	0.4
Retail Trade	746	20.4	0.3
Transportation and Warehousing	450	12.3	0.2
Unknown	74	2.0	0.0
Wholesale Trade	103	2.8	0.0
Macomb	19,177		9.0
Administrative and Support and Waste Management and Remediation Services	2,140	11.2	1.0
Construction	2,544	13.3	1.2
Manufacturing	1,924	10.0	0.9
Other Services	4,931	25.7	2.3
Retail Trade	1,100	5.7	0.5
Transportation and Warehousing	4,148	21.6	1.9
Unknown	339	1.8	0.2
Wholesale Trade	2,051	10.7	1.0
Monroe	3,413		1.6
Administrative and Support and Waste Management and Remediation Services	429	12.6	0.2
Construction	437	12.8	0.2
Manufacturing	309	9.0	0.1
Other Services	786	23.0	0.4
Retail Trade	215	6.3	0.1
Transportation and Warehousing	953	27.9	0.4
Unknown	63	1.9	0.0
Wholesale Trade	221	6.5	0.1
Oakland	38,248		17.9
Administrative and Support and Waste Management and Remediation Services	4,916	12.9	2.3
Construction	4,361	11.4	2.0
Manufacturing	2,979	7.8	1.4
Other Services	10,435	27.3	4.9

Retail Trade	2,223	5.8	1.0
Transportation and Warehousing	8,466	22.1	4.0
Unknown	594	1.6	0.3
Wholesale Trade	4,274	11.2	2.0
St. Clair	1,227		0.6
Administrative and Support and Waste Management and Remediation Services	329	26.8	0.2
Construction	86	7.0	0.0
Manufacturing	89	7.3	0.0
Other Services	97	7.9	0.0
Retail Trade	42	3.4	0.0
Transportation and Warehousing	444	36.2	0.2
Unknown	45	3.7	0.0
Wholesale Trade	95	7.8	0.0
Washtenaw	10,333		4.8
Administrative and Support and Waste Management and Remediation Services	811	7.8	0.4
Construction	861	8.3	0.4
Manufacturing	1,027	9.9	0.5
Other Services	2,501	24.2	1.2
Retail Trade	932	9.0	0.4
Transportation and Warehousing	2,416	23.4	1.1
Unknown	143	1.4	0.1
Wholesale Trade	1,642	15.9	0.8
Wayne	138,128		64.5
Administrative and Support and Waste Management and Remediation Services	10,141	7.3	4.7
Construction	6,481	4.7	3.0
Manufacturing	5,686	4.1	2.7
Other Services	22,363	16.2	10.4
Retail Trade	46,270	33.5	21.6
Transportation and Warehousing	31,223	22.6	14.6
Unknown	1,522	1.1	0.7
Wholesale Trade	14,442	10.5	6.7
Grand Total	214,192		100.0

To locate the major transportation arteries of the Wayne County AoA, Michigan utilized MDOT's Annual Average Daily Traffic (AADT) Tool to export 2023 AADT data for trunkline and non-trunkline roads within the eight-county area. The visual findings of this portion of the Traffic and Commuting Patterns analysis can be seen in Figure 23, which shows the largest cluster and concentration of trunkline and

non--trunkline roads with an AADT of over 20,001 being located in the southeast portion of Oakland County, the southern portion of Macomb County, and much of Wayne County.

Figure 23. 2023 Annual average daily traffic estimates for trunkline and non-trunkline roads in the Wayne County AoA.



4.1.3 Wayne County AoA - Meteorology

Wind Rose Analysis

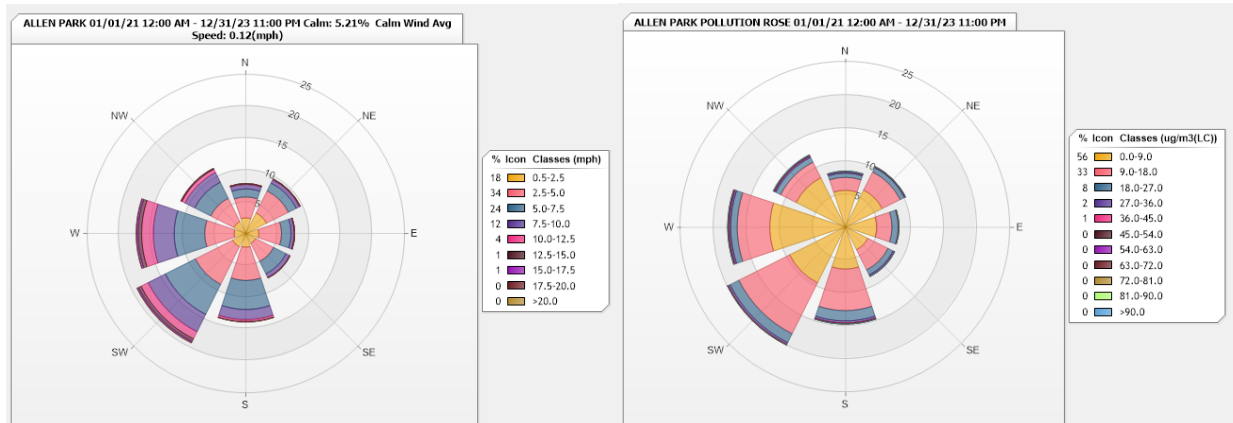
As discussed in Section 3.3, Michigan generated wind and pollution roses for the monitoring sites and several airports in the Wayne County AoA prior to the USEPA's finalizing wind roses on the PM_{2.5} Designations Mapping Tool. Included in Attachment 2 are the wind roses from the USEPA's PM_{2.5} Designation Mapping Tool for the Detroit area where monitoring sites exceed the 2024 PM_{2.5} standard. The USEPA's wind roses use units of m/s and show data from the 2021-2023 DV timeframe. Discussed further below in this section are wind and pollution roses for each violating monitor in the Wayne County AoA.

Allen Park (261630001)

Wind and pollution roses for the Allen Park monitoring site are presented in Figure 24. The wind rose for Allen Park indicates that the most common wind speed, 34% of the time, is between 2.5 and 5.0 mph. It

also shows that the winds come mostly from the southwest and west at this monitoring site. Additionally, the pollution rose shows that 56% of the time PM_{2.5} concentrations are between 0.0 and 9.0 µg/m³. The pollution rose also indicates that the winds at this site are from the southwest, west, and south the majority of the time.

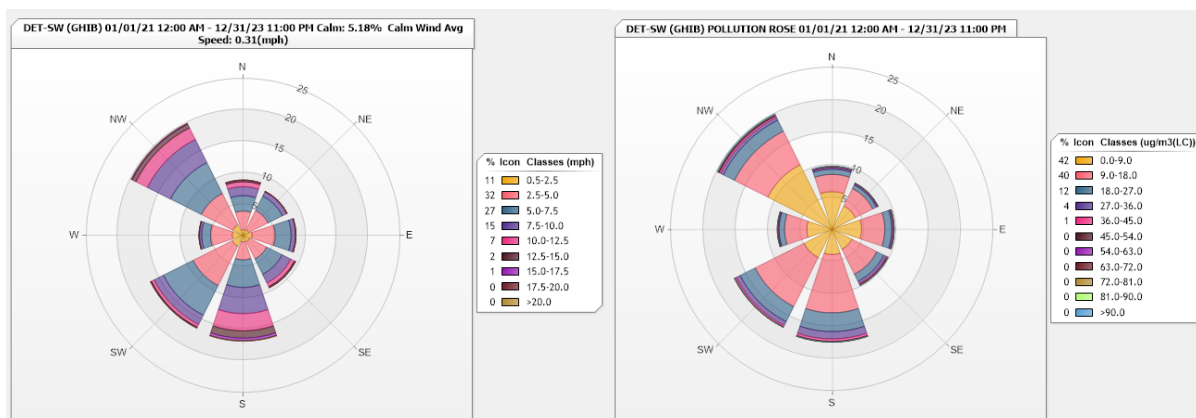
Figure 24. Allen Park Wind (left) and Pollution Roses (right) for 2021-2023 DV.



Detroit-SW (261630015)

Wind and pollution roses for the Detroit-SW monitoring site are presented in Figure 25. The wind rose for Detroit-SW indicates that the most common wind speed, 32% of the time, is between 2.5 and 5.0 mph. It also shows that the winds come mostly from the northwest, southwest, and south at this monitoring site. Additionally, the pollution rose shows that 42% of the time PM_{2.5} concentrations are between 0.0 and 9.0 µg/m³, and 40% of the time PM_{2.5} concentrations are between 9.0 and 18.0 µg/m³. The PM_{2.5} concentrations are more likely to be lower than 9.0 µg/m³ when the winds are from the north and northwest rather than other directions. The pollution rose also indicates that the winds at this monitoring site are from the northwest, southwest, and south the majority of the time. It should be noted that while siting criteria have been applied to the meteorological instruments at this site, it is likely that the overall prevailing wind patterns in the area are not accurately being recorded at the monitoring site due to the closeness of surrounding buildings. So, while the data is representative of near-monitor conditions, it may not be representative of winds beyond the immediate area of the monitoring site.

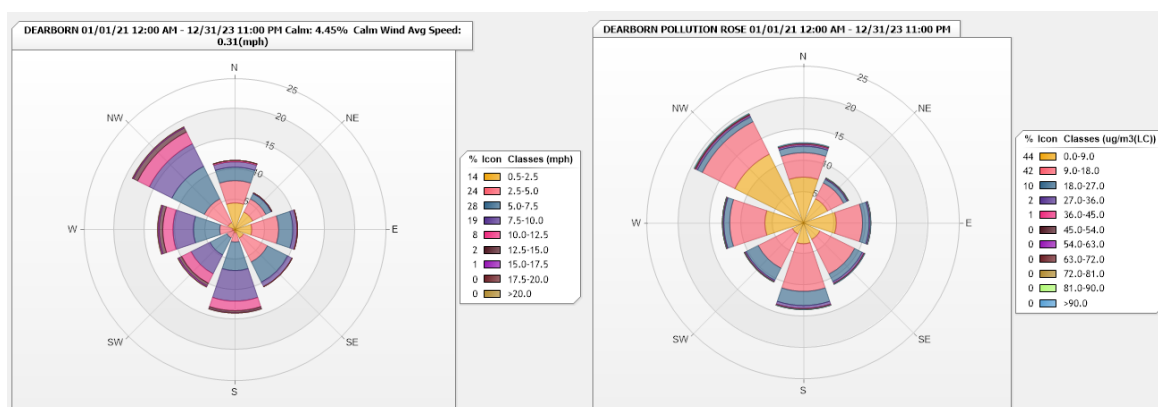
Figure 25. Detroit-SW Wind (left) and Pollution Roses (right) for 2021-2023 DV.



Dearborn (261630033)

Wind and pollution roses for the Dearborn monitoring site are presented in Figure 26. The wind rose for Dearborn indicates that the most common wind speed, 28% of the time, is between 5.0 and 7.5 mph. It also shows that the winds come mostly from the northwest at this site. The pollution rose shows that 44% of the time, PM_{2.5} concentrations are between 0.0 and 9.0 µg/m³, and 42% of the time PM_{2.5} concentrations are between 9.0 and 18.0 µg/m³. The PM_{2.5} concentrations are more likely to be lower than 9.0 µg/m³ when the winds are from the northwest rather than other directions, while winds from the southeast are much more likely to result in concentrations greater than 9 µg/m³.

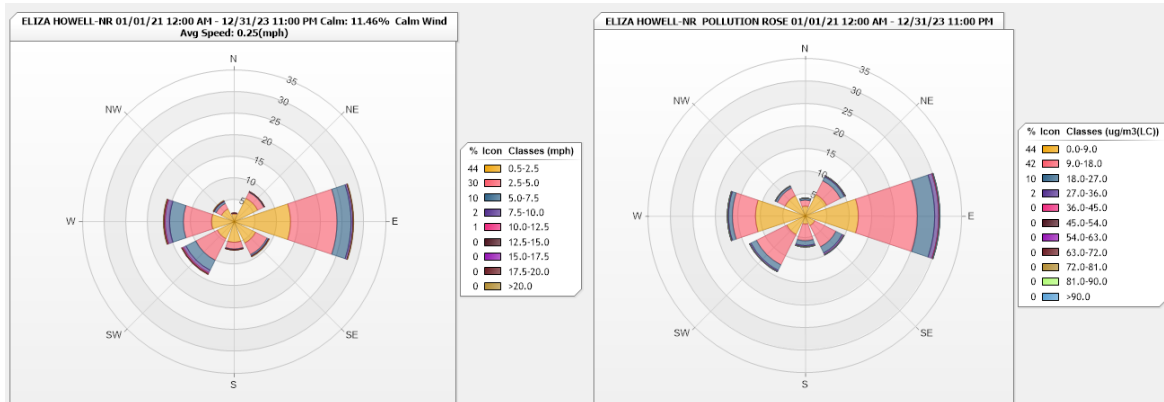
Figure 26. Dearborn Wind (left) and Pollution Roses (right) for 2021-2023 DV.



Eliza Howell Near Road (261630093)

Wind and pollution roses for the Eliza Howell monitoring site are presented in as Figure 27. The wind rose for Eliza Howell indicates that the most common wind speed, 44% of the time, is between 0.5 and 2.5 mph. It also shows that the winds come mostly from the northwest at this site. The pollution rose shows that 44% of the time, PM_{2.5} concentrations are between 0.0 and 9.0 µg/m³, and 42% of the time, PM_{2.5} concentrations are between 9.0 and 18.0 µg/m³. The pollution rose also indicates that PM_{2.5} migrates to the monitoring site from the east the majority of the time. It should be noted that this site is located immediately adjacent to and north of I-96, and is likely influenced by roadway travel, so that the measurements may not be representative of regional wind patterns.

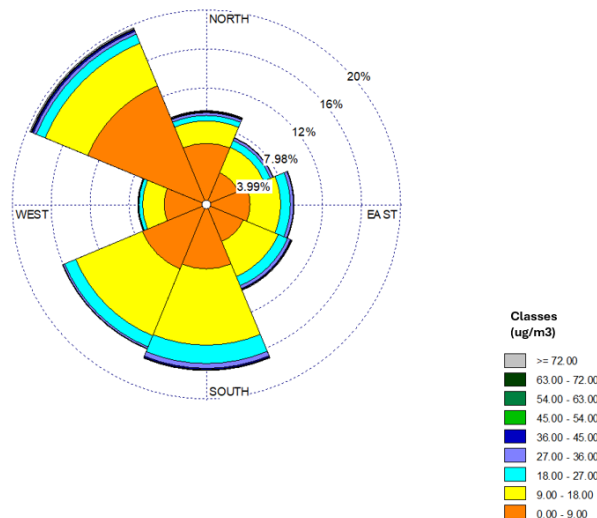
Figure 27. Eliza Howell-Near Road Wind (left) and Pollution Roses (right) for 2021-2023 DV.



NMH 48217 (261630097)

The pollution rose for the NMH 48217 monitoring site is presented in Figure 28. This monitor does not measure wind speed or direction, nor does it monitor continuous PM_{2.5} data. Therefore the pollution rose was created using a different program, and the meteorology data was supplemented with wind speed and direction data from the Detroit-SW monitor. The pollution rose also indicates that PM_{2.5} migrates to the monitoring site from the northwest the majority of the time. The pollution rose shows PM_{2.5} concentrations out of the northwest are between 0.0 and 9.0 µg/m³ 13% of the time, between 9.0 and 18.0 µg/m³ 5% of the time, between 18.0 and 27.0 µg/m³ 1% of the time, between 27.0 and 36.0 µg/m³ 0.5% of the time, and between 36.0 and 45.0 µg/m³ 0.5% of the time. The PM_{2.5} concentrations are more likely to be lower than 9.0 µg/m³ when the winds are from the north, northwest, and west rather than other directions.

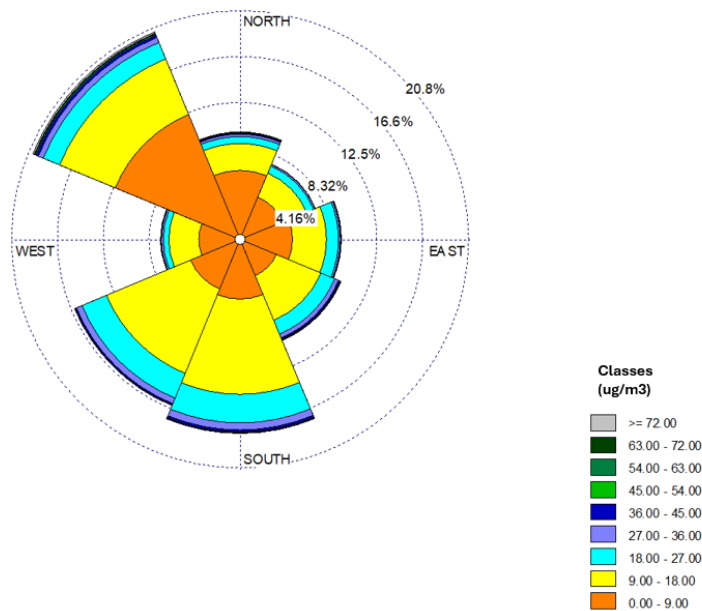
Figure 28. NMH 48217 Pollution Rose for 2021-2023 DV.



DP4th (261630098)

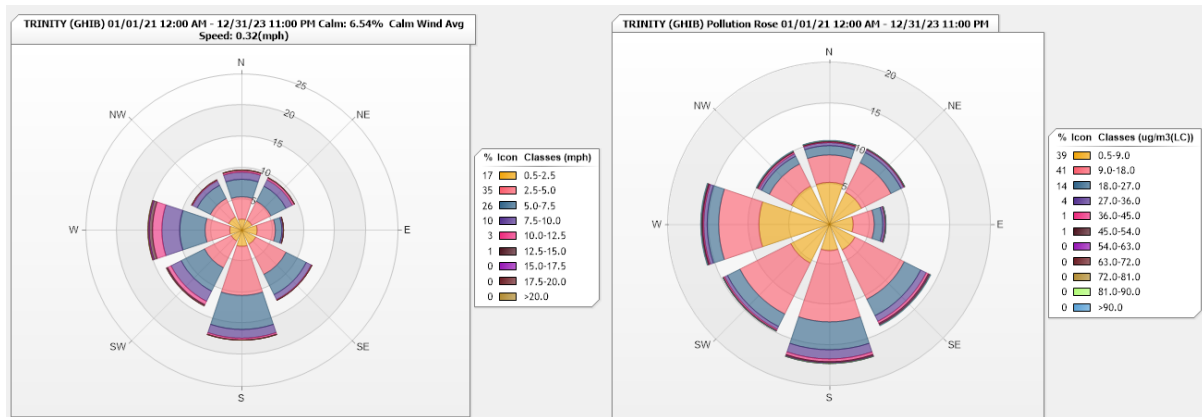
The pollution rose for the DP4th monitoring site is presented in Figure 29. This monitor does not measure wind speed or direction, nor does it monitor continuous PM_{2.5} data. Therefore, the pollution rose was created using a different program and the meteorology data was supplemented with wind speed and direction data from the Detroit-SW monitor. The pollution rose also indicates that PM_{2.5} migrates to the monitoring site from the northwest the majority of the time. The pollution rose shows PM_{2.5} concentrations out of the northwest are between 0.0 and 9.0 µg/m³ 12% of the time, between 9.0 and 18.0 µg/m³ 6% of the time, between 18.0 and 27.0 µg/m³ 3% of the time, between 27.0 and 36.0 µg/m³ 1% of the time, and 36.0 and 45.0 µg/m³ 1% of the time. The PM_{2.5} concentrations are more likely to be lower than 9.0 µg/m³ when the winds are from the north and northwest rather than other directions.

Figure 29. DP4th Pollution Rose for 2021-2023 DV.

Trinity (261630099)

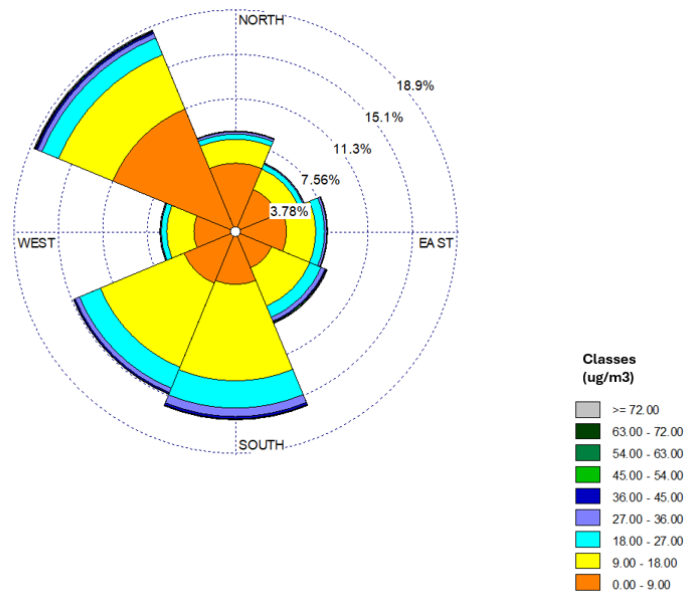
Wind and pollution roses for the Trinity monitoring site are presented in Figure 30. The wind rose for Trinity indicates that the most common wind speed, 35% of the time, is between 2.5 and 5.0 mph. It also shows that the winds come mostly from the south and west at this monitoring site. Additionally, the pollution rose shows that 41% of the time PM_{2.5} concentrations are between 9.0 and 18.0 µg/m³, and 39% of the time PM_{2.5} concentrations are between 0.5 and 9.0 µg/m³. The PM_{2.5} concentrations are more likely to be lower than 9.0 µg/m³ when the winds are from the north, northwest, and west rather than other directions, while winds from the south and southeast are much more likely to result in concentrations greater than 9.0 µg/m³.

Figure 30. Trinity Wind (left) and Pollution Roses (right) for 2021-2023 DV.

**Military Park (261630100)**

The pollution roses for the Military Park monitoring site are presented in Figure 31. This monitor does not measure wind speed or direction, nor does it monitor continuous PM_{2.5} data. The pollution rose was created using a different program and the meteorology data was supplemented with wind speed and direction data from the Detroit-SW monitor. The pollution rose also indicates that PM_{2.5} migrates to the monitoring site from the northwest the majority of the time. The pollution rose shows PM_{2.5} concentrations out of the northwest are between 0.0 and 9.0 µg/m³ 11% of the time, between 9.0 and 18.0 µg/m³ 5% of the time, between 18.0 and 27.0 µg/m³ 2% of the time, between 27.0 and 36.0 µg/m³ 1% of the time, and 36.0 and 45.0 µg/m³ 1% of the time. The PM_{2.5} concentrations are more likely to be lower than 9.0 µg/m³ when the winds have a northerly component than when winds are from other directions, while winds from the southwest and south are much more likely to result in concentrations greater than 9.0 µg/m³.

Figure 31. Military Park Pollution Rose for 2021-2023 DV.

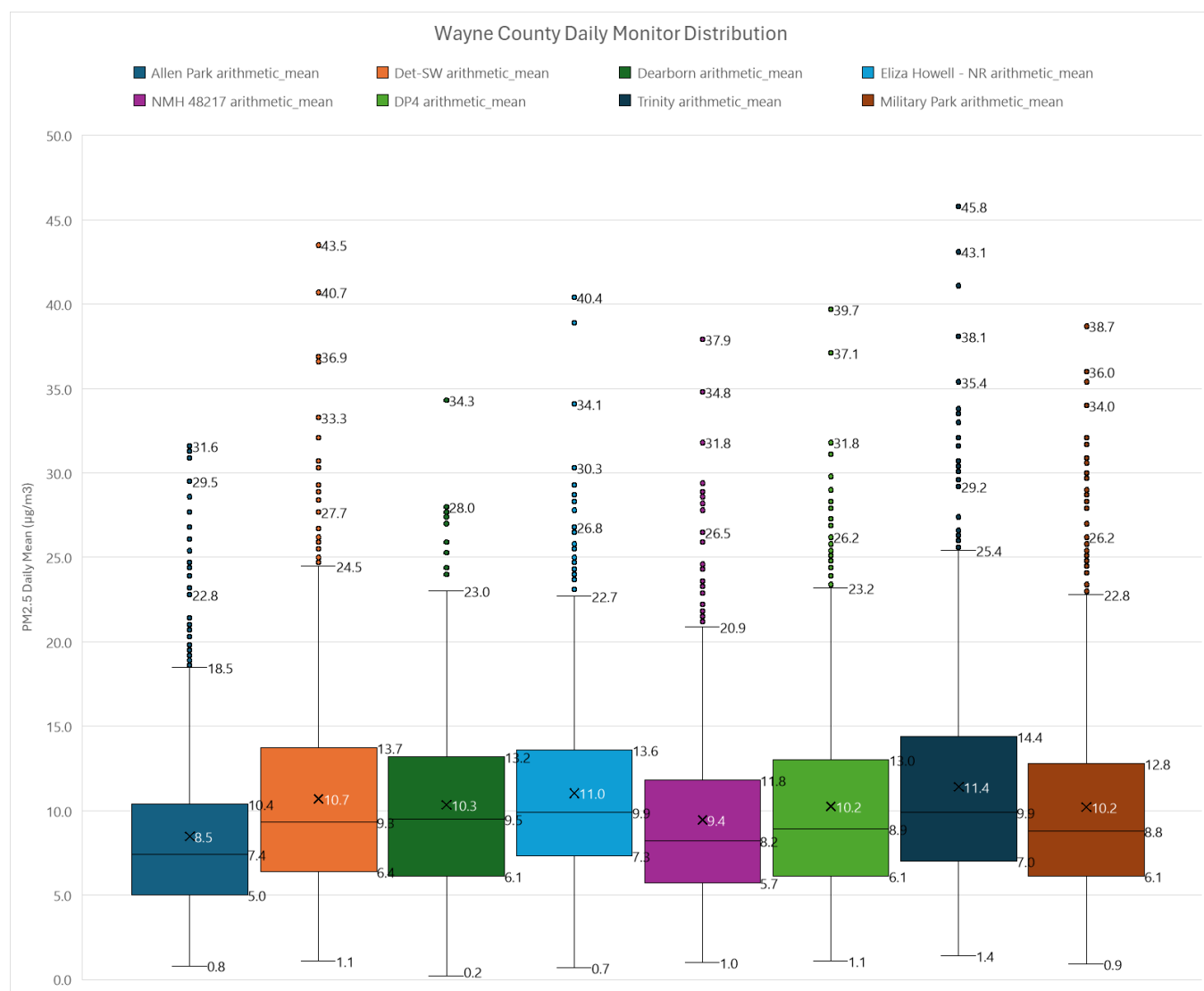


Magnitude of Exceedance Analysis

Michigan reviewed daily PM_{2.5} means from 2021 through 2023 to understand the distribution and level of exceedances at the violating air monitors in Wayne County. In this magnitude of exceedance analysis Michigan removed days that were potentially influenced by wildfire events to best determine any local areas contributing to violations at the monitors that are within the regulatory authority of the state. To determine days potentially influenced by wildfires, Michigan utilized the USEPA PM_{2.5} Tiering Tool for Exceptional Events Analysis¹⁴. The days removed for the Wayne County magnitude of exceedance study were all from June 2023 and July 25 through 29, 2023, as well as July 4 for 2021, 2022, and 2023. The remaining dates and daily PM_{2.5} levels were displayed in a box plot to determine outliers which most represent the highest levels of pollution. Figure 32 shows the results of this analysis for each exceeding monitor in Wayne County.

¹⁴ PM_{2.5} Tiering Tool - for Exceptional Events Analysis | USEPA. (2024, February 22). USEPA. <https://www.epa.gov/air-quality-analysis/pm25-tiering-tool-exceptional-events-analysis>

Figure 32. Wayne County Magnitude of Exceedance Analysis.

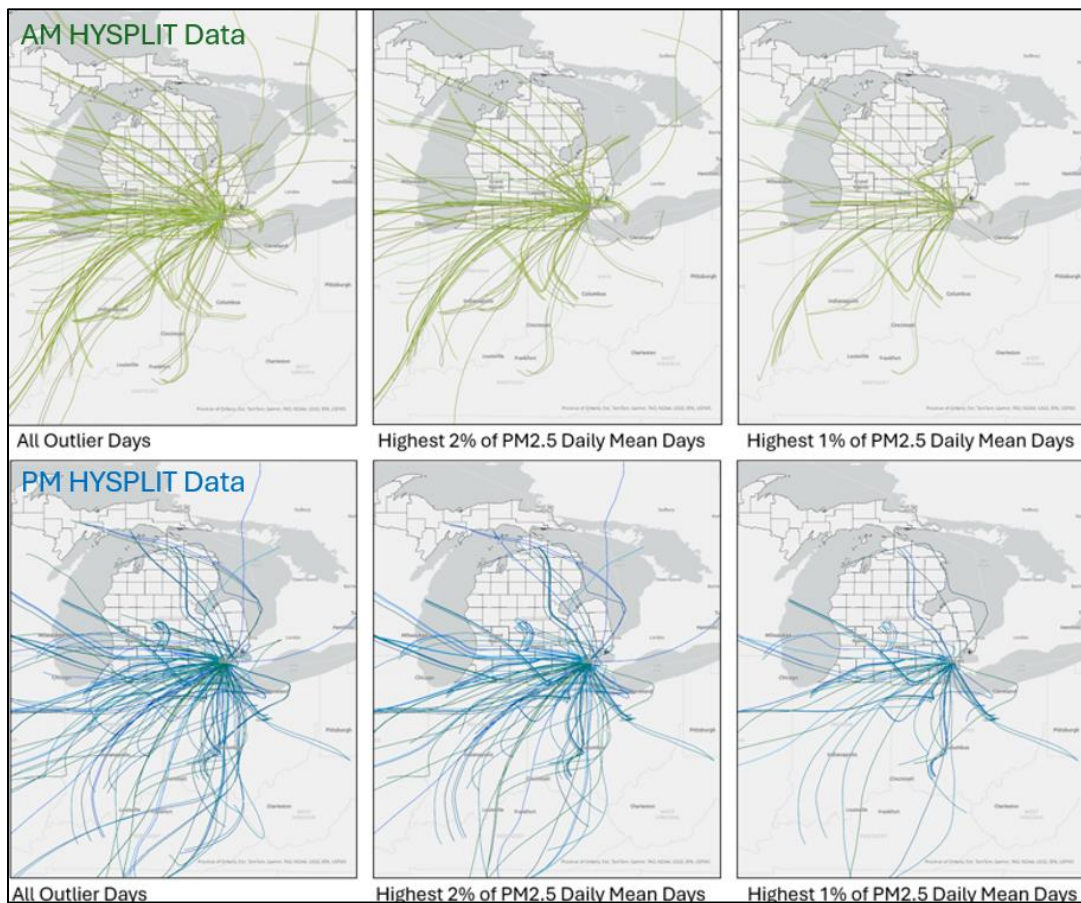


In Figure 32, the dots represent outlier data, that significantly deviate from the majority of the data within the set. The box portion represents the middle 50% of the data, the line inside the box represents the median value, and the lines extending from the box (whiskers) show the minimum and maximum values representing 1.5 times the interquartile range. The following HYSPLIT model analysis examines the resulting outlier dates from this magnitude of exceedance study in relation to back trajectories to identify the path traversed for an air parcel arriving at the monitor location. These back trajectories are used to identify the locations from where pollution may be transported to the monitoring location.

HYSPLIT Model Analysis

HYSPLIT is a model developed by the National Oceanic and Atmospheric Administration (NOAA) and is a complete system for computing simple air parcel trajectories¹⁵. This tool uses gridded meteorology data to simulate how wind advects air parcels. The USEPA provided AM and PM HYSPLIT modeling for the 2021-2023 period nationally for all exceeding monitors. The methodology they used can be found in the Designations Guidance document. Michigan plotted the exceeding monitor HYSPLIT data using ArcGIS Pro to geographically analyze the data. Utilizing the results of the magnitude of exceedance study Michigan created definition queries to review back trajectories for all outlier dates, representing the highest 2% and 1% of PM_{2.5} daily means. Figure 33 shows a compilation of the resulting maps from this analysis for both the AM and PM HYSPLIT datasets. The AM dataset shows the back trajectory of each outlier day at 8 AM backwards for 24 hours, illustrating where air traveled primarily from the day prior. The PM dataset shows the back trajectory of each outlier day at 10 PM backwards for 24 hours, illustrating where air traveled primarily the day of and night prior to the outlier day. Both are important considerations when pairing with the PM_{2.5} daily mean data, which represent the whole day rather than a particular time period within the day.

Figure 33. HYSPLIT Maps showing outlier days from the Magnitude of Exceedance study for the Wayne County Exceeding Air Monitors for 2021-2023.



¹⁵ HYSPLIT. (n.d.). Air Resources Laboratory. <https://www.arl.noaa.gov/hysplit/>

The maps in Figure 33 show a majority of the air parcels coming from the southerly and westerly directions, and to a lesser extent from the northerly, easterly, and westerly directions. This distribution remains similar even when looking at only the highest 1% of PM_{2.5} daily mean days. Michigan utilized tools within ArcGIS Pro to determine the start and end points of each daily back trajectory and calculate the general direction of each line. There are limitations to this methodology since these trajectories are not straight lines and a line could curve and end in a different directional quadrant than where it spent most of its time. Figures 34 and 35 show the number of lines that originated from the northeast, northwest, southeast, and southwest quadrants from the monitoring location for both the AM and PM HYPLIT data, respectively. This analysis includes all outlier dates determined from the previous magnitude of exceedance analysis for 2021-2023 for the seven monitors in Wayne County. The figures also include a 20% error bar to conservatively represent the limitation of determining the directional quadrant, as discussed earlier.

Figure 34. Count of AM HYPSLITs for each directional quadrant at all exceeding Wayne County monitors for all outlier dates from 2021-2023.

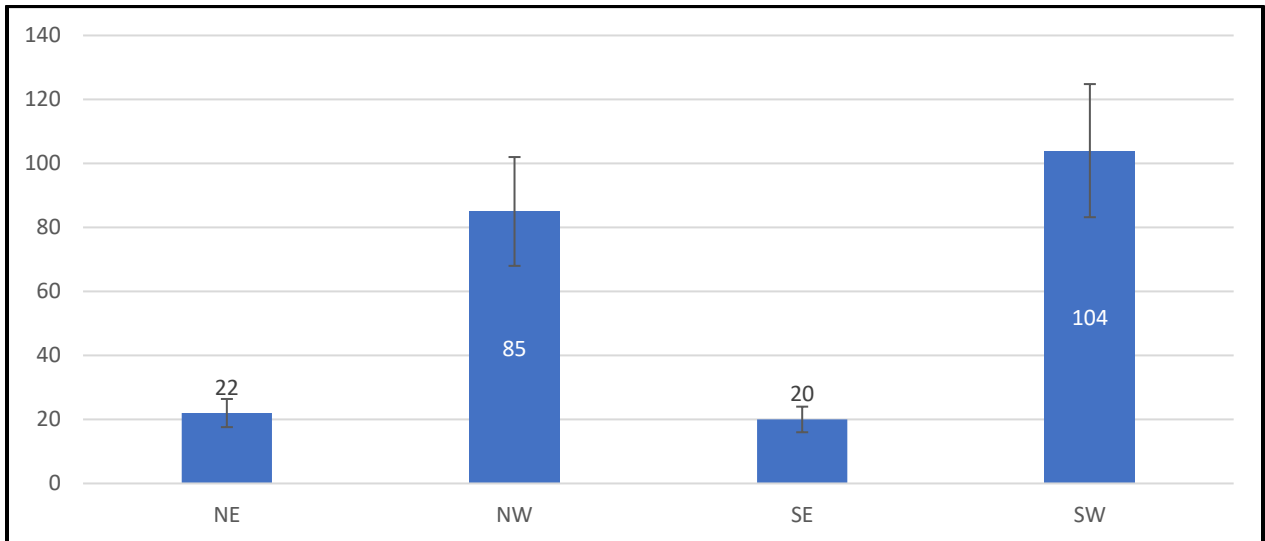
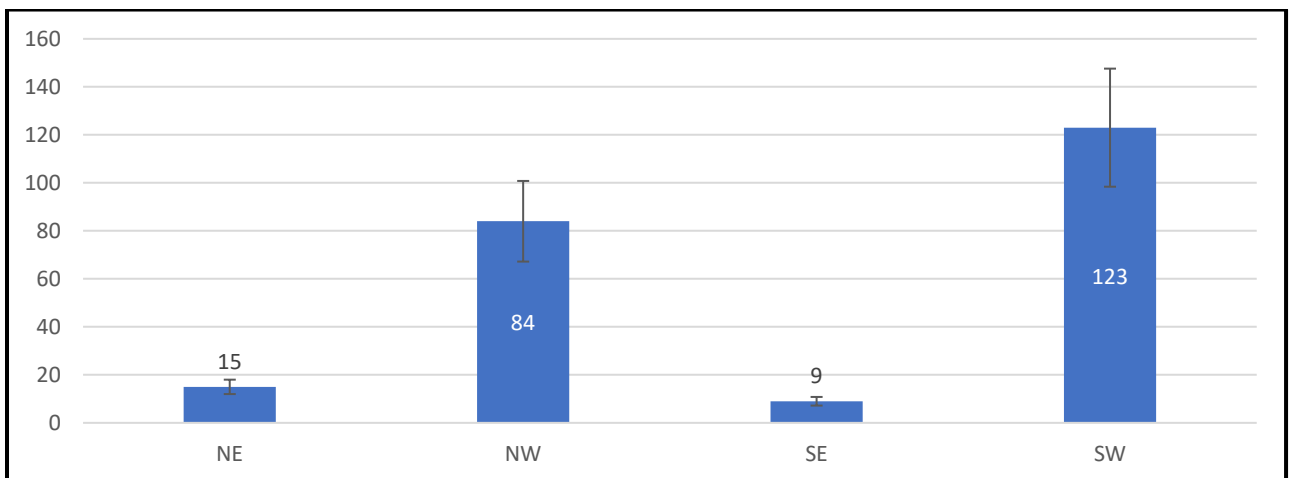


Figure 35. Count of PM HYPSLITs for each directional quadrant at all exceeding Wayne County monitors for all outlier dates from 2021-2023.



Figures 34 and 35 show that, for both AM and PM HYSPLITs on the outlier dates, the most influence comes from the southwest (45-53%) and northwest (36-37%). The wind rose analysis discussed earlier showed that the dominant wind is from the southwest quadrant, so that was expected; however, this HYSPLIT analysis also detects a significant northwesterly influence on days when the monitor experiences higher PM_{2.5}. Since this data is broken down into four directions there are limitations on determining how much of the influence may be coming from westerly winds as opposed to northwesterly or southwesterly winds. When the quantitative data from Figures 34 and 35 are paired with the qualitative maps in Figure 33, it can be deduced that for higher daily levels of PM_{2.5} air parcels come from the west, as well as the northwest and southwest, with more coming from the southwest. As stated previously the USEPA's Regulatory Impact Assessment (see Footnote 2) found that large reductions in NO_x and SO₂ in recent decades have reduced regional background concentration and increased the importance of urban influences for PM_{2.5} emissions. Michigan acknowledges there may be limitations to deriving directional data from HYSPLIT trajectories that can, in many cases, have end points outside the urban areas.

4.1.4 Wayne County AoA - Geography and Topography

The Wayne County AoA does not have any significant geographical or topographical obstructions known to affect air pollution transport. Therefore, this factor does not impact the analysis of this area.

4.1.5 Wayne County AoA - Jurisdictional Boundaries

The Detroit-Warren-Dearborn CBSA currently includes Lapeer, St. Clair, Macomb, Oakland, Livingston, and Wayne counties. Livingston, Macomb, Monroe, Oakland, St. Clair, Washtenaw, and Wayne counties were previously designated as nonattainment under the 1997 and 2006 annual PM_{2.5} standard as part of the Detroit-Ann Arbor NAA.

4.1.6 Wayne County AoA - Environmental Justice

The Designations Guidance suggested, for the purposes of outreach or developing designation recommendations, that states use the USEPA's classification criteria for "disadvantaged communities" in identifying areas of environmental justice concern around monitors violating the PM_{2.5} NAAQS. According to the USEPA, "Disadvantaged communities are defined as any community that meets at least one of the following characteristics: communities reflected in the Climate and Economic Justice Screening Tool (CEJST); any census block group that is at or above the 90th percentile for any of the Environmental Justice Screening and Mapping Tool's (EJSCREEN) Supplemental Indexes when compared to the nation or state; and/or any geographic area within Tribal lands as included in EJSCREEN" (see Footnote 1).^{16,17}

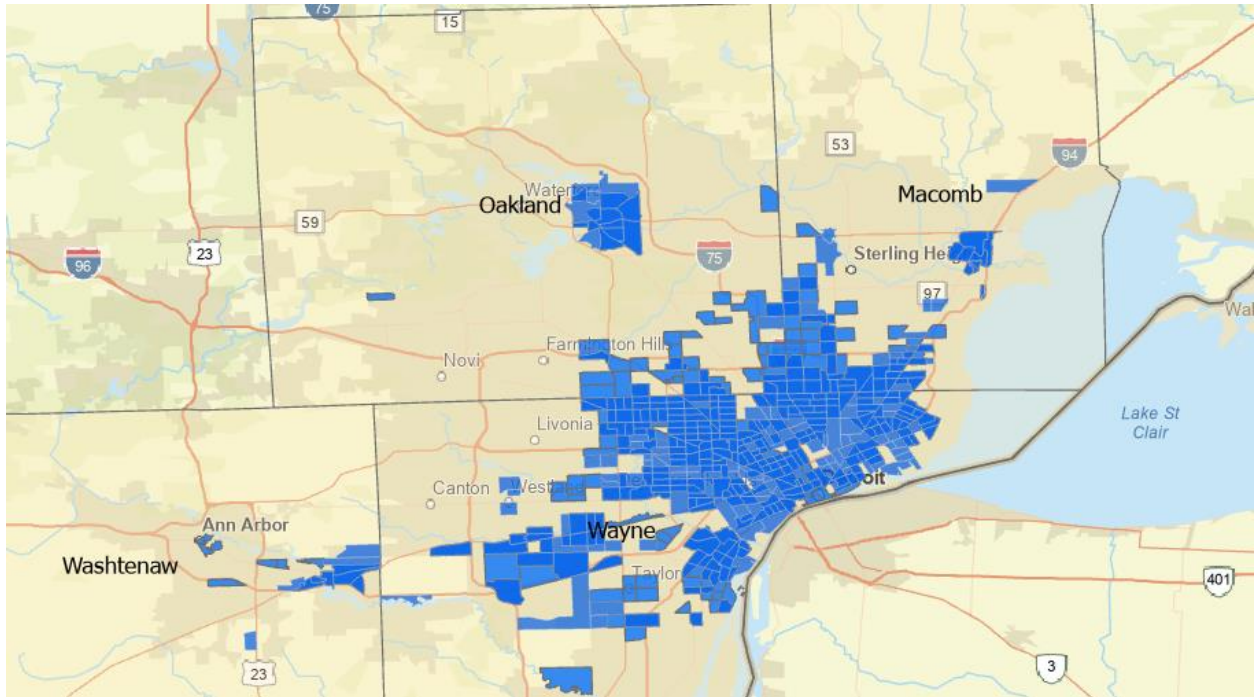
For the Wayne County AoA, Michigan identified census tracts that meet the USEPA's "disadvantaged community" criteria. Michigan chose to conduct an environmental justice analysis for only four of the eight Wayne County AoA counties (Macomb, Oakland, Washtenaw, and Wayne County) considering that these four counties make up approximately 88% of the total population of the Wayne County AoA (as shown in Table 12). In Figure 36, those census block groups that meet the USEPA's criteria for being

¹⁶ (n.d.). Climate and Economic Justice Screening Tool [Review of Climate and Economic Justice Screening Tool]. US Council on Environmental Quality. <https://screeningtool.geoplatform.gov/en/#3/33.47/-97.5>

¹⁷ (2024, November 18). EJScreen: Environmental Justice Screening and Mapping Tool [Review of EJScreen: Environmental Justice Screening and Mapping Tool]. USEPA. <https://www.epa.gov/ejscreen>

classified as a “disadvantaged community” are shown in blue. The largest continuous cluster and concentration of these “disadvantaged community” census block groups encompasses a large area within the northeast portion of Wayne County, the southeast portion of Oakland County, and the southwest corner of Macomb County. Additionally, scattered “disadvantaged community” census block groups can be seen in the eastern part of Washtenaw County, as well as Central Oakland, Macomb, and Wayne counties.

Figure 36. “Disadvantaged Communities” at the Census Block Group Level in Macomb, Oakland, Washtenaw, and Wayne Counties.



Per the Designations Guidance, Michigan completed outreach to interested parties in the Detroit area. Michigan spoke with the following communities and associations regarding the revised 2024 PM_{2.5} NAAQS, the designations process, and future attainment planning: Detroit Hamtramck Coalition, Eastside Community Network, Asthma Collaborative of Detroit, The Ecology Center Air Quality Sensor Learning Collaborative, SEMCOG, and the Eastern Chapter of the Air & Waste Management Association.

On December 2, 2024, the USEPA posted a non-regulatory docket (EPA-HQ-OAR-2024-0078) on the purpose of providing an opportunity for the public to provide feedback on the outreach process states might undertake in developing the recommendations they submit to the USEPA, and outreach that the USEPA might undertake associated with issuing final designations.¹⁸ In an effort to better inform the public of this, Michigan utilized its GovDelivery email distribution service to disseminate the links to the non-regulatory docket and other recently posted USEPA PM_{2.5} resources.

¹⁸ (2024, December 2). Regulations.gov. <https://www.regulations.gov/search?documentTypes=Other&filter=EPA-HQ-OAR-2024-0078>

4.1.7 Wayne County AoA - Conclusions

Livingston, Macomb, Monroe, Oakland, St. Clair, Washtenaw, and Wayne counties have historically been part of the nonattainment area for PM_{2.5} NAAQS under the 1997 and 2006 standards.

The meteorological analyses showed concentrations at the violating monitors are most frequently from the southwest. The magnitude of exceedance analysis was able to identify outliers for high PM_{2.5} days at the exceeding monitors. When the HYSPLIT data was analyzed for these dates, it again showed a strong southwesterly influence with a smaller but still significant northwesterly influence. The data showed that when monitors experience PM_{2.5} concentrations above 9.0 µg/m³, winds are from the south and southwest.

The results of the PM_{2.5} Source Contribution study conducted by the University of Michigan showed a strong mobile contribution to the exceeding monitors in Wayne County. The study also showed high contributions from ferrous metal (e.g., steel and coke) and soils/dust (construction, paved, and unpaved roads) that align with the point and nonpoint emissions analysis conducted for this area.

Review of the 2022 emissions data showed that Wayne County has the highest PM_{2.5} and precursor emissions from all sectors (i.e., point, nonpoint, onroad, and nonroad), followed to a lesser extent by Oakland, St. Clair, and Macomb counties. Across the board, the nonpoint sector is the largest contributor to direct PM_{2.5} and precursors for the Wayne County AoA with a majority of emissions coming from residential wood combustion, commercial cooking, and dust from paved and unpaved roads. The highest PM_{2.5} point source emissions are located within Wayne County. While there are large NO_x and SO₂ contributions from the St. Clair/Belle River and Monroe power plants, these facilities are expected to have significant reductions in the near future. Additionally, St. Clair and Monroe counties are not typically in the path where air parcels predominately come from to impact monitors based on the meteorology portion of this analysis. USEPA findings (see Footnote 2) additionally state that NO_x and SO₂ reductions over the last decade have created more of an environment where PM_{2.5} direct emissions from urban areas are found to be the main contributors to PM_{2.5} pollution across the nation.

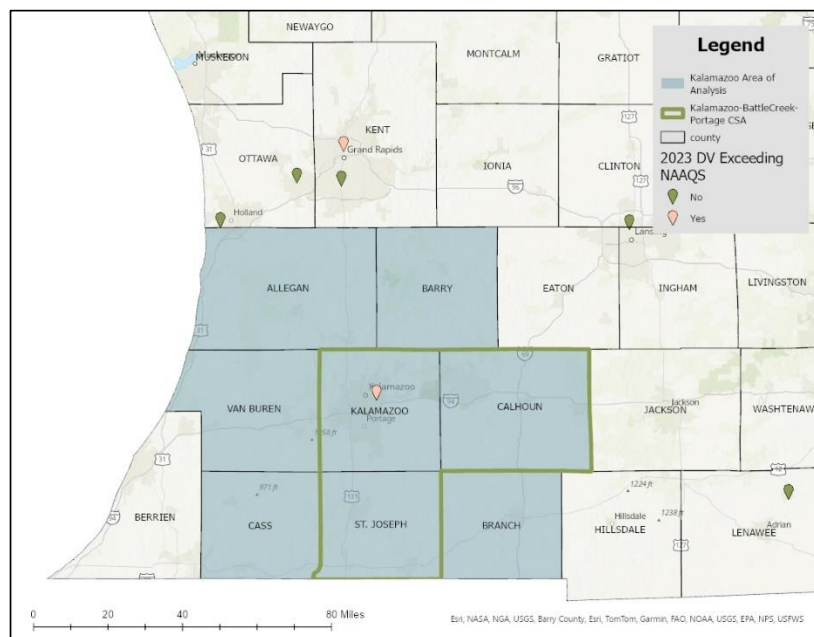
Michigan agrees that PM_{2.5} likely comes from local urban sources within the Wayne County AoA, especially considering that there are several exceeding monitors within a localized area of Wayne County, while monitors attaining the PM_{2.5} NAAQS are situated at the northern end of the county and at the borders of the adjacent counties. Michigan's historic DV trends analysis shows a long-term decline in PM_{2.5} concentrations at the Oak Park and East 7 Mile attaining monitoring sites, with the exception of peaks in 2023 likely due to Canadian wildfire influences. This historic trend at neighboring monitors further demonstrates that PM_{2.5} in the Wayne County AoA is likely attributable to local influences within the urban area rather than broad sources across several counties.

Given the results of all these analyses, Michigan recommends that Wayne County be designated as nonattainment.

4.2.0 Kalamazoo County Area

The Kalamazoo Area was evaluated because the Kalamazoo air monitoring site (260770008) has a 2021-2023 DV of 10.4 $\mu\text{g}/\text{m}^3$, exceeding the 9.0 $\mu\text{g}/\text{m}^3$ PM_{2.5} NAAQS. Michigan analyzed the CSA identified as the Kalamazoo-Battle Creek-Portage Area, as well as adjoining Allegan, Barry, Branch, Cass, and Van Buren counties while evaluating the Kalamazoo area. The Kalamazoo-Battle Creek-Portage Area consists of Kalamazoo, Calhoun, and St. Joseph counties. Included as Figure 37 below is the AoA for the Kalamazoo-Portage, Michigan Area. The red markers depicted in Figure 37 are air quality monitor locations with 2021-2023 DV above the revised PM_{2.5} NAAQS; the green markers depict air quality monitor locations with 2021-2023 DV below the revised PM_{2.5} NAAQS. Historically, the Kalamazoo Area has not had any PM_{2.5} NAAAs.

Figure 37. Area of Analysis for the Kalamazoo-Portage, Michigan Area.



The sections included below present the five factors analysis Michigan completed for this area.

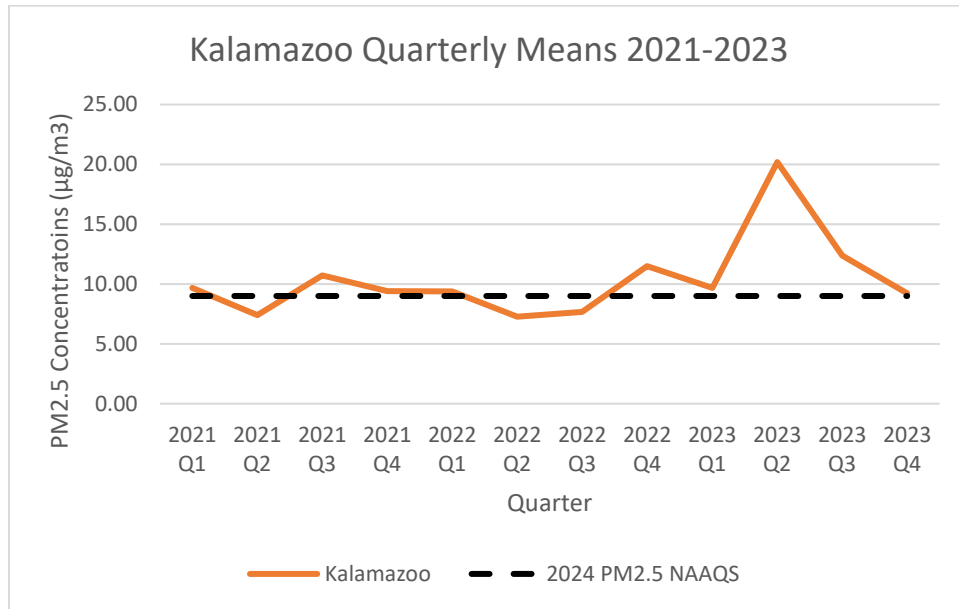
4.2.1 Kalamazoo - Air Quality Data

Air Quality Data

The AoA for the Kalamazoo-Battle Creek-Portage Area, Michigan consists of one air monitoring site. This site is located at the Kalamazoo County fairgrounds in the central portion of Kalamazoo County and is depicted in Figure 37 as a red marker, as it is exceeding the NAAQS at 10.4 $\mu\text{g}/\text{m}^3$.

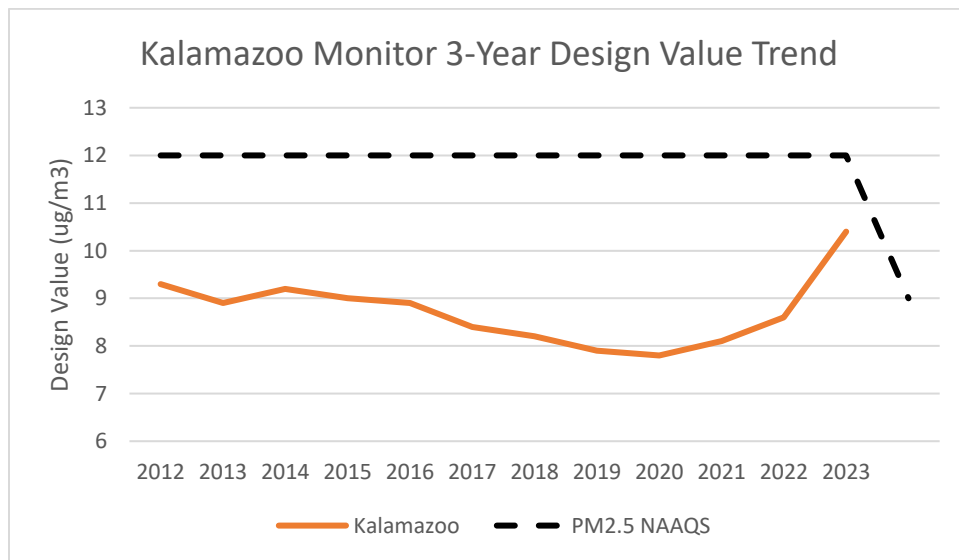
A trends analysis is depicted in Figure 38, which shows quarterly mean concentrations of PM_{2.5} from 2021-2023. A high quarter can increase the mean for a year, and therefore can increase the DV. There is a slight uptick in PM_{2.5} concentrations in the first and third quarters of 2021, the fourth quarter of 2022, and the third quarter of 2023, associated with the fall and winter months when PM_{2.5} concentrations are generally higher. Additionally, the large peak of PM_{2.5} concentrations in the second quarter of 2023 is associated with the Canadian wildfires that occurred during that time period. The high PM_{2.5} concentration in the second quarter of 2023 increased the overall DV for 2021-2023, as seen in Figure 38.

Figure 38. Kalamazoo Quarterly Means Trends Analysis.



Lastly, Michigan compiled 10 years of PM_{2.5} DVs for a historical analysis, presented below in Figure 39. The Kalamazoo monitoring site generally trended downward from 2012 to 2020; however, from 2021 to 2023 PM_{2.5} concentrations trended upward. It is likely that the upward trend for the monitoring site depicted in Figure 39 is associated with the Canadian wildfire impact seen earlier in the second and third quarters of 2023 and to a much lesser extent, wildfire smoke observed over Michigan in the summer of 2021.

Figure 39. Kalamazoo Monitor 3-year Design Value Trend.



PM_{2.5} Compositional Analysis**Urban Increment Analysis**

To better understand and differentiate the influence of more distant emissions sources from the influence of closer emissions sources, Michigan conducted an urban increment analysis. For this analysis Michigan utilized two different methodologies. The first method compared speciation data from the closest CSN monitors in urban areas with that of IMPROVE sites within 150 miles of the exceeding monitoring site. The IMPROVE sites are meant to represent rural background PM_{2.5} concentrations. The second methodology utilized satellite-derived global and regional PM_{2.5} data for 2022 developed by the Atmospheric Composition and Analysis Group at Washington University¹⁹. Urban and suburban census tract areas were then removed to determine rural and urban mean concentrations. A complete description of the process used for this methodology can be found in Attachments 3 and 4. The findings for the Kalamazoo County AoA of both methodologies are discussed below.

USEPA Urban Increment Methodology

As described in the Designations Guidance, “the basic approach for the urban increment analysis is to calculate the difference between the ambient PM_{2.5} speciation levels at an urban area monitoring site and the ambient PM_{2.5} speciation levels at a nearby rural monitoring site(s).” To calculate the rural background the USEPA recommends averaging the data from all IMPROVE monitors located within 150 miles of a violating AQS site, and if no IMPROVE monitors are within 150 miles, data from the next closest IMPROVE site should be used. Based on this methodology, Michigan used annual/quarterly PM_{2.5} speciation data from ISWS Climate Station, Illinois IMPROVE monitor located in central Illinois to represent the PM_{2.5} rural background concentration, since no other IMPROVE monitors were within the 150-mile radius from the Kalamazoo Fairgrounds monitoring site. The Kalamazoo Fairgrounds monitor is not a CSN monitor, so the next closest CSN monitor was used, the Grand Rapids (GR) – Monroe monitor, which is situated about 50 miles north of the Kalamazoo Fairgrounds monitor. The Grand Rapids area that this CSN monitor is in has an overall higher emissions profile than that of Kalamazoo, which Michigan took into consideration when evaluating the urban increment data. Table 15 shows the CSN and IMPROVE sites utilized as part of this analysis and the distance the IMPROVE monitor was from the exceeding Kalamazoo Fairgrounds PM_{2.5} monitoring site.

Table 15. Kalamazoo Fairgrounds Monitor – CSN/IMPROVE Monitor Pairing for Urban Increment

County	AQS Site ID	Local Site Name	Valid 2021-2023 Annual Design Value (µg/m ³)	Nearest CSN Site Name (State Abrev)	Nearest IMPROVE Site Name (State Abrev)	Nearest IMPROVE Site Distance (mi) from AQS Site
Kalamazoo	260770008	Kalamazoo Fairgrounds	10.4	GR-Monroe (MI)	ISWS Climate Station (IL)	213

In Table 16 below, Michigan presents the speciated and total annual average PM_{2.5} urban increments for the Kalamazoo Fairgrounds AQS monitor based on quarterly speciated PM_{2.5} concentration data from the GR-Monroe CSN monitor and the ISWS Climate Station, Illinois IMPROVE monitor. The quarterly speciated data that was used to produce these calculations can be found in Attachment 3 - Urban Increment USEPA Methodology. As shown in Table 16 and Figure 40, the PM_{2.5} component that contributed the most to the total PM_{2.5} urban increment on an average annual basis is the organic matter portion of PM_{2.5} (1.537 µg/m³). It is important to emphasize that this analysis was completed using data from the GR-Monroe CSN monitor (closest CSN monitor), which is approximately 50 miles

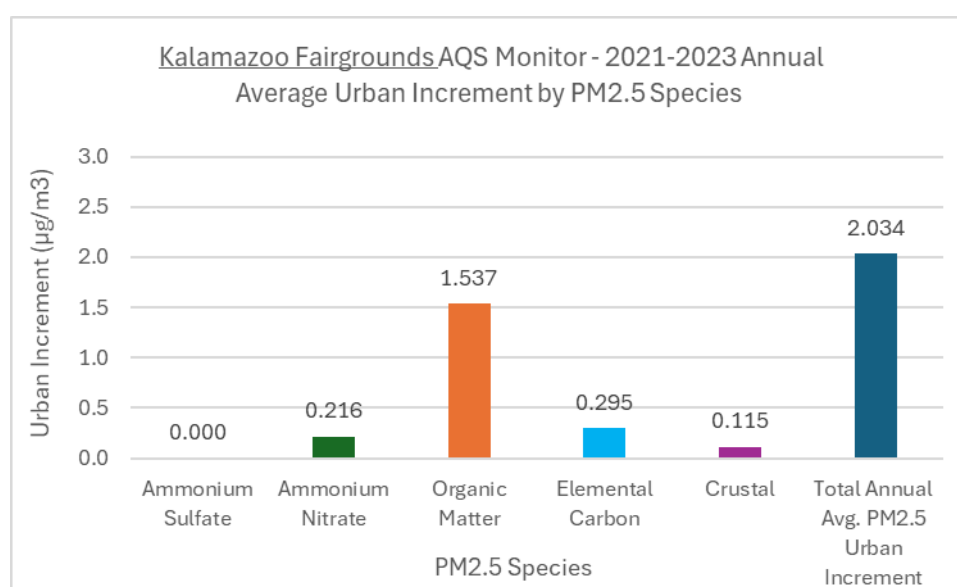
¹⁹ Satellite-derived PM_{2.5}. Atmospheric Composition Analysis Group. (n.d.). <https://sites.wustl.edu/acag/datasets/surface-pm2-5/>

north of the Kalamazoo Fairgrounds monitoring site and outside of the Kalamazoo County AoA. As such, the results of this analysis are given the appropriate consideration.

Table 16. Kalamazoo Fairground Monitor – 2021-2023 Annual Average Urban Increments by PM_{2.5} Species

Local Site Name [Site ID]	Annual Avg. Ammonium Sulfate Increment	Annual Avg. Ammonium Nitrate Increment	Annual Avg. OM Increment	Annual Avg. EC Increment	Annual Avg. Crustal Increment	Total Annual Avg. PM _{2.5} Urban Increment	Units
Kalamazoo Fairgrounds [260770008]	0.000	0.216	1.537	0.295	0.115	2.034	(µg/m ³)

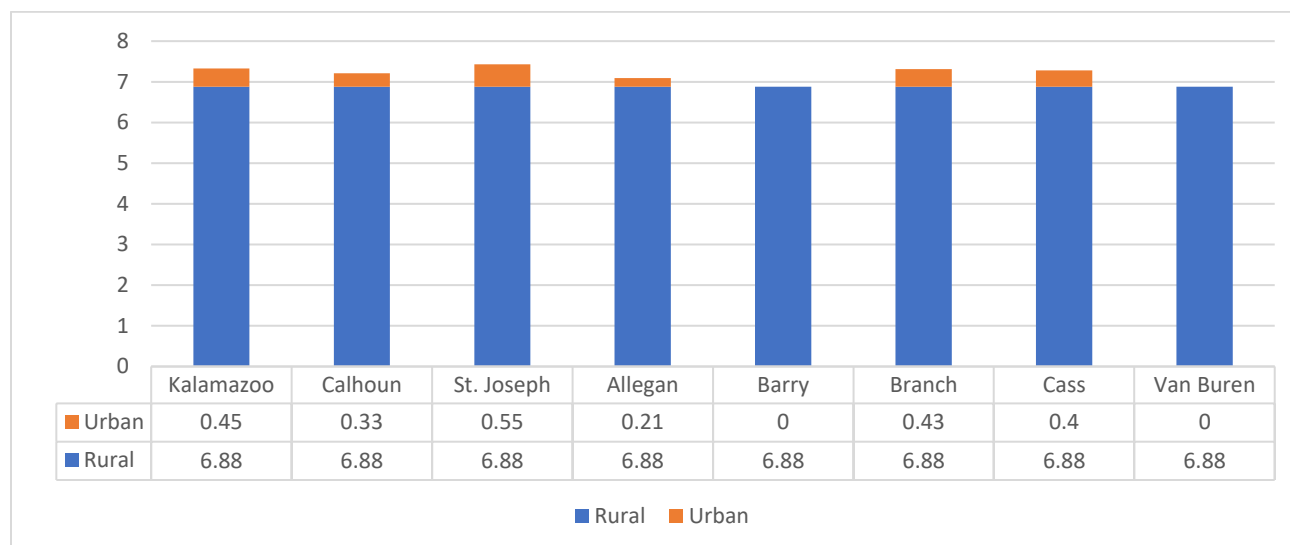
Figure 40. Kalamazoo Fairgrounds Monitor – 2021-2023 Annual Average Urban Increments by PM_{2.5} Species.



Satellite-derived Urban Increment Methodology

As stated, Michigan conducted a secondary approach to calculating the urban increment, as outlined in Attachment 4. The findings of this satellite-derived urban increment analysis are presented in Figure 41, which shows a rural background of 6.88 µg/m³ and urban increments less than 0.55 µg/m³. Note that in two counties, there was no urban increment. The urban increments are low in this area of the state. The two larger cities within this area are relatively small in comparison with Detroit. Therefore, the smaller urban increments are expected for this mostly rural area of the state.

Figure 41. Satellite-derived Urban Increments for Kalamazoo AoA.



There are some differences between the two methodologies, which also have their own respective limitations. With the USEPA Designations Guidance methodology, Michigan is able to better understand the speciated breakdown across the whole 3-year period (2021-2023), whereas the satellite data the analysis is limited to 2022 PM_{2.5} data. Conversely, the USEPA approach looks only at exceeding monitoring sites and not surrounding areas, and is limited by the use of a single CSN monitor in Kent County. The satellite-derived approach is able to show potential urban increments for the surrounding counties in the AoA. For both approaches the totals found at the monitor or county do not align directly with the monitoring DVs. This is again due to the constraints of relying on CSN and IMPROVE monitors. CSN monitors are a component of national PM_{2.5} monitoring, the purpose of which is not to establish if the NAAQS are being attained. Rather, they are intended to provide expanded gravimetric PM_{2.5} measurements, to support assessment of trends, development of effective SIPs and determination of regulatory compliance, development of control strategies, aiding in the interpretation of health studies of PM_{2.5} constituents, characterization of annual and seasonal spatial variation of aerosols, and comparison to the IMPROVE network.

Michigan has factored in these limitations in determining the final nonattainment boundaries. Due to the constraints of this analysis, Michigan did not heavily weight the findings but rather utilized broad conclusions to help better understand the causes of PM_{2.5} pollution in the Kalamazoo County AoA. From this analysis, the main conclusions are that organic matter, followed by crustal matter, and to a lesser extent ammonium nitrate contribute most to the PM_{2.5} urban increments, with the acknowledgement that these results are most representative of the Grand Rapids area and to a lesser extent the Kalamazoo County AoA. The urban increments from the USEPA method attribute about 2 µg/m³ to urban influence, whereas the satellite-derived results were less than 0.55 µg/m³ in counties throughout the AoA. This remains consistent with what Michigan would expect, since the area in question is heavily rural, with two smaller urban areas whose influence is not anticipated to be large.

4.2.2 Kalamazoo - Emissions Data

Emissions Trends

Figure 42 presents PM_{2.5}, NO_x, SO_x, VOC, and NH₃ (PM_{2.5} and precursors) emissions data for the Kalamazoo County AoA (see Footnote 6). The most significant emissions in the Kalamazoo County AoA

are from nonpoint (85%) followed by onroad (7%), point (4%), and lastly nonroad (5%) sources. Figure 43 represents the emissions distribution in a pie chart showing distribution percentages. To assist in determining potential influence of adjacent county emissions on the exceeding monitors within Kalamazoo County, Michigan reviewed emissions trends from the Kalamazoo-Battle Creek-Portage CSA, which included Kalamazoo, Calhoun, and St. Joseph counties. When looking at the Kalamazoo-Battle Creek-Portage CSA, the distribution of sector contributions shifts but the order remains the same as for the Kalamazoo AoA. The sector and county contributions are discussed further below.

Figure 42. PM_{2.5} and Precursor Emissions Data for the Kalamazoo County AoA.

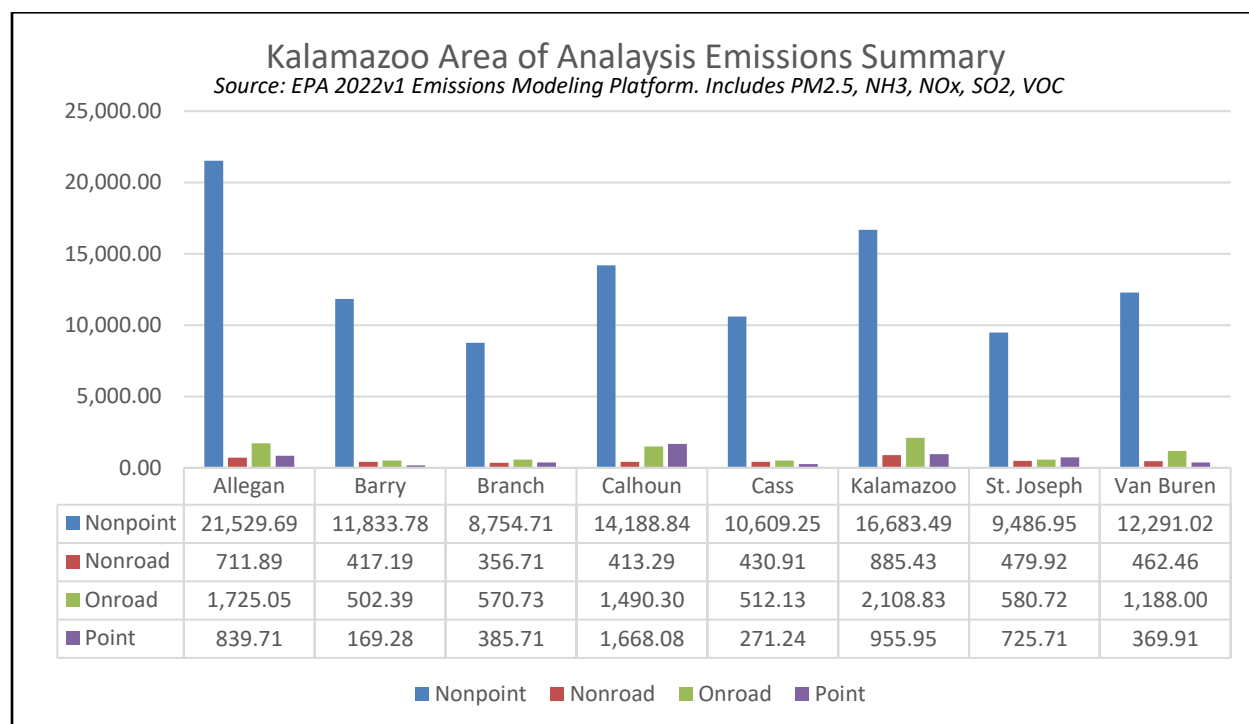
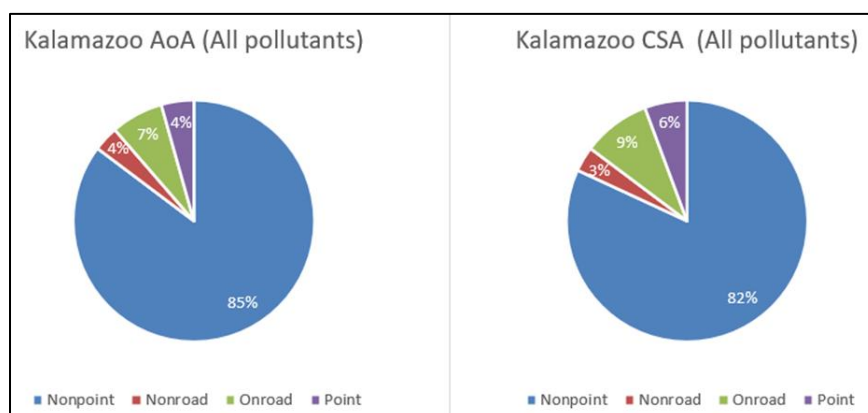


Figure 43. PM_{2.5} and Precursor Emissions Distribution for Kalamazoo County AoA and CSA.



The top 10 PM_{2.5} nonpoint sector categories are listed in Table 17 for the Kalamazoo County AoA and in Table 18 for the Kalamazoo-Battle Creek-Portage CSA. Since many of the nonpoint source sectors are correlated with population, it is reasonable to expect more nonpoint emissions from areas with higher

population densities. Later in this section there is a discussion of the population density within the Kalamazoo County AoA (see Figure 46). Therefore, Michigan took into consideration population density when assessing the nonpoint source county level inventory. Fuel Combustion from residential wood is highest for both the Kalamazoo AoA and the Kalamazoo-Battle Creek-Portage CSA, followed by dust from unpaved roads, and agriculture – crops and livestock dust. The Kalamazoo County AoA overall has higher emissions from the nonpoint sectors than the Kalamazoo-Battle Creek-Portage CSA; however, the distribution is relatively the same between the two areas with only a few small differences.

Table 17. Top 10 Nonpoint Sector Categories for the Kalamazoo County AoA in tons per year for Combined PM_{2.5}.

Nonpoint sector category	PM2.5(tpy)	Overall percentage
Fuel Comb - Residential - Wood	2,607.89	32.7
Dust - Unpaved Road Dust	1,514.54	19.0
Agriculture - Crops & Livestock Dust	1,117.50	14.0
Waste Disposal	946.07	11.9
Dust - Paved Road Dust	561.82	7.1
Commercial Cooking	378.53	4.8
Fuel Comb - Industrial Boilers, ICEs - Biomass	363.95	4.6
Dust - Construction Dust	111.20	1.4
Fires - Prescribed Fires	102.43	1.3
Industrial Processes - Mining	101.59	1.3

Table 18. Top 10 Nonpoint Sector Categories for the Kalamazoo-Battle Creek-Portage CSA in tons per year for Combined PM_{2.5}.

Nonpoint sector category	PM2.5 (tpy)	Overall percentage
Fuel Comb - Residential - Wood	1,108.96	32.1
Dust - Unpaved Road Dust	509.52	14.7
Agriculture - Crops & Livestock Dust	467.59	13.5
Waste Disposal	361.70	10.5
Commercial Cooking	251.75	7.3
Dust - Paved Road Dust	249.04	7.2
Fuel Comb - Industrial Boilers, ICEs - Biomass	219.12	6.3
Dust - Construction Dust	93.09	2.7
Industrial Processes - Mining	52.60	1.5
Fires - Prescribed Fires	50.95	1.5

For the PM_{2.5} and precursor point source contributions based on Figure 42, Calhoun County has the highest point contribution. Michigan also looked at individual pollutant contributions based on the data provided by the USEPA for 2022 County and Facility level⁴ (see Table 19), for which Calhoun County is highest for PM_{2.5} and all precursors. Table 20 shows the top 10 facilities for each pollutant and which county they are in.

Table 19. Kalamazoo County AoA county-level PM_{2.5} and precursor point source emissions breakdown.²⁰

County	PM _{2.5} Primary	NH ₃	NO _x	SO ₂	VOC
Allegan	72.9	1.8	422.3	36.9	305.8
Barry	11.1	0.3	91.8	4.3	61.7
Branch	59.5	2.5	148.7	27.1	148
Calhoun	461.6	79.6	516.6	37.9	572.4
Cass	17	51.2	71.4	6.7	124.8
Kalamazoo	68	11	355.4	9.4	512.1
St. Joseph	54.3	2.3	226.1	7	435.9
Van Buren	93.9	17.5	219.5	17.4	21.5

Table 20. Facility Level Emissions Data by Pollutant for the Kalamazoo County AoA.²

PM _{2.5} (Total 423 tpy)		
Calhoun	Knauf Insulation, Inc.	148.76
Calhoun	The Andersons Marathon Holdings LLC	92.11
Calhoun	Post Foods	68.20
Calhoun	Keebler Foods Company	15.00
St. Joseph	Banks Hardwoods, Inc.	10.02
NO _x (Total 1,098 tpy)		
Calhoun	The Andersons Marathon Holdings LLC	124.71
St. Joseph	Consumers Energy - White Pigeon Compressor Station	97.49
Kalamazoo	Graphic Packaging International LLC	95.96
Calhoun	WestRock California, LLC	91.75
Kalamazoo	Pharmacia & Upjohn Co. LLC, a subsidiary of Pfizer	64.67
Calhoun	Post Foods	55.84
Kalamazoo	Western Michigan University	51.26
Kalamazoo	Kaiser Aluminum Fabricated Products LLC	36.21
Kalamazoo	CMS Generation Kalamazoo River Generating Station	33.17
Calhoun	C&C Energy LLC	32.09
Calhoun	Woodworth Inc. Homer	31.84
St. Joseph	Banks Hardwoods, Inc.	29.97
Calhoun	Graphic Packaging International, LLC	27.63
Calhoun	Battle Creek	24.73
St. Joseph	Westside Recycling and Disposal Facility	22.33
NH ₃ (Total 92.98 tpy)		
Calhoun	Knauf Insulation, Inc.	73.17
Kalamazoo	Graphic Packaging International, LLC	6.86

²⁰ USEPA 2022 County and Facility Emissions for PM_{2.5} Designations spreadsheet, <https://www.epa.gov/particle-pollution-designations/particle-pollution-designations-memorandum-and-data-2024-revised#C>

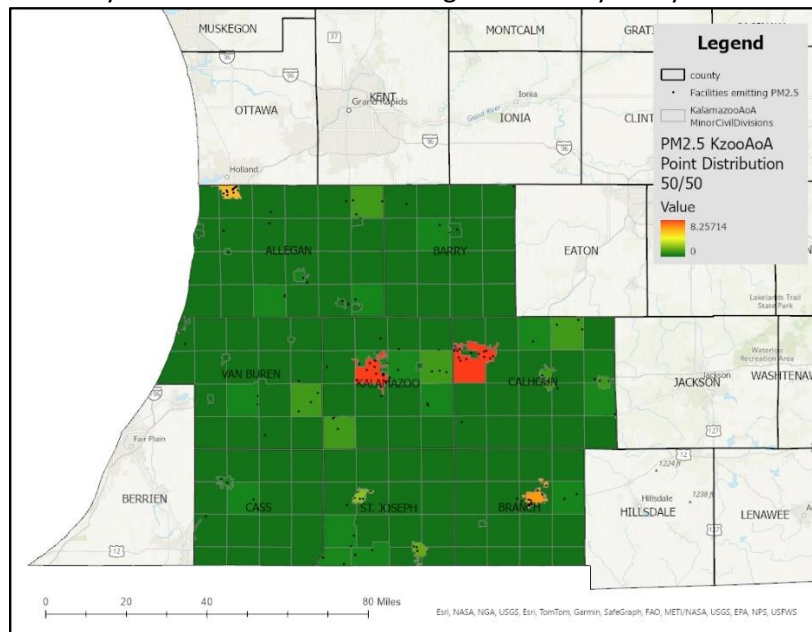
Kalamazoo	Pharmacia & Upjohn Co. LLC, a subsidiary of Pfizer	2.56
Calhoun	Woodworth, Inc. Homer	2.49
Calhoun	WestRock California, LLC	1.422
SO₂ (Total 54.31 tpy)		
Calhoun	The Andersons Marathon Holdings LLC	15.47
Calhoun	C&C Energy LLC	12.47
St. Joseph	Westside Recycling and Disposal Facility	4.69
Calhoun	C&C Expanded Sanitary Landfill	4.47
Calhoun	Knauf Insulation, Inc.	2.25
VOC (Total 1,520.41 tpy)		
Kalamazoo	Kalsec, Incorporated	192.37
Calhoun	The Andersons Marathon Holdings LLC	127.93
Calhoun	DENSO Manufacturing Michigan, Inc.	101.85
St. Joseph	Metal Technologies, Inc. Three Rivers Gray Iron	70.17
St. Joseph	Banks Hardwood, Inc.	65.84
Kalamazoo	Graphic Packaging International LLC	59.64
St. Joseph	Morgan Olson, LLC	58.42
Kalamazoo	Schafer Bakery Division - Kalamazoo Plant	47.97
Calhoun	Post Foods	43.29
St. Joseph	Bayer Great Lakes Production Co., LLC	39.12
Calhoun	Duncan Aviation Inc.	38.72
Calhoun	Brembo North America, Inc.	35.25
Kalamazoo	Summit Polymers-Vicksburg	34.69
Calhoun	Knauf Insulation, Inc.	34.06
St. Joseph	Prairie River Woodworking, LLC	32.47
St. Joseph	Westside Recycling and Disposal Facility	32.21
St. Joseph	Aquatic Co.	32.19
Calhoun	Buckeye Terminals, LLC-Marshall Terminal	29.66
Kalamazoo	Allnex USA, Inc.	27.57
Calhoun	WestRock California, LLC	26.46
Kalamazoo	Summit Polymers Plant 18	24.76
St. Joseph	Summit Polymers, Inc. - Syntech Plant	24.55
St. Joseph	Ox Paperboard White Pigeon Mill	24.07
Calhoun	TRMI	22.50

Calhoun County has the highest overall point source emissions contributions for the Kalamazoo AoA. Michigan reviewed the largest facilities contributing to those emissions, listed in Table 20. These facilities included: Denso Manufacturing (State Registration Number (SRN): N1192), The Andersons Marathon Holdings LLC (SRN: B8570), Knauf Insulation (SRN: B7205), and Post Foods LLC (SRN: B1548). Knauf Insulation and The Andersons Marathon Holdings LLC are both located on the eastern edge of Calhoun County, while Post Foods LLC and Denso are located near the City of Battle Creek in the northwestern portion of Calhoun County. All these facilities are regulated by the AQD under the USEPA-approved Renewable Operating Permit (ROP) program and are subject to Michigan's Air Pollution Control Rules for Prevention of Significant Deterioration of Air Quality for PM_{2.5} and respective precursor emissions, as well as related National Emission Standards developed by the USEPA. To comply with these regulations

the Andersons Marathon Holdings LLC, Knauf Insulation, and Post Foods all have implemented PM_{2.5} control equipment such as, but not limited to baghouses, wet scrubbers, thermal oxidizers, low NOx burners, and cartridge filter dust collection systems. A complete review of these facilities and their ROPs can be found on Michigan's Air Quality Permitting webpage, which provides a Source Master List Sorted by SRN.²¹ The wind rose and HYSPLIT analysis do not show a strong easterly or northeasterly wind influence on the Kalamazoo monitor, therefore any additional reductions made from these facilities are not anticipated to have an impact on the overall DV at the Kalamazoo monitoring site.

Lastly, to better understand the overall distribution of PM_{2.5} and precursors at point sources in the Kalamazoo County AoA, Michigan utilized the PM_{2.5} facility level data from the 2022v1 EMP provided by the USEPA, and completed a weighted overlay analysis to determine where areas of high PM_{2.5} and precursor emissions coincided with high facility count at a city/township level. This helped better refine the county level data discussed earlier. To complete this analysis, the data from the 2022v1 EMP were converted to a raster and totals for total PM_{2.5} emissions and facility count were summarized for each city and township area. These data were then rasterized and scored on a scale from 0 to 1. Both the emissions and count layers were then multiplied against each other with equal weight (i.e., 50% each). The final output is shown in Figure 45, which depicts areas with high PM_{2.5} emissions and facility count in red, and areas with fewer emissions and facilities in dark green.

Figure 45. Kalamazoo County AoA Point Distribution Weighted Overlay Analysis for PM_{2.5} emissions.



The results of this analysis show a large facility and PM_{2.5} emissions concentration in the cities of Kalamazoo and Battle Creek. However, there are only a handful of large sources in the counties, and they are mostly located outside of these two big city boundaries. In this case, the weighted overlay highlights where many facilities with small emissions are located. Most of the Kalamazoo AoA has few to no point sources and the emissions are relatively low in comparison to the statewide level.

²¹ Source ID Company Address City ZIP Code County On-Line Documents* Source Master List Sorted by Source ID. (n.d.). Retrieved December 16, 2024, from https://www.egle.state.mi.us/aps/downloads/srn/Sources_By_SRN.pdf

Population density and degree of urbanization

Michigan looked at the population density and degree of urbanization for the Kalamazoo County AoA using the U.S. Census Bureau's 2020 Census Demographic and Housing Characteristics. Figure 46 shows that Kalamazoo County has the highest population density in the Kalamazoo County AoA and therefore has the highest degree of urbanization. The areas of highest population density are in central and western Kalamazoo County. Further, northwestern Calhoun County has the second highest area of population density. Michigan gathered total 2023 county-level population data for each county in the Kalamazoo County AoA, and calculated percentages representing the contribution of each county's total population to the total population of the Kalamazoo County AoA, as shown in Table 21 (see Footnote 10). In 2023, the largest counties in the Kalamazoo AoA by population were Kalamazoo County (262,215), Calhoun County (133,366), and Allegan County (121,939).

Figure 46. Population Density Map for the Kalamazoo Area of Analysis.

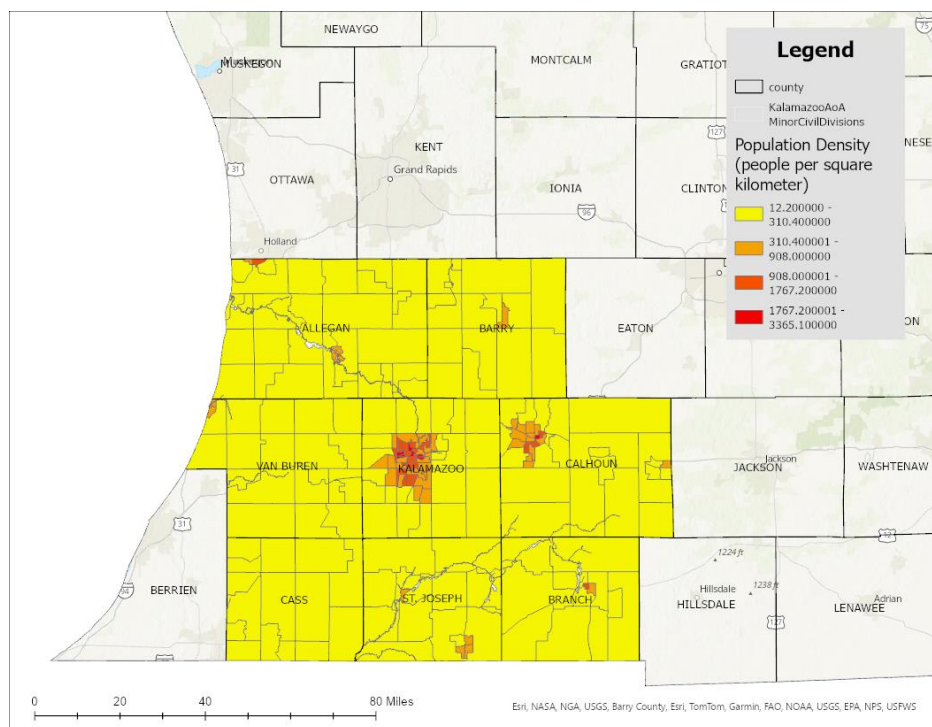


Table 21. Annual estimate of the resident population of each county in the Kalamazoo County AoA in 2023.

County	Total Population by County	Percentage (%) of Total Kalamazoo AoA Population by County
Allegan	121,939	15.0
Barry	63,808	7.8
Branch	45,215	5.5
Calhoun	133,366	16.4
Cass	51,642	6.3
Kalamazoo	262,215	32.2
St. Joseph	60,878	7.5
Van Buren	75,798	9.3
Total Kalamazoo AoA Population		814,861

Traffic and Commuting Patterns

The Designations Guidance recommended that analyses relating to traffic and commuting patterns “examine the location of major transportation arteries and information on traffic volume and commuting in and around the area containing a violating monitor.” Michigan chose to adhere to this recommendation, and included the following supplemental analyses to help bolster and support the emissions-related evaluations in this section for the Kalamazoo County AoA.

For the eight-county Kalamazoo AoA, which includes Allegan, Barry, Branch, Calhoun, Cass, Kalamazoo, St. Joseph, and Van Buren counties, Michigan looked at total annual VMT data at the county level. Additionally, Michigan accessed county-level commercial VMT data to gain a better understanding of the impact of emissions from heavy-duty onroad vehicles that travel within these eight counties on the violating PM_{2.5} monitor within Kalamazoo County.

In Table 22, annual average VMT data are shown for the years 2021, 2022, and 2023. The data were extracted from the *2023 Michigan Roadway Statewide Statistics Report (2023 MRSSR)*²², which was developed by the MDOT. Similarly, the USEPA released a spreadsheet on November 25, 2024, entitled “2022 Vehicle Miles Traveled” appended to its *Particle Pollution Designations Memorandum and Data for the 2024 Revised Annual PM_{2.5} NAAQS* webpage that contains VMT estimates for each state-county pairing in the United States for the year 2022.²³ The VMT estimates included within the spreadsheet were found to be identical to the 2022 VMT estimates in the 2023 MRSSR. Rather than rely upon one year of VMT data, Michigan calculated a three-year (2021-2023) annual average VMT (in thousands) for

²² (2023, December 31). 2023 Michigan Roadway Statewide Statistics - Legal System (LS) by County [Review of 2023 Michigan Roadway Statewide Statistics - Legal System (LS) by County]. Michigan MDOT. <https://www.michigan.gov/mdot/-/media/Project/Websites/MDOT/Programs/Planning/Asset-Management/HPMS/Statewide-Statistics-LS-County.pdf?rev=ba3c4320b5b34678a505a7dd061649b6&hash=D31A3CE838AAC2BAA1FAB05BD6FC9F12>

²³ (2024). Particle Pollution Designations Memorandum and Data for the 2024 Revised Annual PM_{2.5} NAAQS [Review of Particle Pollution Designations Memorandum and Data for the 2024 Revised Annual PM_{2.5} NAAQS]. USEPA. <https://www.epa.gov/particle-pollution-designations/particle-pollution-designations-memorandum-and-data-2024-revised>

each county within the Kalamazoo AoA. It was found that Kalamazoo County (2,491,592), Calhoun County (1,606,376), and Allegan County (1,573,748) had the largest three-year annual average VMT within the Kalamazoo AoA. This finding is also depicted in Figure 47. In regard to commercial VMT, which is an estimate of vehicle travel by commercial vehicles (single-unit and combination trucks and buses), it was determined that Calhoun County (239,738), Kalamazoo County (232,714), and Van Buren County (187,149) had the largest three-year average commercial VMT within the Kalamazoo AoA. This finding is shown in Table 23 and Figure 48.

Table 22. Annual VMT Estimates by County in the Kalamazoo County AoA (in thousands).

County	2021	2022	2023	Three-Year Annual Average (2021-2023)
Allegan	1,568,234	1,560,109	1,592,901	1,573,748
Barry	416,541	416,246	423,294	418,694
Branch	495,119	490,515	481,088	488,907
Calhoun	1,604,328	1,585,927	1,628,873	1,606,376
Cass	481,052	475,615	493,473	483,380
Kalamazoo	2,467,969	2,477,543	2,529,263	2,491,592
St. Joseph	529,363	552,882	592,912	558,386
Van Buren	1,040,427	1,027,593	1,050,008	1,039,343
Totals	8,603,033	8,586,430	8,791,812	8,660,425

Figure 47. Annual VMT Estimates by County in the Kalamazoo County AoA.

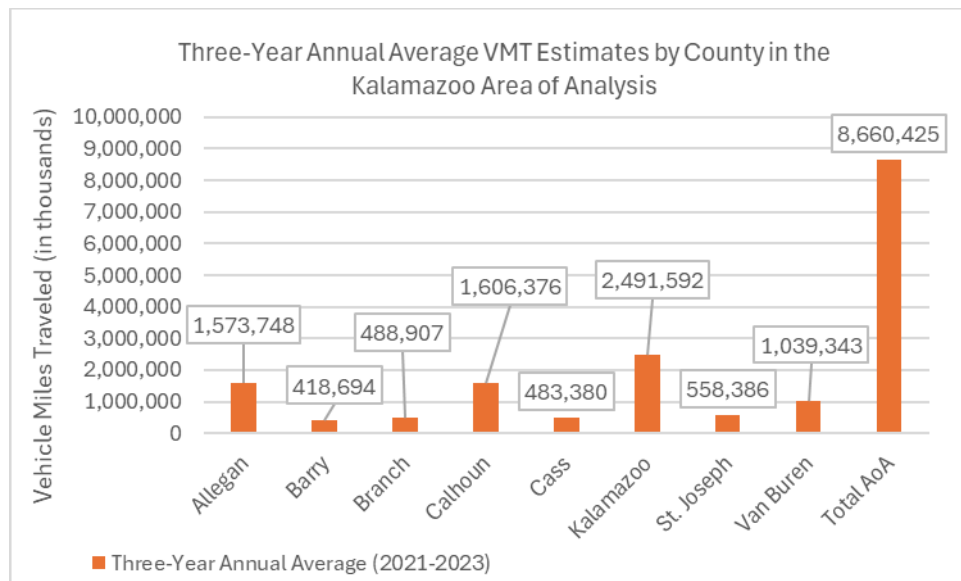
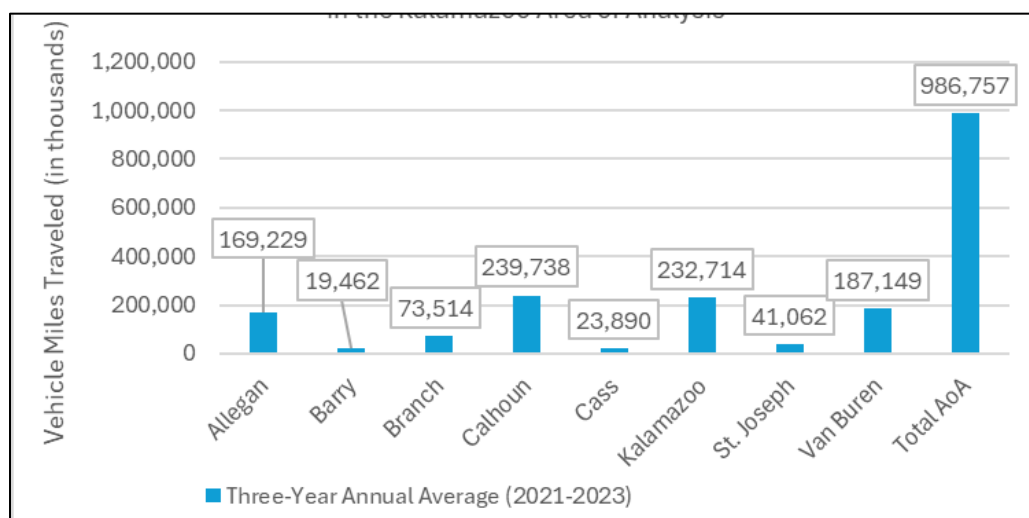


Table 23. Commercial VMT Estimates by County in the Kalamazoo County AoA (in thousands).

County	2021	2022	2023	Three-Year Annual Average (2021-2023)
Allegan	175,570	166,220	165,896	169,229
Barry	22,645	17,764	17,976	19,462
Branch	79,335	73,957	67,251	73,514
Calhoun	245,460	234,265	239,489	239,738
Cass	26,754	22,490	22,425	23,890
Kalamazoo	253,064	230,136	214,942	232,714
St. Joseph	41,165	40,622	41,398	41,062
Van Buren	187,958	181,517	191,972	187,149
Total AoA	1,031,951	966,971	961,349	986,757

Figure 48. Annual commercial VMT estimates by county in the Kalamazoo County AoA.

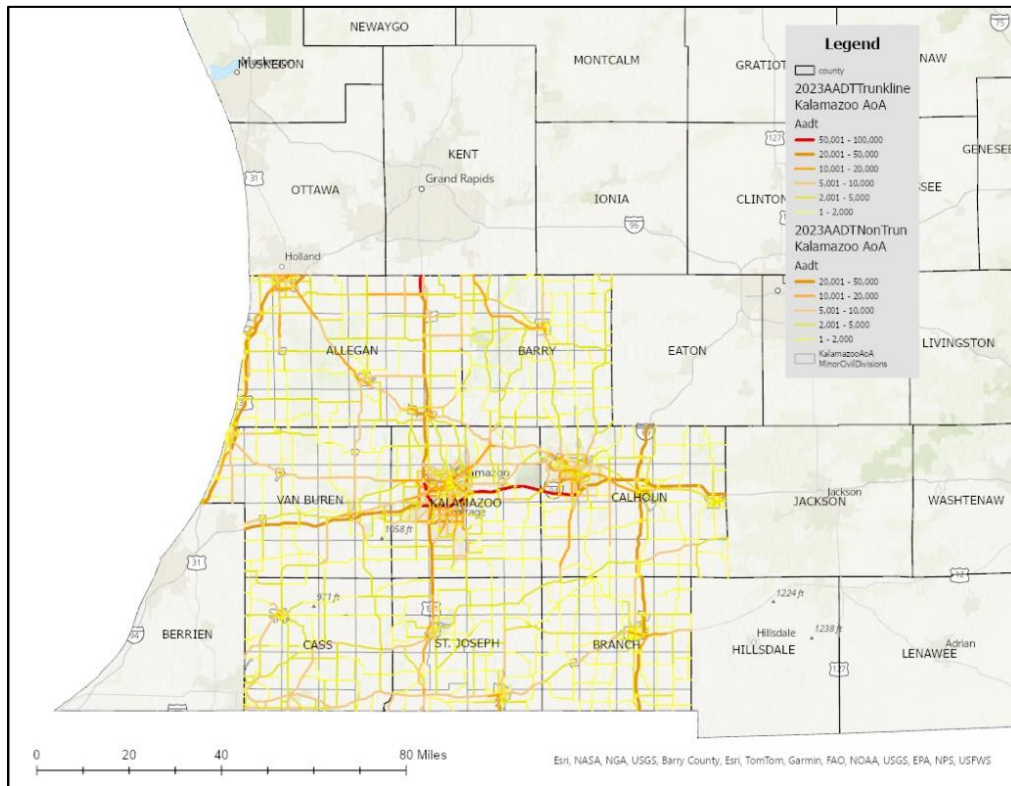


In an effort to locate the major transportation arteries of the Kalamazoo County AoA, Michigan utilized MDOT's AADT Tool to export 2023 AADT data for trunkline and non-trunkline roads within the eight-county area.²⁴ The visual findings of this portion of the Traffic and Commuting Patterns analysis can be seen in Figure 49, which shows the largest clusters and concentrations of trunkline and non-trunkline roads with an AADT of over 20,001 as located in the central portion of Kalamazoo County (City of Kalamazoo, City of Portage, etc.) and the northwest quadrant of Calhoun County (City of Battle Creek).

²⁴ (2023). Michigan Traffic AADT [Review of Michigan Traffic AADT]. Michigan MDOT.

<https://experience.arcgis.com/experience/05113e1c2c1742a0b07cd22a77b46ee2/page/Michigan-Traffic-AADT/>

Figure 49. 2023 AADT Estimates for Trunkline and Non-trunkline Roads in the Kalamazoo County AoA.

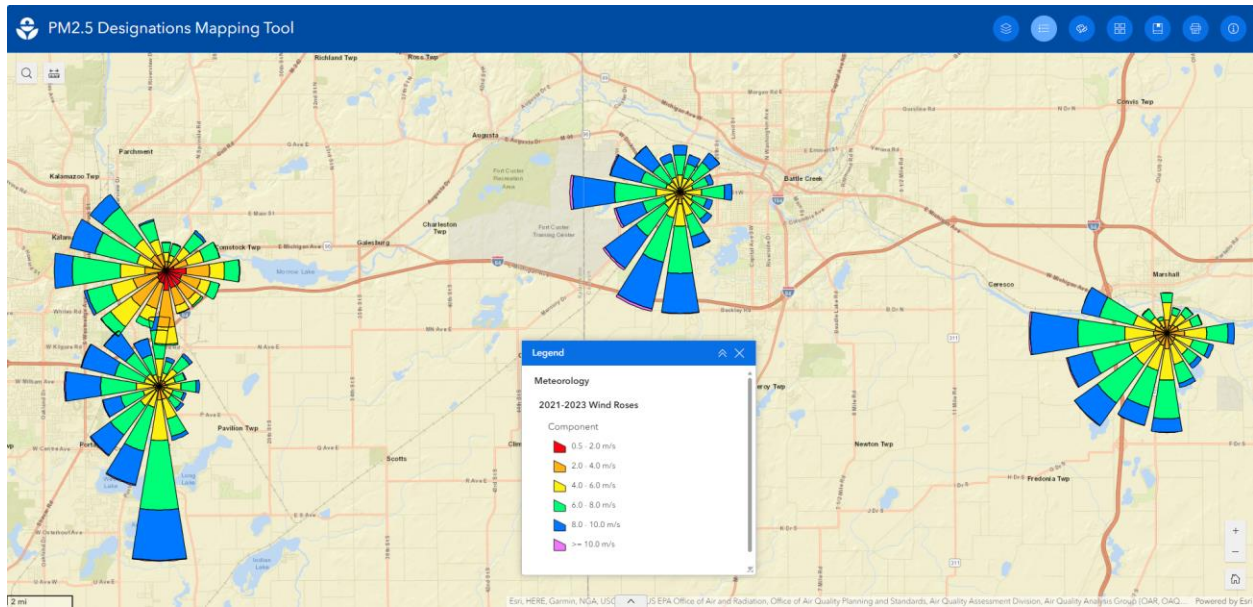


4.2.3 Kalamazoo - Meteorology

Wind Rose Analysis

As discussed in Section 3.3 Factor 3: Meteorology, EGLE staff generated wind and pollution roses for the monitoring sites and several airports in the Kalamazoo area prior to the USEPA's finalizing wind roses on the PM_{2.5} Designations Mapping Tool. Displayed in Figure 50 are the wind roses from the USEPA's PM_{2.5} Designation Mapping Tool for the Kalamazoo area. The USEPA's wind roses are in m/s and show data from the 2021-2023 DV timeframe. Discussed further below in this section are wind and pollution roses for the Kalamazoo monitoring site.

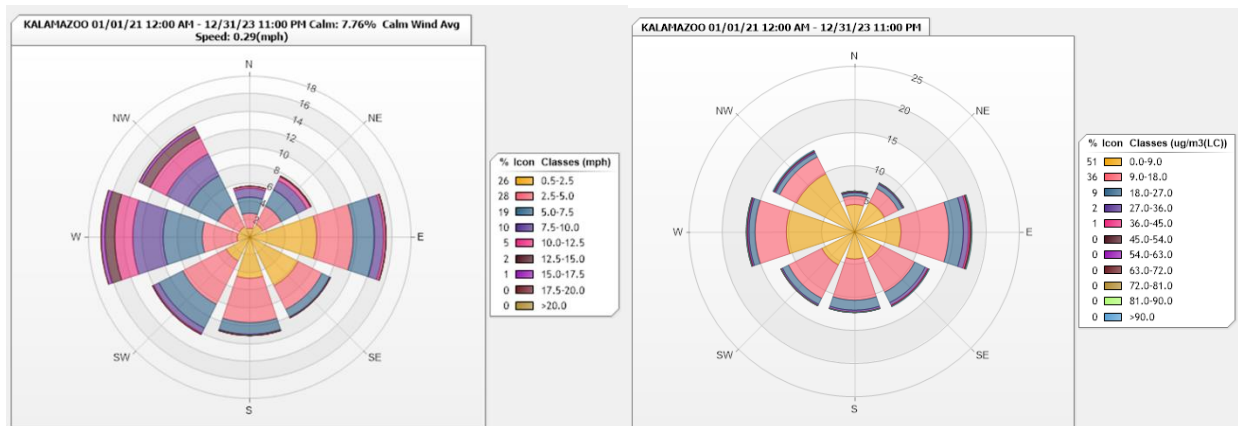
Figure 50. Wind Roses from the USEPA's PM_{2.5} Designation Mapping Tool.



Kalamazoo (260770008)

Wind and pollution roses for the Kalamazoo monitoring site are shown in Figure 51. The wind rose indicates that the most common wind speed, 28% of the time, was between 2.5 and 5.0 mph. The wind rose indicates that the wind mostly comes from the west, east, northwest, and southwest at this monitoring site. Additionally, the pollution rose shows that 51% of the time PM_{2.5} concentrations are between 0.0 and 9.0 µg/m³. The pollution rose also indicates that PM_{2.5} migrates to the monitoring site from the east, west, and northwest the majority of the time.

Figure 51. Kalamazoo Wind (left) and Pollution Roses (right) for 2021-2023 DV.

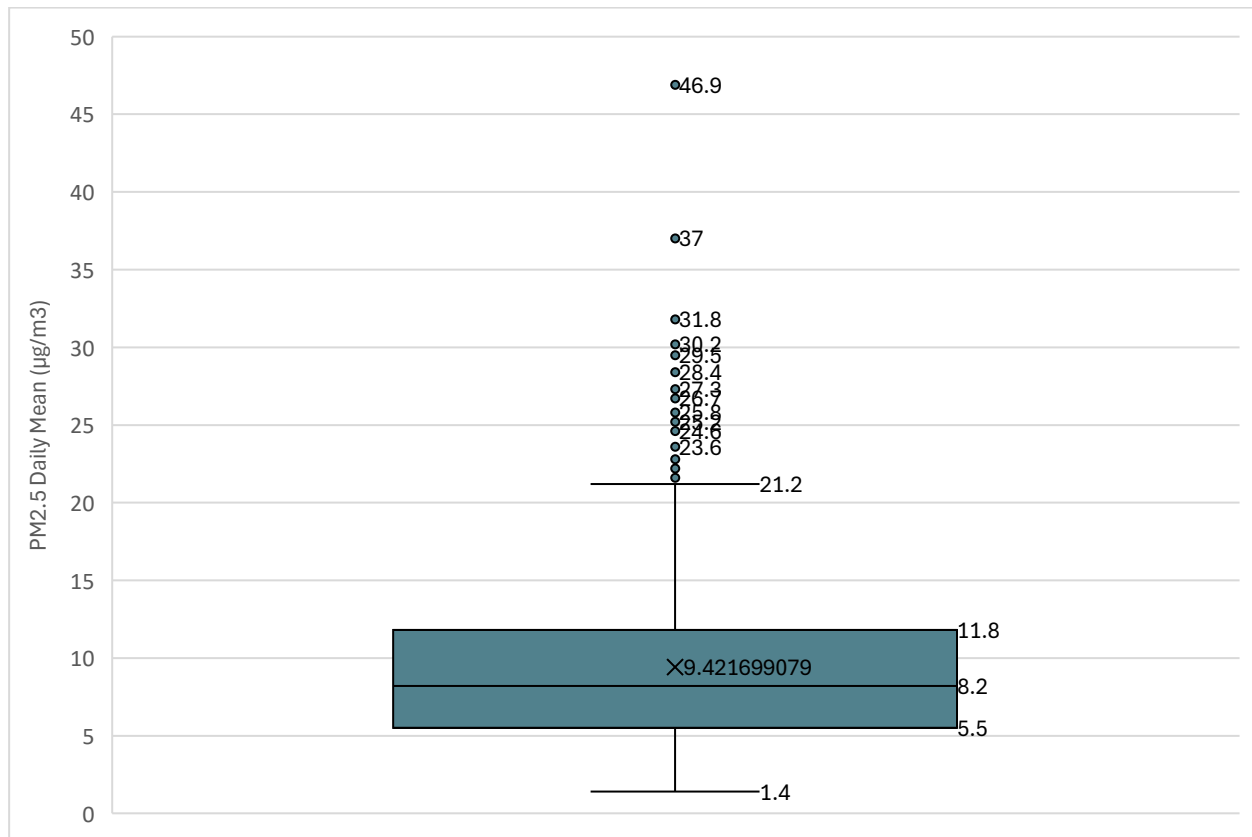


Magnitude of Exceedances

Michigan reviewed daily PM_{2.5} means to understand the distribution and level of exceedances at the violating air monitors in Kalamazoo County. In this magnitude of exceedance analysis, Michigan removed days that were potentially influenced by wildfire events to best determine any local areas contributing to the violations at the monitors that are within the regulatory authority of the state. To determine days potentially influenced by wildfires, Michigan utilized the USEPA PM_{2.5} Tiering Tool for Exceptional Events

Analysis²⁵. The days removed for the Wayne County magnitude of exceedance study were all from June 2023 and July 25 through 29, 2023; August 1, 2021; as well as July 4 for 2021, 2022, and 2023 (note: it is likely additional days were impacted by wildfire smoke during the three-year timeframe; however, these are the days excluded using this screening approach for this exercise). The remaining dates and daily PM_{2.5} levels were analyzed using a box plot to determine outliers which most represent the highest levels of pollution. Figure 52 shows the results of this analysis.

Figure 52. Kalamazoo County Magnitude of Exceedance Analysis.



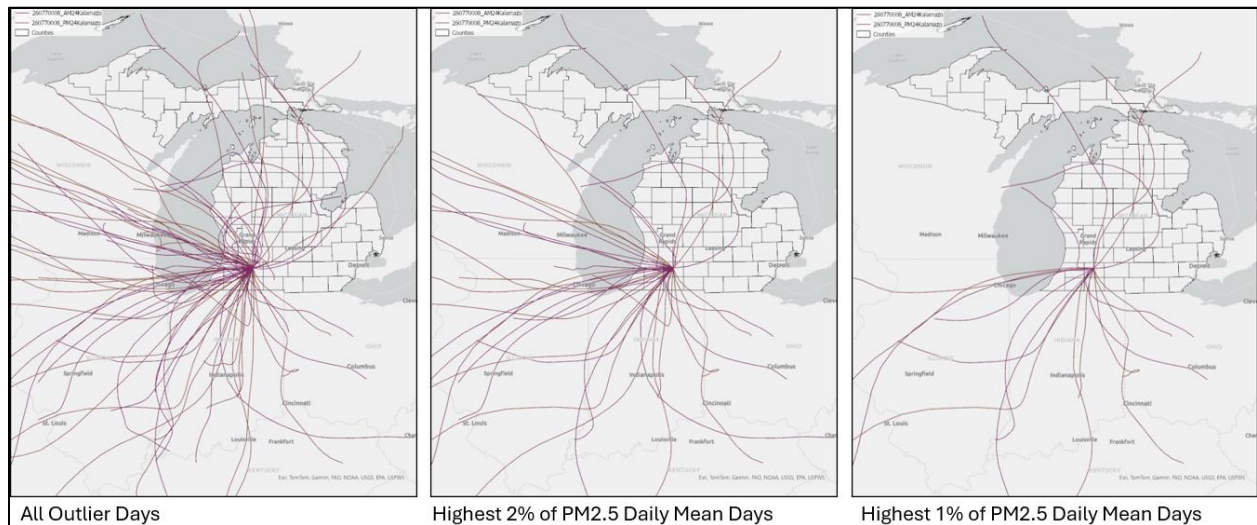
In Figure 52, the dots represent outlier that significantly deviate from the majority of data within the set. The box portion represents the middle 50% of the data, the line inside the box represents the median value, and the lines extending from the box (whiskers) show the minimum and maximum values representing 1.5 times the interquartile range. The following HYSPLIT model analysis examines the resulting outlier dates from this magnitude of exceedance study in relation to back trajectories to better identify the path the pollutant particles may have traveled prior to arriving at the air quality monitors.

²⁵ PM_{2.5} Tiering Tool - for Exceptional Events Analysis | US EPA. (2024, February 22). US EPA. <https://www.epa.gov/air-quality-analysis/pm25-tiering-tool-exceptional-events-analysis>

HYSPLIT Trajectories

HYSPLIT is a model developed by NOAA and is a complete system for computing simple air parcel trajectories²⁶. This tool uses gridded meteorology data to simulate how wind advects air parcels. The USEPA provided AM and PM HYSPLIT modeling for the 2021-2023 period nationally for all exceeding monitors. The methodology they used can be found in the Designations Guidance document. Michigan plotted the exceeding monitor HYSPLIT data using ArcGIS Pro to geographically analyze the data. Utilizing the results of the magnitude of exceedance study, Michigan created definition queries to review back trajectories for all outlier dates, representing the highest 2% and 1% of PM_{2.5} daily means. Figure 53 shows a compilation of the resulting maps from this analysis for both the AM and PM HYSPLIT datasets. The AM data set shows the back trajectory of each outlier day at 8 AM backwards for 24 hours, illustrating where air traveled primarily from the prior day. The PM dataset shows the back trajectory of each outlier day at 10 PM backwards for 24 hours, illustrating where air traveled primarily the day of and night prior to the outlier day. Both are important considerations when pairing with the PM_{2.5} daily mean data which represent the whole day rather than a particular time period during the day.

Figure 53. AM and PM HYSPLIT Map showing outlier days from the Magnitude of Exceedance study at the Kalamazoo Air Monitor for 2021-2023.



The maps in Figure 53 show that the majority of the air parcels, on days with elevated PM_{2.5} concentrations, come from southerly and westerly directions, with some northeasterly and northwesterly influence. This distribution remains similar even when looking at only the highest 1% of PM_{2.5} daily mean days. Michigan utilized tools within ArcGIS Pro to determine the start and end points of each daily back trajectory and to calculate the general direction of each line. There are limitations to this methodology since these trajectories are not straight lines and a line could curve and end in a different directional quadrant than where it spent most of its time. Figures 54 and 55 show the number of lines from the monitoring location that originated from the northeast, northwest, southeast, and southwest quadrants for both the AM and PM HYSPLIT data, respectively. The analysis includes all outlier dates from the Kalamazoo air monitor determined from the previous magnitude of exceedance analysis for 2021-2023. The figures also include a 20% error bar to conservatively represent the limitation of determining the directional quadrant, as discussed earlier.

²⁶ HYSPLIT. (n.d.). Air Resources Laboratory. <https://www.arl.noaa.gov/hysplit/>

Figure 54. Count AM HYPsLITs for each directional quadrant at the Kalamazoo County air monitor for all outlier dates from 2021-2023.

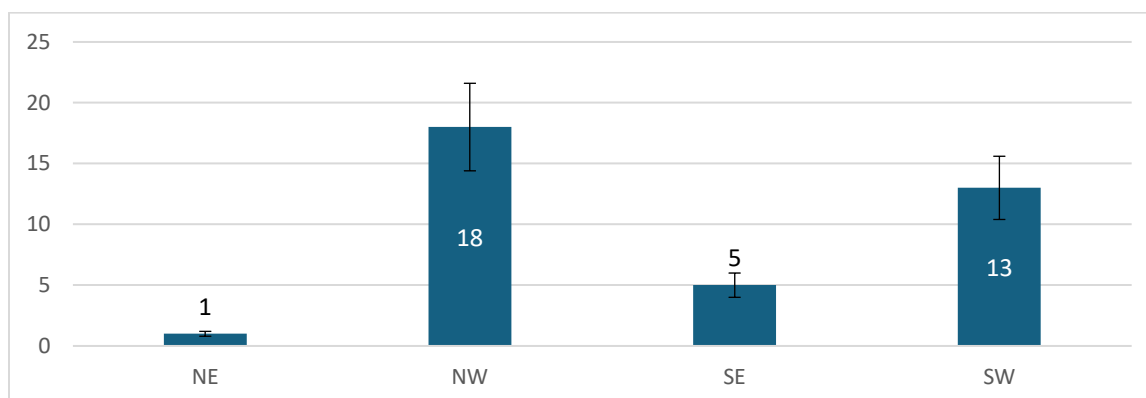
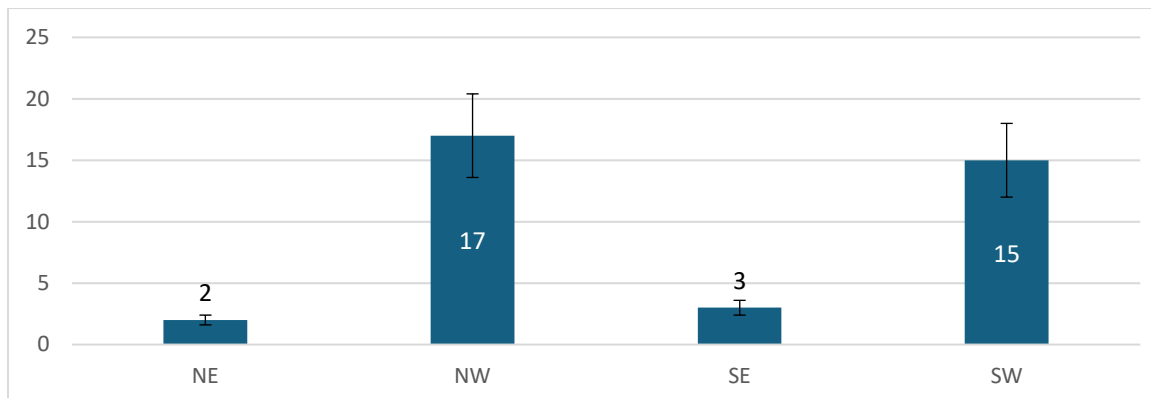


Figure 55. Count PM HYPsLITs for each directional quadrant at the Kalamazoo County air monitor for all outlier dates from 2021-2023.



Figures 54 and 55 show that for both AM and PM HYPsLITs on the outlier dates, the most influence is from the northwest (46-49%) and southwest (35-40%). The wind rose analysis discussed earlier showed that the monitors do not experience one dominant wind direction but rather a spread from the west, east and southwest, with a significant contribution from the westerly direction. Since this data is broken down into four directions, there are limitations on determining how much of the influence may be coming from westerly winds as opposed to northwesterly or southwesterly winds. When the quantitative data from Figures 54 and 55 are paired with the qualitative maps in Figure 53, it can be deduced that for higher daily levels of PM_{2.5} air parcels come from the west, as well as the northwest and southwest, with more coming from the southwest. The modest easterly influence also is noted from this analysis.

4.2.4 Kalamazoo - Geography and Topography

The Kalamazoo County AoA does not have any significant geographical or topographical obstructions known to affect air pollution transport. Therefore, this factor does not impact the analysis of this area.

4.2.5 Kalamazoo - Jurisdictional Boundaries

The Kalamazoo area has not been in nonattainment for any of the previous PM_{2.5} NAAQS. The Kalamazoo air monitor is part of a one-county CBSA, the Kalamazoo-Portage CBSA, and the larger three-county CSA area, the Kalamazoo-Battle Creek-Portage CSA, which includes Kalamazoo, Calhoun, and St. Joseph

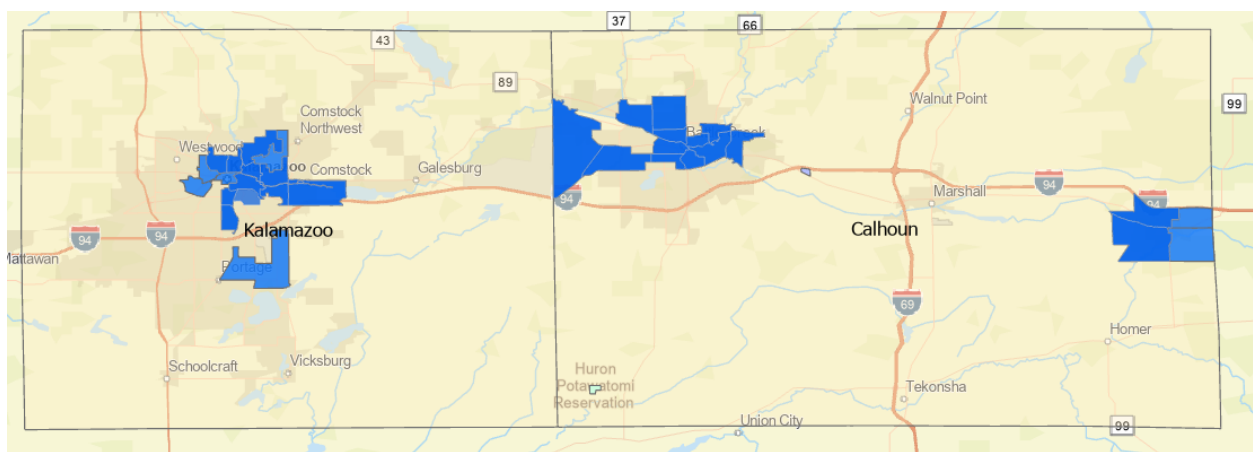
counties. Michigan's analysis included both the CBSA and CSA as well as the adjacent counties of Allegan, Barry, Branch, Cass, and Van Buren.

4.2.6 Kalamazoo - Environmental Justice

The Designations Guidance suggested that states use the USEPA’s classification criteria for “disadvantaged communities” for purposes of outreach or developing designation recommendations that address environmental justice concern in the communities, townships, and counties surrounding a violating monitor for the PM_{2.5} NAAQS. According to the USEPA, “Disadvantaged communities are defined as any community that meets at least one of the following characteristics: communities reflected in the CEJST; any census block group that is at or above the 90th percentile for any of the Environmental Justice Screening and Mapping Tool’s (EJSCREEN) Supplemental Indexes when compared to the nation or state; and/or any geographic area within Tribal lands as included in EJSCREEN,” (see Footnotes 1, 15, and 16).

For the Kalamazoo AoA, Michigan decided to conduct an evaluation based on the USEPA’s methodology to identify location(s) of the census tracts that meet the USEPA’s “disadvantaged community” criteria. Michigan chose to conduct an EJ analysis for only two counties of the eight Kalamazoo County AoA (Calhoun and Kalamazoo County) considering that these two counties make up approximately 50% of the total population of the Kalamazoo AoA (as shown in Table 21). In Figure 56, clusters of “disadvantaged community” census block groups (shown in blue) can be seen in central Kalamazoo County (City of Kalamazoo, City of Portage, etc.), the northwest portion of Calhoun County (City of Battle Creek), and an eastern portion of Calhoun County (City of Albion). It should also be emphasized that the federally recognized tribal land of the Nottawaseppi Huron Band of Potawatomi Indians is in the southwest corner of Calhoun County (near Athens) and central Calhoun County (near Ceresco).

Figure 56. “Disadvantaged Communities” at the Census Block Group Level in Kalamazoo and Calhoun Counties



Per the *Designations Guidance* Memorandum, Michigan completed outreach to interested parties in the Kalamazoo area. Michigan staff spoke with the following communities and associations regarding the revised 2024 PM_{2.5} NAAQS, the designations process, and future attainment planning: The City of Kalamazoo Environmental Concerns Committee, Kalamazoo Area Transportation Study, and the

Kalamazoo Area Environmental Health Advisory Council. Michigan staff also attended the annual Michigan Tribal Environmental Group meeting in Sault Ste. Marie on July 17, 2024, and engaged with tribal leaders and staff (including those from the Nottawaseppi Huron Band of Potawatomi Indians in Calhoun County) on the topic of the revised PM_{2.5} NAAQS, and the state/tribal area designations process that follows.

On December 2, 2024, the USEPA posted a non-regulatory docket ([EPA-HQ-OAR-2024-0078](#)) to [Regulations.gov](#) for the purpose of providing an opportunity for the public to provide feedback on the recommendations that states submit to the USEPA, and outreach that the USEPA might undertake in issuing final designations. To better inform the public of this, Michigan utilized its GovDelivery email distribution service to disseminate the links to the non-regulatory docket and other recently posted USEPA PM_{2.5} resources.

4.2.7 Kalamazoo – Conclusions

Kalamazoo County and the AoA counties have not historically been part of a PM_{2.5} NAA. The analyses Michigan conducted show that winds experienced at the violating monitor are generally from east, west, and southwest directions. The HYSPLIT back trajectories for the days when the monitor experiences the highest PM_{2.5} pollution further showed a northwesterly and southwesterly influence. The exceeding Kalamazoo monitor is situated immediately southeast of the largest city in the area, Kalamazoo, and approximately 15 miles west-southwest of the second largest, the City of Battle Creek. The largest point sources in the area reside in the western portion of Calhoun County, which is not considered to contribute to the exceedance at the monitoring site, since there was no strong correlation found from the urban increment, wind rose, or HYSPLIT analyses. The second largest point source contributions are from Kalamazoo County. In addition, Kalamazoo County has the highest onroad and nonroad emissions.

While the nonpoint sector is the largest contributor to the Kalamazoo area, many nonpoint inventory sectors are typically correlated with population density. The Kalamazoo County AoA is largely rural, with only small areas in Kalamazoo and the City of Battle Creek containing the highest populations. However, the nonpoint sectors in Tables 17 and 18 show that the most important sectors of PM_{2.5} and precursor emissions in both the Kalamazoo County AoA and Kalamazoo-Battle Creek-Portage CSA are fuel combustion of residential wood, dust from unpaved roads, and agricultural – crops and livestock dust. As previously acknowledged, much of the Kalamazoo County AoA is rural, so the larger nonpoint contributions from these sectors are in alignment with the overall land use of the area.

Michigan's urban increment analysis showed less influence from surrounding areas on the Kalamazoo County AoA than in the Wayne County AoA discussed earlier in this document. Moreover, organic carbon was the dominant urban species contributing to PM_{2.5} at the nearest CSN monitor at Grand Rapids, similar to what was found in the Wayne County AoA.

While the point source distribution showed high emissions from Calhoun County, when all factors are considered those areas east of the monitor are not expected to influence the Kalamazoo monitoring site. Therefore, Michigan recommends the nonattainment area be limited to Kalamazoo County.

4.3.0 Houghton Lake Monitor

The Houghton Lake monitor (AQS ID: 26-113-0001) located in Missaukee County has a 2023 DV of 9.4 $\mu\text{g}/\text{m}^3$. Michigan reviewed historical DV trends, potential area contributions, wildfire impacts, and estimated the 2024 DV for which the USEPA will base their final designations. Based on this information, Michigan recommends the area be designated as in attainment.

Michigan reviewed and estimated the 2024 DV for the Houghton Lake monitor based on quarter 1 through quarter 3 monitored data and estimated quarter 4 data for 2024. The review of the data suggests the monitor will be attaining the new NAAQS with the 2024 DV. The USEPA has stated they will be making their final designations based on the 2024 DV. From this 2024 DV analysis, along with the low emissions inventory and rural geography of the area, Michigan is recommending attainment for the area around the Houghton Lake monitor.

4.3.1 Houghton Lake - Air Quality Data

Michigan compiled 19 years of PM_{2.5} DVs for a historical analysis, which is presented in Figure 57. The Houghton Lake monitoring site PM_{2.5} concentrations generally trend down from 2005 to 2020; however, from 2021 to 2023, PM_{2.5} concentrations trended upward. In 2021 and 2023 (and to a lesser extent 2022) Michigan saw an increase in wildfire smoke plumes over the state during the warmer months. It is likely that the upward trend in recent years at this rural site is due to the impacts from these distant wildfires. The peak in the second quarter of 2023 is associated with the well-documented Canadian wildfire impacts during the second and third quarters of 2023 in the upper Midwest.

Figure 57. Houghton Lake DVs from 2005-2023.

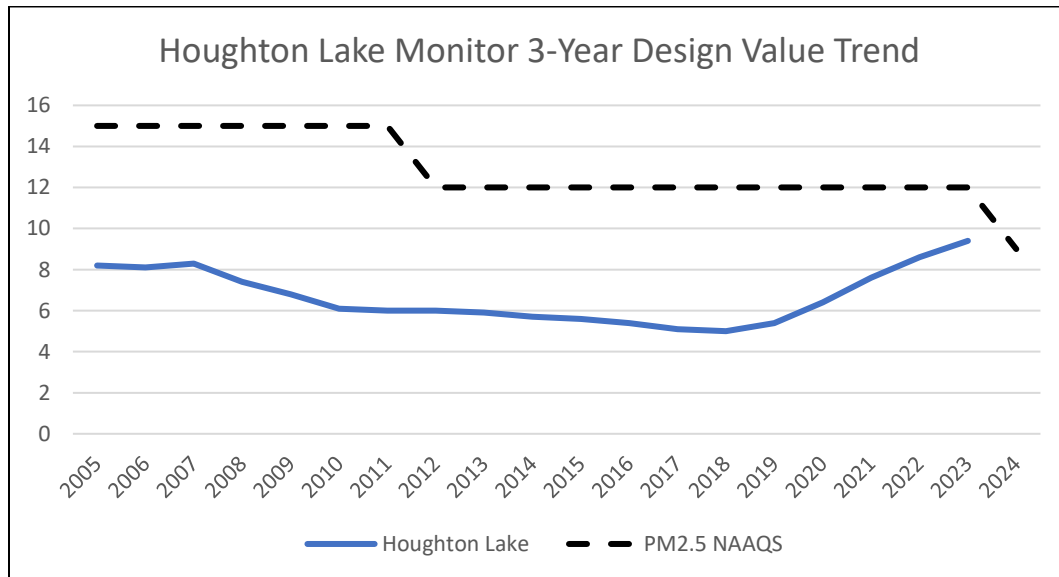
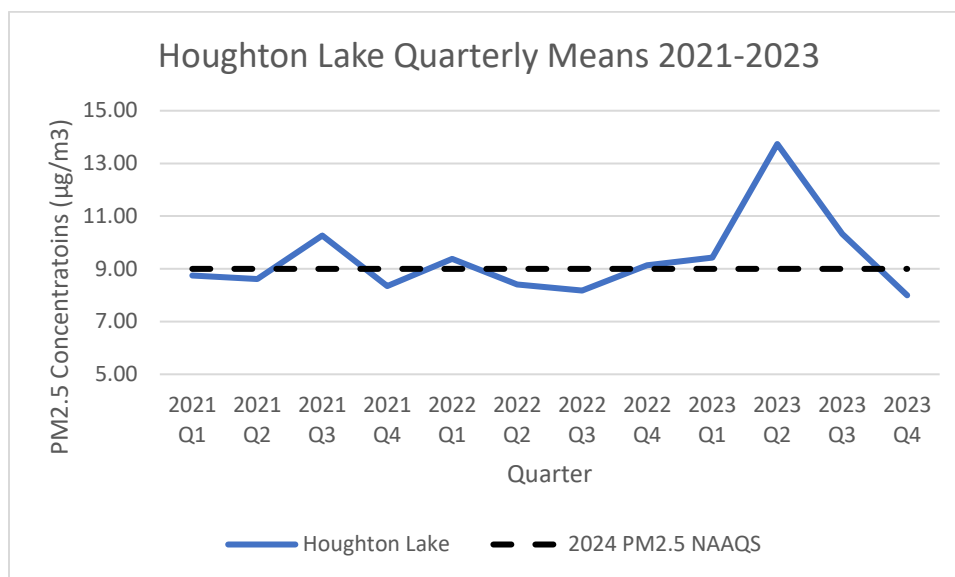


Figure 58. Houghton Lake quarterly means from 2021-2023.



Air quality in Missaukee County, where the exceeding Houghton Lake monitor (26-113-0001) is located, was impacted in June and July 2023, by smoke entering the region from wildfires in Canada. Wildfires across Canada during this period produced smoke plumes that impacted surface air quality throughout the Great Lakes Basin. The smoke from these fires produced PM_{2.5} pollution episodes across the region that had significant health impacts as well as implications for the regulatory air monitors. One of the regulatory impacts of the wildfire smoke was the effect on the air quality DV for Missaukee County within the Cadillac CBSA. The Houghton Lake monitor is the only air quality monitor located in the Cadillac CBSA. The days evaluated for wildfire impacts in 2023 were: June 3 through 9, 22, 27 through 29, and July 25 through 27. Table 24 shows the resulting 2021-2023 DV with and without these dates included. Based on this analysis, the Houghton Lake monitor would be meeting the PM_{2.5} NAAQS but for the impacts of the Canadian wildfire smoke.

Table 24. 2023 DV Comparison with and without wildfire events.

Site (AQ5 ID)	Design Value including wildfire dates	Design Value excluding wildfire dates
Houghton Lake (26-113-0001)	9.4	9.0

The USEPA will be making final designations based on 2022-2024 monitoring data; therefore, Michigan also evaluated preliminary 2024 data to estimate a 2022-2024 DV. This designation recommendation was written prior to the conclusion of 2024 so to estimate the 2024 DV for the Houghton Lake monitor, Michigan used 2022 and 2023 data along with monitor-reported data for quarters 1 through 3 of 2024, which included PM_{2.5} data exported from AQS (January through June) and Air Now Tech (July through September). Three methodologies were used to estimate the 2024 quarter 4 value. The first methodology used 2019-2023 quarter 4 data to derive a 5-year average, which represented the 2024 quarter 4 mean. The second methodology estimated quarter 4 by using Air Now Tech data (October and November) and estimated the December 2024 value by using the 2019 through 2023 average 24-hour daily concentration. The third methodology estimated quarter 4 by using Air Now Tech data (October

and November) and estimated the December 2024 value by using the 2019 through 2023 maximum 24-hour daily concentration.

The results of this analysis, presented in Table 25, show that under each scenario the Houghton Lake monitor will be below the 9 µg/m³ 2024 PM_{2.5} NAAQS. This is most likely to be reflected in the data the USEPA will use to make their final area designations.

Table 25. Houghton Lake Monitor Estimated 2024 DV Analysis

County	Site ID	2021-2023 DV	Est. DV ¹	Est. DV ²	Est. DV ³
Missaukee	26-113-0001	9.4	8.04	7.80	7.91

1. 2019-2023 Q4 average used to calculate 2024 Q4 average and annual mean.
2. 2019-2023 average 24-hour daily concentration used for Dec. to calculate 2024 Q4 average and annual mean.
3. 2019-2023 maximum 24-hour daily concentration used for Dec. to calculate 2024 Q4 average and annual mean.

Considering the long-term trends in the ambient data, the obvious wildfire smoke impacts, and the local land use and rural nature of the area, along with the preliminary 2024 monitoring data, Michigan expects the area to attain the new annual PM_{2.5} NAAQS once the 2024 data are validated and certified. If, during validation of the 2024 data, it is determined the 2024 DV will not attain the standard, the wildfire smoke events of 2023 will have regulatory significance and Michigan will expeditiously prepare an Exceptional Events Demonstration for the USEPA's consideration.

4.3.2 Houghton Lake - Emissions Data

The Houghton Lake air monitor is in Missaukee County, a part of the Cadillac CBSA, which also includes Wexford County. Michigan reviewed county and facility level emissions for these counties. Table 26a shows the overall emissions from each county and Table 26b shows the facility breakdown for PM_{2.5} and all precursors.

Table 26a. County Level PM_{2.5} and precursor emissions for the Cadillac CBSA (tpy).

Missaukee County	PM _{2.5}	NH ₃	NO _x	SO ₂	VOC
<i>Point</i>	24.4	0	205.2	182.6	56.8
<i>Nonpoint</i>	220	1,166.8	204.1	15.8	1,149.4
<i>Onroad</i>	3.8	10.1	110.1	0.4	60.7
<i>Nonroad</i>	14.9	0.3	101.6	0.1	392.4
Wexford County	PM _{2.5}	NH ₃	NO _x	SO ₂	VOC
<i>Point</i>	23.1	0.1	229.4	65.2	269.6
<i>Nonpoint</i>	318.6	241.1	156	8.8	677.4
<i>Onroad</i>	9.4	27.2	271.6	1.1	137.9
<i>Nonroad</i>	8.8	0.2	68.5	0.1	250

Table 26b. Facility PM_{2.5} and precursor emissions for the Cadillac CBSA (tpy).

PM_{2.5} (Total 36.01 tpy)		
Wexford	Cadillac Casting, Inc.	18.63
Missaukee	National Energy of McBain LLC	8.64
Missaukee	Biewer Sawmill Inc.	3.69
Wexford	Rieth Riley Construction Co. Inc.	1.47
Wexford	Cadillac Renewable Energy Facility	0.98
Wexford	Wexford County Landfill	0.71
Wexford	Akwel Cadillac USA, Inc.	0.59
Missaukee	SRM Concrete LLC	0.57
Wexford	Hutchinson Antivibration Systems, Inc.	0.37
Wexford	Wexford County	0.22
Wexford	AAR Mobility Systems	0.08
Missaukee	Home Acres Sky Ranch	0.05
Wexford	Hound Resources - Wexford 10 Facility	0.01
Missaukee	Moorestown Airpark	0.01
Wexford	Bunchs Half Acre	0.00
Wexford	Rec Boat Holdings-Trailer	0.00
Wexford	AAR Mobility Systems	0.00
Wexford	Rec Boat Holdings LLC - Cruiser Plant	0.00
Wexford	Rec Boat Holdings LLC - Sport and Engineering	0.00
NO_x (Total 434.61 tpy)		
Wexford	Cadillac Renewable Energy Facility	189.90
Missaukee	National Energy of McBain LLC	148.66
Missaukee	Biewer Sawmill Inc.	47.52
Wexford	Cadillac Casting, Inc.	15.12
Missaukee	SRM Concrete LLC	8.91
Wexford	Hound Resources - Wexford 10 Facility	8.46
Wexford	Rieth Riley Construction Co. Inc.	5.66
Wexford	Wexford County Landfill	4.23
Wexford	Hutchinson Antivibration Systems, Inc.	2.57
Wexford	Akwel Cadillac USA, Inc.	2.39
Wexford	Wexford County	0.64
Wexford	AAR Mobility Systems	0.47
Missaukee	Home Acres Sky Ranch	0.09
Missaukee	Moorestown Airpark	0.01
Wexford	Bunchs Half Acre	0.00
Wexford	Rec Boat Holdings-Trailer	0.00
Wexford	AAR Mobility Systems	0.00
Wexford	Rec Boat Holdings LLC - Cruiser Plant	0.00
Wexford	Rec Boat Holdings LLC - Sport and Engineering	0.00
NH₃ (Total 0.10 tpy)		
Wexford	Akwel Cadillac USA, Inc.	0.08
Wexford	AAR Mobility Systems	0.01
Missaukee	National Energy of McBain LLC	0.00
Wexford	Hutchinson Antivibration Systems, Inc.	0.00

Wexford	Cadillac Renewable Energy Facility	0.00
Missaukee	Biewer Sawmill Inc.	0.00
Wexford	Cadillac Casting, Inc.	0.00
Missaukee	SRM Concrete LLC	0.00
Wexford	Hound Resources - Wexford 10 Facility	0.00
Wexford	Rieth Riley Construction Co. Inc.	0.00
Wexford	Wexford County Landfill	0.00
Wexford	Wexford County	0.00
Missaukee	Home Acres Sky Ranch	0.00
Missaukee	Moorestown Airpark	0.00
Wexford	Bunchs Half Acre	0.00
Wexford	Rec Boat Holdings-Trailer	0.00
Wexford	AAR Mobility Systems	0.00
Wexford	Rec Boat Holdings LLC - Cruiser Plant	0.00
Wexford	Rec Boat Holdings LLC - Sport and Engineering	0.00
SO₂ (Total 247.84 tpy)		
Missaukee	National Energy of McBain LLC	177.48
Wexford	Cadillac Renewable Energy Facility	62.51
Missaukee	Biewer Sawmill Inc.	4.55
Wexford	Wexford County Landfill	2.06
Missaukee	SRM Concrete LLC	0.59
Wexford	Rieth Riley Construction Co. Inc.	0.40
Wexford	Wexford County	0.10
Wexford	Cadillac Casting, Inc.	0.10
Missaukee	Homes Acres Sky Ranch	0.02
Wexford	Hutchinson Antivibration Systems, Inc.	0.02
Wexford	Akwel Cadillac USA, Inc.	0.01
Wexford	AAR Mobility Systems	0.00
Missaukee	Moorestown Airpark	0.00
Wexford	Hound Resources - Wexford 10 Facility	0.00
Wexford	Bunchs Half Acre	0.00
Wexford	Rec Boat Holdings-Trailer	0.00
Wexford	AAR Mobility Systems	0.00
Wexford	Rec Boat Holdings LLC - Cruiser Plant	0.00
Wexford	Rec Boat Holdings LLC - Sport and Engineering	0.00
VOC (Total 326.37 tpy)		
Wexford	Cadillac Casting, Inc.	95.44
Wexford	Rec Boat Holdings LLC - Cruiser Plant	58.99
Wexford	Rec Boat Holdings LLC - Sport and Engineering	55.31
Missaukee	Biewer Sawmill Inc.	55.24
Wexford	Akwel Cadillac USA, Inc.	27.63
Wexford	Wexford County Landfill	8.32
Wexford	AAR Mobility Systems	8.16
Wexford	AAR Mobility Systems	5.85
Wexford	Hutchinson Antivibration Systems, Inc.	3.86
Wexford	Rec Boat Holdings-Trailer	1.95

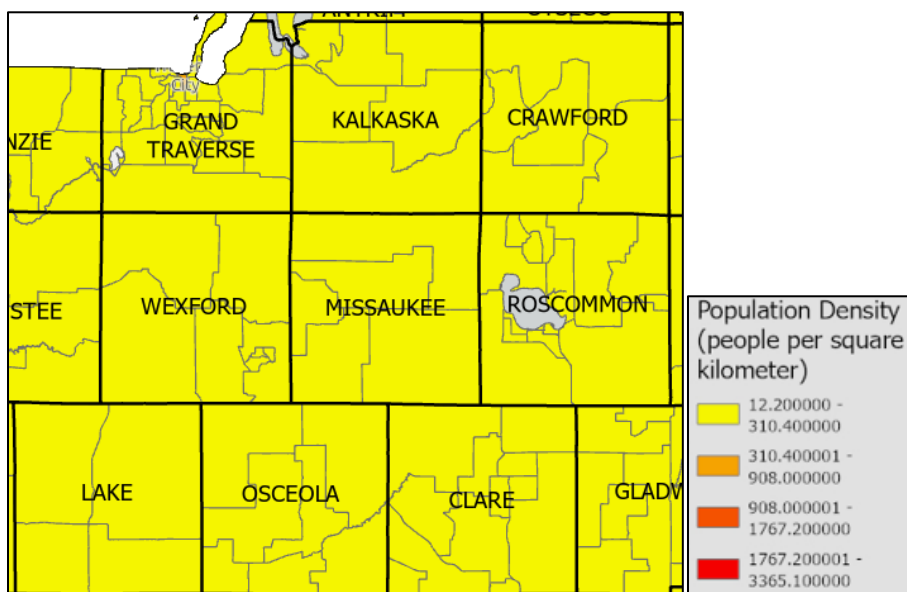
Wexford	Rieth Riley Construction Co. Inc.	1.16
Wexford	Hound Resources - Wexford 10 Facility	1.08
Wexford	Wexford County	0.90
Wexford	Cadillac Renewable Energy Facility	0.89
Missaukee	SRM Concrete, LLC	0.73
Missaukee	National Energy of McBain, LLC	0.62
Missaukee	Home Acres Sky Ranch	0.19
Missaukee	Moorestown Airpark	0.03
Wexford	Bunchs Half Acre	0.01

There are only 19 point source facilities in the Cadillac CBSA, all with PM_{2.5} emissions under 10 tpy, therefore there are no significant or large industrial sources of direct PM_{2.5} impacting the Houghton Lake monitor.

Population Density and Degree of Urbanization

Michigan looked at the population density and degree of urbanization for Missaukee County and surrounding areas using the U.S. Census Bureau's 2020 Census Demographic and Housing Characteristics. Review of Figure 59 shows that there are no large cities or areas of high population density.

Figure 59. Population Density Map for Missaukee County.



4.3.3 Houghton Lake – Meteorology

Upon completion of the wildfire impacts, 2024 DV analysis, emission, and population density analyses, this factor was not relevant to Michigan's final recommendation.

4.3.4 Houghton Lake - Geography and Topography

Missaukee County does not have any significant geographical or topographical obstructions known to affect air pollution transport. Therefore, this factor does not impact the analysis of this area.

4.3.5 Houghton Lake - Jurisdictional Boundaries

The Houghton Lake monitor is part of Missaukee County, which is part of the Cadillac CBSA. The Cadillac CBSA is made up of Missaukee and Wexford counties. This area has not previously been in nonattainment for previous PM_{2.5} NAAQS.

4.3.6 Houghton Lake – Conclusions

After review of potential wildfire impacts to the 2023 DV and 2024 DV discussed above, Michigan recommends this area be designated as in attainment. The area is part of a very rural northern airshed with minimal PM_{2.5} and precursor emissions and facilities. The USEPA will be basing their final designations based on the 2022-2024 PM_{2.5} monitoring data, which is anticipated to show attainment at this monitor, and Michigan concludes the facilities and population in this area are not contributing to nonattainment.

4.4.0 Washtenaw Area

The Ypsilanti monitor (AQS ID: 26-161-0008) located in Washtenaw County has a 2023 DV of 9.3 µg/m³. Michigan reviewed historical DV trends, wildfire impacts, and estimated the 2024 DV for which the USEPA will base their final designations. Michigan recommends the area be designated as in attainment.

Michigan reviewed and estimated the 2024 DV for the Ypsilanti monitor based on quarter 1 through quarter 3 monitoring data and estimated quarter 4 data for 2024. The review of this data suggests the monitor will be attaining the new NAAQS with the 2024 DV. The USEPA has stated they will be making their final designation based on the 2024 DVs. From this 2024 DV analysis and the historic DV trends, Michigan recommends the designation of attainment for Washtenaw County, which contains the Ypsilanti monitor.

4.4.1 Washtenaw - Air Quality Data

Michigan compiled 10 years of PM_{2.5} DVs for a historical analysis, which is presented in Figure 60. Review of this figure indicates the Ypsilanti monitoring site is generally trending down from 2012 to 2020; however, from 2021 to 2023 PM_{2.5} concentrations trended upward. In 2021 and 2023 (and to a lesser extent 2022) Michigan saw an increase in wildfire smoke plumes over the state during the warmer months. It is likely that the upward trend in recent years at this site is due, at least in part, to the impacts from these distant wildfires. The peak in quarter 2 of 2023 for the monitoring site depicted on Figure 61 is associated with the well-documented Canadian wildfire impacts during the second and third quarters of 2023 in the upper Midwest.

Figure 60. Ypsilanti DVs from 2012-2023.

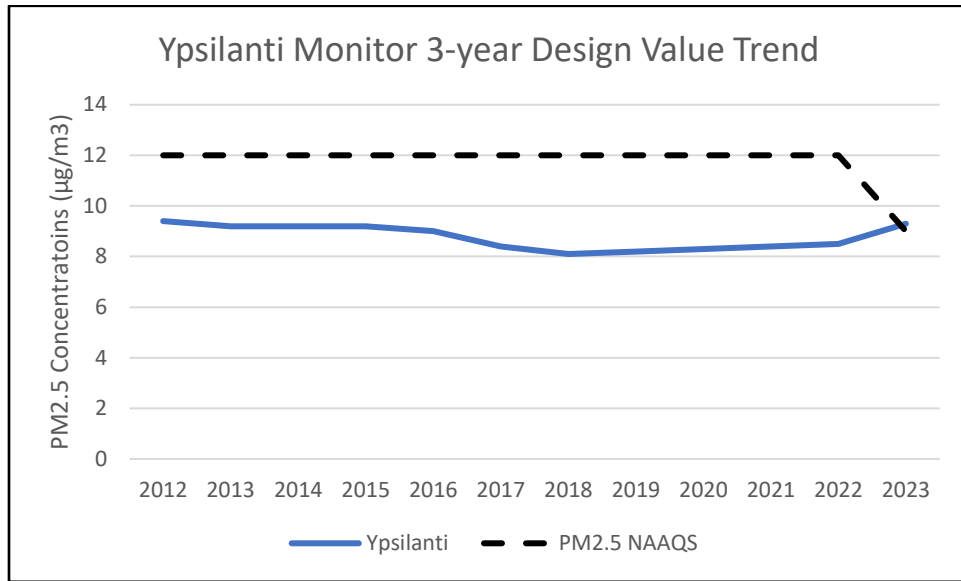
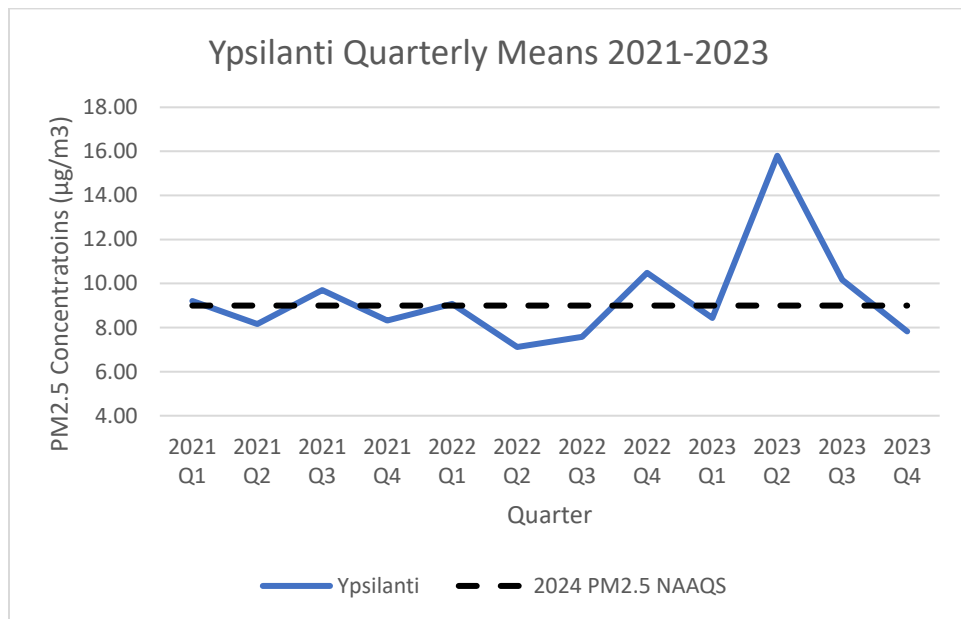


Figure 61. Ypsilanti quarterly means from 2021-2023.



Air quality in Washtenaw County where the exceeding Ypsilanti monitor (26-161-0008) is located was impacted in June 2023 by smoke entering the region from wildfires in Canada. Wildfires across Canada during this period produced smoke plumes that impacted surface air quality throughout the Great Lakes Basin. The smoke from these fires produced PM_{2.5} pollution episodes across the region that had significant health impacts as well as implications for the regulatory air monitors. One of the regulatory impacts of the fire smoke was the effect on the air quality DV for Washtenaw County. The Ypsilanti monitor is the only air quality monitor located in the county. The days evaluated for wildfire impacts in 2023 were: June 7 through 8, and 27 through 29. Table 27 shows the resulting 2021-2023 DV with and without these dates included. Based on this analysis, the Ypsilanti monitor would be meeting the PM_{2.5} NAAQS but for the impacts from the Canadian wildfire smoke.

Table 27. 2023 DV Comparison with and without wildfire events.

Site (AQS ID)	Design Value including wildfire dates	Design Value excluding wildfire dates
Ypsilanti (26-161-0008)	9.3	8.9

The USEPA will be making final designations based on 2022-2024 monitoring data, therefore Michigan also evaluated preliminary 2024 data to estimate a 2022-2024 DV. This designation recommendation was written prior to the conclusion of 2024, so to estimate the 2024 DV for the Ypsilanti monitor Michigan used 2022 and 2023 data along with monitor-reported data for quarters 1 through 3 of 2024, which included PM_{2.5} data exported from AQS (January through June) and Air Now Tech (July through September). Three methodologies were used to estimate the 2024 quarter 4 value. The first methodology used 2019-2023 quarter 4 data to derive a 5-year average, which represented the 2024 quarter 4 mean. The second methodology estimated quarter 4 by using Air Now Tech data (October and November) and estimated the December 2024 value by using the 2019 through 2023 average 24-hour daily concentration. The third methodology estimated quarter 4 by using Air Now Tech data (October and November) and estimated the December 2024 value by using the 2019 through 2023 maximum 24-hour daily concentration.

The results of this analysis are shown in Table 28 below. The results show that under each scenario the Ypsilanti monitor will be below the 9 µg/m³ 2024 PM_{2.5} NAAQS. This is most likely to be reflected in the data the USEPA will use to make their final area designations.

Table 28. Houghton Lake Monitor Estimated 2024 DV Analysis

County	Site ID	2021-2023 DV	Est. DV ¹	Est. DV ²	Est. DV ³
Washtenaw	26-161-0008	9.3	8.78	8.67	8.87

1. 2019-2023 Q4 average used to calculate 2024 Q4 average and annual mean.
2. 2019-2023 average 24-hr daily concentration used for Dec. to calculate 2024 Q4 average and annual mean.
3. 2019-2023 maximum 24-hr daily concentration used for Dec. to calculate 2024 Q4 average and annual mean.

Considering the obvious wildfire smoke impacts, and the local land use, along with the preliminary 2024 monitoring data, Michigan expects the area to attain the new annual PM_{2.5} NAAQS once the 2024 data are validated and certified. If, during the validation of the 2024 data, it is determined the 2024 DV will not attain the standard, the wildfire smoke events of 2023 will have regulatory significance and Michigan will expeditiously prepare an Exceptional Events Demonstration for the USEPA's consideration.

4.4.2 Washtenaw - Emissions Data

Upon completion of the wildfire impacts and 2022-2024 DV analyses, this factor was not relevant to Michigan's final recommendation.

4.4.3 Washtenaw - Meteorology

Upon completion of the wildfire impacts and 2022-2024 DV analyses, this factor was not relevant to Michigan's final recommendation.

4.4.4 Washtenaw – Geography and Topography

Washtenaw County does not have any significant geographical or topographical obstructions known to affect air pollution transport. Therefore, this factor does not impact the analysis of this area.

4.4.5 Washtenaw – Jurisdictional Boundaries

The Ypsilanti air monitor is part of Washtenaw County, which is part of the Ann Arbor CBSA. This area was previously part of the Detroit – Ann Arbor NAA for the 1997 and 2006 PM_{2.5} NAAQS.

4.4.6 Washtenaw – Conclusions

After review of potential wildfire impacts to the 2023 DV and 2024 DV discussed above, Michigan recommends this area be designated as in attainment. The Ypsilanti monitor is expected to be in attainment based on the 2022-2024 data the USEPA will use to make their final designations. However, it is important to note that Michigan still considered Washtenaw County as part of the Wayne County AoA to determine any potential influences Washtenaw County had on the exceeding monitors in Wayne County.

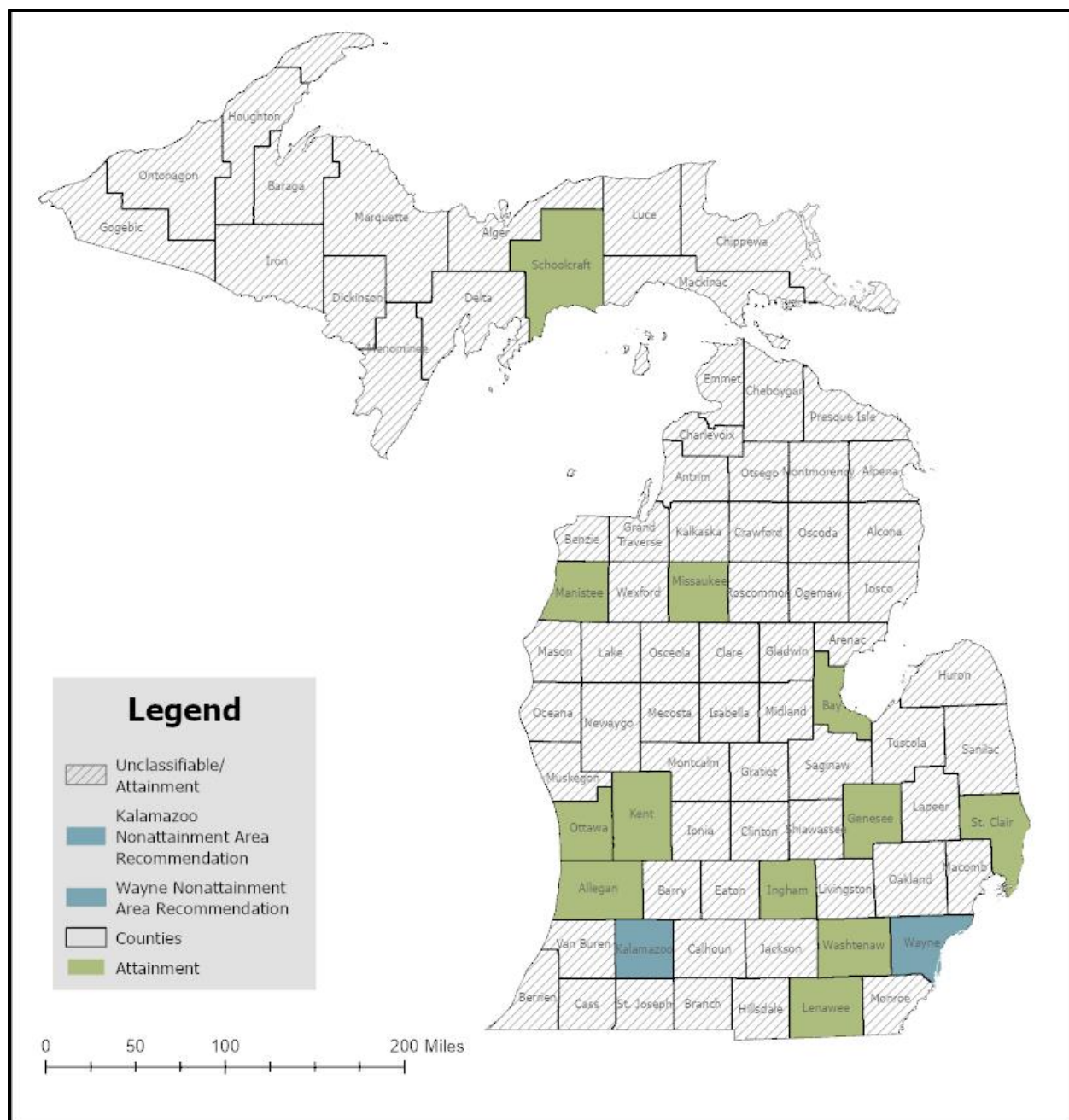
4.5.0 Kent County Area

Michigan is submitting a separate Exceptional Events Demonstration, which shows regulatory significance of wildfire impacts occurring on June 6 through 8, 26 through 29, 2023 and July 25 and 26, 2023 at the Grand Rapids monitor (AQ5 ID: 26-081-0020). This demonstration shows that with those dates excluded, the Grand Rapids monitor would be in attainment for the 2024 PM_{2.5} NAAQS; therefore, Michigan did not evaluate the five factors within the USEPA's Designations Guidance for this area.

5.0 Conclusion and Final Designation Recommendations

In this document, the State of Michigan makes recommendations to the USEPA concerning the designation of attainment, unclassifiable/attainment, and nonattainment areas in Michigan for the 2024 annual PM_{2.5} NAAQS. The designation recommendations are based primarily on air quality monitoring data for 2021-2023, with two areas also addressing preliminary data for 2022-2024. Figure 62 shows Michigan's final 2024 PM_{2.5} NAAQS Designation Recommendation, while the following sections summarize the areas Michigan is recommending as attainment, unclassifiable/attainment, and nonattainment based on the analyses discussed in this document.

Figure 62. Michigan's 2024 PM_{2.5} NAAQS Designation Recommendations.



5.1 Recommended Nonattainment Areas

Table 29. Michigan’s designation recommendation for nonattainment areas for the 2024 PM_{2.5} NAAQS.

CBSA	Counties in the CBSA	Historical 1997 Nonattainment Counties	Historical 2006 Nonattainment Counties	Historical 2012 Nonattainment Counties	Recommended Nonattainment Counties for 2024 NAAQS
Detroit-Warren-Dearborn CBSA	Lapeer, St. Clair, Macomb, Oakland, Livingston, and Wayne.	Livingston, Macomb, Monroe, Oakland, St. Clair, Washtenaw, Wayne.	Livingston, Macomb, Monroe, Oakland, St. Clair, Washtenaw, Wayne.	None	Wayne
CBSA, the Kalamazoo-Portage CBSA	Kalamazoo	None	None	None	Kalamazoo

5.2 Recommended Attainment Areas

Michigan recommends that the USEPA designate the counties listed below as attainment areas because they have monitors showing attainment of the 2024 annual PM_{2.5} standard based on the 2021-2023 monitoring data, attainment is anticipated based on 2022-2024 monitoring data, or Michigan is submitting an Exceptional Event Demonstration to exclude wildfire dates that will then show attainment based on the 2021-2023 monitoring data. Additionally, these areas are not contributing to nonattainment of the standard in other areas.

Attainment Counties: Allegan, Bay, Genessee, Ingham, Kent, Lenawee, Macomb, Manistee, Missaukee, Oakland, Ottawa, Schoolcraft, St. Clair, and Washtenaw.

5.3 Unclassifiable/Attainment Areas

Michigan recommends the USEPA designate the counties set forth below as unclassifiable/attainment areas because they do not have monitors showing attainment or nonattainment of the 2024 annual PM_{2.5} standard. Additionally, they have not been determined to be contributing to nonattainment of the standard in another area.

The recommended “unclassifiable/attainment areas” counties are provided as follows:

Alcona County	Barry County	Charlevoix County
Alger County	Benzie County	Cheboygan County
Alpena County	Berrien County	Chippewa County
Antrim County	Branch County	Clare County
Arenac County	Calhoun County	Clinton County
Baraga County	Cass County	Crawford County

Delta County	Keweenaw County	Oceana County
Dickinson County	Lake County	Ogemaw County
Eaton County	Lapeer County	Ontonagon County
Emmet County	Leelanau County	Osceola County
Gladwin County	Livingston County	Oscoda County
Gogebic County	Luce County	Otsego County
Grand Traverse County	Mackinac County	Presque Isle County
Gratiot County	Marquette County	Roscommon County
Hillsdale County	Mason County	Saginaw County
Houghton County	Mecosta County	Sanilac County
Huron County	Menominee County	Shiawassee County
Ionia County	Midland County	St. Joseph County
Iosco County	Monroe County	Tuscola County
Iron County	Montcalm County	Van Buren County
Isabella County	Montmorency County	Wexford County
Jackson County	Muskegon County	
Kalkaska County	Newaygo County	

Attachment 1

Michigan CSA and CBSA Maps

Below are maps showing Michigan's Combined Statistical Area (CSA) and Core Based Statistical Area (CBSA) as of the creation of this document. The areas are color coded with a legend featuring the names for each area.

Figure 1. Michigan CSAs

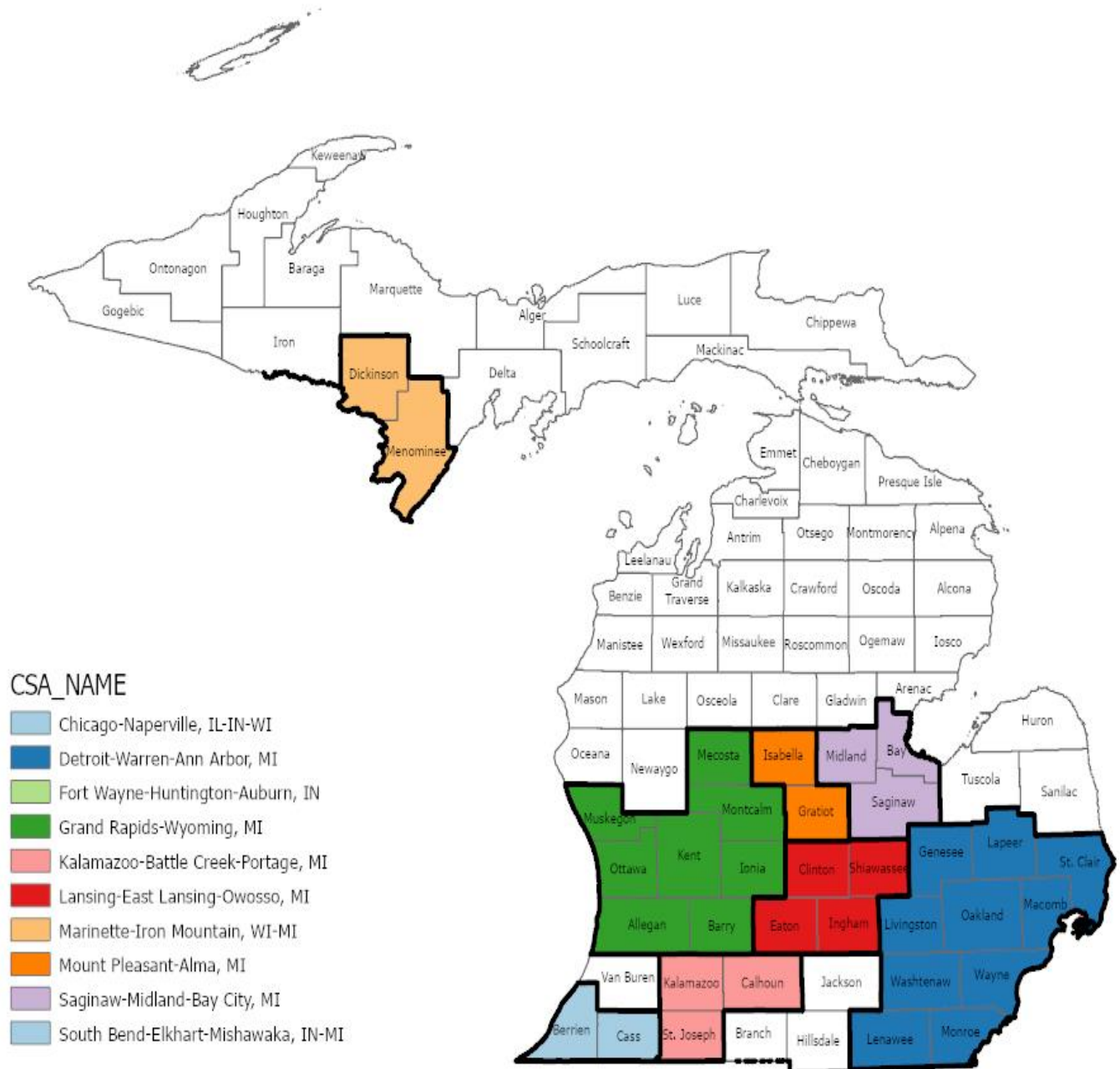
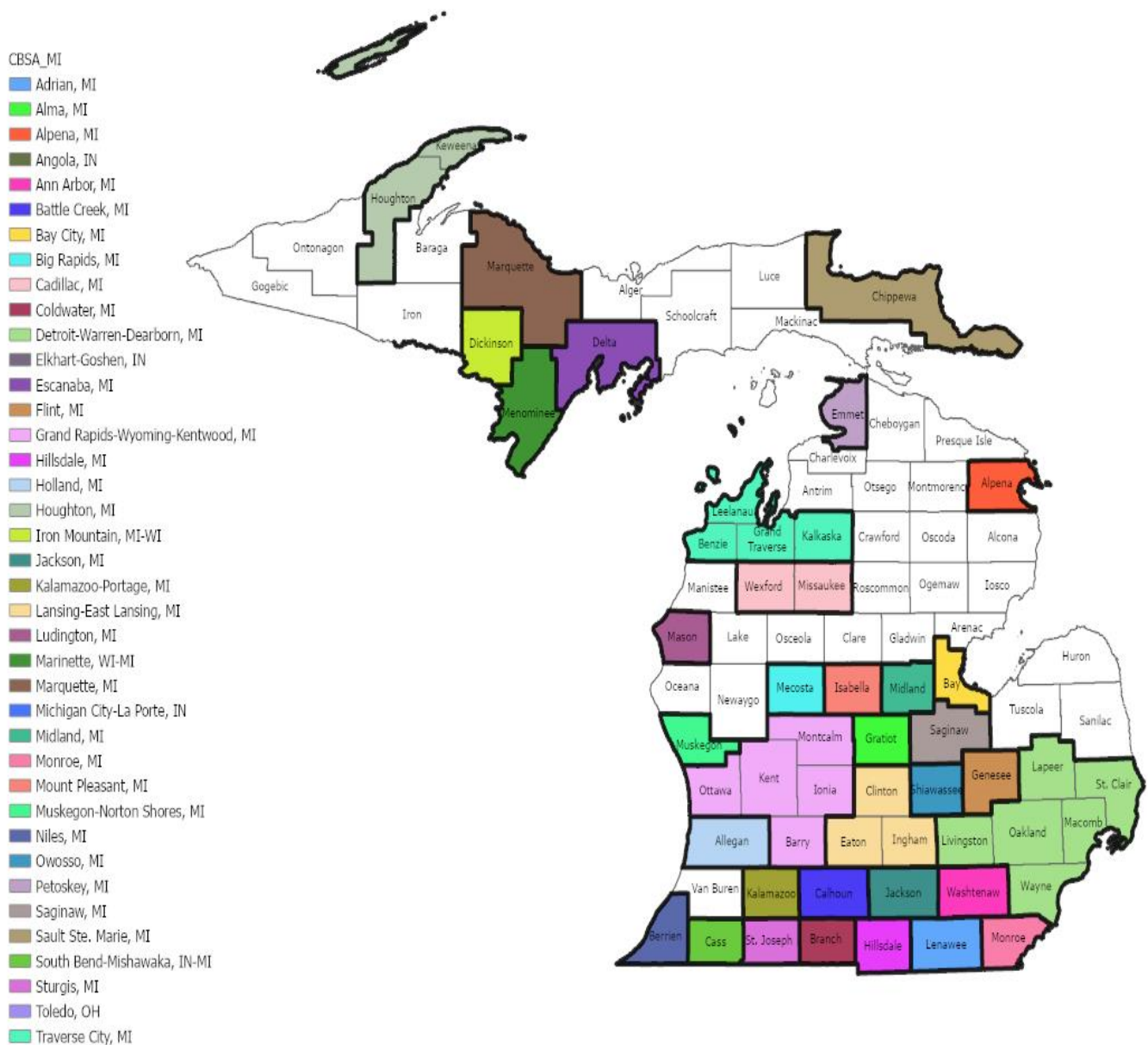


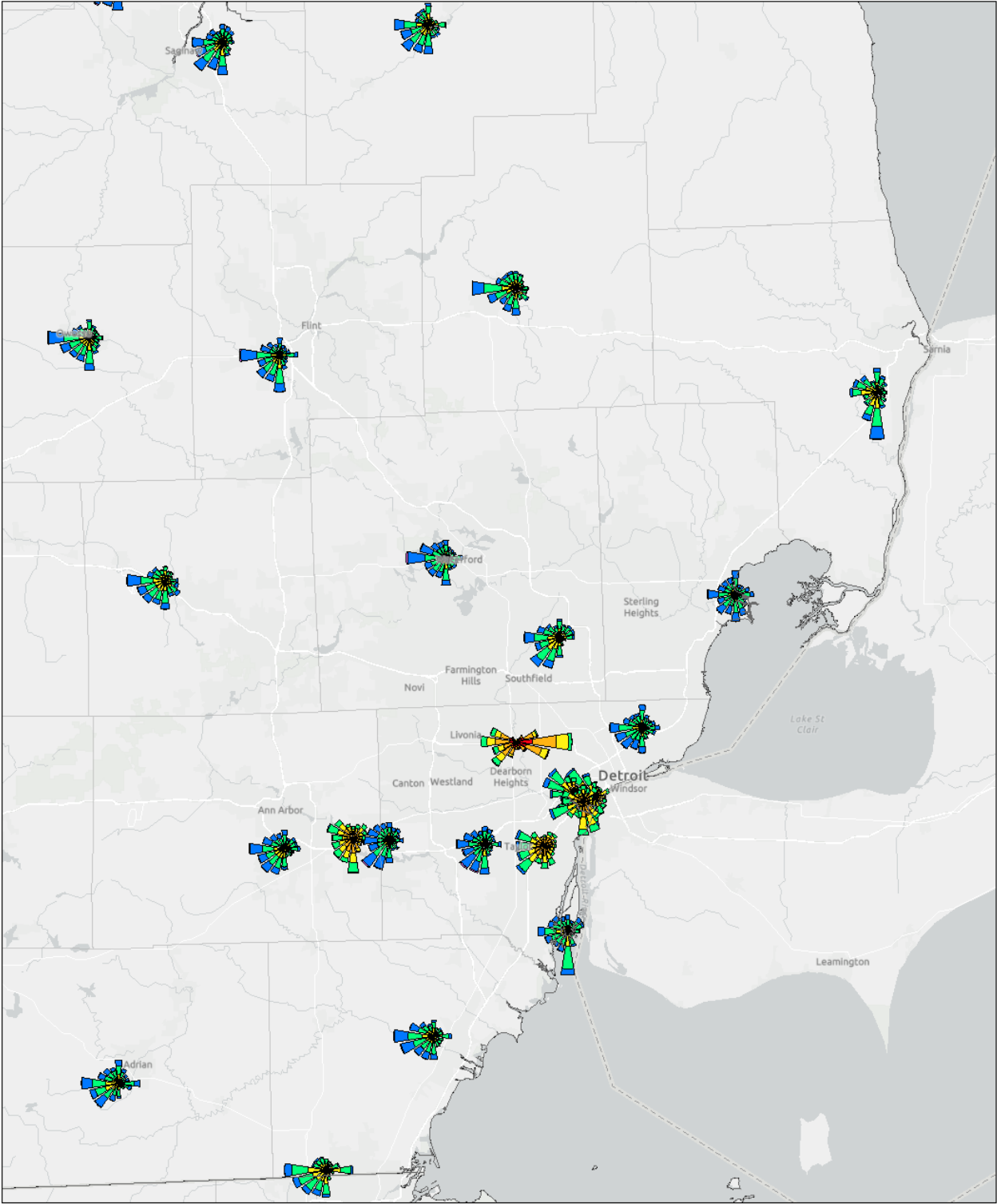
Figure 2. Michigan CBSAs



Attachment 2

Southeast Michigan Wind Roses

Detroit Area Wind Roses



12/11/2024, 2:22:02 PM

Attachment 3

Urban Increment USEPA Methodology

Quarterly Speciated Urban Increment Data (2021-2023)

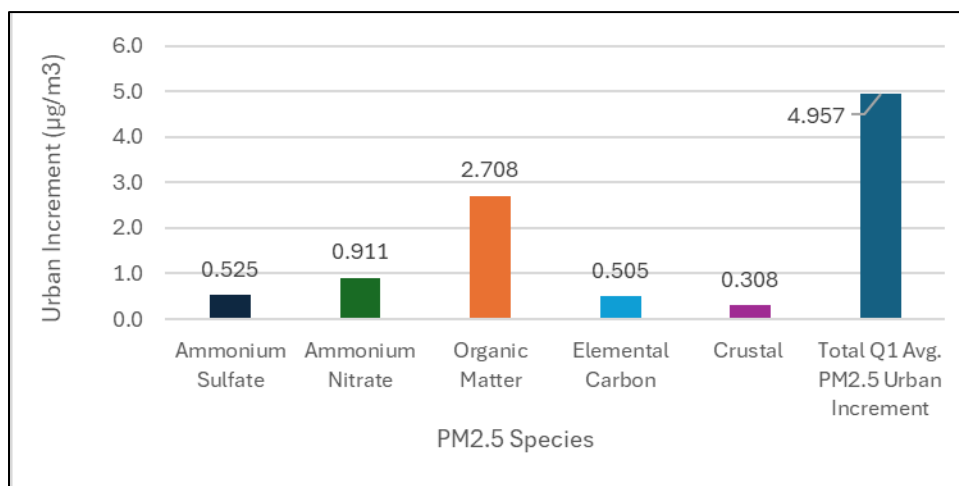
Military Park, DP4th, and DET-SW AQS Monitors [Quarterly Averages (Q1-Q4)]

In Table 1 Michigan presents the results of its computations for the speciated and total quarter 1 (Q1) average PM_{2.5} urban increments for Michigan's Military Park, DP4th, and Detroit-SW monitors using three years (2021-2023) of quarter 1 speciated PM_{2.5} concentration data from the Detroit-SW CSN monitor and the St. John's Road – Quaker City, Ohio IMPROVE monitor. As shown in Table 1 and Figure 1, the PM_{2.5} component that contributed the most (on average) to the Q1 PM_{2.5} urban increment is the organic matter portion of PM_{2.5} (2.708 (µg/m³)).

Table 1. Military Park, DP4th, and DET-SW Monitors – 2021-2023 Q1 Average Urban Increment by PM_{2.5} Species

Local Site Name [Site ID]	Q1 Avg. Ammonium Sulfate Increment	Q1 Avg. Ammonium Nitrate Increment	Q1 Avg. OM Increment	Q1 Avg. EC Increment	Q1 Avg. Crustal Increment	Total Q1 Avg. PM _{2.5} Urban Increment	Units
Military Park [261630100], DP4th [261630098], DET- SW [261630015]	0.525	0.911	2.708	0.505	0.308	4.957	(µg/m ³)

Figure 1. Military Park, DP4th, and DET-SW Monitors – 2021-2023 Q1 Average Urban Increment by PM_{2.5} Species

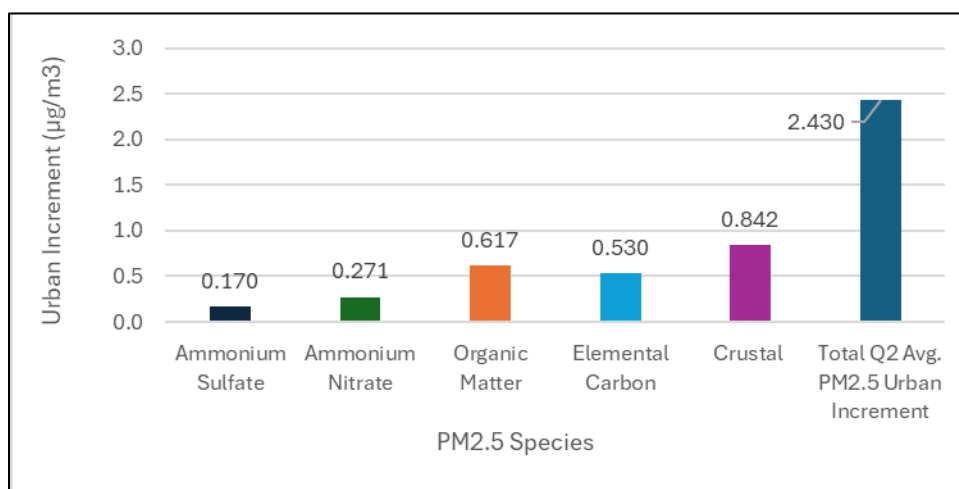


In Table 2 Michigan presents the results of its computations for the speciated and total quarter 2 (Q2) average PM_{2.5} urban increments for Michigan's Military Park, DP4th, and Detroit-SW monitors using three years (2021-2023) of quarter 2 speciated PM_{2.5} concentration data from the Detroit-SW CSN monitor and the St. John's Road – Quaker City, Ohio IMPROVE monitor. As shown in Table 2 and Figure 2, the PM_{2.5} component that contributed the most (on average) to the Q2 PM_{2.5} urban increment is the crustal portion of PM_{2.5} (.842 (µg/m³)).

Table 2. Military Park, DP4th, and DET-SW Monitors – 2021-2023 Q2 Average Urban Increment by PM_{2.5} Species

Local Site Name [Site ID]	Q2 Avg. Ammonium Sulfate Increment	Q2 Avg. Ammonium Nitrate Increment	Q2 Avg. OM Increment	Q2 Avg. EC Increment	Q2 Avg. Crustal Increment	Total Q2 Avg. PM _{2.5} Urban Increment	Units
Military Park [261630100], DP4th [261630098], DET- SW [261630015]	0.170	0.271	0.617	0.530	0.842	2.430	(µg/m ³)

Figure 2. Military Park, DP4th, and DET-SW Monitors – 2021-2023 Q2 Average Urban Increment by PM_{2.5} Species

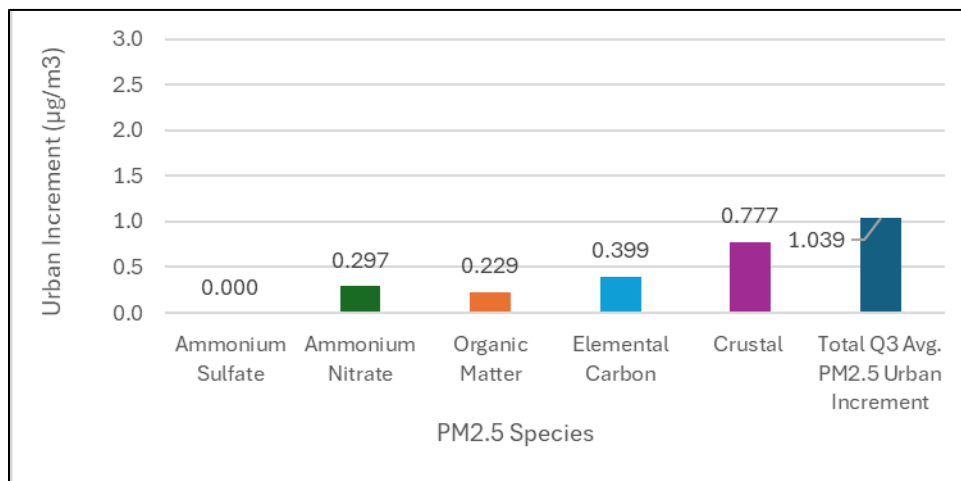


In Table 3 Michigan presents the results of its computations for the speciated and total quarter 3 (Q3) average PM_{2.5} urban increments for Michigan’s Military Park, DP4th, and Detroit-SW monitors using three years (2021-2023) of quarter 3 speciated PM_{2.5} concentration data from the Detroit-SW CSN monitor and the St. John’s Road – Quaker City, Ohio IMPROVE monitor. As shown in Table 3 and Figure 3, the PM_{2.5} component that contributed the most (on average) to the Q3 PM_{2.5} urban increment is the crustal portion of PM_{2.5} (.777 (µg/m³)).

Table 3. Military Park, DP4th, and DET-SW Monitors – 2021-2023 Q3 Average Urban Increment by PM_{2.5} Species

Local Site Name [Site ID]	Q3 Avg. Ammonium Sulfate Increment	Q3 Avg. Ammonium Nitrate Increment	Q3 Avg. OM Increment	Q3 Avg. EC Increment	Q3 Avg. Crustal Increment	Total Q3 Avg. PM _{2.5} Urban Increment	Units
Military Park [261630100], DP4th [261630098], DET- SW [261630015]	0.000	0.297	0.229	0.399	0.777	1.039	(µg/m ³)

Figure 3. Military Park, DP4th, and DET-SW Monitors – 2021-2023 Q3 Average Urban Increment by PM_{2.5} Species

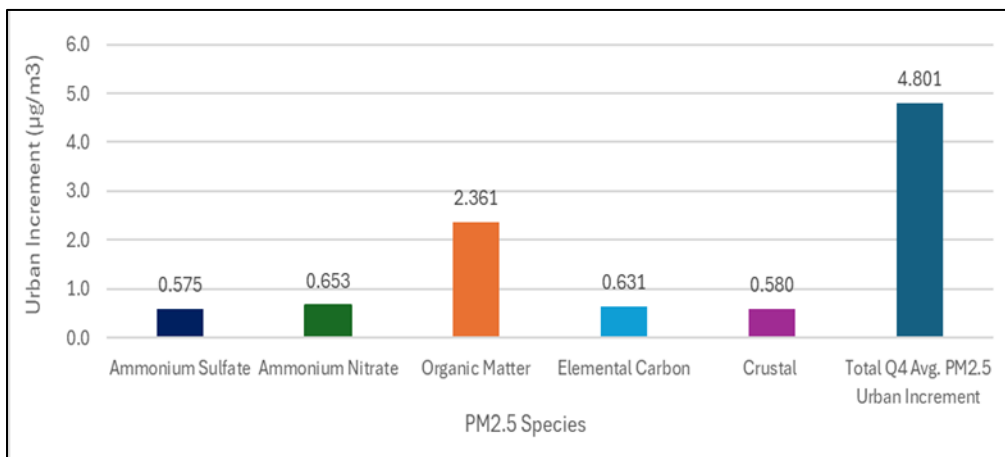


In Table 4 Michigan presents the results of its computations for the speciated and total quarter 4 (Q4) average PM_{2.5} urban increments for Michigan’s Military Park, DP4th, and Detroit-SW monitors using three years (2021-2023) of quarter 4 speciated PM_{2.5} concentration data from the Detroit-SW CSN monitor and the St. John’s Road – Quaker City, Ohio IMPROVE monitor. As shown in Table 4 and Figure 4, the PM_{2.5} component that contributed the most (on average) to the Q4 PM_{2.5} urban increment is the organic matter portion of PM_{2.5} (2.361 (µg/m³)).

Table 4. Military Park, DP4th, and DET-SW Monitors – 2021-2023 Q4 Average Urban Increment by PM_{2.5} Species

Local Site Name [Site ID]	Q4 Avg. Ammonium Sulfate Increment	Q4 Avg. Ammonium Nitrate Increment	Q4 Avg. OM Increment	Q4 Avg. EC Increment	Q4 Avg. Crustal Increment	Total Q4 Avg. PM _{2.5} Urban Increment	Units
Military Park [261630100], DP4th [261630098], DET- SW [261630015]	0.575	0.653	2.361	0.631	0.580	4.801	(µg/m ³)

Figure 4. Military Park, DP4th, and DET-SW Monitors – 2021-2023 Q4 Average Urban Increment by PM_{2.5} Species



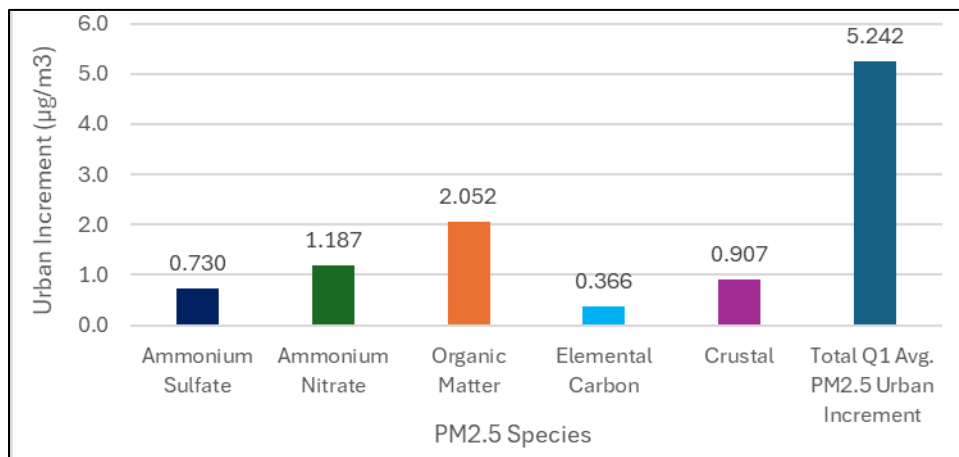
Trinity St. Marks, Eliza-NR, and Dearborn Public Schools AQS Monitors [Quarterly Averages (Q1-Q4)]

In Table 5 Michigan presents the results of its computations for the speciated and total quarter 1 (Q1) average PM_{2.5} urban increments for Michigan’s Trinity St. Marks, Eliza-NR, and Dearborn Public Schools monitors using three years (2021-2023) of quarter 1 speciated PM_{2.5} concentration data from the Dearborn Public Schools CSN monitor and the St. John’s Road – Quaker City, Ohio IMPROVE monitor. As shown in Table 5 and Figure 5, the PM_{2.5} component that contributed the most (on average) to the Q1 PM_{2.5} urban increment is the organic matter portion of PM_{2.5} (2.052 (µg/m³)).

Table 5. Trinity St. Marks, Eliza-NR, and Dearborn Public Schools Monitors – 2021-2023 Q1 Average Urban Increment by PM_{2.5} Species

Local Site Name [Site ID]	Q1 Avg. Ammonium Sulfate Increment	Q1 Avg. Ammonium Nitrate Increment	Q1 Avg. OM Increment	Q1 Avg. EC Increment	Q1 Avg. Crustal Increment	Total Q1 Avg. PM _{2.5} Urban Increment	Units
Trinity St. Marks [261630099], Eliza-NR [261630093], Dearborn Public Schools [261630033]	0.730	1.187	2.052	0.366	0.907	5.242	(µg/m ³)

Figure 5. Trinity St. Marks, Eliza-NR, and Dearborn Public Schools Monitors – 2021-2023 Q1 Average Urban Increment by PM_{2.5} Species

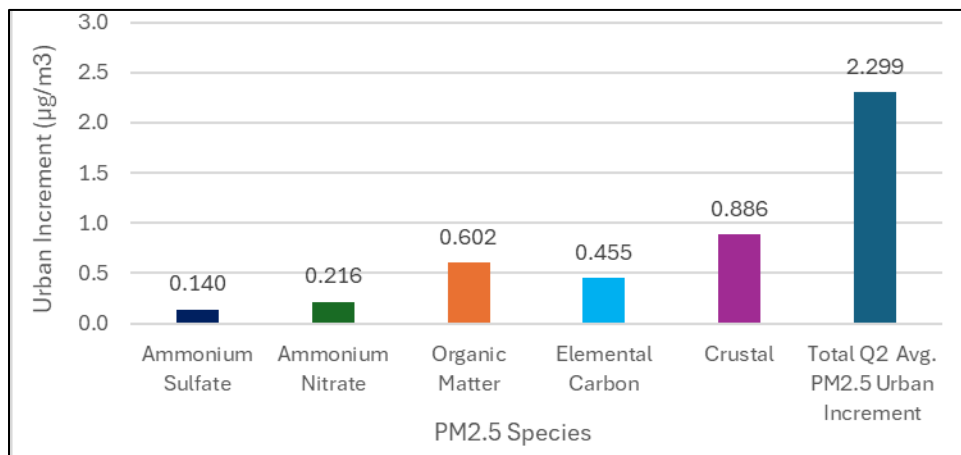


In Table 6 Michigan presents the results of its computations for the speciated and total quarter 2 (Q2) average PM_{2.5} urban increments for Michigan’s Trinity St. Marks, Eliza-NR, and Dearborn Public Schools monitors using three years (2021-2023) of quarter 2 speciated PM_{2.5} concentration data from the Dearborn Public Schools CSN monitor and the St. John’s Road – Quaker City, Ohio IMPROVE monitor. As shown in Table 6 and Figure 6, the PM_{2.5} component that contributed the most (on average) to the Q2 PM_{2.5} urban increment is the crustal portion of PM_{2.5} (.886 (µg/m³)).

Table 6. Trinity St. Marks, Eliza-NR, and Dearborn Public Schools Monitors – 2021-2023 Q2 Average Urban Increment by PM_{2.5} Species

Local Site Name [Site ID]	Q2 Avg. Ammonium Sulfate Increment	Q2 Avg. Ammonium Nitrate Increment	Q2 Avg. OM Increment	Q2 Avg. EC Increment	Q2 Avg. Crustal Increment	Total Q2 Avg. PM _{2.5} Urban Increment	Units
Trinity St. Marks [261630099], Eliza-NR [261630093], Dearborn Public Schools [261630033]	0.140	0.216	0.602	0.455	0.886	2.299	(µg/m³)

Figure 6. Trinity St. Marks, Eliza-NR, and Dearborn Public Schools Monitors – 2021-2023 Q2 Average Urban Increment by PM_{2.5} Species

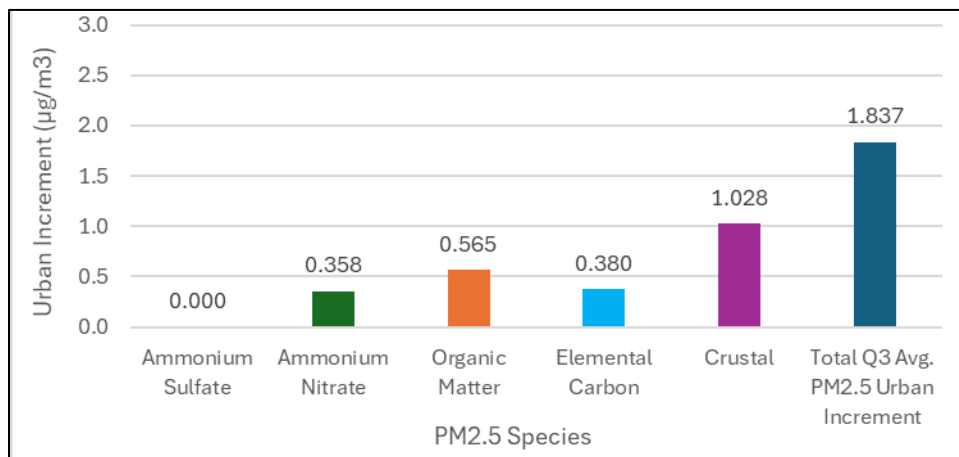


In Table 7 Michigan presents the results of its computations for the speciated and total quarter 3 (Q3) average PM_{2.5} urban increments for Michigan’s Trinity St. Marks, Eliza-NR, and Dearborn Public Schools monitors using three years (2021-2023) of quarter 3 speciated PM_{2.5} concentration data from the Dearborn Public Schools CSN monitor and the St. John’s Road – Quaker City, Ohio IMPROVE monitor. As shown in Table 7 and Figure 7, the PM_{2.5} component that contributed the most (on average) to the Q3 PM_{2.5} urban increment is the crustal portion of PM_{2.5} (1.028 (µg/m³)).

Table 7. Trinity St. Marks, Eliza-NR, and Dearborn Public Schools Monitors – 2021-2023 Q3 Average Urban Increment by PM_{2.5} Species

Local Site Name [Site ID]	Q3 Avg. Ammonium Sulfate Increment	Q3 Avg. Ammonium Nitrate Increment	Q3 Avg. OM Increment	Q3 Avg. EC Increment	Q3 Avg. Crustal Increment	Total Q3 Avg. PM _{2.5} Urban Increment	Units
Trinity St. Marks [261630099], Eliza-NR [261630093], Dearborn Public Schools [261630033]	0.000	0.358	0.565	0.380	1.028	1.837	(µg/m ³)

Figure 7. Trinity St. Marks, Eliza-NR, and Dearborn Public Schools Monitors – 2021-2023 Q3 Average Urban Increment by PM_{2.5} Species

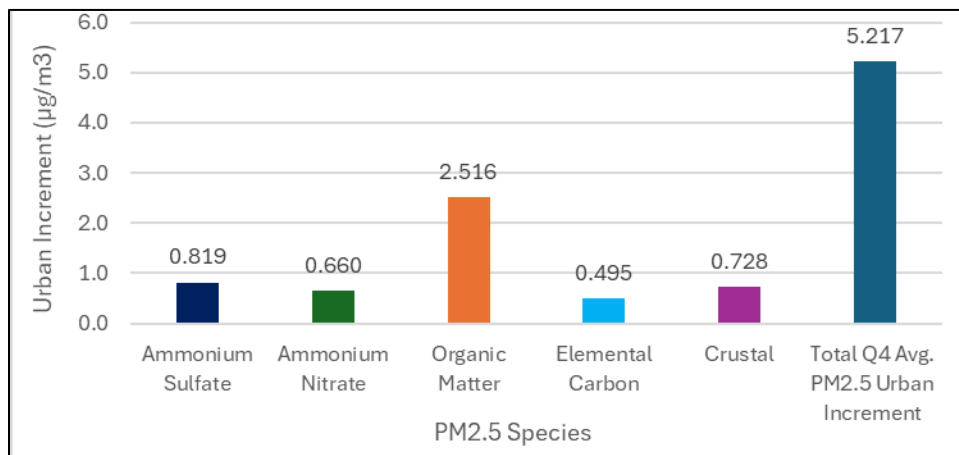


In Table 8, Michigan presents the results of its computations for the speciated and total quarter 4 (Q4) average PM_{2.5} urban increments for Michigan’s Trinity St. Marks, Eliza-NR, and Dearborn Public Schools monitors using three years (2021-2023) of quarter 4 speciated PM_{2.5} concentration data from the Dearborn Public Schools CSN monitor and the St. John’s Road – Quaker City, Ohio IMPROVE monitor. As shown in Table 8 and Figure 8, the PM_{2.5} component that contributed the most (on average) to the Q4 PM_{2.5} urban increment is the organic matter portion of PM_{2.5} (2.516 (µg/m³)).

Table 8. Trinity St. Marks, Eliza-NR, and Dearborn Public Schools Monitors – 2021-2023 Q4 Average Urban Increment by PM_{2.5} Species

Local Site Name [Site ID]	Q4 Avg. Ammonium Sulfate Increment	Q4 Avg. Ammonium Nitrate Increment	Q4 Avg. OM Increment	Q4 Avg. EC Increment	Q4 Avg. Crustal Increment	Total Q4 Avg. PM _{2.5} Urban Increment	Units
Trinity St. Marks [261630099], Eliza-NR [261630093], Dearborn Public Schools [261630033]	0.819	0.660	2.516	0.495	0.728	5.217	(µg/m³)

Figure 8. Trinity St. Marks, Eliza-NR, and Dearborn Public Schools Monitors – 2021-2023 Q4 Average Urban Increment by PM_{2.5} Species



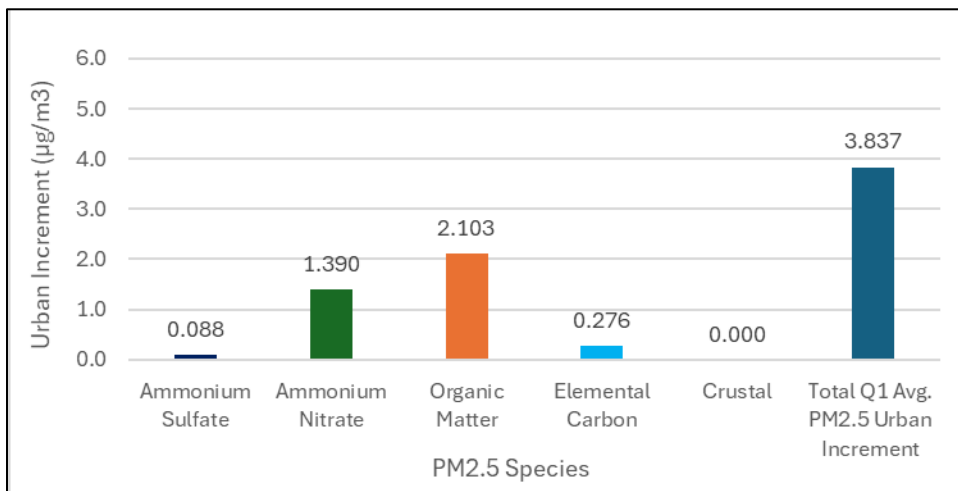
Allen Park AQS Monitor [Quarterly Averages (Q1-Q4)]

In Table 9 Michigan presents the results of its computations for the speciated and total quarter 1 (Q1) average PM_{2.5} urban increments for Michigan's Allen Park monitor using three years (2021-2023) of quarter 1 speciated PM_{2.5} concentration data from the Allen Park CSN monitor and the St. John's Road – Quaker City, Ohio IMPROVE monitor. As shown in Table 9 and Figure 9, the PM_{2.5} component that contributed the most (on average) to the Q1 PM_{2.5} urban increment is the organic matter portion of PM_{2.5} (2.103 (µg/m³)). Similarly, the urban/local contribution of ammonium nitrate to the total Q1 average PM_{2.5} concentration was also found to be significant (1.390 (µg/m³)).

Table 9. Allen Park Monitor – 2021-2023 Q1 Average Urban Increment by PM_{2.5} Species

Local Site Name [Site ID]	Q1 Avg. Ammonium Sulfate Increment	Q1 Avg. Ammonium Nitrate Increment	Q1 Avg. OM Increment	Q1 Avg. EC Increment	Q1 Avg. Crustal Increment	Total Q1 Avg. PM _{2.5} Urban Increment	Units
Allen Park [261630001]	0.088	1.390	2.103	0.276	0.000	3.837	(µg/m ³)

Figure 9. Allen Park Monitor – 2021-2023 Q1 Average Urban Increment by PM_{2.5} Species

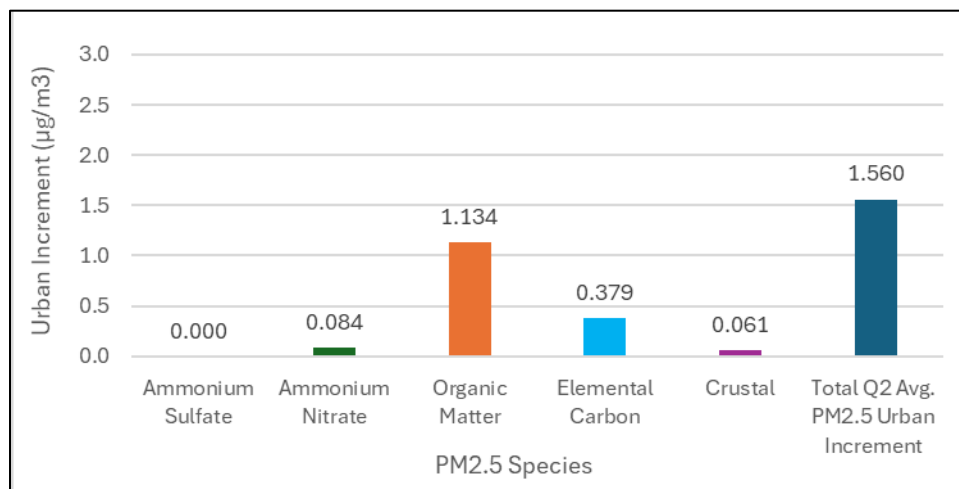


In Table 10 Michigan presents the results of its computations for the speciated and total quarter 2 (Q2) average PM_{2.5} urban increments for Michigan's Allen Park monitor using three years (2021-2023) of quarter 2 speciated PM_{2.5} concentration data from the Allen Park CSN monitor and the St. John's Road – Quaker City, Ohio IMPROVE monitor. As shown in Table 10 and Figure 10, the PM_{2.5} component that contributed the most (on average) to the Q2 PM_{2.5} urban increment is the organic matter portion of PM_{2.5} (1.134 (µg/m³)).

Table 10. Allen Park Monitor – 2021-2023 Q2 Average Urban Increment by PM_{2.5} Species

Local Site Name [Site ID]	Q2 Avg. Ammonium Sulfate Increment	Q2 Avg. Ammonium Nitrate Increment	Q2 Avg. OM Increment	Q2 Avg. EC Increment	Q2 Avg. Crustal Increment	Total Q2 Avg. PM _{2.5} Urban Increment	Units
Allen Park [261630001]	0.000	0.084	1.134	0.379	0.061	1.560	(µg/m³)

Figure 10. Allen Park Monitor – 2021-2023 Q2 Average Urban Increment by PM_{2.5} Species

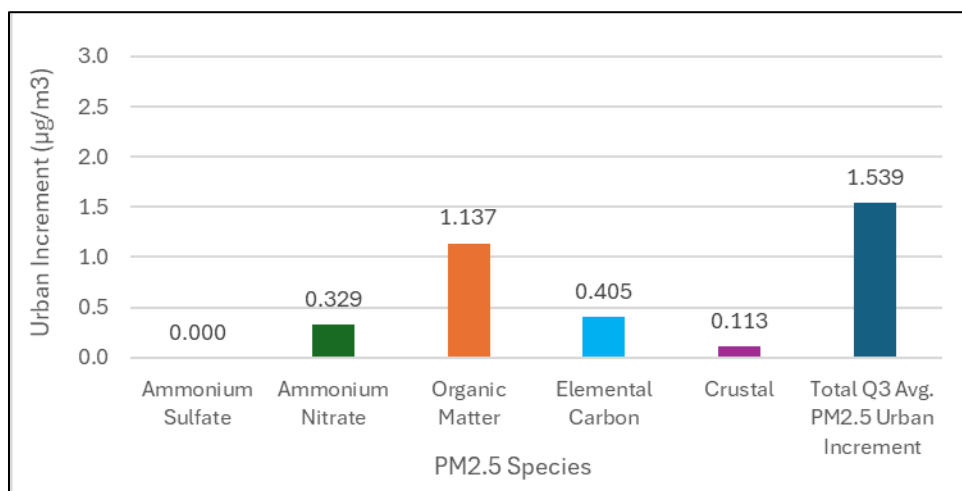


In Table 11 Michigan presents the results of its computations for the speciated and total quarter 3 (Q3) average PM_{2.5} urban increments for Michigan's Allen Park monitor using three years (2021-2023) of quarter 3 speciated PM_{2.5} concentration data from the Allen Park CSN monitor and the St. John's Road – Quaker City, Ohio IMPROVE monitor. As shown in Table 11 and Figure 11, the PM_{2.5} component that contributed the most (on average) to the Q3 PM_{2.5} urban increment is the organic matter portion of PM_{2.5} (1.137 (µg/m³)).

Table 11. Allen Park Monitor – 2021-2023 Q3 Average Urban Increment by PM_{2.5} Species

Local Site Name [Site ID]	Q3 Avg. Ammonium Sulfate Increment	Q3 Avg. Ammonium Nitrate Increment	Q3 Avg. OM Increment	Q3 Avg. EC Increment	Q3 Avg. Crustal Increment	Total Q3 Avg. PM _{2.5} Urban Increment	Units
Allen Park [261630001]	0.000	0.329	1.137	0.405	0.113	1.539	(µg/m ³)

Figure 11. Allen Park Monitor – 2021-2023 Q3 Average Urban Increment by PM_{2.5} Species

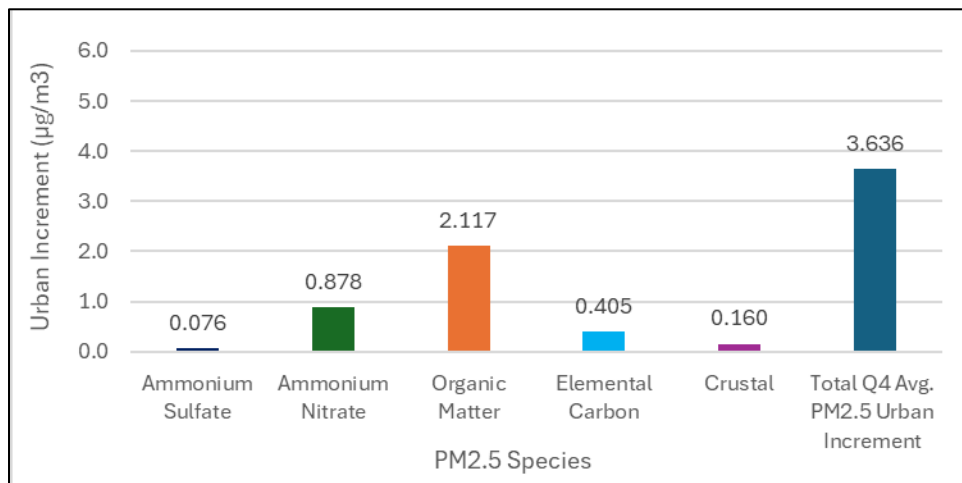


In Table 12 Michigan presents the results of its computations for the speciated and total quarter 4 (Q4) average PM_{2.5} urban increments for Michigan's Allen Park monitor using three years (2021-2023) of quarter 4 speciated PM_{2.5} concentration data from the Allen Park CSN monitor and the St. John's Road – Quaker City, Ohio IMPROVE monitor. As shown in Table 12 and Figure 12, the PM_{2.5} component that contributed the most (on average) to the Q4 PM_{2.5} urban increment is the organic matter portion of PM_{2.5} (2.117 (µg/m³)).

Table 12. Allen Park Monitor – 2021-2023 Q4 Average Urban Increment by PM_{2.5} Species

Local Site Name [Site ID]	Q4 Avg. Ammonium Sulfate Increment	Q4 Avg. Ammonium Nitrate Increment	Q4 Avg. OM Increment	Q4 Avg. EC Increment	Q4 Avg. Crustal Increment	Total Q4 Avg. PM _{2.5} Urban Increment	Units
Allen Park [261630001]	0.076	0.878	2.117	0.405	0.160	3.636	(µg/m ³)

Figure 12. Allen Park Monitor – 2021-2023 Q4 Average Urban Increment by PM_{2.5} Species



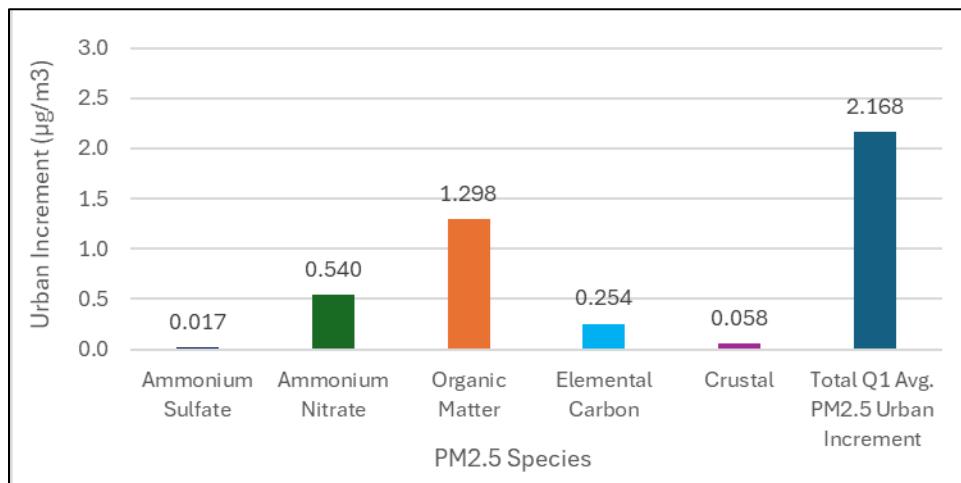
Kalamazoo Fairgrounds AQS Monitor [Quarterly Averages (Q1-Q4)]

In Table 13 Michigan presents the results of its computations for the speciated and total quarter 1 (Q1) average PM_{2.5} urban increments for Michigan's Kalamazoo Fairgrounds AQS monitor using three years (2021-2023) of quarter 1 speciated PM_{2.5} concentration data from the GR-Monroe CSN monitor and the ISWS Climate Station, Illinois IMPROVE monitor. As shown in Table 13 and Figure 13, the PM_{2.5} component that contributed the most (on average) to the Q1 PM_{2.5} urban increment is the organic matter portion of PM_{2.5} (1.298 (µg/m³)).

Table 13. Kalamazoo Fairground Monitor – 2021-2023 Q1 Average Urban Increments by PM_{2.5} Species

Local Site Name [Site ID]	Q1 Avg. Ammonium Sulfate Increment	Q1 Avg. Ammonium Nitrate Increment	Q1 Avg. OM Increment	Q1 Avg. EC Increment	Q1 Avg. Crustal Increment	Total Q1 Avg. PM _{2.5} Urban Increment	Units
Kalamazoo Fairgrounds [260770008]	0.017	0.540	1.298	0.254	0.058	2.168	(µg/m ³)

Figure 13. Kalamazoo Fairgrounds Monitor – 2021-2023 Q1 Average Urban Increments by PM_{2.5} Species

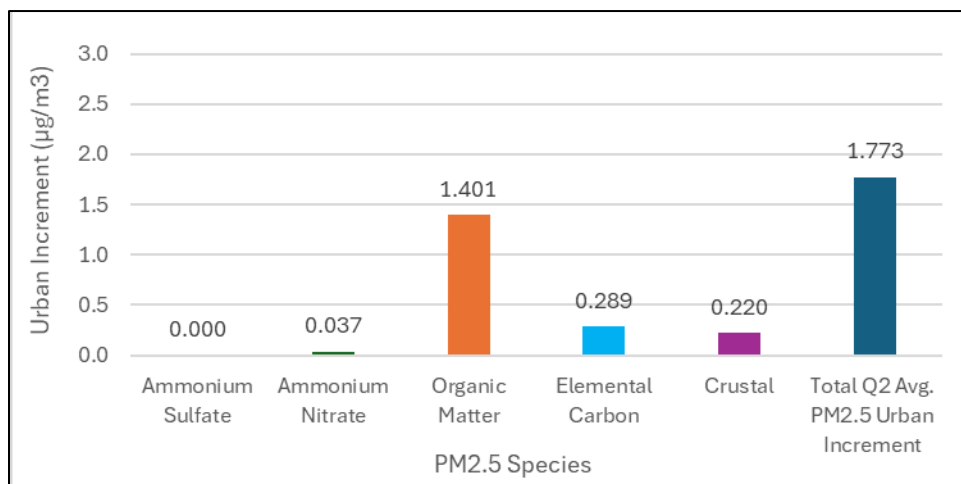


In Table 14 Michigan presents the results of its computations for the speciated and total quarter 2 (Q2) average PM_{2.5} urban increments for Michigan’s Kalamazoo Fairgrounds AQS monitor using three years (2021-2023) of quarter 2 speciated PM_{2.5} concentration data from the GR-Monroe CSN monitor and the ISWS Climate Station, Illinois IMPROVE monitor. As shown in Table 14 and Figure 14, the PM_{2.5} component that contributed the most (on average) to the Q2 PM_{2.5} urban increment is the organic matter portion of PM_{2.5} (1.401 (µg/m³)).

Table 14. Kalamazoo Fairground Monitor – 2021-2023 Q2 Average Urban Increments by PM_{2.5} Species

Local Site Name [Site ID]	Q2 Avg. Ammonium Sulfate Increment	Q2 Avg. Ammonium Nitrate Increment	Q2 Avg. OM Increment	Q2 Avg. EC Increment	Q2 Avg. Crustal Increment	Total Q2 Avg. PM _{2.5} Urban Increment	Units
Kalamazoo Fairgrounds [260770008]	0.000	0.037	1.401	0.289	0.220	1.773	(µg/m³)

Figure 14. Kalamazoo Fairgrounds Monitor – 2021-2023 Q2 Average Urban Increments by PM_{2.5} Species

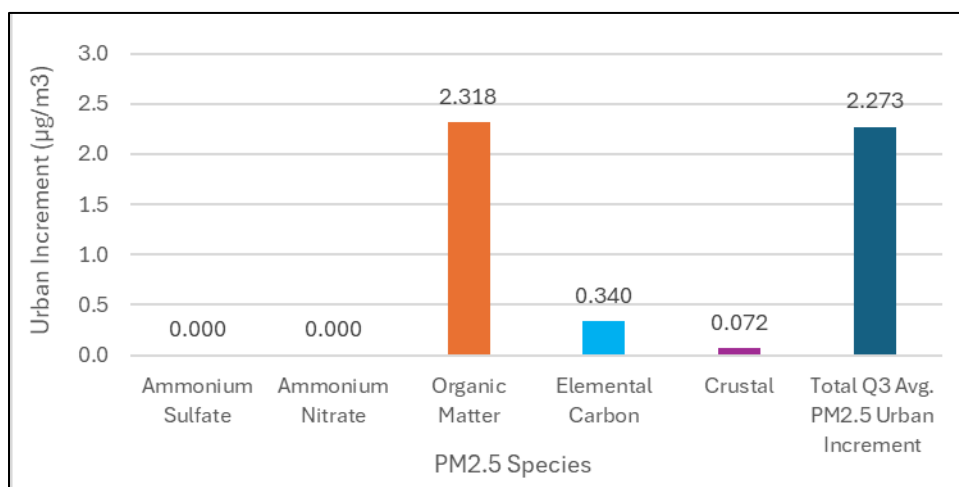


In Table 15 Michigan presents the results of its computations for the speciated and total quarter 3 (Q3) average PM_{2.5} urban increments for Michigan’s Kalamazoo Fairgrounds AQS monitor using three years (2021-2023) of quarter 3 speciated PM_{2.5} concentration data from the GR-Monroe CSN monitor and the ISWS Climate Station, Illinois IMPROVE monitor. As shown in Table 15 and Figure 15, the PM_{2.5} component that contributed the most (on average) to the Q3 PM_{2.5} urban increment is the organic matter portion of PM_{2.5} (2.318 (µg/m³)).

Table 15. Kalamazoo Fairground Monitor – 2021-2023 Q3 Average Urban Increments by PM_{2.5} Species

Local Site Name [Site ID]	Q3 Avg. Ammonium Sulfate Increment	Q3 Avg. Ammonium Nitrate Increment	Q3 Avg. OM Increment	Q3 Avg. EC Increment	Q3 Avg. Crustal Increment	Total Q3 Avg. PM _{2.5} Urban Increment	Units
Kalamazoo Fairgrounds [260770008]	0.000	0.000	2.318	0.340	0.072	2.273	(µg/m ³)

Figure 15. Kalamazoo Fairgrounds Monitor – 2021-2023 Q3 Average Urban Increments by PM_{2.5} Species

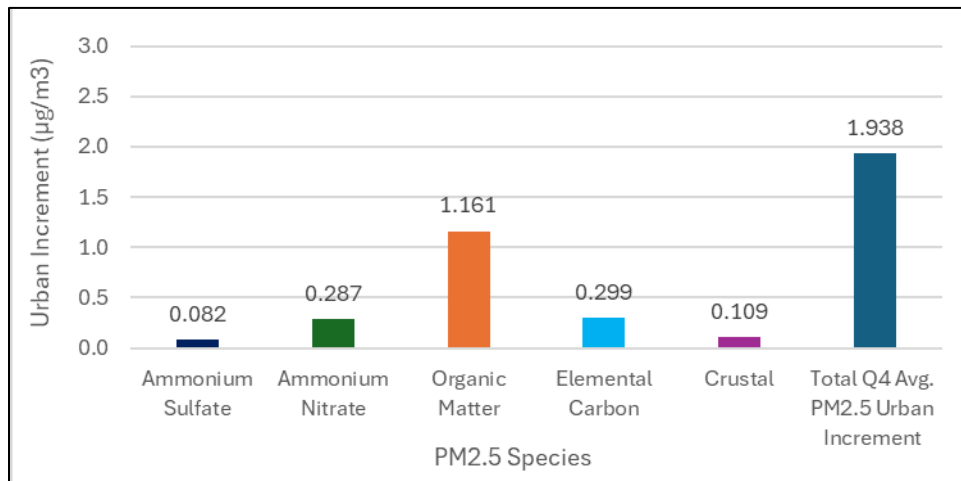


In Table 16 Michigan presents the results of its computations for the speciated and total quarter 4 (Q4) average PM_{2.5} urban increments for Michigan’s Kalamazoo Fairgrounds AQS monitor using three years (2021-2023) of quarter 4 speciated PM_{2.5} concentration data from the GR-Monroe CSN monitor and the ISWS Climate Station, Illinois IMPROVE monitor. As shown in Table 16 and Figure 16, the PM_{2.5} component that contributed the most (on average) to the Q4 PM_{2.5} urban increment is the organic matter portion of PM_{2.5} (1.161 (µg/m³)).

Table 16. Kalamazoo Fairground Monitor – 2021-2023 Q4 Average Urban Increments by PM_{2.5} Species

Local Site Name [Site ID]	Q4 Avg. Ammonium Sulfate Increment	Q4 Avg. Ammonium Nitrate Increment	Q4 Avg. OM Increment	Q4 Avg. EC Increment	Q4 Avg. Crustal Increment	Total Q4 Avg. PM _{2.5} Urban Increment	Units
Kalamazoo Fairgrounds [260770008]	0.082	0.287	1.161	0.299	0.109	1.938	(µg/m ³)

Figure 16. Kalamazoo Fairgrounds Monitor – 2021-2023 Q4 Average Urban Increments by PM_{2.5} Species



Attachment 4

Urban Increment Satellite-derived Methodology

Due to the placement of the IMPROVE and CSN monitors under the USEPA methodology, Michigan explored a secondary approach to the urban increment analysis that utilized satellite-derived global and regional PM_{2.5} data developed by the Atmospheric Composition and Analysis Group at Washington University in St. Louis¹. This satellite data approach was initially explored by the Lake Michigan Air Directors Consortium (LADCO). Michigan had discussions with LADCO to create an urban increment analysis specific to Michigan. The data provided by Washington University was a combination of satellite, modeling, and surface data to produce “annual and monthly ground-level fine particulate matter (PM_{2.5}) by combining Aerosol Optical Depth retrievals from the NASA MODIS, MISR, SeaWiFS, and VIIRS with the GEOS-Chem chemical transport model, and subsequently calibrating to global ground-based observations using a residual Convolutional Neural Network.” The data is available for the years 1998-2022 on a 0.01-degree grid. Michigan utilized the 2022 annual PM_{2.5} dataset as a viable alternative to surface monitors for use in an urban increment analysis due to the spatial continuity and correlation with surface observations. Michigan acknowledges that there are limitations of this approach due to the lack of 2021 and 2023 data, as well as differences when compared with the exceeding monitor PM_{2.5} 2022 annual means, which are typically higher than what this analysis captures.

In order to complete this analysis, the global data was clipped down to the U.S. national boundary and converted into a raster format to be compatible with the ArcGIS platform. The data was then further clipped down to the State of Michigan boundary and translated to a point feature class representing the centroids of each raster cell (about 1km-by-1km grid cells). The raster values representing the 2022 annual PM_{2.5} were extracted to the point feature class. Figure 4.2-1 is a map showing the resulting PM_{2.5} values using a graduated color scale for each point.

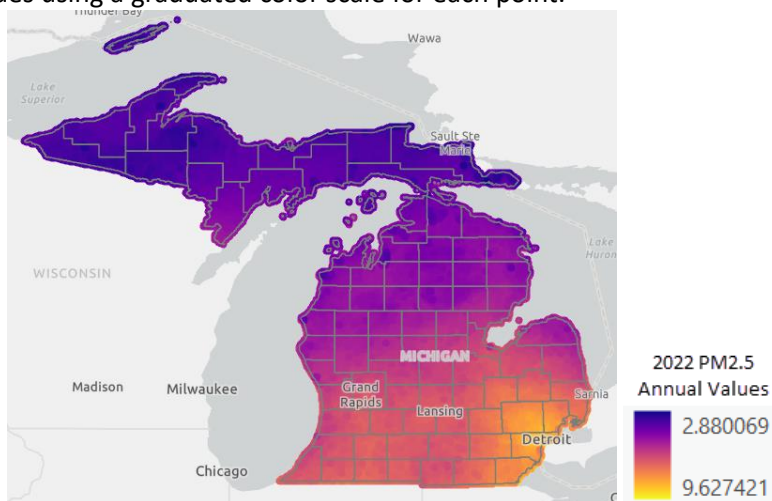


Figure 4.2-1 Washington University 2022 PM_{2.5} Annual data for Michigan.

LADCO initially calculated the rural background for Michigan for the state as a whole, however when compared to other states in the region, Michigan’s rural background concentration was much lower than the rest. After discussion, it was noted that the northern portion of Michigan had PM_{2.5} annual numbers that were significantly lower than that of southern Michigan. Combining this with the USEPA methodology that utilizes IMPROVE monitors within 150 miles of the urban area to determine rural background, Michigan determined it would be more accurate to calculate rural background for Kalamazoo based only on the southern portion of Michigan. Michigan utilized the mean concentration

¹ <https://sites.wustl.edu/acag/datasets/surface-pm2-5/>

($6.99\mu\text{g}/\text{m}^3$) in conjunction with county boundaries to determine the best latitudinal plane to divide the state for this analysis. The chosen plane was designed to be more conservative than using the mean data, and it was also closer to representing a 150-mile radius from Kalamazoo. The left map in Figure 4.2-2 displays data at or above the mean of $6.99\mu\text{g}/\text{m}^3$ while the right map shows the line drawn at 43.819°N . Figure 4.2-3 shows the 150-mile buffers for the center of Kalamazoo and Wayne counties. These data were utilized to represent the rural background concentration for lower Michigan.

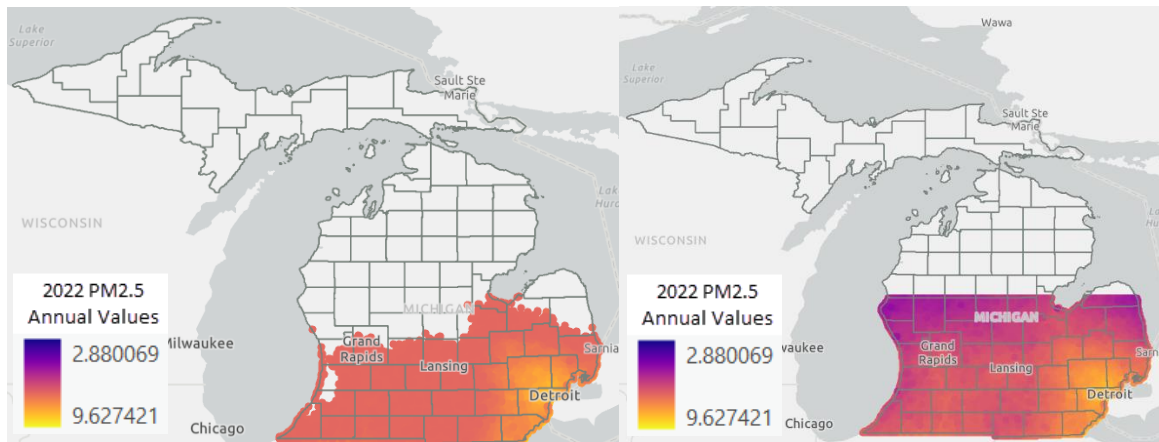


Figure 4.2-2 Left map represents $\text{PM}_{2.5}$ values at or above $6.99\mu\text{g}/\text{m}^3$. Right Map represents latitudinal clip at 43.819°N .

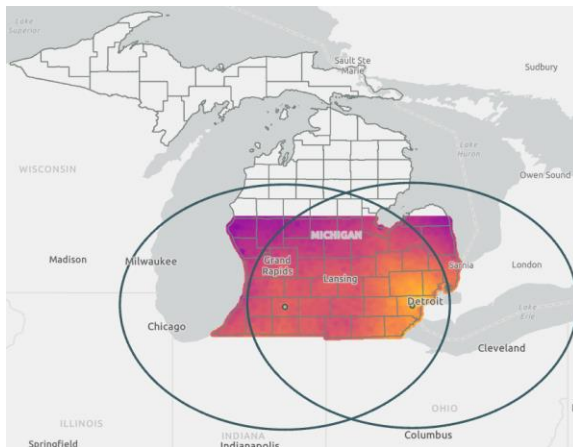


Figure 4.2-3 Map showing Lower Peninsula values compared to 150-mile buffers for the centroids of Kalamazoo and Wayne counties.

To calculate rural and urban concentrations, the urban values needed to be separated out. The American Community Survey 2017 census tract data was used because it classified tracts based on urban, suburban, and rural. The urban and suburban tracts (see Figure 4.2-4) values were removed to calculate the rural background $\text{PM}_{2.5}$ concentration for lower Michigan, which is the mean of the remaining values. This resulted in a rural background concentration of $6.88\mu\text{g}/\text{m}^3$.

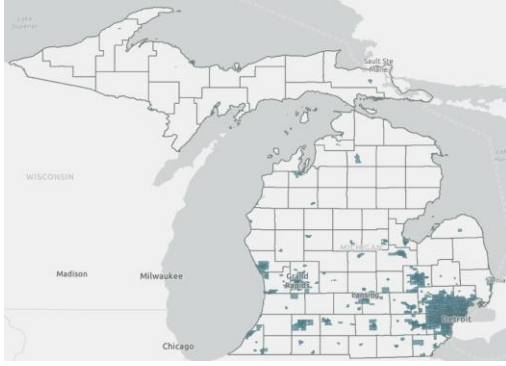


Figure 4.2-4 ACS 2017 Urban and suburban tracts shown in blue.

To calculate the urban increment, the mean for each county was calculated based on the 2022 $PM_{2.5}$ annual values within the urban and suburban tracts. The rural mean was then subtracted from the county urban means to yield the urban increment.