

MICHIGAN AIR QUALITY ANNUAL REPORT

2022



MICHIGAN DEPARTMENT OF
ENVIRONMENT, GREAT LAKES, AND ENERGY

Michigan.gov/EGLE | 800-662-9278



The report is available digitally at Michigan.gov/Air.

Air Quality Annual Report

2022

EXECUTIVE SUMMARY

This report gives an overview of the air quality for 2022. Current data for Michigan can be found on M_{air} (deqmiair.org) and Air Quality alerts can be delivered directly to email by signing up for the Michigan EnviroFlash program (<http://miair.enviroflash.info/>). Data in this report are collected by the Michigan Department of Environment, Great Lakes, and Energy (EGLE).

The federal Clean Air Act (CAA) requires the United States Environmental Protection Agency (USEPA) to establish National Ambient Air Quality Standards (NAAQS) for six criteria pollutants considered harmful to public health and the environment.

The six pollutants monitored by EGLE, Air Quality Division (AQD) are:

1. Carbon monoxide (CO)
2. Lead (Pb)
3. Nitrogen dioxide (NO₂)
4. Ozone (O₃)
5. Particulate matter smaller than 10 and 2.5 microns in diameter (PM₁₀ and PM_{2.5}, respectively)
6. Sulfur dioxide (SO₂)

EGLE has established a network of more than 40 monitoring sites throughout the state that monitor for one or more of the criteria pollutants (**Figure 1.2** and **Table 1.2**).

Congress passed the CAA in 1970; however, Michigan has had a long-standing history of environmental awareness well before the Act was established. In 1887, Detroit was the first city in Michigan to adopt an air quality ordinance, which declared that the dense smoke from burning coal was a public nuisance.

The USEPA reviews the criteria pollutant standards every five years. Over time, based upon health data, the standards have been tightened to better protect public health (see Appendix C). Areas that meet the NAAQS are considered in “attainment.” Locations where air pollution levels persistently exceed the NAAQS may be designated as “nonattainment.” The tightening standards are why some areas in the state may be redesignated to nonattainment from attainment even though monitoring shows that air quality continues to improve.

Since EGLE began monitoring in the early 1970s, criteria pollutant levels have continually decreased (see Chap. 2-7). The air is much cleaner today than when the CAA began. The entire state of Michigan is in attainment for CO, Pb, NO₂, and particulate matter. Although portions of the state are in nonattainment for SO₂ and O₃, as illustrated in the figure, levels of these pollutants are still decreasing. The NAAQS levels have also decreased recently, which prompted these nonattainment areas. EGLE is currently working on State Implementation Plans (SIPs) to reduce pollutants further and bring the entire state into attainment for SO₂ and O₃.

Several changes to the monitoring network occurred during 2022.

- The Tapered Element Oscillating Monitors (TEOMs) for PM₁₀ and PM_{2.5} at Dearborn were switched to federal equivalent method (FEM) T640X.
- The Thermo beta attenuation monitors (BAM) at Ypsilanti and Tecumseh was switched to a T640.
- The Livonia-Near Road (Livonia-NR) monitor is in the process of moving since site access was lost in July 2019.
- The Photochemical Assessment Monitoring Station (PAMS) network was started in 2021 and ran for June, July and August at Grand Rapids and Detroit-E 7 Mile for a second year in 2022.
- The Detroit-W. Jefferson site was shut down in March 2021 due to loss of site access.

Attainment Status for the National Ambient Air Quality Standards

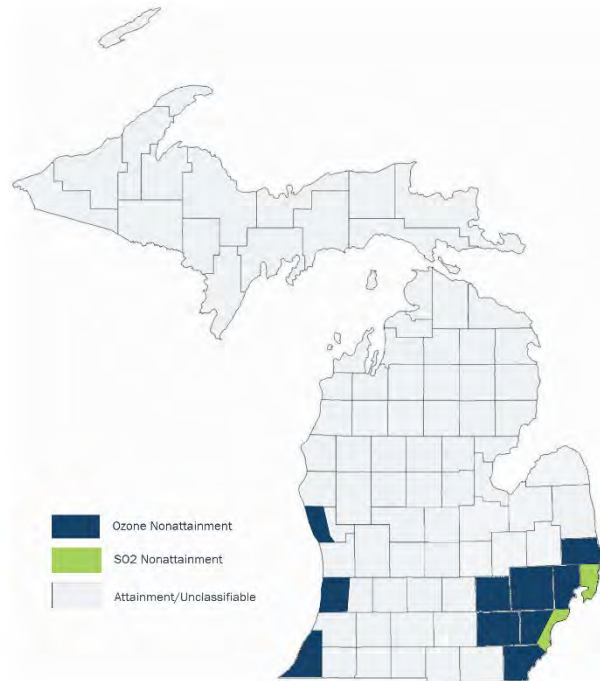


TABLE OF CONTENTS

EXECUTIVE SUMMARY	i
TABLE OF CONTENTS	iii
INTRODUCTION	1
CHAPTER 1: BACKGROUND INFORMATION.....	2
National Ambient Air Quality Standards (NAAQS)	2
Michigan Air Sampling Network.....	3
Current Attainment Status	8
Mair – Air Quality Information in Real-Time.....	9
Air Quality Index.....	9
Air Quality Forecasts	12
Air Quality Notification	12
AIRNow.....	12
CHAPTER 2: CARBON MONOXIDE (CO).....	13
CHAPTER 3: LEAD (Pb).....	17
CHAPTER 4: NITROGEN DIOXIDE (NO ₂).....	22
CHAPTER 5: SULFUR DIOXIDE (SO ₂).....	27
CHAPTER 6: OZONE (O ₃).....	33
CHAPTER 7: PARTICULATE MATTER (PM ₁₀ , PM _{10-2.5} , PM _{2.5} , CHEMICAL SPECIATION, AND TSP)	44
PM ₁₀	46
PM _{10-2.5}	50
PM _{2.5}	50
Continuous PM _{2.5} Network:.....	55
Speciation Monitors:.....	55
CHAPTER 8: TOXIC AIR POLLUTANTS	62
National Monitoring Efforts and Data Analysis.....	62
How Does EGLE AQD Evaluate Air Toxics in Michigan?	63
Evaluation of Air Monitoring Data	65
CHAPTER 9: METEOROLOGICAL INFORMATION	66
CHAPTER 10: SPECIAL PROJECTS	67

APPENDICES

Appendix A: Criteria Pollutant Summary For 2022

Appendix B: 2022 Air Toxics Monitoring Summary for Metals, VOCs, Carbonyls, PAHs, & Speciated PM_{2.5}

Appendix C: Summary

Appendix D: Acronyms and Their Definitions

INTRODUCTION

Air quality regulations in Michigan are based on National Ambient Air Quality Standards (NAAQS) established by the United States Environmental Protection Agency (USEPA) based on the federal Clean Air Act (CAA). The NAAQS designates six criteria pollutants considered harmful to public health and the environment. The USEPA must describe the characteristics and potential health and welfare effects for these criteria pollutants. The standards define the maximum permissible concentration of criteria pollutants in the air (see Table 1.1).

The Michigan Department of Environment, Great Lakes, and Energy (EGLE), Air Quality Division (AQD) monitors the six criteria pollutants, which are:

- Carbon monoxide (CO);
- Lead (Pb);
- Nitrogen dioxide (NO₂);
- Ozone (O₃);
- Particulate matter smaller than 10 and 2.5 microns in diameter (PM₁₀ and PM_{2.5}, respectively); and
- Sulfur dioxide (SO₂).

Chapters 2 through 7 provide information on each of the six criteria pollutants and include:

- Michigan's monitoring requirements for 2022;
- Attainment/Nonattainment status;
- Monitoring site locations (tables and maps show all the monitors active in 2022); and
- Air quality trends from 2017-2022 broken down by location.¹

The 2022 data for each criteria pollutant is available in **Appendix A**.

The AQD also monitors air toxics. Air toxics are air contaminant for which there is no national ambient air quality standard and which is or may become harmful to public health or the environment when present in the outdoor atmosphere in sufficient quantities and duration.² This data can be found in **Appendix B**.

The purpose of this report is to provide a snapshot of Michigan's 2022 air quality data, air quality trends, overview of the monitoring network (available in much greater detail in the 2022 Network Review),³ air toxics monitoring program, and other AQD programs, such as Mair and the Emissions Inventory.⁴

¹ Air quality trends are based on actual statewide monitored readings, which are also listed in the USEPA's Air Quality Subsystem Quick Look Report Data at [EPA.gov/airtrends/](https://www.epa.gov/airtrends/).

² An overview of Michigan Air Toxic Rules is available on the AQD website at [Michigan.gov/Air](https://www.michigan.gov/Air) (select "Toxics.")

³ Available online at [Michigan's 2022 Ambient Air Monitoring Network Review](https://www.michigan.gov/Air).

⁴ Online information about criteria pollutants and air toxics, along with this and previous Annual Air Quality Reports, are available via the AQD's website at [Michigan.gov/Air](https://www.michigan.gov/Air) (select "Monitoring.")

CHAPTER 1: BACKGROUND INFORMATION

This section summarizes the development of the NAAQS (see Appendix C) and how compliance with these standards is determined. Also included is an overview of Michigan's air sampling network, attainment status of the state, and information on M_{air} and the Air Quality Index (AQI).

National Ambient Air Quality Standards (NAAQS)

Under the CAA, the USEPA established a primary and secondary NAAQS for each criteria pollutant. The primary standard is designed to protect public health with an adequate margin of safety, including the health of the most susceptible individuals in a population, such as children, the elderly, and those with chronic respiratory ailments. Secondary standards are chosen to protect public welfare (personal comfort and well-being) and the environment.

In addition, the NAAQS have various averaging times to address health impacts. Short averaging times reflect the potential for acute (immediate) effects, whereas long-term averaging times are designed to protect against chronic (long-term) effects.

NAAQS have been established for CO, Pb, NO₂, PM, O₃, and SO₂. **Table 1.1** lists the primary and secondary NAAQS, averaging time, and concentration level for each criteria pollutant in effect in 2022. The concentrations are listed as parts per million (ppm), micrograms per cubic meter (µg/m³), and/or milligrams per cubic meter (mg/m³).

Table 1.1: NAAQS in Effect during 2022 for Criteria Pollutants

Pollutant	Primary (health) Level	Primary Averaging Time	Secondary (welfare) Level	Secondary Averaging Time
CO 8-hour average	9 ppm (10 mg/m ³)	8-hour average, not to be exceeded more than once per year (1971)	None*	None*
CO 1-hour average	35 ppm (40 mg/m ³)	1-hour average, not to be exceeded more than once per year (1971)	None*	None*
Lead	0.15 µg/m ³	Maximum rolling 3-month average (2008)	Same as Primary	Same as Primary
NO ₂ Annual mean	0.053 ppm (100 µg/m ³)	Annual mean (1971)	Same as Primary	Same as Primary
NO ₂ 1-hour average	0.100 ppm	98 th percentile of 1-hour average, averaged over 3 years (2010)	Same as Annual	Same as Annual
PM ₁₀	150 µg/m ³	24-hour average, not to be exceeded more than once per year over 3 years (1987)	Same as Primary	Same as Primary
PM _{2.5} Annual average	12.0 µg/m ³	Annual mean averaged over 3 years (2012)	15.0 µg/m ³	Annual mean
PM _{2.5} 24-hour average	35 µg/m ³	98 th percentile of 24-hour concentration, averaged over 3 years (2006)	Same as Primary	Same as Primary
Ozone	0.070 ppm	Annual 4 th highest 8-hour daily max averaged over 3 years (2015)	Same as Primary	Same as Primary
SO ₂	0.075 ppm	99 th percentile of 1-hour daily max averaged over 3 years (2010)	0.5 ppm	3 hours

* In 1985, the USEPA revoked the secondary standard for CO (for public welfare) due to a lack of evidence of adverse effects on public welfare at or near ambient concentrations.

Michigan Air Sampling Network

EGLE's AQD operates the Michigan Air Sampling Network (MASN), along with other governmental agencies. For instance, the O₃ and PM_{2.5} monitors in Manistee County are at tribal station operated by the Little River Band of Ottawa Indians. **Figure 1.1** is a picture of the new shelter at the Jenison site. **Figure 1.2** shows a map of the 2022 MASN monitoring sites.

The MASN consists of federal reference method (FRM) monitors that enable continuous monitoring for the gaseous pollutants CO, NO₂, O₃, and SO₂, providing real-time hourly data. PM and Pb monitors measure concentrations over a 24-hour period. In addition, continuous PM_{2.5} and PM₁₀ monitors provide real-time hourly data for PM. PM_{2.5} chemical speciation monitors determine the chemical composition of PM_{2.5}. The MASN data is also used to provide timely reporting to EGLE's air quality reporting web page (Mlair, see later in this chapter). The types of monitoring conducted in 2022 and the MASN locations are shown in **Tables 1.2a-c**.

Figure 1.1: Jenison Monitoring Site



The **NCore network** began January 1, 2011, as part of the USEPA's 2006 amended air monitoring requirements. NCore is a multi-pollutant network that integrates several advanced measurement systems for particles, pollutant gases, and meteorology. Michigan has two NCore sites, Allen Park and Grand Rapids. Further information on this network is provided in **Chapters 2** through **7**.

The **Near-roadway Monitoring Network** focuses on vehicle emissions and how they disperse near roadways. Data from these sites are presented in **Chapters 2, 5, and 7**.

Figure 1.2: MASN Monitoring Sites

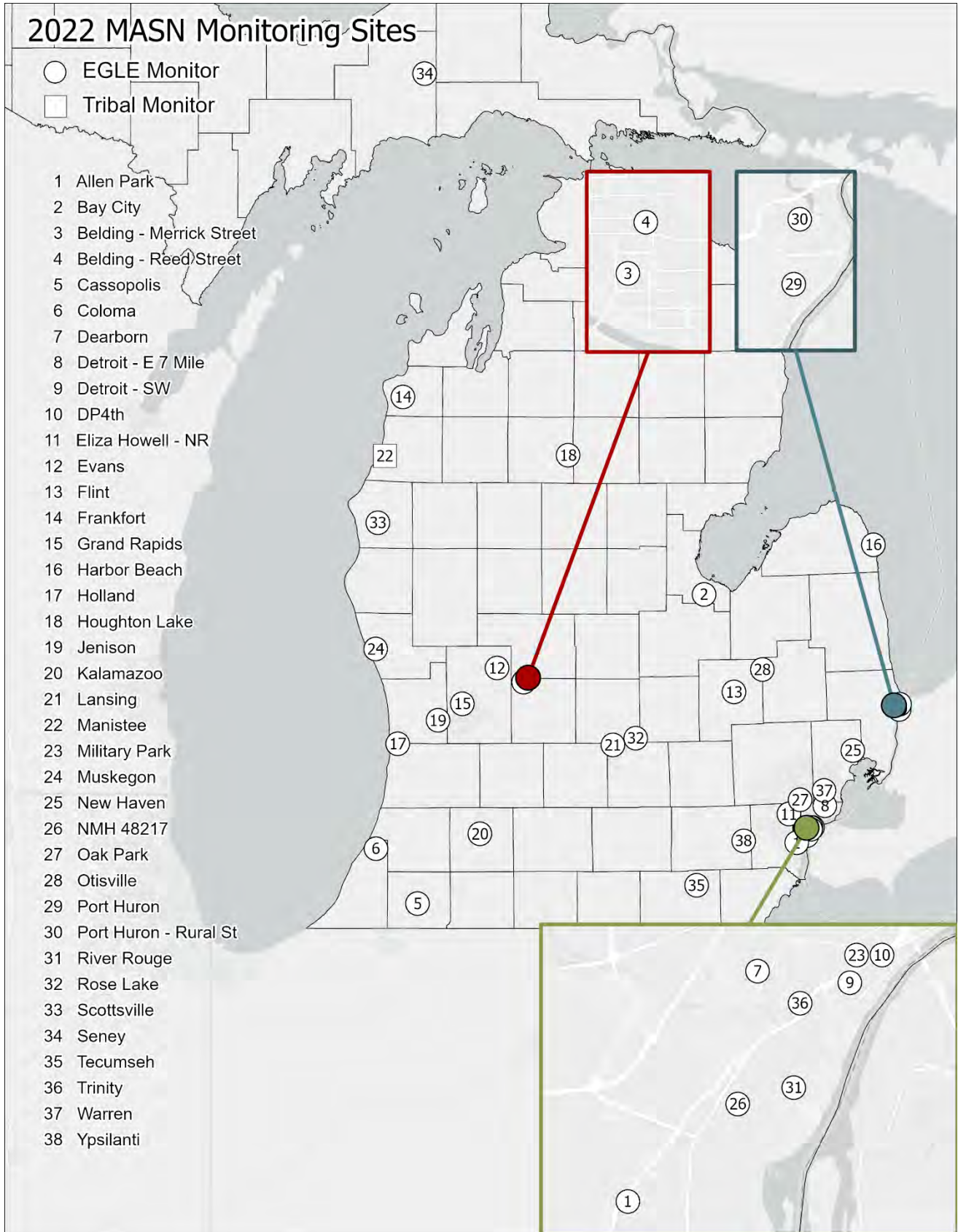


Table 1.2a: Types of Monitoring Conducted in 2022 and MASN Locations in Detroit Ann Arbor Area

Airs ID	Site Name	CO	NO ₂	Trace NO _y	O ₃	PM ₁₀	PM _{2.5} FRM	PM _{2.5} Continuous	PM _{2.5} Speciation	SO ₂	VOC	PAHs	Carbonyls	Trace Metals (As, Cd, Mn, Ni, Pb)	Wind Speed & Direction, Temp.	Relative Humidity	Solar Radiation	Barometric Pressure
260910007	Tecumseh				√			√F							√			√
260990009	New Haven				√			√F					√		√	√	√	
260991003	Warren				√													
261250001	Oak Park				√		√								√			
261470005	Port Huron				√			√F		√					√			
261470031	Port Huron-Rural St.													√				
261610008	Ypsilanti				√		√	√F							√			√
261630001	Allen Park	√*		√	√	√ [^]	√	√F	√+A	√*					√	√		√
261630005	River Rouge												√	√	√			
261630015	Detroit-SW ⁵		√			√	√	√F	√+A	√	√		√	√	√	√		√
261630019	Detroit-E 7 Mile		√	√	√		√				√		√		√	√		√
261630033	Dearborn					√ [^]	√	√T	√+A		√	√	√	√#	√	√		√
261630093	Eliza Howell-NR	√	√					√F							√			
261630097	New Mount Hermon (NMH) 48217							√F		√				√				
261630098	Detroit Police 4 th Precinct (DP4th)	√	√					√F	A	√				√				
261630099	Trinity	√	√					√F	A	√				√	√			
261630100	Military Park		√					√F	A	√				√				

√ = Data Collected

= 9 additional metals sampled: Ba, Be, Cr, Co, Cu, Fe, Mo, V, Zn

F = FEM continuous PM_{2.5} monitor

T = TEOM (non-FEM) continuous PM_{2.5} monitor

* = Trace monitor

[^] = Continuous PM₁₀ monitor

A = Aethalometer monitor

⁵ Detroit-SW is renamed from Detroit-W. Fort St., Southwestern High School (SWHS), N. Delray to reflect the site more accurately and maintain some continuity from its previous names.

Table 1.2b: Types of Monitoring Conducted in 2022 and MASN Locations in Other MI CSAs

Area (CSA)	Airs ID	Site Name	CO	NO ₂	Trace NO _y	O ₃	PM ₁₀	PM _{2.5} FRM	PM _{2.5} Continuous	PM _{2.5} Speciation	SO ₂	VOC	Carbonyls	Trace Metals (As, Cd, Mn, Ni, Pb)	Wind Speed & Direction, Temp.	Relative Humidity	Solar Radiation	Barometric Pressure
Flint	260490021	Flint				√		√	√F						√			√
Flint	260492001	Otisville				√									√			
Grand Rapids	261390005	Jenison				√	√ [^]		√F						√			
Grand Rapids	260810020	Grand Rapids	√*	√	√	√	√ [^]	√	√F	√	√*	√	√		√			√
Grand Rapids	260810022	Evans				√									√			
Lansing/ E. Lansing	260650018	Lansing		√		√		√	√F		√				√			√
Lansing/ E. Lansing	260370002	Rose Lake				√												

√ = Data Collected

F = FEM continuous PM_{2.5} monitor

* = Trace monitor

[^] = Continuous PM₁₀ monitor

Table 1.2c: Types of Monitoring Conducted in 2022 and MASN Locations in Michigan Counties

County	Airs ID	Site Name	CO	NO ₂	Trace NO _y	O ₃	PM ₁₀	PM _{2.5} FRM	PM _{2.5} Continuous	PM _{2.5} Speciation	SO ₂	VOC	Carbonyls	Trace Metals (As, Cd, Mn, Ni, Pb)	Wind Speed & Direction, Temp.	Relative Humidity	Solar Radiation	Barometric Pressure
Huron	260630007	Harbor Beach				√									√			
Bay	260170014	Bay City							√F						√			
Missaukee	261130001	Houghton Lake		√		√			√F						√			√
Allegan	260050003	Holland				√			√F						√	√	√	√
Benzie	260190003	Frankfort ⁶				√												
Berrien	260210014	Coloma				√									√			
Cass	260270003	Cassopolis				√									√			
Kalamazoo	260770008	Kalamazoo				√			√F						√			
Manistee	261010922	Manistee (Tribal)				√		√							√		√	√
Mason	261050007	Scottville				√									√			
Muskegon	261210039	Muskegon				√									√			
Schoolcraft	261530001	Seney				√			√F						√	√	√	√
Ionia	260670002	Belding-Reed St.													√			
Ionia	260670003	Belding-Merrick St.												√				

√ = Data Collected

F = FEM continuous PM_{2.5} monitor

⁶ Also called Benzonia.

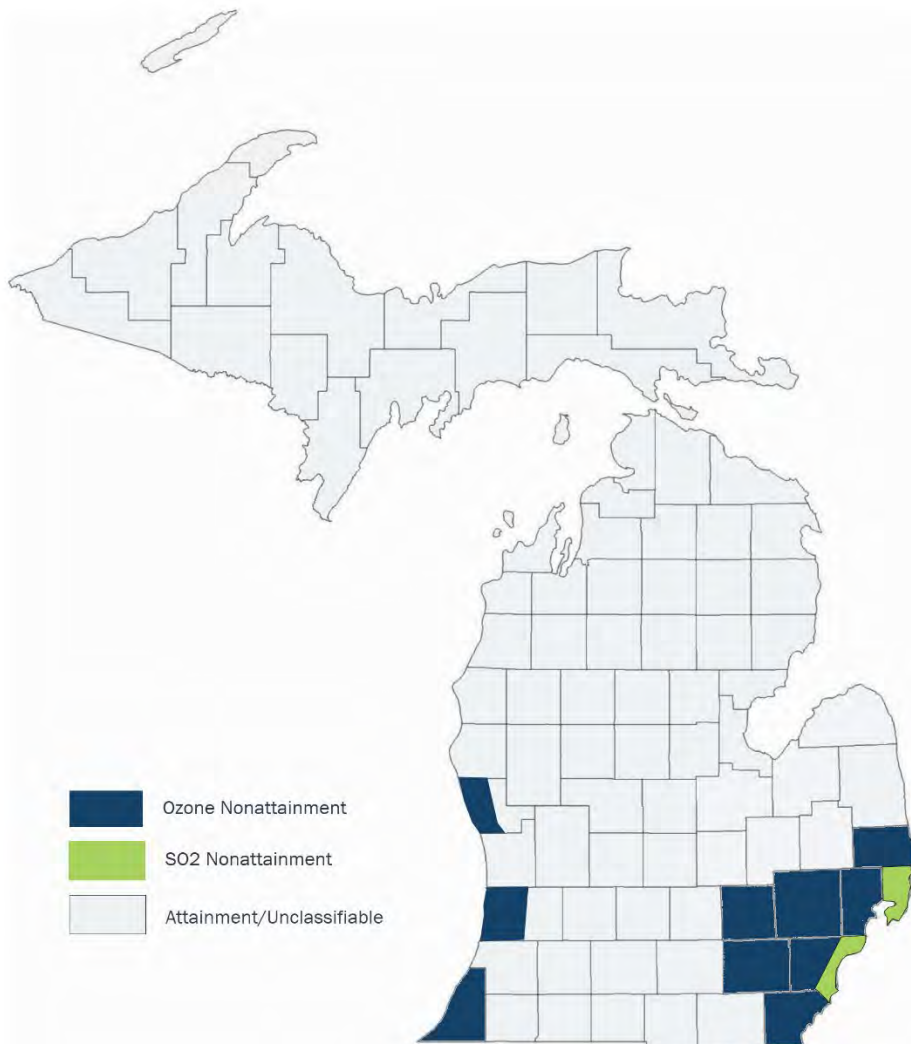
Current Attainment Status

Areas of the state that are below the NAAQS concentration level are called attainment areas. The entire state of Michigan is in attainment for the following pollutants:

- CO;
- Pb;
- NO₂; and
- Particulate Matter.

Nonattainment areas are those that have been classified by the USEPA as having concentrations over the NAAQS level. Portions of the state are in nonattainment for SO₂ and O₃ (see **Figure 1.3**). The SO₂ nonattainment level includes a portion of Wayne County and a portion of St. Clair County. Ozone nonattainment areas include a portion of Allegan County; all of Berrien County; a portion of Muskegon County; and the 7-county area of Southeast Michigan, which includes Livingston, Macomb, Monroe, Oakland, St. Clair, Washtenaw, and Wayne Counties. Nonattainment status for O₃ was effective on August 3, 2019.

Figure 1.3: 2022 Attainment Status for the National Ambient Air Quality Standards

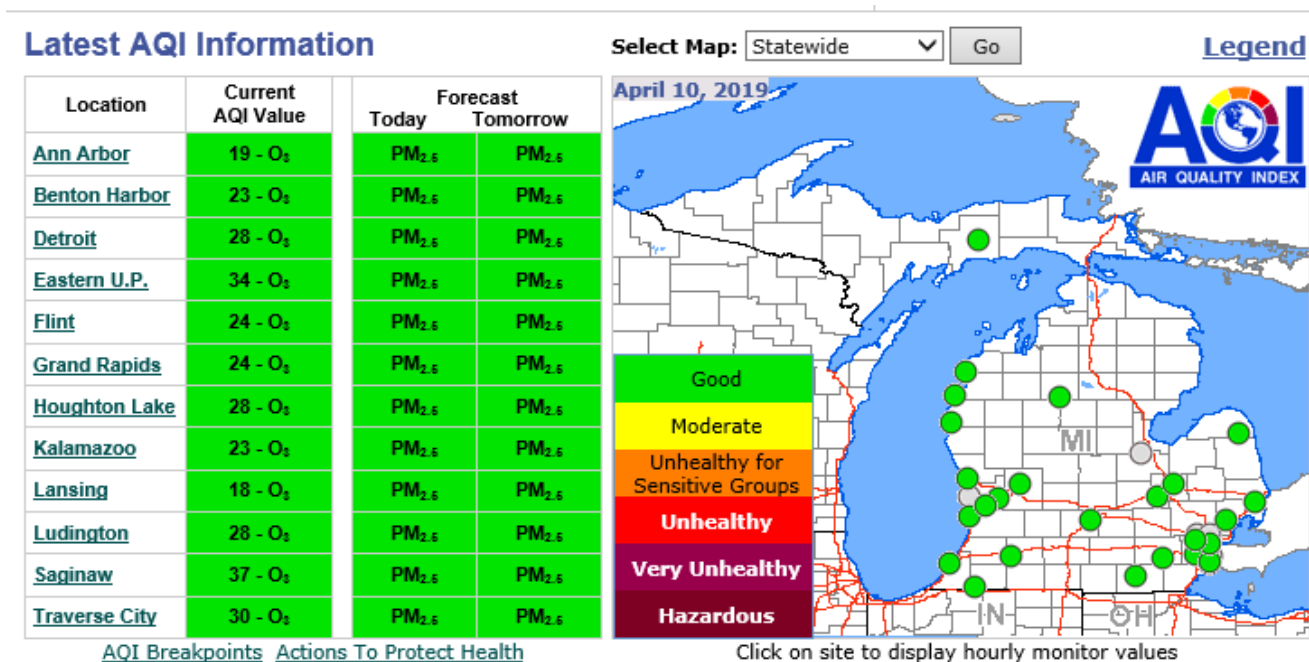


Mlair – Air Quality Information in Real-Time

Mlair is the internet tool that provides real-time air quality information via EGLE’s web page. The deqmiar.org webpage shows the current Air Quality Index (AQI) map and displays air quality forecasts for “today” and “tomorrow.” **Mlair** also hosts EnviroFlash (Enviroflash.info/), the automated air quality notification system.

Air Quality Index

The AQI is a tool developed to communicate current air quality information to the public. The current day’s color-coded AQI values, ranging from Good to Hazardous (see **Table 1.3**), are displayed in a forecast table and as dots on a Michigan map (see example below).



As can be seen from the AQI bar graphs for the Detroit-Warren-Dearborn area (**Figure 1.4**) and the Grand Rapids-Wyoming area (**Figure 1.5**), air quality in Michigan is generally in the Good or Moderate range. An area will occasionally fall into the Unhealthy for Sensitive Groups range, but rarely reaches Unhealthy levels.

In the Detroit area there were two days in the Unhealthy Group due to PM_{2.5} and SO₂, 22 days were in the Unhealthy for Sensitive Groups (USG); six days were due to ozone, 12 days were due to PM_{2.5}, and four days were due to SO₂. In the Detroit area, PM_{2.5} leads the AQI with 259 days, meaning that pollutant has the highest AQI value of all the pollutants measured per day.

In the Grand Rapids area, two days were in the Unhealthy and two in the USG groups; all due to ozone. In the Grand Rapids area, ozone and PM_{2.5} were nearly equal with 177 PM_{2.5} AQI days and 182 ozone AQI days, meaning those pollutants have the highest AQI value of all the pollutants measured per day.

Figure 1.4: 2022 AQI Days per Pollutant for Detroit-Warren-Dearborn MSA, numbers next to categories are for the Overall AQI Value (1st bar on graph)

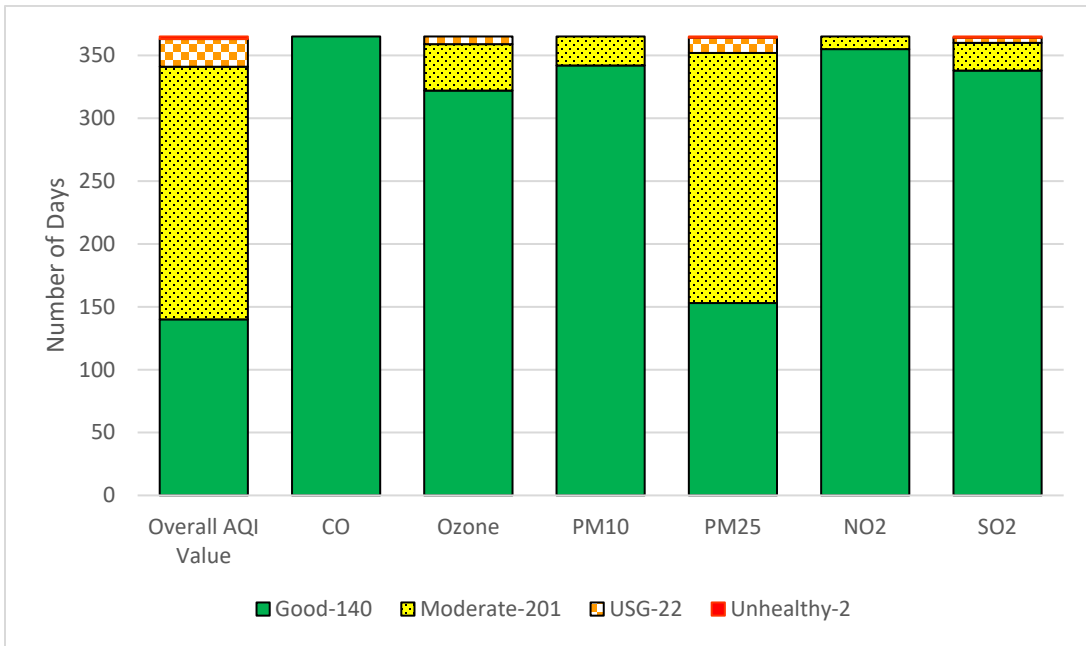
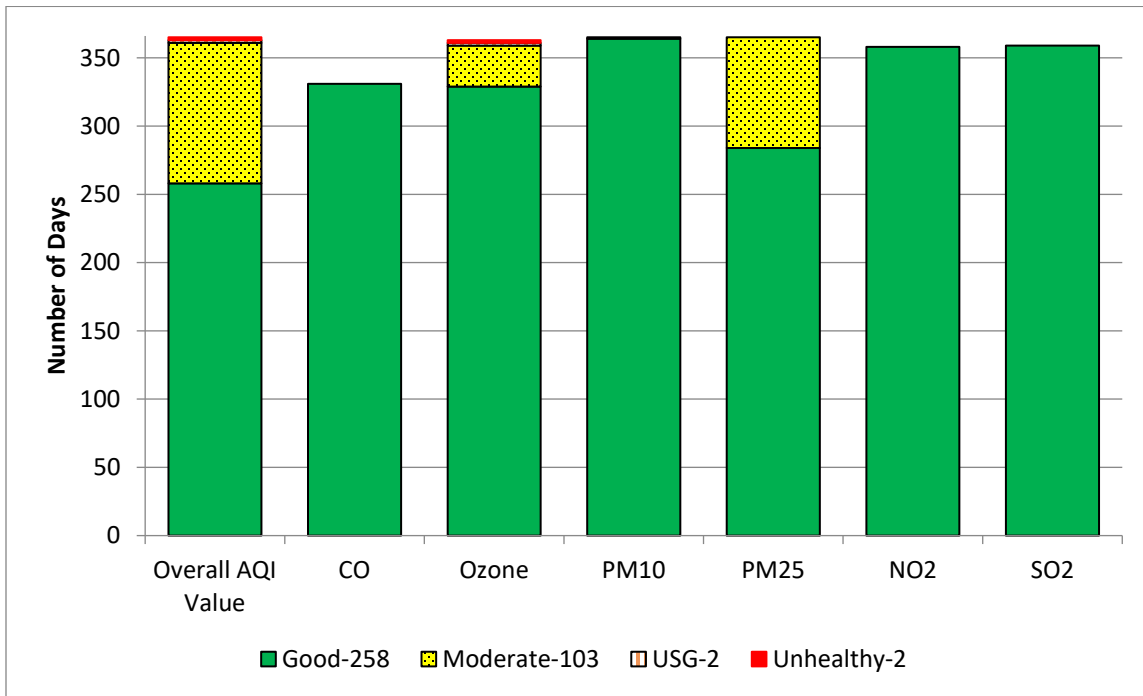


Figure 1.5: 2022 AQI Days per Pollutant for Grand Rapids-Wyoming MSA, numbers next to categories are for the Overall AQI Value (1st bar on graph)



Mlair includes an “[Air Quality Index Fact Sheet](#),” which contains activity recommendations based on the AQI levels (also **Table 1.3**).

Table 1.3: AQI Colors and Health Statements

AQI Color, Category and Value	<u>Particulate Matter</u> ($\mu\text{g}/\text{m}^3$) 24-hour	<u>Ozone</u> (ppm) 8-hour / 1-hour	<u>Carbon Monoxide</u> (ppm) 8-hour	<u>Sulfur Dioxide</u> (ppm) 24-hour	<u>Nitrogen Dioxide</u> (ppm) 1-hour
GREEN: Good 1- 50	None	None	None	None	None
YELLOW: Moderate 51- 100	Unusually sensitive people should consider shorter & less intense outdoor activities.	Unusually sensitive people should consider reducing prolonged or heavy exertion.	None	None	Unusually sensitive people should consider limiting prolonged outdoor exertion.
ORANGE: Unhealthy for Sensitive Groups 101- 150	Sensitive groups such as people with heart or lung disease, children, teens, & older adults, minority population & outdoor workers should do shorter & less intense outdoor activities.	Sensitive groups such as people with lung disease (e.g., asthma), children, teens, & older adults, and people who are active outdoors should reduce prolonged or heavy exertion.	Sensitive groups such as people with heart disease (e.g., angina), should reduce heavy exertion & avoid sources of CO, such as heavy traffic.	People with asthma should consider reducing outdoor exertion.	Sensitive groups such as people with asthma, children, & older adults should limit prolonged outdoor exertion especially near busy roads.
RED: Unhealthy 151- 200	Sensitive groups should avoid long or intense outdoor activities. Everyone should reduce long or intense activities.	Sensitive groups should not do prolonged or heavy exertion. Everyone should reduce prolonged or heavy exertion.	Sensitive groups should reduce moderate exertion & avoid sources of CO, such as heavy traffic.	Children, people with asthma or lung disease should reduce outdoor exertion.	Sensitive groups should avoid prolonged exertion near roads. Everyone should limit prolonged exertion near roads.
PURPLE: Very Unhealthy 201- 300	Sensitive groups should avoid all physical activity outdoors. Everyone else should avoid long or intense activities.	Sensitive groups should avoid all physical activity outdoors. Everyone else should avoid long or intense outdoor exertion.	People with heart disease, such as angina, should avoid exertion & sources of CO, such as heavy traffic.	Children, people with asthma or lung disease should avoid outdoor exertion. Everyone should reduce outdoor exertion.	Sensitive groups should avoid all outdoor exertion. Everyone should avoid prolonged exertion especially near busy roads.
MAROON: Hazardous 301- 500	Sensitive groups should remain indoors & keep activity levels low. Everyone should avoid all physical activity outdoors.	Everyone should avoid all physical activity outdoors.	People with heart disease, such as angina, should avoid exertion & CO sources, such as heavy traffic. Everyone should limit heavy exertion.	Children, people with asthma or lung disease should remain indoors. Everyone should avoid outdoor exertion.	Sensitive groups should remain indoors. Everyone should avoid all outdoor exertion.

Air Quality Forecasts

AQD meteorologists provide air pollution forecasts to alert the public when air pollution levels may become elevated. *Action!* Days are declared when levels are expected to reach or exceed the Unhealthy for Sensitive Groups AQI health indicator. On *Action!* Days, businesses, industry, government, and the public are encouraged to reduce air pollution levels by limiting vehicle use, refueling only after 6 PM, carpooling, walking, biking, or taking public transit, deferring the use of gasoline-powered lawn and recreation equipment, limiting the use of volatile chemicals, and curtailing all burning. More information on voluntary air *pollution* control measures can be found under the *Action!* Days tab on Mlair.

The weather plays a significant role in air quality (see Chapter 9 for an annual weather summary) and can either help increase or decrease the amount of pollution in the air. High temperatures, sun, and longer days (i.e., more daylight hours) are conducive to ozone formation, whereas rain tends to wash pollutants out of the air. *Action!* Days are declared when meteorological conditions are conducive for the formation of elevated ground-level O₃ or PM_{2.5} concentrations.

Table 1.4 shows that there were some *Action!* Days declared during the summer of 2022.

Table 1.4: Action! Days Declared During Summer 2022

Location	Year	Number	Dates
Ann Arbor	2022	5	6/15, 6/25, 7/11, 7/18, 7/19
Benton Harbor	2022	6	6/15, 6/20, 6/21, 6/30, 7/11, 7/19
Detroit	2022	5	6/15, 6/25, 7/11, 7/18, 7/19
Grand Rapids	2022	6	6/15, 6/20, 6/21, 6/30, 7/11, 7/19
Ludington	2022	4	6/15, 6/20, 6/21, 7/19

Air Quality Notification

EnviroFlash is a free service that provides automated air quality (AQI) and ultraviolet (UV) forecasts to subscribers. Those enrolled receive email or mobile phone text messages when the health level they select is predicted to occur. AIRNow iPhone and Android applications deliver ozone and fine particulate air quality forecasts plus detailed, real-time information that can be used to better protect health when planning daily activities. To learn more about this program, go to deqmiair.org. To receive notices, go to Enviroflash.info/ and enter your information. . Michigan's EnviroFlash network has the potential to reach up to 98 percent of the state's population.

AIRNow

EGLE supplies Michigan air monitoring data to AIRNow, the USEPA's nationwide air quality mapping system. Information about AIRNow is available at AirNow.gov or you can select the AIRNow link at the bottom of each Mlair web page.

CHAPTER 2: CARBON MONOXIDE (CO)

Carbon monoxide is a gas formed during incomplete burning of fuel. CO is colorless, odorless, and tasteless, and is lethal at elevated concentrations. Levels peak during the colder months primarily due to cold temperatures that affect combustion efficiency of engines. The CO NAAQS is 9 ppm for the second highest 8-hour average and 35 ppm for the second highest 1-hour average. Its sources and effects are provided below.

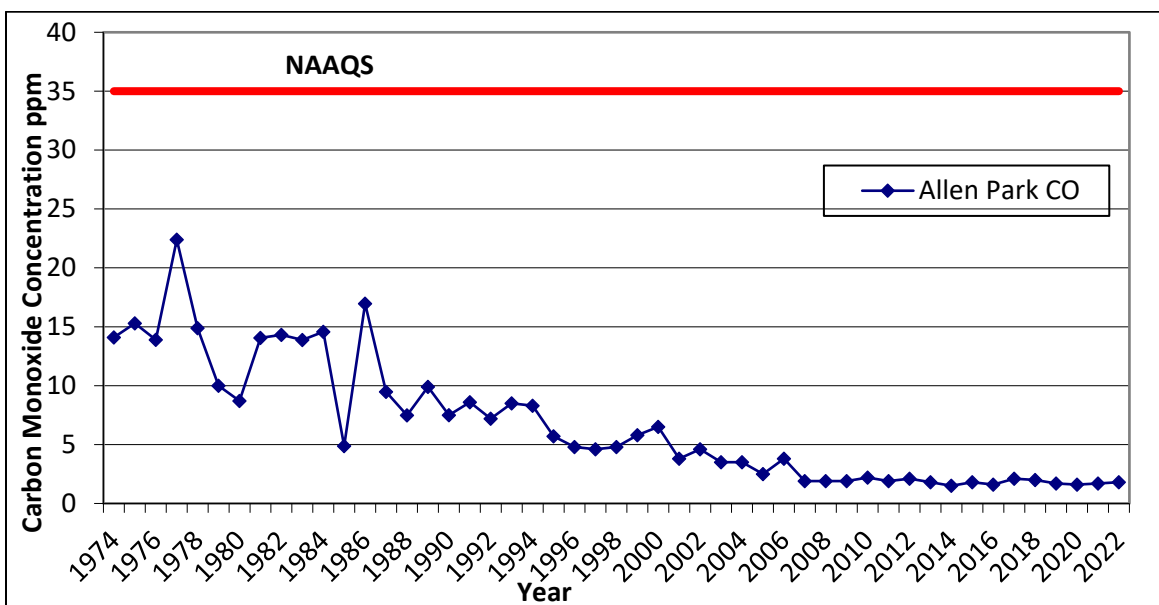
Sources: CO is given off whenever fuel or other carbon-based materials are burned. Outdoor exposure sources include automobile exhaust, industrial processes (metal processing and chemical production), and non-vehicle fuel combustion. Natural sources include volcanoes, forest fires, and photochemical reactions in the atmosphere. Indoor exposure sources include wood stoves and fireplaces, gas ranges with continuous pilot flame ignition, unvented gas or kerosene heaters, and cigarette smoke.

Effects: CO enters the bloodstream through the lungs, where it displaces oxygen delivered to the organs and tissues. Elevated levels can cause visual impairment, interfere with mental acuity by reducing learning ability and manual dexterity, and can decrease work performance in the completion of complex tasks. In extreme cases, unconsciousness and death can occur. CO also alters atmospheric photochemistry, contributing to the formation of ground-level O₃, which can trigger serious respiratory problems.

Population most at risk: Those who suffer from cardiovascular (heart and respiratory) disease, fetuses, infants, and the elderly are most at risk for exposure to elevated levels of CO. People with angina and peripheral vascular disease are especially at risk, as their circulatory systems are already compromised and less efficient at carrying oxygen; however, elevated CO levels can also affect healthy people.

Historical trends: Southeast Michigan has been monitoring CO for nearly 50 years. **Figure 2.1** shows the CO trend at Allen Park to be well below the 1-hour standard of 35 ppm. This standard has not changed since 1971.

Figure 2.1: Historical 1-hour CO Averages at Allen Park



Figures 2.2 and 2.3 show CO emission sources and CO emissions by county (courtesy of the USEPA's State and County Emission Summaries).

Figure 2.2: CO Emissions by Source Sector for Michigan 2017 in Tons (NEI 2017)

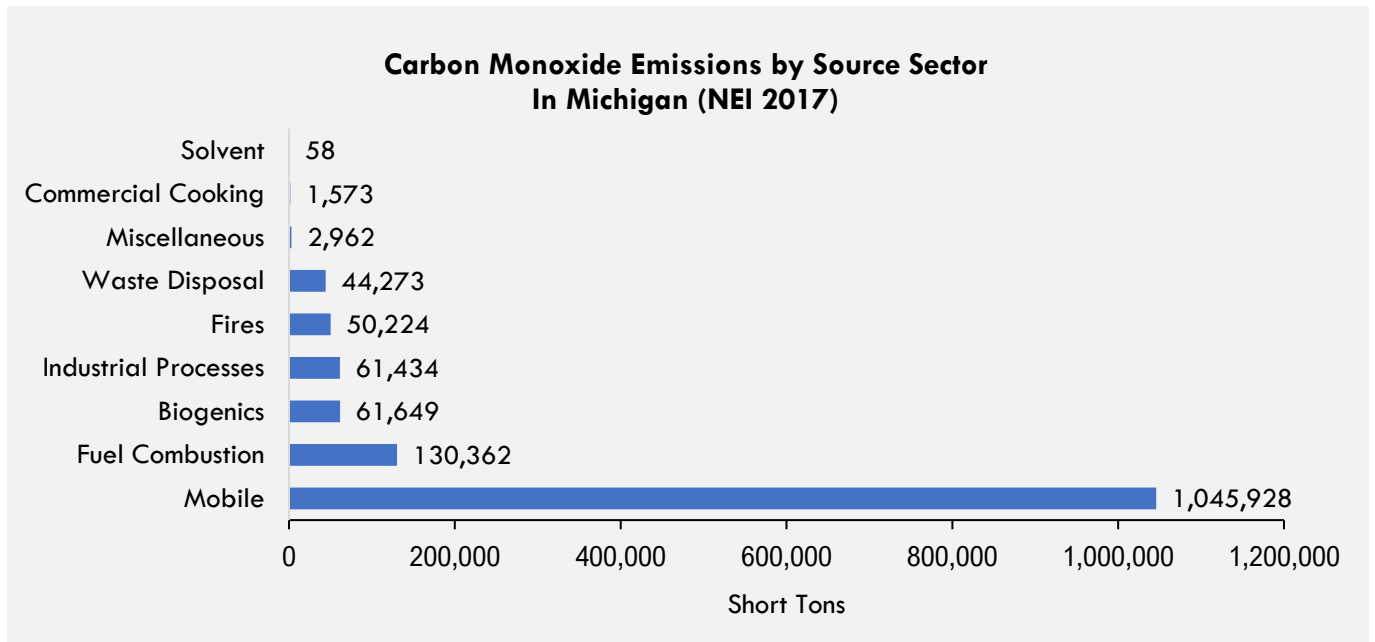


Figure 2.3: CO Emissions in 2017 (NEI)

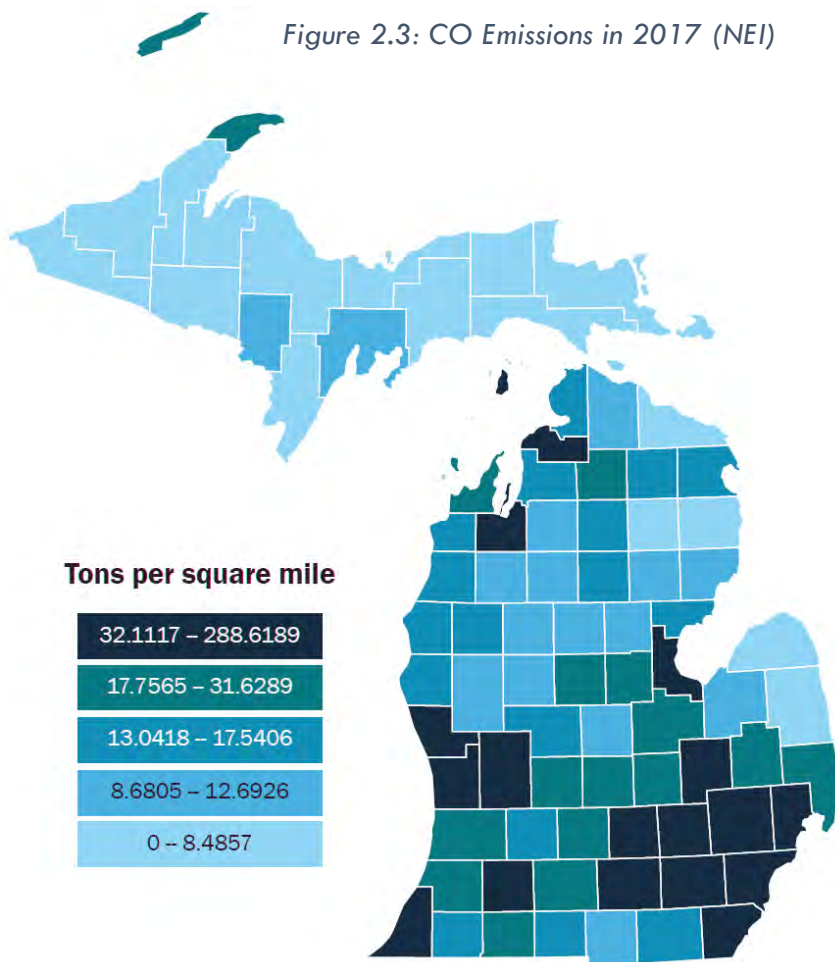


Figure 2.4 shows the location of each CO monitor that operated in 2022.

- Near-roadway network sites: Eliza Howell-NR;
- NCore Network: Grand Rapids and Allen Park measure trace CO (lower detection levels 1-50 ppm);
- Gordie Howe International Bridge (GHIB) project: DP4th and Trinity, started summer and fall 2018, respectively.

Figure 2.4: CO Monitors in 2022

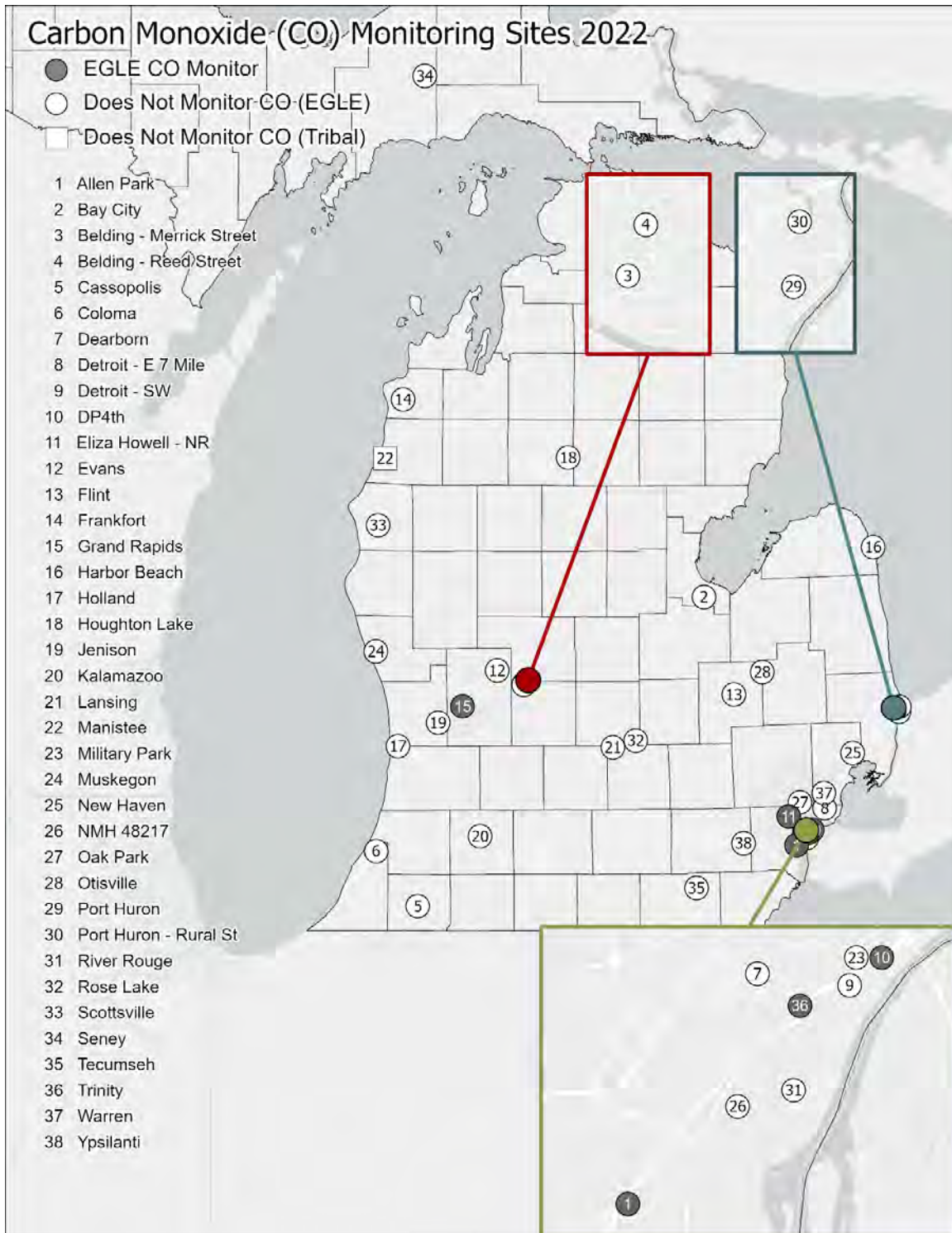


Figure 2.5 shows the second highest 1-hour CO concentrations for Michigan from 2017-2022, which demonstrates there have not been any exceedances of the 1-hour CO NAAQS.

Figure 2.5: CO Levels in Michigan from 2017-2022 (2nd Highest 1-hour Maximum Values)

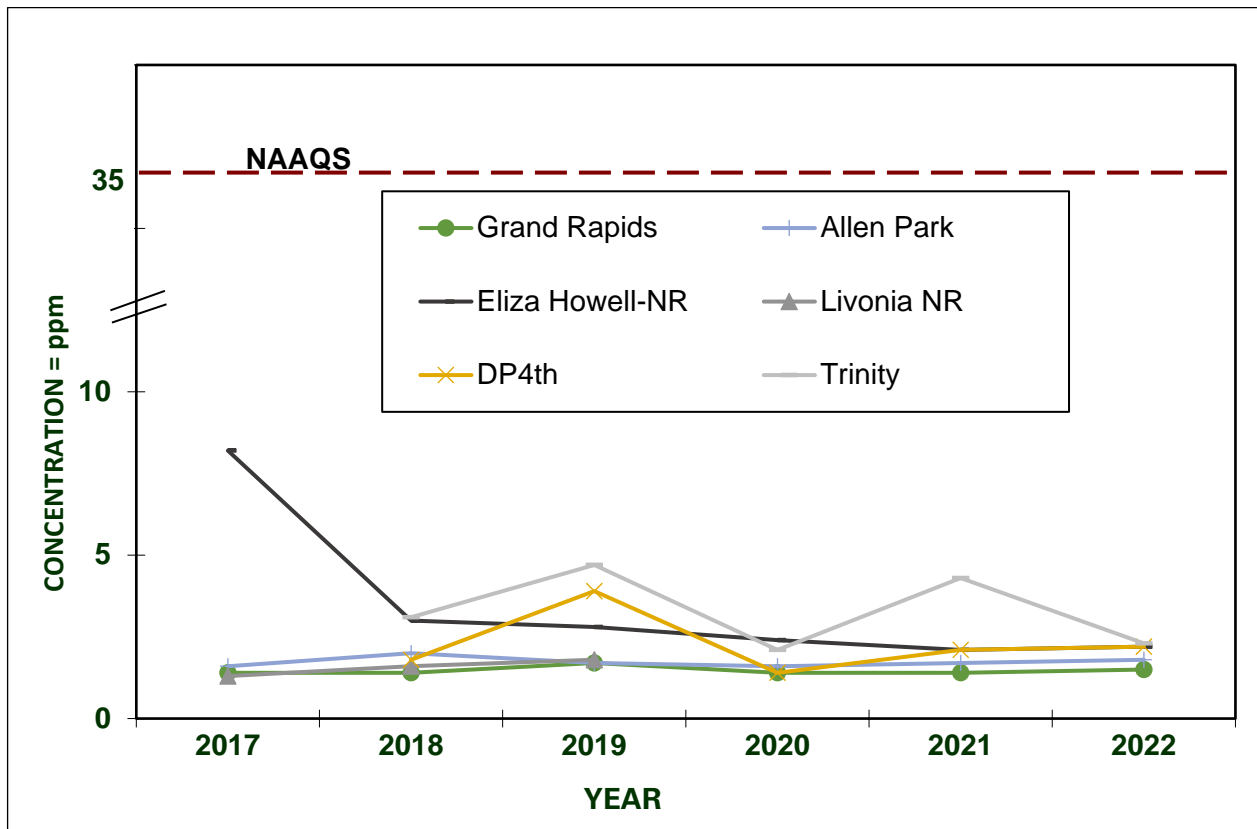
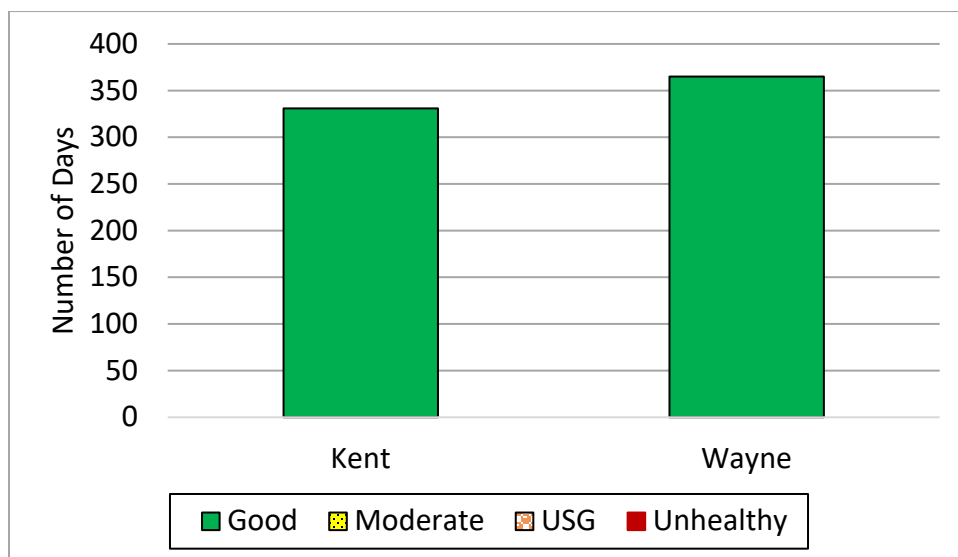


Figure 2.6 shows the AQI values per day in counties where CO is monitored. All days were in the good AQI range.

Figure 2.6: 2022 AQI Days for CO in Michigan Counties.



CHAPTER 3: LEAD (Pb)

Lead is a highly toxic metal found in coal, oil, and other fuels. It is also found in older paints, municipal solid waste, and sewage sludge, and may be released to the atmosphere during combustion. In 2008, the USEPA lowered the Pb NAAQS from a maximum quarterly average of $1.5 \mu\text{g}/\text{m}^3$ to a 3-month rolling average of $0.15 \mu\text{g}/\text{m}^3$. Its sources and effects are presented below.

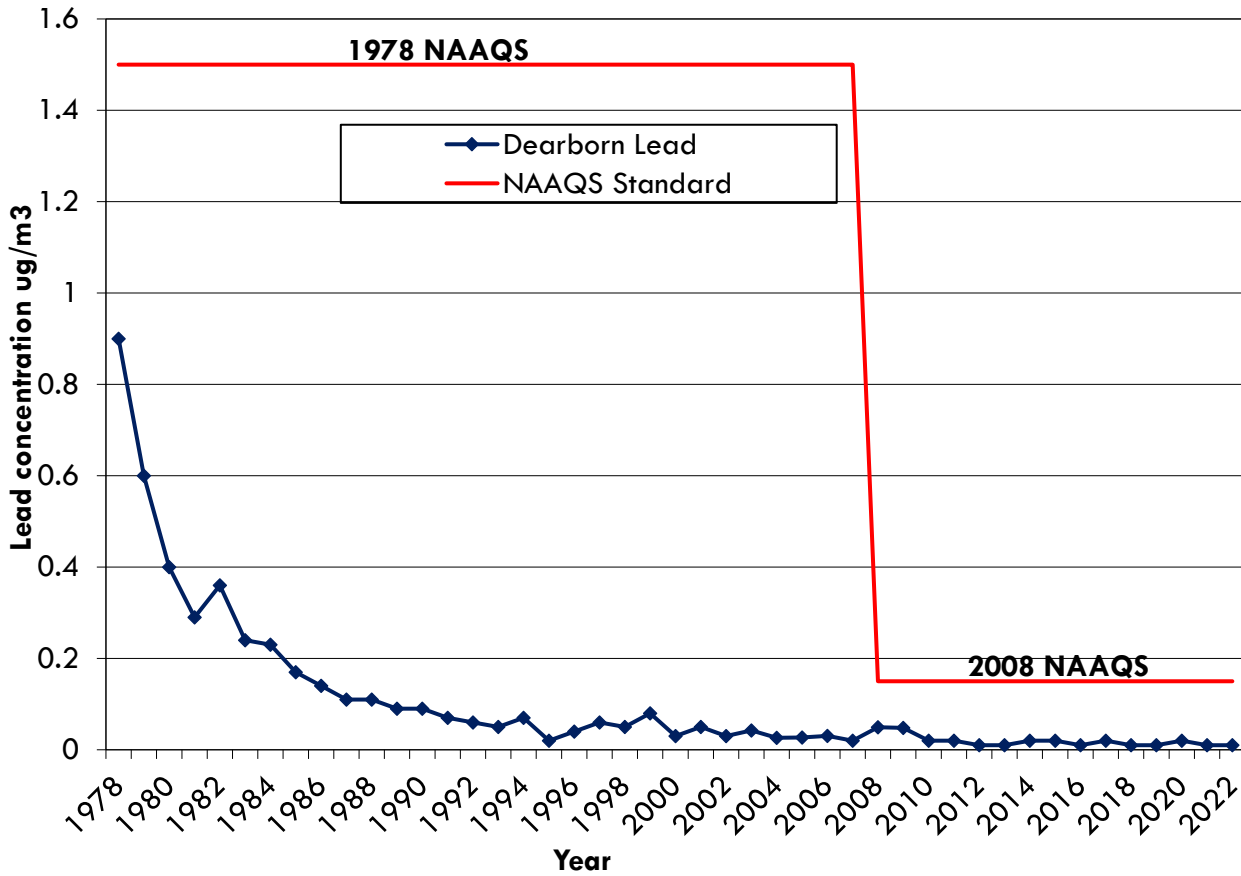
Sources: With the phase-out of leaded gas in the 1970s, the major sources of Pb emissions have been due to ore and metals processing and piston-engine aircraft operating on leaded aviation fuel. Other industrial sources include Pb acid battery manufacturers, waste incinerators, and utilities. The highest air concentrations of Pb are usually found near lead smelters.

Effects: Exposure occurs through the inhalation or ingestion of Pb in food, water, soil, or dust particles. Pb primarily accumulates in the body's blood, bones, and soft tissues, and adversely affects the nervous system as well as the cardiovascular system, reproductive system, blood, kidneys, and other organs.

Population most at risk: Fetuses and children are most at risk since low levels of Pb may cause central nervous system damage. Excessive Pb exposure during the early years of life is associated with lower IQ scores and neurological impairment (seizures, mental development, and behavioral disorders). Even at low doses, lead exposure is associated with changes in fundamental enzymatic, metabolic, and homeostatic mechanisms in the body, and Pb may be a factor in high blood pressure and subsequent heart disease.

Historical trends: Southeast Michigan has been monitoring for lead for over 40 years. **Figure 3.1** shows the trend for lead at Dearborn. The largest decrease in Pb in the air is due to the removal of Pb in gasoline. By 1975, most newly manufactured vehicles no longer required leaded gasoline, and as a result, there was a dramatic decrease in ambient Pb levels. In 1996, the USEPA banned the sale of leaded fuel for use in on-road vehicles. The graph also shows the decrease in the Pb standard that occurred in 2008.

Figure 3.1: Historical Quarterly/3-Month Averages for Lead at Dearborn



Figures 3.2 and 3.3 show Pb emission sources and Pb emissions by county (courtesy of the USEPA’s State and County Emission Summaries).

Figure 3.2: Pb Emissions by Source Sector

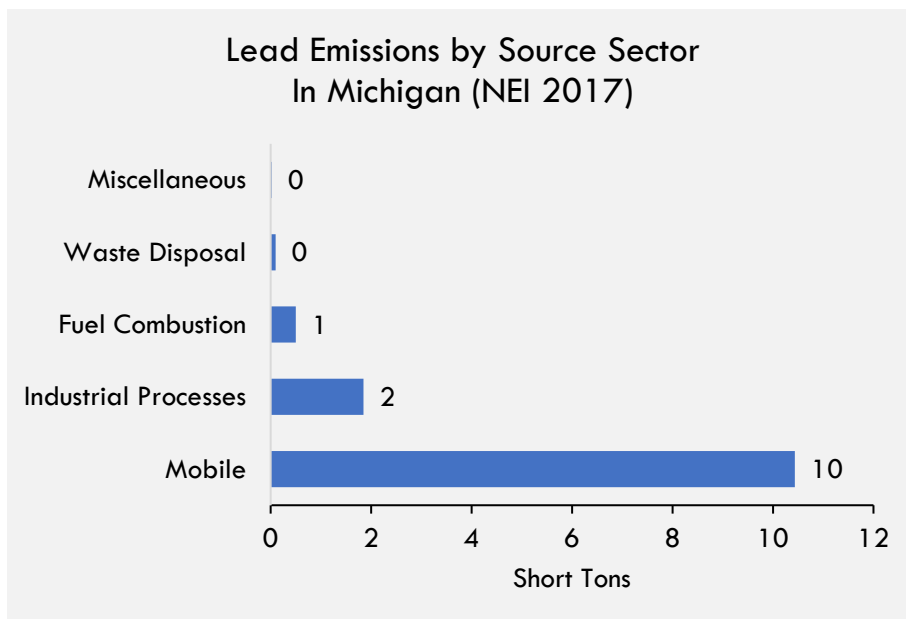


Figure 3.3: Pb Emissions in 2017 (NEI)

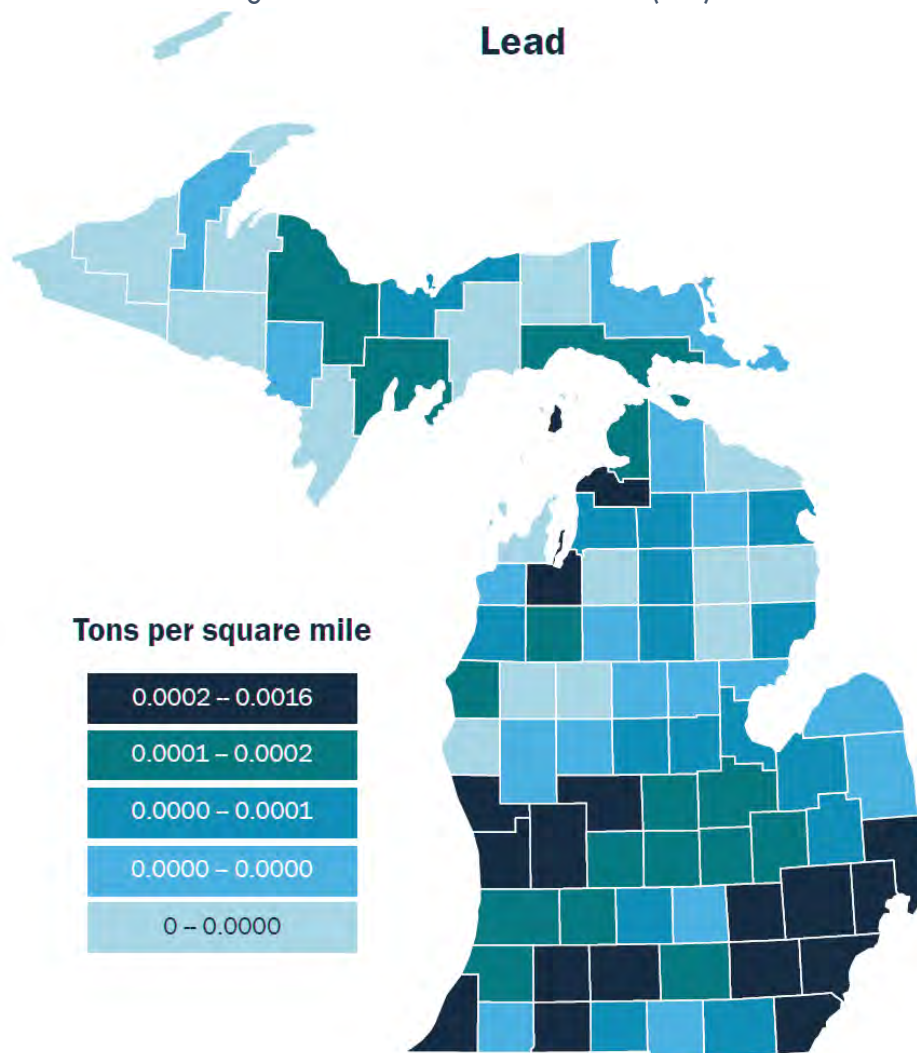


Figure 3.4 shows the location of the Pb monitors in the MASN in 2022. When the Pb NAAQS was lowered in 2008, the monitoring network was modified to consist of source-oriented monitors and population-oriented monitors. As part of the 2008 Pb NAAQS, EGLE must monitor near stationary sources emitting more than $\frac{1}{2}$ ton of Pb per year.

- Source-oriented sites: Port Huron-Rural St. and Belding-Merrick St.
- National Air Toxics Trend Sites (NATTS): Dearborn lead and trace metals, both as total suspended particulate (TSP) and PM_{10} . Lead measurements as $PM_{2.5}$ are also made throughout the $PM_{2.5}$ speciation network.
- Network consistency: River Rouge, NMH 48217, and Detroit-SW. On January 1, 2018, lead sampling was started at all the TSP metals sites to maintain consistency and to be more protective of public health. Many older homes, which often contain lead-based paint, are being demolished in the Detroit area near these monitors. Detroit-W. Jefferson was shut down in March 2022 due to loss of site access.
- Secondary monitor: Port Huron-Rural St. to comply with the USEPA's collocation regulations.
- GHIB project: DP4th, Trinity, and Military Park.

Figure 3.4: Lead (Pb) Monitors in 2022

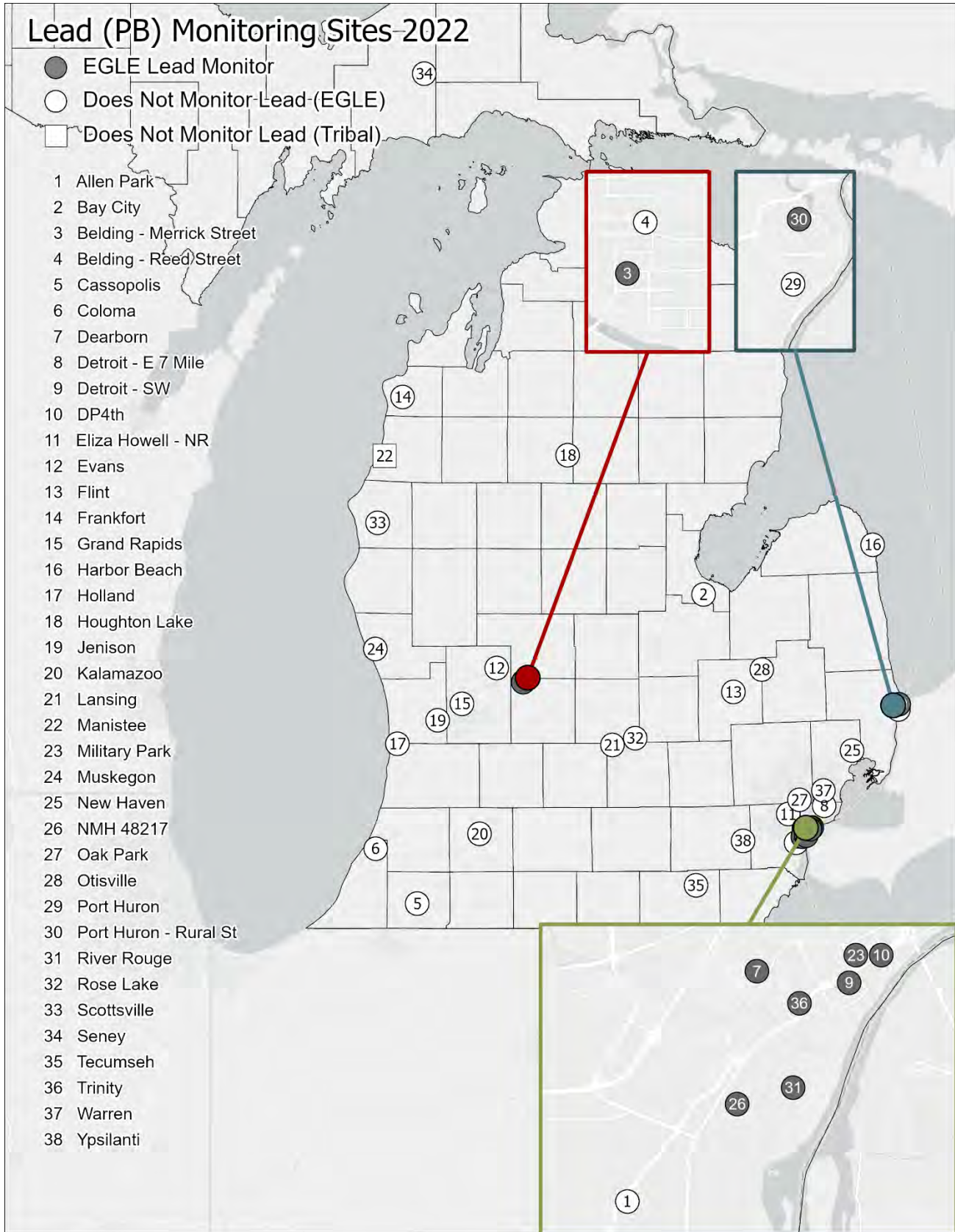
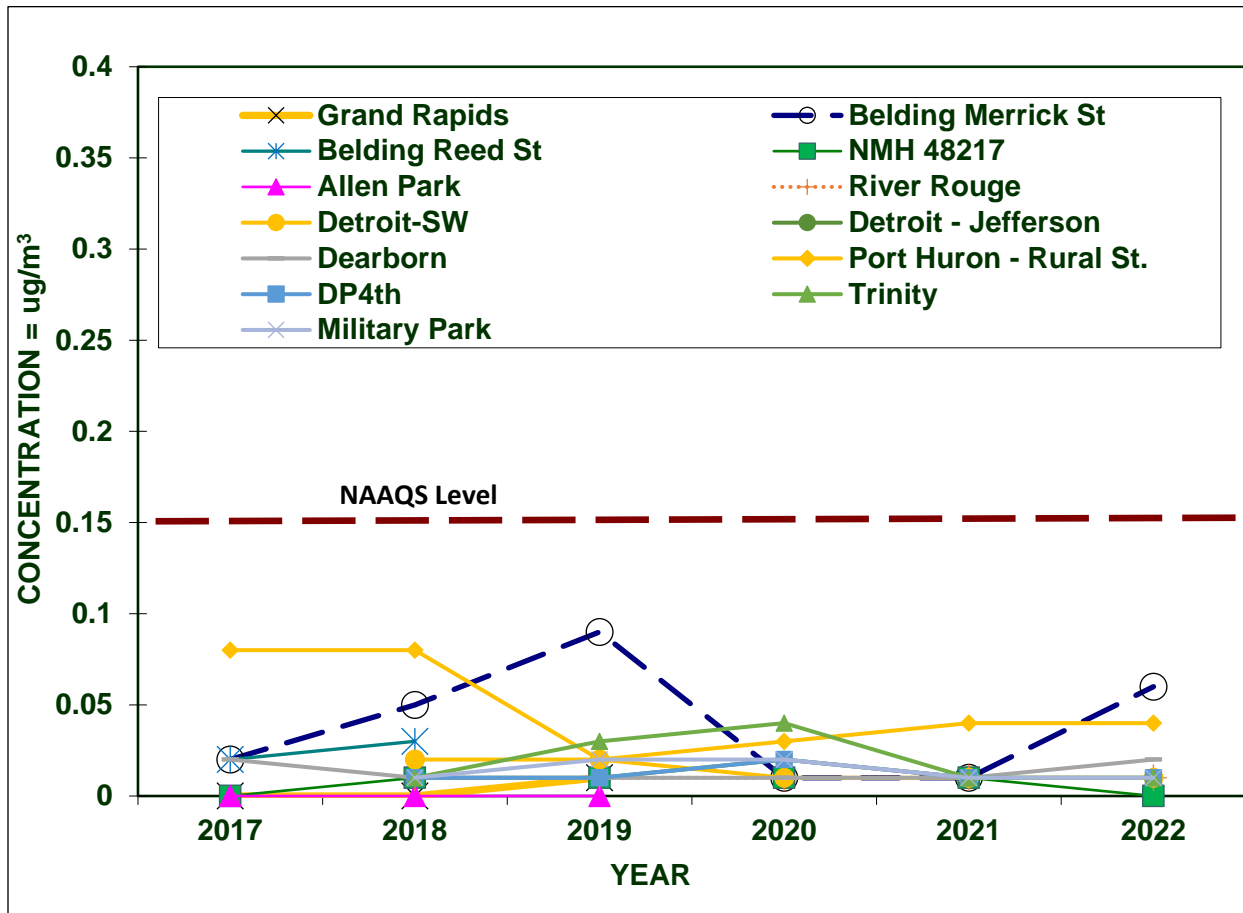


Figure 3.5 shows the maximum 3-month rolling average values for Pb from 2017 to 2022. All Pb monitor sites in Michigan are well below the standard.

Figure 3.5: Lead Levels in Michigan from 2017-2022 (Maximum 3-Month Average Values)



CHAPTER 4: NITROGEN DIOXIDE (NO₂)

Nitrogen dioxide is a reddish-brown, highly reactive gas formed through oxidation of nitric oxide (NO). Upon dilution, it becomes yellow or invisible. High concentrations produce a pungent odor and lower levels have an odor like bleach. NO_x is the term used to describe the sum of NO, NO₂, and other nitrogen oxides. NO_x can lead to the formation of O₃ and NO₂ and can react with other substances in the atmosphere to form particulate matter or acidic products that are deposited in rain (acid rain), fog, or snow. Since 1971, the primary and secondary standard for NO₂ was an annual mean of 0.053 ppm. In January 2010, the USEPA added a 1-hour NO₂ standard of 100 ppb, taking the form of the 98th percentile averaged over three years. The sources and effects of NO₂ are as follows:

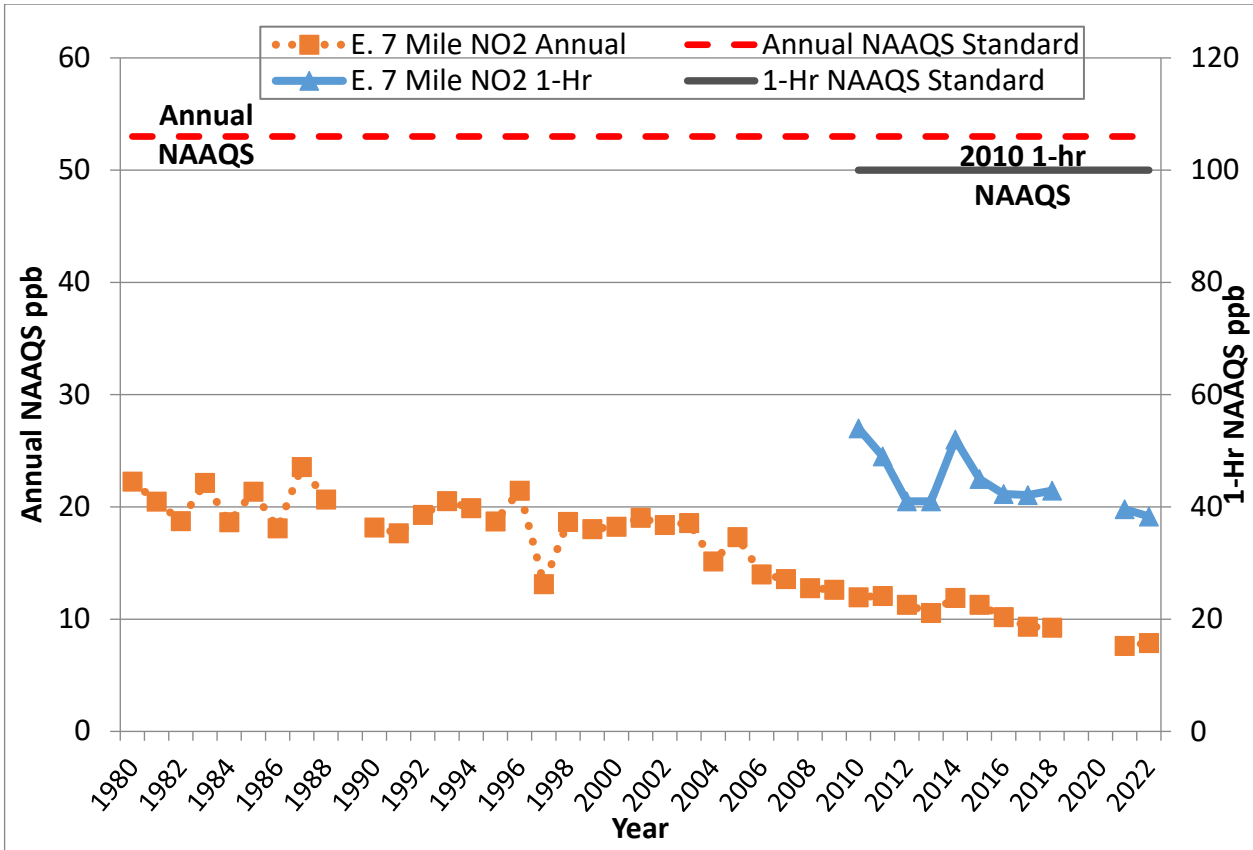
Sources: NO_x compounds and their transformed products occur both naturally and because of human activities. Natural sources of NO_x are lightning, forest fires, bacterial processes in soil, and stratospheric intrusion. Stratospheric intrusion is when the air in the upper atmosphere (stratosphere) descends towards the surface of the earth and mixes with the air at breathing level. Ammonia and other nitrogen compounds produced naturally are important in the cycling of nitrogen through the ecosystem. Major sources of man-made (anthropogenic) NO_x emissions come from high-temperature combustion processes such as those occurring in automobiles and power plants. Home heaters and gas stoves produce substantial amounts of NO₂ in indoor settings.

Effects: Exposure to NO₂ occurs through the respiratory system, irritating the lungs. Short-term NO₂ exposures (i.e., less than three hours) can produce coughing and changes in airway responsiveness and lung function. Evidence suggests that long-term exposures to NO₂ may lead to increased susceptibility to respiratory infection and may cause structural changes in the lungs. Exercise increases the ventilation rate and hence exposure to NO₂. Nitrate particles and NO₂ can block the transmission of light, resulting in visibility impairment (i.e., smog or haze). Nitrogen deposition can lead to fertilization, excessive nutrient enrichment, or acidification of terrestrial, wetland, and aquatic systems that can upset the delicate balance in those ecosystems.

Population most at risk: Individuals with pre-existing respiratory illnesses and asthmatics are more sensitive to the effects of NO₂ than the general population. Short-term NO₂ exposure can increase respiratory illnesses in children.

Historical trends: Southeast Michigan has been monitoring for NO₂ for 50 years. **Figure 4.1** shows the trend for NO₂ at Detroit-E 7 Mile Road, which has been well below the annual standard of 53 ppb and shows a downward trend. In 2010, the USEPA added a 1-hour standard for NO₂, which has also remained well below the standard in Michigan. Southeast Michigan is highly industrialized; therefore, it is a good indicator of the air quality improvement for the rest of the state.

Figure 4.1: Historical Annual and 1-hour NO₂ at Detroit-E 7 Mile



Note: Detroit-E 7 Mile measured NO_y 2019-2020 until NO₂ monitor was installed with the PAMS network.

Figures 4.2 and 4.3 show NO₂ emission sources and NO₂ emissions by county (courtesy of the USEPA’s State and County Summaries).

Figure 4.2: Nitrogen Oxide Emissions by Source Sector

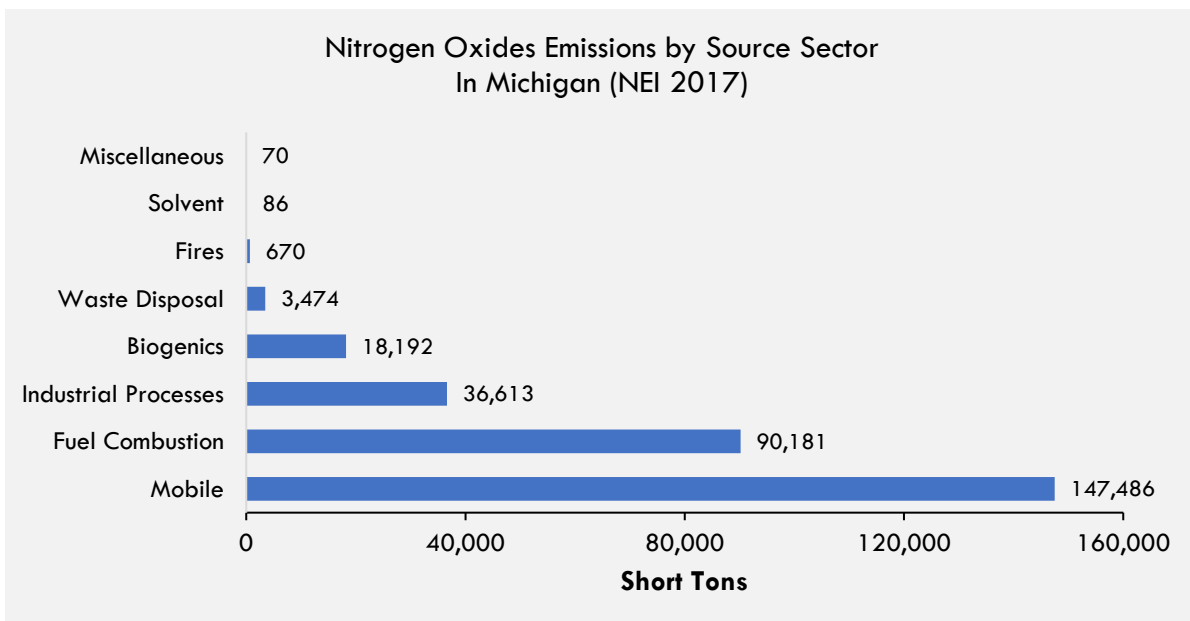


Figure 4.3: Nitrogen Oxide Emissions in 2017 (NEI)

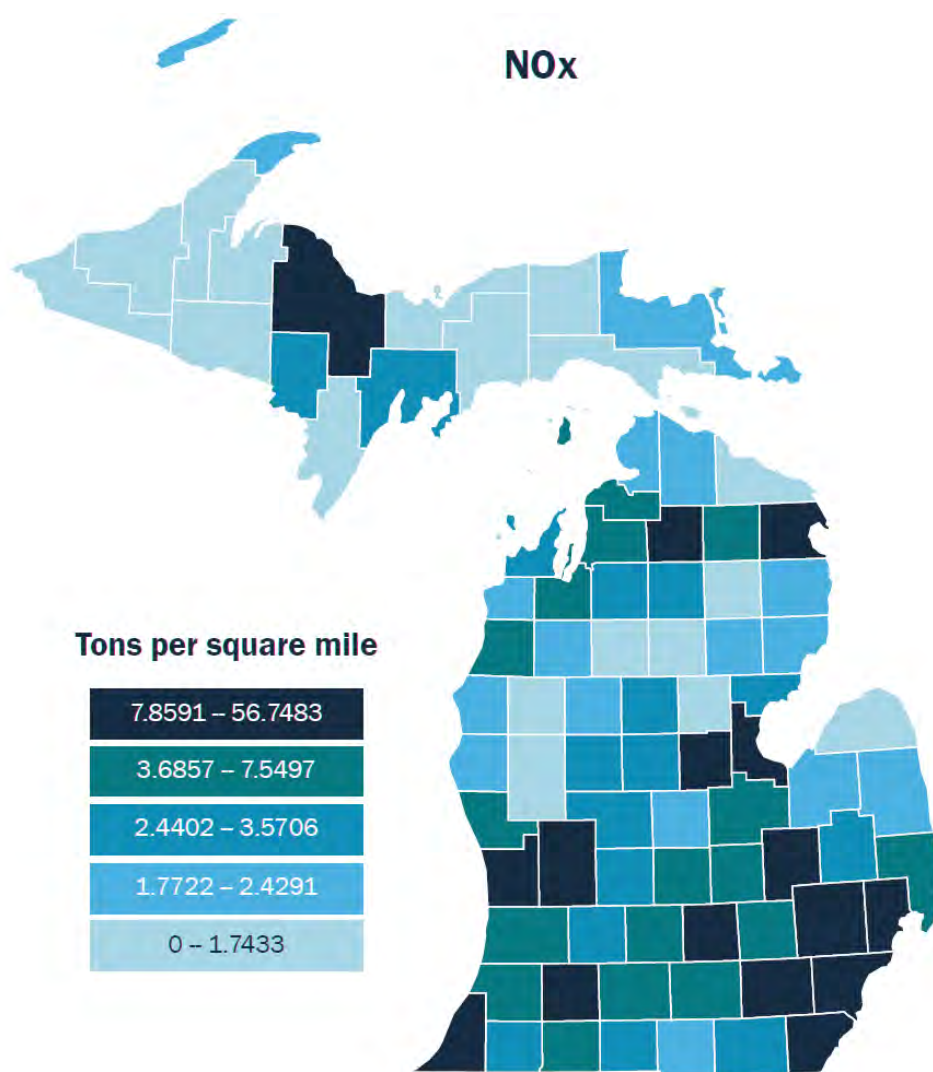
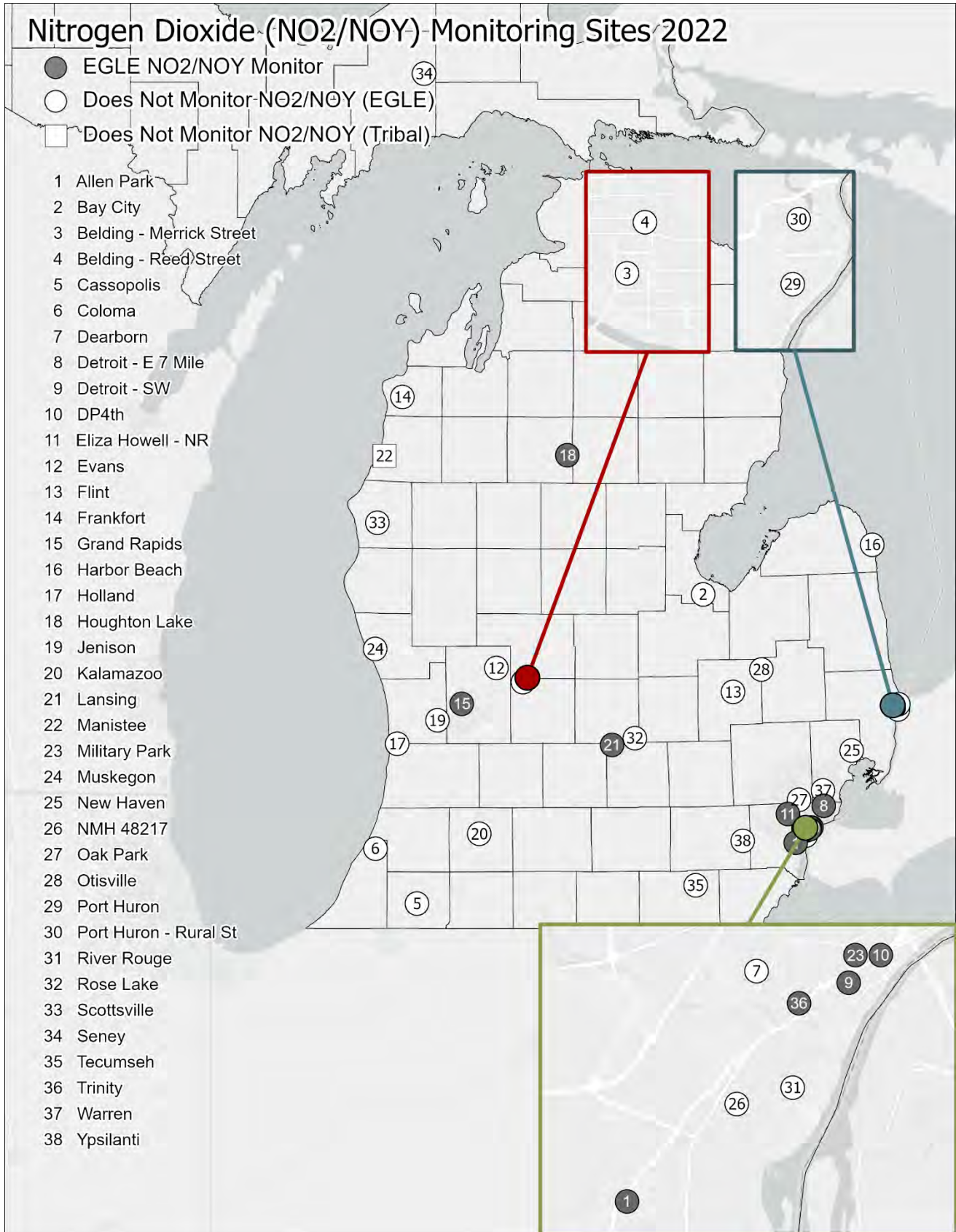


Figure 4.4 shows the location of all NO₂ monitors that operated in 2022.

- Downwind urban scale sites: Detroit-E 7 Mile in Detroit and Grand Rapids for the Grand Rapids area. The NO₂ monitor at Jenison was shut down when NO₂ was added for the PAMS network at Grand Rapids.
- Near-roadway Network sites: Detroit Eliza Howell-NR site, the downwind site was shut down since it is not necessary for the near-roadway network. The Livonia roadway site needed to be moved because EGLE lost site access. A suitable replacement was constructed in the summer of 2023.
- NCore sites: Grand Rapids and Allen Park monitor NO_y, which includes NO_x, nitric acid, and organic and inorganic nitrates (not used for attainment/nonattainment purposes).
- Photochemical Assessment Monitoring Station (PAMS) Network: The NO_x monitor at Detroit-E 7 Mile was switched to an NO_y for PAMS. Direct NO₂ was added at Detroit-E 7 Mile for the PAMS network.
- Background monitors for modeling: Lansing and Houghton Lake.
- GHIB project: Detroit-SW, DP4th, Trinity, and Military Park.

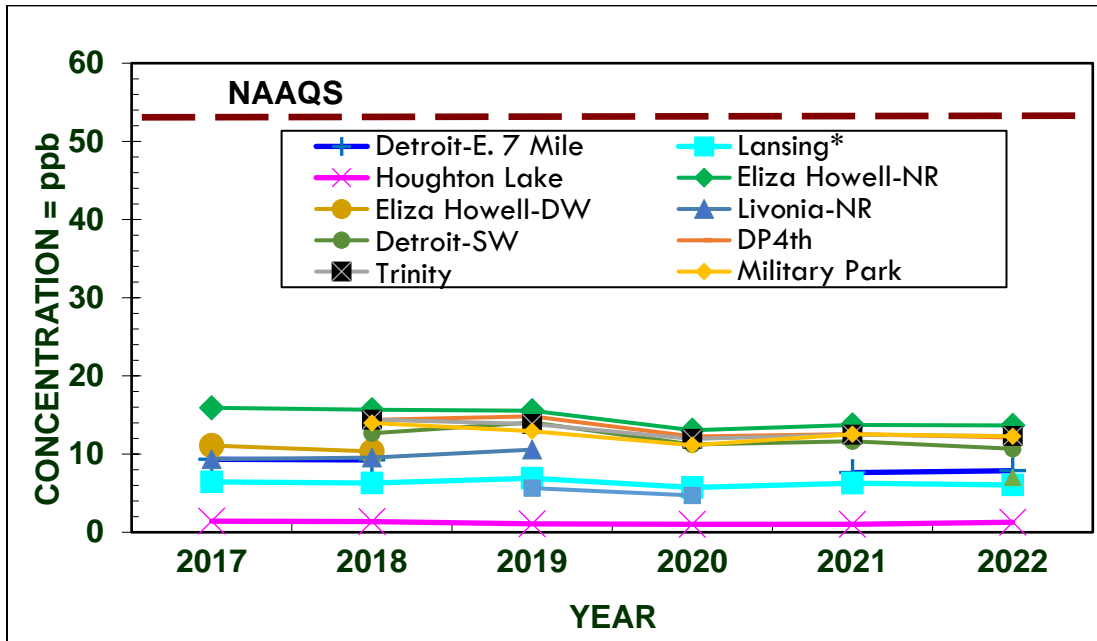
Figure 4.4: NO₂/NO_y Monitors in 2022



Michigan’s ambient NO₂ levels have always been well below the NAAQS. Since March 3, 1978, all areas in Michigan have been in attainment for the annual NO₂ NAAQS. As shown in **Figure 4.5**, all monitoring sites have had an annual NO₂ concentration at less than half of the 0.053 ppm NAAQS.

Even though there are no nonattainment areas for NO₂ in Michigan and monitoring for attainment purposes is not required, monitors continue to operate to support photochemical model validation work.

Figure 4.5: NO₂ Levels in Michigan from 2017-2022 (Annual Arithmetic Mean)**

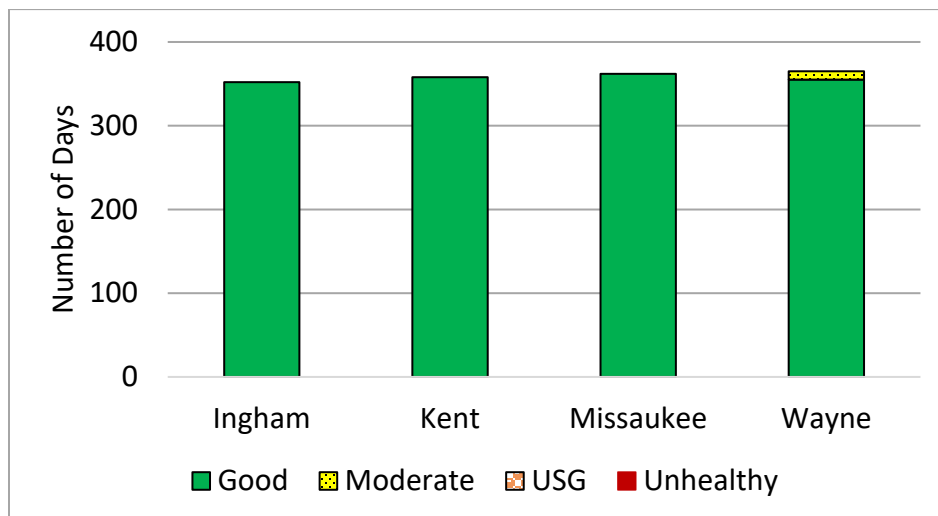


* Indicated site was moved in 2018 and concentrations were averaged together for both locations.

** Since Allen Park is monitoring NO_x, that site is not included in graph.

Figure 4.6 shows the AQI values per day in counties where NO₂ is monitored. All days were in the good AQI range, except for 10 days in Wayne County that were in the moderate AQI range.

Figure 4.6: 2022 AQI Days for NO₂ in Michigan Counties



CHAPTER 5: SULFUR DIOXIDE (SO₂)

Sulfur dioxide is a gas formed by the burning of sulfur-containing material. Odorless at typical ambient concentrations, SO₂ can react with other atmospheric chemicals to form sulfuric acid. At higher concentrations it has a pungent, irritating odor like a struck match. When sulfur-bearing fuel is burned, the sulfur is oxidized to form SO₂, which then reacts with other pollutants to form aerosols. These aerosols can form particles in the air causing increases in PM_{2.5} levels. In liquid form, it is found in clouds, fog, rain, aerosol particles, and in surface films on these particles. In June 2010, the USEPA changed the primary SO₂ standard to a 99th percentile of 1-hour concentrations not to exceed 0.075 ppm, averaged over a 3-year period. The secondary standard has not changed and is a 3-hour average that cannot exceed 0.5 ppm once per year. Its sources and effects are presented below.

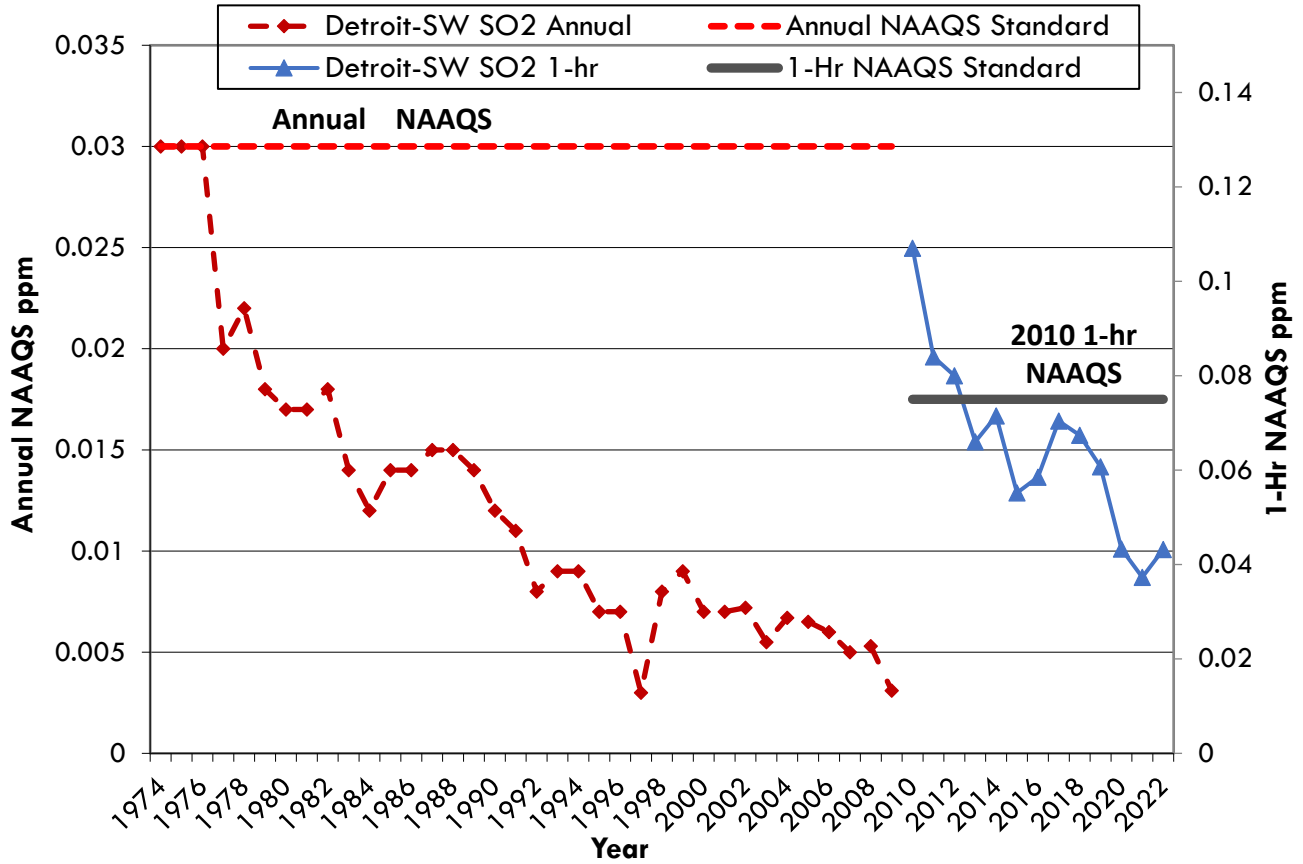
Sources: Coal-burning power plants are the largest source of SO₂ emissions. Other sources include industrial processes such as extracting metal from ore, and non-road transportation sources; and natural sources such as volcanoes. SO₂ and particulate matter are often emitted together.

Effects: Exposure to elevated levels can aggravate symptoms in asthmatics and cause respiratory problems in healthy groups. SO₂ and NO_x together are the major precursors to acid rain and are associated with the acidification of soils, lakes, and streams, as well as accelerated corrosion of buildings and monuments.

Population most at risk: Asthmatics, children, and the elderly are especially sensitive to SO₂ exposure. Asthmatics receiving short-term exposures during moderate exertion may experience reduced lung function and symptoms, such as wheezing, chest tightness, or shortness of breath. Depending on the concentration, SO₂ may also cause symptoms in people who do not have asthma.

Historical trends: Southeast Michigan has been monitoring for SO₂ for over 45 years. **Figure 5.1** shows the SO₂ trend for the old annual standard and the new 1-hour standard for Detroit-SW. Michigan had been in attainment for SO₂ since 1982 with levels consistently well below the annual SO₂ NAAQS. In 2010, when the USEPA changed the standard from an annual average to a 1-hour standard, a portion of Wayne County was designated nonattainment. In September 2016, a portion of St. Clair County was also designated as nonattainment by the USEPA based on emissions and modeling. Even though the areas are in nonattainment for the 1-hour SO₂ standard, SO₂ concentrations have decreased at these sites and are currently under the NAAQS, although modeling results are not below the NAAQS.

Figure 5.1: Historical Annual and 1-hour SO₂ Averages at Detroit-SW



Figures 5.2 and 5.3 show SO₂ emission sources and SO₂ emissions by county (courtesy of the USEPA’s State and County Emission Summaries).

Figure 5.2: SO₂ Emissions by Source Sector

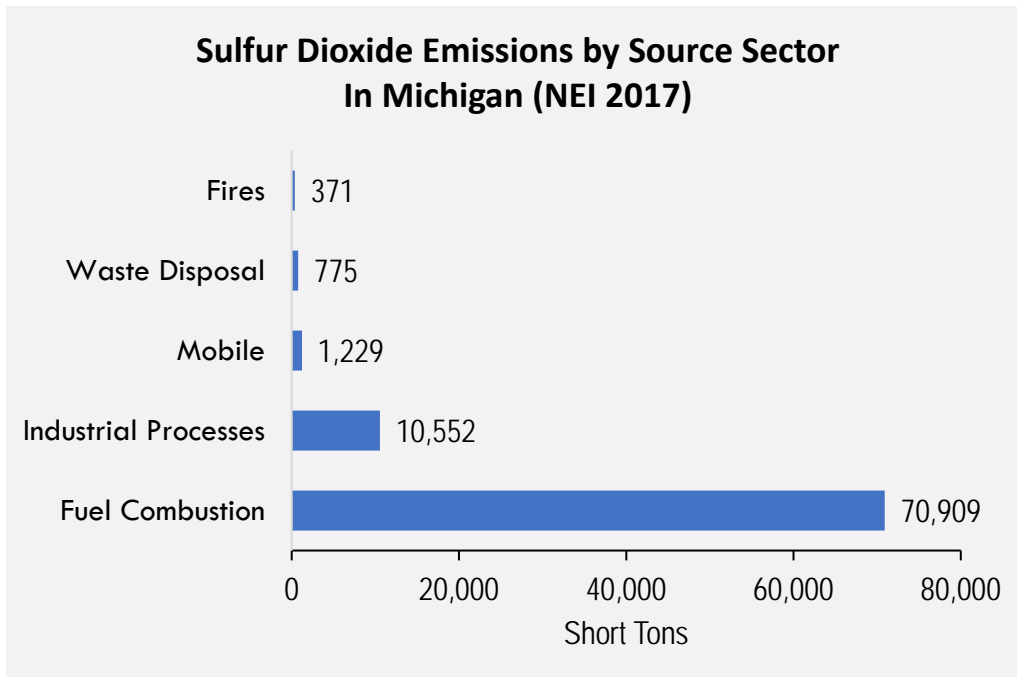


Figure 5.3: SO₂ Emissions in 2017 (NEI)

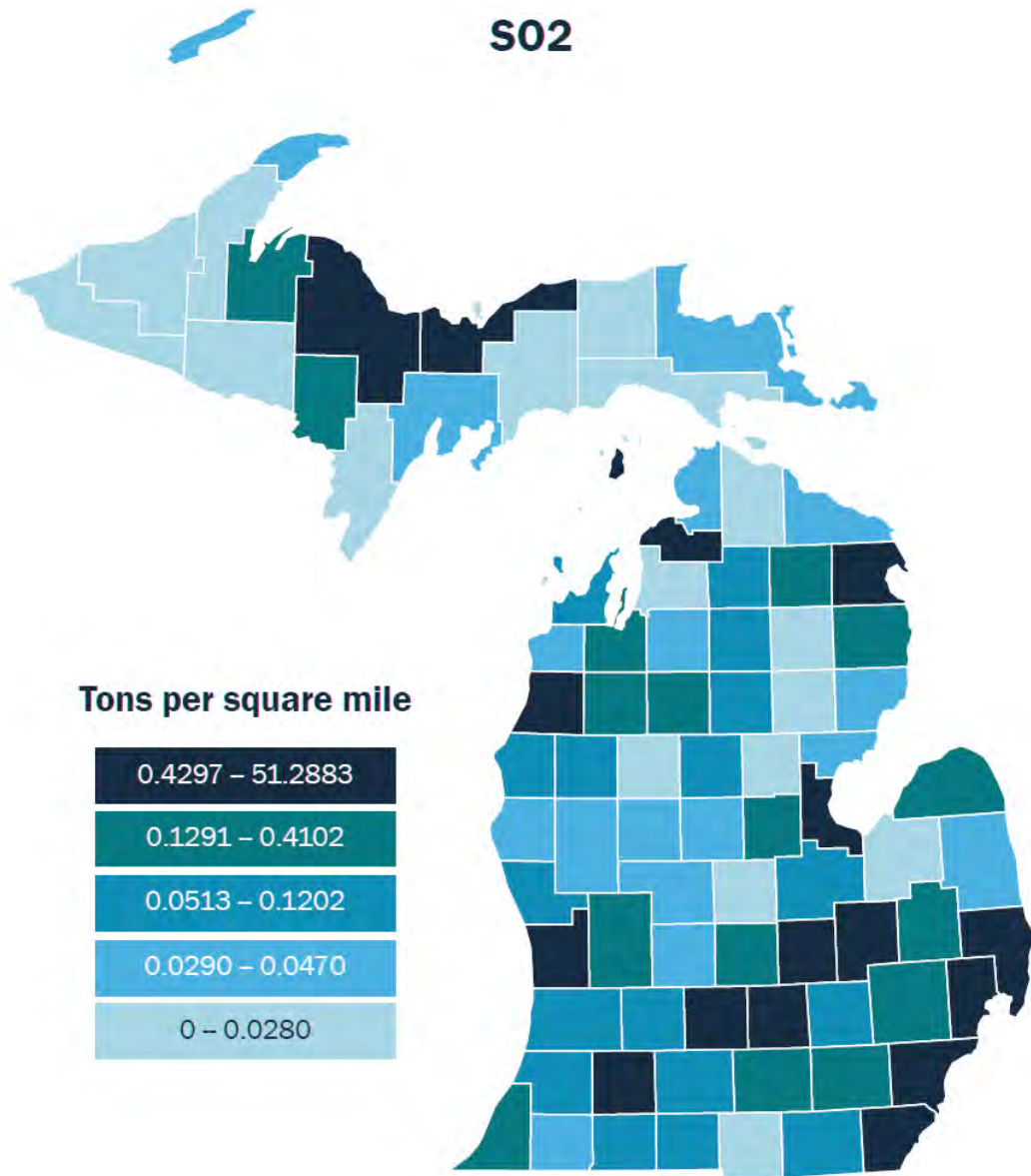


Figure 5.4 shows the location of each SO₂ monitor that operated in 2022.

- NCore sites: Allen Park and Grand Rapids have trace SO₂ monitors that have lower detection limits than traditional SO₂ monitors.
- Source-oriented sites: Lansing, Port Huron, and Detroit-SW. Two other source-oriented sites, Sterling State Park and West Olive, were shut down due to low SO₂ concentrations.
- Community monitoring project: NMH 48217.
- GHIB project: DP4th, Trinity, and Military Park.

Figure 5.4: SO₂ Monitors in 2022

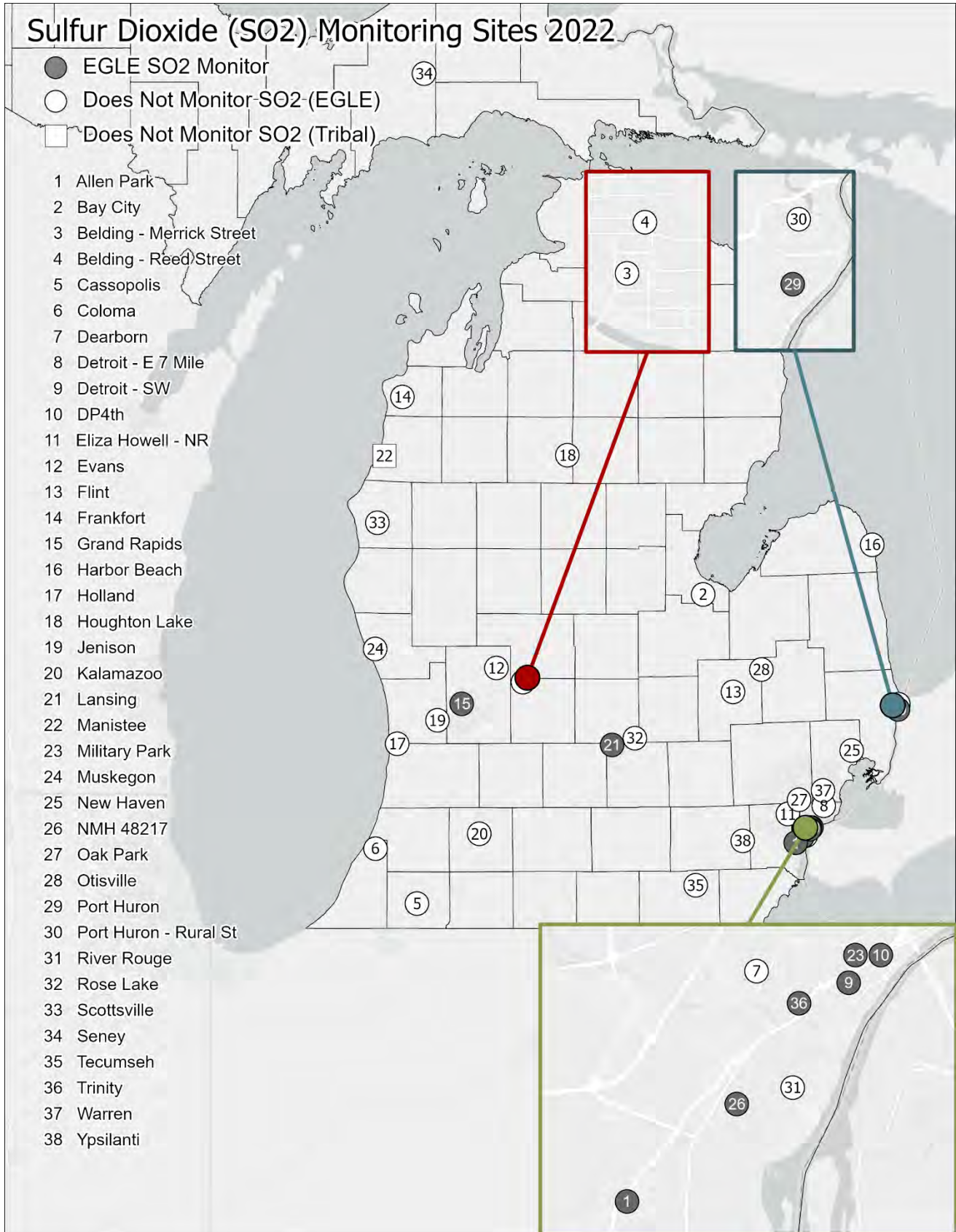


Figure 5.5 shows that all the SO₂ sites in Michigan are below the standard even though there is a nonattainment area for SO₂. The standard is a 3-year average, thus having one point above the NAAQS level line does not mean the monitor is over the standard. SO₂ pollution is extremely variable and would require a large monitoring network to designate areas as attainment. Therefore, SO₂ attainment depends on both emission modeling and monitoring data.

The NCore sites, Grand Rapids and Allen Park, monitor for trace SO₂. For trend purposes, all SO₂ data are graphed together in **Figure 5.5**.

Figure 5.5: SO₂ Levels in Michigan from 2017-2022 (1-hour 99th Percentile)

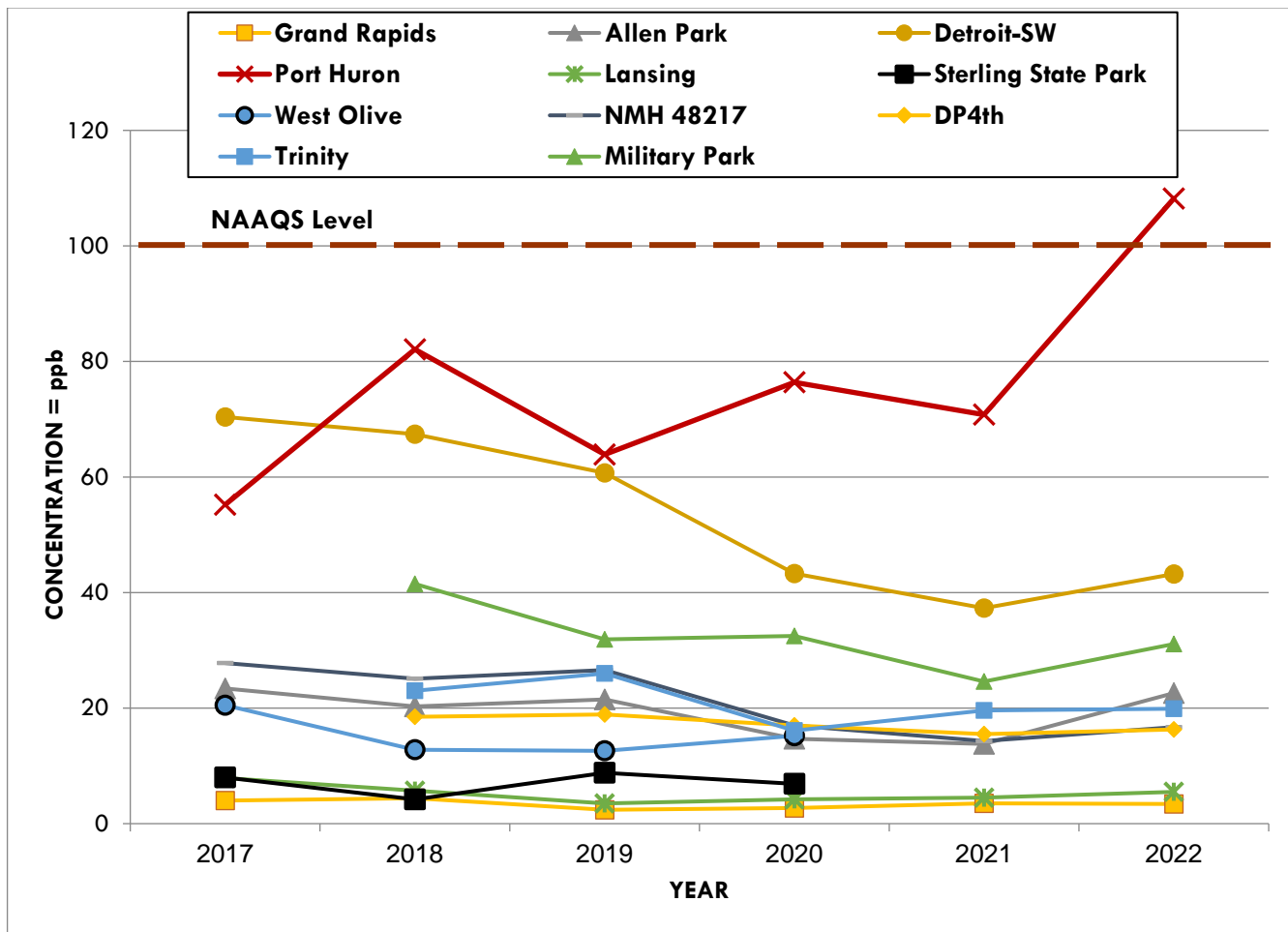
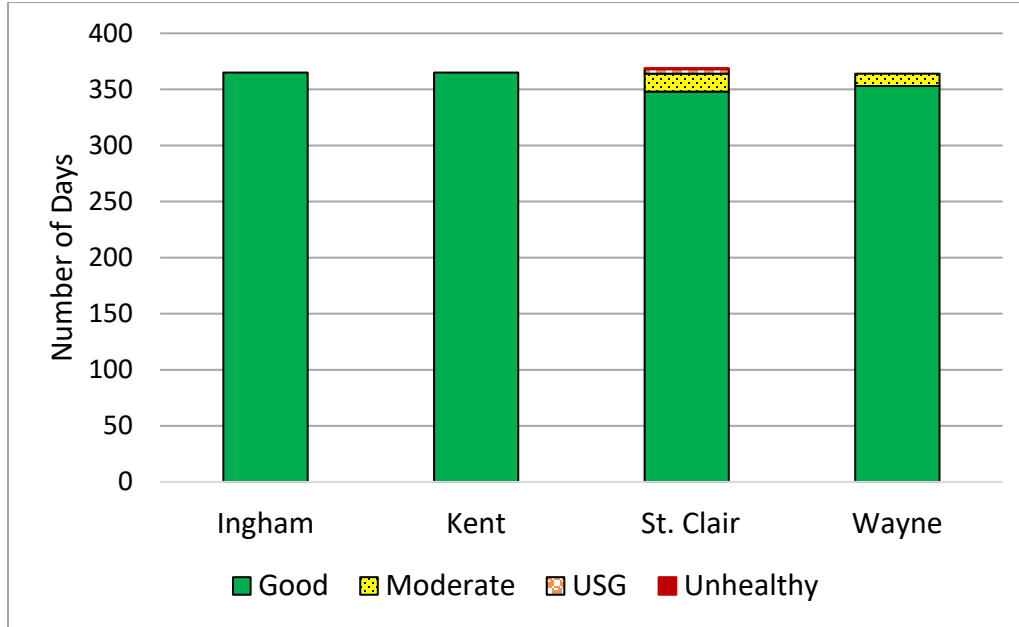


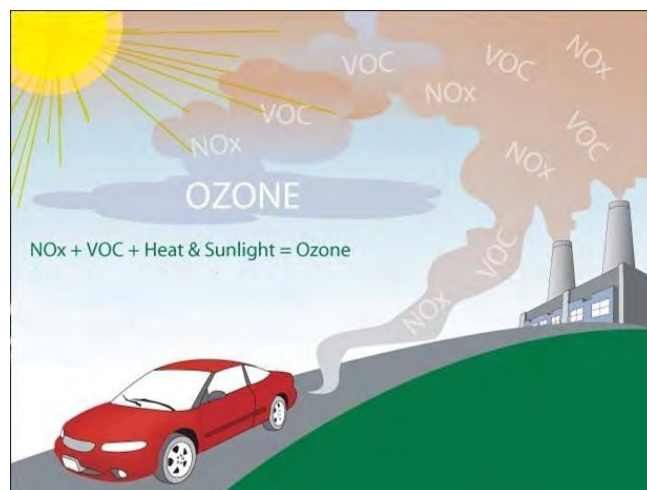
Figure 5.6 shows the AQI values per day in counties where SO₂ is monitored. All days were in the good AQI range, except for 27 days in the moderate AQI range in St. Clair and Wayne Counties, and four days in the Unsafe for Sensitive Groups and one day in the Unhealthy Group in St. Clair County.

Figure 5.6: 2022 AQI Days for SO₂ in Michigan Counties



CHAPTER 6: OZONE (O₃)

Ground-level O₃ is created by reactions involving nitrogen oxides (NO_x) and volatile organic compounds (VOCs), or hydrocarbons, in the presence of sunlight as the illustration to the right depicts (image courtesy of the USEPA). These reactions usually occur during the hot summer months as ultraviolet radiation from the sun initiates a sequence of photochemical reactions. In Earth's upper atmosphere (the stratosphere), O₃ helps by absorbing much of the sun's ultraviolet radiation, but in the lower atmosphere (the troposphere), it is an air pollutant. Ozone is also a key ingredient of urban smog and can be transported hundreds of miles under certain meteorological conditions. Ozone levels are



often higher in rural areas than in cities due to transport to regions downwind from the actual emissions of NO_x and VOCs. Shoreline monitors along Lake Michigan often measure high O₃ concentrations due to transport from upwind states. The O₃ NAAQS was revised by the USEPA and became effective in November 2015. It is a 3-year average of the 4th highest daily maximum 8-hour average concentration that must not exceed 0.070 ppm. The sources and effects of O₃ follow.

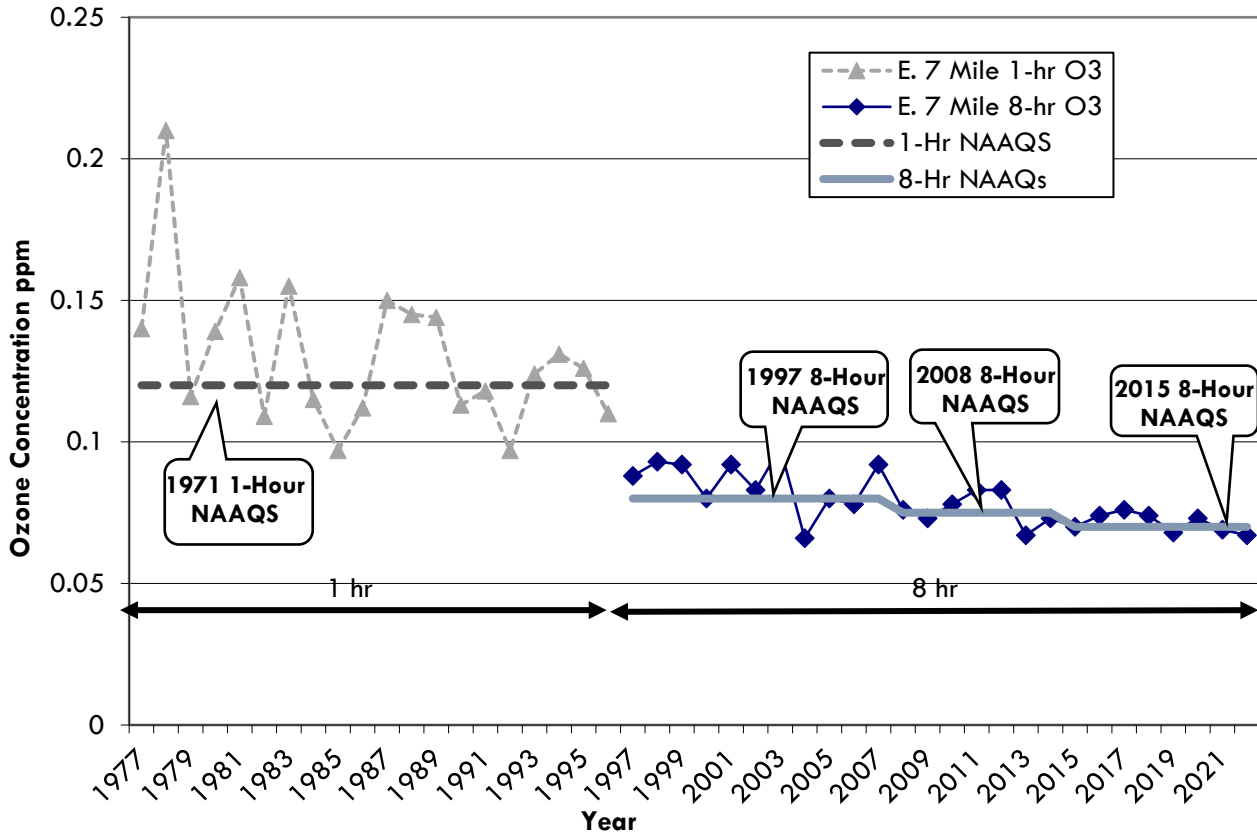
Sources: Major sources of NO_x and VOCs are engine exhaust, emissions from industrial facilities, combustion from power plants, gasoline vapors, chemical solvents, and biogenic emissions from natural sources. Ground-level O₃ can also be transported hundreds of miles under certain wind regimes. As a result, the long-range transport of air pollutants impacts the air quality of regions downwind from the actual area of formation.

Effects: Elevated O₃ exposure can irritate airways, reduce lung function, aggravate asthma and chronic lung diseases like emphysema and bronchitis, and inflame and damage the cells lining the lungs. Other effects include increased respiratory related hospital admissions with symptoms such as chest pain, shortness of breath, throat irritation, and cough. Ozone may also reduce the immune system's ability to fight off bacterial infections in the respiratory system, and long-term, repeated exposure may cause permanent lung damage. Ozone also impacts vegetation and forest ecosystems, including agricultural crop and forest yield reductions, diminished resistance to pests and pathogens, and reduced survivability of tree seedlings.

Population most at risk: Individuals most susceptible to the effects of O₃ exposure include those with a pre-existing or chronic respiratory disease, children who are active outdoors, and adults who actively exercise or work outdoors.

Historical trends: Southeast Michigan has been monitoring for O₃ for over 40 years. **Figure 6.1** shows the O₃ levels at the Detroit-E 7 Mile site. This graph shows how the standard changed from a 1-hour average of 0.120 ppm to an 8-hour average of 0.08 ppm in 1997. The standard was further lowered to 0.070 ppm at the end of 2015. Ozone depends on weather conditions, so concentrations are more variable than other pollutants. Ozone is also monitored primarily in warmer months. In the 2015 NAAQS, the ozone season was extended by two months, from March 1 to October 31.

Figure 6.1: Historical 1-hour and 8-hour Ozone at Detroit-E 7 Mile



Figures 6.2 and 6.3 show VOC emission sources and VOC emissions by county (courtesy of the USEPA’s State and County Emission Summaries).

Figure 6.2: VOC Emissions by Source Sector

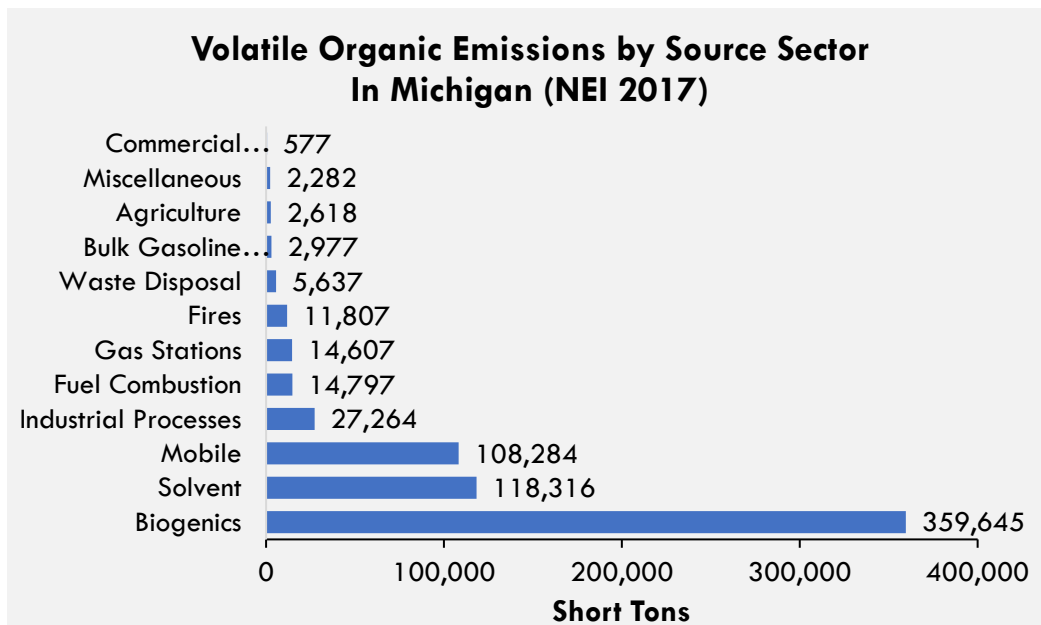


Figure 6.3: VOC Emissions in 2017

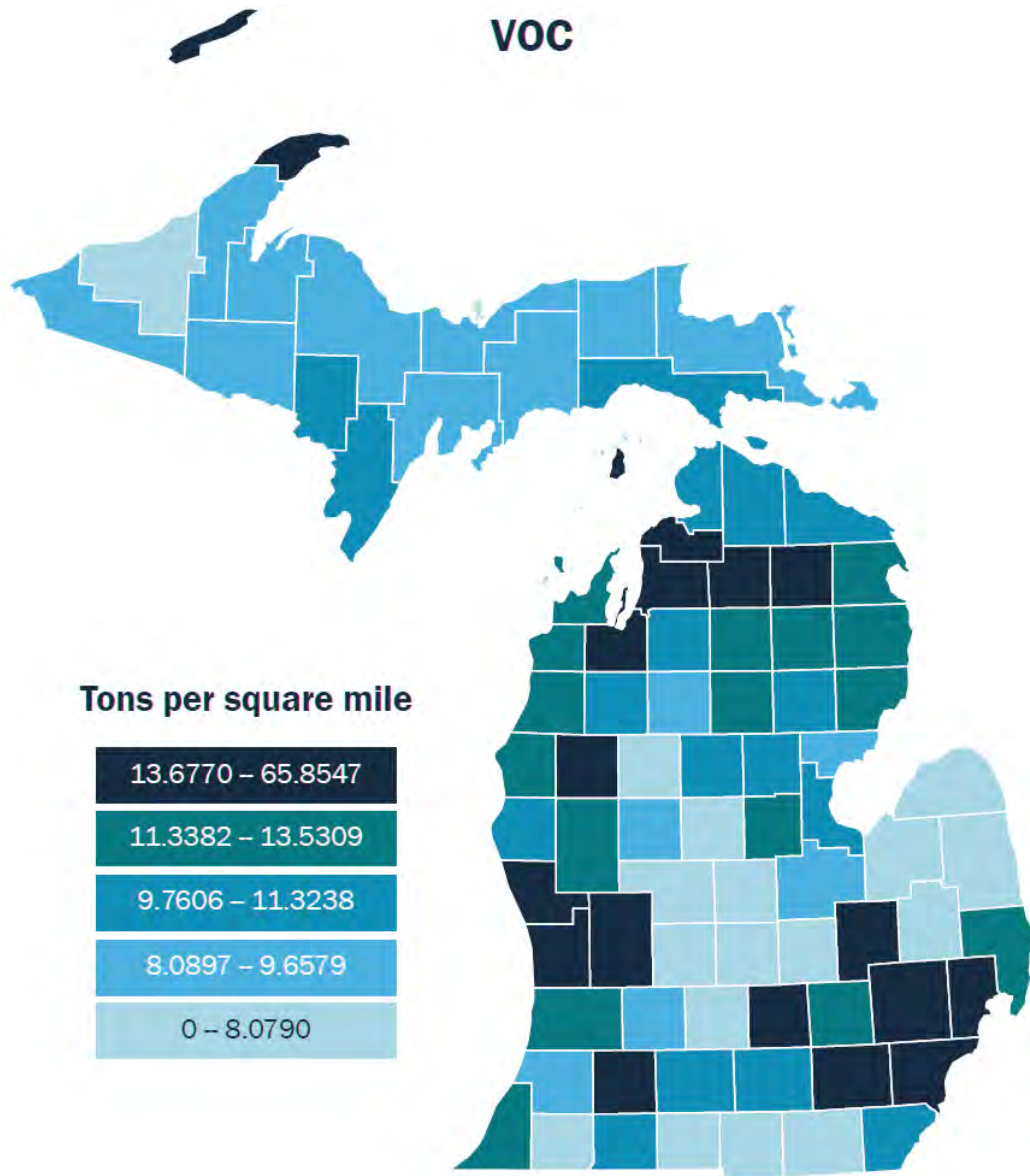


Figure 6.4 (following) shows all O₃ air quality monitors active in Michigan at the beginning of the 2022 ozone season.

- Background site monitors: Houghton Lake, Scottville, Seney.
- Transport site monitors: Frankfort, Coloma, Harbor Beach, Holland, Muskegon, Tecumseh.
- Tribal site: Manistee.
- Population-oriented monitors: All other sites.

Figure 6.4: Ozone Monitors in 2022

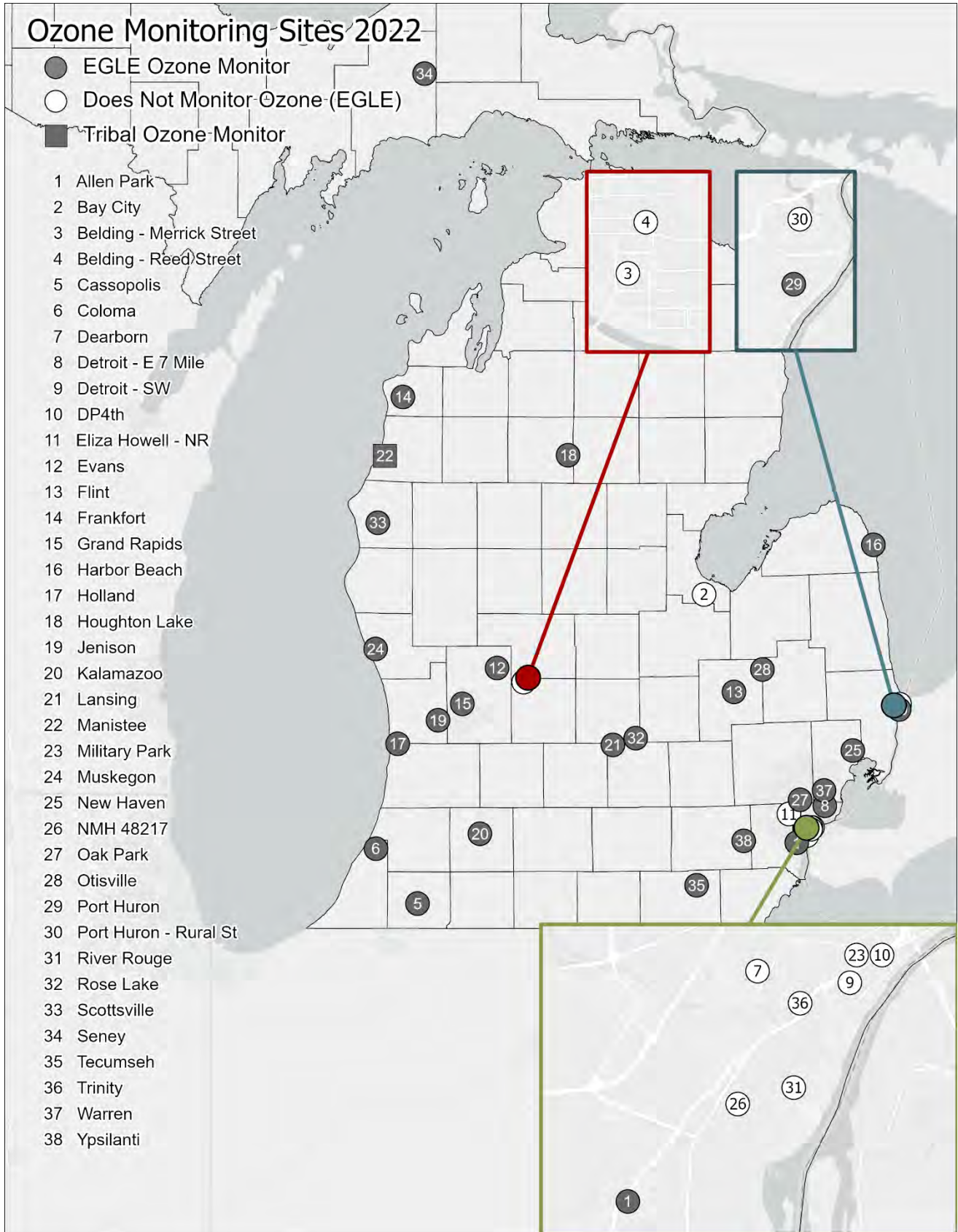


Table 6.1 shows the 3-year averages of O₃. The USEPA uses these values (called design values) to determine attainment/nonattainment areas. The USEPA made their final designations for the 2015 standard on April 30, 2018 (effective August 3, 2018) based on 2014-2016 data. Livingston, Macomb, Monroe, Oakland, St. Clair, Washtenaw, and Wayne Counties were designated nonattainment in Southeast Michigan; and all of Berrien County, and portions of Allegan and Muskegon Counties were designated nonattainment in Western Michigan. In 2019, Berrien County was below the standard and a redesignation request was submitted to the USEPA in January 2020. Berrien County experienced elevated O₃ in 2020, and the USEPA has suspended action on the redesignation request. In 2021, Southeast Michigan was below the standard and a redesignation request was submitted to the USEPA in December 2021. The USEPA has not yet acted on the submitted redesignation request because of a subsequent high value at a monitor in 2022. EGLE has submitted data requesting that the high value be modified because of transported smoke impacts, and USEPA is to make a decision on the request soon.

The O₃ monitoring season in Michigan is from March 1 through October 31. During this time, O₃ monitoring data is available for the public via the AQD's website (discussed in Chapter 1). However, year-round O₃ monitoring is conducted at the following four sites: Allen Park, Grand Rapids, Houghton Lake, and Lansing. This data helps in attainment designations, urban area quality, and population exposure assessments.

Table 6.1: 3-Year Average of the 4th Highest 8-hour Ozone Values from 2018-2020, 2019-2021, and 2020-2022 (concentrations in ppm)

Areas	County	Monitor Sites	2018-2020	2019-2021	2020-2022
Detroit-Ann Arbor	Lenawee	Tecumseh	0.065	0.064	0.066
Detroit-Ann Arbor	Macomb	New Haven	0.071	0.068	0.069
Detroit-Ann Arbor	Macomb	Warren	0.068	0.066	0.068
Detroit-Ann Arbor	Oakland	Oak Park	0.072	0.069	0.069
Detroit-Ann Arbor	St. Clair	Port Huron	0.071	0.070	0.069
Detroit-Ann Arbor	Washtenaw	Ypsilanti	0.067	0.066	0.068
Detroit-Ann Arbor	Wayne	Allen Park	0.067	0.067	0.070
Detroit-Ann Arbor	Wayne	Detroit-E 7 Mile	0.071	0.070	0.069
Flint	Genesee	Flint	0.065	0.064	0.067
Flint	Genesee	Otisville	0.065	0.065	0.067
Grand Rapids	Ottawa	Jenison	0.071	0.069	0.071
Grand Rapids	Kent	Grand Rapids	0.071	0.070	0.071
Grand Rapids	Kent	Evans	0.065	0.065	0.067
Muskegon Co	Muskegon	Muskegon	0.076	0.074	0.079
Allegan Co	Allegan	Holland	0.073	0.075	0.075
Huron	Huron	Harbor Beach	0.068	0.068	0.070
Kalamazoo-Battle	Kalamazoo	Kalamazoo	0.068	0.065	0.068
Lansing-East Lansing	Ingham	Lansing	0.062	0.060	0.062
Lansing-East Lansing	Clinton	Rose Lake	0.063	0.061	0.064
Benton Harbor	Berrien	Coloma	0.072	0.071	0.073
Benzie Co	Benzie	Frankfort	0.064	0.064	0.068
Cass Co	Cass	Cassopolis	0.071	0.068	0.070
Mason Co	Mason	Scottville	0.064	0.064	0.067
Missaukee Co	Missaukee	Houghton Lake	0.064	0.063	0.065
Manistee Co	Manistee	Manistee	0.059	0.061	0.062
Schoolcraft Co	Schoolcraft	Seney	0.063	0.064	0.066

Numbers in bold indicate 3-year averages over the 2015 ozone standard of 0.070 ppm.

Tables 6.2 and 6.3 highlight the number of days when two or more O₃ monitors exceeded 0.070 ppm. It also specifies in which month they occurred and the temperature range.

Table 6.2: 2022 West Michigan Ozone Season

Daily High Temperature Range	Mar Days	Mar O ₃ Days	Apr Days	Apr O ₃ Days	May Days	May O ₃ Days	Jun Days	Jun O ₃ Days	Jul Days	Jul O ₃ Days	Aug Days	Aug O ₃ Days	Sep Days	Sep O ₃ Days	Oct Days	Oct O ₃ Days
≥ 95	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0
90 ≤ 94	0	0	0	0	0	0	2	1	4	1	0	0	0	0	0	0
85 ≤ 89	0	0	0	0	7	0	7	4	7	0	7	0	1	0	0	0
80 ≤ 84	0	0	1	0	2	0	7	1	13	0	17	0	9	0	0	0
75 ≤ 79	0	0	0	0	4	0	6	0	7	0	5	0	6	0	4	0
70 ≤ 74	0	0	1	0	2	0	6	0	0	0	1	0	2	0	5	0
65 ≤ 69	2	0	2	0	7	0	1	0	0	0	0	0	4	0	6	0
60 ≤ 64	2	0	2	0	4	0	0	0	0	0	1	0	5	0	3	0
55 ≤ 59	4	0	5	0	2	0	0	0	0	0	0	0	2	0	2	0
50 ≤ 54	3	0	3	0	3	0	0	0	0	0	0	0	1	0	8	0
49 ≤	20	0	16	0	0	0	0	0	0	0	0	0	0	0	3	0
Totals	31	0	30	0	31	0	30	7	31	1	31	0	30	0	31	0

Days: Number of days during month when the daily high temperature falls within the specified temperature range.

O₃ Days: Number of days, during specified temperature range, when two or more area monitors exceeded 70 ppb.

West Michigan had seven O₃ exceedance days in June and one day in July when O₃ exceeded 0.070 ppm at two or more monitors. The temperature on those days ranged between 80°F and <95°F.

Table 6.3: 2022 Southeast Michigan Ozone Season

Daily High Temperature Range	Mar Days	Mar O ₃ Days	Apr Days	Apr O ₃ Days	May Days	May O ₃ Days	Jun Days	Jun O ₃ Days	Jul Days	Jul O ₃ Days	Aug Days	Aug O ₃ Days	Sep Days	Sep O ₃ Days	Oct Days	Oct O ₃ Days
≥ 95	0	0	0	0	0	0	2	0	1	0	2	0	0	0	0	0
90 ≤ 94	0	0	0	0	1	0	3	1	8	1	3	0	0	0	0	0
85 ≤ 89	0	0	1	0	6	0	7	2	11	0	11	0	8	0	0	0
80 ≤ 84	0	0	1	0	4	0	8	0	9	0	12	0	8	0	0	0
75 ≤ 79	0	0	0	0	5	0	7	0	2	0	3	0	2	0	6	0
70 ≤ 74	1	0	2	0	3	0	3	0	0	0	0	0	3	0	4	0
65 ≤ 69	1	0	3	0	5	0	0	0	0	0	0	0	5	0	7	0
60 ≤ 64	5	0	2	0	4	0	0	0	0	0	0	0	3	0	5	0
55 ≤ 59	2	0	2	0	2	0	0	0	0	0	0	0	1	0	4	0
50 ≤ 54	4	0	9	0	1	0	0	0	0	0	0	0	0	0	1	0
49 ≤	18	0	10	0	0	0	0	0	0	0	0	0	0	0	4	0
Totals	31	0	30	0	31	0	30	3	31	1	31	0	30	0	31	0

Days: Number of days during month when the daily high temperature falls within the specified temperature range.

O₃ Days: Number of days, during specified temperature range, when two or more area monitors exceeded 70 ppb.

Southeast Michigan had three O₃ exceedance days in June, and one day in July when O₃ exceeded 0.070 ppm at two or more ozone monitors. The temperature for those days ranged between 85°F and 94°F.

Table 6.4 gives a breakdown of the O₃ days and the specific monitors that went over the standard in western, central/upper, and eastern Michigan in 2022.

Table 6.4: 8-Hour Exceedance Days (>.070 ppm) and Monitor Locations with Exceedances of the Ozone Standard

Date	Western Michigan	Central/Upper Mich.	Eastern Michigan	Total
5/12/2022			Flint, Otisville	2
6/14/2022	Muskegon			1
6/15/2022	Muskegon			1
6/16/2022	Coloma, Holland			2
6/20/2022	Cassopolis, Coloma, Evans, Frankfort, Holland, Jenison, Kalamazoo, Manistee, Muskegon, Scottville	Seney		11
6/21/2022	Coloma, Evans, Frankfort, Holland, Jenison, Manistee, Muskegon, Scottville		Port Huron	9
6/24/2022	Evans, Grand Rapids, Jenison		Detroit-E 7 Mile, New Haven	5
6/25/2022			Allen Park, Detroit-E 7 Mile, Harbor Beach, Otisville, Ypsilanti	5
6/28/2022	Muskegon			1
6/29/2022	Cassopolis, Coloma		Allen Park	3
6/30/2022	Coloma, Frankfort, Grand Rapids, Holland, Jenison, Manistee, Muskegon	Houghton Lake	Allen Park, Detroit-E 7 Mile, Port Huron, Warren	12
7/3/2022	Coloma			1
7/4/2022			Allen Park, Detroit-E 7 Mile	2
7/19/2022	Holland, Muskegon			2
			TOTAL	57

On June 30, 2022, there were 12 monitors that exceeded the level of the standard. The site with the most exceedances in the Western region of Michigan was Muskegon with seven. The central/upper Michigan sites, Seney and Houghton Lake, both with one exceedance. Allen Park and Detroit-E 7 Mile had four exceedances in Eastern Michigan.

Figure 6.5 shows the 4th highest 8-hour O₃ values for Southeast Michigan monitoring sites from 2017-2022. No sites violated the 3-year standard.

Figure 6.6 shows the 4th highest 8-hour O₃ values for the Grand Rapids-Muskegon-Holland CSA. Muskegon, Holland, Grand Rapids, and Jenison violated the 3-year standard.

Figure 6.7 shows the 4th highest 8-hour O₃ values for mid-Michigan. Coloma violated the 3-year standard.

Figure 6.8 shows the 4th highest 8-hour O₃ values for the Northern Lower and Upper Peninsulas. No sites violated the 3-year standard.

Figure 6.5: O₃ Levels in Detroit-Warren-Flint CSA from 2017-2022 (4th highest 8-hour O₃ values)

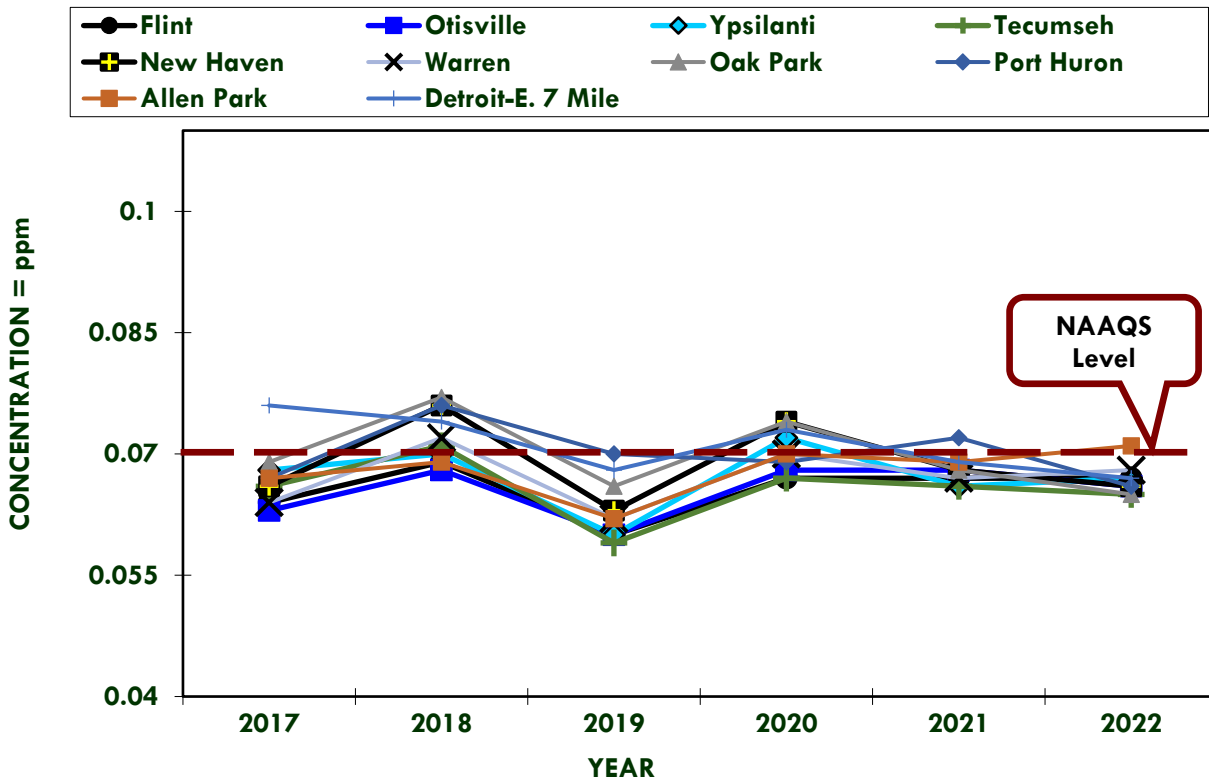


Figure 6.6: O₃ Levels in Grand Rapids-Muskegon-Holland CSA from 2017-2022 (4th highest 8-hour O₃ values)

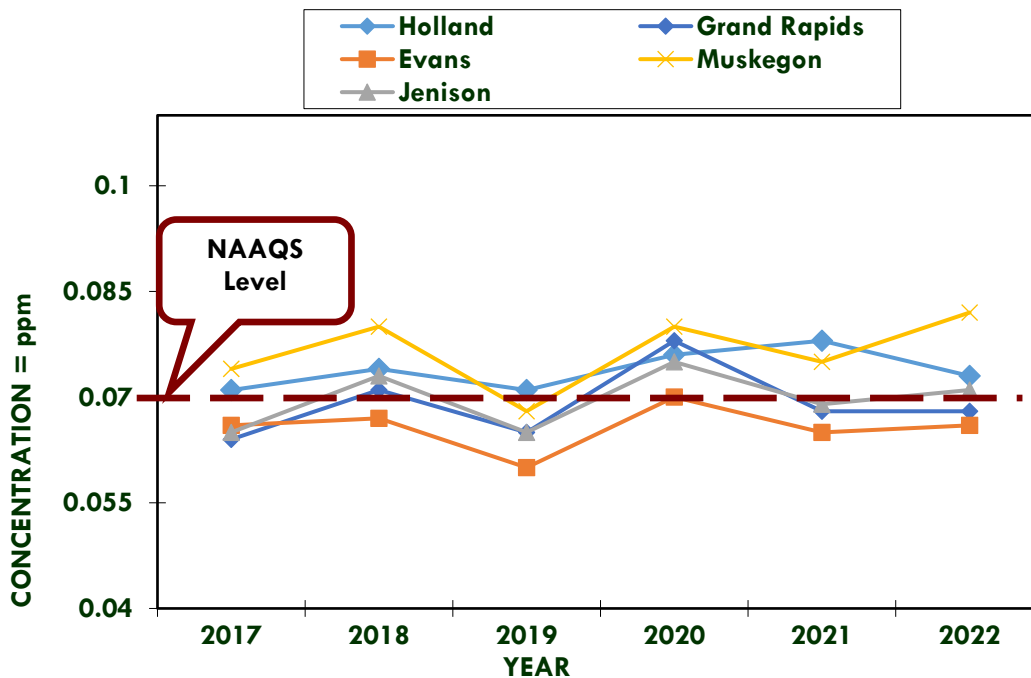


Figure 6.7: O₃ Levels in Kalamazoo-Portage MSA, Lansing-E. Lansing-Owosso CSA, Niles Benton Harbor MSA, and South Bend-Mishawaka (IN-MI) MSAs from 2017-2022 (4th highest 8-hour O₃ values)

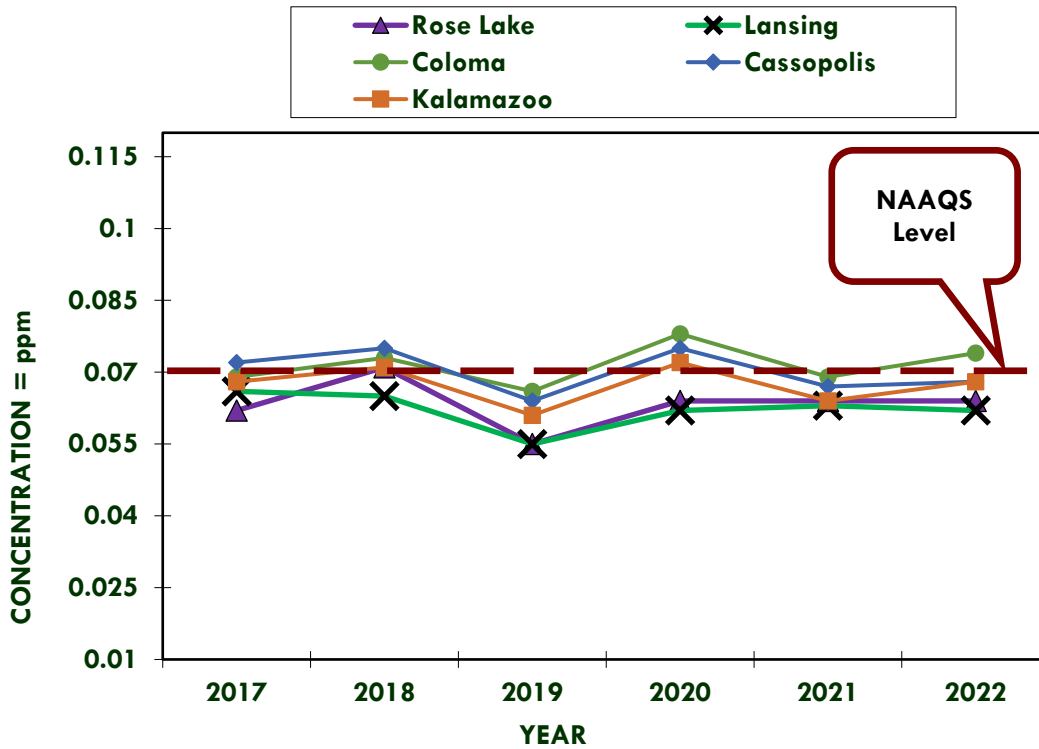


Figure 6.8: O₃ Levels in Michigan's Northern Lower and Upper Peninsula Areas from 2017-2022 (4th highest 8-hour O₃ values)

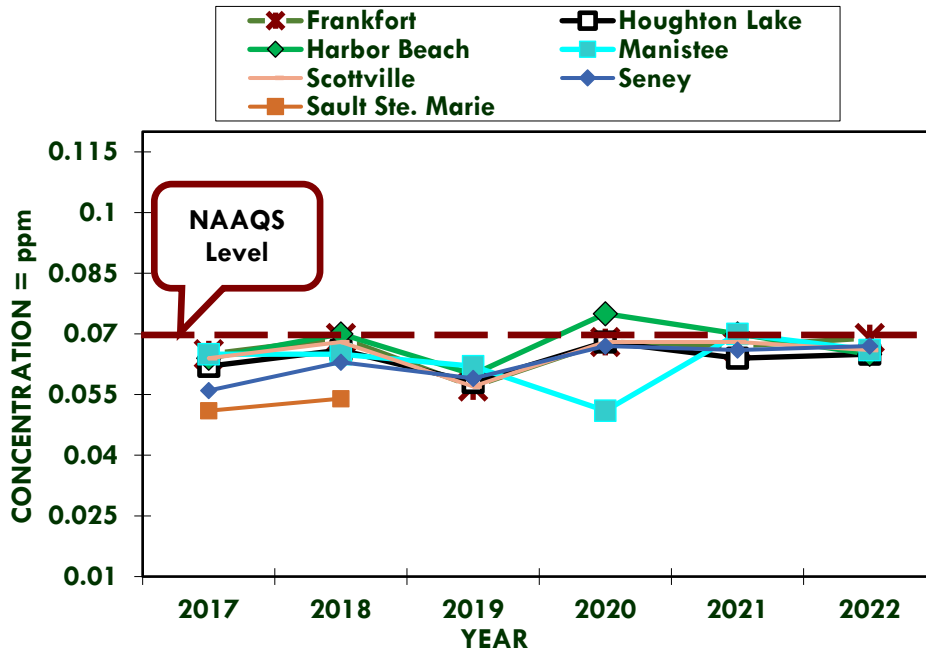
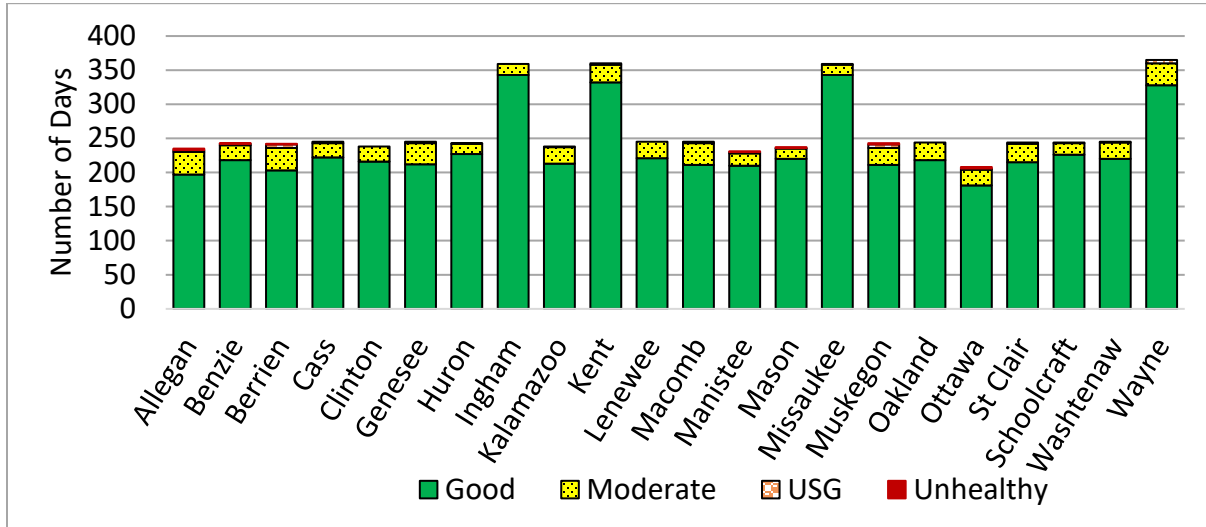


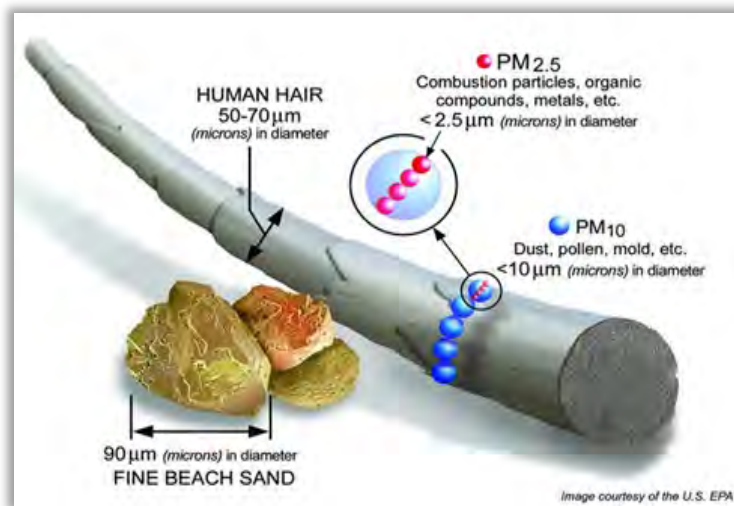
Figure 6.9 shows the AQI values per day in counties where ozone is monitored. Most days were in the good to moderate AQI range. Most counties had a few days in the USG range. Eight counties had one or two days in the unhealthy AQI range.

Figure 6.9: 2022 AQI Days for O₃ in Michigan Counties



CHAPTER 7: PARTICULATE MATTER (PM₁₀, PM_{10-2.5}, PM_{2.5}, CHEMICAL SPECIATION, AND TSP)

Particulate matter (PM) is a general term used for a mixture of solid particles and liquid droplets (aerosols) found in the air. These are further categorized according to size; larger particles with diameters of less than 50 micrometers (μm) are classified as total suspended particulates (TSP). PM₁₀ consists of “coarse particles” less than 10 (about one-seventh the diameter of a human hair), and PM_{2.5} are much smaller, “fine particles” equal to or less than 2.5 μm in diameter. PM₁₀ has a 24-hour average standard of 150 $\mu\text{g}/\text{m}^3$ not to be exceeded more than once per year over three years. PM_{2.5} has an annual average standard of 12 $\mu\text{g}/\text{m}^3$ and a 98th percentile 24-hour concentration of 35 $\mu\text{g}/\text{m}^3$ averaged over three years. The sources and effects of PM follow.



Sources: PM can be emitted directly (primary) or may form in the atmosphere (secondary). Most manmade particulate emissions are classified as TSP. PM₁₀ consists of primary particles that can originate from power plants, various manufacturing processes, wood stoves and fireplaces, agriculture and forestry practices, fugitive dust sources (road dust and windblown soil), and forest fires. PM_{2.5} can come from primary particle emissions or through secondary reactions that include VOCs, SO₂, and NO_x emissions originating from power plants, motor vehicles (especially diesel trucks and buses), industrial facilities, and other types of combustion sources.

Effects: Exposure to PM can aggravate existing cardiovascular ailments and even cause death in susceptible populations. PM may affect breathing and the cellular defenses of the lungs and has been linked with heart and lung disease. Smaller particles (PM₁₀ and smaller) pose the greatest problems because they can penetrate deep in the lungs and possibly into the bloodstream. PM is the major cause of reduced visibility in many parts of the United States. PM_{2.5} is considered a primary visibility-reducing component of urban and regional haze. Airborne particles impact vegetation ecosystems and damage paints, building materials, and surfaces. Deposition of acid aerosols and salts increases corrosion of metals and impacts plant tissue.

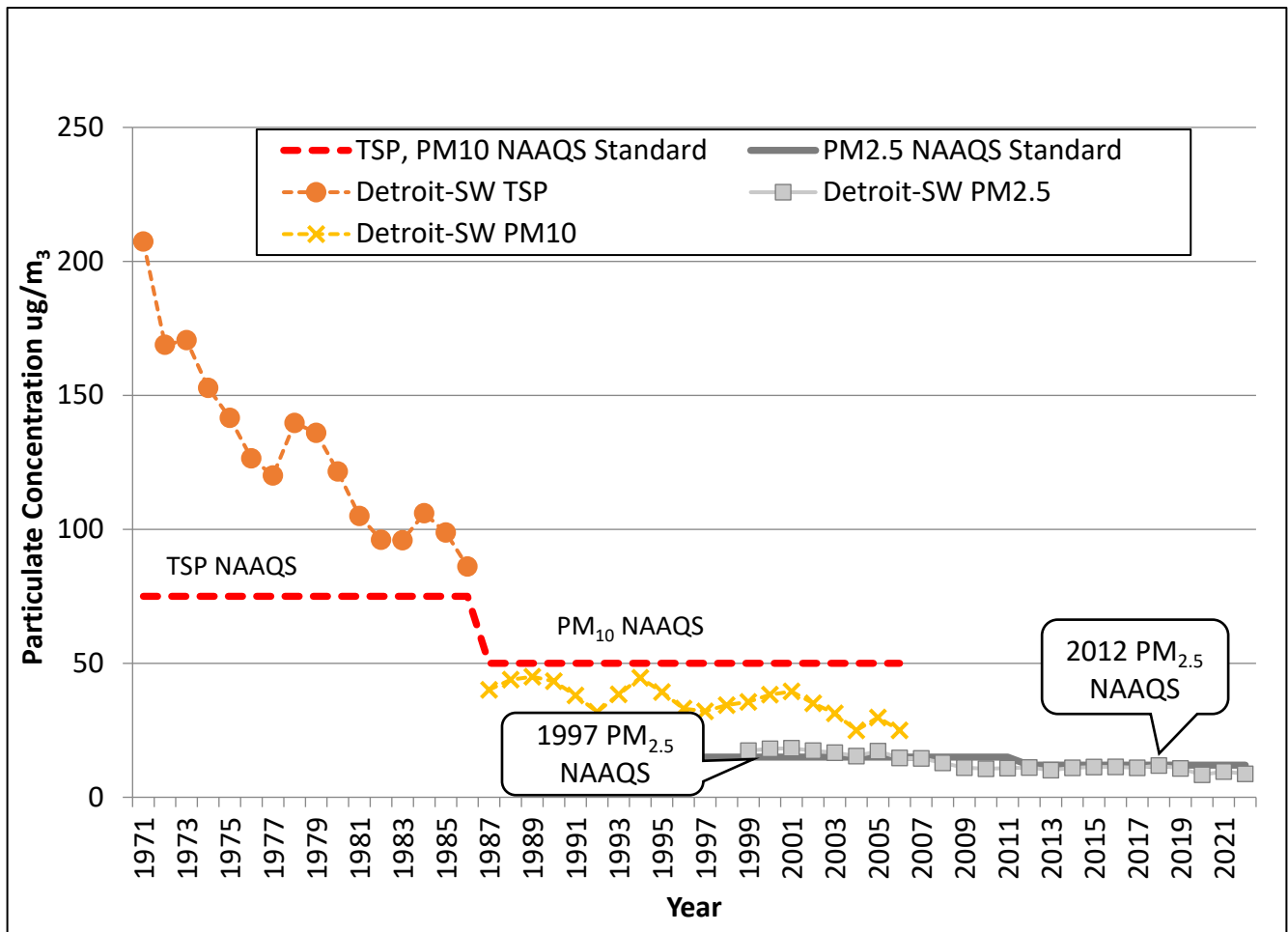
Population most at risk: People with heart or lung disease, the elderly, and children are at highest risk from exposure to PM.

Historical trends: Southeast Michigan has been monitoring for particulate for over 40 years. **Figure 7.1** shows the trends for PM. In 1971, the USEPA promulgated an annual and 24-hour particulate standard based on total suspended particulates (TSP). In 1987, the USEPA changed the standard to PM₁₀. Health studies indicated that particles smaller than 10 microns affect respiration. In 1997, the USEPA added additional NAAQS for a smaller particle fraction size, PM_{2.5}, which can get deeper into the lungs and possibly into the blood stream. In 2006, the USEPA revoked the PM₁₀ annual standard but kept the PM₁₀

24-hour standard. The $PM_{2.5}$ 24-hour standard was also reduced from $65 \mu\text{g}/\text{m}^3$ to $35 \mu\text{g}/\text{m}^3$. In 2012, the USEPA reduced the annual standard from $15 \mu\text{g}/\text{m}^3$ to $12 \mu\text{g}/\text{m}^3$.

Particulate trends show that particulate concentrations have decreased, and the state is in compliance for all particulate NAAQS; however, Michigan has had past nonattainment issues in Southeast Michigan for TSP, PM_{10} and $PM_{2.5}$.

Figure 7.1: Historical Annual PM at Detroit-SW



PM₁₀

Figures 7.2 and 7.3 show PM₁₀ emission sources and PM₁₀ emissions by county (courtesy of the USEPA’s State and County Emission Summaries).

Figure 7.2: PM₁₀ Emissions by Source Sector

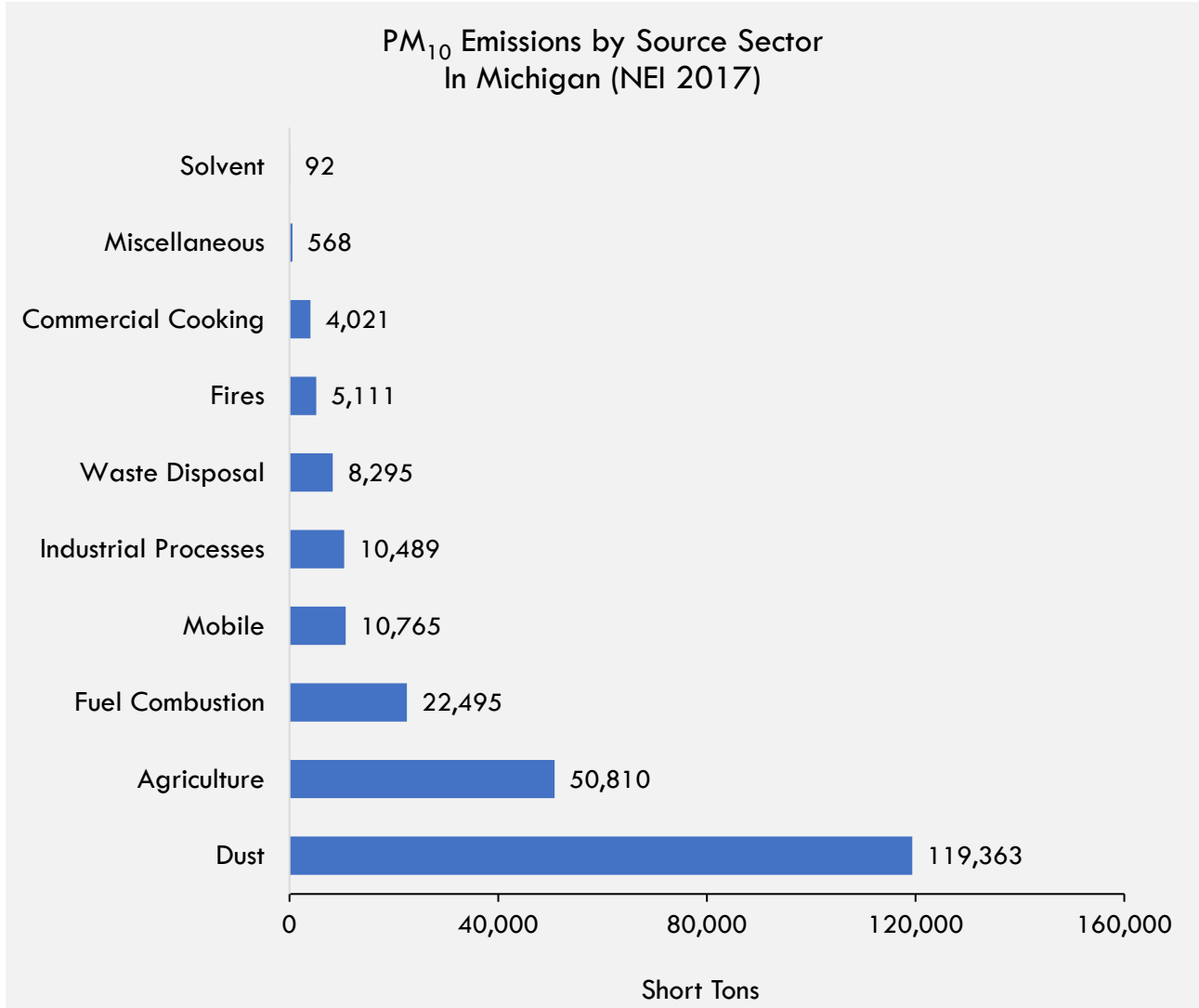
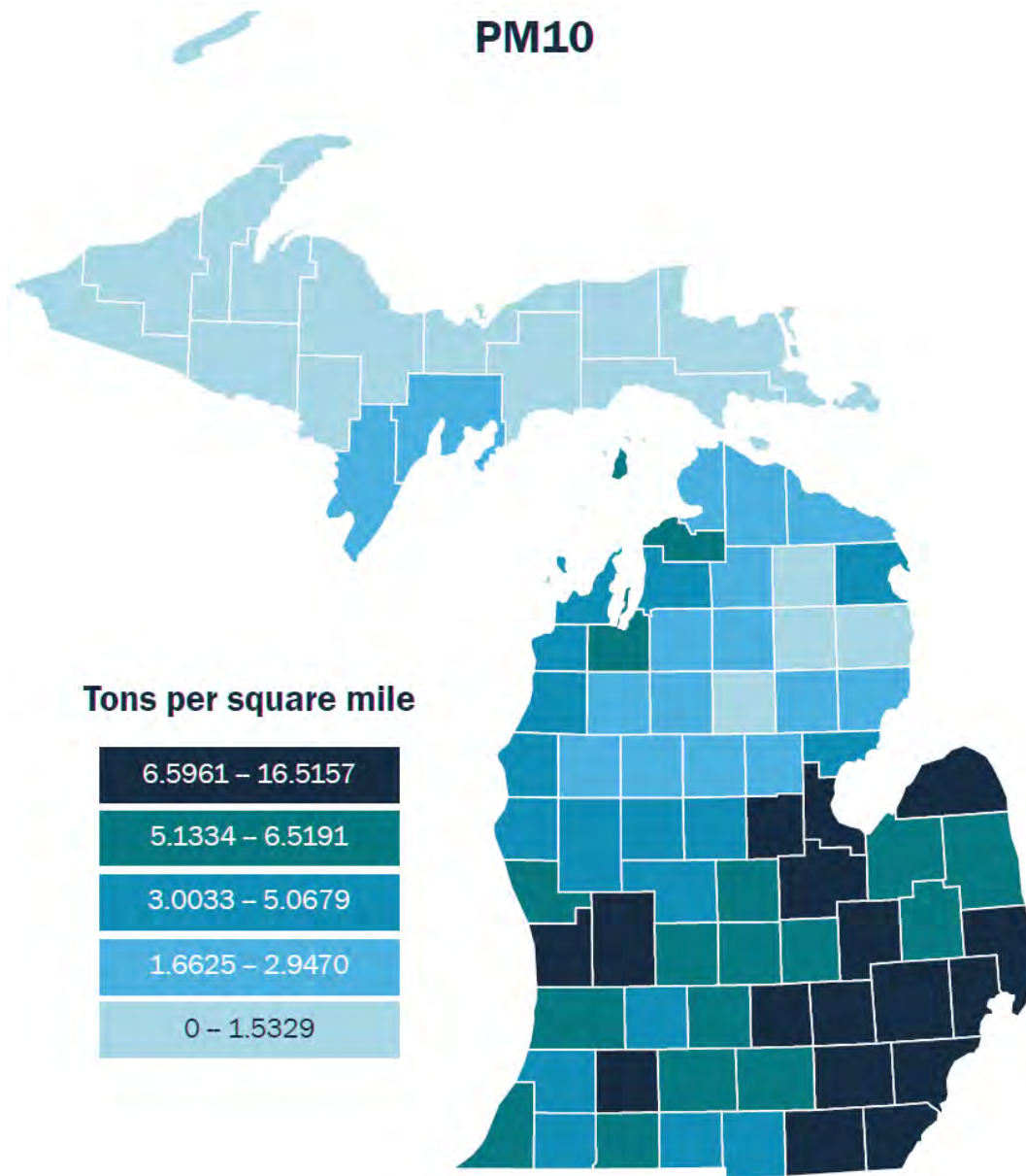


Figure 7.3: PM₁₀ Emissions in 2017



Since October 1996, all areas in Michigan have been in attainment with the PM₁₀ NAAQS. Due to the recent refocus upon PM_{2.5} and because of the relatively low concentrations of PM₁₀ measured in recent years, Michigan’s PM₁₀ network has been reduced to a minimum level. **Table 1.2** identifies the locations of PM₁₀ monitoring stations that were operating in Michigan during 2022. These monitors are located mainly in the state’s largest populated urban areas: three in the Detroit area and two in Grand Rapids. In late fall of 2020, Grand Rapids, Jenison, and Allen Park PM₁₀ continuous monitors (T640X), which also collect PM_{2.5} data, were installed.

Figure 7.4 shows the location of each PM₁₀ monitor. All PM₁₀ monitors are population-oriented monitors. A second PM₁₀ monitor was added to the Grand Rapids area in Jenison (**Figure 7.5**) based on the USEPA’s population requirements.

Figure 7.4: PM₁₀ Monitors in 2022

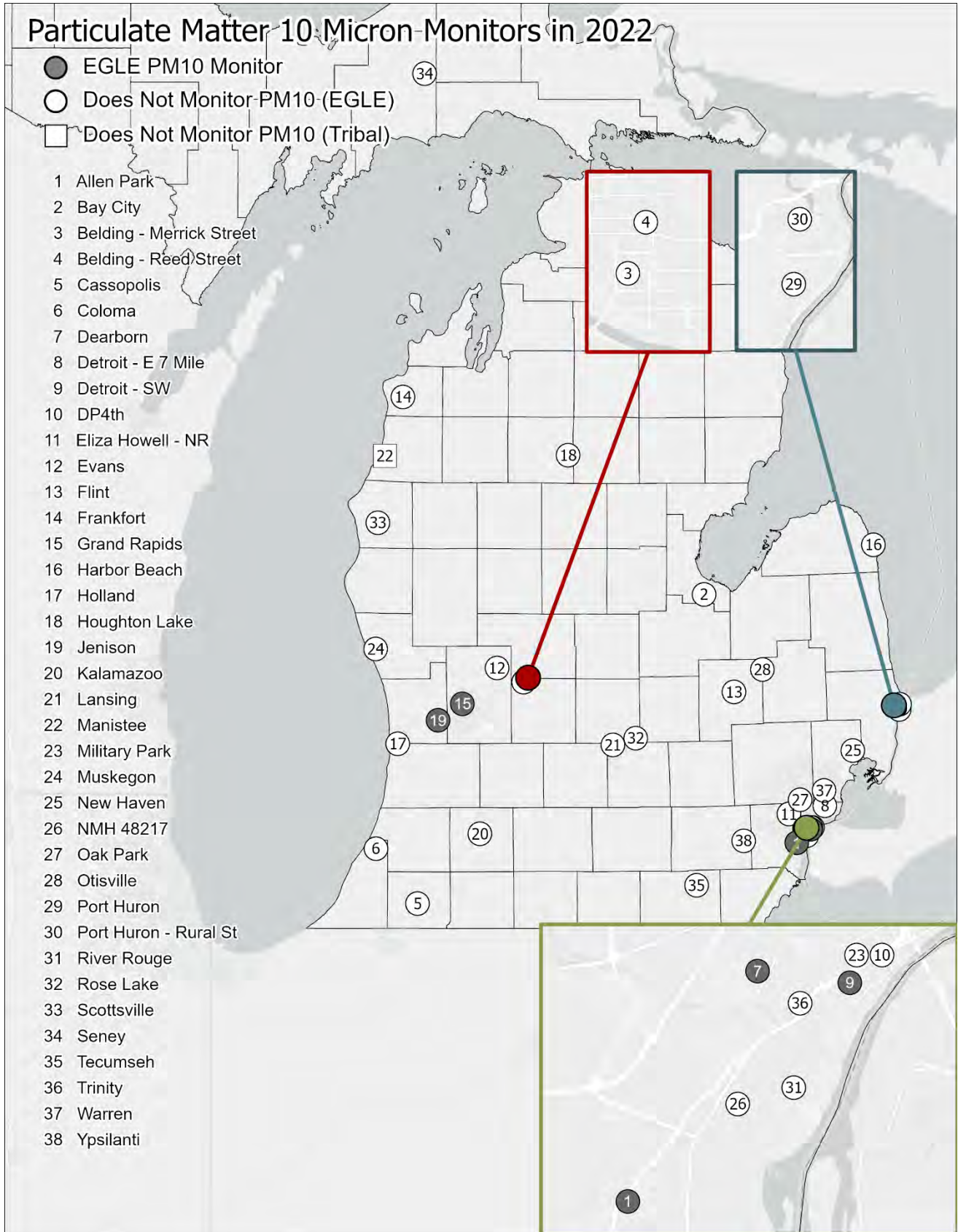


Figure 7.5 shows the PM₁₀ levels in Michigan compared to the 24-hour average NAAQS of 150 µg/m³. This standard must not be exceeded on average more than once per year over a 3-year period. The design value is the 4th highest value over a 3-year period. The PM₁₀ levels at all sites in Michigan are well below the national standard.

Figure 7.5: 24-Hour PM₁₀ Design Value

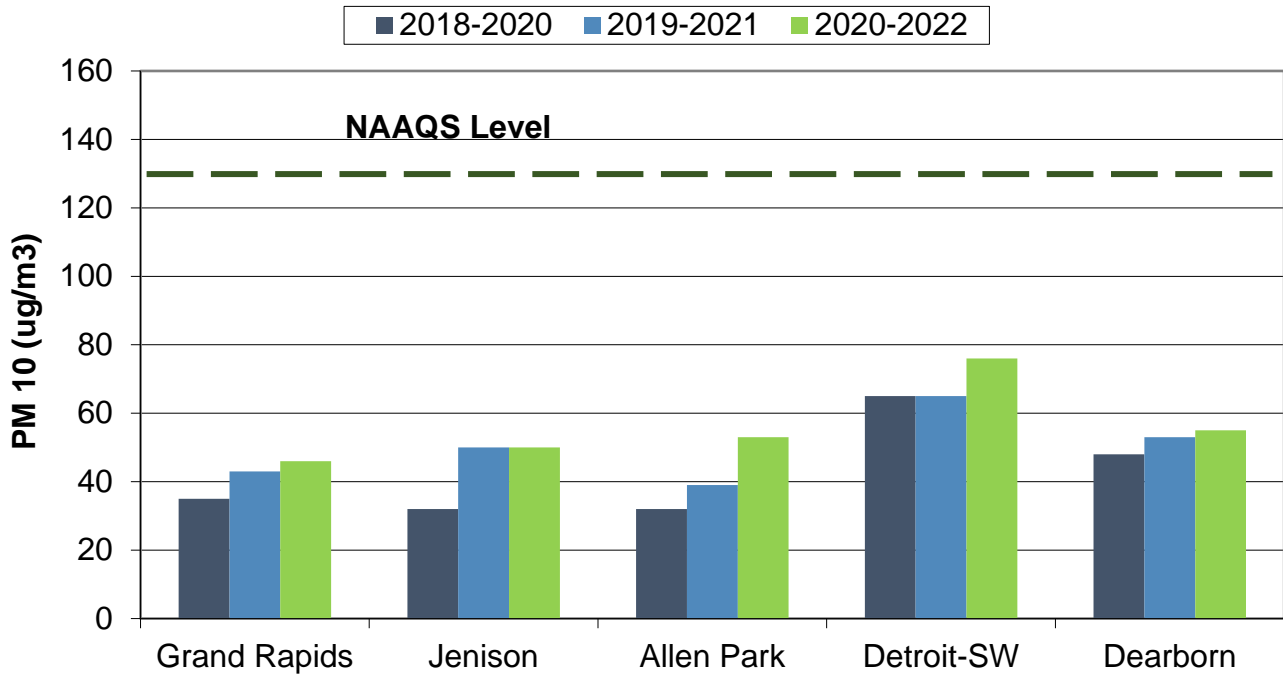
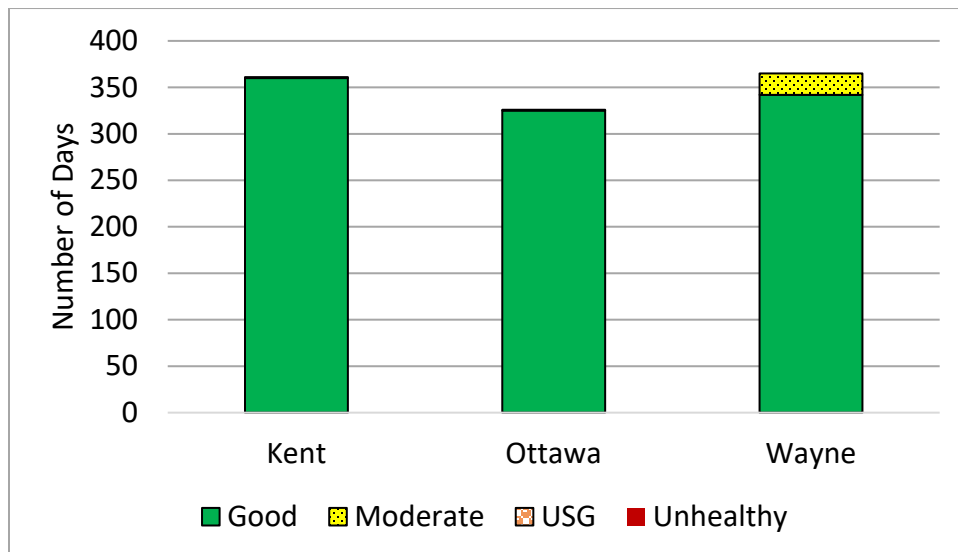


Figure 7.6 shows the AQI values per day in counties where PM₁₀ is monitored. All days were in the good AQI range except for one day in the moderate AQI range in Kent and Ottawa County and 23 days in the moderate AQI range in Wayne County.

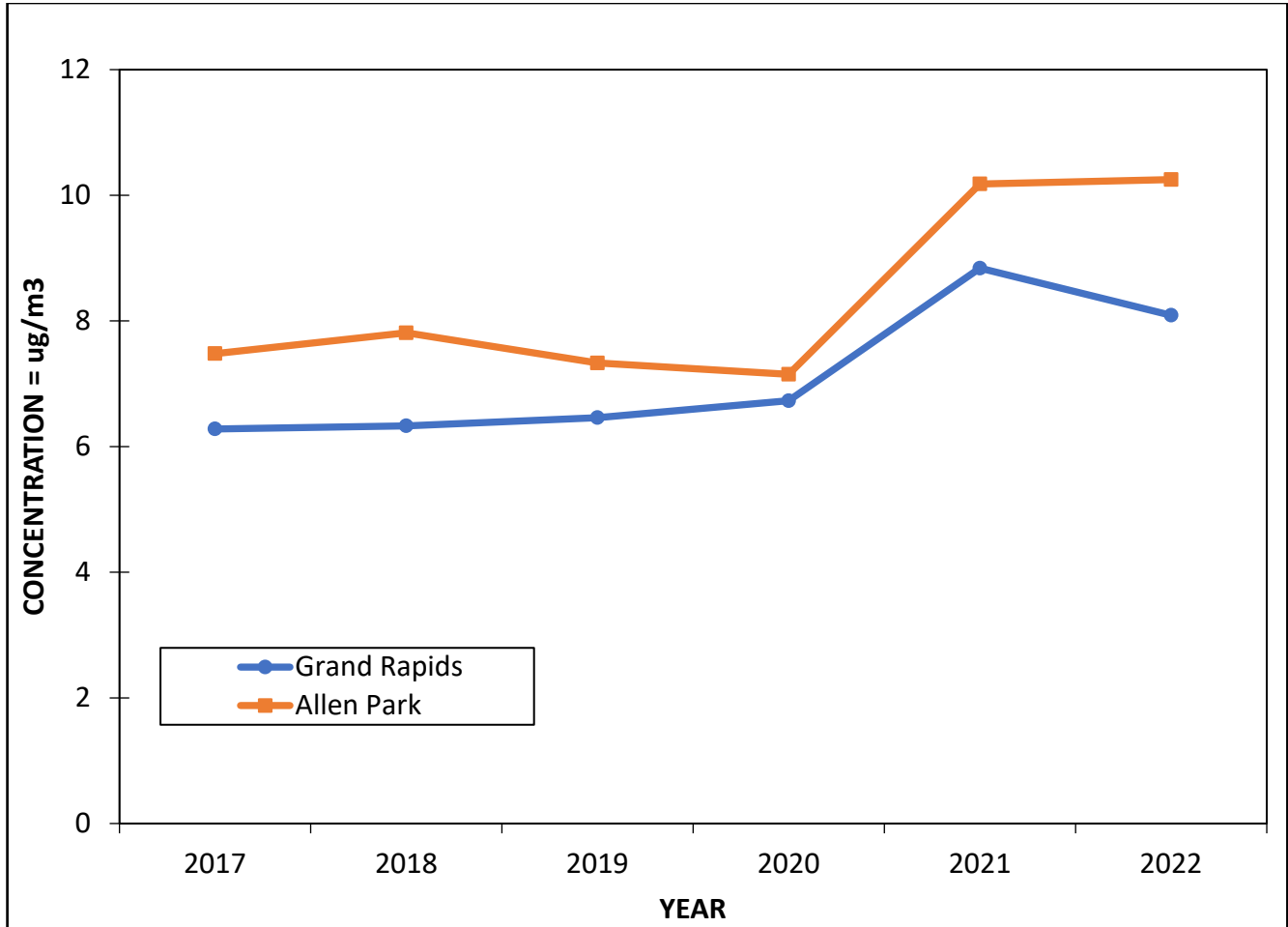
Figure 7.6: 2022 AQI Day for PM₁₀ in Michigan Counties



PM_{10-2.5}

The 2006 amended air monitoring regulations specified that measurements of PM coarse (PM_{10-2.5}) needed to be added to the NCore sites.⁷ EGLE began PM coarse monitoring at Allen Park and Grand Rapids in 2010. **Figure 7.7** shows the PM_{10-2.5} levels in Michigan.

Figure 7.7: PM Coarse Levels in Michigan from 2017-2022 (Annual Arithmetic Mean)



PM_{2.5}

In December 2012, the USEPA revised the annual primary standard to 12 µg/m³ while the annual secondary standard remained at 15 µg/m³. The primary and secondary 24-hour standard remained at 35 µg/m³. In December 2014, the USEPA determined that no area in Michigan violated the 2012 standard, and the state was classified as unclassifiable/attainment.

Figures 7.8 and 7.9 show PM_{2.5} emission sources and PM_{2.5} emissions by county (from the USEPA’s State and County Emission Summaries).

⁷ Current information can be found at [NCore Guidance Documents](#) | [AMTIC](#) | [TTN](#) | [US EPA](#) .

Figure 7.8: PM_{2.5} Emissions by Source Sector

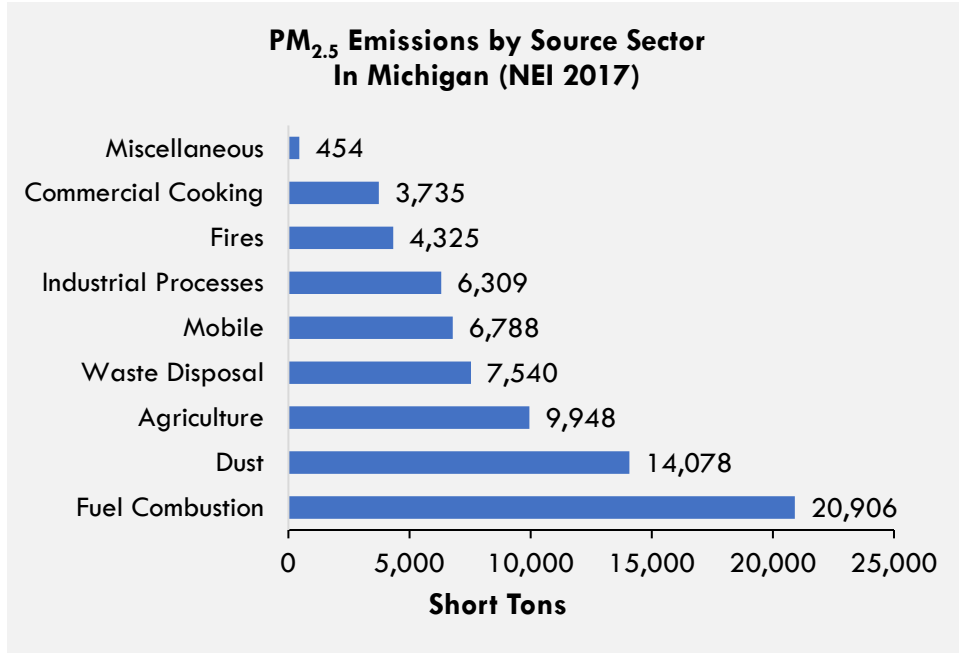
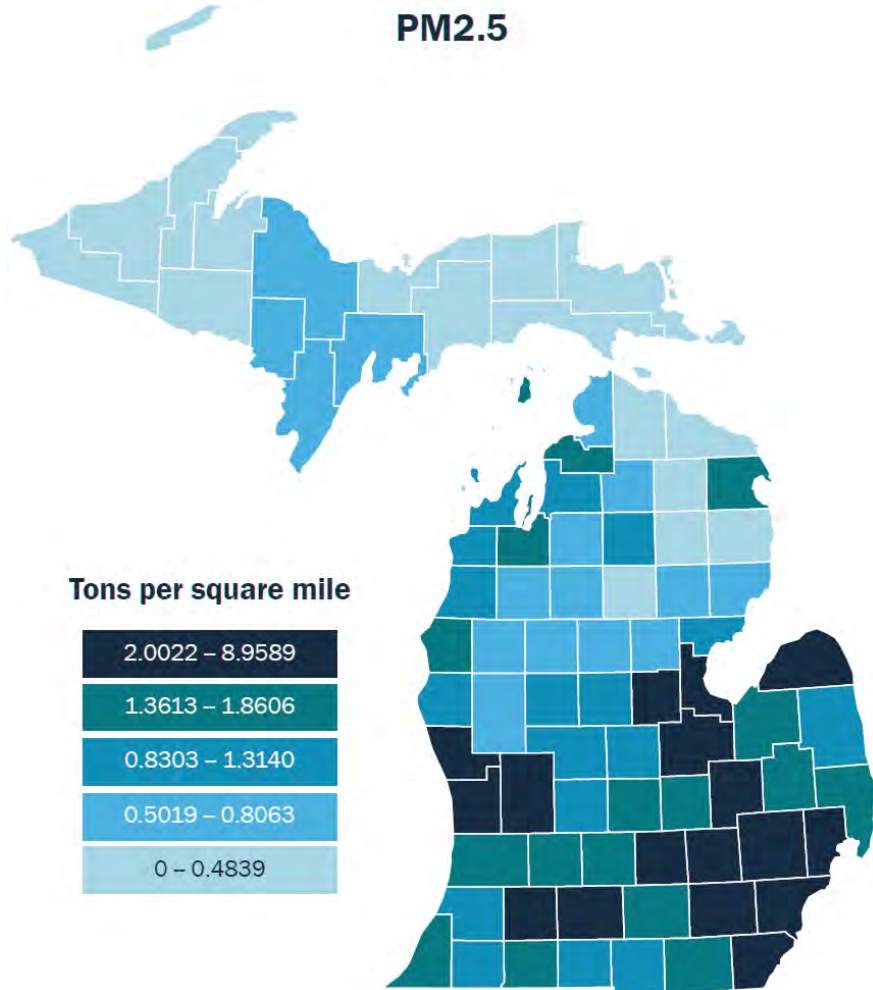


Figure 7.9: PM_{2.5} Emissions in 2017



Fine particulate matter ($PM_{2.5}$) is measured using three techniques: a filter-based FRM, Continuous Methods, and Chemical Speciation Methods. These methods are described in more detail in Appendix A.

$PM_{2.5}$ FRM Monitoring Network: $PM_{2.5}$ FRM filter-based monitors are deployed to characterize background or regional $PM_{2.5}$ transport collectively from upwind sources as well as population-oriented sites. Several changes occurred in the FRM network in 2022. See **Table 7.1** for the recent changes in PM monitoring.

Figure 7.10 shows the location of each $PM_{2.5}$ monitor.

- Loss of site access shut down: Livonia Near-roadway is being relocated, a suitable replacement is under construction.
- Collocation sites: Four $PM_{2.5}$ FRM monitoring sites are collocated with PM_{10} monitors to allow for $PM_{2.5}$ and PM_{10} comparisons.⁸ Collocated PM_{10} and $PM_{2.5}$ sites include Dearborn, Allen Park, Grand Rapids and Detroit-SW. Allen Park, Grand Rapids, Jenison, and Dearborn (installed 12/2022) also have collocated PM_{10} and $PM_{2.5}$ but monitors were switched from FRMs and TEOMs to continuous FEM T640X, which measure PM_{10} , $PM_{2.5}$, and PM coarse. The T640X particulate instruments determine the concentration of particulates in the air using a light scattering technique. The T640X is FEM for both $PM_{2.5}$ and PM_{10} , and then it subtracts the two to get PM coarse.
- Switched TEOMs to T640s: NMH 48217 switched to a T640 in July 2021 and Dearborn switched to a T640X in December 2022.
- Switched BAM to T640: Ypsilanti and Tecumseh switched Thermo BAMs to a T640 in September 2022. Ypsilanti is now running collocated T640s.

⁸ Requirements for $PM_{2.5}$ FRM sites are obtained from the Revised Requirements for Designation of Reference and Equivalent Methods for $PM_{2.5}$ and Ambient Air Quality Surveillance from PM [62 CFR 38763]; Guidance for Using Continuous Monitors in $PM_{2.5}$ Monitoring Networks [EPA-454/R-98-012, May 1998]; and Appendix N to Part 50 – Interpretation of the National Ambient Air Quality Standards for PM [40 CFR Part 50, July 1, 1998].

Table 7.1: Recent Changes in PM Monitoring

Site	AQS ID	Date Installed‡	Date Removed‡	FRM Removed	TEOM Removed	Thermo BAM Removed	TSP Removed	Hi-vol PM ₁₀ Removed	T640 Installed	T640X Installed	Met One BAM Installed	Thermo BAM Installed
Allen Park*	261630001	10/6/20	1/1/21		√		√	√		√		
Bay City	260170014	10/24/19	1/1/20	√	√						√	
DP4th	261630098	10/13/20				√			√			
Eliza Howell-NR	261630093	1/1/20									√	
Grand Rapids*†	260810020	10/22/20	1/1/21		√		√	√		√		
Holland	260050003	9/18/19	1/1/20	√							√	
Houghton Lake	261130001	11/28/18	1/1/19	√	√						√	
Jenison*	261390005	10/19/20	1/1/21	√				√		√		
Kalamazoo	260770008	10/20/20	1/1/21	√	√				√			
Lansing	260650018	9/20/20	1/1/21		√				√			
Military Park	261630100	9/25/20				√			√			
New Haven	260990009	11/4/20	1/1/21	√					√			
Port Huron	261470005	11/6/20	1/1/21	√	√				√			
Tecumseh	260910007	9/27/22				√			√			
Detroit-SW	261630015	9/29/20				√			√			
Trinity	261630099	10/5/20				√			√			
NMH 48217	261630097	7/22/21			√				√			
Dearborn	261630033	12/7/22	12/7/22		√					√		
Ypsilanti††	261610008	10/12/22	1/1/23	√		√			√			

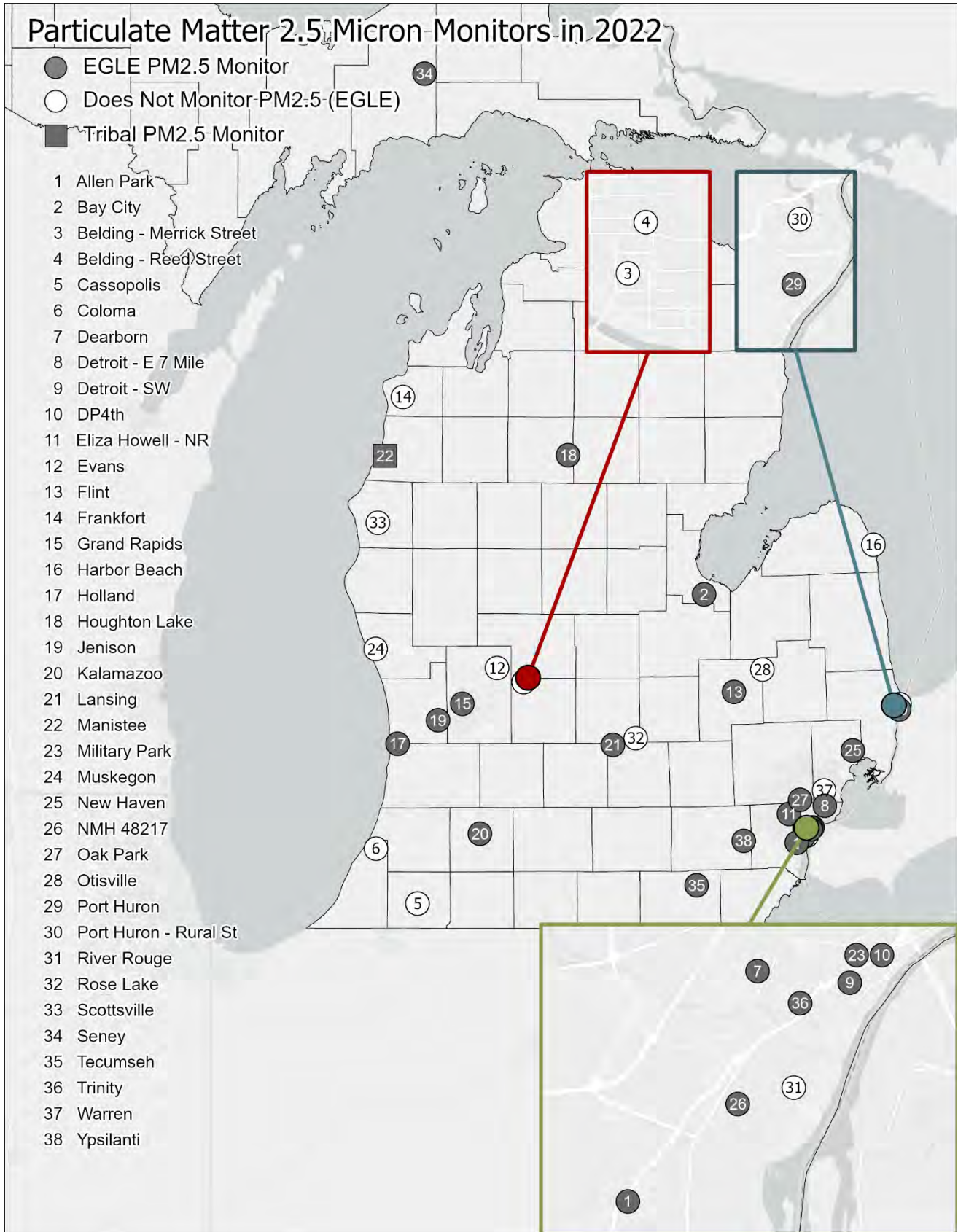
* Low volume FRM for coarse PM (PM_c) removed.

†Second FRM removed.

††Both collocated FRMs were removed, the Thermo BAM removed and is now running collocated T640s.

‡If both a date installed and date removed are indicated, the instruments were run in testing mode for that time period between the installed and removed date.

Figure 7.10: PM_{2.5} Monitors in 2022



Continuous PM_{2.5} Network:

Short-term measurements of PM_{2.5} or PM₁₀ are updated on an hourly basis using TEOM, BAM, or T640 instruments. At least one continuous monitor is required at the NCore PM_{2.5} monitoring site in a metropolitan area with a population greater than one million. Both Detroit (Allen Park) and Grand Rapids meet this requirement.⁹ Under the revised 2006 air monitoring regulations, 50 percent of the FRM monitoring sites are now required to have a continuous PM_{2.5} monitor. For Michigan, there are 10 FRM monitoring sites, seven of which also had TEOMs, T640s, or BAMs.

- T640X replaced TEOMs: The Dearborn PM_{2.5} TEOM and PM₁₀ TEOM was replaced by a T640X in December 2022.
- T640 replaced Thermo BAM: The Ypsilanti monitor had multiple changes. The Thermo BAM was switched to a T640 in September 2022, and a second collocated T640 was installed in October 2022. The collocated FRM was run until the end of 2022. Also, the Thermo BAM at Tecumseh was replaced by a T640.

Speciation Monitors:

Speciation monitors consist of filter-based, 24-hour monitors and continuous speciation monitors, aethalometers. Continuous monitors are used to determine diurnal changes in PM_{2.5} composition.

- 24-hour speciation monitors: Allen Park and Grand Rapids (NCore sites), Dearborn (NATTS site), and Detroit-SW. The Tecumseh speciation monitor was shut down in 2019. These monitors are placed in population-oriented stations in both urban and rural locations. PM_{2.5} chemical speciation samples are collected over a 24-hour period and analyzed to determine various components of PM_{2.5}. The primary objectives of the chemical speciation monitoring sites are to provide data that will be used to determine sources of poor air quality and to support the development of attainment strategies. Historical speciation data for Michigan indicates that PM_{2.5} is made up to 30 percent nitrate compounds, 30 percent sulfate compounds, 30 percent organic carbon, and 10 percent unidentified or trace elements.
- Aethalometers: Allen Park, Dearborn, and the GHIB project (DP4th, Trinity, Military Park and Detroit-SW started in 2018). These continuous monitors measure black carbon using light absorption techniques. Black carbon is a combustion by-product typical of transportation sources. In addition to causing adverse health effects, and black carbon absorbs light, contributing to climate change.

Table 1.2 in Chapter 1 shows all of Michigan's PM_{2.5} FRM monitoring stations operating in 2022 and denotes which sites have FRM, FEM, Speciation, or Aethalometer monitors in operation.

⁹ Under the Guidance for Using Continuous Monitors in PM_{2.5} Monitoring Networks [EPA-454/R-98-012, May 1998].

Table 7.2 provides the design value, the 3-year average of the annual mean PM_{2.5} concentrations for 2020-2022. Michigan’s levels are below the 12 µg/m³ primary standard.¹⁰

Table 7.2: 3-Year Average of the Annual Mean PM_{2.5} Concentrations For 2020-2022

Areas	County	Monitoring Sites	2020	2021	2022	2020-2022 Mean
Detroit-Ann Arbor	Lenawee	Tecumseh	8.2	8.5*	8.3	8.3
Detroit-Ann Arbor	Macomb	New Haven	6.0	9.7	8.8	8.2
Detroit-Ann Arbor	Oakland	Oak Park	7.4	8.2	6.8	7.5
Detroit-Ann Arbor	St. Clair	Port Huron	6.7	9.3	8.5	8.2
Detroit-Ann Arbor	Washtenaw	Ypsilanti	8.2	8.8	8.9	8.7
Detroit-Ann Arbor	Wayne	Allen Park	7.5	10.6	8.9	9.0
Detroit-Ann Arbor	Wayne	Detroit-E 7 Mile	7.5	8.3	7.2	7.6
Detroit-Ann Arbor	Wayne	Detroit-SW	9.1	11.0	11.8	10.6
Detroit-Ann Arbor	Wayne	Dearborn	9.4	10.3	9.3	9.7
Detroit-Ann Arbor	Wayne	Eliza Howell-NR	10.6	11.5*	11.0	11.0
Detroit-Ann Arbor	Wayne	NMH 48217	--	9.8*	9.5	9.7
Detroit-Ann Arbor	Wayne	DP4	9.6	11.1	9.8	10.2
Detroit-Ann Arbor	Wayne	Trinity	10.7	12.4	12.0	11.7
Detroit-Ann Arbor	Wayne	Military Park	10.9*	11.2	10.9	11.0
Flint	Genesee	Flint	6.0	7.3	8.2	7.2
Grand Rapids	Ottawa	Jenison	7.4	10.1	8.9*	8.8
Grand Rapids	Kent	Grand Rapids	7.7	10.3*	9.4	9.2
Allegan County	Allegan	Holland	6.0	7.0	6.7	6.6
Kalamazoo-Battle Creek	Kalamazoo	Kalamazoo	7.6	10.6	10.3	9.5
Lansing-East Lansing	Ingham	Lansing	7.1	9.6	8.7	8.5
Bay County	Bay	Bay City	4.7	6.1	6.4	5.8
Missaukee County	Missaukee	Houghton Lake	8.0*	9.0	8.9	8.6
Manistee County	Manistee	Manistee	5.1*	5.0*	4.2*	4.8
Schoolcraft County	Schoolcraft	Seney	4.6*	6.8	6.1	5.8

* Indicates site does not have a complete year of data.

¹⁰ For comparison to the standard, the average annual mean is rounded to the nearest 0.1 µg/m³.

Table 7.3 provides the 24-hour 98th percentile PM_{2.5} concentrations for 2020-2022 showing Michigan's levels are below the 35 µg/m³ standard (3-year average).¹¹

Table 7.3: 24-Hour 98th Percentile PM_{2.5} Concentrations for 2020-2022

Areas	County	Monitoring Sites	2020	2021	2022	2020-2022 Mean
Detroit-Ann Arbor	Lenawee	Tecumseh	18.7	18.9	23.0	20
Detroit-Ann Arbor	Macomb	New Haven	15.5	22.5	24.8	21
Detroit-Ann Arbor	Oakland	Oak Park	23.3	18.5	21.9	21
Detroit-Ann Arbor	St. Clair	Port Huron	16.6	22.6	21.3	20
Detroit-Ann Arbor	Washtenaw	Ypsilanti	19.8	17.8	25.5	21
Detroit-Ann Arbor	Wayne	Allen Park	26.3	22.7	25.7	25
Detroit-Ann Arbor	Wayne	Detroit-E 7 Mile	17.7	20.0	19.8	19
Detroit-Ann Arbor	Wayne	Detroit-SW	24.1	26.9	30.8	27
Detroit-Ann Arbor	Wayne	Dearborn	21.0	22.3	25.3	23
Detroit-Ann Arbor	Wayne	Eliza Howell-NR	23.2	24.3*	28.5	25
Detroit-Ann Arbor	Wayne	NMH 48217	--	21.6*	25.6	24
Detroit-Ann Arbor	Wayne	DP4th	22.9	24.2	26.4	25
Detroit-Ann Arbor	Wayne	Trinity	26.6	28.3	32.5	29
Detroit-Ann Arbor	Wayne	Military Park	27.8*	27.2	30.7	2
Flint	Genesee	Flint	14.5	16.8	19.9	17
Grand Rapids	Ottawa	Jenison	17.9	25.8	24.2*	23
Grand Rapids	Kent	Grand Rapids	17.6	25.4	24.9	23
Allegan County	Allegan	Holland	13.1	18.3	17.7	16
Kalamazoo-Battle Creek	Kalamazoo	Kalamazoo	18.0	26.5	29.4	25
Lansing-East Lansing	Ingham	Lansing	21.6	23.3	22.7	23
Bay County	Bay	Bay City	14.0	16.4	17.6	16
Missaukee County	Missaukee	Houghton Lake	15.2	18.7	17.0	17
Manistee County	Manistee	Manistee	13.3*	15.4*	18.2*	16
Schoolcraft County	Schoolcraft	Seney	10.6*	19.8	14.6	15

* Indicates site does not have a complete year of data.

¹¹ The 98th percentile value was obtained from the USEPA AQS. For comparing calculated values to the standard, the 3-year, 24-hour average is rounded to the nearest 1 µg/m³.

Figures 7.11 through 7.14 illustrate the current annual mean PM_{2.5} trend for each monitoring site in Michigan. For clarity, monitoring sites within the Detroit-Warren-Ann Arbor CSA have been separated into two graphs.

Figure 7.11 shows the 2022 levels in Wayne County remain below the PM_{2.5} NAAQS standard based on a 3-year average. Historically, Dearborn has had the highest concentrations in the state, but Trinity now has the highest concentrations. The GHIB sites are included in these graphs.

Figure 7.12 contains the remainder of those sites in the Detroit-Warren-Flint CSA that are outside of Wayne County. These sites also show readings in 2022 are below the PM_{2.5} NAAQS.

Figure 7.13 combines the PM_{2.5} monitoring sites located in West Michigan Grand Rapids-Kentwood-Muskegon CSA, Kalamazoo, and Benton Harbor MSAs. All sites are below the annual PM_{2.5} NAAQS.

Figure 7.14 displays the remaining monitoring sites in the Northern Lower and Upper Peninsulas. All sites are below the annual PM_{2.5} NAAQS standard.

Figure 7.11: Detroit-Warren-Ann Arbor CSA (Wayne County Only), Annual Arithmetic Means for PM_{2.5} from 2017-2022

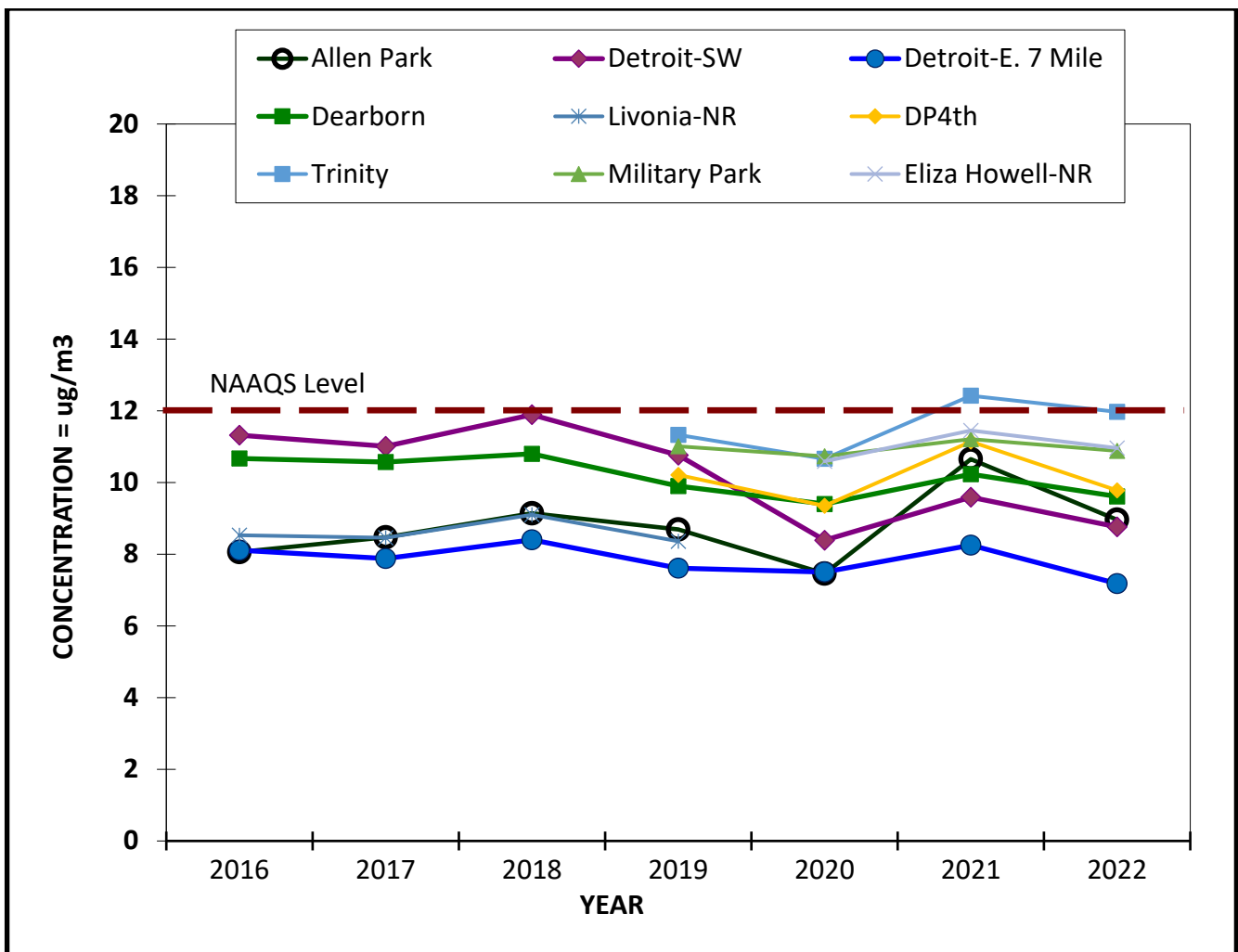


Figure 7.12: Detroit-Warren-Ann Arbor CSA (Without Wayne County), Annual Arithmetic Means for PM_{2.5} from 2017-2022

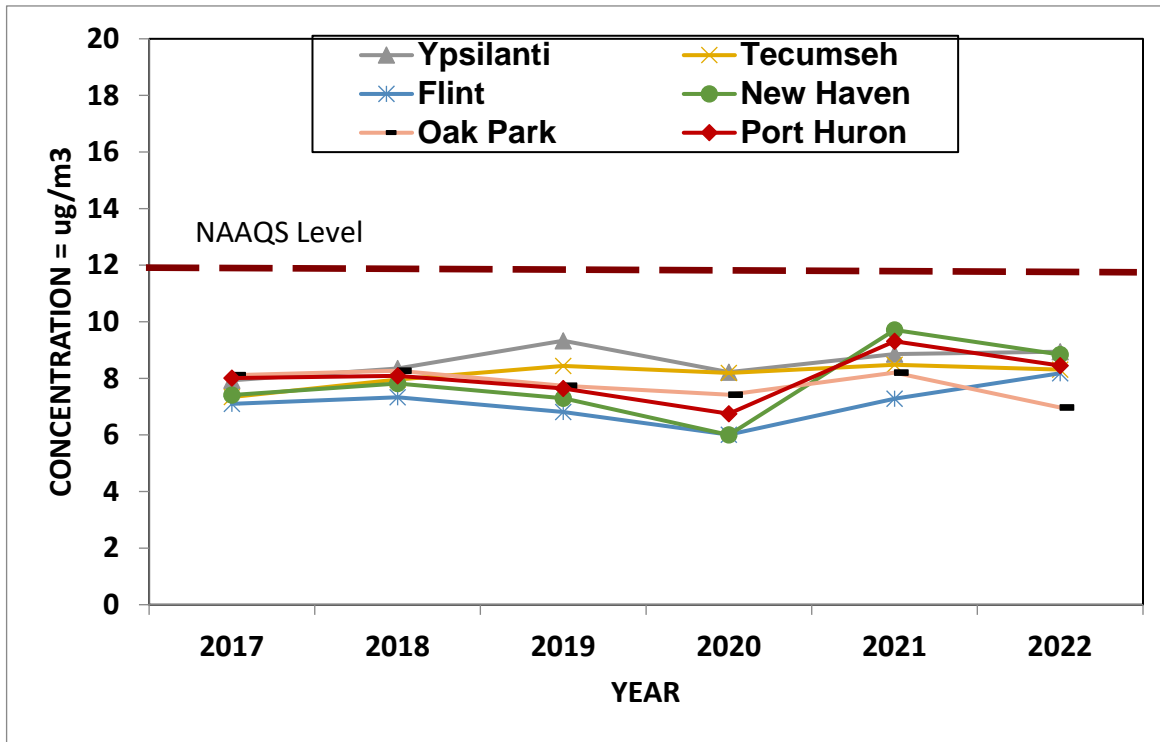


Figure 7.13: West Michigan Grand Rapids-Kentwood-Muskegon CSA, Kalamazoo, and Benton Harbor MSAs, Annual Arithmetic Means for PM_{2.5} from 2017-2022

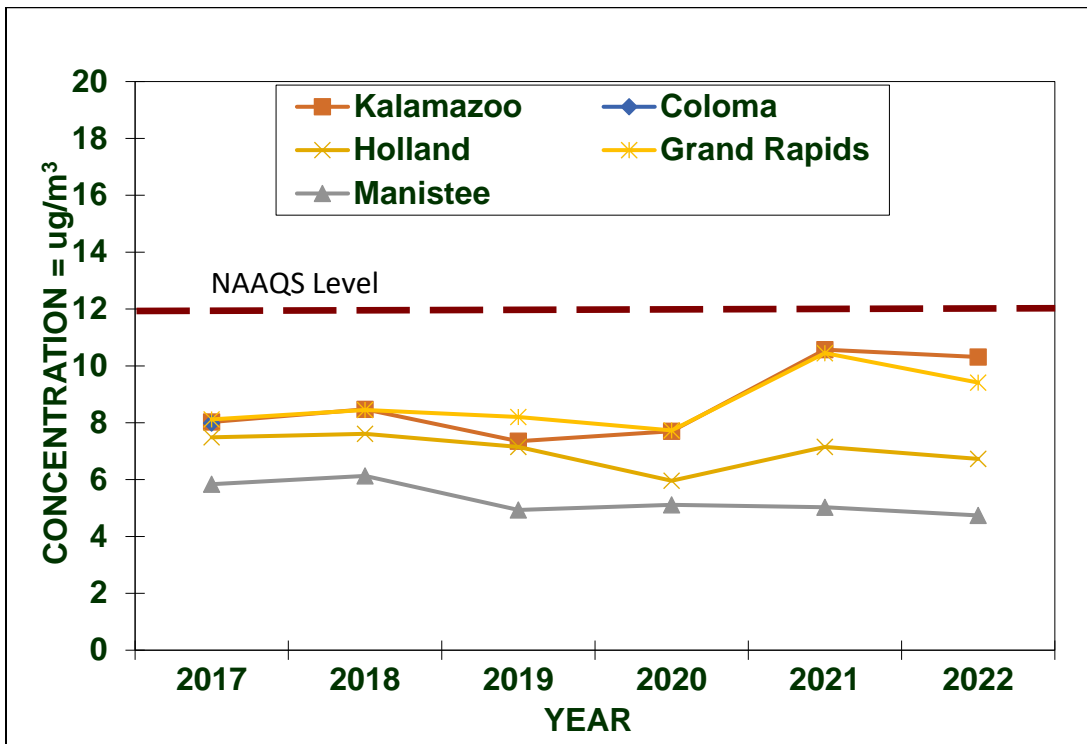


Figure 7.14: Lansing-East Lansing MSA, Bay City MSA, Cadillac MiSA and Upper Peninsula Annual Arithmetic Means for PM_{2.5} from 2017-2022

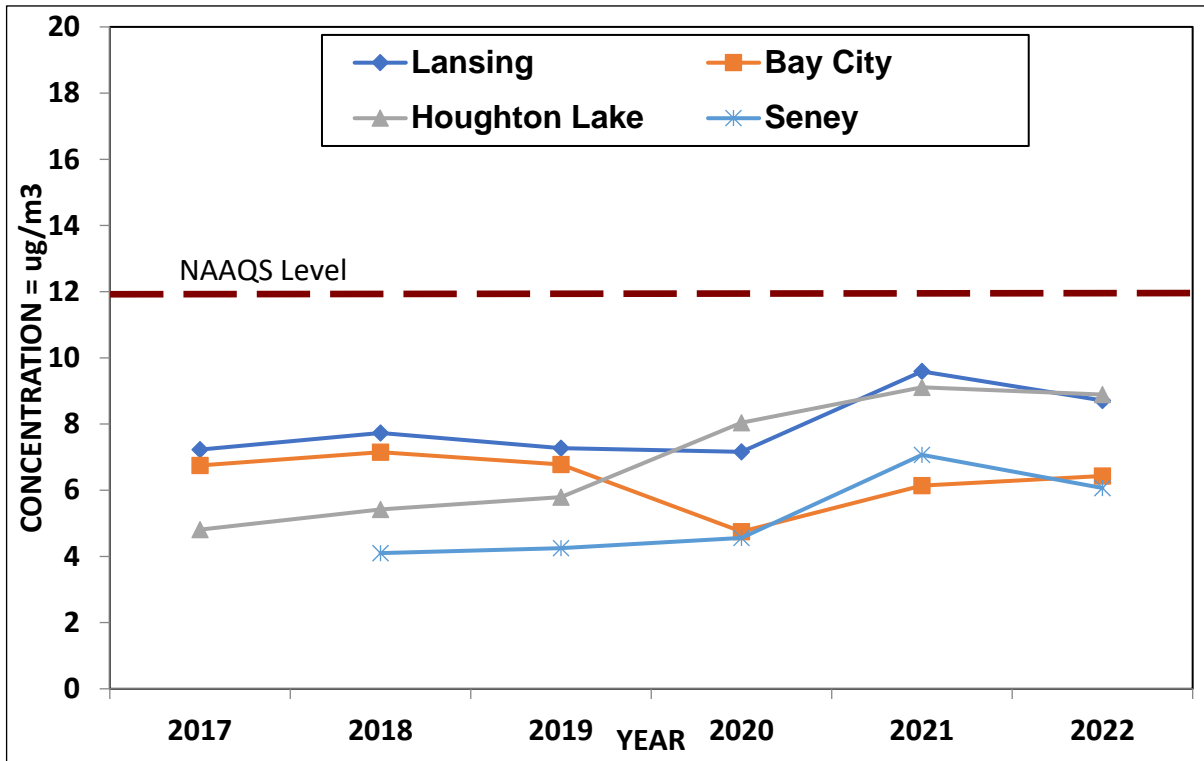
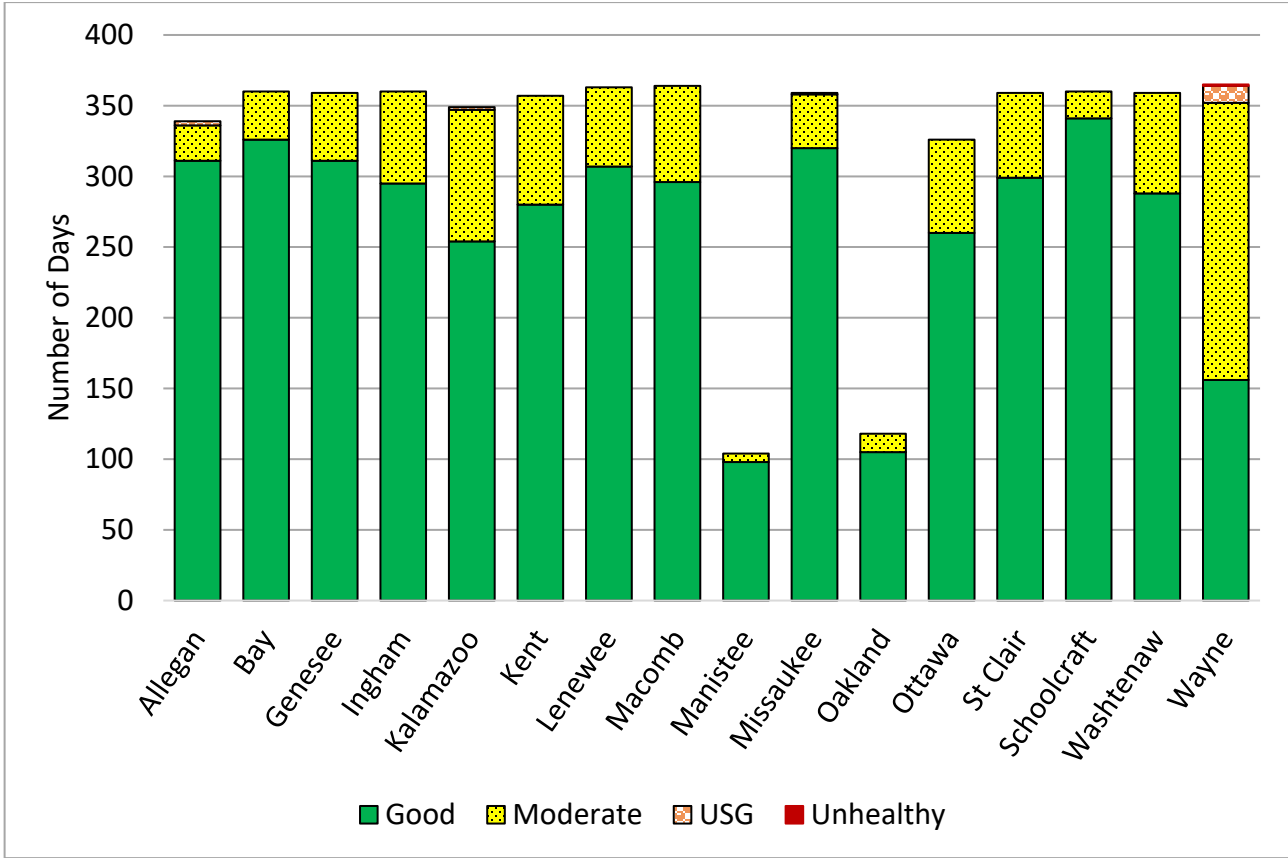


Figure 7.15 shows the AQI values per day in counties where PM_{2.5} is monitored. Most days were in the good to moderate AQI range. Four counties had days in the USG AQI range; Allegan, Kalamazoo, Missaukee, and Wayne. Wayne County also had one day in the Unhealthy Group.

Figure 7.15: 2022 AQI Days for PM_{2.5} in Michigan



CHAPTER 8: TOXIC AIR POLLUTANTS

The AQD monitors outdoor air for a wide variety of substances classified as toxic air pollutants. Toxic air pollutants, or air toxics, are different than the six criteria pollutants discussed in previous chapters. Under the Clean Air Act, the USEPA regulates a specific subset of air toxics called Hazardous Air Pollutants (HAPs), of which there are 188 ([EPA.gov/HAPS](https://www.epa.gov/haps)).

Sources: Air toxics can come from stationary sources including factories and power plants. Mobile sources, such as cars and trucks, also emit air toxics. Natural sources of air toxics include forest fires and volcanic eruptions.

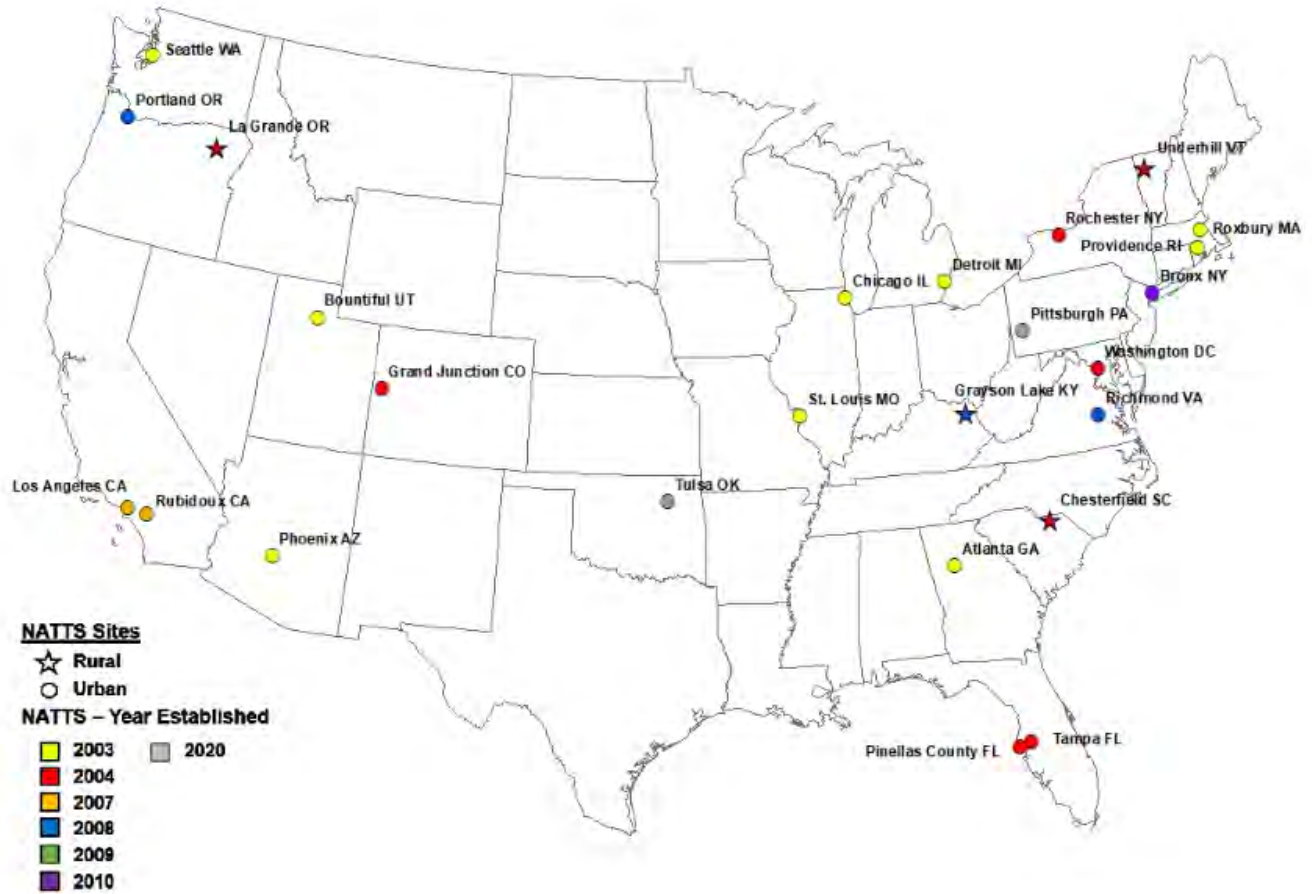
Effects: Once air toxics enter the body, there is a wide range of potential health effects. They include: the aggravation of asthma; irritation to the eyes, nose, and throat; carcinogenicity (causing cancer); developmental toxicity (birth defects); nervous system effects; and various other effects. Some effects appear after a short period of intense exposure, while others may appear after relatively lower long-term exposure, or after a long period of time has passed since the exposure ended. Most toxic effects are not unique to one substance. For example, both acidic and basic compounds may affect the nose. And some effects may be of concern only after the substance has deposited to the ground or to a water body (e.g., mercury, dioxin), followed by human exposure after eating fish or produce that has accumulated the substance. Additionally, various people may have a broad range of susceptibility to air toxics.

Population most at risk: People with asthma, children, and older adults are at highest risk from exposure to air toxics.

National Monitoring Efforts and Data Analysis

Michigan participates in a national program that identifies air toxics levels, detects trends, and prioritizes air toxics research. The AQD operates a site in Dearborn that is part of the USEPA's National Air Toxics Trend Sites (NATTS). The purpose of the NATTS network is to detect trends in high-risk air toxics such as benzene, formaldehyde, chromium, and 1,3-butadiene; and to measure the progress of air toxics regulatory programs at the national level. Currently, the NATTS network contains 27 stations; 20 urban and seven rural (see **Figure 8.1**). The USEPA requires that the NATTS sites measure VOCs, carbonyls, PAHs, and trace metals on a once-every-six-day sampling schedule. The Dearborn NATTS site measures trace metals as TSP, PM₁₀, and PM_{2.5}.

Figure 8.1: National Air Toxics Trends Sites



How Does EGLE AQD Evaluate Air Toxics in Michigan?

The AQD samples the air for toxics using a network of air monitors similar to the national network shown above. Michigan’s air toxics monitors are typically located in urban areas. **Table 8.1** lists the air toxics monitoring stations and what category of air toxic was measured at each station in 2022.

Table 8.1: 2022 Toxics Sampling Sites

Site Name	VOC	Carbonyl	PAHs	Metals TSP	Metals PM ₁₀	Speciated PM _{2.5}
Allen Park						x
Dearborn	x	x	x	x	x	x
Detroit-SW	x	x		x		x
Grand Rapids						x
Belding-Merrick St.				x		
NMH 48217				x		
Port Huron-Rural St.				x		
River Rouge		x		x		
DP4th				x		
Military Park				x		
Trinity				x		
New Haven		x				

Categories of Air Toxics:

- **Metals:** Examples include aluminum, arsenic, barium, beryllium, cadmium, chromium, cobalt, copper, iron, lead, manganese, mercury, molybdenum, nickel, vanadium, and zinc.
- **Organic Substances:** Further divided into sub-categories that include:
 - VOCs, including benzene (found in gasoline), perchloroethylene (emitted from some dry-cleaning facilities), and methylene chloride (a solvent and paint stripper used by industry);
 - Carbonyl compounds; e.g., formaldehyde, acetone, and acetaldehyde; and
 - Polycyclic aromatic hydrocarbons (PAHs); e.g., benzo(a)pyrene and naphthalene.
- **Other substances:** Asbestos, dioxin, and radionuclides such as radon.

Each category of air toxic must be collected using specific sampling devices. For example, VOCs are collected in metal canisters, carbonyls are collected in plastic cartridges, and metals are collected on quartz filter paper. Metals are also collected in various size fractions; e.g., PM_{2.5}, PM₁₀ and TSP. Air toxics are sampled for 24 hours (midnight to midnight), typically once every six or every 12 days. Once a sample has been collected it is either dropped off or mailed to a laboratory for analysis.

At the end of every year the air toxics monitoring data is tabulated into summary tables (see Appendix B); one table for every monitoring site. These air toxics summaries provide statistics about each pollutant measured at that location over the year. Examples of data in the tables include how many samples were taken over the year, how many samples were above the method detection limit, and what the annual average air concentration for a specific air toxic is at that location. This year's air toxics data also contains the regional annual averages for specific air pollutants for comparison. These concentrations were obtained from the USEPA data repository called Air Quality Subsystem ([EPA.gov/AQS](https://www.epa.gov/aqs)). The three NATTS sites chosen for calculating a regional average were Chicago, Illinois (170314201), St. Louis, Missouri (295100085), and Pittsburgh, Pennsylvania (420030008). These monitors are in urban sites in close proximity to Michigan.

Evaluation of Air Monitoring Data

The evaluation of air toxics measurements is difficult due to several factors. There are no federal air quality standards like the NAAQS for air toxics. Michigan has developed health-based screening levels, however, the screening levels are derived for use in Michigan's air new source review permitting program and are not comparable to levels measured in the ambient air. Other challenges in evaluating air toxics include:

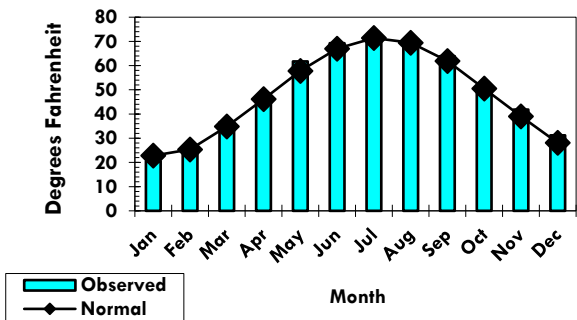
- No scientific consensus on how to account for the potential cumulative or interactive toxic effects from exposure to all substances in ambient air.
- For some air toxics, the analytical detection limits are not low enough to consistently measure the amount present.
- Air toxics also pose a challenge due to monitoring and analytical methods that are either unavailable for some compounds (e.g., poly- and perfluoroalkyl substances or PFAS) or cost-prohibitive for others (e.g., dioxins).
- Timeliness: After an air sample is collected it takes several weeks or months (depending on the type of pollutant) to get the analytical results back from the laboratory.

Most of Michigan's air toxics levels are lower or in the same range as other air toxics levels in the region (see Appendix B).

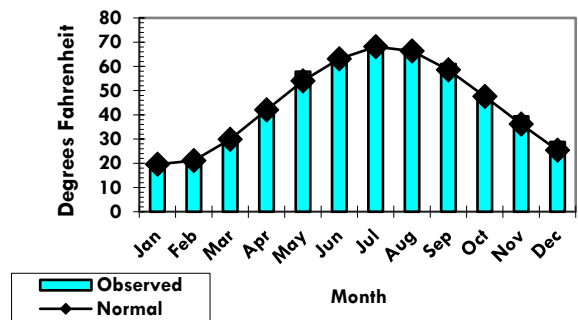
CHAPTER 9: METEOROLOGICAL INFORMATION

Figures 9.1 through 9.3 show average daily temperatures, and Figures 9.4 through 9.6 show total monthly precipitation amounts compared to their climatic norms for sites in the Northern Lower, Southern Lower, and Upper Peninsulas. These figures were constructed by averaging data from several National Weather Service stations and therefore are not meant to be representative of any one single location in Michigan. Instead, they are intended to depict the regional trends that occurred during the year 2022.

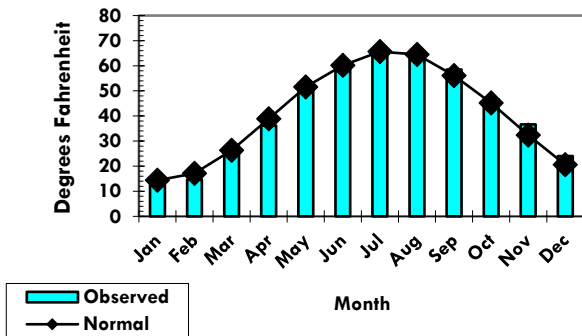
**Figure 9.1: Southern Lower Peninsula
Observed Average Monthly Temperatures vs.
Normal Average Monthly Temperatures**



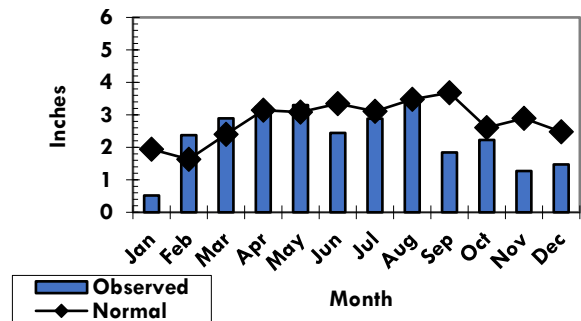
**Figure 9.2: Northern Lower Peninsula
Observed Average Monthly Temperatures vs.
Normal Average Monthly Temperatures**



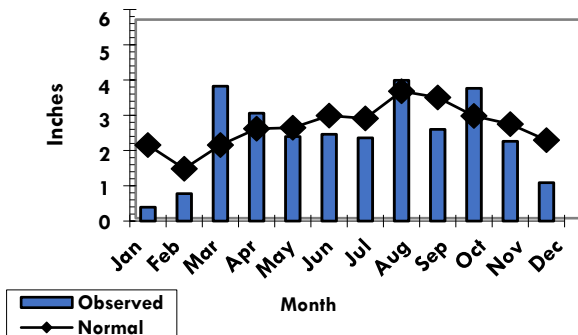
**Figure 9.3: Upper Peninsula
Observed Average Monthly Temperatures vs.
Normal Average Monthly Temperatures**



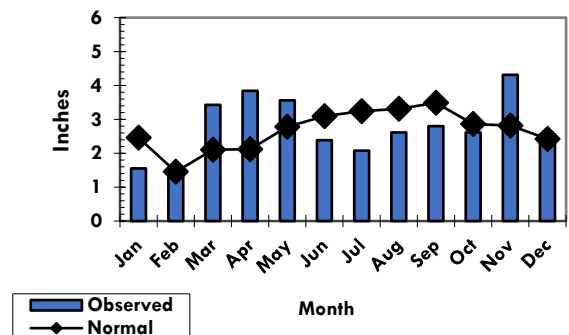
**Figure 9.4: Southern Lower Peninsula
Observed Monthly Precipitation vs.
Normal Monthly Precipitation**



**Figure 9.5: Northern Lower Peninsula
Observed Monthly Precipitation vs.
Normal Monthly Precipitation**



**Figure 9.6: Upper Peninsula
Observed Monthly Precipitation vs.
Normal Monthly Precipitation**



CHAPTER 10: SPECIAL PROJECTS

Gordie Howe International Bridge (GHIB)

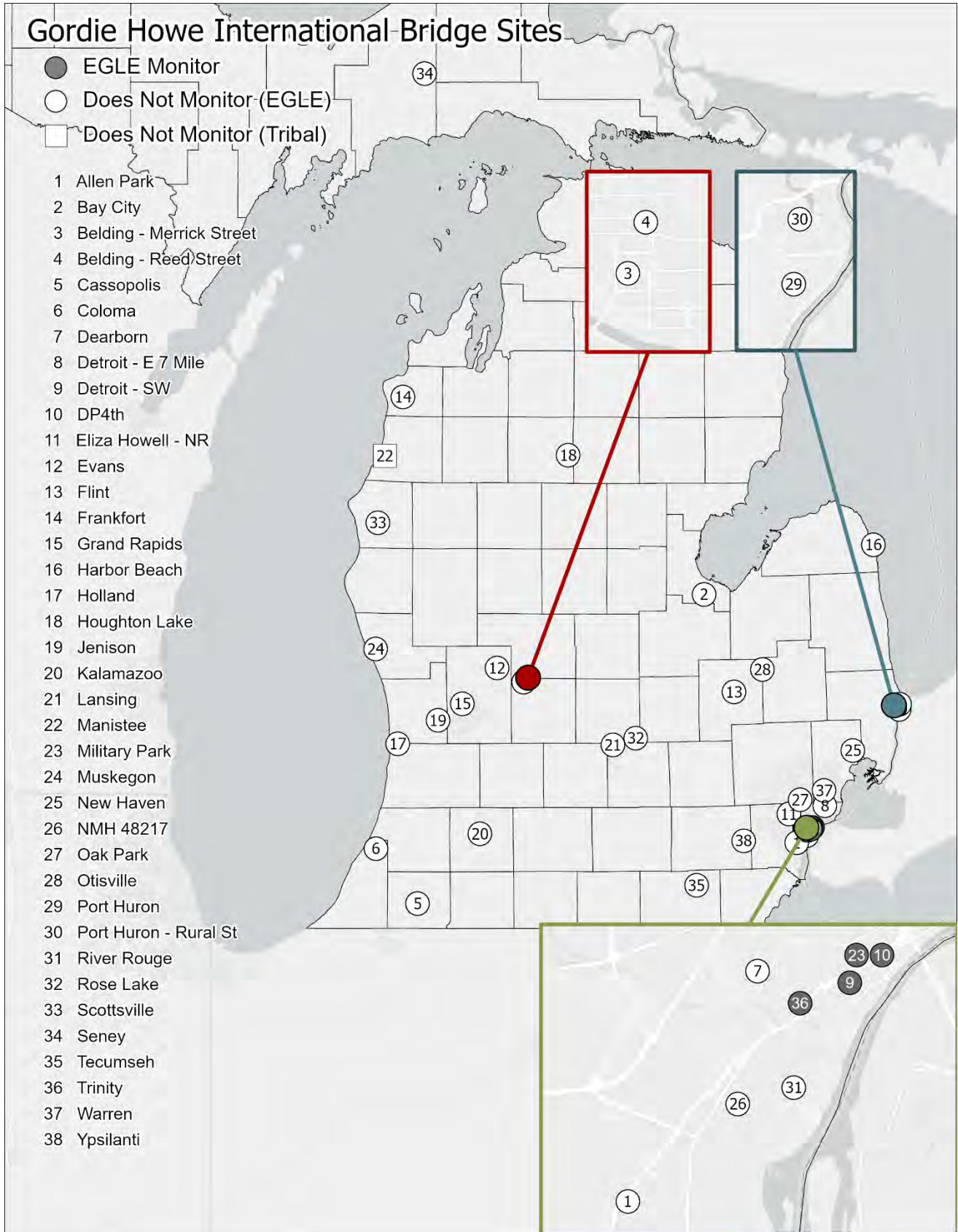
In a joint Canadian-American venture, the GHIB is being constructed to link Windsor, Ontario and Detroit, Michigan. Demolition and earthmoving work for the project was conducted in 2017-2019 and construction activities began in 2020 with some delays due to the COVID 19 pandemic. The bridge is anticipated to open sometime in the 2024-2025 timeframe. For additional information about the bridge construction, go to: [Gordie Howe International Bridge](#).

EGLE added three new air monitoring sites in 2017-2018 to conduct community ambient air quality monitoring in the Delray community. The three new sites were added to monitor air pollutants before, during, and after construction of the bridge. In addition, NO_x, continuous PM_{2.5}, and black carbon were added to the existing Detroit-SW (261630015) monitoring site for this project. The sites include:

- **Trinity (261630099):** Meteorological parameters, NO_x, SO₂, CO, continuous PM_{2.5}, black carbon, and five trace metals (Pb, Mn, As, Cd, and Ni).
- **DP4th (26160098):** NO_x, SO₂, CO, continuous PM_{2.5}, black carbon, and five trace metals (Pb, Mn, As, Cd, and Ni).
- **Military Park (261630100):** NO_x, SO₂, continuous PM_{2.5}, black carbon, and five trace metals (Pb, Mn, As, Cd, and Ni).
- **Detroit-SW (261630015):** Meteorological parameters, NO_x, SO₂, continuous PM_{2.5}, Speciated, PM₁₀, black carbon, VOCs, carbonyls, and five trace metals (Pb, Mn, As, Cd, and Ni).

The data from these sites is reported, along with the other sites in the previous chapters and in the following appendices. Monitor locations relevant to the GHIB are shown in **Figure 10.1**.

Figure 10.1: Gordie Howe International Bridge Sites



Stellantis

On October 4, 2022, outdoor air sampling was conducted on the FCA (Stellantis) US LLC Detroit Assembly Complex - Mack ("DACM") property, located at 4000 St. Jean, Detroit, Wayne County, Michigan. The purpose of the sampling was to determine whether community odor complaints were linked to specific air pollutants exiting the building at points other than the stacks, including doorways, vents, openings, or storage piles. These types of releases are called "fugitive emissions." All samples were taken on the DACM property and are **not** considered ambient air.

The objective of the outdoor sampling was to identify which possible chemical compounds could be the source of community concerns and odor complaints EGLE is receiving based on odor thresholds and chemical process fingerprints. The sampling was also conducted to identify possible chemicals for future evaluations.

The compounds of interest included VOCs, esters, naphthas, glycol ethers, alcohols, and aldehydes. Sampling was conducted at five locations surrounding the paint shop and a sixth site on the northeast corner of the property. The final report with the results can be found at: [Detroit Assembly Complex Stellantis On-Site Sampling Report, Mack Avenue, Detroit, Michigan](#)

City of Kalamazoo

In May 2022, the AQD conducted experimental drone flights over the City of Kalamazoo's Wastewater Treatment Plant (WWTP), located at 1415 Harrison Street, Kalamazoo, Michigan. These drone flights were part of an experimental sampling study using several pollutant sensors to evaluate fugitive emissions. The drone was equipped with sensors to measure VOCs, hydrogen sulfide, sulfur dioxide, nitrogen oxide, and formaldehyde. Elevated levels of formaldehyde were detected in several locations by the drone's electrochemical sensor. Due to the nature of that study, sensor data were used to indicate that further investigation was needed.

To evaluate whether formaldehyde was present in communities near the WWTP, a short-term sampling study was conducted. Sampling was conducted in four locations: a neighborhood west of the WWTP, on the western perimeter of the WWTP, at the Open Roads Bike Program to the east, and at the AQD's Kalamazoo air monitoring site. Sampling was conducted for five days at all four locations. The final report with the results can be found at: [Kalamazoo Community Sampling Report 2022](#).

Appendix A: Criteria Pollutant Summary for 2022

Appendix A utilizes the USEPA's 2022 Air Quality System (AQS) Quick Look Report Data to present a summary of ambient air quality data collected for the criteria pollutants at monitoring locations throughout Michigan. Concentrations of non-gaseous pollutants are generally given in $\mu\text{g}/\text{m}^3$ and in ppm for gaseous pollutants. The following define some of the terms listed in **Appendix A** reports.

Site I.D.: The AQS site ID is the USEPA's code number for these sites.

POC: The Parameter Occurrence Code or POC is used to assist in distinguishing different uses of monitors, i.e., under Pb, NO_2 , and SO_2 , POC #1-5 are used to help differentiate between individual monitors. For PM, the POC numbers are used more for the type of monitoring, such as:

- 1 – FRM or FEM;
- 2 – Typically collocated FRM or FEM;
- 3 – TEOM hourly PM_{10} and $\text{PM}_{2.5}$ measurements; and
- 5 – $\text{PM}_{2.5}$ speciation monitors (shown at right is a Met One SASS – Speciation air sampling system).

OBS: For Pb, TSP, $\text{PM}_{2.5}$, and PM_{10} , the #OBS (number of observations) refers to the number of valid 24-hour values gathered.

For continuous monitors (CO , NO_2 , O_3 , $\text{PM}_{2.5}$, TEOM, BAM, T640, T640X, and SO_2), #OBS refers to the total valid hourly averages obtained from the analyzer.

Values: The value is listed for each criteria pollutant per its NAAQS (primary and secondary). The number of exceedances per site for the primary and secondary standards utilize running averages for continuous monitors (except for O_3) and does not include averages considered invalid due to limited sampling times. For example, a particulate mean based only on six months could not be considered as violating the annual standard. As noted, each site is allowed one short-term standard exceedance before a violation is determined.

Wtd. Arith. Mean: Weighted Arithmetic Mean. The annual mean is weighted by calendar quarter for the year. Averages are calculated for each quarter and the quarterly means are used to calculate the annual mean.



Air Quality Annual Report 2022

Criteria Pollutant Summary For 2022

CO Measured in ppm

Site ID	POC	City	County	Year	# OBS	1-hr Highest Value	1-hr 2 nd Highest Value	1-hr OBS > 35	8-hr Highest Value	8-hr 2 nd Highest Value	8-hr OBS > 9
260810020	1	Grand Rapids	Kent	2022	7500	1.6	1.5	0	1.2	1.2	0
261630001	1	Allen Park	Wayne	2022	7876	1.9	1.8	0	1.2	1.1	0
261630093	1	Eliza Howell-NR	Wayne	2022	8558	2.2	2.2	0	2.0	1.7	0
261630098	1	DP4th	Wayne	2022	8103	2.3	2.2	0	1.6	1.6	0
261630099	1	Trinity	Wayne	2022	8073	2.4	2.3	0	1.6	1.5	0

Pb (24-hour) measure in µg/m³

Site ID	POC	City	County	Year	# OBS	Highest rolling 3-month Arith Mean	Highest Value (24-hr)	2 nd Highest Value (24-hr)
260670003	1	Belding-Merrick St.	Ionia	2022	55	0.06	0.577	0.126
261470031	1	Port Huron-Rural St.	St. Clair	2022	60	0.04	0.216	0.166
261630005	1	River Rouge	Wayne	2022	58	0.01	0.034	0.022
261630015	1	Detroit-SW	Wayne	2022	58	0.01	0.029	0.024
261630033	1	Dearborn	Wayne	2022	58	0.02	0.231	0.54
261630097	1	NMH 48217	Wayne	2022	61	0.01	0.014	0.008
261630098	1	DP4th	Wayne	2022	61	0.01	0.016	0.013
261630099	1	Trinity	Wayne	2022	61	0.01	0.024	0.022
261630100	1	Military Park	Wayne	2022	61	0.01	0.030	0.020

Air Quality Annual Report 2022

NO₂ measured in ppb

Site ID	POC	City	County	Year	# OBS	1-Hr Highest Value	1-Hr 2 nd Highest Value	98 th Percentile 1-hr	Annual Arith Mean
260650018	1	Lansing	Ingham	2022	8102	49.4	43.9	36.8	6.05
260810020	1	Grand Rapids	Kent	2022	8564	42.7	41.8	36.1	7.01
261130001	1	Houghton Lake	Missaukee	2022	8256	9.7	9.1	7.5	1.29
261630015	1	Detroit-SW	Wayne	2022	8298	71.5	57.2	46.7	10.68
261630019	1	Detroit-E 7 Mile	Wayne	2022	8463	45.5	41.7	38.3	7.88
261630093	1	Eliza Howell-NR	Wayne	2022	8667	57.6	56.1	42.7	13.67
261630098	1	DP4th	Wayne	2022	8123	65.9	55.6	48.2	12.12
261630099	1	Trinity	Wayne	2022	7959	64.2	54.6	44.2	12.32
261630100	1	Military Park	Wayne	2022	8255	66.5	59.7	50.8	12.27

NO_y measured in ppb, non-regulatory

Site ID	POC	City	County	Year	# OBS	1-Hr Highest Value	1-Hr 2 nd Highest Value	Annual Arith Mean
260810020	1	Grand Rapids	Kent	2022	4089	143.9	142.1	10.18*
261630001	1	Allen Park	Wayne	2022	7037	271.5	229.3	14.51
261630019	1	Detroit-E 7 Mile	Wayne	2022	7985	182.5	177.0	10.85

* Indicates the site does not have a complete year of data.

Air Quality Annual Report 2022

O₃ (1-hour) measured in ppm, non-regulatory

Site ID	POC	City	County	Year	Num Measured	Num Req	Highest Value
260050003	1	Holland	Allegan	2022	235	245	0.118
260190003	1	Frankfort	Benzie	2022	243	245	0.094
260210014	1	Coloma	Berrien	2022	232	245	0.102
260270003	2	Cassopolis	Cass	2022	237	245	0.079
260370002	2	Rose Lake	Clinton	2022	238	245	0.073
260490021	1	Flint	Genesee	2022	244	245	0.074
260492001	1	Otisville	Genesee	2022	245	245	0.082
260630007	1	Harbor Beach	Huron	2022	243	245	0.090
260650018	1	Lansing	Ingham	2022	237	245	0.073
260770008	1	Kalamazoo	Kalamazoo	2022	238	245	0.079
260810020	1	Grand Rapids	Kent	2022	345	365	0.089
260810022	1	Evans	Kent	2022	236	245	0.095
260910007	1	Tecumseh	Lenawee	2022	244	245	0.075
260990009	1	New Haven	Macomb	2022	244	245	0.087
260991003	1	Warren	Macomb	2022	244	245	0.082
261010922	1	Manistee	Manistee	2022	231	245	0.097
261050007	1	Scottville	Mason	2022	235	245	0.102
261130001	1	Houghton Lake	Missaukee	2022	240	245	0.080
261210039	1	Muskegon	Muskegon	2022	243	245	0.114
261250001	2	Oak Park	Oakland	2022	244	245	0.078
261390005	1	Jenison	Ottawa	2022	208	245	0.108
261470005	1	Port Huron	St. Clair	2022	244	245	0.100
261530001	1	Seney	Schoolcraft	2022	244	245	0.080
261610008	1	Ypsilanti	Washtenaw	2022	245	245	0.078
261630001	2	Allen Park	Wayne	2022	364	365	0.082
261630019	2	Detroit-E 7 Mile	Wayne	2022	235	245	0.084

Air Quality Annual Report 2022

O₃ (8-hour) measured in ppm

Site ID	POC	City	County	Year	% OBS	Valid Days Measured	Highest Value	2 nd Highest Value	3 rd Highest Value	4 th Highest Value	Day Max > 0.070
260050003	1	Holland	Allegan	2022	95	233	0.103	0.095	0.080	0.073	5
260190003	1	Frankfort	Benzie	2022	98	240	0.086	0.079	0.076	0.069	3
260210014	1	Coloma	Berrien	2022	94	230	0.088	0.080	0.074	0.074	5
260270003	2	Cassopolis	Cass	2022	93	229	0.076	0.073	0.069	0.068	2
260370002	2	Rose Lake	Clinton	2022	95	233	0.067	0.065	0.064	0.064	0
260490021	1	Flint	Genesee	2022	99	243	0.071	0.070	0.067	0.067	1
260492001	1	Otisville	Genesee	2022	99	243	0.074	0.073	0.067	0.066	2
260630007	1	Harbor Beach	Huron	2022	98	241	0.077	0.067	0.067	0.065	1
260650018	1	Lansing	Ingham	2022	96	236	0.068	0.067	0.065	0.062	0
260770008	1	Kalamazoo	Kalamazoo	2022	96	235	0.076	0.070	0.068	0.068	1
260810020	1	Grand Rapids	Kent	2022	94	342	0.081	0.072	0.070	0.068	2
260810022	1	Evans	Kent	2022	95	233	0.080	0.077	0.071	0.066	3
260910007	1	Tecumseh	Lenawee	2022	99	243	0.069	0.069	0.066	0.065	0
260990009	1	New Haven	Macomb	2022	99	243	0.078	0.070	0.069	0.066	1
260991003	1	Warren	Macomb	2022	99	243	0.073	0.070	0.068	0.068	1
261010922	1	Manistee	Manistee	2022	94	230	0.088	0.080	0.076	0.066	3
261050007	1	Scottville	Mason	2022	96	234	0.090	0.078	0.066	0.066	2
261130001	1	Houghton Lake	Missaukee	2022	97	237	0.073	0.066	0.066	0.065	1
261210039	1	Muskegon	Muskegon	2022	98	240	0.100	0.093	0.082	0.082	7
261250001	2	Oak Park	Oakland	2022	99	243	0.070	0.068	0.067	0.065	0
261390005	1	Jenison	Ottawa	2022	84	206	0.091	0.088	0.072	0.071	4
261470005	1	Port Huron	St. Clair	2022	98	239	0.080	0.077	0.069	0.066	2
261530001	1	Seney	Schoolcraft	2022	98	241	0.078	0.070	0.070	0.067	1
261610008	1	Ypsilanti	Washtenaw	2022	99	243	0.071	0.068	0.068	0.067	1
261630001	2	Allen Park	Wayne	2022	99	363	0.075	0.072	0.072	0.071	4
261630019	2	Detroit-E 7 Mile	Wayne	2022	94	231	0.075	0.071	0.070	0.067	2

Air Quality Annual Report 2022

PM_{2.5} (24-hour) FRM measured in µg/m³ at local conditions

Site ID	POC	Monitor	City	County	Year	# OBS	Highest Value	2 nd Highest Value	3 rd Highest Value	4 th Highest Value	98%	Wtd. Arith. Mean
260490021	2	FRM	Flint	Genesee	2022	59	20.9	19.3	18.5	18.2	19.3	7.14
260650018	2	FRM	Lansing	Ingham	2022	57	21.5	20.2	17.9	15.3	20.2	7.16
260810020	2	FRM	Grand Rapids	Kent	2022	58	24.7	23.6	19.7	17.3	23.6	6.99
261010922	1	FRM	Manistee	Manistee	2022	62	18.7	18.2	15.8	14.0	18.2	4.74*
261250001	1	FRM	Oak Park	Oakland	2022	118	23.9	23.3	21.9	21.3	21.9	6.97
261610008	2	FRM	Ypsilanti	Washtenaw	2022	58	26.2	21.2	18.0	18.0	21.2	7.69
261630001	2	FRM	Allen Park	Wayne	2022	119	28.9	27.2	19.6	18.9	19.6	7.64
261630015	1	FRM	Detroit-SW	Wayne	2022	102	27.0	24.9	23.5	22.5	23.5	8.76*
261630019	1	FRM	Detroit-E 7 Mile	Wayne	2022	114	25.2	24.6	19.8	19.4	19.8	7.18
261630033	1	FRM	Dearborn	Wayne	2022	103	27.4	27.4	25.3	24.1	25.3	9.61
261630033	2	FRM	Dearborn	Wayne	2022	51	29.1	25.7	25.3	22.5	25.7	9.98*

* Indicates the mean does not satisfy summary criteria, annual data incomplete.

Air Quality Annual Report 2022

PM_{2.5} (24-hour) FEM measured in µg/m³ at local conditions

Site ID	POC	Monitor	City	County	Year	# OBS	Highest Value	2 nd Highest Value	3 rd Highest Value	4 th Highest Value	98%	Wtd. Arith. Mean
260050003	1	BAM	Holland	Allegan	2022	338	51.3	46.1	22.6	21.5	17.7	6.73
260170014	1	BAM	Bay City	Bay	2022	354	27.2	23.0	20.9	20.6	17.6	6.43
260490021	1	BAM	Flint	Genesee	2022	359	25.1	24.0	22.1	21.4	19.9	8.18
260650018	1	T640	Lansing	Ingham	2022	358	31.3	25.0	24.9	24.8	22.7	8.71
260770008	1	T640	Kalamazoo	Kalamazoo	2022	339	48.8	38.8	33.7	31.4	29.4	10.31
260810020	1	T640X	Grand Rapids	Kent	2022	354	34.6	31.9	31.5	31.0	24.9	9.41
260910007	1	BAM	Tecumseh	Lenawee	2022	360	28.5	27.7	26.8	25.8	23.0	8.31
260990009	1	T640	New Haven	Macomb	2022	364	31.3	29.0	27.1	27.0	24.8	8.84
261130001	1	BAM	Houghton Lake	Missaukee	2022	359	53.1	25.8	23.2	20.6	17.0	8.89
261390005	1	T640X	Jenison	Ottawa	2022	326	33.0	31.9	30.9	29.5	24.2	8.93*
261470005	1	T640	Port Huron	St. Clair	2022	359	30.2	29.0	27.8	25.7	21.3	8.45
261530001	1	BAM	Seney	Schoolcraft	2022	360	19.6	18.4	16.4	15.6	14.6	6.07
261610008	1	BAM	Ypsilanti	Washtenaw	2022	359	34.1	28.9	28.7	28.5	25.5	8.94
261630001	1	T640X	Allen Park	Wayne	2022	335	31.9	31.4	29.6	27.8	25.4	8.96
261630015	2	T640	Detroit-SW	Wayne	2022	354	45.6	45.4	42.4	38.8	32.2	12.86
261630093	1	BAM	Eliza Howell-NR	Wayne	2022	359	48.6	47.4	38.9	30.3	28.5	10.96
261630097	1	T640	NMH 48217*	Wayne	2022	363	38.9	32.8	30.4	30.0	25.6	9.50
261630098	1	T640	DP4th	Wayne	2022	365	38.1	32.8	31.0	30.0	26.4	9.78
261630099	1	T640	Trinity	Wayne	2022	364	47.7	43.0	40.0	37.5	32.5	11.97
261630100	1	T640	Military Park	Wayne	2022	358	39.7	37.0	36.4	35.0	30.7	10.88

* Indicates the mean does not satisfy summary criteria, annual data incomplete.

Air Quality Annual Report 2022

PM_{2.5} Continuous, (1-hour) measure in µg/m³, non-regulatory

Site ID	POC	Monitor	City	County	Year	# OBS	Highest Value	Wtd. Arith. Mean
261630033	3	TEOM	Dearborn	Wayne	2022	7796	176	19.4

PM₁₀ (24-hour) measured in µg/m³

Site ID	POC	Monitor	City	County	Year	# OBS	# Req.	Valid Days	% OBS	Highest Value	2 nd Highest Value	3 rd Highest Value	4 th Highest Value	Wtd Arith Mean
260810020	1	T640X	Grand Rapids	Kent	2022	8414	365	350	96	95	49	47	43	16.8
261390005	1	T640X	Jenison	Ottawa	2022	7827	365	326	89	94	53	50	44	16.4*
261630001	1	T640X	Allen Park	Wayne	2022	7430	365	306	84	89	68	57	53	19.4*
261630015	1	GRAV	Detroit-SW	Wayne	2022	59	61	59	97	81	76	75	61	25.6
261630033	1	GRAV	Dearborn	Wayne	2022	56	31	31	100	63	55	41	40	21.8
261630033	9	GRAV	Dearborn	Wayne	2022	29	31	28	90	59	45	43	36	24.7

* Indicates the mean does not satisfy summary criteria, annual data incomplete.

PM₁₀ TEOM (1-hour) measured in µg/m³, non-regulatory

Site ID	POC	Monitor	City	County	Year	# OBS	Highest Value	Wtd. Arith. Mean
261630033	3	TEOM	Dearborn	Wayne	2022	7796	59	18.9*

* Indicates the mean does not satisfy summary criteria, annual data incomplete.

PM_{10-2.5} (1-hour) measured in µg/m³, non-regulatory

Site ID	Monitor	City	County	Year	# OBS	Highest Value	2 nd Highest Value	3 rd Highest Value	4 th Highest Value	Wtd. Arith. Mean
260810020	T640X	Grand Rapids	Kent	2022	8528	168.2	92.1	91.3	90.3	8.09
261630001	T640X	Allen Park	Wayne	2022	8118	881.7	412.8	265.4	250.1	10.25

Air Quality Annual Report 2022

SO₂ measured in ppb

Site ID	POC	City	County	Year	# OBS	1-hr Highest Value	1-hr 2 nd Highest Value	99 th %ile: 1-hr	24-hr Highest Value	24-hr 2 nd Highest Value	OBS >0.5	Arith Mean
260650018	1	Lansing	Ingham	2022	8167	11.3	10.9	5.5	2.6	2.5	0	1.25
260810020	2	Grand Rapids	Kent	2022	8221	4.3	4.0	3.4	1.4	1.0	0	0.32
261470005	1	Port Huron	St. Clair	2022	8247	259.6	157.7	108.2	47.5	46.9	0	2.40
261630001	1	Allen Park	Wayne	2022	8158	39.1	31.9	22.6	7.0	3.7	0	0.35
261630015	1	Detroit-SW	Wayne	2022	8357	57.2	49.8	43.2	24.5	22.8	0	2.68
261630097	1	NMH 48217	Wayne	2022	8355	37.8	22.0	16.7	8.5	7.6	0	1.40
261630098	1	DP4th	Wayne	2022	8220	27.4	24.6	16.3	6.6	6.3	0	1.64
261630099	1	Trinity	Wayne	2022	8261	28.0	27.6	19.9	9.3	7.7	0	1.18
261630100	1	Military Park	Wayne	2022	8319	46.6	34.2	31.1	20.8	13.8	0	1.53

* Indicates the mean does not satisfy summary criteria, annual data incomplete.

APPENDIX B: 2022 AIR TOXICS MONITORING SUMMARY FOR METALS, VOCS, CARBONYLS, PAHS, & SPECIATED PM_{2.5}

Appendix B provides summary statistics of ambient air concentrations of various substances monitored in Michigan during 2022. At each monitoring site, air samples were taken over a 24-hour period (midnight to midnight). These samples represent the average air concentration during that 24-hour period. The frequency of air samples collected is typically done once every 6 or 12 days. Sometimes the sampled air concentration is lower than the laboratory's analytical method detection level (MDL). When the concentration is lower than the MDL, two options are used to estimate the air concentrations. The calculation of the minimum average ("Average (ND=0)") uses 0.0 µg/m³ for a value less than the MDL. In the calculation of the maximum average ("Average (ND=MDL/2)") the MDL divided by 2 (i.e., 1/2 the MDL) is substituted for air concentrations less than the MDL.

The average of NATTS sites is the 2022 average of three urban, non-Michigan NATTS sites near Michigan. Averages were calculated for each available toxic for Chicago, Illinois (170314201); St. Louis, Missouri (295100085); and Pittsburgh, Pennsylvania (420030008) using the Average (ND=0) method described above. Where the averages are "—," none of those three sites reported that toxic in AQS.

Table B shows the monitoring stations and what types of air toxics were monitored at each station in 2022. The following terms and acronyms are used in the **Appendix B-1** and **B-2** data tables:

- Num Obs: Number of Observations (number of daily air samples taken during the year)
- Obs>MDL: Number of daily samples above the MDL
- Average (ND=0): Average air concentration in 2022, assuming daily samples below MDL were equal to 0.0 µg/m³
- Average (ND=MDL/2): Average air concentration in 2022, assuming daily samples below MDL were equal to one half the MDL.
- MDL: Analytical MDL in units of µg/m³
- Max1: Highest daily air concentration during 2022
- Max2: Second highest daily air concentration during 2022
- Max3: Third highest daily air concentration during 2022
- Average of NATTS Sites: The average of three urban, non-Michigan NATTS sites near Michigan
- ITSL: Initial Threshold Screening Level
- Acute % of ITSL: Max1 value/acute ITSL
- Chronic % of ITSL: Annual average/chronic ITSL
- µg/m³: Micrograms per cubic meter (1,000,000 µg = 1 g)

Air Quality Annual Report 2022

Table B.1: 2022 Toxics Sampling Sites

Site Name	VOC	Carbonyl	PAHs	Metals TSP	Metals PM ₁₀	Speciated PM _{2.5}
Allen Park						x
Dearborn	x	x	x	x	x	x
Detroit-SW	x	x		x		x
Grand Rapids						x
Belding-Merrick St.				x		
NMH 48217				x		
Port Huron-Rural St.				x		
River Rouge		x		x		
DP4th				x		
Military Park				x		
Trinity				x		
New Haven		x				

VOC = volatile organic compound

PAHs = polycyclic aromatic hydrocarbon

TSP = total suspended particulate

PM₁₀ = particulate matter with aerodynamic diameter less than 10 µm

Mn = manganese.

Appendix B-1 Tables

Dearborn (261630033) Concentrations in micrograms per cubic meter ($\mu\text{g}/\text{m}^3$)

Chemical Name	Num Obs	Obs> MDL	Average (ND=0)	Average (ND=MDL/2)	MDL	Max 1	Max 2	Max 3	Average of NATTS Sites
1,1,2,2-Tetrachloroethane	53	3	0.000504	0.0369	0.0763	0.013	0.0103	0.00343	0.00273
1,1,2-Trichloro-1,2,2-Trifluoroethane	54	54	0.588	0.588	0.0753	0.766	0.74	0.723	0.581
1,1,2-Trichloroethane	54	1	0.000485	0.0266	0.0534	0.0262	0	0	0.00178
1,1-Dichloroethane	54	25	0.00258	0.011	0.0309	0.0101	0.0085	0.00729	0.00396
1,1-Dichloroethylene	54	1	0.000352	0.0214	0.0427	0.019	0	0	0.00325
1,2,4-Trichlorobenzene	54	32	0.0129	0.11	0.474	0.124	0.122	0.107	0.0132
1,2,4-Trimethylbenzene	38	32	0.692	0.696	0.0583	4	2.87	1.96	0.836
1,2-Dichlorobenzene	54	19	0.00266	0.0381	0.109	0.0259	0.0228	0.0204	0.00807
1,2-Dichloropropane	53	2	0.00112	0.0209	0.0412	0.0319	0.0273	0	0.00428
1,3,5-Trimethylbenzene	54	54	0.154	0.154	0.073	1.16	0.846	0.644	0.304
1,3-Butadiene	54	53	0.0336	0.034	0.0434	0.146	0.131	0.0679	0.0375
1,3-Dichlorobenzene	54	17	0.00219	0.0354	0.0968	0.0253	0.018	0.0168	0.00446
1,4-Dichlorobenzene	54	54	0.0237	0.0237	0.0989	0.141	0.109	0.0619	0.68
Acenaphthene (TSP) Stp	59	53	0.00599	0.006	8.01E-05	0.0323	0.0261	0.021	0.0112
Acenaphthylene (TSP) Stp	55	40	0.000287	0.000288	7.04E-06	0.00142	0.001	0.00091	0.000313
Acetaldehyde	67	67	1.39	1.39	0.0552	8.11	2.4	2.33	3.32
Acetone	67	67	2.49	2.49	0.319	4.74	4.71	4.47	2.51
Acetonitrile	54	50	0.911	0.92	0.195	3.24	2.69	2.22	10.9
Acetylene	54	54	0.684	0.684	0.117	3.35	1.83	1.46	1.46
Acrolein - Verified	54	54	0.475	0.475	0.361	2.23	1.2	1.2	0.836
Acrylonitrile	52	24	0.0328	0.0427	0.0367	0.103	0.0972	0.097	0.0051

Air Quality Annual Report 2022

Chemical Name	Num Obs	Obs> MDL	Average (ND=0)	Average (ND=MDL/2)	MDL	Max 1	Max 2	Max 3	Average of NATTS Sites
<i>Anthracene (TSP) Stp</i>	59	59	0.000356	0.000356	2.92E-05	0.00151	0.00132	0.00117	0.000442
<i>Arsenic (TSP) Stp</i>	87	87	0.00114	0.00114	2.33E-05	0.0022	0.0021	0.00201	--
<i>Arsenic PM₁₀ Lc</i>	85	85	0.000998	0.000998	--	0.00199	0.00197	0.00193	0.000862
<i>Arsenic PM₁₀ Stp</i>	96	95	0.000967	0.000967	3.00E-05	0.00265	0.00213	0.00202	0.000547
<i>Barium (TSP) Stp</i>	87	87	0.0237	0.0237	0.00594	0.277	0.0552	0.0427	--
<i>Barium PM₁₀ Lc</i>	85	85	0.015	0.015	--	0.266	0.037	0.0275	--
<i>Barium PM₁₀ Stp</i>	96	96	0.014	0.014	0.00115	0.261	0.0367	0.0278	--
<i>Benzaldehyde</i>	66	66	0.18	0.18	0.0878	5.12	0.201	0.192	0.313
<i>Benzene</i>	54	54	0.613	0.613	0.0341	1.38	1.23	1.12	0.577
<i>Benzo[A]Anthracene (TSP) Stp</i>	59	59	0.000131	0.000131	8.61E-06	0.0005	0.000414	0.00035	9.32E-05
<i>Benzo[A]Pyrene (TSP) Stp</i>	59	55	0.000125	0.000125	1.12E-05	0.00084	0.000403	0.0004	0.000102
<i>Benzo[B]Fluoranthene (TSP) Stp</i>	52	52	0.000278	0.000278	1.29E-05	0.00139	0.00116	0.00098	0.000194
<i>Benzo[E]Pyrene (TSP) Stp</i>	59	57	0.000179	0.000179	1.46E-05	0.00073	0.000697	0.0006	0.000123
<i>Benzo[G,H,I]Perylene (TSP) Stp</i>	59	58	0.00019	0.00019	6.55E-06	0.00073	0.000548	0.00049	0.000135
<i>Benzo[K]Fluoranthene (TSP) Stp</i>	59	59	0.000113	0.000113	1.55E-05	0.00047	0.000403	0.00038	7.90E-05
<i>Beryllium (TSP) Stp</i>	87	87	8.10E-05	8.10E-05	5.29E-05	0.00024	0.00022	0.00022	--
<i>Beryllium PM₁₀ Lc</i>	85	72	1.64E-05	1.64E-05	--	7.84E-05	6.25E-05	5.72E-05	6.73E-06
<i>Beryllium PM₁₀ Stp</i>	96	81	1.65E-05	1.80E-05	2.08E-05	8.00E-05	8.00E-05	6.00E-05	5.14E-06
<i>Bromochloromethane</i>	54	2	9.81E-05	0.022	0.0453	0.00265	0.00265	0	0.00692
<i>Bromodichloromethane</i>	54	16	0.00287	0.0508	0.142	0.0241	0.0194	0.0134	5.86
<i>Bromoform</i>	54	53	0.0155	0.0168	--	0.101	0.0289	0.0248	0.275
<i>Bromomethane</i>	54	54	0.0691	0.0691	0.0691	1.24	0.516	0.106	0.041
<i>Butyraldehyde</i>	67	67	0.133	0.133	0.0511	1.28	0.353	0.286	0.33

Air Quality Annual Report 2022

Chemical Name	Num Obs	Obs> MDL	Average (ND=0)	Average (ND=MDL/2)	MDL	Max 1	Max 2	Max 3	Average of NATTS Sites
<i>Cadmium (TSP) Stp</i>	87	87	0.000257	0.000257	1.10E-05	0.00146	0.00094	0.0009	--
<i>Cadmium PM₁₀ Lc</i>	85	85	0.000134	0.000134	--	0.00041	0.000381	0.00034	0.000163
<i>Cadmium PM₁₀ Stp</i>	96	96	0.00014	0.00014	3.94E-05	0.00054	0.00041	0.00038	8.52E-05
<i>Carbon Disulfide</i>	54	54	0.064	0.064	0.0481	0.207	0.163	0.146	0.0844
<i>Carbon Tetrachloride</i>	54	54	0.501	0.501	0.0698	0.629	0.61	0.579	0.553
<i>Chlorobenzene</i>	54	17	0.00847	0.026	0.0512	0.0433	0.0401	0.0364	0.00498
<i>Chloroethane</i>	54	52	0.0247	0.0253	0.0393	0.0665	0.0602	0.0475	0.0534
<i>Chloroform</i>	54	54	0.386	0.386	0.0368	0.635	0.62	0.581	8.99
<i>Chloromethane</i>	54	53	1.03	1.03	0.0709	1.36	1.35	1.25	1.12
<i>Chloroprene</i>	54	0	0	0.0366	0.0732	0	0	0	0.000872
<i>Chromium (TSP) Stp</i>	87	87	0.00496	0.00496	0.0015	0.0157	0.0153	0.0135	--
<i>Chromium PM₁₀ Lc</i>	85	85	0.00277	0.00277	--	0.0111	0.00525	0.00489	0.00409
<i>Chromium PM₁₀ Stp</i>	96	96	0.00277	0.00277	0.00125	0.0109	0.00694	0.00518	0.00221
<i>Chrysene (TSP) Stp</i>	45	43	0.000208	0.000208	1.15E-05	0.00087	0.000422	0.00042	0.000186
<i>Cis-1,2-Dichloroethene</i>	54	0	0	0.0423	0.0845	0	0	0	0.000364
<i>Cis-1,3-Dichloropropene</i>	54	1	0.00048	0.0165	0.0326	0.0259	0	0	0.00124
<i>Cobalt (TSP) Stp</i>	87	87	0.000281	0.000281	2.93E-05	0.00111	0.00087	0.00078	--
<i>Cobalt PM₁₀ Lc</i>	85	83	0.00014	0.00014		0.00053	0.000512	0.00043	0.000165
<i>Cobalt PM₁₀ Stp</i>	96	94	0.000138	0.000138	1.04E-05	0.00051	0.00051	0.00042	0.000119
<i>Copper (TSP) Stp</i>	87	87	0.0161	0.0161	0.00139	0.154	0.0979	0.0588	--
<i>Copper PM₁₀ Lc</i>	85	85	0.0123	0.0123	--	0.168	0.0309	0.0279	--
<i>Copper PM₁₀ Stp</i>	96	96	0.0131	0.0131	0.00114	0.165	0.0461	0.0351	--
<i>Coronene (TSP) Stp</i>	58	55	8.57E-05	8.58E-05	5.89E-06	0.00025	0.00024	0.00022	5.69E-05

Air Quality Annual Report 2022

Chemical Name	Num Obs	Obs> MDL	Average (ND=0)	Average (ND=MDL/2)	MDL	Max 1	Max 2	Max 3	Average of NATTS Sites
<i>Crotonaldehyde</i>	67	37	0.0149	0.0192	0.0193	0.0883	0.0828	0.0765	0.0236
<i>Dibenzo[A,H]Anthracene (TSP) Stp</i>	59	30	2.17E-05	2.34E-05	6.78E-06	0.00018	0.000101	7.96E-05	1.32E-05
<i>Dibromochloromethane</i>	54	38	0.00328	0.0169	0.0867	0.0537	0.00767	0.00596	3.06
<i>Dichlorodifluoromethane</i>	54	54	2.51	2.51	0.0812	3.03	3	2.83	2.47
<i>Dichloromethane</i>	54	54	9.5	9.5	0.706	90.3	38.9	31.6	5.87
<i>Ethyl Acrylate</i>	54	0	0	0.0268	0.0538	0	0	0	0
<i>Ethylbenzene</i>	54	54	0.283	0.283	0.0467	0.834	0.773	0.586	0.27
<i>Ethylene Dibromide</i>	54	2	0.000612	0.0454	0.0932	0.0292	0.00384	0	0.00415
<i>Ethylene Dichloride</i>	54	54	0.0585	0.0585	0.0289	0.0951	0.0911	0.089	0.0595
<i>Ethylene Oxide</i>	53	52	0.189	0.19	0.0783	0.728	0.512	0.503	0.226
<i>Fluoranthene (TSP) Stp</i>	59	59	0.00336	0.00336	4.50E-05	0.0216	0.0129	0.0126	0.00365
<i>Fluorene (TSP) Stp</i>	59	59	0.005	0.005	5.63E-05	0.0251	0.0212	0.0177	0.00831
<i>Formaldehyde</i>	67	67	2.68	2.68	0.0587	13.1	7.03	4.96	6.55
<i>Freon 114</i>	54	54	0.121	0.121	0.0555	0.144	0.143	0.143	0.122
<i>Hexachlorobutadiene</i>	54	36	0.00351	0.0909	0.633	0.0533	0.0128	0.0117	0.00692
<i>Hexanaldehyde</i>	65	65	0.27	0.27	0.157	3.55	0.618	0.558	0.979
<i>Indeno[1,2,3-Cd]Pyrene (TSP) Stp</i>	59	49	0.000141	0.000142	8.21E-06	0.00078	0.000762	0.00043	9.80E-05
<i>Iron (TSP) Stp</i>	87	87	1.47	1.47	0.0295	6.06	5.87	4.97	--
<i>Iron PM₁₀ Lc</i>	85	85	0.635	0.635	--	2.28	1.77	1.51	--
<i>Iron PM₁₀ Stp</i>	96	96	0.63	0.63	0.0129	2.32	1.93	1.85	--
<i>Lead (TSP) Lc FRM/FEM</i>	89	89	0.0113	0.0113	--	0.231	0.0547	0.0415	--
<i>Lead PM₁₀ Lc</i>	85	85	0.00622	0.00622	--	0.0539	0.021	0.0197	0.00513

Air Quality Annual Report 2022

Chemical Name	Num Obs	Obs> MDL	Average (ND=0)	Average (ND=MDL/2)	MDL	Max 1	Max 2	Max 3	Average of NATTS Sites
<i>M/P Xylene</i>	54	54	0.81	0.81	0.125	3.31	2.68	1.91	0.836
<i>Manganese (TSP) Stp</i>	87	87	0.087	0.087	0.000971	0.381	0.298	0.295	--
<i>Manganese PM₁₀ Lc</i>	85	85	0.0327	0.0327	--	0.198	0.118	0.101	0.0134
<i>Manganese PM₁₀ Stp</i>	96	96	0.0322	0.0322	0.000384	0.201	0.124	0.11	0.00771
<i>Methyl Chloroform</i>	54	52	0.0103	0.0112	0.0582	0.0322	0.0256	0.0169	0.0147
<i>Methyl Ethyl Ketone</i>	67	66	0.316	0.316	0.0321	1.02	0.7	0.691	0.486
<i>Methyl Isobutyl Ketone</i>	54	54	0.197	0.197	0.101	0.656	0.5	0.447	0.183
<i>Methyl Methacrylate</i>	54	0	0	0.12	0.239	0	0	0	0.00137
<i>Methyl Tert-Butyl Ether</i>	54	0	0	0.0133	0.0265	0	0	0	0.00398
<i>Molybdenum (TSP) Stp</i>	87	87	0.000883	0.000883	0.000292	0.00648	0.00548	0.00186	--
<i>Molybdenum PM₁₀ Lc</i>	85	85	0.000863	0.000863	--	0.00609	0.00566	0.00185	--
<i>Molybdenum PM₁₀ Stp</i>	96	96	0.000901	0.000901	0.000158	0.00624	0.0058	0.0048	--
<i>Naphthalene (TSP) Stp</i>	59	59	0.0563	0.0563	0.00248	0.159	0.141	0.117	0.0541
<i>Nickel (TSP) Stp</i>	87	87	0.0018	0.0018	0.000796	0.00698	0.00635	0.00538	--
<i>Nickel PM₁₀ Lc</i>	85	85	0.00109	0.00109	--	0.00363	0.0035	0.00344	0.000923
<i>Nickel PM₁₀ Stp</i>	96	96	0.00114	0.00114	0.00287	0.00423	0.00417	0.00357	0.00106
<i>N-Octane</i>	46	30	0.101	0.111	0.0584	0.382	0.295	0.281	0.191
<i>O-Xylene</i>	54	54	0.281	0.281	0.064	0.942	0.734	0.704	0.325
<i>Perylene (TSP) Stp</i>	59	13	9.36E-06	1.38E-05	1.14E-05	0.0002	9.93E-05	5.22E-05	7.60E-06
<i>Phenanthrene (TSP) Stp</i>	59	59	0.0103	0.0103	0.000156	0.0544	0.0409	0.0338	0.0151
<i>PM₁₀ Total 0-10 μm Stp</i>	86	86	22.5	22.5	--	63	55	45	15.3
<i>Propionaldehyde</i>	67	67	0.308	0.308	0.0797	1.83	0.855	0.708	0.476
<i>Propylene</i>	54	54	1.3	1.3	0.102	3.39	2.72	2.65	1.4

Air Quality Annual Report 2022

Chemical Name	Num Obs	Obs> MDL	Average (ND=0)	Average (ND=MDL/2)	MDL	Max 1	Max 2	Max 3	Average of NATTS Sites
<i>Pyrene (TSP) Stp</i>	59	59	0.00181	0.00181	3.84E-05	0.0109	0.00594	0.00573	0.00172
<i>Styrene</i>	54	54	0.543	0.543	0.0554	2.7	1.65	1.52	0.436
<i>Tert-Amyl Methyl Ether</i>	54	1	0.000348	0.0206	0.0415	0.0188	0	0	0.00138
<i>Tert-Butyl Ethyl Ether</i>	54	1	0.000256	0.0158	0.0318	0.0138	0	0	0.00176
<i>Tetrachloroethylene</i>	54	54	0.416	0.416	0.177	2.89	2.77	2.58	0.109
<i>Toluene</i>	54	54	1.03	1.03	0.167	3.77	2.44	2.13	1.9
<i>Trans-1,2-Dichloroethylene</i>	54	28	0.0357	0.0433	0.0327	1.34	0.186	0.107	0.012
<i>Trans-1,3-Dichloropropene</i>	54	0	0	0.026	0.0518	0	0	0	0.000568
<i>Trichloroethylene</i>	42	11	0.00741	0.0324	0.0702	0.0398	0.0382	0.0376	0.0369
<i>Trichlorofluoromethane</i>	54	54	1.41	1.41	0.126	1.78	1.72	1.71	2.99
<i>Valeraldehyde</i>	51	49	0.124	0.124	0.0539	1.82	0.379	0.198	0.301
<i>Vanadium (TSP) Stp</i>	87	87	0.00284	0.00284	8.60E-05	0.00991	0.00979	0.00881	--
<i>Vanadium PM₁₀ Lc</i>	85	85	0.00123	0.00123	--	0.00312	0.003	0.00295	--
<i>Vanadium PM₁₀ Stp</i>	96	96	0.00121	0.00121	4.38E-05	0.00328	0.00306	0.00303	--
<i>Vinyl Chloride</i>	54	6	0.000369	0.0095	0.0206	0.00665	0.00486	0.00307	0.00796
<i>Zinc (TSP) Stp</i>	87	87	0.127	0.127	0.00826	0.434	0.412	0.4	--
<i>Zinc PM₁₀ Lc</i>	85	85	0.078	0.078	--	0.32	0.306	0.295	--
<i>Zinc PM₁₀ Stp</i>	96	96	0.0758	0.0758	0.00526	0.326	0.31	0.309	--

Air Quality Annual Report 2022

Detroit-SW (261630015) Concentrations in micrograms per cubic meter ($\mu\text{g}/\text{m}^3$)

Chemical Name	Num Obs	Obs> MDL	Average (ND=0)	Average (ND=MDL/2)	MDL	Max 1	Max 2	Max 3	Average of NATTS Sites
1,1,2,2-Tetrachloroethane	29	4	0.000497	0.0323	0.0723	0.00412	0.00412	0.00343	0.00273
1,1,2-Trichloro-1,2,2-Trifluoroethane	29	29	0.599	0.599	0.0734	0.717	0.697	0.697	0.581
1,1,2-Trichloroethane	29	1	0.000848	0.0263	0.0528	0.0246	0	0	0.00178
1,1-Dichloroethane	29	16	0.00225	0.00917	0.0312	0.00688	0.00567	0.00526	0.00396
1,1-Dichloroethylene	29	4	0.000574	0.0195	0.0437	0.00476	0.00436	0.00396	0.00325
1,2,4-Trichlorobenzene	29	19	0.00776	0.0899	0.47	0.0742	0.0275	0.0186	0.0132
1,2,4-Trimethylbenzene	14	7	0.211	0.225	0.0576	1.56	0.619	0.328	0.836
1,2-Dichlorobenzene	29	14	0.00193	0.0303	0.11	0.0114	0.00661	0.00601	0.00807
1,2-Dichloropropane	29	0	0	0.0207	0.0414	0	0	0	0.00428
1,3,5-Trimethylbenzene	29	29	0.0638	0.0638	0.073	0.366	0.16	0.134	0.304
1,3-Butadiene	29	28	0.035	0.0358	0.0442	0.154	0.0861	0.0657	0.0375
1,3-Dichlorobenzene	29	10	0.00114	0.0329	0.097	0.0102	0.00481	0.00421	0.00446
1,4-Dichlorobenzene	29	29	0.0178	0.0178	0.1	0.0433	0.0307	0.0295	0.68
Acetaldehyde	32	32	2.57	2.57	--	4.58	4.02	3.64	3.32
Acetone	32	32	4.4	4.4	--	18.5	15.6	14	2.51
Acetonitrile	29	28	8.46	8.46	0.207	25.9	16.4	16.2	10.9
Acetylene	29	29	0.665	0.665	0.117	2.22	1.9	1.68	1.46
Acrolein - Unverified	32	28	0.0516	0.0516	--	0.12	0.0924	0.0918	--
Acrolein - Verified	28	28	1.29	1.29	0.375	10	7.41	1.93	0.836
Acrylonitrile	28	14	0.0534	0.0626	0.0366	0.217	0.176	0.174	0.0051
Arsenic (TSP) Stp	58	58	0.00144	0.00144	2.47E-05	0.00451	0.0045	0.00347	--
Benzaldehyde	32	32	0.167	0.167	--	0.576	0.318	0.3	0.313
Benzene	29	29	0.694	0.694	0.0337	1.43	1.21	1.2	0.577

Air Quality Annual Report 2022

Chemical Name	Num Obs	Obs> MDL	Average (ND=0)	Average (ND=MDL/2)	MDL	Max 1	Max 2	Max 3	Average of NATTS Sites
<i>Bromochloromethane</i>	29	10	0.00104	0.0156	0.0436	0.00423	0.00423	0.0037	0.00692
<i>Bromodichloromethane</i>	29	3	0.00111	0.0681	0.151	0.0147	0.00938	0.00804	5.86
<i>Bromoform</i>	29	28	0.0141	0.016	0.118	0.0269	0.0217	0.0207	0.275
<i>Bromomethane</i>	29	29	0.0515	0.0515	0.0726	0.163	0.151	0.104	0.041
<i>Cadmium (TSP) Stp</i>	58	58	0.000175	0.000175	1.00E-05	0.00039	0.00037	0.00034	--
<i>Carbon Disulfide</i>	29	29	0.164	0.164	0.0468	0.511	0.508	0.445	0.0844
<i>Carbon Tetrachloride</i>	29	29	0.515	0.515	0.0704	0.607	0.575	0.563	0.553
<i>Chlorobenzene</i>	29	3	0.00159	0.0237	0.0501	0.018	0.017	0.011	0.00498
<i>Chloroethane</i>	29	27	0.0312	0.0327	0.0407	0.121	0.0826	0.0792	0.0534
<i>Chloroform</i>	29	29	0.137	0.137	0.037	0.346	0.332	0.25	8.99
<i>Chloromethane</i>	29	28	0.987	0.988	0.0668	1.36	1.23	1.18	1.12
<i>Chloroprene</i>	29	0	0	0.0373	0.0745	0	0	0	0.000872
<i>Cis-1,2-Dichloroethene</i>	29	1	0.000438	0.0421	0.0865	0.0127	0	0	0.000364
<i>Cis-1,3-Dichloropropene</i>	29	0	0	0.0162	0.0323	0	0	0	0.00124
<i>Crotonaldehyde</i>	32	7	0.0148	0.0148	--	0.131	0.0796	0.0747	0.0236
<i>Dibromochloromethane</i>	29	19	0.00209	0.0182	0.0826	0.00511	0.00426	0.00426	3.06
<i>Dichlorodifluoromethane</i>	29	29	2.53	2.53	0.0766	3.01	2.81	2.76	2.47
<i>Dichloromethane</i>	29	29	0.367	0.367	0.631	0.969	0.545	0.538	5.87
<i>Ethyl Acrylate</i>	29	0	0	0.0269	0.0539	0	0	0	0
<i>Ethylbenzene</i>	29	29	0.202	0.202	0.0473	0.421	0.418	0.345	0.27
<i>Ethylene Dibromide</i>	29	2	0.000265	0.042	0.0903	0.00538	0.00231	0	0.00415
<i>Ethylene Dichloride</i>	29	29	0.0547	0.0547	0.0289	0.0971	0.0822	0.0737	0.0595
<i>Ethylene Oxide</i>	29	28	0.722	0.723	0.0797	8.04	4.85	1.21	0.226
<i>Formaldehyde</i>	32	32	2.3	2.3	--	5.93	4.61	4.4	6.55
<i>Freon 114</i>	29	29	0.14	0.14	0.0563	0.198	0.184	0.181	0.122

Air Quality Annual Report 2022

Chemical Name	Num Obs	Obs> MDL	Average (ND=0)	Average (ND=MDL/2)	MDL	Max 1	Max 2	Max 3	Average of NATTS Sites
<i>Hexachlorobutadiene</i>	29	20	0.00246	0.0838	0.684	0.0139	0.00746	0.00533	0.00692
<i>Hexanaldehyde</i>	32	30	0.136	0.136	--	0.318	0.317	0.262	0.979
<i>Lead (TSP) Lc FRM/FEM</i>	58	58	0.00732	0.00732	--	0.0295	0.0246	0.0179	--
<i>M/P Xylene</i>	29	29	0.497	0.497	0.129	1.31	1.29	0.869	0.836
<i>Manganese (TSP) Stp</i>	58	58	0.053	0.053	0.00101	0.171	0.153	0.143	--
<i>Methacrolein</i>	32	31	0.117	0.117	--	0.307	0.302	0.27	--
<i>Methyl Chloroform</i>	29	27	0.0101	0.0123	0.0605	0.0316	0.0131	0.0125	0.0147
<i>Methyl Isobutyl Ketone</i>	29	29	0.126	0.126	0.11	0.25	0.245	0.224	0.183
<i>Methyl Methacrylate</i>	28	0	0	0.125	0.25	0	0	0	0.00137
<i>Methyl Tert-Butyl Ether</i>	29	0	0	0.0129	0.0258	0	0	0	0.00398
<i>Nickel (TSP) Stp</i>	58	58	0.00242	0.00242	0.000733	0.00932	0.00729	0.00605	--
<i>N-Octane</i>	27	23	0.135	0.14	0.0619	0.303	0.258	0.249	0.191
<i>O-Xylene</i>	29	29	0.235	0.235	0.065	0.591	0.504	0.421	0.325
<i>PM₁₀ Total 0-10 µm Stp</i>	59	59	26.1	26.1	--	81	76	75	15.3
<i>Propionaldehyde</i>	32	31	0.343	0.343	--	0.59	0.583	0.53	0.476
<i>Propylene</i>	29	29	1.36	1.36	0.0878	3.51	3.44	2.81	1.4
<i>Styrene</i>	29	29	3.67	3.67	0.0537	10.7	9.84	9.07	0.436
<i>Tert-Amyl Methyl Ether</i>	29	0	0	0.0197	0.0393	0	0	0	0.00138
<i>Tert-Butyl Ethyl Ether</i>	29	0	0	0.0153	0.0307	0	0	0	0.00176
<i>Tetrachloroethylene</i>	29	29	0.251	0.251	0.183	0.648	0.593	0.477	0.109
<i>Tolualdehydes</i>	32	2	0.00773	0.00773	--	0.202	0.0453	0	--
<i>Toluene</i>	29	29	1.05	1.05	0.161	2.93	2.66	2.04	1.9
<i>Trans-1,2-Dichloroethylene</i>	29	12	0.00384	0.0134	0.0332	0.0226	0.0214	0.0103	0.012
<i>Trans-1,3-Dichloropropene</i>	29	0	0	0.0248	0.0494	0	0	0	0.000568
<i>Trichloroethylene</i>	28	25	0.0379	0.0417	0.0683	0.107	0.0736	0.065	0.0369

Air Quality Annual Report 2022

Chemical Name	Num Obs	Obs> MDL	Average (ND=0)	Average (ND=MDL/2)	MDL	Max 1	Max 2	Max 3	Average of NATTS Sites
<i>Trichlorofluoromethane</i>	29	29	1.38	1.38	0.123	1.7	1.55	1.54	2.99
<i>Valeraldehyde</i>	32	32	0.194	0.194	--	0.509	0.49	0.377	0.301
<i>Vinyl Chloride</i>	29	3	0.000996	0.0101	0.0204	0.0115	0.0092	0.00818	0.00796

Port Huron-Rural St. (261470031) Concentrations in micrograms per cubic meter ($\mu\text{g}/\text{m}^3$)

Chemical Name	Num Obs	Obs> MDL	Average (ND=0)	Average (ND=MDL/2)	MDL	Max 1	Max 2	Max 3	Average of NATTS Sites
<i>Arsenic (TSP) Stp</i>	92	92	0.000856	0.000856	2.24E-05	0.00552	0.00541	0.00332	--
<i>Cadmium (TSP) Stp</i>	92	92	0.000384	0.000384	1.00E-05	0.00828	0.00129	0.00119	--
<i>Lead (TSP) Lc FRM/FEM</i>	92	92	0.0258	0.0258	--	0.216	0.166	0.166	--
<i>Manganese (TSP) Stp</i>	92	92	0.0104	0.0104	0.000934	0.0401	0.0393	0.0385	--
<i>Nickel (TSP) Stp</i>	92	92	0.000759	0.000759	0.000715	0.00248	0.00246	0.00245	--

River Rouge (261630005) Concentrations in micrograms per cubic meter ($\mu\text{g}/\text{m}^3$)

Chemical Name	Num Obs	Obs> MDL	Average (ND=0)	Average (ND=MDL/2)	MDL	Max 1	Max 2	Max 3	Average of NATTS Sites
<i>Acetaldehyde</i>	33	33	2.66	2.66	--	4.96	4.34	4.1	3.32
<i>Acetone</i>	33	33	4.29	4.29	--	16.6	14.1	12.1	2.51
<i>Acrolein - Unverified</i>	33	28	0.0544	0.0544	--	0.171	0.0882	0.088	--
<i>Arsenic (TSP) Stp</i>	60	60	0.000914	0.00089	2.33E-05	0.00326	0.00238	0.00231	--
<i>Benzaldehyde</i>	33	30	0.119	0.119	--	0.563	0.371	0.263	0.313
<i>Cadmium (TSP) Stp</i>	60	60	0.00035	0.00035	1.00E-05	0.00123	0.00115	0.00085	--
<i>Crotonaldehyde</i>	33	9	0.0284	0.0284	--	0.313	0.228	0.0852	0.0236
<i>Formaldehyde</i>	33	32	2.36	2.36	--	6.53	6.31	4.3	6.55

Air Quality Annual Report 2022

Chemical Name	Num Obs	Obs> MDL	Average (ND=0)	Average (ND=MDL/2)	MDL	Max 1	Max 2	Max 3	Average of NATTS Sites
<i>Hexanaldehyde</i>	33	31	0.118	0.118	--	0.438	0.239	0.231	0.979
<i>Lead (TSP) Lc FRM/FEM</i>	59	59	0.00517	0.00517	--	0.0346	0.0224	0.0104	--
<i>Manganese (TSP) Stp</i>	60	60	0.0338	0.0344	0.00084	0.126	0.101	0.0908	--
<i>Methacrolein</i>	33	30	0.116	0.116	--	0.37	0.359	0.268	--
<i>Nickel (TSP) Stp</i>	60	60	0.00146	0.00146	0.000544	0.0104	0.00587	0.00506	--
<i>Propionaldehyde</i>	33	32	0.334	0.334	--	0.774	0.705	0.655	0.476
<i>Tolualdehydes</i>	33	5	0.0241	0.0241	--	0.372	0.155	0.129	--
<i>Valeraldehyde</i>	33	31	0.156	0.156	--	0.472	0.456	0.341	0.301

Belding-Merrick St. (260670003) Concentrations in micrograms per cubic meter (µg/m³)

Chemical Name	Num Obs	Obs> MDL	Average (ND=0)	Average (ND=MDL/2)	MDL	Max 1	Max 2	Max 3	Average of NATTS Sites
<i>Arsenic (TSP) Stp</i>	51	50	0.00102	0.00102	2.65E-05	0.00879	0.0034	0.00276	--
<i>Cadmium (TSP) Stp</i>	51	50	0.000298	0.000299	1.22E-05	0.00818	0.00219	0.00072	--
<i>Lead (TSP) Lc FRM/FEM</i>	54	54	0.0167	0.0167	--	0.578	0.126	0.0247	--
<i>Manganese (TSP) Stp</i>	51	51	0.012	0.012	0.00113	0.114	0.0707	0.0336	--
<i>Nickel (TSP) Stp</i>	51	51	0.000818	0.000818	0.000825	0.00772	0.00499	0.00357	--

Air Quality Annual Report 2022

NMH 48217 (261630097) Concentrations in micrograms per cubic meter ($\mu\text{g}/\text{m}^3$)

Chemical Name	Num Obs	Obs> MDL	Average (ND=0)	Average (ND=MDL/2)	MDL	Max 1	Max 2	Max 3	Average of NATTS Sites
<i>Arsenic (TSP) Stp</i>	60	60	0.000889	0.000889	2.28E-05	0.00294	0.00269	0.00237	--
<i>Cadmium (TSP) Stp</i>	60	60	0.000117	0.000117	1.00E-05	0.00033	0.00029	0.00027	--
<i>Lead (TSP) Lc FRM/FEM</i>	61	61	0.00336	0.00336	--	0.0147	0.00853	0.00822	--
<i>Manganese (TSP) Stp</i>	60	60	0.0196	0.0196	0.000988	0.0748	0.0488	0.0408	--
<i>Nickel (TSP) Stp</i>	60	60	0.000967	0.000967	0.00072	0.00218	0.00205	0.00203	--

DP4th (261630098) Concentrations in micrograms per cubic meter ($\mu\text{g}/\text{m}^3$)

Chemical Name	Num Obs	Obs> MDL	Average (ND=0)	Average (ND=MDL/2)	MDL	Max 1	Max 2	Max 3	Average of NATTS Sites
<i>Arsenic (TSP) Stp</i>	56	56	0.00103	0.00103	2.11E-05	0.00265	0.0024	0.00192	--
<i>Cadmium (TSP) Stp</i>	56	56	0.000112	0.000112	1.00E-05	0.00027	0.00021	0.0002	--
<i>Lead (TSP) Lc FRM/FEM</i>	61	61	0.00601	0.00601	--	0.0169	0.0139	0.0116	--
<i>Manganese (TSP) Stp</i>	56	56	0.0484	0.0484	0.000977	0.101	0.1	0.0926	--
<i>Nickel (TSP) Stp</i>	56	56	0.00172	0.00172	0.000711	0.00435	0.00385	0.00316	--

Trinity (261630099) Concentrations in micrograms per cubic meter ($\mu\text{g}/\text{m}^3$)

Chemical Name	Num Obs	Obs> MDL	Average (ND=0)	Average (ND=MDL/2)	MDL	Max 1	Max 2	Max 3	Average of NATTS Sites
<i>Arsenic (TSP) Stp</i>	61	61	0.00167	0.00167	2.23E-05	0.00924	0.00623	0.00577	--
<i>Cadmium (TSP) Stp</i>	61	61	0.000189	0.000189	1.00E-05	0.00074	0.00053	0.00035	--
<i>Lead (TSP) Lc FRM/FEM</i>	61	61	0.00798	0.00798	--	0.0243	0.0223	0.0193	--
<i>Manganese (TSP) Stp</i>	61	61	0.0707	0.0707	0.000983	0.157	0.15	0.15	--
<i>Nickel (TSP) Stp</i>	61	61	0.00269	0.00269	0.000716	0.00749	0.00731	0.00723	--

Military Park (261630100) Concentrations in micrograms per cubic meter ($\mu\text{g}/\text{m}^3$)

Chemical Name	Num Obs	Obs > MDL	Average (ND=0)	Average (ND=MDL/2)	MDL	Max 1	Max 2	Max 3	Average of NATTS Sites
<i>Arsenic (TSP) Stp</i>	61	61	0.00137	0.00137	2.25E-05	0.013	0.0032	0.00274	--
<i>Cadmium (TSP) Stp</i>	61	61	0.000206	0.000206	1.00E-05	0.00045	0.00045	0.00041	--
<i>Lead (TSP) Lc FRM/FEM</i>	61	61	0.00839	0.00839	--	0.0304	0.0209	0.0177	--
<i>Manganese (TSP) Stp</i>	61	61	0.0496	0.0496	0.00098	0.229	0.159	0.125	--
<i>Nickel (TSP) Stp</i>	61	61	0.00157	0.00157	0.000714	0.00638	0.00455	0.00373	--

Appendix B-2 Speciated PM_{2.5} Data Tables

Dearborn (261630033), Speciated PM_{2.5} (µg/m³)

Chemical Name	Num Obs	Obs> MDL	Average (ND=0)	Average (ND=MDL/2)	MDL	Max 1	Max 2	Max 3	Average of NATTS Sites
Aluminum PM _{2.5} Lc	59	49	0.0603	0.0603	0.0238	1.41	0.146	0.129	0.034
Ammonium Ion PM _{2.5} Lc	59	59	0.477	0.477	0.0129	2.66	1.37	1.32	0.398
Antimony PM _{2.5} Lc	59	29	0.0049	0.0049	0.0168	0.0258	0.0247	0.0229	0.0014
Arsenic PM _{2.5} Lc	59	15	5.93E-06	1.27E-05	0.0001	6.00E-05	5.00E-05	5.00E-05	3.35E-05
Barium PM _{2.5} Lc	59	26	0.0131	0.0131	0.0339	0.22	0.0523	0.0464	0.0046
Bromine PM _{2.5} Lc	59	21	0.000537	0.000569	0.0001	0.00507	0.00399	0.00379	0.00112
Cadmium PM _{2.5} Lc	59	35	0.0046	0.0046	0.0133	0.0238	0.0184	0.017	0.000814
Calcium PM _{2.5} Lc	52	52	0.134	0.134	0.00839	0.534	0.506	0.419	0.0638
Cerium PM _{2.5} Lc	59	28	0.0104	0.0104	0.0401	0.0552	0.0489	0.044	0.00219
Cesium PM _{2.5} Lc	59	31	0.00765	0.00765	0.0272	0.0418	0.0303	0.029	0.00319
Chloride PM _{2.5} Lc	59	59	0.243	0.243	0.0157	3.01	1.22	0.893	0.0705
Chlorine PM _{2.5} Lc	59	57	0.0643	0.0643	0.00301	1.58	0.708	0.134	0.00887
Chromium PM _{2.5} Lc	58	45	0.00151	0.00151	0.00203	0.00661	0.00592	0.00546	0.00145
Cobalt PM _{2.5} Lc	58	18	0.000312	0.000312	0.00168	0.00471	0.00204	0.00179	0
Copper PM _{2.5} Lc	59	55	0.0112	0.0112	0.00461	0.086	0.0492	0.0447	0.00395
Ec Csn_Rev Unadjusted PM _{2.5} Lc Tor	60	60	0.664	0.664	0.00095	1.87	1.32	1.26	0.691
Ec Csn_Rev Unadjusted PM _{2.5} Lc Tot	60	60	0.477	0.477	0.00613	1.12	0.927	0.896	0.473
Ec PM _{2.5} Lc Tor	60	60	0.664	0.664	0.00095	1.87	1.32	1.26	0.649
Ec PM _{2.5} Lc Tot	60	60	0.477	0.477	0.00613	1.12	0.927	0.896	0.473
Ec1 Csn_Rev Unadjusted PM _{2.5} Lc	60	60	0.725	0.725	0.0264	2.55	1.6	1.6	0.856
Ec1 PM _{2.5} Lc	60	60	0.718	0.718	0.0264	2.54	1.6	1.59	0.8
Ec2 Csn_Rev Unadjusted PM _{2.5} Lc	60	60	0.188	0.188	0.0141	0.536	0.404	0.311	0.172

Air Quality Annual Report 2022

Chemical Name	Num Obs	Obs> MDL	Average (ND=0)	Average (ND=MDL/2)	MDL	Max 1	Max 2	Max 3	Average of NATTS Sites
<i>Ec2 PM_{2.5} Lc</i>	60	60	0.178	0.178	0.0141	0.524	0.397	0.299	0.147
<i>Ec3 Csn_Rev Unadjusted PM_{2.5} Lc</i>	60	60	0.0185	0.0185	0.00367	0.0501	0.0466	0.0431	0.0134
<i>Ec3 PM_{2.5} Lc</i>	60	60	0.017	0.017	0.00367	0.0487	0.0459	0.0412	0.00929
<i>Indium PM_{2.5} Lc</i>	59	31	0.00461	0.00461	0.015	0.0348	0.0281	0.0248	0.00219
<i>Iron PM_{2.5} Lc</i>	59	59	0.254	0.254	0.00809	1.37	1.08	0.868	0.137
<i>Lead PM_{2.5} Lc</i>	59	43	0.00636	0.00642	0.00691	0.0475	0.0273	0.0196	0.00369
<i>Magnesium PM_{2.5} Lc</i>	59	38	0.0352	0.0369	0.0469	0.327	0.215	0.174	0.0155
<i>Manganese PM_{2.5} Lc</i>	59	53	0.00844	0.00844	0.00288	0.0617	0.0388	0.0256	0.00497
<i>Nickel PM_{2.5} Lc</i>	59	46	0.000778	0.000778	0.00122	0.00445	0.00314	0.00291	0.000789
<i>Oc Csn_Rev Unadjusted PM_{2.5} Lc Tor</i>	60	60	1.95	1.95	0.208	4.02	3.72	3.23	2.11
<i>Oc Csn_Rev Unadjusted PM_{2.5} Lc Tot</i>	60	60	2.13	2.13	0.21	4.96	4.22	3.52	2.33
<i>Oc PM_{2.5} Lc Tor</i>	60	60	1.78	1.78	0.208	3.87	3.59	3.07	1.89
<i>Oc PM_{2.5} Lc Tot</i>	60	60	1.96	1.96	0.21	4.81	4.09	3.36	2.16
<i>Oc1 Csn_Rev Unadjusted PM_{2.5} Lc</i>	60	60	0.0606	0.0606	0.0124	0.288	0.204	0.171	0.0715
<i>Oc1 PM_{2.5} Lc</i>	60	49	0.0438	0.0438	0.0124	0.265	0.185	0.144	0.0621
<i>Oc2 Csn_Rev Unadjusted PM_{2.5} Lc</i>	60	60	0.554	0.554	0.0224	1.18	1.12	1.06	0.63
<i>Oc2 PM_{2.5} Lc</i>	60	60	0.517	0.517	0.0224	1.15	1.07	1.03	0.563
<i>Oc3 Csn_Rev Unadjusted PM_{2.5} Lc</i>	60	60	0.715	0.715	0.109	1.6	1.48	1.39	0.731
<i>Oc3 PM_{2.5} Lc</i>	60	60	0.653	0.653	0.109	1.53	1.42	1.34	0.642
<i>Oc4 Csn_Rev Unadjusted PM_{2.5} Lc</i>	60	60	0.349	0.349	0.0542	0.713	0.633	0.597	0.329

Air Quality Annual Report 2022

Chemical Name	Num Obs	Obs> MDL	Average (ND=0)	Average (ND=MDL/2)	MDL	Max 1	Max 2	Max 3	Average of NATTS Sites
Oc4 PM _{2.5} Lc	60	60	0.322	0.322	0.0542	0.685	0.603	0.568	0.322
Op Csn_Rev Unadjusted PM _{2.5} Lc Tor	60	59	0.267	0.268	0.0385	0.914	0.857	0.598	0.351
Op Csn_Rev Unadjusted PM _{2.5} Lc Tor	60	59	0.267	0.268	0.0385	0.914	0.857	0.598	0.351
Op PM _{2.5} Lc Tor	60	59	0.249	0.249	0.0385	0.898	0.833	0.586	0.307
Op PM _{2.5} Lc Tot	60	60	0.435	0.435	0.0376	1.84	1.08	0.971	0.55
Phosphorus PM _{2.5} Lc	59	47	0.000312	0.000536	0.00195	0.00562	0.00367	0.00199	0.000839
Potassium Ion PM _{2.5} Lc	59	59	0.119	0.119	0.0133	4.31	0.172	0.136	0.0453
Potassium PM _{2.5} Lc	59	59	0.141	0.141	0.0062	4.08	0.399	0.201	0.0642
Reconstructed Mass PM _{2.5} Lc	57	57	8.43	8.43	0.398	22.8	22.3	18.5	7.24
Rubidium PM _{2.5} Lc	59	32	0.00105	0.00105	0.00315	0.00524	0.00424	0.00351	0.000285
Selenium PM _{2.5} Lc	59	38	0.00127	0.00127	0.0025	0.00701	0.00602	0.00467	0.000547
Silicon PM _{2.5} Lc	58	58	0.147	0.147	0.0105	2.9	0.434	0.308	0.0862
Silver PM _{2.5} Lc	59	31	0.00425	0.00425	0.0125	0.0311	0.0238	0.0195	0.00184
Sodium Ion PM _{2.5} Lc	59	59	0.0527	0.0527	0.0129	0.252	0.232	0.185	0.0346
Sodium PM _{2.5} Lc	59	37	0.0565	0.0565	0.0943	0.351	0.268	0.172	0.0445
Soil PM _{2.5} Lc	59	59	1.35	1.35	0.0782	14.7	3.34	3.07	0.739
Strontium PM _{2.5} Lc	59	42	0.00262	0.00262	0.00293	0.0637	0.0103	0.0078	0.000878
Sulfate PM _{2.5} Lc	59	59	1.22	1.22	0.0312	5.03	2.71	2.58	1
Sulfur PM _{2.5} Lc	59	59	0.41	0.41	0.00031	1.51	0.895	0.877	0.35
Tin PM _{2.5} Lc	59	33	0.00537	0.00537	0.0162	0.0217	0.0192	0.0192	0.00202
Titanium PM _{2.5} Lc	59	55	0.00594	0.00594	0.00381	0.0953	0.0255	0.0111	0.0041
Total Nitrate PM _{2.5} Lc	59	59	1.41	1.41	0.0438	9.7	8.45	4.38	1.16
Vanadium PM _{2.5} Lc	59	17	0.000258	0.000421	0.000463	0.00233	0.00211	0.00201	0.000124
Zinc PM _{2.5} Lc	59	59	0.0498	0.0498	0.00198	0.237	0.236	0.232	0.0172
Zirconium PM _{2.5} Lc	59	27	0.00229	0.00229	0.013	0.0183	0.0149	0.0143	0.000755

Air Quality Annual Report 2022

Allen Park (26163000), Speciated PM_{2.5} (µg/m³)

Chemical Name	Num Obs	Obs> MDL	Average (ND=0)	Average (ND=MDL/2)	MDL	Max 1	Max 2	Max 3	Average of NATTS Sites
Aluminum PM _{2.5} Lc	117	93	0.0356	0.0356	0.0235	1.09	0.139	0.125	0.034
Ammonium Ion PM _{2.5} Lc	118	117	0.457	0.457	0.0129	4	3.05	2.49	0.398
Antimony PM _{2.5} Lc	117	54	0.00483	0.00483	0.0167	0.0352	0.0258	0.0246	0.0014
Arsenic PM _{2.5} Lc	117	33	6.92E-06	1.33E-05	0.0001	6.00E-05	5.00E-05	5.00E-05	3.35E-05
Barium PM _{2.5} Lc	117	62	0.0115	0.0115	0.034	0.0863	0.0596	0.0559	0.0046
Bromine PM _{2.5} Lc	116	34	0.000271	0.000306	0.0001	0.00238	0.00236	0.00232	0.00112
Cadmium PM _{2.5} Lc	117	57	0.00354	0.00354	0.0133	0.0265	0.0199	0.0195	0.000814
Calcium PM _{2.5} Lc	117	117	0.0666	0.0666	0.00802	0.708	0.458	0.343	0.0638
Cerium PM _{2.5} Lc	117	63	0.0128	0.0128	0.0397	0.0611	0.0586	0.0576	0.00219
Cesium PM _{2.5} Lc	117	59	0.00831	0.00831	0.0267	0.0518	0.0503	0.0456	0.00319
Chloride PM _{2.5} Lc	118	118	0.0797	0.0797	0.0161	0.573	0.422	0.352	0.0705
Chlorine PM _{2.5} Lc	116	91	0.00713	0.00713	0.00293	0.236	0.0432	0.043	0.00887
Chromium PM _{2.5} Lc	116	90	0.00137	0.00137	0.00204	0.00624	0.00591	0.00572	0.00145
Cobalt PM _{2.5} Lc	116	34	0.000214	0.000214	0.00168	0.00204	0.0019	0.00156	0
Copper PM _{2.5} Lc	116	72	0.00265	0.00265	0.00451	0.0514	0.0117	0.00867	0.00395
Ec Csn_Rev Unadjusted PM _{2.5} Lc Tor	122	122	0.63	0.63	0.00095	2.69	1.97	1.89	0.691
Ec Csn_Rev Unadjusted PM _{2.5} Lc Tot	122	122	0.404	0.404	0.00608	1.96	1.7	1.47	0.473
Ec PM _{2.5} Lc Tor	216	216	0.571	0.571	0.00911	2.69	1.97	1.89	0.649
Ec PM _{2.5} Lc Tot	122	122	0.404	0.404	0.00608	1.96	1.7	1.47	0.473
Ec1 Csn_Rev Unadjusted PM _{2.5} Lc	122	122	0.764	0.764	0.0264	3.12	2.62	2.21	0.856
Ec1 PM _{2.5} Lc	216	216	0.678	0.678	0.0174	3.11	2.61	2.21	0.8

Air Quality Annual Report 2022

Chemical Name	Num Obs	Obs> MDL	Average (ND=0)	Average (ND=MDL/2)	MDL	Max 1	Max 2	Max 3	Average of NATTS Sites
<i>Ec2 Csn_Rev Unadjusted PM_{2.5} Lc</i>	122	122	0.151	0.151	0.0141	0.405	0.308	0.261	0.172
<i>Ec2 PM_{2.5} Lc</i>	216	216	0.111	0.111	0.0151	0.398	0.299	0.249	0.147
<i>Ec3 Csn_Rev Unadjusted PM_{2.5} Lc</i>	122	122	0.0214	0.0214	0.00367	1.41	0.0546	0.0388	0.0134
<i>Ec3 PM_{2.5} Lc</i>	216	120	0.0112	0.0113	0.00221	1.41	0.0539	0.0381	0.00929
<i>Indium PM_{2.5} Lc</i>	117	71	0.00426	0.00426	0.015	0.0322	0.0224	0.0209	0.00219
<i>Iron PM_{2.5} Lc</i>	116	115	0.0738	0.0738	0.00809	0.638	0.344	0.207	0.137
<i>Lead PM_{2.5} Lc</i>	117	78	0.00373	0.00373	0.00687	0.0199	0.0182	0.0173	0.00369
<i>Magnesium PM_{2.5} Lc</i>	117	74	0.0247	0.0271	0.0466	0.22	0.154	0.147	0.0155
<i>Manganese PM_{2.5} Lc</i>	117	82	0.00257	0.00257	0.00288	0.0156	0.0099	0.00849	0.00497
<i>Nickel PM_{2.5} Lc</i>	116	83	0.000627	0.000638	0.00121	0.00322	0.0028	0.00272	0.000789
<i>Oc Csn_Rev Unadjusted PM_{2.5} Lc Tot</i>	122	122	1.86	1.86	0.208	5.53	4.86	4.04	2.11
<i>Oc Csn_Rev Unadjusted PM_{2.5} Lc Tot</i>	122	122	2.08	2.08	0.21	6.07	6.03	4.79	2.33
<i>Oc PM_{2.5} Lc Tot</i>	216	216	1.59	1.59	0.153	5.39	4.82	4.69	1.89
<i>Oc PM_{2.5} Lc Tot</i>	122	122	1.91	1.91	0.21	5.92	5.89	4.62	2.16
<i>Oc1 Csn_Rev Unadjusted PM_{2.5} Lc</i>	122	122	0.0647	0.0647	0.0125	0.259	0.225	0.215	0.0715
<i>Oc1 PM_{2.5} Lc</i>	216	187	0.0621	0.0621	0.0201	0.494	0.353	0.295	0.0621
<i>Oc2 Csn_Rev Unadjusted PM_{2.5} Lc</i>	122	122	0.567	0.567	0.0224	1.84	1.81	1.33	0.63
<i>Oc2 PM_{2.5} Lc</i>	216	216	0.444	0.444	0.0255	1.81	1.77	1.28	0.563
<i>Oc3 Csn_Rev Unadjusted PM_{2.5} Lc</i>	122	122	0.611	0.611	0.109	2.15	1.76	1.41	0.731

Air Quality Annual Report 2022

<i>Chemical Name</i>	Num Obs	Obs> MDL	Average (ND=0)	Average (ND=MDL/2)	MDL	Max 1	Max 2	Max 3	Average of NATTS Sites
<i>Op PM_{2.5} Lc Tor</i>	216	207	0.229	0.23	0.0249	1.4	0.983	0.865	0.307
<i>Op PM_{2.5} Lc Tot</i>	122	122	0.514	0.514	0.0376	1.88	1.77	1.64	0.55
<i>Phosphorus PM_{2.5} Lc</i>	117	83	0.000287	0.00064	0.00191	0.0044	0.00402	0.00282	0.000839
<i>Potassium Ion PM_{2.5} Lc</i>	118	117	0.0456	0.0456	0.0133	1.47	0.185	0.166	0.0453
<i>Potassium PM_{2.5} Lc</i>	117	117	0.0594	0.0594	0.00613	1.49	0.263	0.142	0.0642
<i>Reconstructed Mass PM_{2.5} Lc</i>	116	116	6.77	6.77	0.398	26.9	23.1	18.4	7.24
<i>Rubidium PM_{2.5} Lc</i>	117	60	0.000621	0.000633	0.00317	0.00687	0.00424	0.00363	0.000285
<i>Selenium PM_{2.5} Lc</i>	117	71	0.000904	0.000904	0.00249	0.00541	0.00497	0.00478	0.000547
<i>Silicon PM_{2.5} Lc</i>	117	115	0.0832	0.0832	0.0104	2.29	0.41	0.376	0.0862
<i>Silver PM_{2.5} Lc</i>	117	67	0.00363	0.00363	0.0124	0.0309	0.0151	0.0151	0.00184
<i>Sodium Ion PM_{2.5} Lc</i>	118	118	0.0313	0.0313	0.0129	0.267	0.206	0.199	0.0346
<i>Sodium PM_{2.5} Lc</i>	117	57	0.0307	0.0311	0.0939	0.353	0.26	0.238	0.0445
<i>Soil PM_{2.5} Lc</i>	116	116	0.583	0.583	0.0767	10.3	2.74	2.53	0.739
<i>Strontium PM_{2.5} Lc</i>	117	69	0.00138	0.00138	0.00289	0.035	0.00558	0.00546	0.000878
<i>Sulfate PM_{2.5} Lc</i>	118	118	0.924	0.924	0.0315	4.71	2.53	2.34	1
<i>Sulfur PM_{2.5} Lc</i>	117	116	0.306	0.306	0.00031	1.55	0.93	0.859	0.35
<i>Tin PM_{2.5} Lc</i>	117	64	0.00438	0.00438	0.0161	0.036	0.0303	0.0201	0.00202
<i>Titanium PM_{2.5} Lc</i>	117	101	0.00399	0.00399	0.00375	0.0682	0.017	0.0121	0.0041
<i>Total Nitrate PM_{2.5} Lc</i>	118	118	1.49	1.49	0.0436	13.3	9.52	7.38	1.16
<i>Vanadium PM_{2.5} Lc</i>	117	30	0.000151	0.000318	0.000467	0.00233	0.00148	0.00107	0.000124
<i>Zinc PM_{2.5} Lc</i>	117	116	0.0129	0.0129	0.00198	0.051	0.0503	0.0436	0.0172
<i>Zirconium PM_{2.5} Lc</i>	117	49	0.00319	0.00319	0.013	0.0345	0.0258	0.02	0.000755

Air Quality Annual Report 2022

Detroit-SW (261630015), Speciated PM_{2.5} (µg/m³)

Chemical Name	Num Obs	Obs> MDL	Average (ND=0)	Average (ND=MDL/2)	MDL	Max 1	Max 2	Max 3	Average of NATTS Sites
<i>Aluminum PM_{2.5} Lc</i>	58	50	0.072	0.072	0.0238	1.31	0.318	0.3	0.034
<i>Ammonium Ion PM_{2.5} Lc</i>	58	58	0.437	0.437	0.0129	2.83	1.85	1.77	0.398
<i>Antimony PM_{2.5} Lc</i>	58	32	0.00486	0.00486	0.0168	0.0258	0.0257	0.0237	0.0014
<i>Arsenic PM_{2.5} Lc</i>	58	14	1.36E-05	1.79E-05	0.0001	0.00048	5.00E-05	5.00E-05	3.35E-05
<i>Barium PM_{2.5} Lc</i>	58	34	0.0115	0.0115	0.034	0.0471	0.038	0.0364	0.0046
<i>Bromine PM_{2.5} Lc</i>	58	15	0.000488	0.000525	0.0001	0.00387	0.0031	0.00296	0.00112
<i>Cadmium PM_{2.5} Lc</i>	58	29	0.00346	0.00346	0.0134	0.0261	0.0136	0.0135	0.000814
<i>Calcium PM_{2.5} Lc</i>	58	58	0.181	0.181	0.0083	1.25	1.06	0.823	0.0638
<i>Cerium PM_{2.5} Lc</i>	58	27	0.00885	0.00885	0.04	0.0539	0.0472	0.0409	0.00219
<i>Cesium PM_{2.5} Lc</i>	58	33	0.0072	0.0072	0.027	0.0392	0.0346	0.031	0.00319
<i>Chloride PM_{2.5} Lc</i>	58	58	0.188	0.188	0.0157	1.06	0.868	0.856	0.0705
<i>Chlorine PM_{2.5} Lc</i>	58	55	0.0232	0.0232	0.00298	0.23	0.091	0.0828	0.00887
<i>Chromium PM_{2.5} Lc</i>	58	39	0.00129	0.00131	0.00205	0.00653	0.00561	0.00447	0.00145
<i>Cobalt PM_{2.5} Lc</i>	58	18	0.000204	0.000204	0.00168	0.00213	0.00207	0.00125	0
<i>Copper PM_{2.5} Lc</i>	58	56	0.0107	0.0107	0.00466	0.029	0.0261	0.0245	0.00395
<i>Ec Csn_Rev Unadjusted PM_{2.5} Lc Tor</i>	58	58	0.724	0.724	0.00095	2.68	1.64	1.56	0.691
<i>Ec Csn_Rev Unadjusted PM_{2.5} Lc Tot</i>	58	58	0.517	0.517	0.00619	1.43	1.14	1.1	0.473
<i>Ec PM_{2.5} Lc Tor</i>	58	58	0.724	0.724	0.00095	2.68	1.64	1.56	0.649
<i>Ec PM_{2.5} Lc Tot</i>	58	58	0.518	0.518	0.00619	1.43	1.14	1.1	0.473
<i>Ec1 Csn_Rev Unadjusted PM_{2.5} Lc</i>	58	58	0.836	0.836	0.0262	3.84	1.93	1.73	0.856
<i>Ec1 PM_{2.5} Lc</i>	58	58	0.83	0.83	0.0262	3.83	1.92	1.72	0.8

Air Quality Annual Report 2022

<i>Chemical Name</i>	Num Obs	Obs> MDL	Average (ND=0)	Average (ND=MDL/2)	MDL	Max 1	Max 2	Max 3	Average of NATTS Sites
<i>Ec2 Csn_Rev Unadjusted PM_{2.5} Lc</i>	58	58	0.167	0.167	0.014	0.316	0.245	0.244	0.172
<i>Ec2 PM_{2.5} Lc</i>	58	58	0.157	0.157	0.014	0.308	0.238	0.232	0.147
<i>Ec3 Csn_Rev Unadjusted PM_{2.5} Lc</i>	58	58	0.0125	0.0125	0.00367	0.0293	0.0288	0.0263	0.0134
<i>Ec3 PM_{2.5} Lc</i>	58	58	0.011	0.011	0.00367	0.0281	0.0279	0.0246	0.00929
<i>Indium PM_{2.5} Lc</i>	58	35	0.00513	0.00513	0.0152	0.0479	0.025	0.0231	0.00219
<i>Iron PM_{2.5} Lc</i>	58	58	0.13	0.13	0.00806	0.921	0.537	0.445	0.137
<i>Lead PM_{2.5} Lc</i>	58	45	0.00401	0.00401	0.00693	0.0138	0.0122	0.0119	0.00369
<i>Magnesium PM_{2.5} Lc</i>	58	42	0.0425	0.043	0.0468	0.319	0.224	0.168	0.0155
<i>Manganese PM_{2.5} Lc</i>	58	50	0.00403	0.00403	0.00291	0.0203	0.0162	0.0135	0.00497
<i>Nickel PM_{2.5} Lc</i>	58	42	0.00101	0.00101	0.00123	0.00744	0.00415	0.00352	0.000789
<i>Oc Csn_Rev Unadjusted PM_{2.5} Lc Tor</i>	58	58	1.92	1.92	0.206	4.93	3.75	3.53	2.11
<i>Oc Csn_Rev Unadjusted PM_{2.5} Lc Tot</i>	58	58	2.13	2.13	0.208	6.19	4.39	3.93	2.33
<i>Oc PM_{2.5} Lc Tor</i>	58	58	1.76	1.76	0.206	4.78	3.62	3.34	1.89
<i>Oc PM_{2.5} Lc Tot</i>	58	58	1.96	1.96	0.208	6.03	4.26	3.74	2.16
<i>Oc1 Csn_Rev Unadjusted PM_{2.5} Lc</i>	58	58	0.0647	0.0647	0.0124	0.414	0.244	0.185	0.0715
<i>Oc1 PM_{2.5} Lc</i>	58	48	0.0479	0.0479	0.0124	0.386	0.22	0.166	0.0621
<i>Oc2 Csn_Rev Unadjusted PM_{2.5} Lc</i>	58	58	0.555	0.555	0.0222	1.27	1.23	1.22	0.63
<i>Oc2 PM_{2.5} Lc</i>	58	58	0.517	0.517	0.0222	1.22	1.2	1.18	0.563
<i>Oc3 Csn_Rev Unadjusted PM_{2.5} Lc</i>	58	58	0.676	0.676	0.107	1.44	1.38	1.37	0.731
<i>Oc3 PM_{2.5} Lc</i>	58	58	0.615	0.615	0.107	1.38	1.32	1.32	0.642
<i>Oc4 Csn_Rev Unadjusted PM_{2.5} Lc</i>	58	58	0.337	0.337	0.0541	0.551	0.533	0.47	0.329
<i>Oc4 PM_{2.5} Lc</i>	58	58	0.311	0.311	0.0541	0.52	0.504	0.439	0.322

Air Quality Annual Report 2022

Chemical Name	Num Obs	Obs> MDL	Average (ND=0)	Average (ND=MDL/2)	MDL	Max 1	Max 2	Max 3	Average of NATTS Sites
<i>Op Csn_Rev Unadjusted PM_{2.5} Lc Tor</i>	58	58	0.292	0.292	0.0382	1.49	0.871	0.659	0.351
<i>Op Csn_Rev Unadjusted PM_{2.5} Lc Tot</i>	58	58	0.498	0.498	0.0374	2.74	1.19	1.06	0.568
<i>Op PM_{2.5} Lc Tor</i>	58	57	0.273	0.273	0.0382	1.47	0.846	0.636	0.307
<i>Op PM_{2.5} Lc Tot</i>	58	58	0.48	0.48	0.0374	2.72	1.18	1.04	0.55
<i>Phosphorus PM_{2.5} Lc</i>	58	45	0.000304	0.000519	0.00194	0.00476	0.00391	0.00363	0.000839
<i>Potassium Ion PM_{2.5} Lc</i>	58	57	0.0375	0.0375	0.0133	0.329	0.114	0.11	0.0453
<i>Potassium PM_{2.5} Lc</i>	58	58	0.0671	0.0671	0.00602	0.388	0.357	0.184	0.0642
<i>Reconstructed Mass PM_{2.5} Lc</i>	57	57	7.92	7.92	0.393	21.6	20.3	18.5	7.24
<i>Rubidium PM_{2.5} Lc</i>	58	26	0.000851	0.000851	0.00316	0.00524	0.00456	0.00379	0.000285
<i>Selenium PM_{2.5} Lc</i>	58	36	0.00102	0.00102	0.00252	0.00521	0.00389	0.00371	0.000547
<i>Silicon PM_{2.5} Lc</i>	58	58	0.187	0.187	0.0105	2.82	0.993	0.923	0.0862
<i>Silver PM_{2.5} Lc</i>	58	34	0.00487	0.00487	0.0125	0.0301	0.0289	0.0252	0.00184
<i>Sodium Ion PM_{2.5} Lc</i>	58	57	0.0343	0.0343	0.0129	0.206	0.198	0.116	0.0346
<i>Sodium PM_{2.5} Lc</i>	29	20	0.0641	0.0641	0.0926	0.327	0.326	0.175	0.0445
<i>Soil PM_{2.5} Lc</i>	58	58	1.24	1.24	0.0781	13.6	6.38	6	0.739
<i>Strontium PM_{2.5} Lc</i>	58	39	0.00185	0.00185	0.00291	0.00908	0.00834	0.00797	0.000878
<i>Sulfate PM_{2.5} Lc</i>	58	58	1.01	1.01	0.0312	3.12	2.39	1.95	1
<i>Sulfur PM_{2.5} Lc</i>	58	58	0.347	0.347	0.00031	0.998	0.856	0.715	0.35
<i>Tin PM_{2.5} Lc</i>	58	32	0.00584	0.00584	0.0162	0.0381	0.0202	0.0186	0.00202
<i>Titanium PM_{2.5} Lc</i>	58	54	0.00631	0.00631	0.00381	0.0887	0.0294	0.0291	0.0041
<i>Total Nitrate PM_{2.5} Lc</i>	58	58	1.35	1.35	0.0444	9.04	6.76	4.06	1.16
<i>Vanadium PM_{2.5} Lc</i>	58	19	0.000284	0.000443	0.000466	0.0024	0.0021	0.00202	0.000124
<i>Zinc PM_{2.5} Lc</i>	58	58	0.0196	0.0196	0.00199	0.0558	0.0502	0.0462	0.0172
<i>Zirconium PM_{2.5} Lc</i>	58	32	0.00353	0.00353	0.013	0.0193	0.0189	0.0129	0.000755

Air Quality Annual Report 2022

Grand Rapids (260810020), Speciated PM_{2.5} (µg/m³)

Chemical Name	Num Obs	Obs> MDL	Average (ND=0)	Average (ND=MDL/2)	MDL	Max 1	Max 2	Max 3	Average of NATTS Sites
Aluminum PM _{2.5} Lc	117	89	0.0271	0.0271	0.0235	0.251	0.198	0.111	0.034
Ammonium Ion PM _{2.5} Lc	117	116	0.424	0.424	0.0129	3.34	2.38	2.24	0.398
Antimony PM _{2.5} Lc	117	58	0.00387	0.00387	0.0166	0.025	0.0243	0.0206	0.0014
Arsenic PM _{2.5} Lc	117	34	6.32E-06	1.27E-05	0.0001	6.00E-05	5.00E-05	5.00E-05	3.35E-05
Barium PM _{2.5} Lc	117	77	0.014	0.014	0.0341	0.309	0.066	0.0561	0.0046
Bromine PM _{2.5} Lc	117	29	0.00035	0.000387	0.0001	0.00417	0.00363	0.00328	0.00112
Cadmium PM _{2.5} Lc	117	64	0.00358	0.00364	0.0133	0.0197	0.0172	0.0155	0.000814
Calcium PM _{2.5} Lc	117	117	0.0435	0.0435	0.00816	0.429	0.252	0.168	0.0638
Cerium PM _{2.5} Lc	117	52	0.00952	0.00952	0.0399	0.0791	0.064	0.0587	0.00219
Cesium PM _{2.5} Lc	117	64	0.00749	0.00749	0.0269	0.0631	0.0325	0.0323	0.00319
Chloride PM _{2.5} Lc	117	117	0.0873	0.0873	0.016	1.3	0.429	0.399	0.0705
Chlorine PM _{2.5} Lc	117	99	0.0075	0.0075	0.00295	0.413	0.0238	0.0222	0.00887
Chromium PM _{2.5} Lc	117	92	0.00144	0.00144	0.00202	0.00766	0.00693	0.00667	0.00145
Cobalt PM _{2.5} Lc	117	33	0.00028	0.00028	0.00168	0.00367	0.00247	0.00205	0
Copper PM _{2.5} Lc	117	75	0.00359	0.00359	0.00463	0.155	0.0138	0.0107	0.00395
Ec Csn_Rev Unadjusted PM _{2.5} Lc Tor	121	120	0.562	0.562	0.00095	2.47	1.9	1.74	0.691
Ec Csn_Rev Unadjusted PM _{2.5} Lc Tot	121	120	0.352	0.352	0.0061	1.56	1.45	1.14	0.473
Ec PM _{2.5} Lc Tor	121	121	0.562	0.562	0.00095	2.47	1.9	1.74	0.649
Ec PM _{2.5} Lc Tot	121	121	0.352	0.352	0.0061	1.56	1.45	1.14	0.473
Ec1 Csn_Rev Unadjusted PM _{2.5} Lc	121	121	0.724	0.724	0.0264	3.26	2.09	1.99	0.856
Ec1 PM _{2.5} Lc	121	120	0.718	0.718	0.0264	3.26	2.08	1.98	0.8

Air Quality Annual Report 2022

Chemical Name	Num Obs	Obs> MDL	Average (ND=0)	Average (ND=MDL/2)	MDL	Max 1	Max 2	Max 3	Average of NATTS Sites
<i>Ec2 Csn_Rev Unadjusted PM_{2.5} Lc</i>	121	121	0.152	0.152	0.0141	0.455	0.404	0.311	0.172
<i>Ec2 PM_{2.5} Lc</i>	121	120	0.142	0.142	0.0141	0.443	0.397	0.302	0.147
<i>Ec3 Csn_Rev Unadjusted PM_{2.5} Lc</i>	121	121	0.0102	0.0102	0.00368	0.0576	0.0445	0.0376	0.0134
<i>Ec3 PM_{2.5} Lc</i>	121	115	0.00874	0.00874	0.00368	0.0569	0.0438	0.0362	0.00929
<i>Indium PM_{2.5} Lc</i>	117	67	0.0048	0.0048	0.015	0.0242	0.0218	0.0208	0.00219
<i>Iron PM_{2.5} Lc</i>	88	88	0.0615	0.0615	0.00788	0.319	0.219	0.201	0.137
<i>Lead PM_{2.5} Lc</i>	117	75	0.00368	0.00368	0.00686	0.0182	0.0172	0.0137	0.00369
<i>Magnesium PM_{2.5} Lc</i>	117	80	0.026	0.028	0.0471	0.311	0.158	0.141	0.0155
<i>Manganese PM_{2.5} Lc</i>	117	85	0.00243	0.00243	0.00289	0.0167	0.015	0.0122	0.00497
<i>Nickel PM_{2.5} Lc</i>	117	86	0.00063	0.00063	0.00122	0.0032	0.0021	0.00204	0.000789
<i>Oc Csn_Rev Unadjusted PM_{2.5} Lc Tor</i>	121	121	1.91	1.91	0.208	7.4	4.98	4.73	2.11
<i>Oc Csn_Rev Unadjusted PM_{2.5} Lc Tot</i>	121	121	2.12	2.12	0.21	8.42	5.36	5.08	2.33
<i>Oc PM_{2.5} Lc Tor</i>	121	120	1.74	1.74	0.208	7.23	4.84	4.55	1.89
<i>Oc PM_{2.5} Lc Tot</i>	121	120	1.96	1.96	0.21	8.26	5.23	4.9	2.16
<i>Oc1 Csn_Rev Unadjusted PM_{2.5} Lc</i>	121	121	0.0696	0.0696	0.0125	0.426	0.338	0.327	0.0715
<i>Oc1 PM_{2.5} Lc</i>	121	99	0.0529	0.0529	0.0125	0.419	0.318	0.311	0.0621
<i>Oc2 Csn_Rev Unadjusted PM_{2.5} Lc</i>	121	121	0.574	0.574	0.0225	2.65	1.63	1.62	0.63
<i>Oc2 PM_{2.5} Lc</i>	121	121	0.536	0.536	0.0225	2.62	1.59	1.59	0.563
<i>Oc3 Csn_Rev Unadjusted PM_{2.5} Lc</i>	121	121	0.643	0.643	0.109	2.61	1.88	1.51	0.731
<i>Oc3 PM_{2.5} Lc</i>	121	121	0.581	0.581	0.109	2.54	1.83	1.47	0.642
<i>Oc4 Csn_Rev Unadjusted PM_{2.5} Lc</i>	121	121	0.302	0.302	0.0543	0.633	0.599	0.561	0.329
<i>Oc4 PM_{2.5} Lc</i>	121	120	0.276	0.276	0.0543	0.615	0.581	0.534	0.322

Air Quality Annual Report 2022

Chemical Name	Num Obs	Obs> MDL	Average (ND=0)	Average (ND=MDL/2)	MDL	Max 1	Max 2	Max 3	Average of NATTS Sites
Op Csn_Rev Unadjusted PM _{2.5} Lc Tot	121	121	0.324	0.324	0.0384	1.29	1.27	1.02	0.351
Op Csn_Rev Unadjusted PM _{2.5} Lc Tot	121	121	0.534	0.534	0.0376	2.29	1.66	1.38	0.568
Op PM _{2.5} Lc Tor	121	120	0.305	0.305	0.0384	1.27	1.25	1.01	0.307
Op PM _{2.5} Lc Tot	121	120	0.516	0.516	0.0376	2.28	1.64	1.36	0.55
Phosphorus PM _{2.5} Lc	117	83	0.000405	0.000723	0.00198	0.00722	0.00669	0.00456	0.000839
Potassium Ion PM _{2.5} Lc	117	115	0.0751	0.0751	0.0133	4.43	0.428	0.178	0.0453
Potassium PM _{2.5} Lc	117	117	0.088	0.088	0.00615	4.15	0.459	0.16	0.0642
Reconstructed Mass PM _{2.5} Lc	116	116	6.53	6.53	0.404	20.8	17.8	17.6	7.24
Rubidium PM _{2.5} Lc	117	60	0.000904	0.000904	0.00314	0.00668	0.00507	0.00502	0.000285
Selenium PM _{2.5} Lc	117	64	0.00072	0.00072	0.00249	0.00453	0.00423	0.00385	0.000547
Silicon PM _{2.5} Lc	117	113	0.0585	0.0585	0.0104	0.573	0.382	0.247	0.0862
Silver PM _{2.5} Lc	117	58	0.00326	0.00326	0.0124	0.0216	0.0187	0.0179	0.00184
Sodium Ion PM _{2.5} Lc	117	116	0.0274	0.0274	0.0129	0.241	0.194	0.138	0.0346
Sodium PM _{2.5} Lc	117	68	0.04	0.04	0.0938	0.443	0.341	0.228	0.0445
Soil PM _{2.5} Lc	117	117	0.439	0.439	0.0769	2.65	2.32	1.9	0.739
Strontium PM _{2.5} Lc	117	69	0.002	0.002	0.0029	0.101	0.00727	0.00628	0.000878
Sulfate PM _{2.5} Lc	117	117	0.855	0.855	0.0315	4.6	3.05	2.18	1
Sulfur PM _{2.5} Lc	117	117	0.295	0.295	0.00031	1.42	1.14	0.78	0.35
Tin PM _{2.5} Lc	117	63	0.00488	0.00488	0.0162	0.0279	0.0234	0.023	0.00202
Titanium PM _{2.5} Lc	117	106	0.00401	0.00401	0.00384	0.0238	0.0173	0.0168	0.0041
Total Nitrate PM _{2.5} Lc	117	117	1.39	1.39	0.0438	10.2	8.62	8.19	1.16
Vanadium PM _{2.5} Lc	117	22	6.91E-05	0.000256	0.000461	0.00112	0.00103	0.00076	0.000124
Zinc PM _{2.5} Lc	117	117	0.0145	0.0145	0.00196	0.135	0.0498	0.0481	0.0172
Zirconium PM _{2.5} Lc	117	59	0.0036	0.0036	0.013	0.0219	0.0219	0.0168	0.000755

Appendix C - SUMMARY

Appendix C summarizes the development of the National Ambient Air Quality Standards (NAAQS) and how compliance with these standards is determined. Also included is the variety of monitoring techniques, requirements used to ensure quality data is obtained, and a history of NAAQS changes that have occurred since inception of the CAA.

National Ambient Air Quality Standards

Under Section 109 of the CAA, the USEPA established a primary and secondary NAAQS for each pollutant for which air quality criteria have been issued. The primary standard is designed to protect public health with an adequate margin of safety, including the health of the most susceptible individuals in a population, such as children, the elderly, and those with chronic respiratory ailments. Factors in selecting the margin of safety for the primary standard include the nature and severity of health effects involved and the size of the sensitive population at risk. Secondary standards are chosen to protect public welfare (personal comfort and well-being) and the environment by limiting economic damage; impacts on visibility and climate; and harmful effects on soil, water, crops, vegetation, wildlife, and buildings.

In addition, the NAAQS have various averaging times to address health impacts. Short averaging times reflect the potential for acute (immediate) effects, whereas long-term averaging times are designed to protect against chronic (long-term) effects.

NAAQS have been established for CO, Pb, NO₂, PM, O₃, and SO₂. **Table C1.1** lists the primary and secondary NAAQS, averaging time, and concentration level for each criteria pollutant in effect in 2022. The concentrations are listed as parts per million (ppm), micrograms per cubic meter ($\mu\text{g}/\text{m}^3$) and/or milligrams per cubic meter (mg/m^3).

Table C1.1: NAAQS in Effect during 2022 for Criteria Pollutants

Pollutant	Primary (health) Level	Primary Averaging Time	Secondary (welfare) Level	Secondary Averaging Time
Carbon Monoxide (CO) 8-hour average	9 ppm (10 mg/m ³)	8-hour average, not to be exceeded more than once per year (1971)	None*	None*
Carbon Monoxide (CO) 1-hour average	35 ppm (40 mg/m ³)	1-hour average, not to be exceeded more than once per year (1971)	None*	None*
Lead (Pb)	0.15 µg/m ³	Maximum rolling 3-month average (2008)	Same as Primary	Same as Primary
Nitrogen Dioxide (NO ₂) Annual mean	0.053 ppm (100 µg/m ³)	Annual mean (1971)	Same as Primary	Same as Primary
Nitrogen Dioxide (NO ₂) 1-hour average	0.100 ppm	98 th percentile of 1-hour average, averaged over 3 years (2010)	Same as Annual	Same as Annual
Particulate Matter (PM ₁₀)	150 µg/m ³	24-hour average, not to be exceeded more than once per year over 3 years (1987)	Same as Primary	Same as Primary
Particulate Matter (PM _{2.5}) Annual average	12.0 µg/m ³	Annual mean averaged over 3 years (2012)	15.0 µg/m ³	Annual mean
Particulate Matter (PM _{2.5}) 24-hour average	35 µg/m ³	98 th percentile of 24-hour concentration, averaged over 3 years (2006)	Same as Primary	Same as Primary
Ozone (O ₃)	0.070 ppm	Annual 4 th highest 8-hour daily max averaged over 3 years (2015)	Same as Primary	Same as Primary
Sulfur Dioxide (SO ₂)	0.075 ppm	99 th percentile of 1-hour daily max averaged over 3 years (2010)	0.5 ppm	3 hours

* In 1985, the USEPA revoked the secondary standard for CO (for public welfare) due to a lack of evidence of adverse effects on public welfare at or near ambient concentrations.

To demonstrate compliance with the NAAQS, the USEPA has defined specific criteria for each pollutant, which are summarized in **Table C1.2**.

Table C1.2: Criteria for the Determination of Compliance with the NAAQS

Pollutant	Criteria for Compliance
CO	Compliance with the CO standard is met when the second highest, non-overlapping, 35 ppm, 1-hour average standard and/or the 9 ppm, 8-hour average standard is not exceeded more than once per year.
Pb	Compliance with the Pb standard is met when daily values collected for 3 consecutive months are averaged and do not exceed the 0.15 µg/m ³ standard.
NO ₂	Compliance is met when the annual arithmetic mean concentration does not exceed the 0.053 ppm standard and the 98 th percentile* of the daily maximum 1-hour concentration averaged over 3 years does not exceed 100 ppb.
PM ₁₀	The 24-hour PM ₁₀ primary and secondary standards are met when 150 µg/m ³ is not exceeded more than once per year on average over 3 years.
PM _{2.5}	The annual PM _{2.5} primary and secondary standards are met when the annual arithmetic mean concentration is less than or equal to 12 µg/m ³ and 15 µg/m ³ , respectively. The 24-hour PM _{2.5} primary and secondary standards are met when the 3-year average of the 98 th percentile** 24-hour concentration is less than or equal to 35 µg/m ³ .
O ₃	The 8-hour O ₃ primary and secondary standards are met when the 3-year average of the 4 th highest daily maximum 8-hour average concentration is less than or equal to 0.070 ppm.
SO ₂	To determine compliance, the 99 th percentile*** 1-hour concentration averaged over a 3-year period does not exceed 0.075 ppm, and the 3-hour average concentration shall not exceed 0.5 ppm more than once per calendar year.

* 98th percentile daily maximum 1-hour value is the value below which nominally 98 percent of all daily maximum 1-hour concentration values fall, using the ranking and selection method specified in Section 5.2 of Appendix S of Code of Federal Regulations (CFR) Part 50.

** 98th percentile is the daily value out of a year of PM_{2.5} monitoring data below which 98 percent of all daily values fall using the ranking and selection method specified in Section 4.5(a) of Appendix N of CFR Part 50.

*** 99th percentile daily maximum 1-hour value is the value below which nominally 99 percent of all daily maximum 1-hour concentration values fall, using the ranking and selection method specified in Section 5 of Appendix T of CFR Part 50.

As part of the USEPA’s grant to EGLE, the AQD provides an Annual Network Review document of all monitoring data collected from the previous year and recommendations on any network changes. These recommendations are based on each monitor’s exceedance history, changes in population distribution, and modifications to federal monitoring requirements under the CAA. Under the amended air monitoring regulations that began in 2007, states are required to solicit public comment (in May of each year) on their future air monitoring network design prior to submitting the Annual Network Review to the USEPA in July.

Types of Monitors

Federal Reference Method (FRM): Method of sampling and analyzing the ambient air for an air pollutant which the USEPA uses as the “gold standard” for measuring that pollutant. FRM monitors are used to designated attainment/nonattainment areas. The gaseous pollutants CO, NO₂, O₃, and SO₂ are measured with continuous FRM monitors that provide real-time hourly data. The FRM for PM and Pb requires filters that measure concentrations over a 24-hour period. These filters must be further analyzed in a laboratory; therefore, the samples’ results are delayed.

Rural Background Monitors: Measure background air quality in non-urban areas.

Aethalometers: Measure carbon black, a combustion by-product typical of transportation sources, by concentrating particulate on a filter tape and measuring changes in optical transmissivity and absorption.

Federal Equivalent Method (FEM): Method for measuring the concentration of an air pollutant in the ambient air that has been designated as equivalent to the FRM.

Continuous Monitors: Measure data in real-time, meaning concentrations of the air pollutant are usually available within an hour on the Mlair website.

TEOM: Tapered Element Oscillating Monitors (TEOMs) are continuous PM monitors that are used for real-time data indications since they are not FRMs and cannot be used for attainment/nonattainment designations.

BAM: Beta attenuation monitors (BAMs) are real-time, continuous PM_{2.5} monitors that are FEM, thus can be used for attainment/nonattainment designations.

T640: A continuous PM_{2.5} monitor that uses a light scattering technique to measure particulates. This FEM method can be used for attainment/nonattainment designations.

T640X: A continuous monitor that measures PM_{2.5}, PM₁₀, and PM coarse that uses a light scattering technique to measure particulates. This FEM method can be used for attainment/nonattainment designation.

PM_{2.5} FRM Monitoring: The concentrations of PM_{2.5} measured over a 24-hour time period are determined using the filter-based gravimetric FRM. Data generated by the FRM monitors are used for comparisons to the NAAQS in Michigan. The sites are in urban, commercial, and residential areas where people are exposed to PM_{2.5}.

Chemical Speciation Monitoring: Provides a better understanding of the chemical composition of PM_{2.5} material and better characterizes background levels. Single event Met-One Speciation Air Sampling System (SASS) monitors are used throughout Michigan’s speciation network.

National Air Toxics Trend Station (NATTS): Network developed to fulfill the need for long-term hazardous air pollutants (HAPs) monitoring data of consistent quality. Among the principal objectives are assessing trends and emission reduction program effectiveness and assessing and verifying air quality models.

NCore Network: Began January 1, 2011, as part of the USEPA's 2006 amended air monitoring requirements. National Core (NCore) sites provide a full suite of measurements at one location. NCore stations collect the following measurements: O₃, SO₂ (trace), CO (trace), NO_x (reactive oxides of nitrogen), PM_{2.5} FRM, continuous PM_{2.5}, speciated PM_{2.5}, PM coarse (PM_{10-2.5}), wind speed, wind directions, relative humidity, and ambient temperature. This information will support scientific studies ranging across technological, health, and atmospheric process disciplines. Michigan has two NCore sites; Allen Park and Grand Rapids.

Near-roadway Monitoring Network: Focuses on vehicle emissions and how they disperse near roadways, was approved by USEPA in 2011. This network, now referred to as the near-roadway network, is focused on high traffic urban roads in Core-Based Statistical Areas (CBSAs) with more than one million people.

Populations-oriented Monitors: Located in an area where many people live, also considered ambient air monitors.

Transport Monitors: Measure air pollutants that have travelled a distance from the emission sources and are formed in the atmosphere when certain pollutants are present; e.g., ozone.

Source-oriented/Point-source Monitors: Located near a specific emissions source (e.g., a factory) of a pollutant.

Primary Monitor: Data from these monitors are used to compare to the NAAQS and must meet quality assurance criteria.

Secondary/Precision/Collocated Monitor: Two or more air samplers, analyzers, or other instruments that are operated simultaneously while located side by side. These are used for quality assurance purposes.

Urban Scale Monitors: Measure air pollution concentrations in more populated urban areas.

Quality Assurance

The AQD's Air Monitoring Section (AMS) ensures that all data collected and reported is of high quality and meets federal requirements. The AMS has a quality system in place that includes a Quality Assurance Project Plan (QAPP), standard operating procedures (SOPs), standardized forms and documentation policies, and a robust audit and assessment program.

The monitoring network adheres to the requirements in Title 40 of the CFR, Parts 50, 53, and 58. This ensures that the monitors are correctly sited, operated in accordance with the Federal Reference Methods, and adhere to the quality assurance requirements.

Quality assurance checks are conducted by site operators at the frequencies required in the regulations and unit procedures. Independent audits are conducted by the AMS's Quality Assurance (QA) Team, which has a separate reporting line of supervision. The quality assurance checks and audits are reported to the USEPA each quarter.

External audits are conducted annually by the USEPA, which conducts Performance Evaluation Program (PEP) audits for PM_{2.5} samplers and the National Performance Audit Program (NPAP) checks for the gaseous monitors. The USEPA also conducts program-wide Technical Systems Audits (TSAs) every three years to evaluate overall program operations and assess adequacy of documentation and records

retention. External audits are also conducted on the laboratory operations for certain analytical techniques using performance evaluations samples.

Historical NAAQS Changes

CO

- 1971 1-hour: Second highest average does not exceed 35 ppm in a year.
- 8-hour: Second highest average does not exceed 9 ppm in a year.

Lead

- 1978 Averaged calendar quarter values do not exceed 1.5 $\mu\text{g}/\text{m}^3$.
- 2008 Averaged 3-month values do not exceed 0.15 $\mu\text{g}/\text{m}^3$.

NO₂

- 1971 Annual average of 53 ppb or less.
- 2010 98th percentile of the 1-hour concentration averaged over 3 years is 100 ppb or less.

Ozone

- 1971 Total photochemical oxidants: 1-hour max. of 0.08 ppm not exceeded once per year.
- 1979 1-hour maximum concentration is 0.12 ppm one or less hours per year.
- 1997 4th highest daily max. 8-hour concentration average over 3 years is 0.08 ppm or less.
- 2008 4th highest daily max. 8-hour concentration averaged over 3 years is 0.075 ppm or less.
- 2015 4th highest daily max. 8-hour concentration averaged over 3 years is 0.070 ppm or less.

PM

- 1971 TSP: 24-hour average not to exceed 260 $\mu\text{g}/\text{m}^3$ more than once per year.
Annual geometric mean of 75 $\mu\text{g}/\text{m}^3$.
- 1987 PM₁₀: Indicator for PM changed from TSP to PM₁₀.
24-hour average not to exceed 150 $\mu\text{g}/\text{m}^3$ more than once per year over a 3-year period.
Annual mean of 50 $\mu\text{g}/\text{m}^3$ or less averaged over 3 years.
- 1997 PM_{2.5}: Annual mean of 15.0 $\mu\text{g}/\text{m}^3$ or less averaged over 3 years.
98th percentile of 24-hour value of 65 $\mu\text{g}/\text{m}^3$ or less averaged over 3 years.
- 2006 PM₁₀: Annual average revoked.
24-hour average retained at 150 $\mu\text{g}/\text{m}^3$.
PM_{2.5}: Annual mean retained at 15 $\mu\text{g}/\text{m}^3$.
98th percentile of 24-hour average of 35 $\mu\text{g}/\text{m}^3$ or less averaged over 3 years.
- 2012 PM_{2.5}: Annual mean of 12.0 $\mu\text{g}/\text{m}^3$ or less averaged over 3 years.

SO₂

- 1971 24-hour concentration of 0.14 ppm not exceeded more than once per year.
- 2010 1-hour average of 99th percentile is 75 ppb or less averaged over 3 years.
Previous standards revoked.

APPENDIX D: ACRONYMS AND THEIR DEFINITIONS

µg/m ³	Micrograms per cubic meter
µm	Micrometer
AIRS ID.....	Aerometric Information Retrieval System Identification Number
AMS	Air Monitoring Section
AQD.....	Air Quality Division
AQES	Air Quality Evaluation Section
AQI.....	Air Quality Index
AQS	Air Quality System (USEPA air monitoring data archive)
As.....	Arsenic
BAM	Beta Attenuation Monitor (hourly PM _{2.5} measurement monitor)
BC.....	Black Carbon
CAA.....	Clean Air Act
CBSA.....	Core-based Statistical Area
Cd.....	Cadmium
CFR.....	Code of Federal Regulations
CO.....	Carbon monoxide
CSA	Consolidated Statistical Area
EGLE.....	Michigan Department of Environment, Great Lakes, and Energy
FEM	Federal Equivalent Method
FRM	Federal Reference Method
GHIB	Gordie Howe International Bridge
HAP	Hazardous Air Pollutant
hr	Hour
ITSL.....	Initial Threshold Screening Level
Lc	Local Conditions
MASN	Michigan Air Sampling Network
MDL.....	Method Detection Limit
mg/m ³	Milligrams per meter cubed
MI	Michigan
Mn	Manganese
MSA	Metropolitan Statistical Area
NAAQS.....	National Ambient Air Quality Standards
NATTS.....	National Air Toxics Trend Sites
NCore	National Core Monitoring Sites
ND	Non-detect
NEI.....	National Emissions Inventory
Ni.....	Nickle
NMH 48217...	New Mount Hermon 48217 ZIP code monitoring site

NO	Nitric Oxide
NO ₂	Nitrogen Dioxide
NO _x	Oxides of Nitrogen
NO _y	Oxides of Nitrogen + nitric acid + organic and inorganic nitrates
NPAP.....	National Performance Audit Program
NR.....	Near-roadway
O ₃	Ozone
Obs/OBS.....	Observations
PAH.....	Polynuclear Aromatic Hydrocarbons
PAMS.....	Photochemical Assessment Monitoring Station
Pb.....	Lead
PBT.....	Persistent, Bioaccumulative and Toxic
PCB.....	Polychlorinated Biphenyls
PEP.....	Performance Evaluation Program
PM.....	Particulate Matter
PM _{2.5}	Particulate Matter with an aerodynamic diameter less than or equal to 2.5 microns
PM ₁₀	Particulate Matter with a diameter of 10 microns or less
PM _{10-2.5}	Coarse PM equal to the concentration difference between PM ₁₀ and PM _{2.5}
PNA.....	Polynuclear Aromatic Hydrocarbons
POC.....	Parameter Occurrence Code
ppb.....	Parts Per Billion
ppm.....	Parts Per Million
QA.....	Quality Assurance
QAPP.....	Quality Assurance Project Plan
SASS.....	Speciation Air Sampling System (PM _{2.5} Speciation Sampler)
SO ₂	Sulfur Dioxide
SOP.....	Standard Operating Procedures
STN.....	Speciation Trend Network (PM _{2.5})
Stp.....	Standard Temperature and Pressure
SVOC.....	Semi-Volatile Compound
SW.....	Southwest
SWHS.....	Southwest High School
TAC.....	Toxic Air Contaminant
TEOM.....	Tapered Element Oscillating Microbalance (hourly PM _{2.5} measurement monitor)
tpy.....	Tons Per Year
TSA.....	Technical Systems Audit
TSP.....	Total Suspended Particulate
US.....	United States
USEPA.....	United States Environmental Protection Agency
UV.....	Ultra-violet
VOC.....	Volatile Organic Compounds

ACKNOWLEDGEMENTS

This publication was prepared utilizing information provided by staff from the Air Monitoring Section (AMS), Air Quality Evaluation Section (AQES) and other staff of the Michigan Department of Environment, Great Lakes, and Energy; Air Quality Division. Copies can be obtained online at: [Michigan.gov/Air](https://www.michigan.gov/Air) under “Monitoring,” then “Annual Air Quality Reports,” or call 517-582-3494* to request a hard copy.

AMS Manager: Susan Kilmer

AQES and AMS Secretary: Lorraine Hickman*

AMS Staff:

Andrew Carl

Peter DeHart

Jason Duncan

Rachel Eagan

Marc Foreman

Eric Gafner

Tom Gauthier

David Gregory

Eric Hansen

Cindy Hodges, Editor

Dan Holcomb

Dan Ling

Bryan Lomerson

Doug Lytwynec

William MacKinnon (contractor at Seney)

Matt Nowak

Matt Riselay

Rebecca Robak

Amy Robinson

Erica Wolf

Michelle Zajac

BioWatch & Sensor Unit staff of the Air Monitoring Section - Jim Voss, Unit Supervisor

AQES Manager: Tom Shanley, and staff of the Strategy Development Unit, Toxics Unit, and the Emissions Reporting & Assessment Unit.

Other units in EGLE: The Environmental Support Division.

The Air Quality Division also wishes to acknowledge the contributions of Corey Wells of the Little River Band of Ottawa Indians, who operates a site in Manistee; and the City of Belding, which operated the air monitoring equipment in Belding.

EGLE does not discriminate on the basis of race, sex, religion, age, national origin, color, marital status, disability, political beliefs, height, weight, genetic information, or sexual orientation in the administration of any of its programs or activities and prohibits intimidation and retaliation, as required by applicable laws and regulations.

To request this material in an alternate format, contact EGLE-Accessibility@Michigan.gov or 800-662-9278.



Bay City District

401 Ketchum Street, Suite B, Bay City, MI 48708-5430
Contact: 989-894-6200
Counties: Arenac, Bay, Clare, Gladwin, Huron, Iosco, Isabella, Midland, Ogemaw, Saginaw, Sanilac, and Tuscola

Detroit District

Cadillac Place, Suite 2-300, 3058 West Grand Blvd.,
Detroit, MI 48202-6058
Contact: 313-456-4681
Counties: Wayne

Grand Rapids District

350 Ottawa Avenue NW, Unit 10, Grand Rapids, MI
49503-2316
Contact: 616-356-0500 (Receptionist), 616-279-8021, or
616-540-1136
Counties: Barry, Ionia, Kent, Mecosta, Montcalm, Muskegon,
Newaygo, Oceana, and Ottawa

Kalamazoo District

7953 Adobe Road, Kalamazoo, MI 49009-5026
Contact: 269-243-0954 or 269-312-1540
Counties: Allegan, Berrien, Branch, Calhoun, Cass,
Kalamazoo, St. Joseph, and Van Buren

Marquette District

1504 West Washington Street, Marquette, MI 49855-3118
Contact: 906-241-0086 or 906-202-0013
Counties: All counties in the Upper Peninsula

Cadillac District

120 West Chapin Street, Cadillac, MI 49601-2158
Contact: 231-775-3960
Counties: Benzie, Grand Traverse, Kalkaska, Lake, Leelanau,
Manistee, Mason, Missaukee, Osceola, and Wexford

Gaylord District

2100 West M-32, Gaylord, MI 49735-9282
Contact: 989-798-0872, 231-780-7031, or 231-492-5954
Counties: Alcona, Alpena, Antrim, Charlevoix, Cheboygan,
Crawford, Emmet, Montmorency, Oscoda, Otsego, Presque
Isle, and Roscommon

Jackson District

State Office Building, 4th Floor, 301 East Louis Glick Highway
Jackson, MI 49201-1535
Contact: 517-285-4797 or 517-416-5992
Counties: Hillsdale, Jackson, Lenawee, Monroe, and
Washtenaw

Lansing District

P.O. Box 30242, Lansing, MI 48909-7742
Contact: 517-294-9288 or 517-275-0439
Counties: Clinton, Eaton, Genesee, Gratiot, Ingham, Lapeer,
Livingston, and Shiawassee

Warren District

27700 Donald Court, Warren, MI 48092-2793
Contact: 586-596-6068 or 586-606-2572
Counties: Macomb, Oakland, and St. Clair