MICHIGAN DEPARTMENT OF ENVIRONMENT, GREAT LAKES, AND ENERGY

AIR QUALITY ANNUAL REPORT

2020

Michigan Department of Environment, Great Lakes, and Energy
Michigan.gov/EGLE | 800-662-9278

Air Quality Annual Report

2020

EXECUTIVE SUMMARY

This report gives an overview of the air quality for 2020. Current data for Michigan can be found on MIair (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:

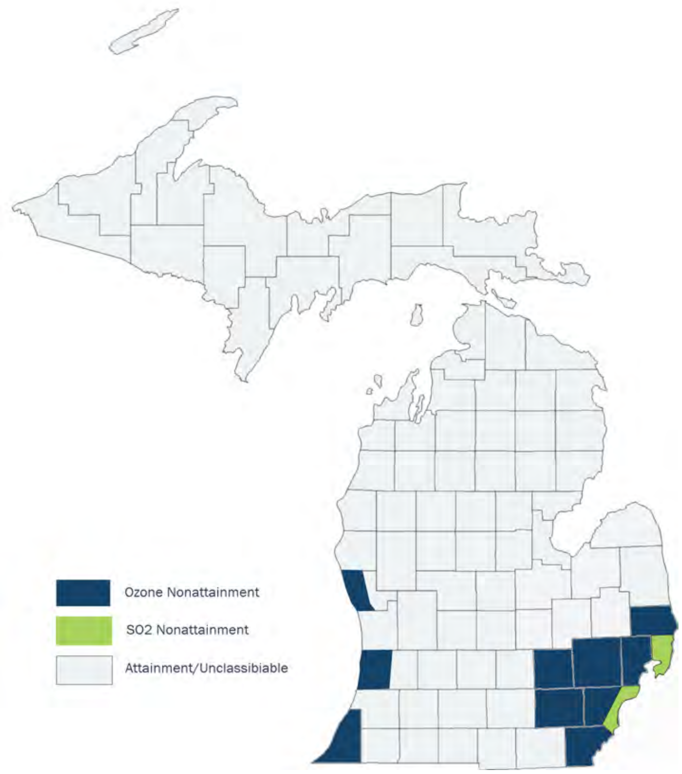
1. Carbon monoxide (CO)
2. Lead (Pb)
3. Nitrogen dioxide (NO_2)
4. Ozone (O_3)
5. Particulate matter smaller than 10 and 2.5 microns in diameter (PM_{10} and $PM_{2.5}$, respectively)
6. Sulfur dioxide (SO_2)

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 1.1 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 designated to nonattainment from attainment even though monitoring shows that air quality continues to improve.

Attainment Status for the National Ambient Air Quality Standards



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, NO_2, and particulate matter. Although portions of the state are in nonattainment for SO_2 and O_3, 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 SO_2 and ozone.

Several changes to the monitoring network occurred during 2020.

- The TSPs were shut down at Allen Park and Grand Rapids since they were no longer required for NCore sites (Chap. 7).
- Several changes were made to the $PM_{2.5}$ network, exchanging Federal Reference Method (FRM) manual filter-based monitors and/or non-regulatory continuous monitors for continuous, federal equivalent method (FEM) monitors due to funding changes. Sites that were affected were Eliza Howell-Near Road (Eliza Howell-NR), Bay City, Holland, Kalamazoo, Lansing, Port Huron, and New Haven. Several of these changes occurred at the end of 2020 and data will not be available until the 2021 report (Chap. 7).
- $PM_{2.5}$, PM_{10} and PM coarse measurements at Allen Park, Grand Rapids, and Jenison were switched to T640X instruments that accomplish the same measurements with one instrument.
- The Livonia-Near Road (Livonia-NR) monitor is in the process of moving since site access was lost in July 2019.
- The NOx monitor at Detroit-E 7 Mile was switched to an NOy and a NOx monitor was added to Jenison.
- Sampling continues for the Gordie Howe International Bridge (GHIB) project special study.
- The Detroit-W. Fort St. site name is being changed to Detroit-Southwest (Detroit-SW).

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INTRODUCTION

Air quality regulations in Michigan are based on National Ambient Air Quality Standards (NAAQS) established by 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. These 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 (NO_2);
- Ozone (O_3);
- Particulate matter smaller than 10 and 2.5 microns in diameter (PM_{10} and $PM_{2.5}$, respectively); and
- Sulfur dioxide (SO_2).

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

- Michigan's monitoring requirements for 2020;
- Attainment / nonattainment status;
- Monitoring site locations (tables and maps show all the monitors active in 2020); and
- Air quality trends from 2015-2020 broken down by location.[1]

The 2020 data for each criteria pollutant is available in **Appendix A.** COVID-19 did not impact air quality data collection in Michigan.

The AQD also monitors air toxics. Air toxics are other hazardous air pollutants that can affect human health and the environment.[2] This data can be found in **Appendix B.**

The purpose of this report is to provide a snapshot of Michigan's 2020 air quality data, air quality trends, overview of the monitoring network (available in much greater detail in the 2020 Network Review),[3] air toxics monitoring program, and other AQD programs, such as MIair 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 www3.epa.gov/airtrends/ .

[2] An Overview of Michigan Air Toxic Rules is available on the AQD website at www.michigan.gov/air (select "Permits," then "Toxics Laws and Rules.")

[3] Available online at Michigan's 2020 Ambient Air Monitoring Network Review

[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 www.michigan.gov/air (select "Monitoring.")

CHAPTER 1: BACKGROUND INFORMATION

This section summarizes the development of the NAAQS (see **Appendix C** for further details) 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 MIair 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, NO_2, PM, O_3, and SO_2. **Table 1.1** lists the primary and secondary NAAQS, averaging time, and concentration level for each criteria pollutant in effect in 2020. The concentrations are listed as parts per million (ppm), micrograms per cubic meter (µg/m^3), and/or milligrams per cubic meter (mg/m^3).

Table 1.1: NAAQS in Effect during 2020 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	98th 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	98th percentile of 24-hour concentration, averaged over 3 years *(2006)*	Same as Primary	Same as Primary
Ozone	0.070 ppm	Annual 4th highest 8-hour daily max averaged over 3 years *(2015)*	Same as Primary	Same as Primary
SO_2	0.075 ppm	99th 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 O_3 and $PM_{2.5}$ monitor in Manistee County is a tribal monitor operated by the Little River Band of Ottawa Indians. **Figure 1.1** is a picture of the Lansing site. **Figure 1.2** is a picture of the Military Park (GHIB) site. **Figure 1.3** shows a map of the 2020 MASN monitoring sites.

The MASN consists of federal reference method (FRM) monitors that enable continuous monitoring for the gaseous pollutants CO, NO_2, O_3, and SO_2 providing real-time hourly data. PM and Pb monitors measure concentrations over a 24-hour period. In addition, continuous $PM_{2.5}$ and PM_{10} 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 2020 and the MASN locations are shown in **Table 1.2.**

Figure 1.1: Lansing site

Figure 1.2: Military Park 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 advance 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-road 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 1.3: 2020 MASN Monitoring Sites

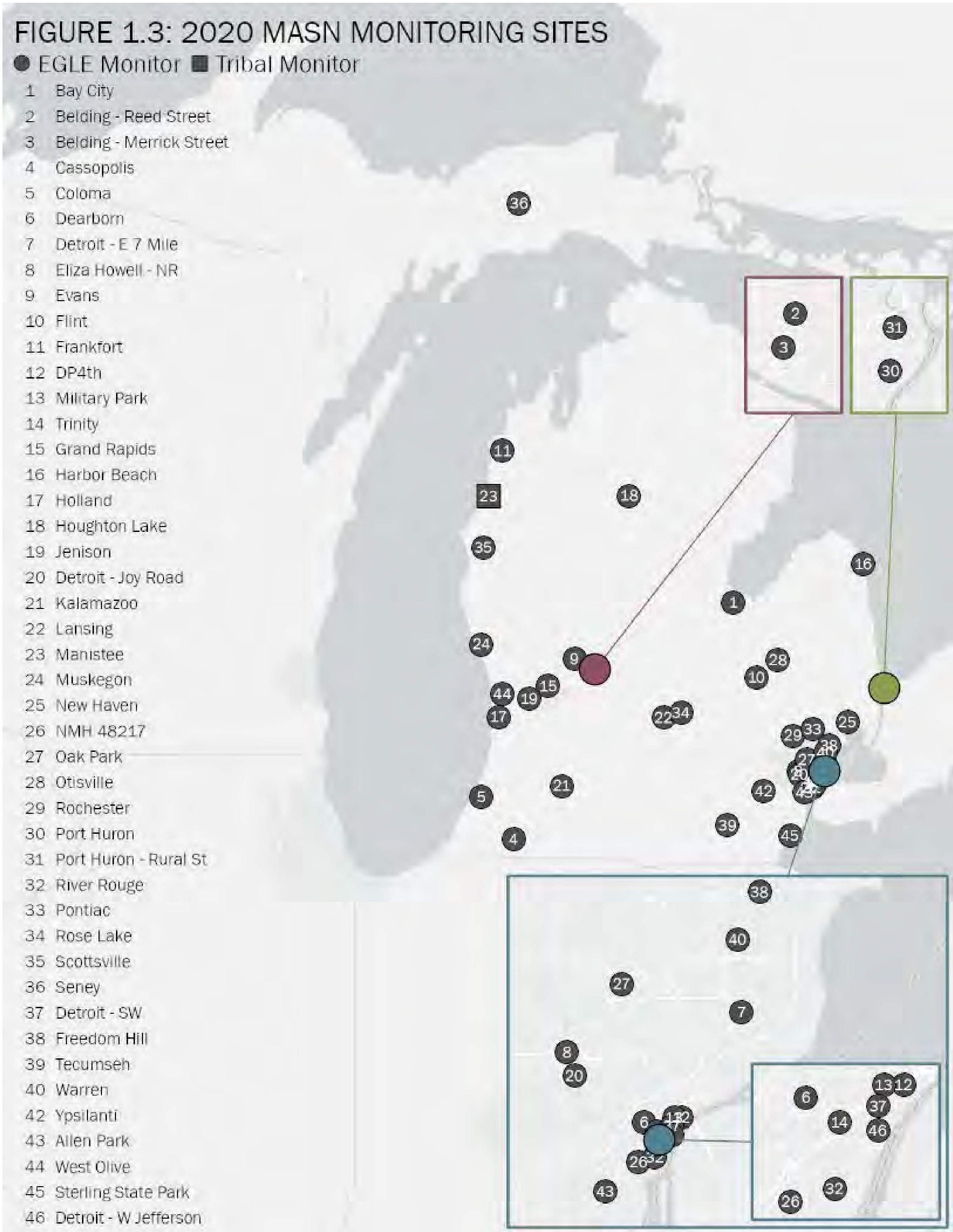


Table 1.2a: Types of Monitoring Conducted in 2020 and MASN Locations in Detroit-Ann Arbor Area.

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	Carbonyls	Trace Metals (As, Cd, Mn, Ni, Pb)	Wind Speed & Direction, Temp.	Relative Humidity	Solar Radiation	Barometric Pressure
260910007	Tecumseh				√			√F						√			√
260990009	New Haven				√		√							√	√	√	
260991003	Warren				√												
261250001	Oak Park				√		√							√			
261470005	Port Huron				√		√	√T		√				√			
261470031	Port Huron-Rural St.												√				
261610008	Ypsilanti				√			√F						√			√
261630001	Allen Park	√*		√	√	√	√	√T	√+A	√*				√	√		√
261630005	River Rouge											√	√	√			
261630015	Detroit-SW[5]		√			√	√	√F	√+A	√	√	√	√	√	√		√
261630019	Detroit-E 7 Mile			√	√		√							√	√		√
261630027	Detroit-W. Jefferson												√				
261630033	Dearborn					√^	√	√T	√+A		√	√	√#	√	√		√
261630093	Eliza Howell-NR	√	√					√F						√			
261630097	New Mount Herman (NMH) 48217							√T		√			√				
261630098	Detroit Police 4th 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 PM_{10} monitor

A = Aethalometer monitor

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

Table 1.2b: Types of Monitoring Conducted in 2020 and MASN Locations in other Michigan 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		√		√	√	√							√			
Grand Rapids	261390011	West Olive									√				√			
Grand Rapids	260810020	Grand Rapids	√*		√	√	√	√	√T	√	√*				√			√
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

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

* = Trace monitor

Table 1.2c: Types of Monitoring Conducted in 2020 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
Monroe	261150006	Sterling State Park									√				√			
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				√		√	√T						√			
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

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

[6] Also called Benzonia.

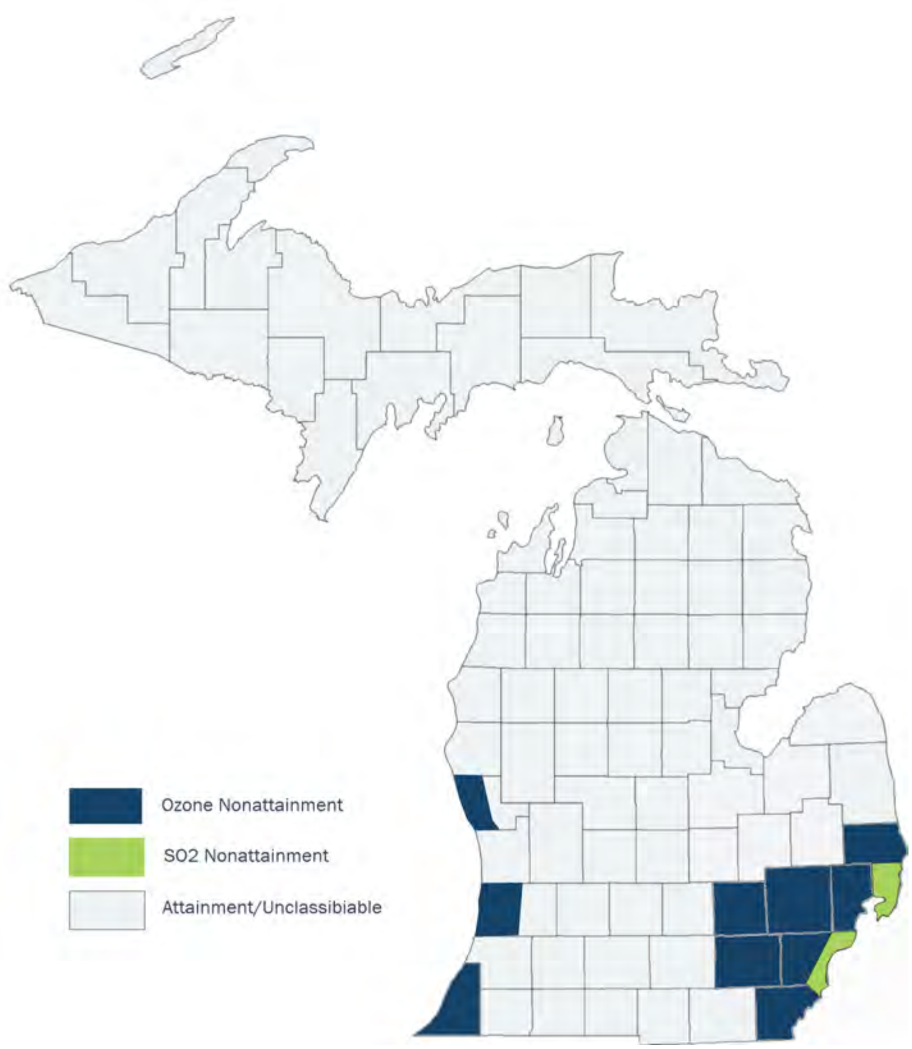
Current Attainment Status

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
- NO_2
- 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 SO_2 and O_3 (see **Figure 1.4**). The SO_2 nonattainment area 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 O_3 was effective on August 3, 2019.

Figure 1.4: Attainment Status for the National Ambient Air Quality Standards



MIair – Air Quality Information in Real-Time

MIair is the internet tool that provides real-time air quality information via EGLE's web page. The deqmiair.org hotlink opens to the current Air Quality Index (AQI) map and displays air quality forecasts for "today" and "tomorrow." **MIair** also hosts EnviroFlash, the automated air quality notification system.

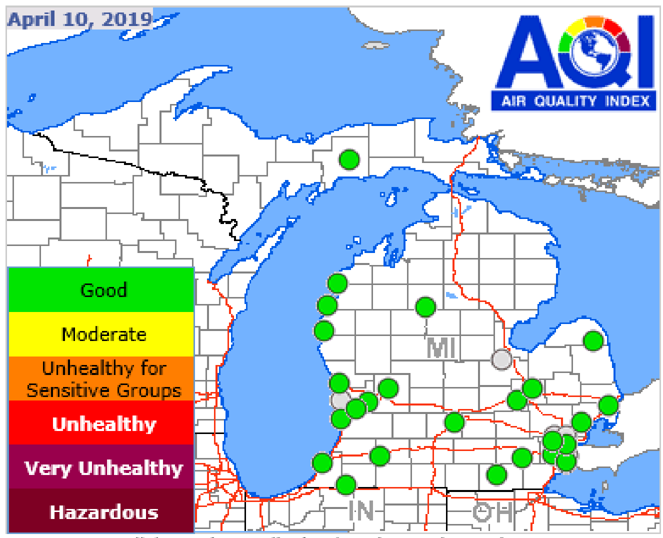
Air Quality Index

The Air Quality Index (AQI) is a simple 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).

Latest AQI Information

Select Map: Statewide Go   Legend

Location	Current AQI Value	Forecast Today	Forecast Tomorrow
Ann Arbor	19 - O_3	$PM_{2.5}$	$PM_{2.5}$
Benton Harbor	23 - O_3	$PM_{2.5}$	$PM_{2.5}$
Detroit	28 - O_3	$PM_{2.5}$	$PM_{2.5}$
Eastern U.P.	34 - O_3	$PM_{2.5}$	$PM_{2.5}$
Flint	24 - O_3	$PM_{2.5}$	$PM_{2.5}$
Grand Rapids	24 - O_3	$PM_{2.5}$	$PM_{2.5}$
Houghton Lake	28 - O_3	$PM_{2.5}$	$PM_{2.5}$
Kalamazoo	23 - O_3	$PM_{2.5}$	$PM_{2.5}$
Lansing	18 - O_3	$PM_{2.5}$	$PM_{2.5}$
Ludington	28 - O_3	$PM_{2.5}$	$PM_{2.5}$
Saginaw	37 - O_3	$PM_{2.5}$	$PM_{2.5}$
Traverse City	30 - O_3	$PM_{2.5}$	$PM_{2.5}$



AQI Breakpoints Actions To Protect Health   Click on site to display hourly monitor values

As can be seen from the AQI bar graphs for the Detroit-Warren-Dearborn area (Figure 1.5) and the Grand Rapids-Wyoming area (Figure 1.6), 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, only two days were in the Unhealthy range, both for $PM_{2.5}$ on July 4 and 5, due to fireworks. In the Unhealthy for Sensitive Groups (USG), 15 days were due to ozone, five were due to $PM_{2.5}$ and four were due to SO_2. In Detroit area, $PM_{2.5}$ leads the AQI 220 days, meaning that pollutant has the highest AQI value of all the pollutants measured per day.

In the Grand Rapids area, only one day was in the Unhealthy range, for $PM_{2.5}$ on July 4, due to fireworks. In the Unhealthy for Sensitive Groups (USG), six days were due to ozone, one was due to $PM_{2.5}$ (on July 5th). In Grand Rapids area, ozone leads the AQI 247 days, meaning that pollutant has the highest AQI value of all the pollutants measured per day.

Figure 1.5: 2020 AQI Days per Pollutant for Detroit-Warren-Dearborn MSA, numbers next to categories are for the Overall AQI Value (First Bar on Graph)

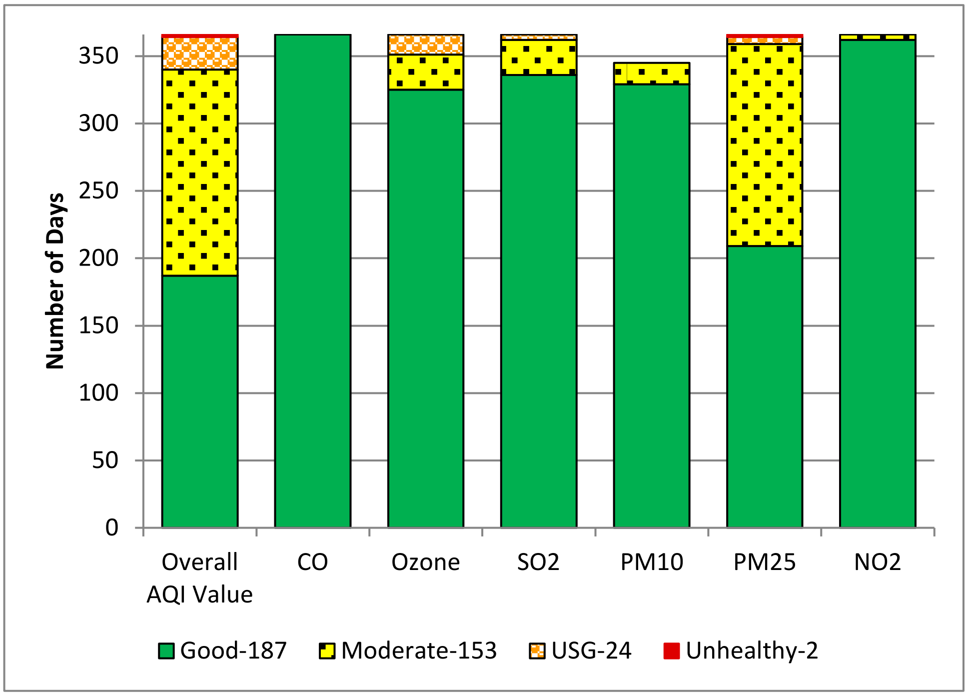
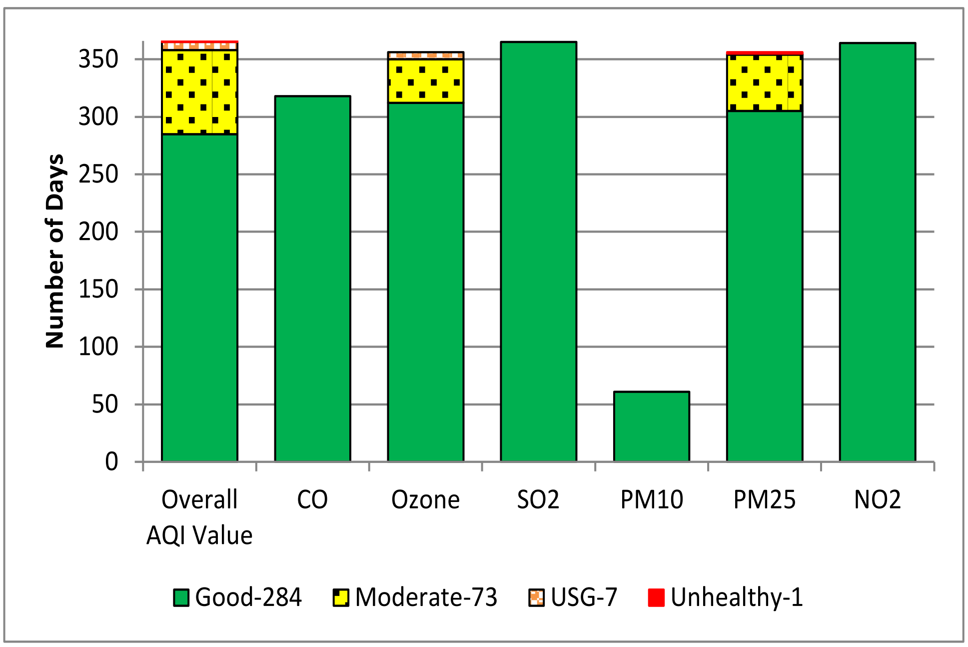


Figure 1.6: 2020 AQI Days Per Pollutant for Grand Rapids-Wyoming MSA, numbers next to categories are for the Overall AQI Value (First Bar on Graph)



MIair includes an "Air Quality Index Fact Sheet" link: michigan.gov/documents/deq/deq-aqd-aqifacts_273090_7.pdf, 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	Particulate Matter (µg/m³) 24-hour	Ozone (ppm) 8-hour / 1-hour	Carbon Monoxide (ppm) 8-hour	Sulfur Dioxide (ppm) 24-hour	Nitrogen Dioxide (ppm) 1-hour
GREEN: Good 1- 50	None	None	None	None	None
YELLOW: Moderate 51- 100	Unusually sensitive people should consider reducing prolonged or heavy exertion.	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	People with heart or lung disease, children, teens, & older adults should reduce prolonged or heavy exertion.	People with heart or lung disease, children, teens, & older adults, and people who are active outdoors should reduce prolonged or heavy exertion.	People with heart disease, such as angina, should reduce heavy exertion & avoid sources of CO, such as heavy traffic.	People with asthma should consider reducing outdoor exertion.	People with lung disease, children, & older adults should limit prolonged outdoor exertion
RED: Unhealthy 151- 200	People with heart or lung disease, children, teen, & older adults should avoid prolonged or heavy exertion. Everyone should reduce prolonged or heavy exertion.	People with heart or lung disease, children, teens & older adults, and people who are active outdoors should avoid prolonged or heavy exertion. Everyone should reduce prolonged or heavy exertion.	People with heart disease, such as angina, should reduce moderate exertion & avoid sources of CO, such as heavy traffic.	Children, asthmatics, & people with heart or lung disease should reduce outdoor exertion.	People with lung disease, children, & older adults should avoid prolonged outdoor exertion. Everyone should limit prolonged outdoor exertion.
PURPLE: Very Unhealthy 201- 300	People with heart or lung disease, children, teens, & older adults should avoid all physical activity outdoors. Everyone else should avoid prolonged or heavy outdoor exertion.	People with heart or lung disease, children & older adults, and people who are active outdoors should avoid all physical activity outdoors. Everyone else should limit outdoor exertion.	People with heart disease, such as angina, should avoid exertion & sources of CO, such as heavy traffic.	Children, asthmatics, & people with heart or lung disease should avoid outdoor exertion. Everyone should reduce outdoor exertion.	People with lung disease, children, & older adults should avoid all outdoor exertion. Everyone else should limit prolonged outdoor exertion.
MAROON: Hazardous 301- 500	People with heart or lung disease, children, teens, & older adults should remain indoors. Everyone should avoid all physical activity outdoors.	People with heart or lung disease, children, and older adults should remain indoors. 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, asthmatics, & people with heart or lung disease should remain indoors. Everyone should avoid outdoor exertion.	Children and People with respiratory disease, such as asthma, should avoid 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 **MIair**.

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 O_3 or $PM_{2.5}$ concentrations.

Table 1.4 shows that there were some *Action!* Days declared during the summer of 2020.

Table 1.4: *Action!* Days Declared During Summer 2020

Location	Year	Number	Dates
Ann Arbor	2020	9	6/18, 6/19, 6/20, 7/5, 7/6, 7/7, 7/8, 7/9, 7/18
Benton Harbor	2020	10	6/18, 6/19, 6/20, 7/5, 7/6, 7/7, 7/8, 7/9, 7/18, 8/26
Detroit	2020	9	6/18, 6/19, 6/20, 7/5, 7/6, 7/7, 7/8, 7/9, 7/18
Flint	2020	2	6/19, 6/20
Grand Rapids	2020	10	6/18, 6/19, 6/20, 7/5, 7/6, 7/7, 7/8, 7/9, 7/18, 8/26
Kalamazoo	2020	2	6/19, 6/20
Ludington	2020	3	6/18, 6/19, 6/20
Traverse City	2020	2	6/19, 6/20

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 particle 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, select the **MIair** button from Michigan's Air Quality page Michigan.gov/air. To receive notices, choose the "Air Quality Notification" tab and click the "Enroll in AQI EnviroFlash" link. 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 hot link at the bottom of each **MIair** 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 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.

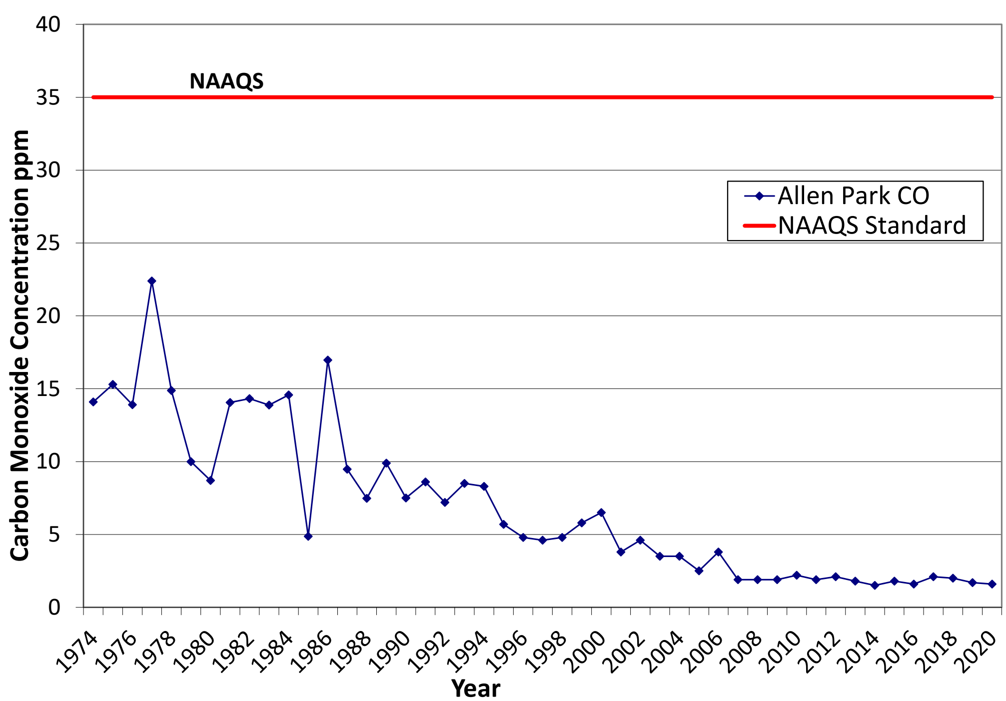
Sources: CO is given off whenever fuel or other carbon-based materials are burned. Outdoor exposure sources include automobile exhaust, industrial processes (metal processing and chemical production), and non-vehicle fuel combustion. Natural sources include volcanos, forest fires, and photochemical reactions 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 O_3, 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 45 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)

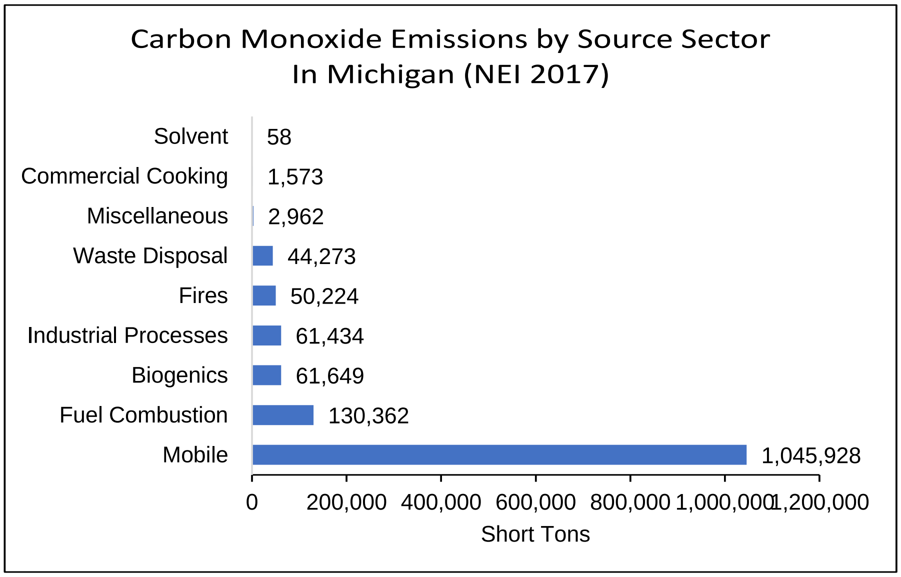


Figure 2.3: CO Emissions in 2017 (NEI)

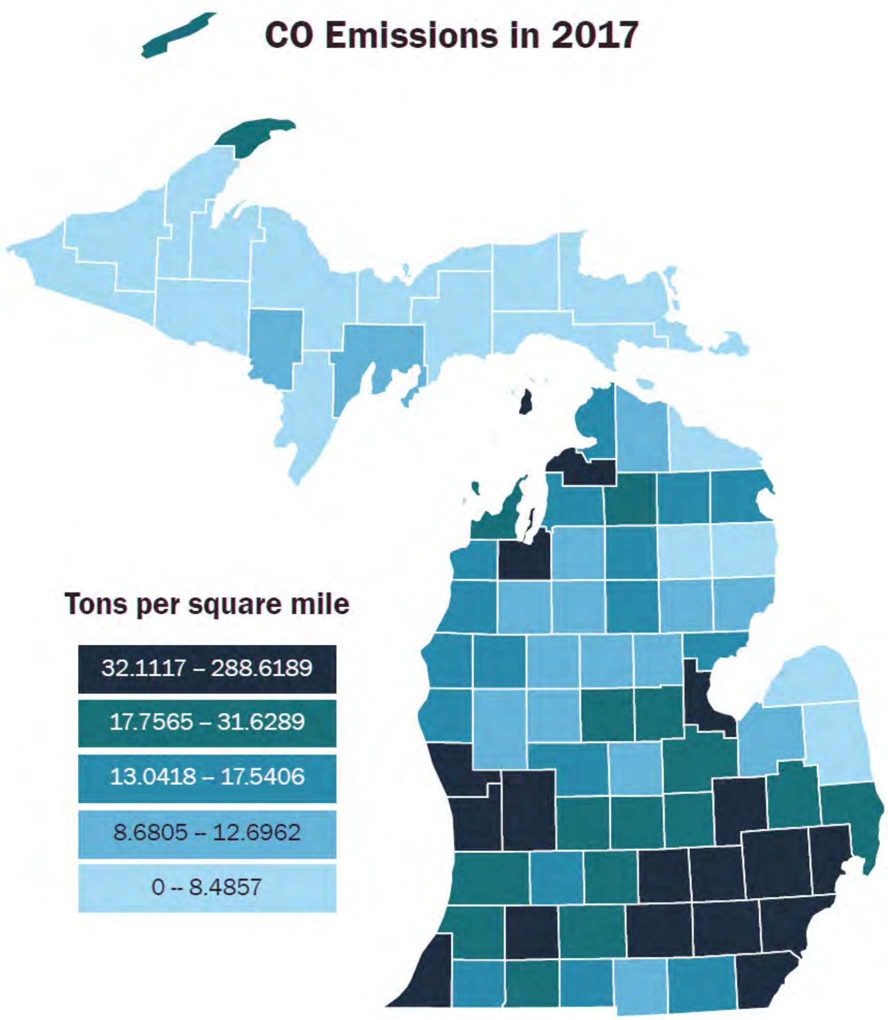


Figure 2.4 shows the location of each CO monitor that operated in 2020.

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

Figure 2.4: CO Monitors in 2020

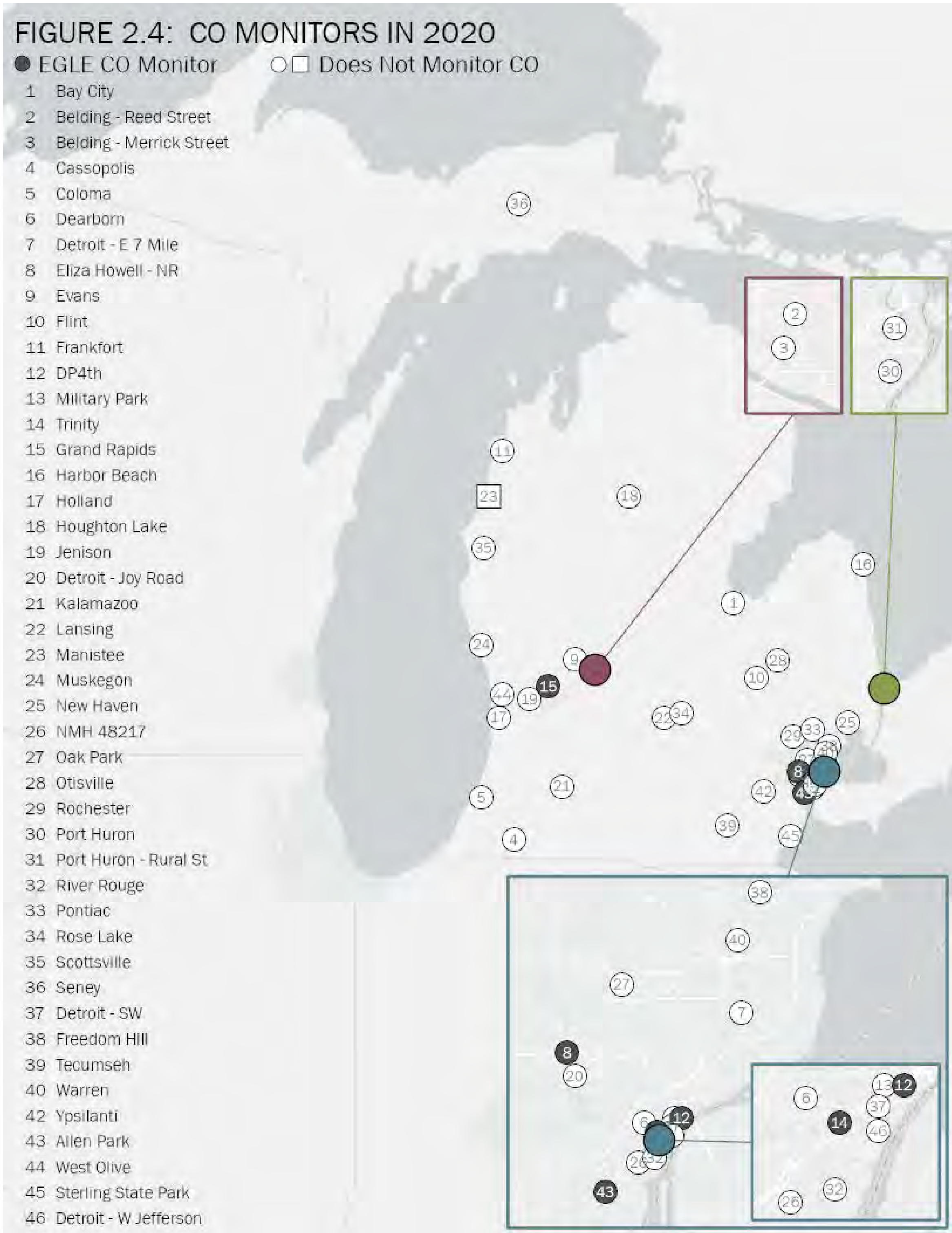


Figure 2.5 shows the second highest 1-hour CO concentrations for Michigan from 2015-2020, which demonstrates there have not been any exceedances of the 1-hour CO NAAQS.

Figure 2.5: CO Levels in Michigan from 2015-2020 (2nd Highest 1-Hour Maximum Values)

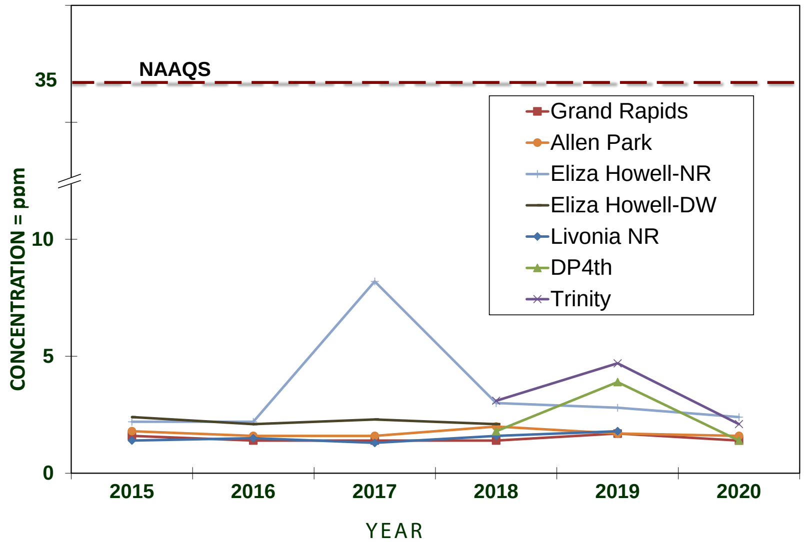
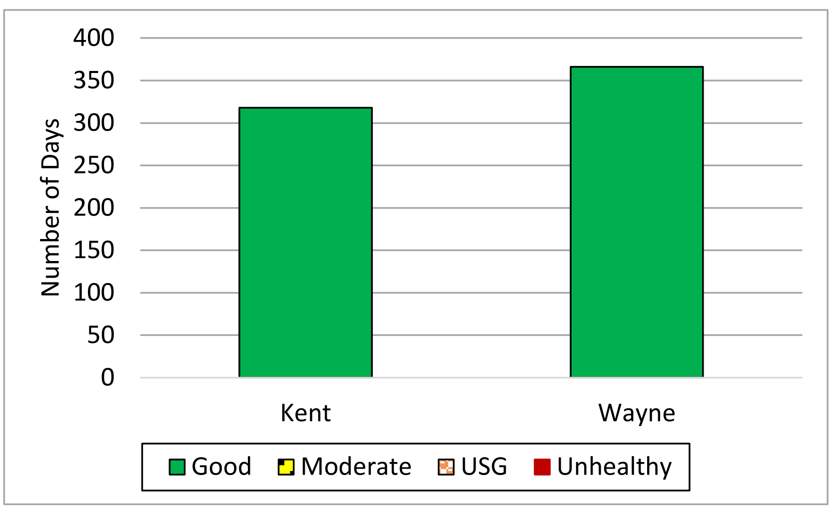


Figure 2.6 shows the AQI values per day in counties where CO is monitored. All days were in the good AQI range.

Figure 2.6: 2020 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 µg/m^3 to a 3-month rolling average of 0.15 µg/m^3. Its sources and effects are presented below.

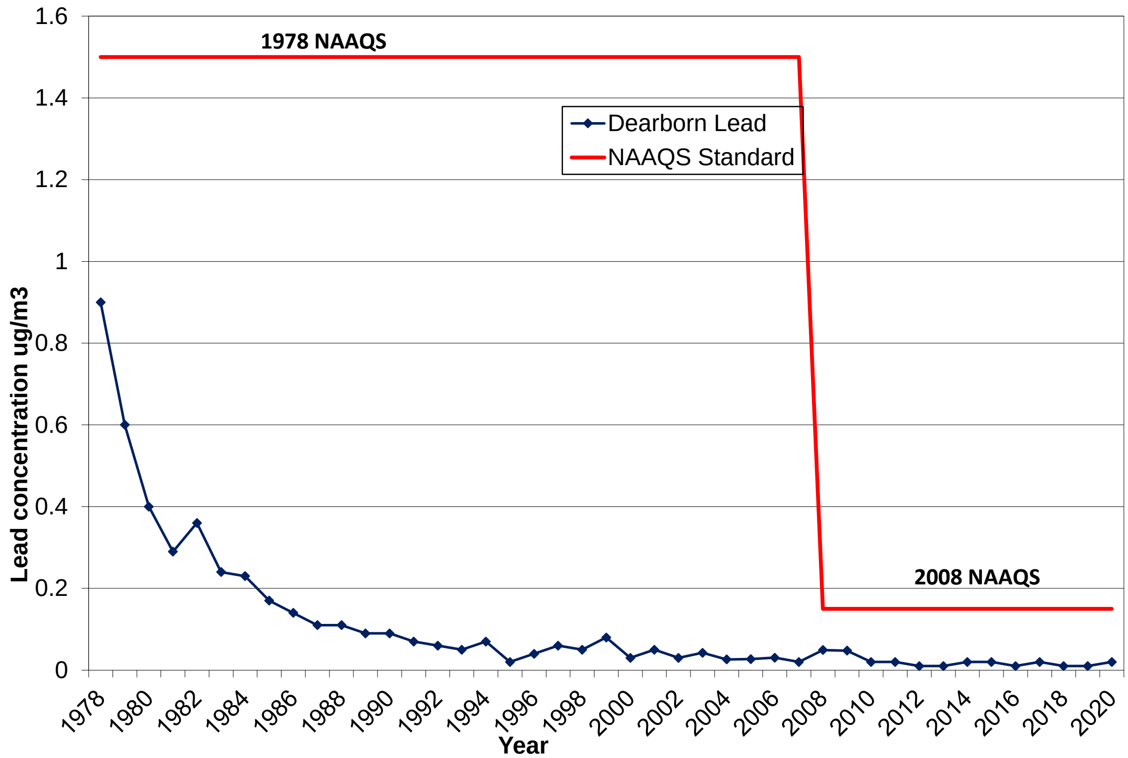
Sources: With the phase-out of leaded gas in the 1970s, the major sources of Pb emissions have been due to ore and metals processing and piston-engine aircraft operating on leaded aviation fuel. Other industrial sources include Pb acid battery manufacturers, waste incinerators, and utilities. The highest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

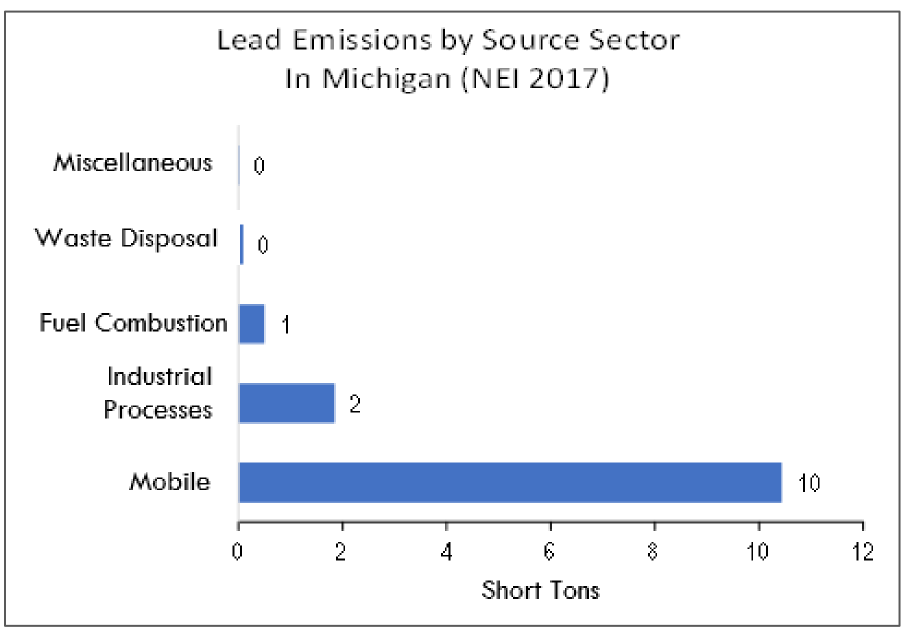


Figure 3.3: Pb Emissions in 2017 (NEI)

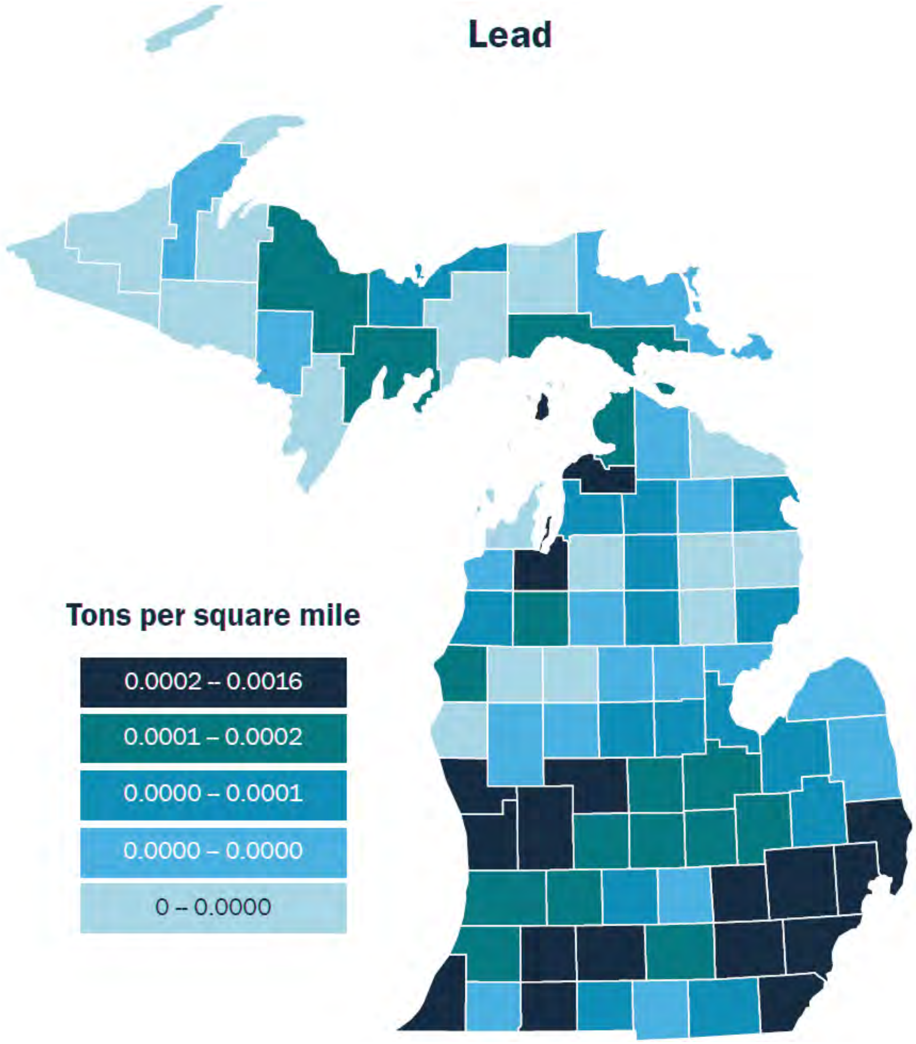


Figure 3.4 shows the location of the Pb monitors in the MASN in 2020. When the Pb NAAQS was lowered in 2008, the monitoring network was modified to consist of source-oriented monitors and population-oriented monitors. As part of the 2008 Pb NAAQS, EGLE must monitor near stationary sources emitting more than 1/2 ton of Pb per year.

- Source-oriented sites: Port Huron-Rural St. and Belding-Merrick St. The second site, Belding-Reed St. was shut down on January 1, 2019, since lead levels are below the standard and both sites are no longer necessary. The two sites in Belding previously were above the standard, but values for both the sites have been below the NAAQS for the past five years. Belding was designated to attainment on July 31, 2018.
- 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.
- NCore sites: Allen Park and Grand Rapids.
- Network consistency: River Rouge, Detroit-W. Jefferson, 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.

- Secondary monitor: Port Huron-Rural St. to comply with the USEPA's collocation regulations.
- Gordie Howe International Bridge (GHIB) project: DP4th, Trinity, and Military Park.

Figure 3.4: Lead (Pb) Monitors in 2020

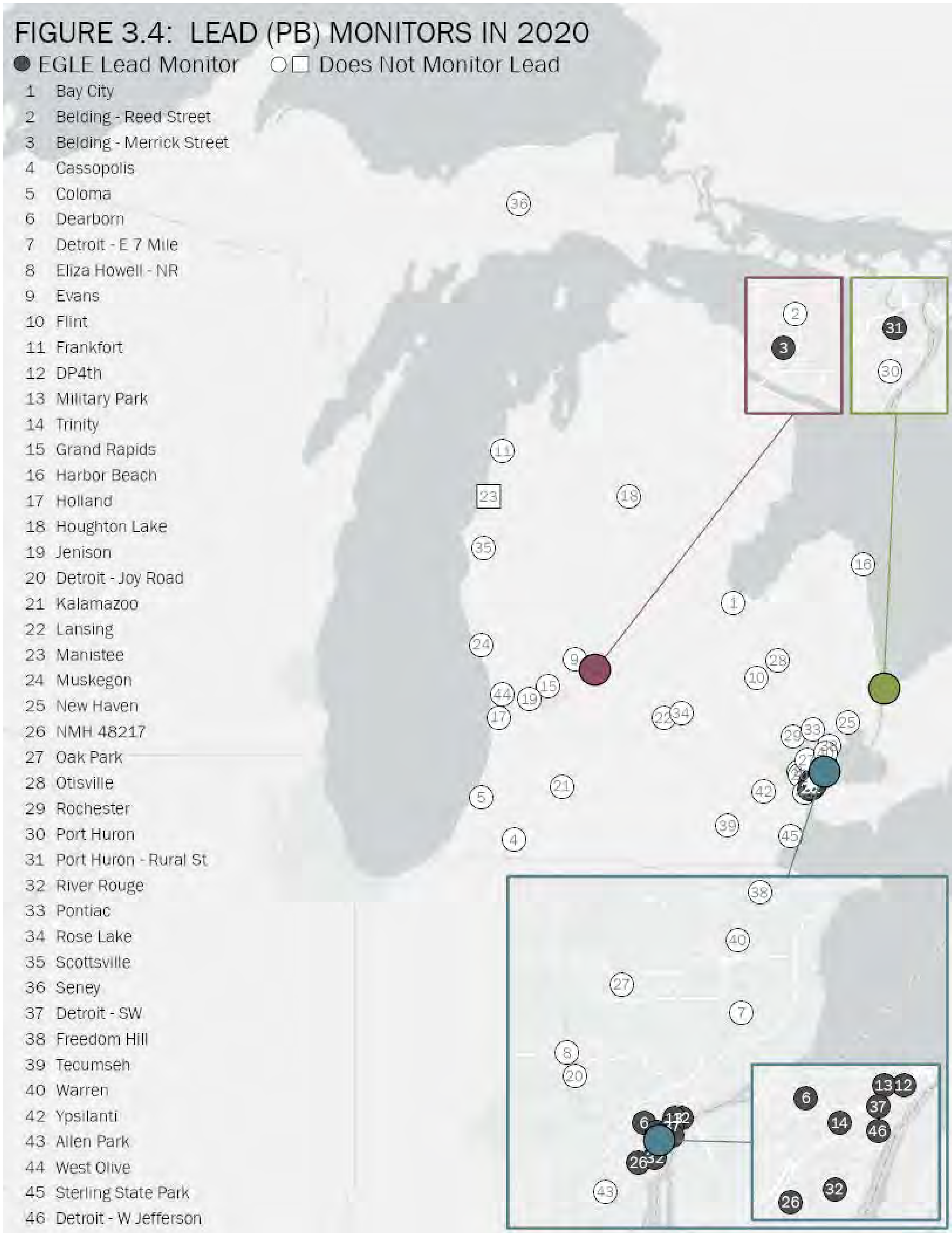
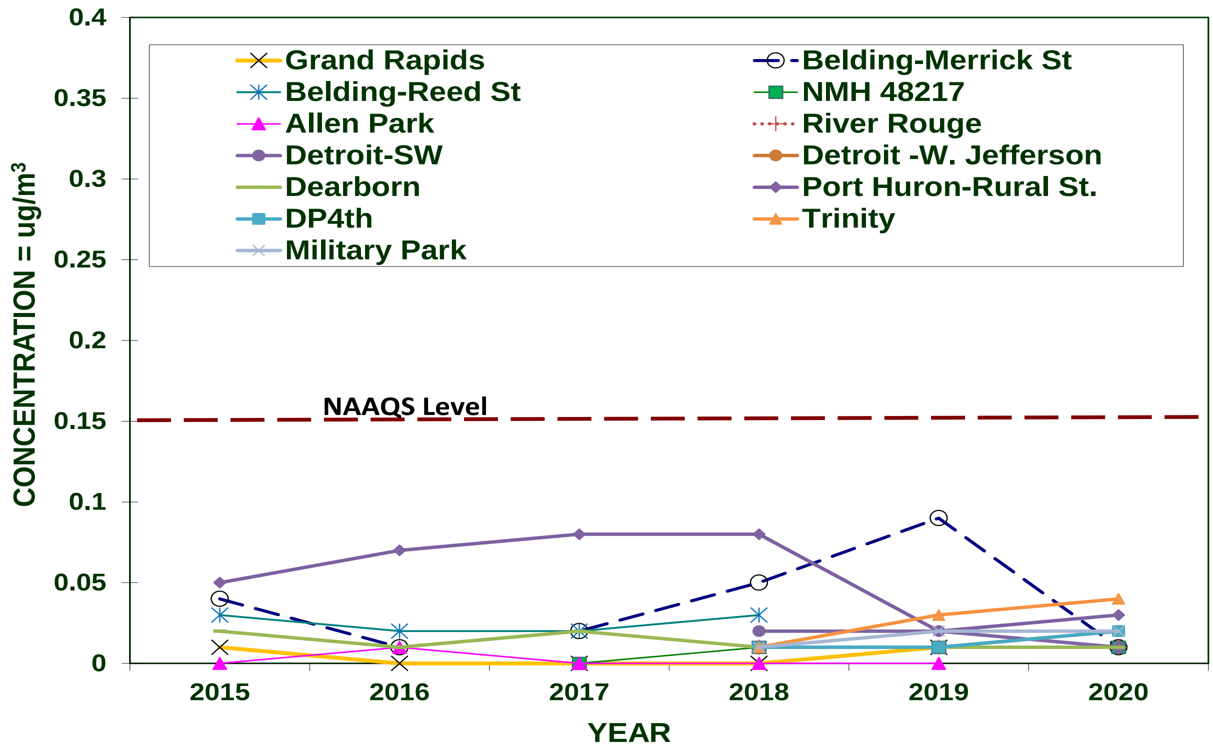


Figure 3.5 shows the maximum 3-month rolling average values for Pb from 2015 to 2020. All Pb monitor sites in Michigan are below the standard.

Figure 3.5: Lead Levels in Michigan from 2015-2020 (Maximum 3-month Average Values)



CHAPTER 4: NITROGEN DIOXIDE (NO_2)

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, NO_2, and other nitrogen oxides. NO_X can lead to the formation of O_3 and NO_2 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 NO_2 was an annual mean of 0.053 ppm. In January 2010, the USEPA added a 1-hour NO_2 standard of 100 ppb, taking the form of the 98th percentile averaged over three years. The sources and effects of NO_2 are as follows:

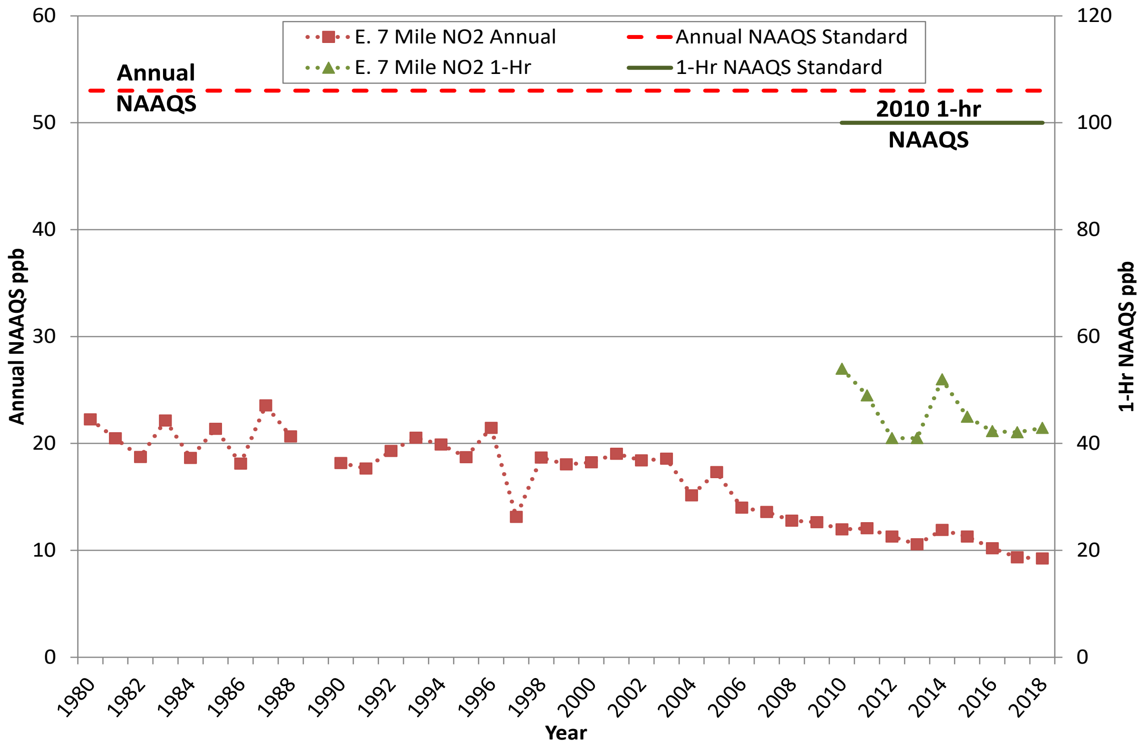
Sources: NO_X compounds and their transformed products occur both naturally and because of human activities. Natural sources of NO_X are lightning, forest fires, bacterial processes in soil, and stratospheric intrusion. Stratospheric intrusion is when the air upper atmosphere (stratosphere) descends 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. The 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 NO_2 in indoor settings.

Effects: Exposure to NO_2 occurs through the respiratory system, irritating the lungs. Short-term NO_2 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 NO_2 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 NO_2. Nitrate particles and NO_2 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 NO_2 than the general population. Short-term NO_2 exposure can increase respiratory illnesses in children.

Historical Trends: Southeast Michigan has been monitoring for NO_2 for 40 years. **Figure 4.1** shows the trend for NO_2 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 $NO_{2,}$ 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 NO_2 at Detroit-E 7 Mile Road



Figures 4.2 and **4.3** show NO_2 emission sources and NO_2 emissions by county (courtesy of the USEPA's State and County Emission Summaries).

Figure 4.2: Nitrogen Oxide Emissions by Source Sector

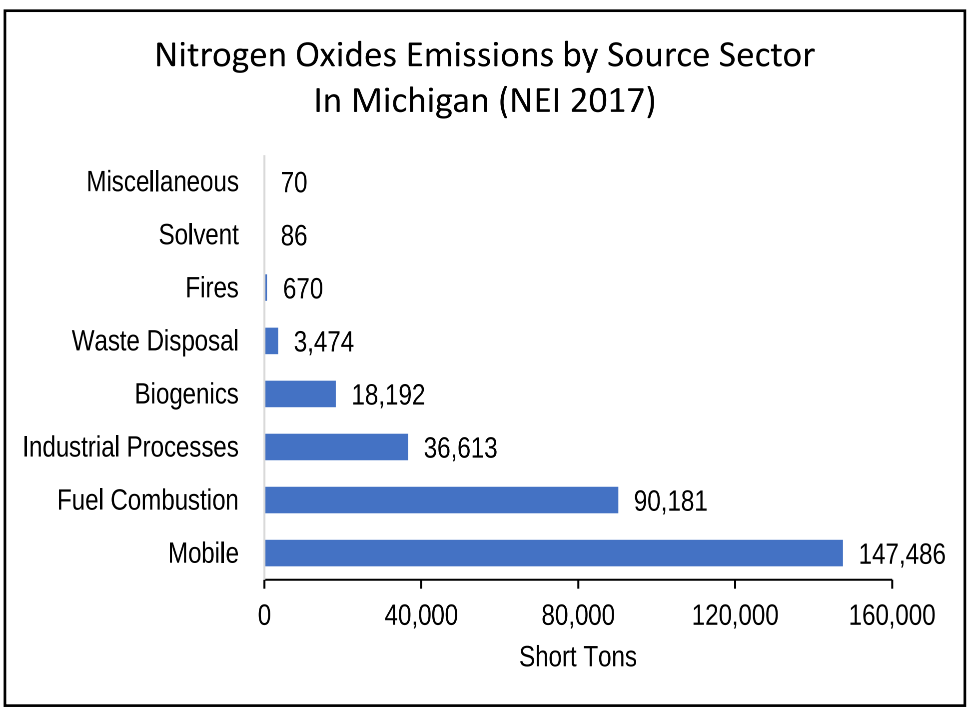


Figure 4.3: Nitrogen Oxide Emissions in 2017 (NEI)

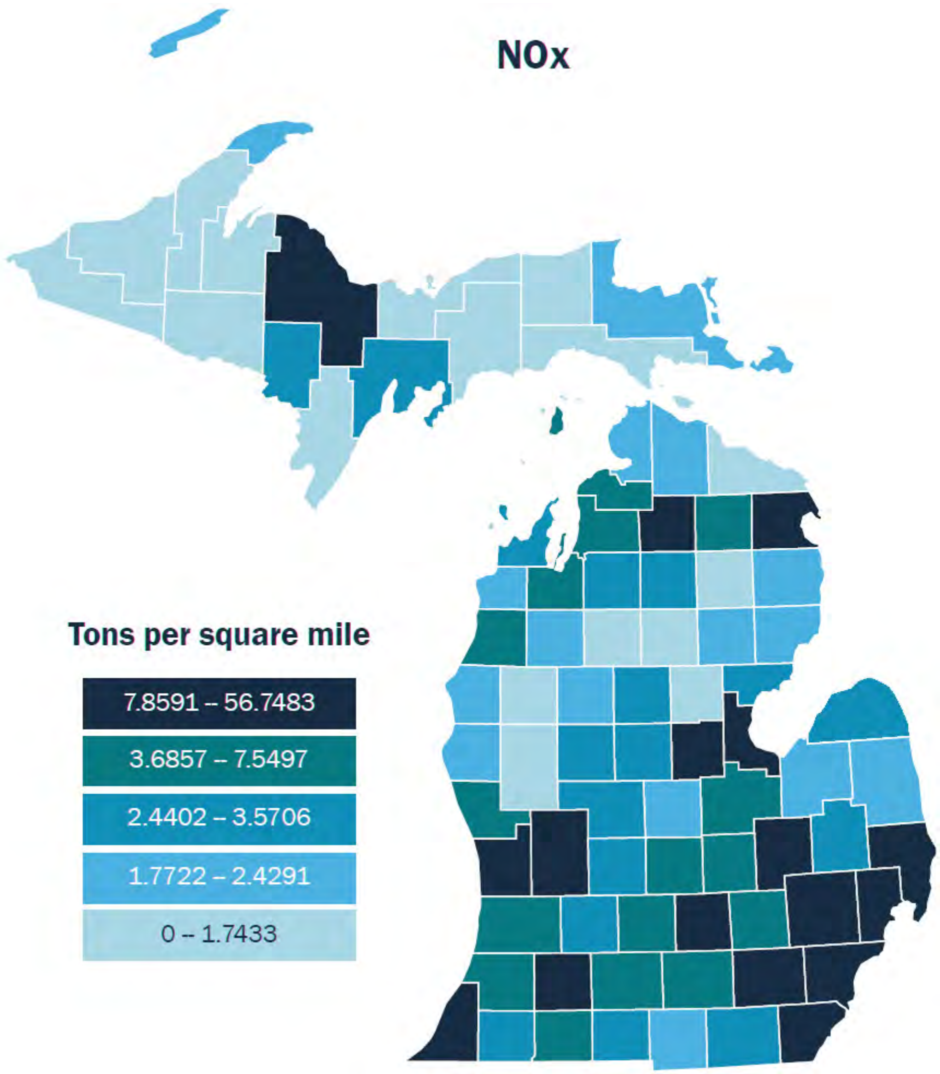
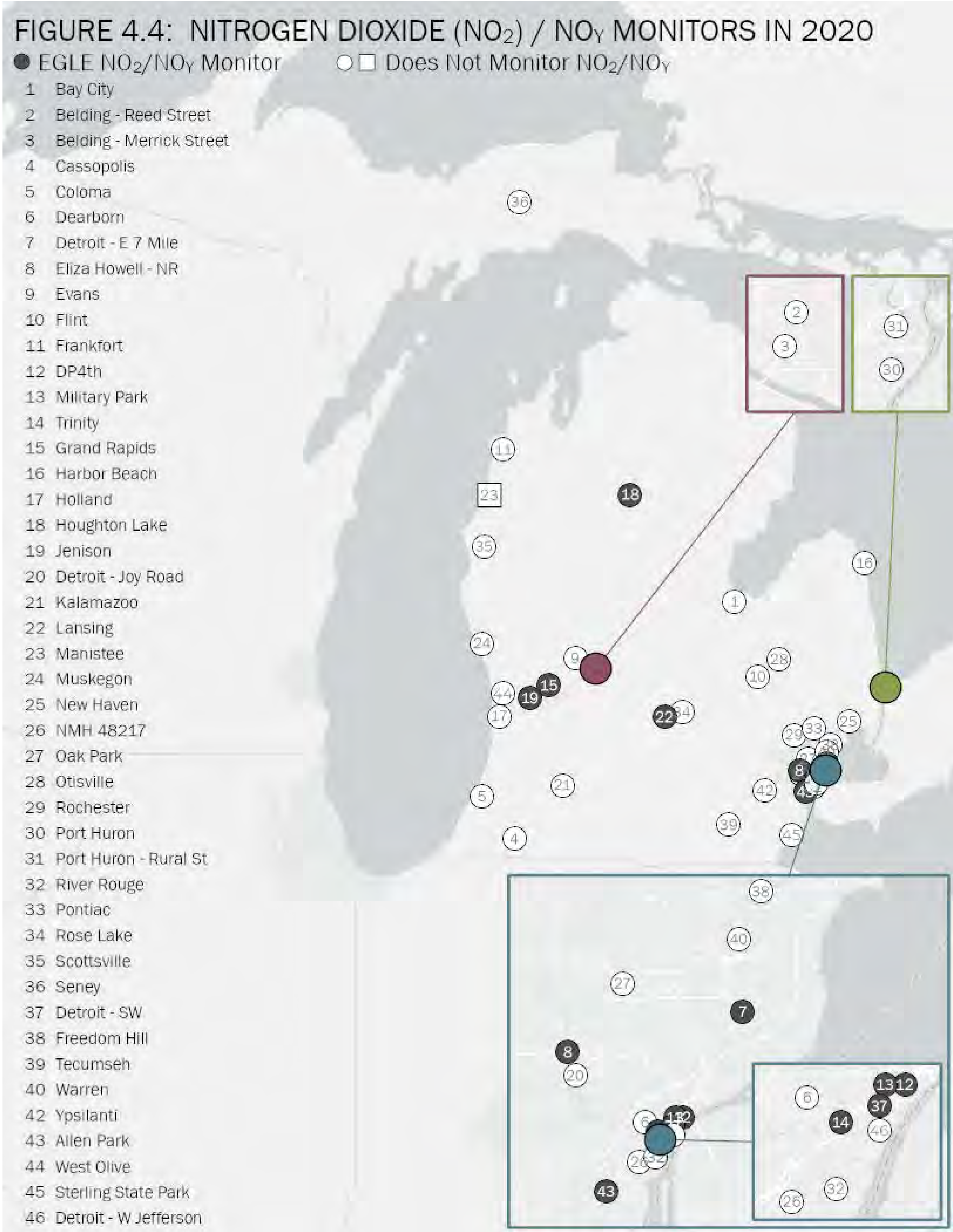


Figure 4.4 shows the location of all NO_2 monitors that operated in 2020.

- Downwind urban scale site: Detroit-E 7 Mile in Detroit and Jenison for the Grand Rapids area.
- Near-roadway Network sites: Detroit Eliza Howell-NR site, the downwind site was shut down since it is not necessary for the near-road network. The Livonia roadway site needed to be moved since EGLE lost site access. A suitable replacement has not been found.
- 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 NOX monitor at Detroit-E 7 Mile was switched to a NOY for PAMS. Direct NO_2 will also be monitored at Detroit-E 7 Mile when the PAMS network is completely installed at this site.
- Background monitors for modeling: Lansing and Houghton Lake.
- GBIH project: Detroit-SW, DP4th, Trinity, and Military Park.

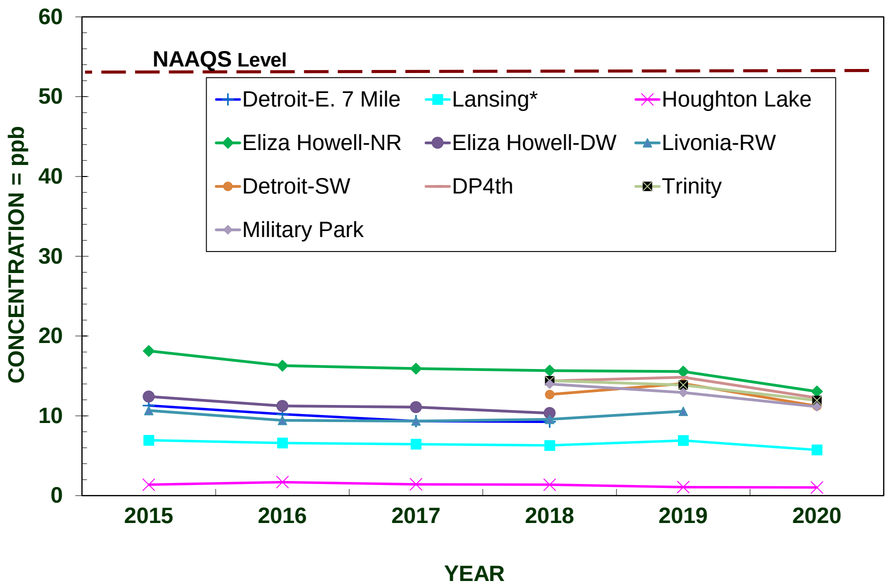
Figure 4.4: Nitrogen Dioxide (NO_2)/NO_Y Monitors in 2020



Michigan's ambient NO_2 levels have always been well below the NAAQS. Since March 3, 1978, all areas in Michigan have been in attainment for the annual NO_2 NAAQS. As shown in **Figure 4.5**, all monitoring sites have had an annual NO_2 concentration at less than half of the 0.053 ppm NAAQS.

Even though there are no nonattainment areas for NO_2 in Michigan and monitoring for attainment purposes is not required, monitors continue to operate to support photochemical model validation work.

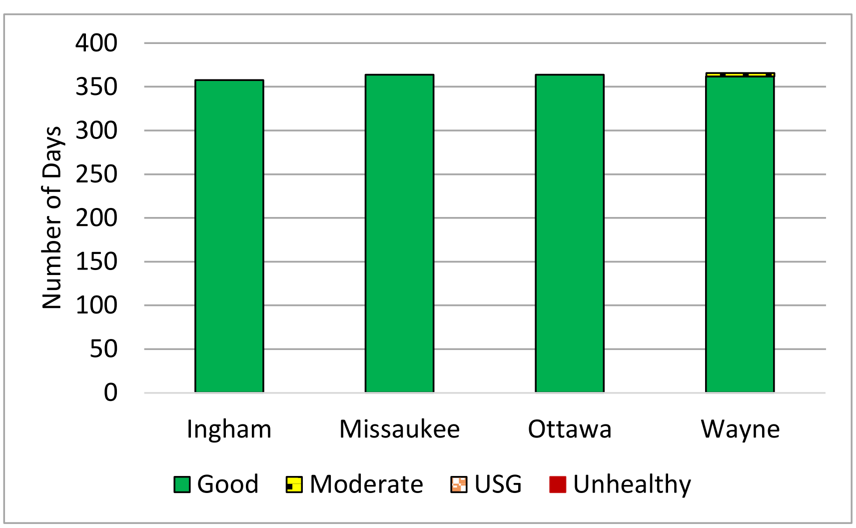
Figure 4.5: NO_2 Levels in MI from 2015-2020 (Annual Arithmetic Mean)**



*Indicates site was moved in 2018 and concentrations were averaged together for both locations.
**Since Allen Park and Grand Rapids are monitoring NO_Y, those sites are not included in graph.

Figure 4.6 shows the AQI values per day in counties where NO_2 is monitored. All days were in the good AQI range except for four days in Wayne County that were in the moderate AQI range.

Figure 4.6: 2020 AQI Days for NO_2 in Michigan Counties



CHAPTER 5: SULFUR DIOXIDE (SO_2)

Sulfur dioxide is a gas formed by the burning of sulfur-containing material. Odorless at typical ambient concentrations, SO_2 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 SO_2, 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 SO_2 standard to a 99^{th} 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.

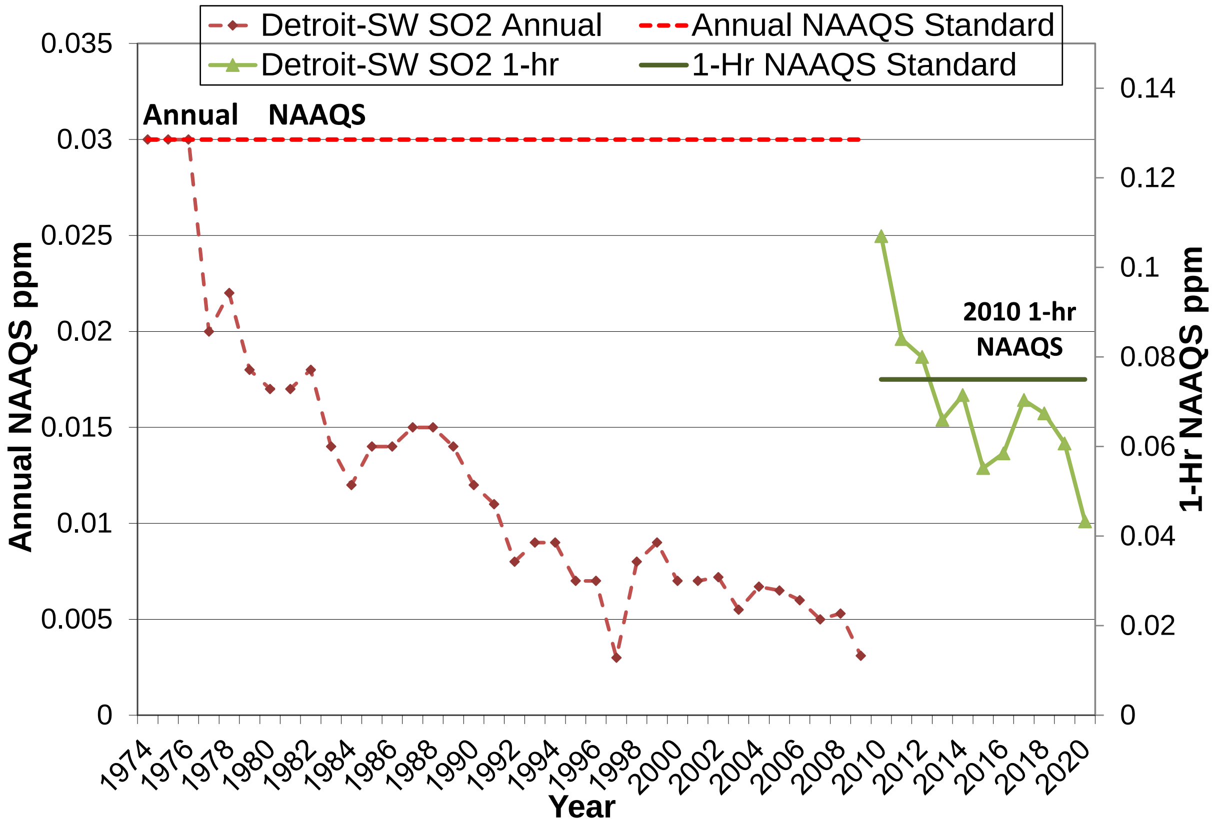
Sources: Coal-burning power plants are the largest source of SO_2 emissions. Other sources include industrial processes such as extracting metal from ore, and non-road transportation sources, and natural sources such as volcanoes. SO_2 and particulate matter are often emitted together.

Effects: Exposure to elevated levels can aggravate symptoms in asthmatics and cause respiratory problems in healthy groups. SO_2 and NOx 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 SO_2 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, SO_2 may also cause symptoms in people who do not have asthma.

Historical Trends: Southeast Michigan has been monitoring for SO_2 for over 45 years. **Figure 5.1** shows the SO_2 trend for the old annual standard and the new 1-hour standard for Detroit-SW. Michigan had been in attainment for SO_2 since 1982 with levels consistently well below the annual SO_2 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 SO_2 standard, SO_2 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 SO_2 Averages at Detroit-SW



Figures 5.2 and **5.3** show SO_2 emission sources and SO_2 emissions by county (courtesy of the USEPA's State and County Emission Summaries).

Figure 5.2: SO_2 Emissions by Source Sector

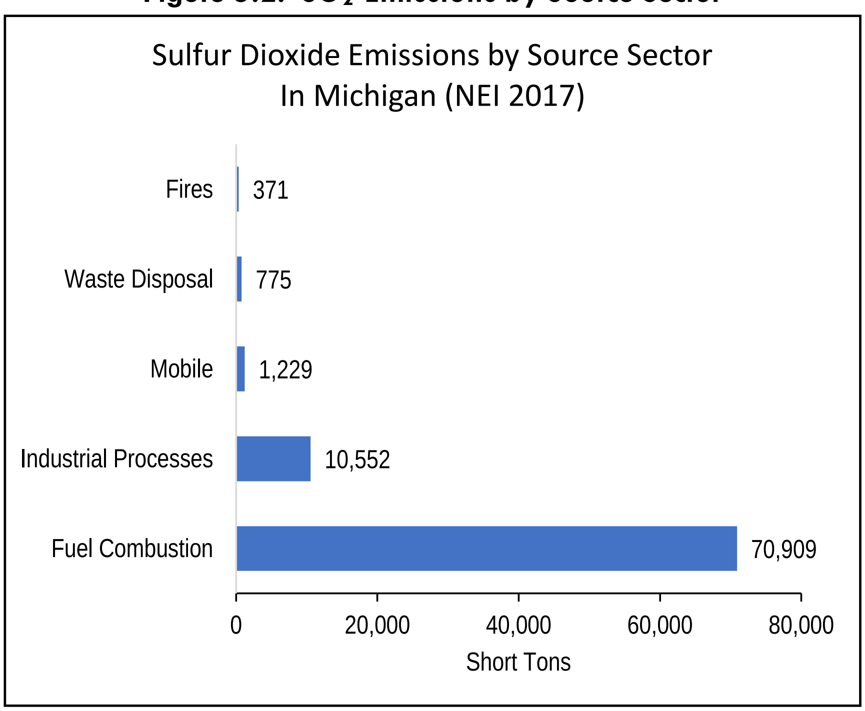


Figure 5.3: SO_2 Emissions in 2017 (NEI)

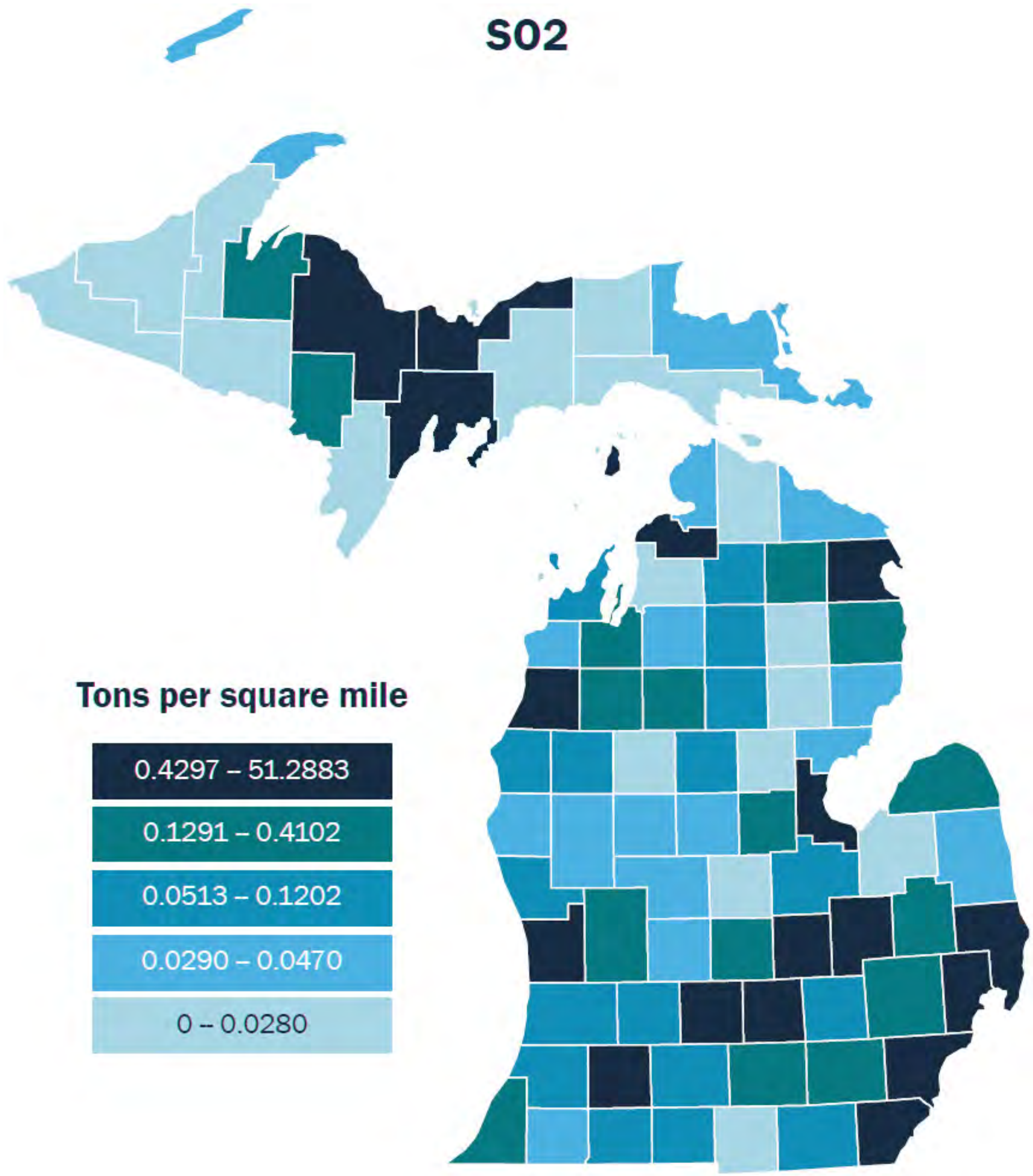


Figure 5.4 shows the location of each SO_2 monitor that operated in 2020.

- NCore sites: Allen Park and Grand Rapids have trace SO_2 monitors that have lower detection limits than traditional SO_2 monitors.
- Source-oriented sites: Lansing, Port Huron, Detroit-SW, Sterling State Park, West Olive.
- Community monitoring project: NMH 48217.
- GHIB project: DP4th, Trinity, and Military Park.

Figure 5.4: Sulfur Dioxide (SO_2) Monitors in 2020

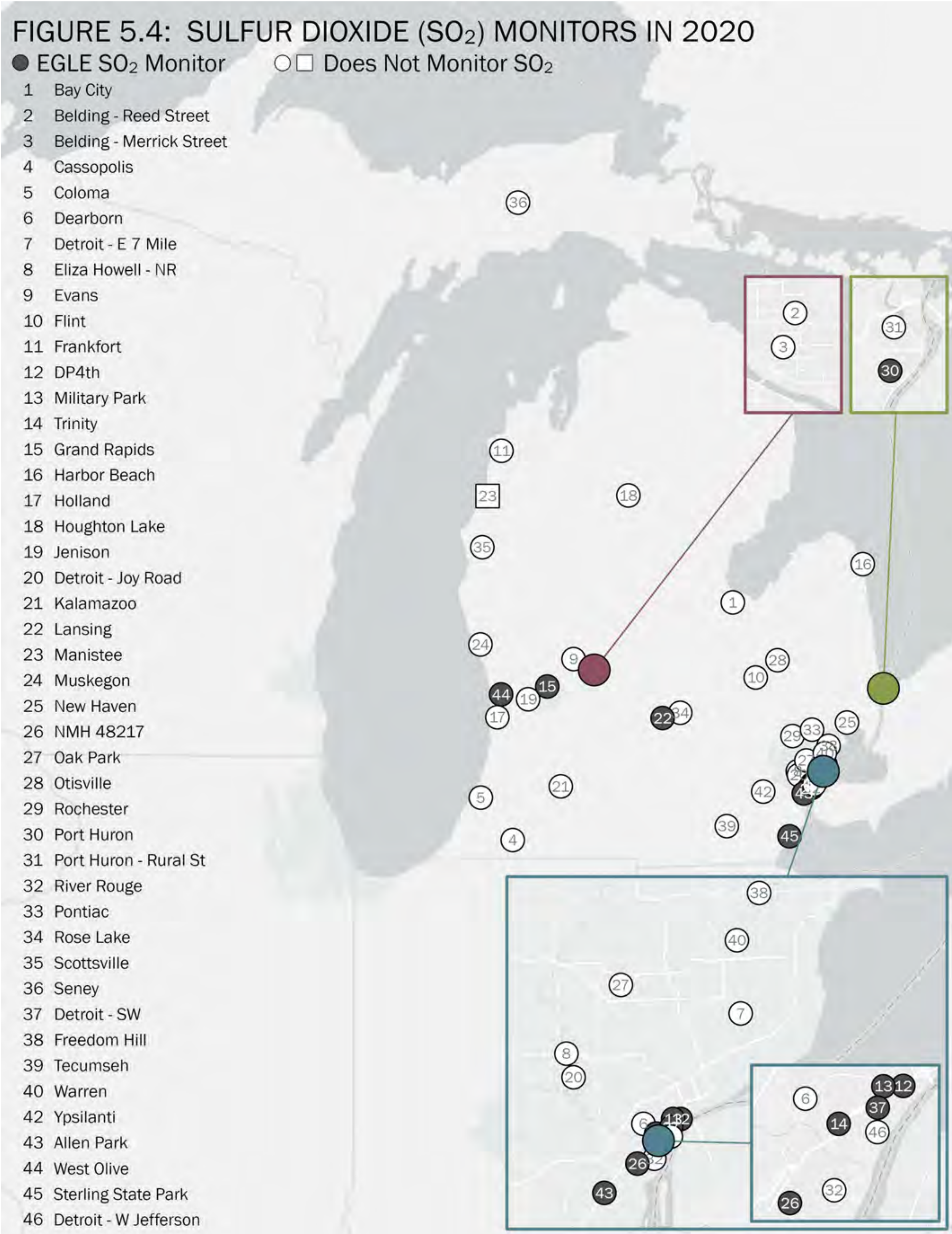


Figure 5.5 shows that all the SO_2 sites in Michigan are below the standard even though there is a nonattainment area for SO_2. The standard is a three-year average, therefore having one point above the NAAQS level line does not mean the monitor is over the standard. SO_2 pollution is extremely variable and would require a large monitoring network to designate areas as attainment. Therefore, SO_2 attainment depends on both emission modeling and monitoring data.

The NCore sites, Grand Rapids and Allen Park, monitor for trace SO_2. For trend purposes, all SO_2 data are graphed together in **Figure 5.5**.

Figure 5.5: SO_2 Level in Michigan from 2015-2020 (1-Hour 99th Percentile)

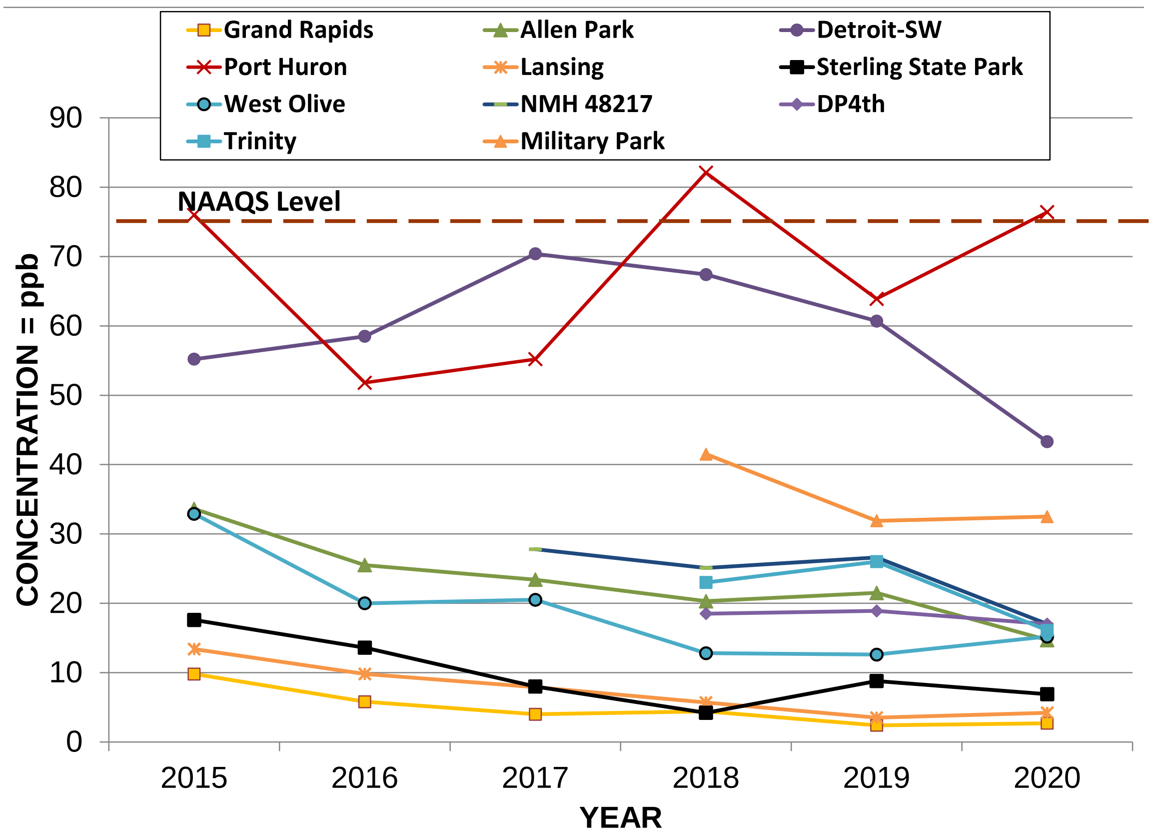
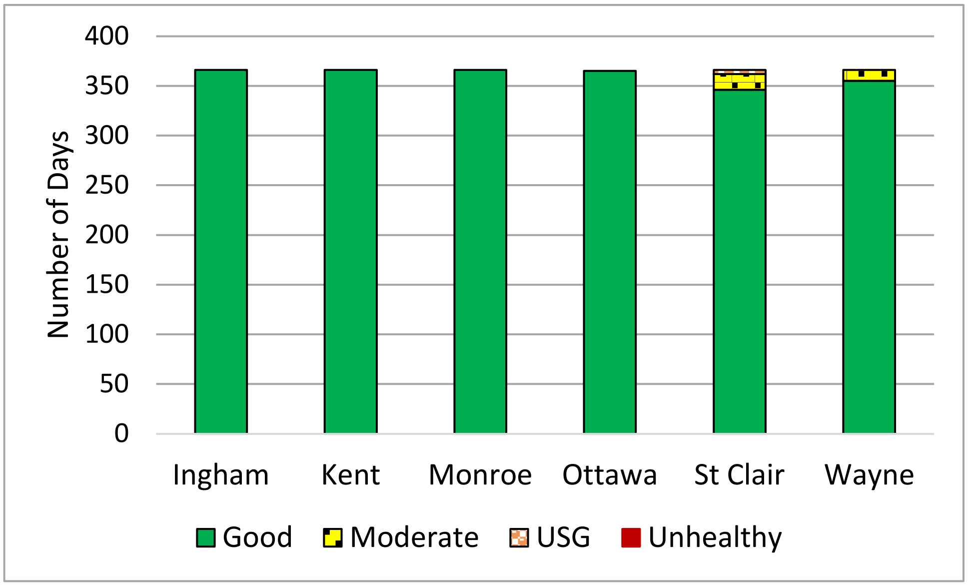
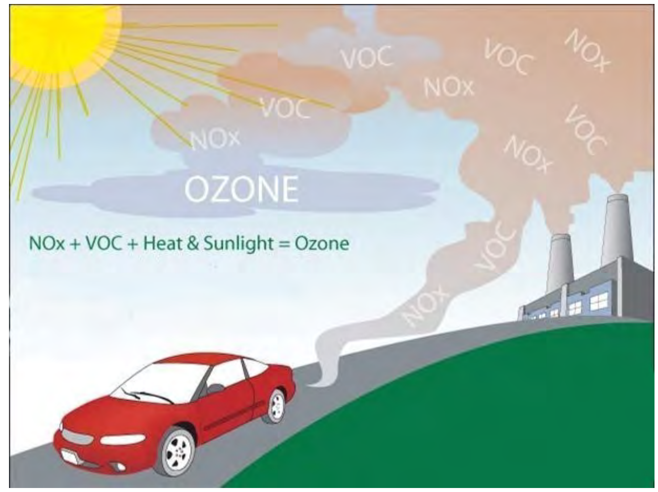


Figure 5.6 shows the AQI values per day in counties where SO_2 is monitored. All days were in the good AQI range except for 27 days in the moderate AQI range in St. Clair and Wayne Counties and four days in the Unsafe for Sensitive Groups (USG) in St. Clair County.

Figure 5.6: 2020 AQI Days for SO_2 in Michigan Counties



CHAPTER 6: OZONE (O_3)



Ground-level O_3 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), O_3 helps by absorbing much of the sun's ultraviolet radiation, but in the lower atmosphere (the troposphere), ozone is an air pollutant. O_3 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 ozone concentrations due to transport from upwind states. The ozone 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 ozone follow.

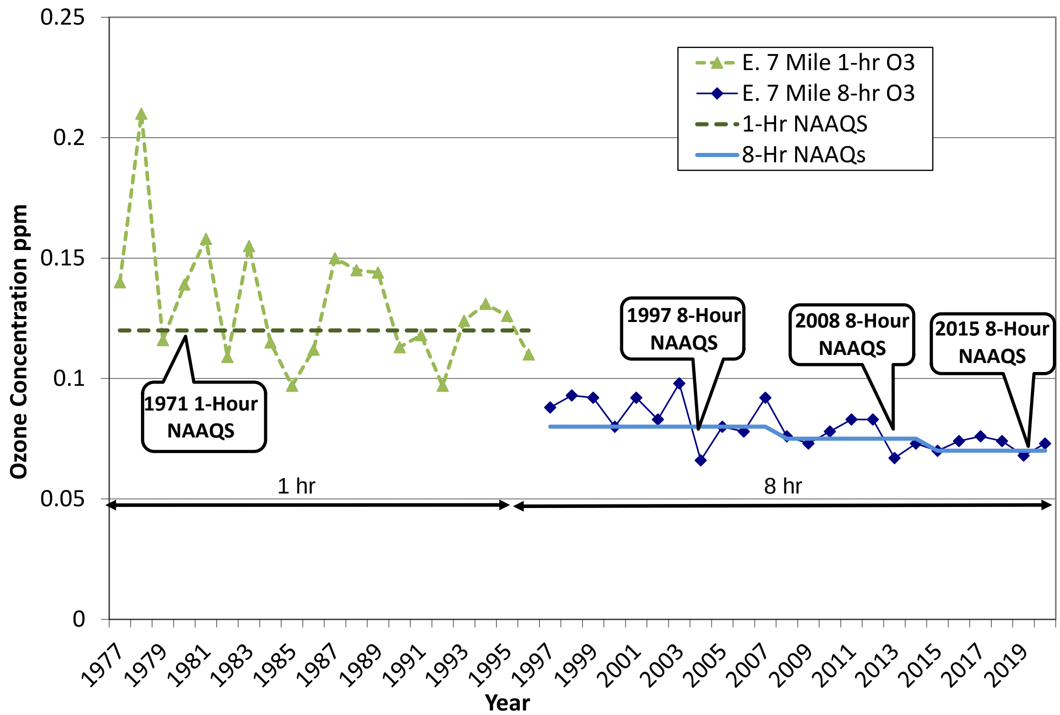
Sources: Major sources of NO_X and VOCs are engine exhaust, emissions from industrial facilities, combustion from power plants, gasoline vapors, chemical solvents, and biogenic emissions from natural sources. Ground-level O_3 can also be transported hundreds of miles under certain wind regimes. As a result, the long-range transport of air pollutants impacts the air quality of regions downwind from the actual area of formation.

Effects: Elevated O_3 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. O_3 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. O_3 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 O_3 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 ozone for over 40 years. **Figure 6.1** shows the ozone levels at the Detroit-E 7 Mile Road 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 0.075 ppm in 2008 and to 0.070 ppm at the end of 2015. Ozone depends on weather conditions, so ozone concentrations are more variable than other pollutants. Ozone is also monitored primarily in warmer months. In the 2015 NAAQS, the ozone season was extended to by two months to 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

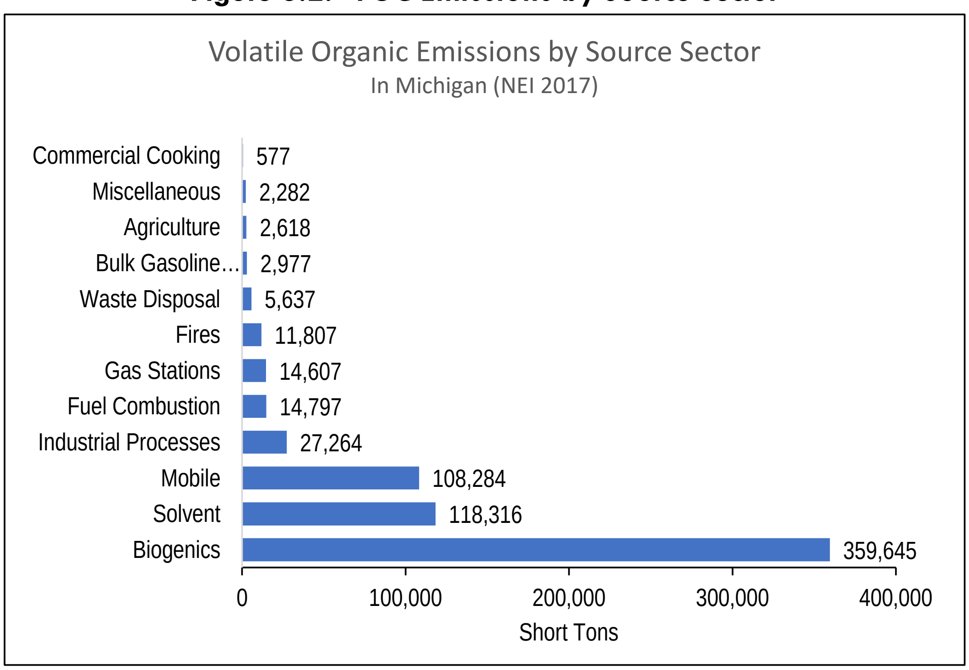


Figure 6.3: VOC Emissions in 2017

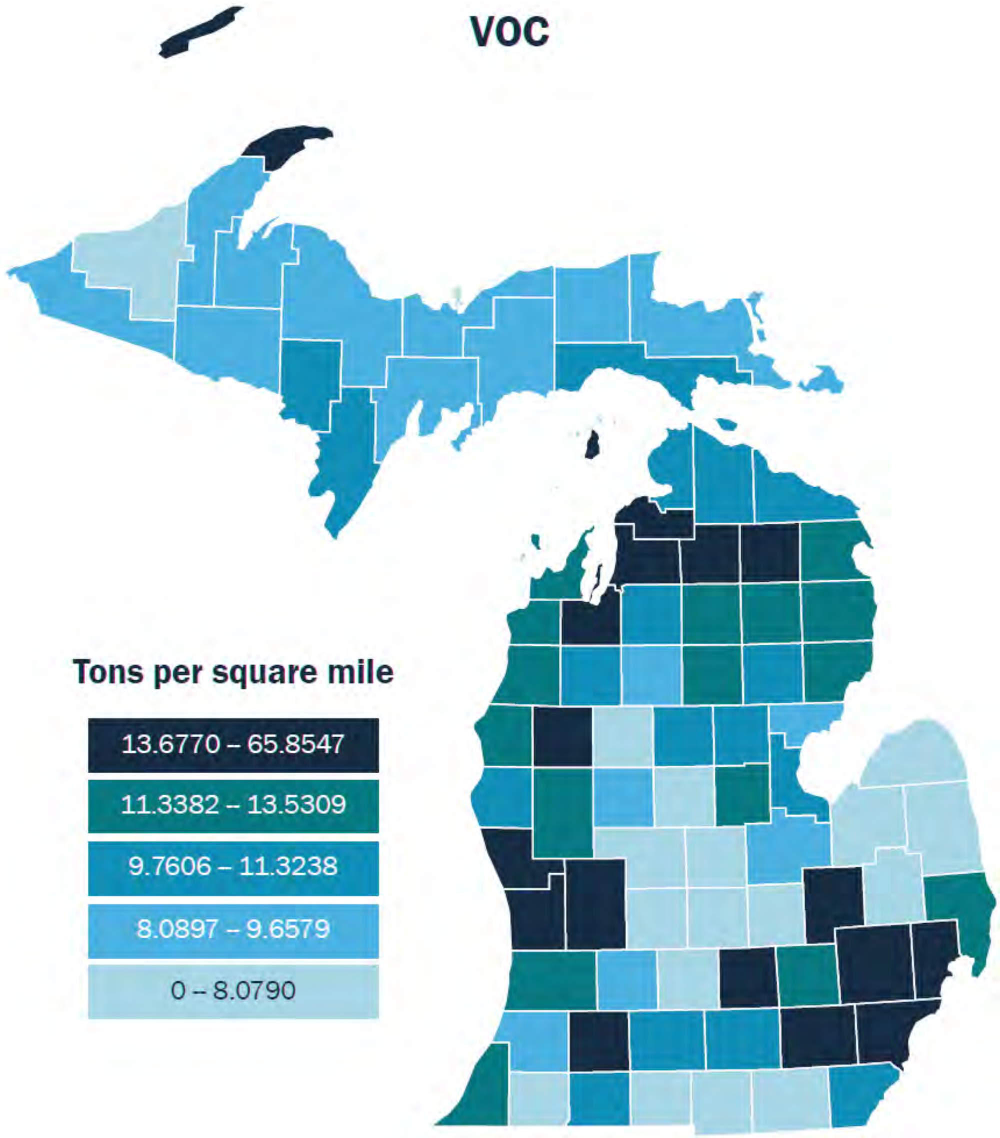


Figure 6.4 shows all O_3 air quality monitors active in Michigan at the beginning of the 2020 ozone season.

- 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 2020

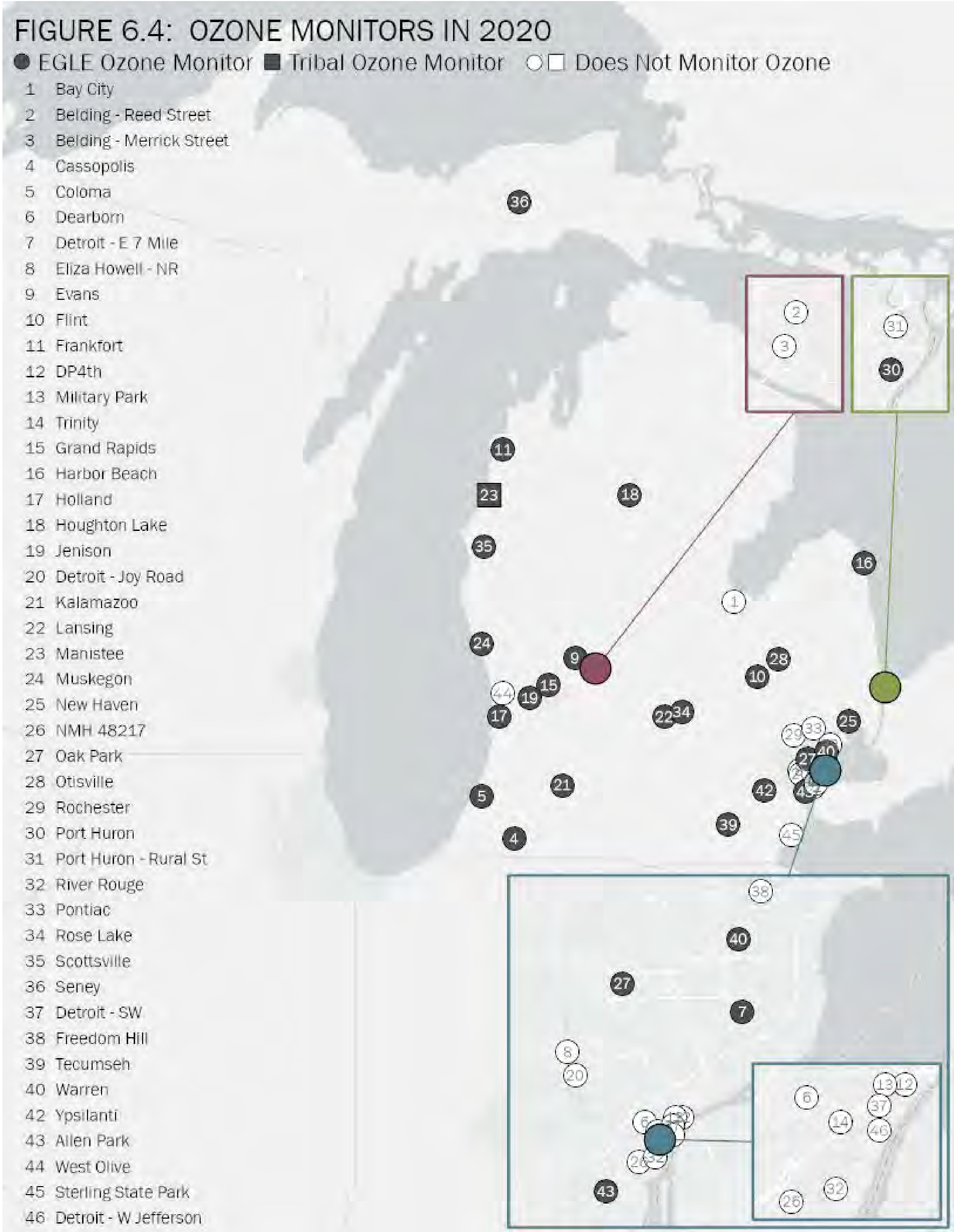


Table 6.1 shows the three-year averages of ozone. The USEPA uses these values (called design values) to determine attainment/nonattainment areas. The USEPA made their final designations for the 2015 standard on April 30, 2018 (effective August 3, 2018) based on 2014-2016 data. Livingston, Macomb, Monroe, 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 ozone in 2020. The USEPA has not yet acted on the submitted redesignation request.

The O_3 monitoring season in Michigan is from March 1 through October 31. During this time O_3 monitoring data is available for the public via the AQD's website (discussed in **Chapter 1**). However, year-round O_3 monitoring is conducted at the following four sites: Allen Park, Grand Rapids, Houghton Lake, and Lansing. This data helps in attainment designations, urban air quality and population exposure assessments.

Table 6.1: 3-Year Average of the 4th Highest 8-hour Ozone Values from 2016-2018, 2017-2019, and 2018-2020 (concentrations in ppm)

Areas	County	Monitor Sites	2016-2018	2017-2019	2018-2020
Detroit-Ann Arbor	Lenawee	Tecumseh	0.068	0.065	0.065
Detroit-Ann Arbor	Macomb	New Haven	**0.072**	0.068	**0.071**
Detroit-Ann Arbor	Macomb	Warren	0.069	0.066	0.068
Detroit-Ann Arbor	Oakland	Oak Park	**0.073**	0.070	**0.072**
Detroit-Ann Arbor	St. Clair	Port Huron	**0.072**	**0.071**	**0.071**
Detroit-Ann Arbor	Washtenaw	Ypsilanti	0.069	0.066	0.067
Detroit-Ann Arbor	Wayne	Allen Park	0.068	0.066	0.067
Detroit-Ann Arbor	Wayne	Detroit-E 7 Mile	**0.074**	**0.072**	**0.071**
Flint	Genesee	Flint	0.068	0.064	0.065
Flint	Genesee	Otisville	0.068	0.063	0.065
Grand Rapids	Ottawa	Jenison	0.070	0.067	**0.071**
Grand Rapids	Kent	Grand Rapids	0.070	0.066	**0.071**
Grand Rapids	Kent	Evans	0.068	0.064	0.065
Muskegon Co	Muskegon	Muskegon	**0.076**	**0.074**	**0.076**
Allegan Co	Allegan	Holland	**0.073**	**0.072**	**0.073**
Huron	Huron	Harbor Beach	0.068	0.064	0.068
Kalamazoo-Battle Creek	Kalamazoo	Kalamazoo	**0.071**	0.066	0.068
Lansing-East Lansing	Ingham	Lansing	0.068*	0.063	0.062
Lansing-East Lansing	Clinton	Rose Lake	0.069*	0.062	0.063
Benton Harbor	Berrien	Coloma	**0.073**	0.069	**0.072**
Benzie Co	Benzie	Frankfort	0.068	0.063	0.064
Cass Co	Cass	Cassopolis	**0.074**	0.070	**0.071**
Mason Co	Mason	Scottville	0.068	0.063	0.064
Missaukee Co	Missaukee	Houghton Lake	0.067	0.062	0.064
Manistee Co	Manistee	Manistee	0.066	0.064	0.059
Schoolcraft Co	Schoolcraft	Seney	0.064	0.059	0.063

Numbers in bold indicate 3-year averages over the 2015 ozone standard of 0.070 ppm.
*The three-year average is using data averaged from sites that were moved.

Tables 6.2 and 6.3 highlight the number of days when two or more O_3 monitors exceeded 0.070 ppm. It also specifies in which month they occurred and the temperature range.

Table 6.2: 2020 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	0	0	0	0	0	0	0	0	0	0
90 ≤94	0	0	0	0	1	0	3	2	10	1	3	1	0	0	0	0
85 ≤ 89	0	0	0	0	2	0	10	4	5	1	11	0	1	0	0	0
80 ≤ 84	0	0	0	0	1	0	7	0	16	0	8	0	3	0	0	0
75 ≤ 79	0	0	1	0	2	0	5	0	0	0	8	0	9	0	1	0
70 ≤ 74	0	0	1	0	6	0	4	0	0	0	1	0	5	0	2	0
65 ≤ 69	0	0	2	0	5	0	1	0	0	0	0	0	4	0	8	0
60 ≤ 64	3	0	6	0	6	0	0	0	0	0	0	0	8	0	1	0
55 ≤ 59	3	0	5	0	4	0	0	0	0	0	0	0	0	0	5	0
50 ≤ 54	5	0	5	0	2	0	0	0	0	0	0	0	0	0	8	0
49 ≤	20	0	10	0	2	0	0	0	0	0	0	0	0	0	6	0
Totals	**31**	**0**	**30**	**0**	**31**	**0**	**30**	**6**	**31**	**2**	**31**	**1**	**30**	**0**	**31**	**0**

Days: Number of days during month when the daily high temperature falls within the specified temperature range.
O_3 Days: Number of days, during specified temperature range, when two or more area monitors exceeded 70 ppb.

West Michigan had six O_3 exceedance days in June; two in July and one in August when ozone exceeded 0.070 ppm at two or more ozone monitors. The temperatures on those days ranged between 85°F and 94°F.

Table 6.3: 2020 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	0	0	1	1	0	0	0	0	0	0
0 ≤94	0	0	0	0	0	0	3	2	9	2	4	0	0	0	0	0
85 ≤ 89	0	0	0	0	3	0	9	2	13	0	10	0	1	0	0	0
80 ≤ 84	0	0	0	0	2	0	10	1	7	0	8	0	6	0	0	0
75 ≤ 79	0	0	0	0	1	0	4	0	1	0	9	0	7	0	3	0
70 ≤ 74	0	0	2	0	5	0	3	0	0	0	0	0	5	0	4	0
65 ≤ 69	1	0	3	0	8	0	1	0	0	0	0	0	7	0	4	0
60 ≤ 64	4	0	6	0	6	0	0	0	0	0	0	0	4	0	4	0
55 ≤ 59	1	0	8	0	2	0	0	0	0	0	0	0	0	0	7	0
50 ≤ 54	7	0	3	0	2	0	0	0	0	0	0	0	0	0	4	0
49 ≤	18	0	8	0	2	0	0	0	0	0	0	0	0	0	5	0
Totals	**31**	**0**	**30**	**0**	**31**	**0**	**30**	**5**	**31**	**3**	**31**	**0**	**30**	**0**	**31**	**0**

Days: Number of days during month when the daily high temperature falls within the specified temperature range.
O_3 Days: Number of days, during specified temperature range, when two or more area monitors exceeded 70 ppb.

Southeast Michigan had five O_3 exceedance days in June, and three in July when ozone exceeded 0.070 ppm at two or more ozone monitors. The temperature for those days ranged between 80°F and 95°F.

Table 6.4 gives a breakdown of the O_3 days and the specific monitors that went over the standard in western, central/upper, and eastern Michigan in 2020.

Table 6.4: 8-Hour Exceedance Days (>0.070 ppm) and Locations
Monitors with Exceedances of the Ozone Standard

Date	Western Michigan	Central/Upper Mich.	Eastern Michigan	Total
5/26/2020			Harbor Beach	1
6/2/2020	Coloma, Evans, Grand Rapids, Holland, Jenison, Kalamazoo, Muskegon			7
6/4/2020			New Haven	1
6/5/2020	Cassopolis, Coloma		New Haven	3
6/9/2020		Houghton Lake	Flint, New Haven, Oak Park, Tecumseh, Ypsilanti	6
6/17/2020	Coloma, Cassopolis, Grand Rapids, Jenison, Kalamazoo	Seney	New Haven, Ypsilanti	8
6/18/2020	Frankfort, Cassopolis, Coloma, Grand Rapids, Holland, Jenison, Kalamazoo, Muskegon, Scottville	Seney	Harbor Beach, New Haven	12
6/19/2020	Frankfort, Cassopolis, Coloma, Evans, Grand Rapids, Holland, Jenison, Kalamazoo, Muskegon, Scottville	Seney	Harbor Beach, Oak Park	13
6/20/2020	Coloma, Grand Rapids, Holland, Jenison, Muskegon		Detroit-E 7 Mile, Harbor Beach, New Haven, Oak Park, Port Huron, Warren, Ypsilanti	12
7/2/2020			Detroit-E 7 Mile	1
7/6/2020			Detroit-E 7 Mile, Harbor Beach, New Haven, Oak Park, Warren	5
7/7/2020	Cassopolis, Kalamazoo		Allen Park, Detroit-E 7 Mile, New Haven, Oak Park, Tecumseh, Ypsilanti	8
7/9/2020			Allen Park, Harbor Beach, New Haven, Oak Park, Ypsilanti	5
7/15/2020			Harbor Beach	1
7/17/2020			New Haven	1
7/25/2020	Coloma, Holland			2
8/21/2020			New Haven	1
8/22/2020			New Haven	1
8/24/2020	Muskegon			1
8/26/2020	Grand Rapids, Holland, Jenison, Muskegon			4
			TOTAL	**93**

On July 19, 2020, there were 13 monitors and on June 18 and June 20, 2020, there were 12 monitor readings that exceeded the level of the standard. The site with the most exceedances in the western region of Michigan was Coloma with seven. The central/upper Michigan sites had Seney with 3 exceedances. New Haven had 12 exceedances each in eastern Michigan.

Figure 6.5 shows the 4th highest 8-hour O_3 values for Southeast Michigan monitoring sites from 2015-2020. Detroit-E 7 Mile, New Haven, Oak Park, and Port Huron site violated the 3-year standard.

Figure 6.6 shows the 4th highest 8-hour O_3 values for Grand Rapids-Muskegon-Holland CSA. Muskegon. Holland, Grand Rapids, and Jenison violated the 3-year standard.

Figure 6.7 shows 4th highest 8-hour O_3 values for mid-Michigan. Cassopolis and Coloma violated the 3-year standard.

Figure 6.8 shows 4th highest 8-hour O_3 values for Northern Lower and Upper Peninsulas. No sites violated the 3-year standard.

Figure 6.5: O_3 Levels in Detroit-Warren-Flint CSA from 2015-2020 - (4th Highest 8-Hour O_3 Values).

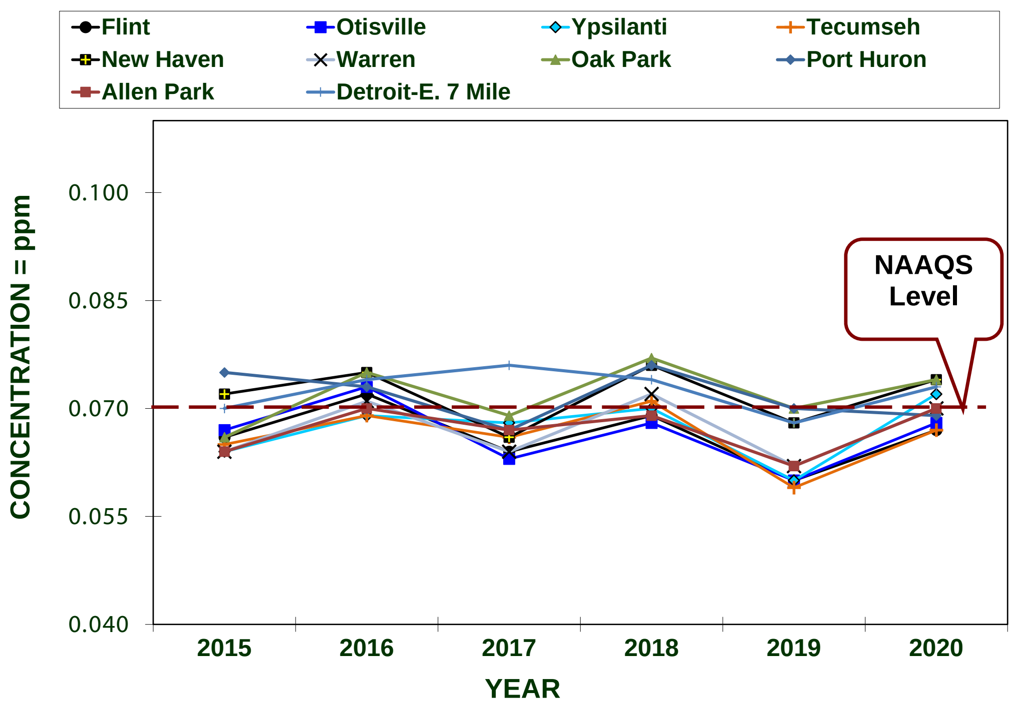


Figure 6.6: O_3 Levels in the Grand Rapids-Muskegon-Holland CSA from 2015-2020 (4th Highest 8-Hour O_3 Values)

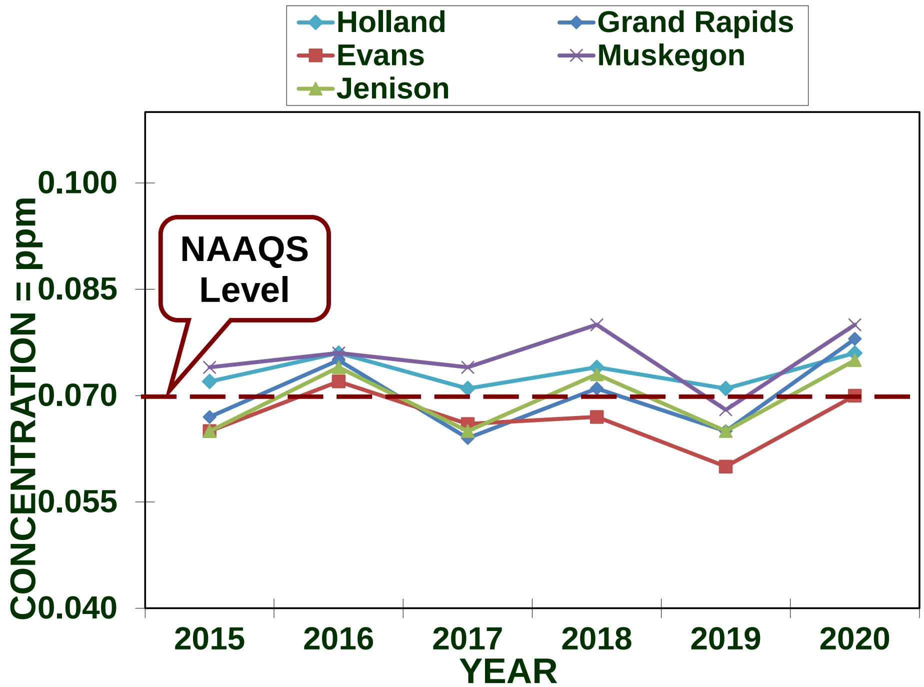


Figure 6.7: O_3 Levels in the Kalamazoo-Portage MSA, Lansing-E. Lansing-Owosso CSA, Niles-Benton Harbor MSA, & South Bend-Mishawaka (IN-MI) MSAs from 2015-2020 (4th Highest 8-Hour O_3 Values)

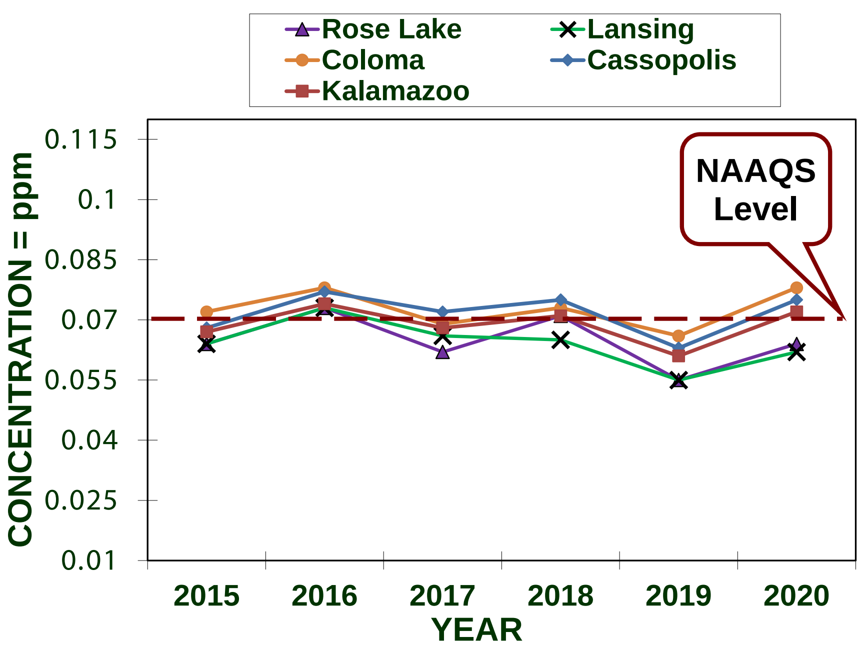


Figure 6.8: O_3 Levels in MI's Northern Lower and Upper Peninsula Areas from 2015-2020 (4th Highest 8-Hour O_3 Values)

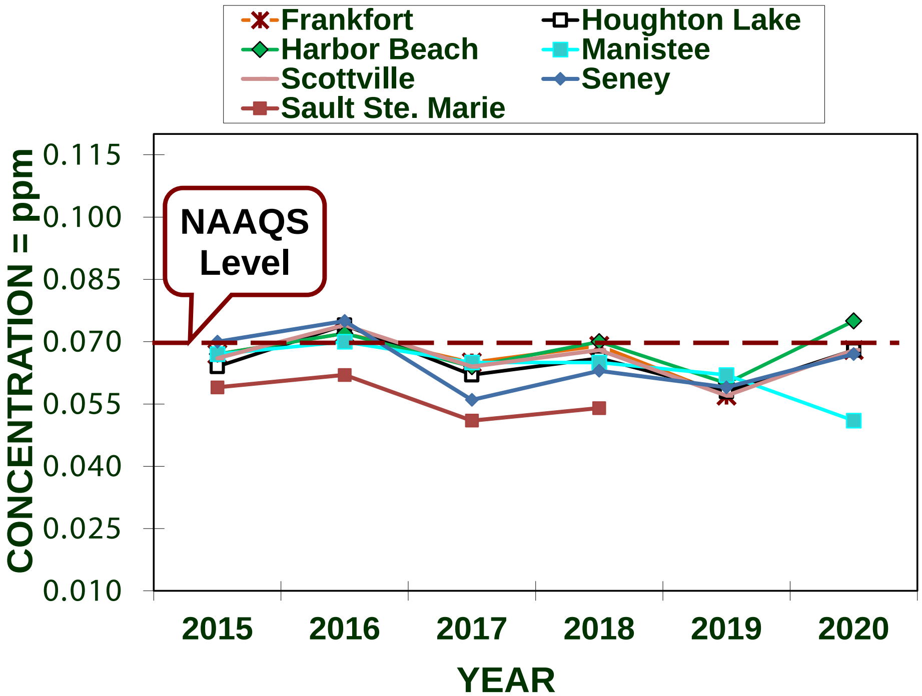
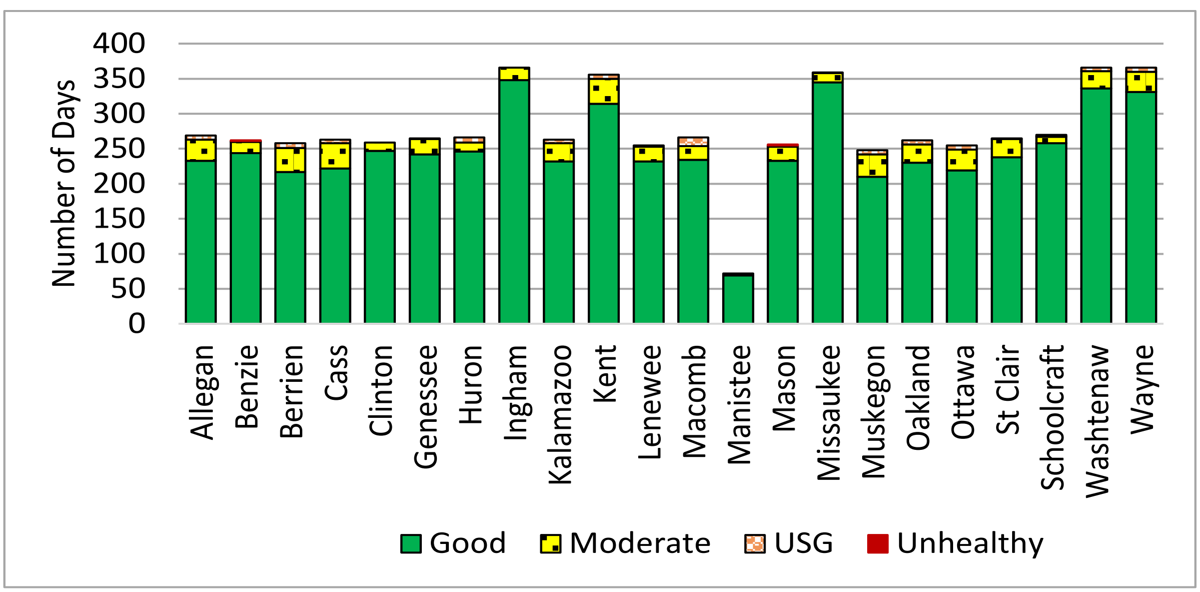


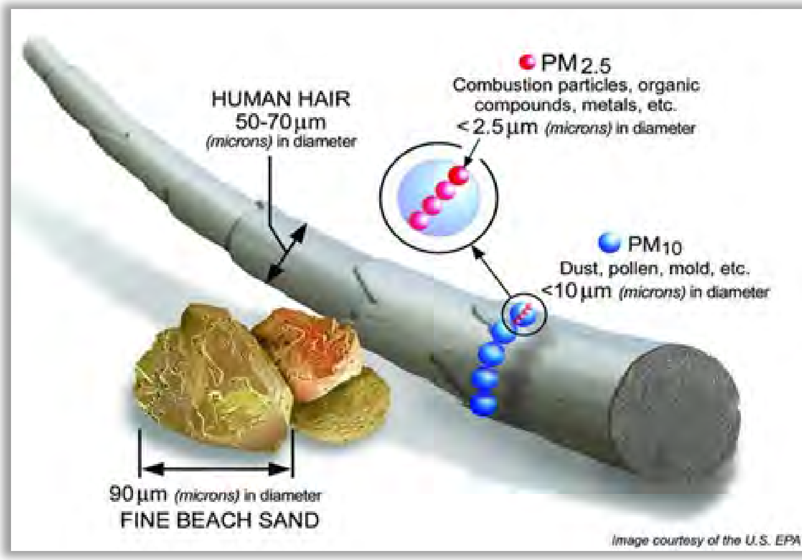
Figure 6.9 shows the AQI values per day in counties where ozone is monitored. Most days were in the good to moderate AQI range. Most counties had a few days in the USG range, Macomb County having the most USG days with 12 days. Two counties had one day each in the unhealthy AQI range: Benzie and Mason Counties.

Figure 6.9: 2020 AQI Days for Ozone in Michigan Counties



CHAPTER 7: PARTICULATE MATTER (PM_{10}, $PM_{10-2.5}$, $PM_{2.5}$, $PM_{2.5}$ 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). PM_{10} consists of "coarse particles" less than 10 µm in diameter (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. PM_{10} has a 24-hour average standard of 150 µg/m^3 not to be exceeded more than once per year over 3 years. $PM_{2.5}$ has an annual average standard of 12 µg/m^3, and a 98th percentile 24-hour concentration of 35 µg/m^3 averaged over 3 years. The sources and effects of PM are as follows:



Sources: PM can be emitted directly (primary) or may form in the atmosphere (secondary). Most man-made particulate emissions are classified as TSP. PM_{10} 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 directly from primary particle emissions or through secondary reactions that include VOCs, SO_2, and NO_X emissions originating from power plants, motor vehicles (especially diesel trucks and buses), industrial facilities, and other types of combustion sources.

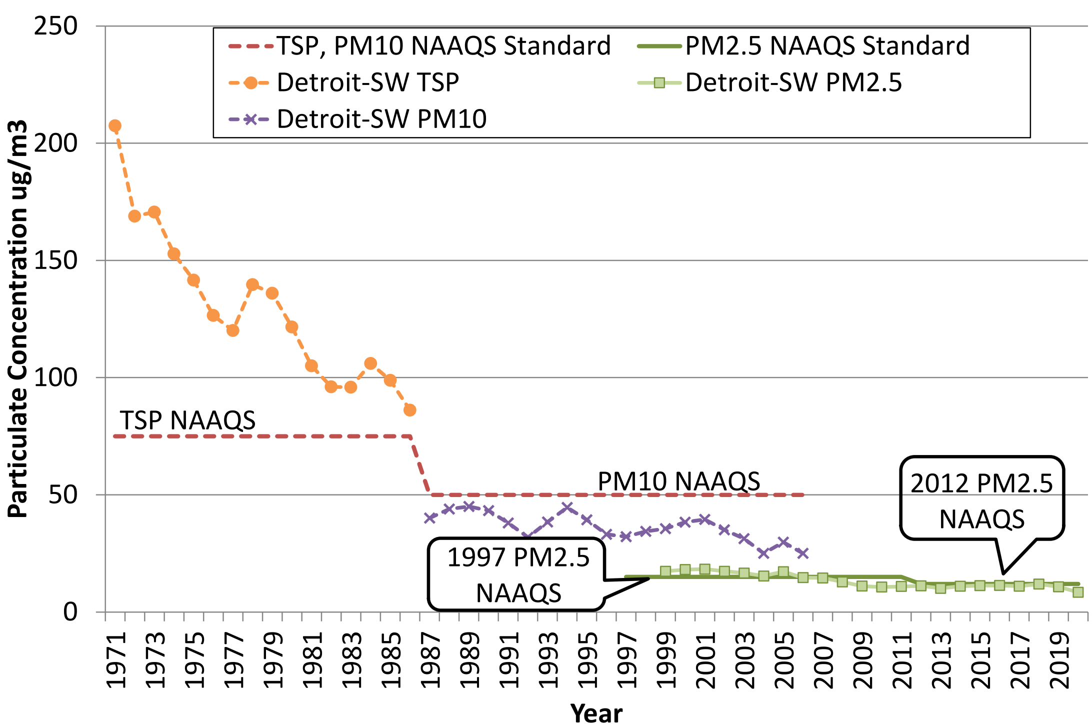
Effects: Exposure to PM can aggravate existing cardiovascular ailments and even cause death in susceptible populations. PM may affect breathing and the cellular defenses of the lungs and has been linked with heart and lung disease. Smaller particles (PM_{10} or smaller) pose the greatest problems, because 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 particulate matter. 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 PM_{10}. 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 PM_{10} annual standard but kept the PM_{10} 24-hour standard. The $PM_{2.5}$ 24-hour standard was also reduced from 65 µg/m^3 to 35 µg/m^3. In 2012, the USEPA reduced the annual standard from 15 µg/m^3 to 12 µg/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 Particulate Matter at Detroit-SW



PM_{10}

Figures 7.2 and **7.3** show PM_{10} emission sources and PM_{10} emissions by county (courtesy of the USEPA's State and County Emission Summaries).

Figure 7.2: PM_{10} Emissions by Source Sector

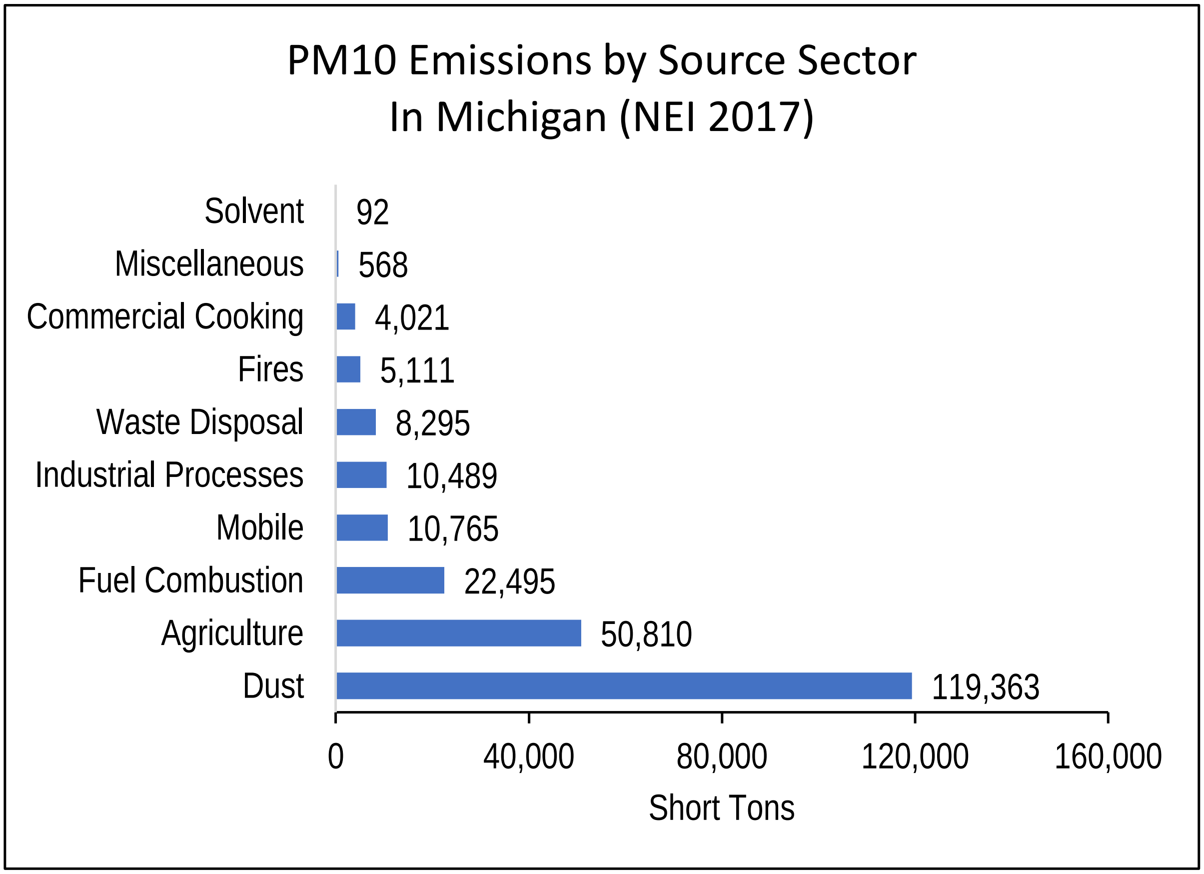
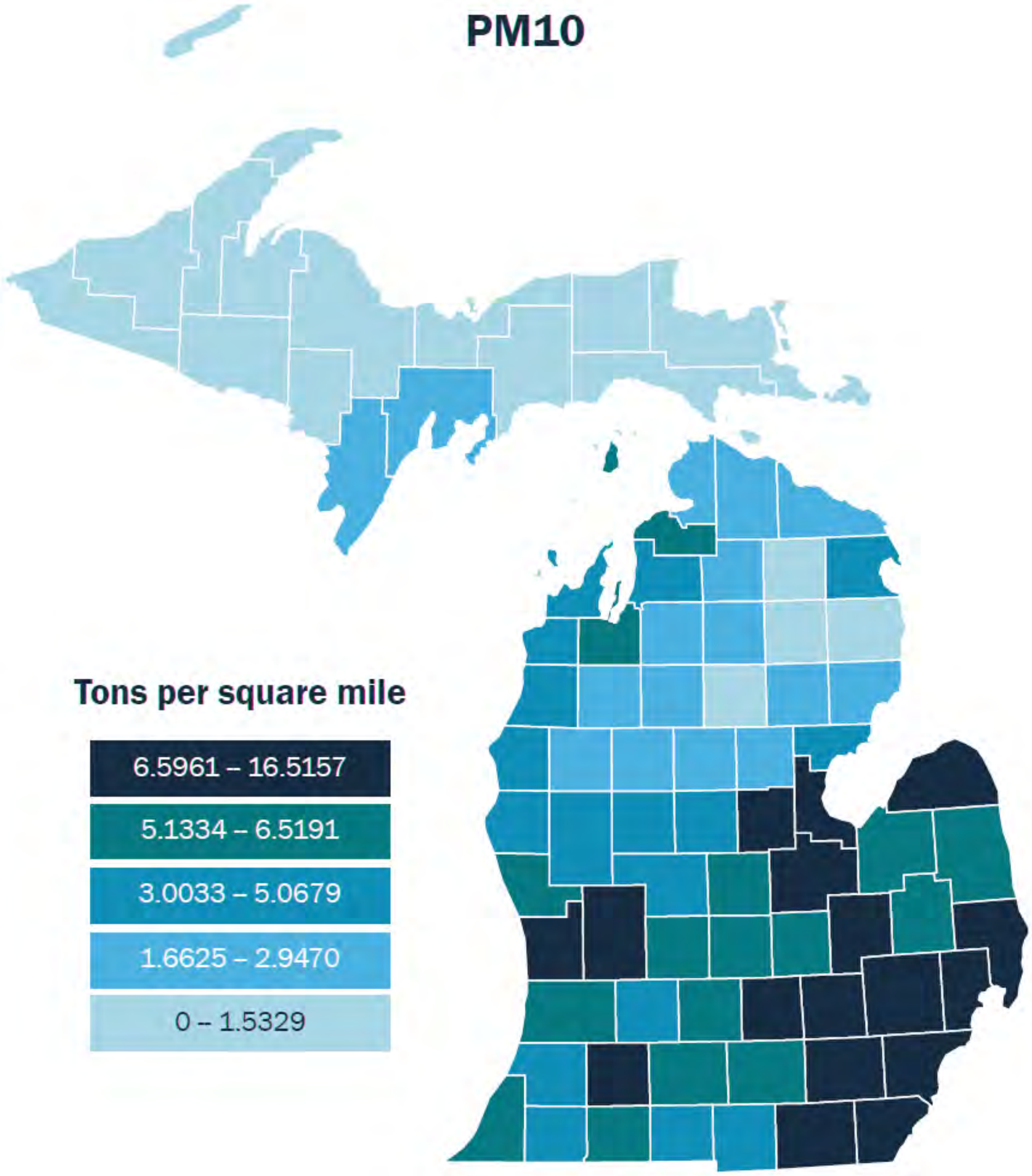


Figure 7.3: PM_{10} Emissions in 2017



Since October 1996, all areas in Michigan have been in attainment with the PM_{10} NAAQS. Due to the recent focus upon $PM_{2.5}$ and because of the relatively low concentrations of PM_{10} measured in recent years, Michigan's PM_{10} network has been reduced to a minimum level. Table 1.2 identifies the locations of PM_{10} monitoring stations that were operating in Michigan during 2020. These monitors are located mostly 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 PM_{10} continuous monitors (T640X), which also collect $PM_{2.5}$ data, were installed. However, filter-based instruments were shut down on January 1, 2021, so the continuous instruments will not be reported in the 2020 report.

Figure 7.4 shows the location of each PM_{10} monitor. All PM_{10} monitors are population-oriented monitors. A second PM_{10} monitor was added to the Grand Rapids area in Jenison (**Figure 7.5**) based on the USEPA's population requirements.

Figure 7.4: PM_{10} Monitors in 2020

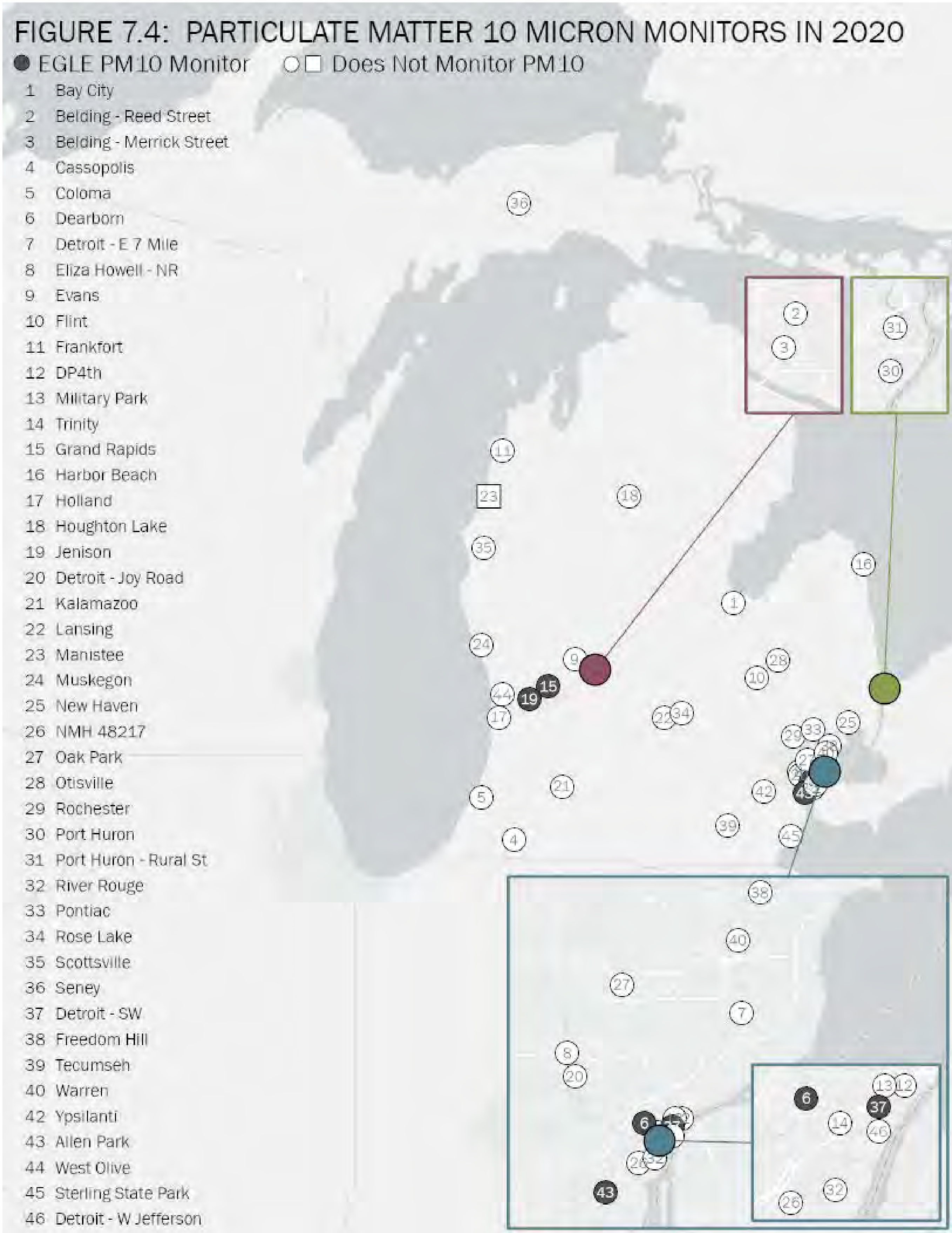


Figure 7.5 shows the PM_{10} levels in Michigan compared to the 24-hour average NAAQS of 150 µg/m^3. This standard must not be exceeded on average more than once per year over a 3-year period. The design value is the 4th highest value over a 3-year period. The PM_{10} levels at all sites in Michigan are well below the national standard.

Figure 7.5: 24-Hour PM_{10} Design Value

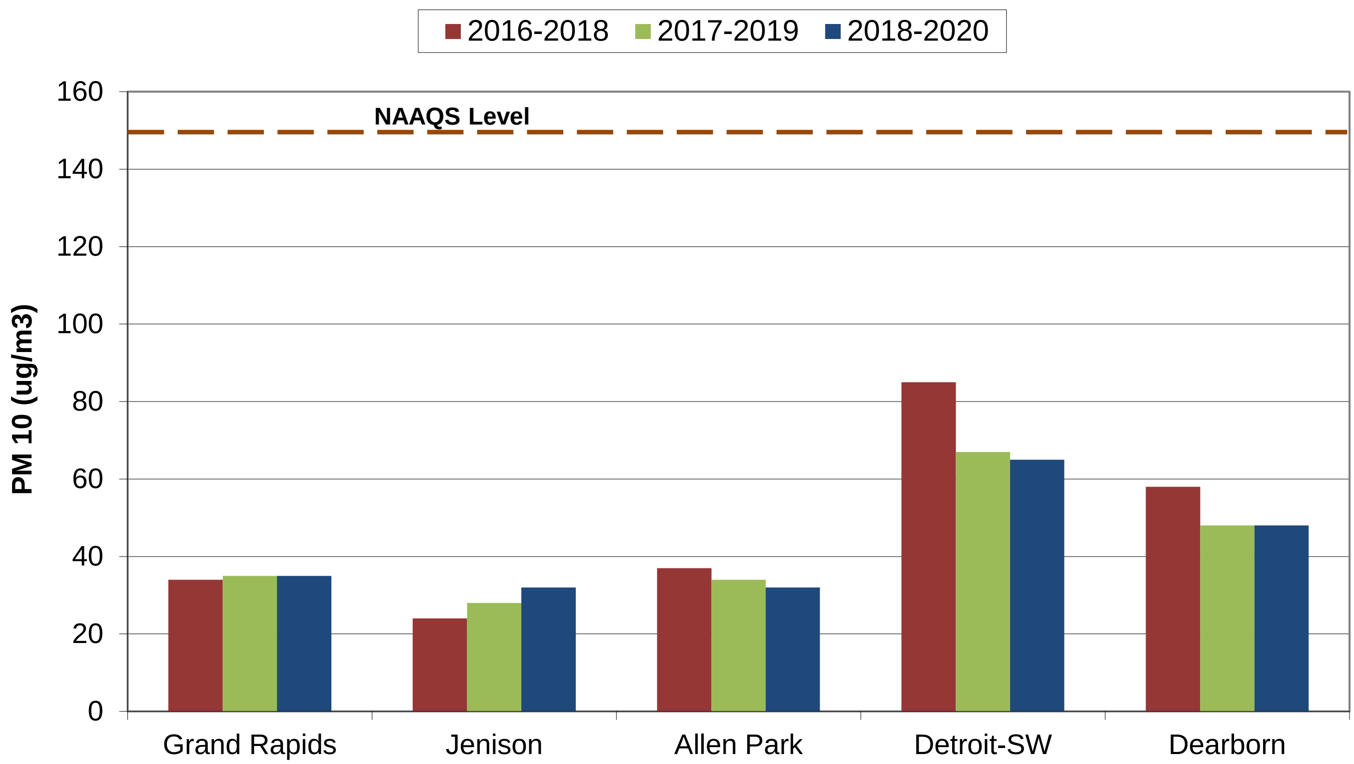
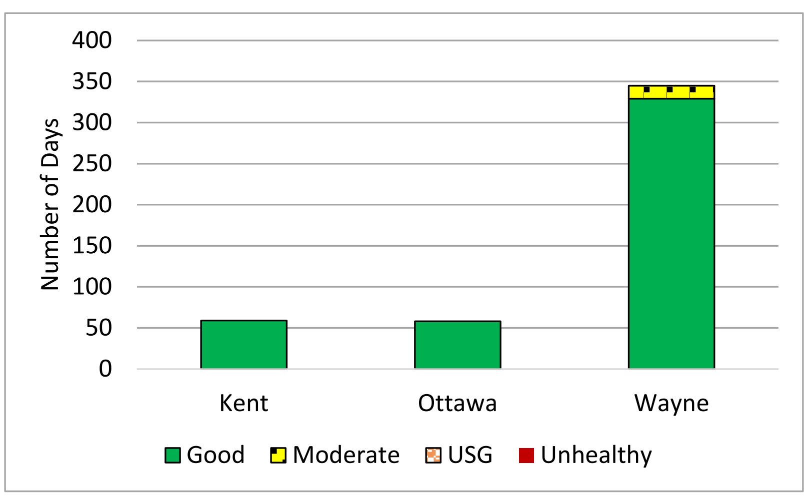


Figure 7.6 shows the AQI values per day in counties where PM_{10} is monitored. All days were in the good AQI range except for 16 days in the moderate AQI range in Wayne County.

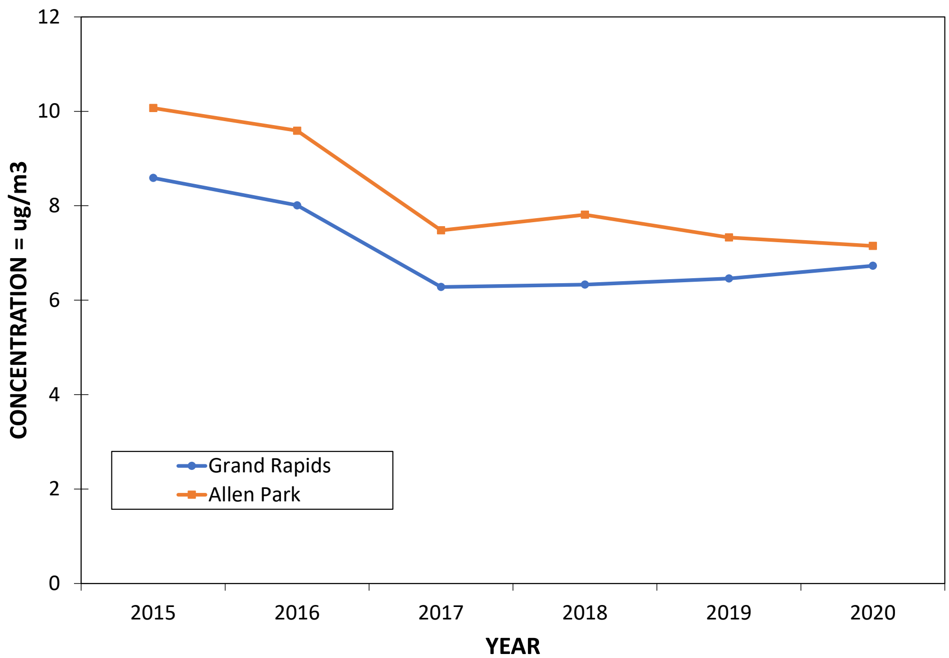
Figure 7.6: 2020 AQI Days for PM_{10} in Michigan Counties



$PM_{10-2.5}$

The 2006 amended air monitoring regulations specified that measurements of PM course ($PM_{10-2.5}$) needed to be added to the NCore sites.[7] EGLE began PM course 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 2015-2020 (Annual Arithmetic Mean)



$PM_{2.5}$

In December 2012, the USEPA revised the annual primary standard to 12 µg/m^3 while the annual secondary standard remained at 15 µg/m^3. The primary and secondary 24-hour standard remained at 35 µg/m^3. 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 www3.epa.gov/ttn/amtic/ncoreguidance.html.

Figure 7.8: $PM_{2.5}$ Emissions by Source Sector

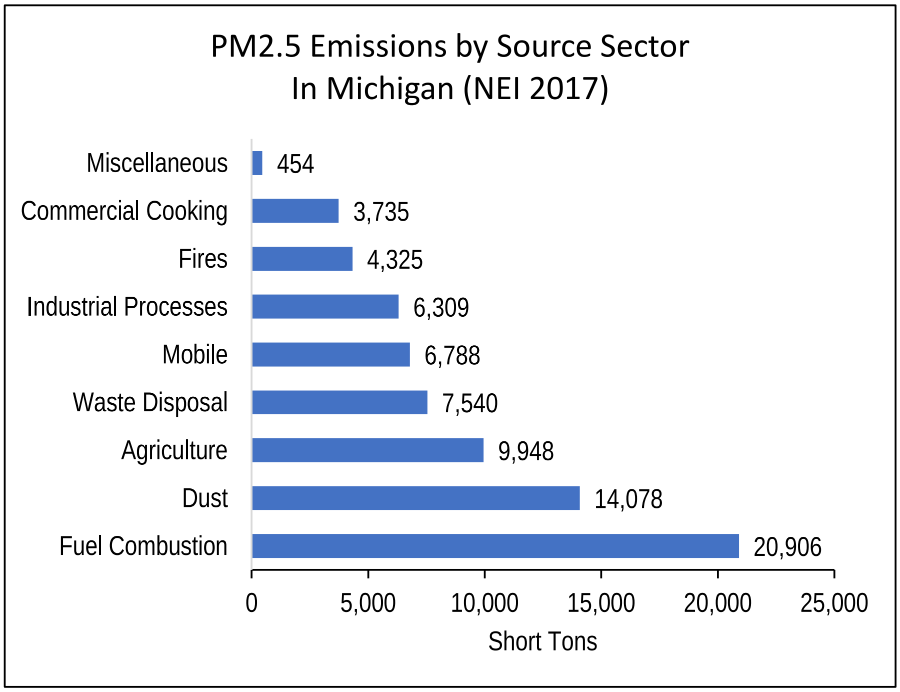
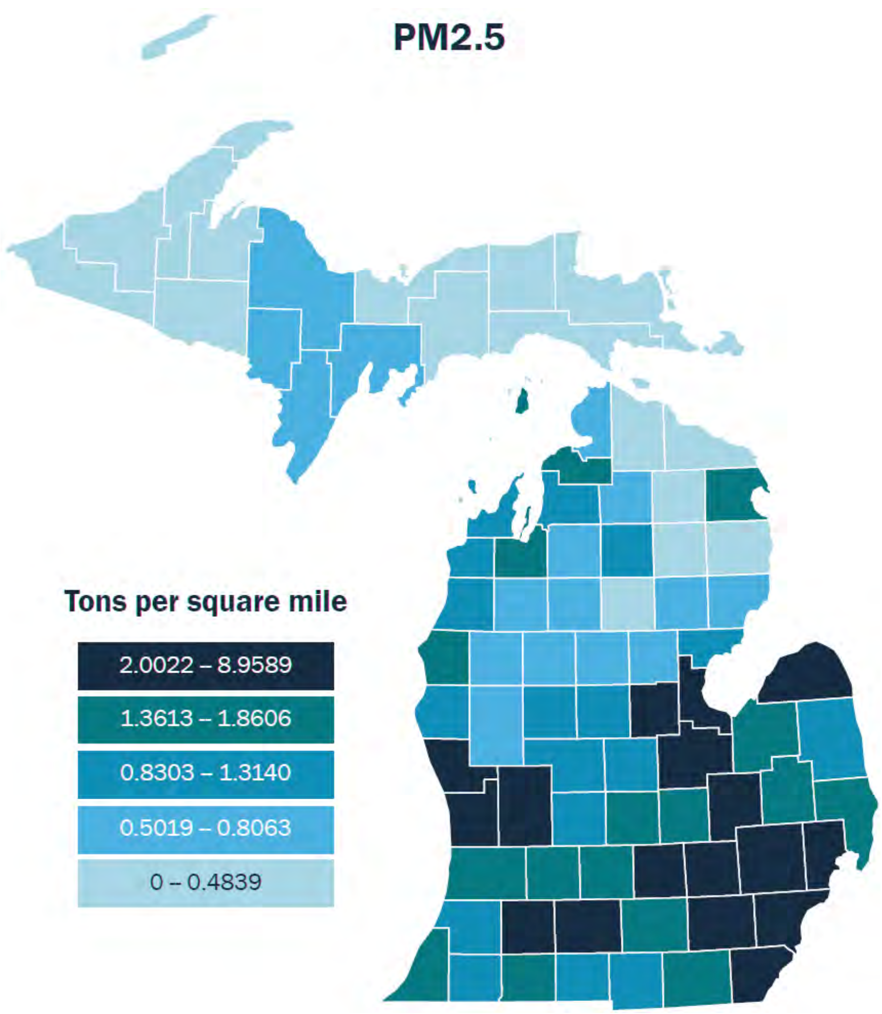


Figure 7.9: $PM_{2.5}$ Emissions in 2017



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.

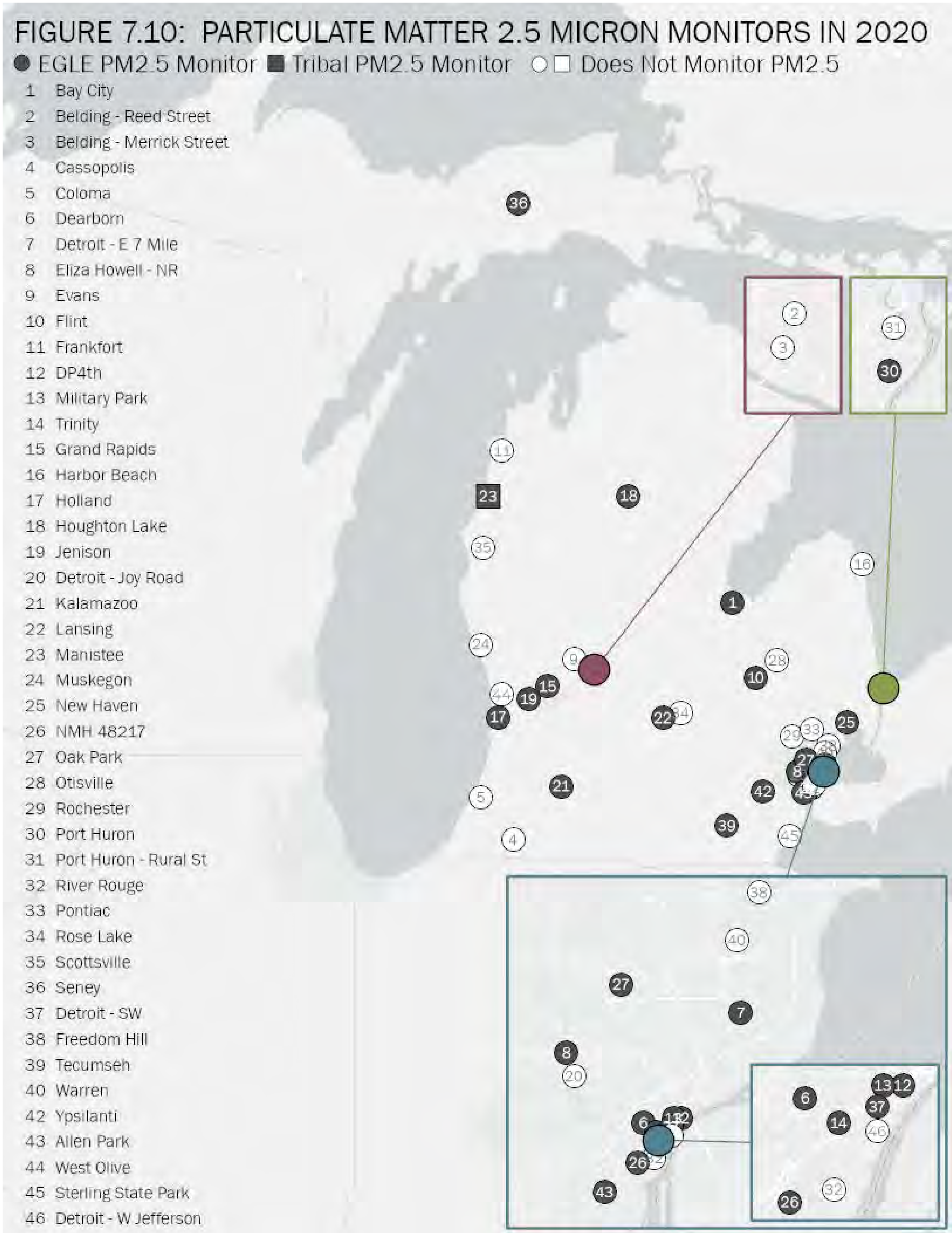
Figure 7.10 shows the location of each $PM_{2.5}$ monitor.

$PM_{2.5}$ 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 2020.

- Loss of site access shut down: Livonia Near-road will be relocated, but a suitable replacement site has not been found yet.
- Collocation sites: Five $PM_{2.5}$ 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 and Detroit-SW. Allen Park, Grand Rapids, and Jenison also have collocated PM_{10} and $PM_{2.5}$ but monitors were switched from FRMs and TEOMs to continuous FEM T640X beginning January 1, 2021, 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 FRM to BAMs: Holland, Bay City, and Ypsilanti (collocated with secondary FRM).
- Switched FRMs to T640s: Kalamazoo, New Haven, and Port Huron were switched to T640s in the fall, but FRMs were collocated at these sites until January 1, 2021. No T640 data is reported in 2020 for these sites. The T640 particulate instruments determine the concentration of particulates in the air using a light scattering technique, but the T640 primarily is used to measure $PM_{2.5}$.

[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 for PM [62 FR 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].

Figure 7.10: $PM_{2.5}$ Monitors in 2020



Continuous $PM_{2.5}$ Network: Short-term measurements of $PM_{2.5}$ or PM_{10} 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 13 FRM monitoring sites, 7 of which also had TEOMs or BAMs.

- T640 replaced TEOMS: Lansing switched to a T640 monitor in September 2020 and is running a collocated filter-based FRM. The T640 data will not be reported until 2021.
- GHIB project: DP4th, Trinity, Military Park and Detroit-SW were switched from BAMs to T640s in fall 2020. These T640 data are reported in the 2020 report.

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 of 30 percent nitrate compounds, 30 percent sulfate compounds, 30 percent organic carbon,[10] 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, a combustion by-product typical of transportation sources.

Table 1.2 in Chapter 1 shows all of Michigan's $PM_{2.5}$ FRM monitoring stations operating in 2020 and denotes which sites have TEOM, FEM, Speciation, or Aethalometer monitors in operation.

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[9] Under the Guidance for Using Continuous Monitors in $PM_{2.5}$ Monitoring Networks [EPA-454/R-98-012, May 1998].
[10] To better understand the chemical composition of the organic carbon fraction, several studies have been conducted in Southeast Michigan to further investigate organic carbon. Information can be found in the Michigan 2012 Ambient Air Monitoring Network Review, available at http://www.michigan.gov/documents/deq/deq-aqd-aqe-2012-Air-Mon-Network-Review_357137_7.pdf

Table 7.1 provides the design value, the 3-year average of the annual mean $PM_{2.5}$ concentrations for 2018-2020. Michigan's levels are below the 12 µg/m³ primary standard.[11]

Table 7.1: 3-Year Average of the Annual Mean $PM_{2.5}$ Concentrations for 2018-2020

Areas	County	Monitoring Sites	2018	2019	2020	2018-2020 Mean
Detroit-Ann Arbor	Lenawee	Tecumseh	8.4	8.5	8.2	8.3
Detroit-Ann Arbor	Macomb	New Haven	7.8	7.3	6.0	7.0
Detroit-Ann Arbor	Oakland	Oak Park	8.3	7.7	7.4	7.8
Detroit-Ann Arbor	St. Clair	Port Huron	8.1	7.6	6.7	7.5
Detroit-Ann Arbor	Washtenaw	Ypsilanti	8.3	8.4	8.2	8.3
Detroit-Ann Arbor	Wayne	Allen Park	9.1	8.7	7.5	8.4
Detroit-Ann Arbor	Wayne	Detroit-Linwood	8.86	--	--	8.9
Detroit-Ann Arbor	Wayne	Detroit-E 7 Mile	8.4	7.6	7.5	7.8
Detroit-Ann Arbor	Wayne	Detroit-SW	11.5	12.1	9.1	10.9
Detroit-Ann Arbor	Wayne	Detroit-W. Lafayette	8.9*	--	--	8.9
Detroit-Ann Arbor	Wayne	Wyandotte	8.0	--	--	8.0
Detroit-Ann Arbor	Wayne	Dearborn	10.6	9.9	9.4	10.0
Detroit-Ann Arbor	Wayne	Livonia	7.4*	--	--	7.4
Detroit-Ann Arbor	Wayne	Livonia-Roadway	9.0	8.4*	--	8.7
Detroit-Ann Arbor	Wayne	Eliza Howell-NR	--	--	10.6	10.6
Flint	Genesee	Flint	7.4	7.2	6.0	6.9
Grand Rapids	Ottawa	Jenison	8.3*	8.3	7.4	8.0
Grand Rapids	Kent	Grand Rapids	8.2	8.00	7.7	8.0
Allegan Co	Allegan	Holland	7.6	7.2	6.0	6.9
Kalamazoo-Battle Creek	Kalamazoo	Kalamazoo	8.4	7.2	7.6	7.8
Lansing-East Lansing	Ingham	Lansing	7.7**	7.3	7.1	7.4
Bay Co	Bay	Bay City	7.1	6.8	4.7	6.2
Missaukee Co	Missaukee	Houghton Lake	5.4	5.8	8.0	6.4
Manistee Co	Manistee	Manistee	6.1	4.9*	5.1*	5.4
Schoolcraft Co	Schoolcraft	Seney	4.1*	4.2	4.6*	4.3

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

**Indicates site was moved during the year and concentrations were averaged together for both locations.

[11] For comparison to the standard, the average annual means is rounded to the nearest 0.1 µg/m³.

Table 7.2 provides the 24-hour 98th percentile $PM_{2.5}$ concentrations for 2018-2020 showing Michigan's levels are below the 35 µg/m^3 standard (3-year average).[12]

Table 7.2: 24-Hour 98th Percentile $PM_{2.5}$ Concentrations for 2018-2020

Areas	County	Monitoring Sites	2018	2019	2020	2018-2020 Mean
Detroit-Ann Arbor	Lenawee	Tecumseh	24.2	22.1	18.7	22
Detroit-Ann Arbor	Macomb	New Haven	18.9	18.7	15.5	18
Detroit-Ann Arbor	Oakland	Oak Park	20.1	18.2	23.3	21
Detroit-Ann Arbor	St. Clair	Port Huron	19.6	20.3	16.6	19
Detroit-Ann Arbor	Washtenaw	Ypsilanti	21.3	22.0	19.8	21
Detroit-Ann Arbor	Wayne	Allen Park	22.8	22.0	26.3	24
Detroit-Ann Arbor	Wayne	Detroit-Linwood	18.6	--	--	19
Detroit-Ann Arbor	Wayne	Detroit-E 7 Mile	21.5	19.6	17.7	20
Detroit-Ann Arbor	Wayne	Detroit-SW	28.1	30.6	24.1	28
Detroit-Ann Arbor	Wayne	Detroit-W. Lafayette	8.9*	--	--	8.9
Detroit-Ann Arbor	Wayne	Wyandotte	20.4	--	--	20
Detroit-Ann Arbor	Wayne	Dearborn	26.1	24.0	21.0	24
Detroit-Ann Arbor	Wayne	Livonia	18.1*	--	--	18
Detroit-Ann Arbor	Wayne	Livonia-Roadway	22.8*	29.0	--	26
Detroit-Ann Arbor	Wayne	Eliza Howell-NR	--	--	23.2	23
Flint	Genesee	Flint	22.2	18.9	14.5	19
Grand Rapids	Ottawa	Jenison	22.3*	24.4	17.9	22
Grand Rapids	Kent	Grand Rapids	18.9	23.2	17.6	20
Allegan Co	Allegan	Holland	21.2	18.2	13.1	18
Kalamazoo-Battle Creek	Kalamazoo	Kalamazoo	19.0	16.9	18.0	18
Lansing-East Lansing	Ingham	Lansing	23.5**	22.3*	21.6	22
Bay Co	Bay	Bay City	17.8	17.5	14.0	16
Missaukee Co	Missaukee	Houghton Lake	16.2	15.1	15.2	16
Manistee Co	Manistee	Manistee	16.9	14.9*	13.3*	15
Schoolcraft Co	Schoolcraft	Seney	19.0*	14.1	10.6*	15

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

**Indicates site was moved during the year and concentrations were averaged together for both locations.

[12] 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/m^3.

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

Figure 7.11 shows the 2020 levels in Wayne County remained below the $PM_{2.5}$ NAAQS standard. Historically, Dearborn has had the highest concentrations in the state, but Detroit-SW now has the highest concentrations. All sites are below the annual $PM_{2.5}$ NAAQS standard. The Gordie Howe International Bridge 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 2020 are below the $PM_{2.5}$ NAAQS.

Figure 7.13 combines the $PM_{2.5}$ monitoring sites located in West Michigan-Grand Rapids-Muskegon-Holland 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-Flint CSA (Wayne County Only) Annual Arithmetic Means for $PM_{2.5}$ from 2015-2020

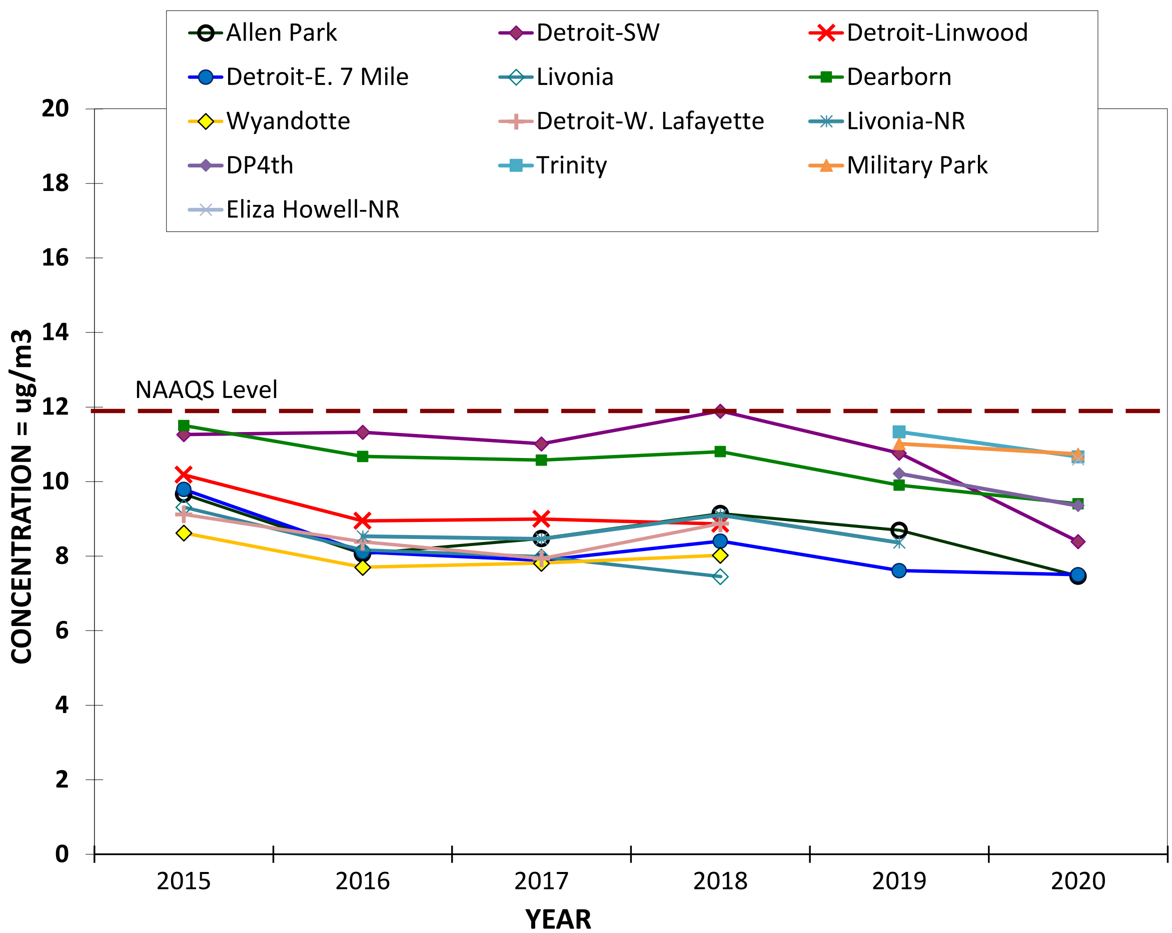


Figure 7.12: Detroit-Warren-Flint CSA (without Wayne County) Annual Arithmetic Means for $PM_{2.5}$ from 2015-2020

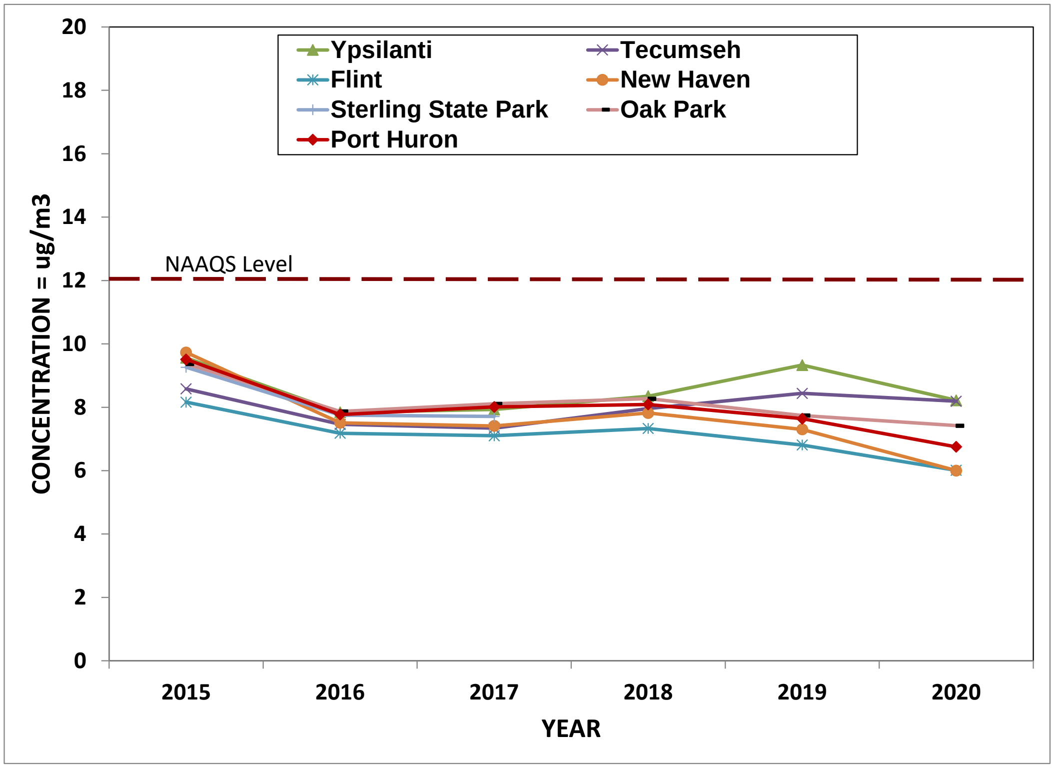


Figure 7.13: West MI - Grand Rapids-Muskegon-Holland CSA, Kalamazoo, and Benton Harbor MSAs Annual Arithmetic Means for $PM_{2.5}$ from 2015-2020

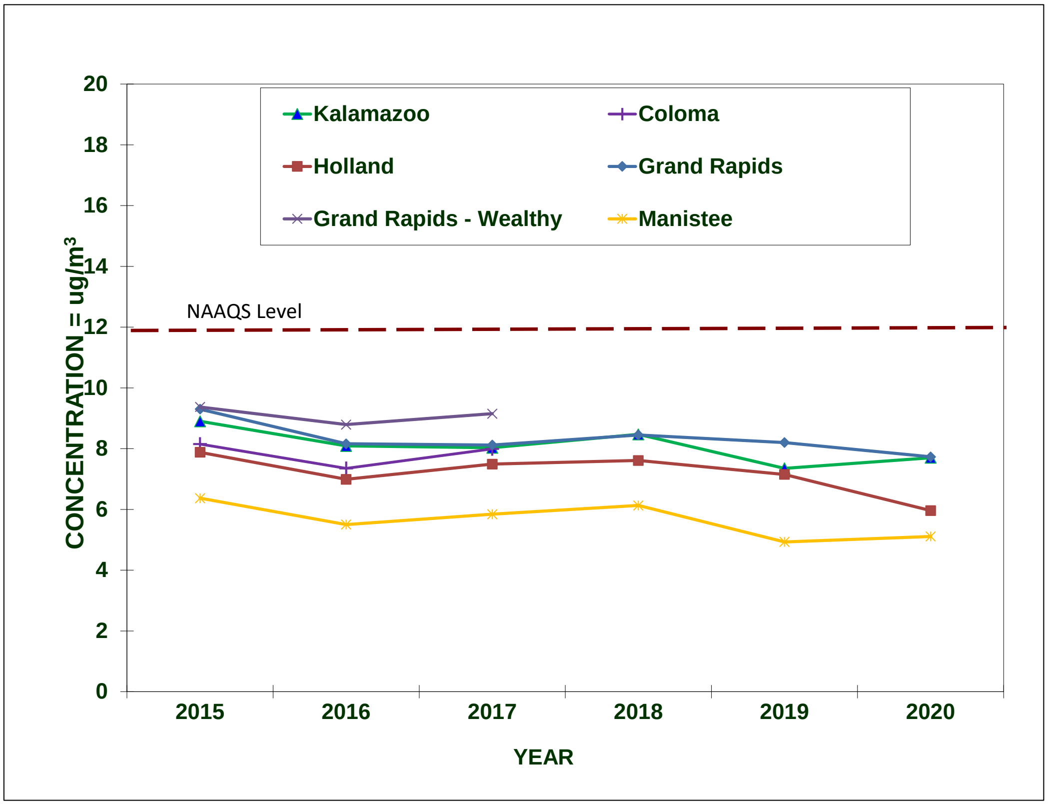


Figure 7.14: Lansing-E. Lansing CSA, Saginaw-Bay City CSA, Cadillac MSA and Upper Peninsula Annual Arithmetic Means for $PM_{2.5}$ from 2015-2020

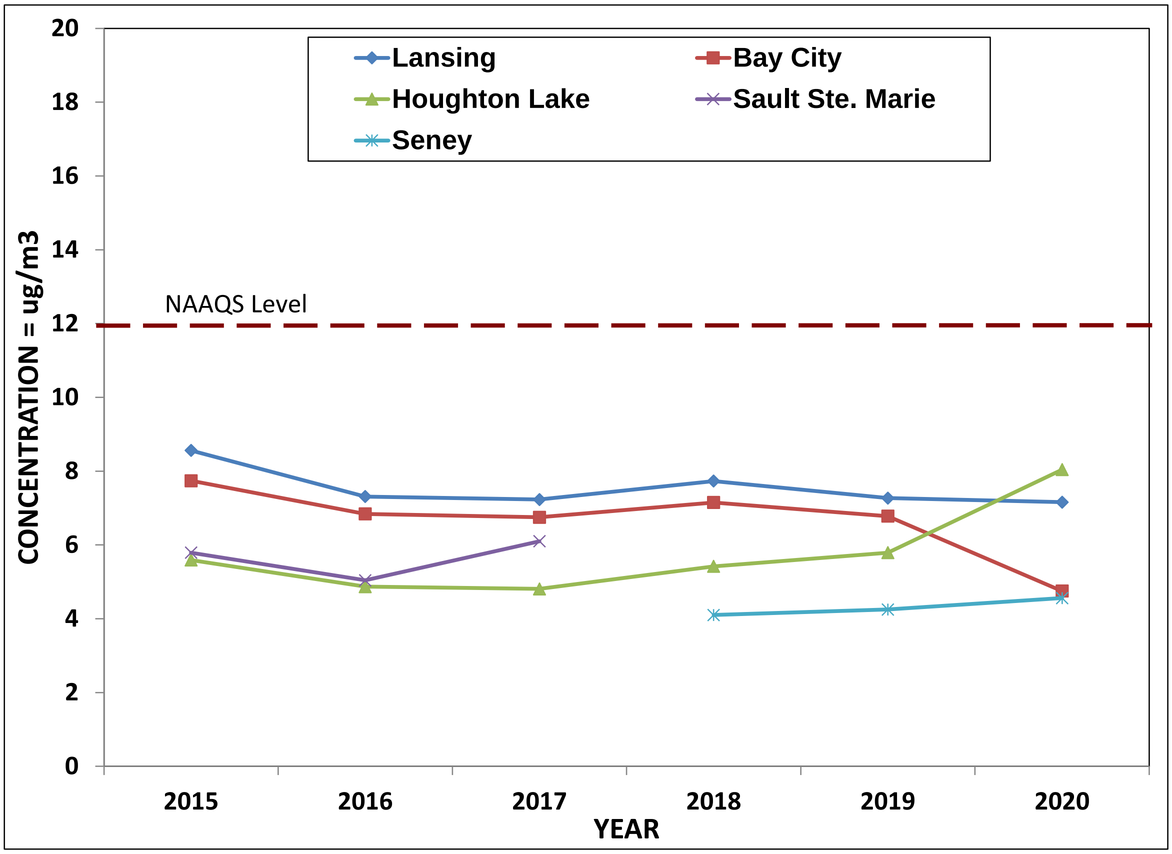
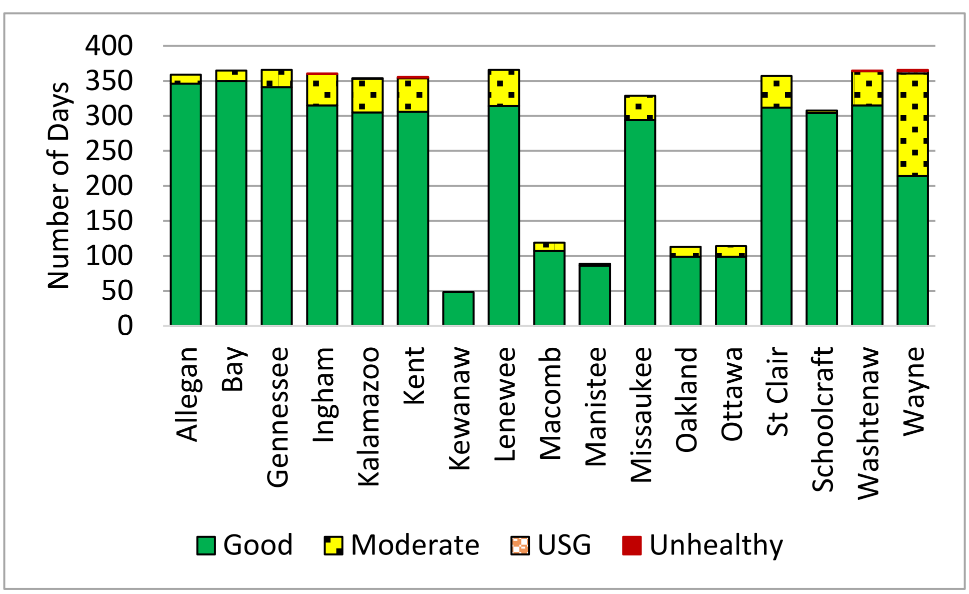


Figure 7.15 shows the AQI values per day in counties where $PM_{2.5}$ is monitored. Most days were in the good to moderate AQI range. Three counties had five days in the USG AQI range, Kalamazoo, and Kent County each had one day, and Wayne County had three days in the USG AQI range. Four counties had AQI values in the Unhealthy range; Ingham, Kent, and Washtenaw Counties had one day, and Wayne County had two days. All these days occurred on July 4th or 5th most likely due to fireworks.

Figure 7.15: 2020 AQI Days for $PM_{2.5}$ in Michigan



CHAPTER 8: TOXIC AIR POLLUTANTS

In addition to the six criteria pollutants discussed in previous chapters, the AQD monitors for a wide variety of substances classified as toxic air pollutants, and/or Hazardous Air Pollutants (HAPs). Under the Clean Air Act, the USEPA specifically addresses a group of 187 HAPs. Under Michigan's air regulations, Toxic Air Contaminants (TACs) are defined as all non-criteria pollutants that may be "*…harmful to public health or the environment when present in the outdoor atmosphere in sufficient quantities and duration.*" The definition of TACs lists 42 substances that are not TACs, indicating that all others are TACs. The sources and effects of toxics are as follows:

Sources: Air toxics come from a variety of mobile, stationary, and indoor man-made sources as well as outdoor natural sources. Mobile sources include motor vehicles, stationary sources include industrial factories and power plants, indoor sources include household cleaners, and natural sources include forest fires and eruptions from volcanoes.

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; developmental toxicity (birth defects); nervous system effects; and various other effects on internal organs. Some effects appear after a shorter period of exposure, while others may appear after 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, 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 exposure through an oral pathway such as the eating of fish or produce. This further complicates the assessment of air toxics concerns due to the broad range of susceptibility that various people may have.

Population most at risk: People with asthma, children, and the elderly are generally at the highest risk for health effects from exposure to air toxics.

Air Toxics can be categorized as:

- **Metals:** Examples include aluminum, arsenic, beryllium, barium, cadmium, chromium, cobalt, copper, iron, mercury, manganese, molybdenum, nickel, lead, vanadium, and zinc.
- **Organic Substances:** Further divided into sub-categories that include –
    - VOCs, include benzene (found in gasoline), perchloroethylene (emitted from some dry-cleaning facilities), and methylene chloride (a solvent and paint stripper used by industry);
    - carbonyl compounds (formaldehyde, acetone, and acetaldehyde);
    - semi-volatile compounds (SVOCs);
    - polycyclic aromatic hydrocarbons (PAHs)/polynuclear aromatic hydrocarbons (PNAs);
    - pesticides and;
    - polychlorinated biphenyls (PCBs).
- **Other substances:** Asbestos, dioxin, and radionuclides such as radon.

Because air toxics are such a large and diverse group of substances, regulatory agencies sometimes further refine these classifications to address specific concerns.

For example:

- Some initiatives have targeted those substances that are persistent, bioaccumulative and toxic (PBT), such as mercury, which accumulates in body tissues.
- The USEPA has developed an Integrated Urban Air Toxics Strategy with a focus on 30 substances (the Urban HAPs List).[13]

The evaluation of air toxics levels is difficult due to several factors.

- There are no health-protective NAAQS. Instead, air quality assessments utilize various short- and long-term screening levels and health-based levels estimated to be safe considering the critical effects of concern for specific substances.
- There is incomplete toxicity information for many substances. For some air toxics, the analytical detection limits are too high to consistently measure the amount present, and in some cases, the risk assessment-based levels are below the detection limits.
- Data gaps are present regarding the potential for interactive toxic effects for co-exposure to multiple substances present in emissions and in ambient air. Air toxics also pose a challenge due to monitoring and analytical methods that are either unavailable for some compounds or cost-prohibitive for others (e.g., dioxins).

These factors make it difficult to accurately assess the potential health concerns of all air toxics. Nevertheless, it is feasible and important to characterize the potential health hazards and risks associated with many air toxics.

Table 8.1 shows the monitoring stations and what air toxic was monitored at each station in 2020. This table can also be found in **Appendix B** with the Air Toxics Monitoring Summary.

[13] USEPA's Air Toxics website: Urban Strategy is located at www.epa.gov/urban-air-toxics.

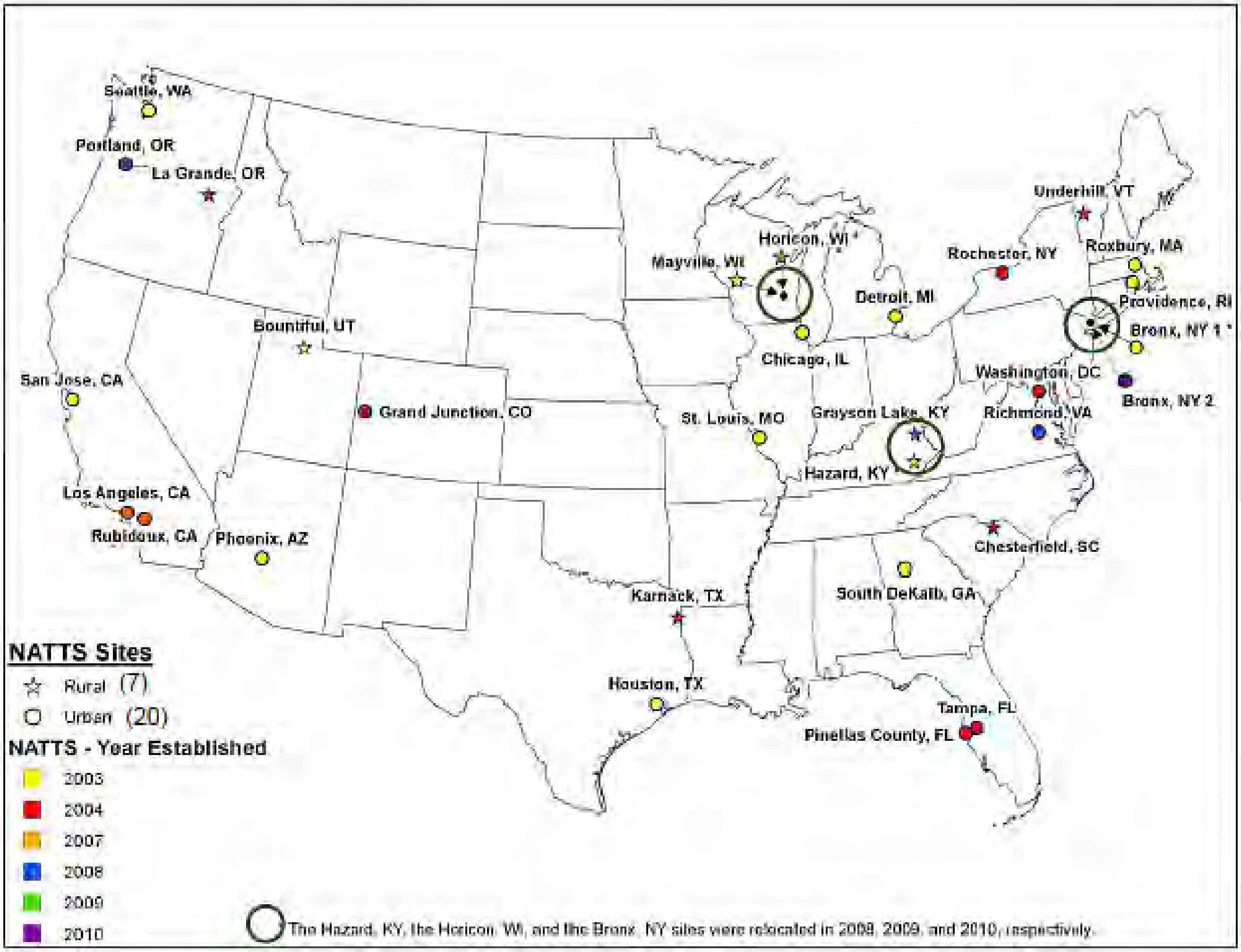
Table 8.1: 2019 Toxics Sampling Sites

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

National Monitoring Efforts and Data Analysis

The USEPA administers national programs that identify air toxics levels, detect trends, and prioritize air toxics research. EGLE participates in these programs. In addition, the AQD operates a site in Dearborn that is part of the USEPA's 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 7 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, PM_{10}, and $PM_{2.5}$.

Figure 8.1: National Air Toxics Trends Sites



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 2020.

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

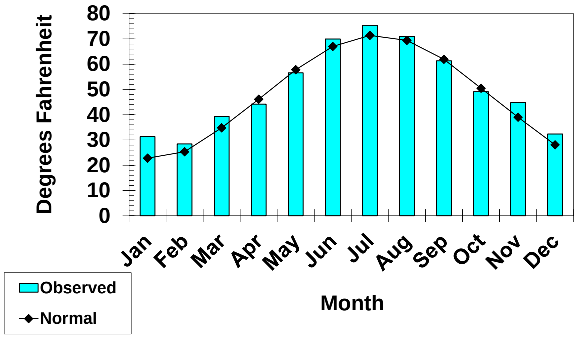


Figure 9.2: Northern Lower Peninsula Observed Average Monthly Temperatures vs. Normal Average Monthly Temperatures

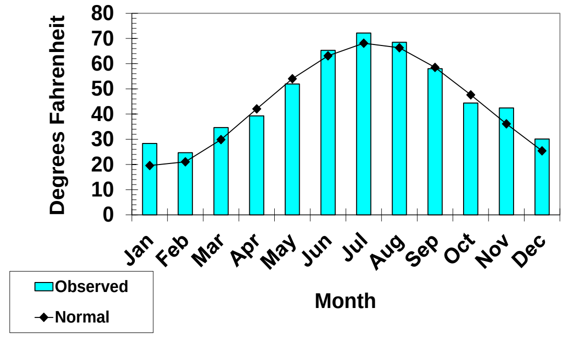


Figure 9.3: Upper Peninsula Observed Average Monthly Temperatures vs. Normal Average Monthly Temperatures

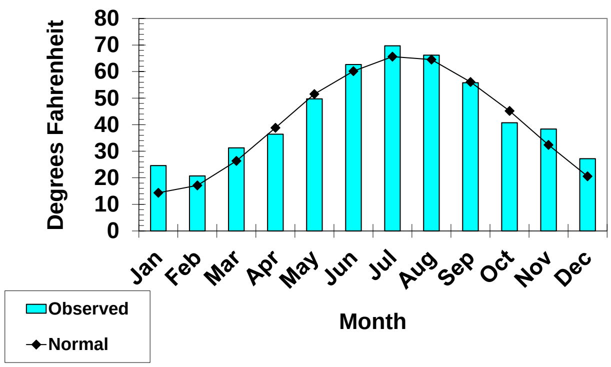


Figure 9.4: Southern Lower Peninsula Observed Monthly Precipitation vs. Normal Monthly Precipitation

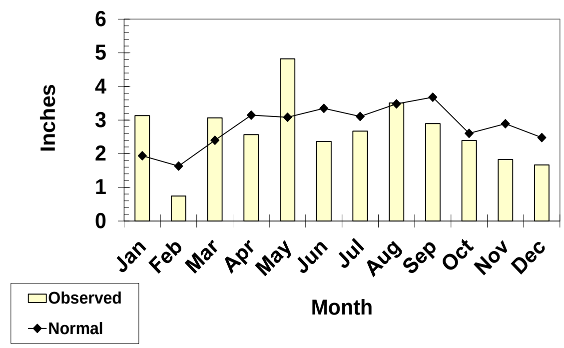


Figure 9.5: Northern Lower Peninsula Observed Monthly Precipitation vs. Normal Monthly Precipitation

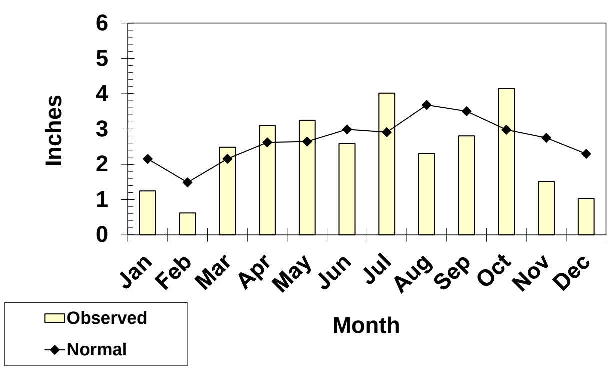
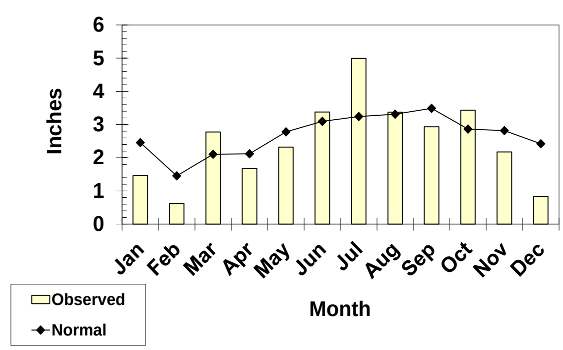


Figure 9.6: Upper Peninsula Observed Monthly Precipitation vs. Normal Monthly Precipitation



CHAPTER 10: SPECIAL PROJECTS

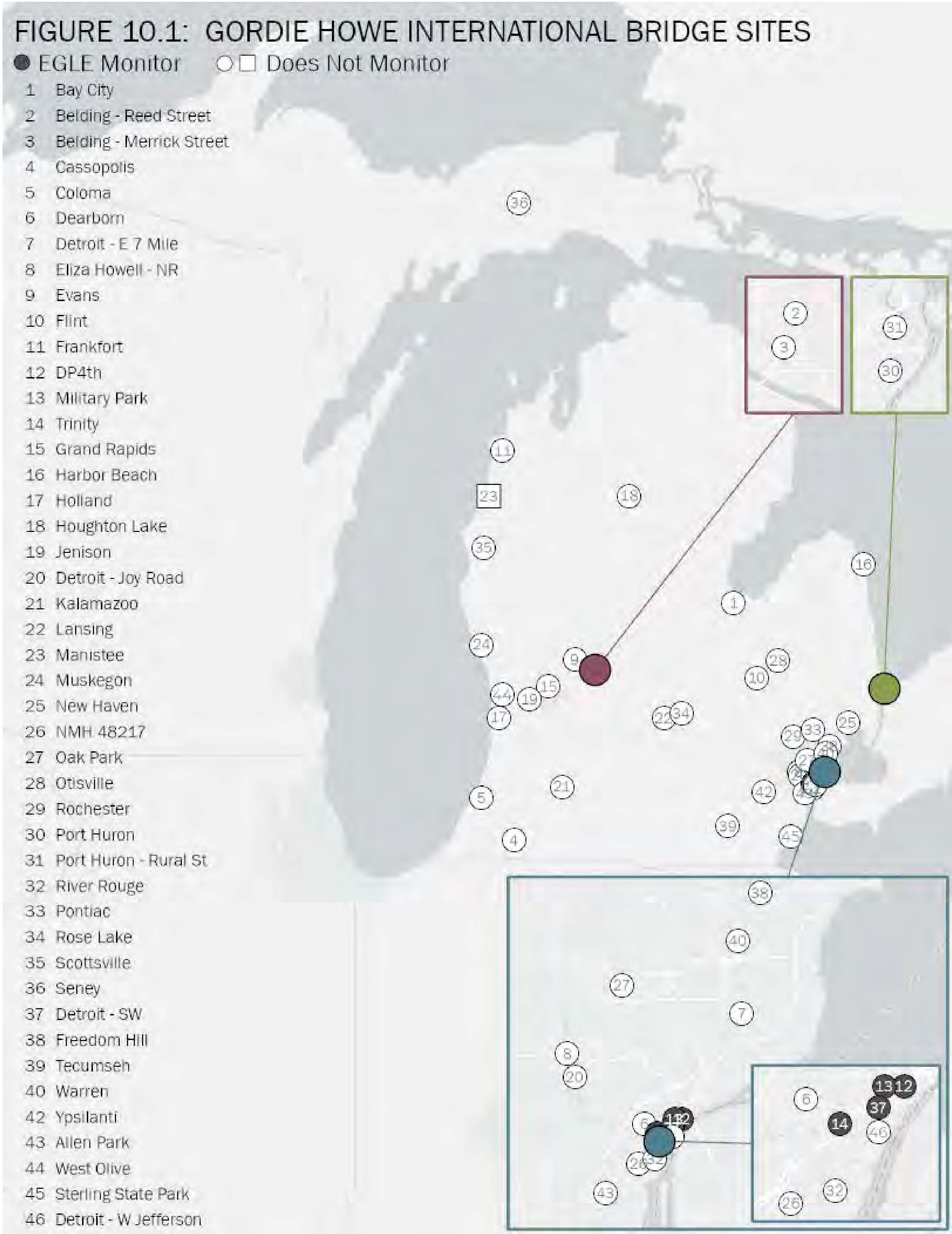
EGLE continues the sampling for the Gordie Howe International Bridge (GHIB). This project is a joint Canadian-American venture. The GHIB will be built linking Windsor, Ontario and Detroit, Michigan. Construction is slated to occur between 2018-2024. For additional information, go to: GordieHoweInternationalBridge.com.

EGLE is conducting ambient air quality monitoring in the Delray community to ascertain air pollution levels in the community. The three new sites will monitor air pollutants before, during, and after construction of the bridge. In addition, NOx, continuous $PM_{2.5}$, and black carbon were added to the Detroit-SW (261630015) monitoring site for this project.

- **Trinity (261630098)**: Meteorological parameters, NOx, SO_2, CO, continuous $PM_{2.5}$, black carbon, and five trace metals (Pb, Mn, As, Cd, and Ni).
- **DP4TH (261630099)**: NOx, SO_2, CO, continuous $PM_{2.5}$, black carbon, and five trace metals (Pb, Mn, As, Cd, and Ni).
- **Military Park (261630100)**: NOx, SO_2, continuous $PM_{2.5}$, black carbon, and five trace metals (Pb, Mn, As, Cd, and Ni).
- **Detroit-SW (261630015):** Meteorological parameters, NOx, SO_2, continuous $PM_{2.5}$, $PM_{2.5}$ Speciated, PM_{10}, 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.

Figure 10.1: Gordie Howe International Bridge Sites



APPENDIX A: CRITERIA POLLUTANT SUMMARY FOR 2020

Appendix A utilizes the USEPA's 2020 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 µg/m^3 and in ppm for gaseous pollutants. The following define some of the terms listed in the **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 - Typicaly collocated FRM;
- 3 - TEOM hourly PM_{10} and $PM_{2.5}$ measurements; and
- 5 - $PM_{2.5}$ speciation monitors (shown at right is a Met One SASS – speciation air sampling system).

 # OBS: For Pb, TSP, $PM_{2.5}$, 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, $PM_{2.5}$ TEOM, BAM 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.

Criteria Pollutant Summary For 2020

CO measured in ppm

Site ID	POC	City	County	Year	# OBS	1-hr Highest Value	1-hr 2nd Highest Value	1-hr OBS > 35	8-hr Highest Value	8-hr 2nd Highest Value	8-hr OBS > 9
260810020	1	Grand Rapids	Kent	2020	7136	1.5	1.4	0	1.1	1.1	0
261630001	1	Allen Park	Wayne	2020	8259	1.7	1.6	0	1.2	1.2	0
261630093	1	Eliza Howell-NR	Wayne	2020	8191	2.4	2.4	0	2.1	1.8	0
261630098	1	DP4th	Wayne	2020	8349	1.4	1.4	0	1.1	1.1	0
261630099	1	Trinity	Wayne	2020	8367	2.3	2.1	0	1.4	1.3	0

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

Pb (24-hour) measured in µg/m^3

Site ID	POC	City	County	Year	# OBS	Highest rolling 3-month Arith Mean	Highest Value (24-hr)	2nd Highest Value (24-hr)
260670003	1	Belding-Merrick St.	Ionia	2020	60	0.01	.028	.009
261470031	1	Port Huron-Rural St.	St. Clair	2020	61	0.03	0.121	0.119
261630005	1	River Rouge	Wayne	2020	61	0.01	0.014	0.013
261630015	1	Detroit-SW	Wayne	2020	61	0.01	0.021	0.020
261630027	1	Detroit-W. Jefferson	Wayne	2020	61	0.02	0.086	0.031
261630033	1	Dearborn	Wayne	2020	60	0.01	0.093	0.051
261630097	1	NMH 48217	Wayne	2020	61	0.01	0.020	0.017
261630098	1	DP4th	Wayne	2020	61	0.02	0.103	0.052
261630099	1	Trinity	Wayne	2020	62	0.04	0.056	0.030
261630100	1	Military Park	Wayne	2020	61	0.02	0.096	0.079

NO_2 measured in ppb

Site ID	POC	City	County	Year	# OBS	1-Hr Highest Value	1-Hr 2nd Highest Value	98th Percentile 1-hr	Annual Arith Mean
260650018	1	Lansing	Ingham	2020	8178	39.5	35.1	33.0	5.73
261130001	1	Houghton Lake	Missaukee	2020	8327	13.7	11.1	3.4	1.02
261390005	1	Jenison	Ottawa	2020	8318	29.7	29.7	28.2	4.71
261630015	1	Detroit-SW	Wayne	2020	8094	47.1	45.6	38.2	11.23
261630093	1	Eliza Howell-NR	Wayne	2020	8101	42.9	41.8	39.1	13.05
261630098	1	DP4th	Wayne	2020	8278	80.0	47.1	43.6	12.25
261630099	1	Trinity	Wayne	2020	7908	59.6	49.3	39.9	11.94
161630100	1	Military Park	Wayne	2020	7847	75.4	70.4	43.3	11.14

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

NO_Y measured in ppb

Site ID	POC	City	County	Year	# OBS	1-Hr Highest Value	1-Hr 2nd Highest Value	Annual Arith Mean
260810020	1	Grand Rapids	Kent	2020	6392	181.5	154.6	10.29
261630001	1	Allen Park	Wayne	2020	8270	206.4	202.1	12.55
261630019	1	Detroit-E 7 Mile	Wayne	2020	7538	132.1	128.0	9.50

O_3 (1-hour) measured in ppm

Site ID	POC	City	County	Year	Num Meas	Num Req	Highest Value	2nd Highest Value	3rd Highest Value	4th Highest Value	Day Max >/= 0.125 Measured	Values >/= 0.125 Estimated	Missed Days < 0.125 Standard
260050003	1	Holland	Allegan	2020	245	245	0.092	0.090	0.083	0.081	0	0	0
260190003	1	Frankfort	Benzie	2020	244	245	0.097	0.080	0.076	0.074	0	0	1
260210014	1	Coloma	Berrien	2020	245	245	0.097	0.087	0.086	0.081	0	0	0
260270003	2	Cassopolis	Cass	2020	236	245	0.080	0.080	0.079	0.079	0	0	2
260370002	2	Rose Lake	Clinton	2020	239	245	0.076	0.073	0.071	0.068	0	0	0
260490021	1	Flint	Genesee	2020	245	245	0.101	0.083	0.075	0.075	0	0	0
260492001	1	Otisville	Genesee	2020	243	245	0.076	0.075	0.074	0.074	0	0	0
260630007	1	Harbor Beach	Huron	2020	245	245	0.107	0.102	0.090	0.083	0	0	0
260650018	1	Lansing	Ingham	2020	239	245	0.071	0.069	0.068	0.068	0	0	0
260770008	1	Kalamazoo	Kalamazoo	2020	245	245	0.078	0.078	0.078	0.076	0	0	0
260810020	1	Grand Rapids	Kent	2020	353	366	0.095	0.083	0.083	0.082	0	0	5
260810022	1	Evans	Kent	2020	245	245	0.084	0.081	0.077	0.076	0	0	0
260910007	1	Tecumseh	Lenawee	2020	245	245	0.082	0.073	0.072	0.072	0	0	0
260990009	1	New Haven	Macomb	2020	245	245	0.089	0.088	0.088	0.086	0	0	0
260991003	1	Warren	Macomb	2020	245	245	0.083	0.083	0.081	0.079	0	0	0
261010922	1	Manistee	Manistee	2020	69	245	0.073	0.069	0.061	0.058	0	0	0
261050007	1	Scottville	Mason	2020	238	245	0.092	0.077	0.076	0.075	0	0	0
261130001	1	Houghton Lake	Missaukee	2020	232	245	0.079	0.074	0.072	0.071	0	0	2

Site ID	POC	City	County	Year	Num Meas	Num Req	Highest Value	2nd Highest Value	3rd Highest Value	4th Highest Value	Day Max >/= 0.125 Measured	Values >/= 0.125 Estimated	Missed Days < 0.125 Standard
261210039	1	Muskegon	Muskegon	2020	243	245	0.098	0.097	0.090	0.085	0	0	2
261250001	2	Oak Park	Oakland	2020	244	245	0.086	0.083	0.081	0.081	0	0	1
261390005	1	Jenison	Ottawa	2020	245	245	0.090	0.090	0.083	0.083	0	0	0
261470005	1	Port Huron	St. Clair	2020	245	245	0.085	0.083	0.081	0.077	0	0	0
261530001	1	Seney	Schoolcraft	2020	244	245	0.082	0.080	0.077	0.072	0	0	1
261610008	1	Ypsilanti	Washtenaw	2020	243	245	0.086	0.082	0.081	0.078	0	0	2
261630001	2	Allen Park	Wayne	2020	342	366	0.106	0.084	0.081	0.080	0	0	2
261630019	2	Detroit-E 7 Mile	Wayne	2020	239	245	0.086	0.083	0.081	0.080	0	0	4

* Indicates site was moved from Lansing (260650012) to Lansing on Filley St (260650018).

O_3 (8-hour) measured in ppm

Site ID	POC	City	County	Year	% OBS	Valid Days Measured	Highest Value	2nd Highest Value	3rd Highest Value	4th Highest Value	Day Max > 0.070
260050003	1	Holland	Allegan	2020	100	245	0.081	0.079	0.078	0.076	6
260190003	1	Frankfort	Benzie	2020	100	245	0.091	0.078	0.069	0.068	2
260210014	1	Coloma	Berrien	2020	100	245	0.085	0.082	0.079	0.078	7
260270003	2	Cassopolis	Cass	2020	95	233	0.077	0.075	0.075	0.075	5
260370002	1	Rose Lake	Clinton	2020	97	238	0.068	0.067	0.065	0.064	0
260490021	1	Flint	Genesee	2020	100	245	0.078	0.069	0.068	0.067	1
260492001	1	Otisville	Genesee	2020	100	244	0.070	0.069	0.068	0.068	0
260630007	1	Harbor Beach	Huron	2020	100	245	0.085	0.083	0.078	0.075	7
260650018	1	Lansing	Ingham	2020	97	238	0.064	0.063	0.062	0.062	0
260770008	1	Kalamazoo	Kalamazoo	2020	100	244	0.075	0.074	0.073	0.072	5
260810020	1	Grand Rapids	Kent	2020	96	353	0.083	0.080	0.079	0.078	6
260810022	1	Evans	Kent	2020	100	244	0.076	0.071	0.070	0.070	2
260910007	1	Tecumseh	Lenawee	2020	100	245	0.077	0.071	0.068	0.067	2
260990009	1	New Haven	Macomb	2020	100	245	0.078	0.076	0.075	0.074	12
260991003	1	Warren	Macomb	2020	100	245	0.077	0.071	0.070	0.070	2
261010922	1	Manistee	Manistee	2020	69	245	0.064	0.061	0.059	0.051	0
261050007	1	Scottville	Mason	2020	96	236	0.089	0.074	0.068	0.068	2
261130001	1	Houghton Lake	Missaukee	2020	93	229	0.072	0.069	0.069	0.068	1
261210039	1	Muskegon	Muskegon	2020	98	241	0.083	0.083	0.083	0.080	6
261250001	2	Oak Park	Oakland	2020	98	241	0.078	0.077	0.076	0.074	6
261390005	1	Jenison	Ottawa	2020	100	244	0.085	0.081	0.077	0.075	6
261470005	1	Port Huron	St. Clair	2020	100	245	0.072	0.070	0.070	0.069	1
261530001	1	Seney	Schoolcraft	2020	99	243	0.080	0.076	0.073	0.067	3
261610008	1	Ypsilanti	Washtenaw	2020	99	243	0.074	0.073	0.072	0.072	5
261630001	2	Allen Park	Wayne	2020	93	339	0.073	0.071	0.070	0.070	2
261630019	2	Detroit-E 7 Mile	Wayne	2020	97	238	0.076	0.075	0.074	0.073	4

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

Site ID	POC	Monitor	City	County	Year	# OBS	Highest Value	2nd Highest Value	3rd Highest Value	4th Highest Value	98%	Wtd. Arith. Mean
260490021	1	FRM	Flint	Genesee	2020	61	22.0	15.6	15.2	13.7	15.6	6.56
260650018	1	FRM	Lansing	Ingham	2020	60	31.8	21.6	16.9	16.5	21.6	7.06
260770008	1	FRM	Kalamazoo	Kalamazoo	2020	111	38.3	27.4	18.0	17.7	18.0	7.70
260770008	2	FRM	Kalamazoo	Kalamazoo	2020	61	26.0	17.4	15.3	14.3	17.4	7.11
260810020	1	FRM	Grand Rapids	Kent	2020	116	47.9	19.3	17.6	16.4	17.6	7.73
260990009	1	FRM	New Haven	Macomb	2020	119	16.7	16.5	15.5	15.1	15.5	6.00
261010922	1	FRM	Manistee	Manistee	2020	88	14.2	13.3	12.7	11.7	13.3	5.11*
261250001	1	FRM	Oak Park	Oakland	2020	112	29.0	25.3	23.3	17.7	23.3	7.42
261390005	1	FRM	Jenison	Ottawa	2020	114	33.2	17.9	17.9	16.8	17.9	7.39
261470005	1	FRM	Port Huron	St. Clair	2020	119	24.5	17.9	16.6	16.2	16.6	6.75
261610008	1	FRM	Ypsilanti	Washtenaw	2020	60	32.8	16.9	15.0	14.4	16.9	7.17
261630001	1	FRM	Allen Park	Wayne	2020	117	41.9	29.4	26.3	18.2	26.3	7.46
261630015	1	FRM	Detroit-SW	Wayne	2020	122	30.3	26.8	19.5	17.6	19.5	8.39
261630019	1	FRM	Detroit-E 7 Mile	Wayne	2020	116	28.4	17.9	17.7	17.0	17.7	7.50
261630033	1	FRM	Dearborn	Wayne	2020	120	37.6	30.4	21.0	21.0	21.0	9.40
261630033	2	FRM	Dearborn	Wayne	2020	57	30.8	21.4	20.9	19.8	21.4	9.08

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

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

Site ID	POC	Monitor	City	County	Year	# OBS	Highest Value	2nd Highest Value	3rd Highest Value	4th Highest Value	98%	Wtd. Arith. Mean
260050003	3	BAM	Holland	Allegan	2020	359	30.4	21.7	15.8	14.7	13.1	5.96
260170014	3	BAM	Bay City	Bay	2020	365	23.1	15.6	14.7	14.3	14.0	4.75
260490021	3	BAM	Flint	Genesee	2020	366	33.3	21.4	19.1	17.4	14.5	6.01
260910007	3	BAM	Tecumseh	Lenawee	2020	366	30.4	30.4	29.0	28.9	18.7	8.19
261130001	3	BAM	Houghton Lake	Missaukee	2020	329	19.3	19.3	16.4	16.2	15.2	8.04*
261530001	3	BAM	Seney	Schoolcraft	2020	282	17.3	15.4	14.5	13.1	10.6	4.56*
261610008	3	BAM	Ypsilanti	Washtenaw	2020	365	67.8	34.2	31.8	27.9	19.8	8.22
261630015	3	BAM/ T640	Detroit-SW**	Wayne	2020	289	38.5	35.6	34.1	30.2	25.9	9.57*
261630093	3	BAM	Eliza Howell-NR	Wayne	2020	356	108.9	45.8	40.7	34.2	23.2	10.59

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

**TIECO BAMs were switched out to T640s in the fall of 2020.

$PM_{2.5}$ Continuous, Non-Regulatory (1-hour) measured in µg/m³

Site ID	POC	Monitor	City	County	Year	# OBS	Highest Value	2nd Highest Value	3rd Highest Value	4th Highest Value	Wtd. Arith. Mean
260650012	3	TEOM	Lansing	Ingham	2020	6106	455.1	384.5	306.5	224.7	7.44
260770008	3	TEOM	Kalamazoo	Kalamazoo	2020	6907	169.0	162.9	144.5	126.9	7.38
260810020	3	TEOM	Grand Rapids	Kent	2020	6513	715.8	249.1	241.9	228.2	7.73
261470005	3	TEOM	Port Huron	St. Clair	2020	7373	122.7	56.6	45.6	44.3	7.22
261630001	3	TEOM	Allen Park	Wayne	2020	6400	216.0	208.0	174.0	144.0	8.34
261630015	3	BAM/T640	Detroit-SW**	Wayne	2020	8345	270.6	227.9	188.8	183.8	12.60
261630033	3	TEOM	Dearborn	Wayne	2020	8284	342.0	217.1	165.7	100.9	9.19
261630097	3	TEOM	NMH 48217	Wayne	2020	8495	450.7	343.8	319.9	88.9	8.33
261630098	3	BAM/T640	DP4th**	Wayne	2020	8735	95.0	93.4	85.4	80.0	9.59
261630099	3	BAM/T640	Trinity**	Wayne	2020	8308	270.6	162.3	120.9	101.3	10.75
261630100	3	BAM/T640	Military Park**	Wayne	2020	7552	220.6	214.5	159.0	120.5	10.76

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

**TIECO BAMs were switched out to T640s in the fall of 2020.

PM10 (24-hour) measured in µg /m3

Site ID	POC	Monitor	City	County	Year	# OBS	# Req.	Valid Days	% OBS	Highest Value	2nd Highest Value	3rd Highest Value	4th Highest Value	Wtd Arith Mean
260810020	1	GRAV	Grand Rapids	Kent	2020	59	61	58	95	28	27	26	24	8.6
261390005	1	GRAV	Jenison	Ottawa	2020	58	61	57	93	22	21	21	21	7.2
261630001	1	GRAV	Allen Park	Wayne	2020	62	61	59	97	34	27	26	23	9.6
261630015	1	GRAV	Detroit-SW	Wayne	2020	58	61	57	93	59	48	47	46	16.3
261630033	1	GRAV	Dearborn	Wayne	2020	60	61	59	97	53	49	48	47	22.9
261630033	9	GRAV	Dearborn	Wayne	2020	29	31	29	94	59	50	47	44	24.2

PM_{10} TEOM (1-hour) measured in µg/m^3

Site ID	POC	Monitor	City	County	Year	# OBS	Highest Value	2nd Highest Value	3rd Highest Value	4th Highest Value	Wtd. Arith. Mean
261630033	3	TEOM	Dearborn	Wayne	2020	8086	57	50	49	44	16.9

$PM_{10-2.5}$ (24-hour) measured in µg/m^3

Site ID	Monitor	City	County	Year	# OBS	Highest Value	2nd Highest Value	3rd Highest Value	4th Highest Value	Wtd. Arith. Mean
260810020	GRAV	Grand Rapids	Kent	2020	107	25.5	22.5	17.5	17.2	6.73
261630001	GRAV	Allen Park	Wayne	2020	102	21.3	20.9	19.9	19.2	7.15

SO_2 measured in ppb

Site ID	POC	City	County	Year	# OBS	1-hr Highest Value	1-hr 2nd Highest Value	99th %ile: 1-hr	24-hr Highest Value	24-hr 2nd Highest Value	OBS >0.5	Arith Mean
260650018	1	Lansing	Ingham	2020	8379	5.5	4.6	4.2	2.1	1.9	0	1.32
260810020	2	Grand Rapids	Kent	2020	8409	11.0	3.0	2.7	1.4	1.2	0	0.49
261150006	1	Sterling State Park	Monroe	2020	8302	8.7	7.0	6.9	2.4	2.3	0	0.59
261390011	1	West Olive	Ottawa	2020	8278	18.6	16.7	15.2	10.5	5.8	0	0.69
261470005	1	Port Huron	St. Clair	2020	8382	106.3	104.3	76.4	26.4	17.1	0	1.88
261630001	1	Allen Park	Wayne	2020	8337	18.2	17.2	14.7	3.1	2.8	0	0.49
261630015	1	Detroit-SW	Wayne	2020	8380	5437	45.3	43.3	27.0	14.6	0	2.34
261630097	1	NMH 48217	Wayne	2020	8251	24.8	21.7	17.0	3.7	3.7	0	0.60
261630098	1	DP4th	Wayne	2020	8353	31.1	28.3	17.0	4.3	4.1	0	1.14
261630099	1	Trinity	Wayne	2020	8258	21.4	18.8	16.1	9.0	6.2	0	0.71
261630100	1	Military Park	Wayne	2020	8199	40.8	36.0	32.5	13.0	12.4	0	1.61

APPENDIX B: 2020 AIR TOXICS MONITORING SUMMARY FOR METALS, VOCS, CARBONYL COMPOUNDS, PAHS, HEXAVALENT CHROMIUM & SPECIATED $PM_{2.5}$

Appendix B provides summary statistics of ambient air concentrations of various substances monitored in Michigan during 2020. At each monitoring site, air samples were taken over a 24-hour period (midnight to midnight). These air 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 concentration. The calculation of the minimum average ("Average (ND=0)") uses 0.0 $\mu g/m^3$ 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., ½ the MDL) is substituted for air concentrations less than the MDL.

Table B shows the monitoring stations and what types of air toxics were monitored at each station in 2020. The following terms and acronyms are used in **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 2020, assuming daily samples below MDL were equal to 0.0 $\mu g/m^3$.
- Average (ND=MDL/2): average air concentration in 2020, assuming daily samples below MDL were equal to one half the MDL.
- MDL: Analytical MDL in units of $\mu g/m^3$
- Max1: Highest daily air concentration during 2020
- Max2: Second highest daily air concentration during 2020
- Max3: Third highest daily air concentration during 2020
- $\mu g/m^3$: Micrograms per cubic meter (1,000,000 μg = 1 g)

Table B: 2019 Toxics Sampling Sites

SITE NAME	VOC	Carbonyl	PAHs	Metals TSP	Metals PM_{10}	Speciated $PM_{2.5}$
Allen Park				x	x	x
Dearborn	x	x	x	x	x	x
Detroit-SW	x	x		x		x
Detroit-W. Jefferson				x		
Grand Rapids				x		x
Belding-Merrick St.				x		
NMH 48217				x		
Port Huron-Rural St.				x		
River Rouge		x		x		
DP4th				x		
Military Park				x		
Trinity				x		

VOC = volatile organic compound; PAHs = polycyclic aromatic hydrocarbon; TSP = total suspended particulate
PM_{10} = particulate matter with aerodynamic diameter less than 10 µm; Mn = manganese.

APPENDIX B-1 DATA TABLES

Dearborn (261630033) 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
1,1,2,2-Tetrachloroethane	58	1	0.00102	0.059	0.118	0.059	0	0
1,1,2-Trichloro-1,2,2-Trifluoroethane	58	58	0.529	0.529	0.0649	0.716	0.614	0.598
1,1,2-Trichloroethane	58	1	9.41E-05	0.0257	0.0523	0.0055	0	0
1,1-Dichloroethane	58	0	0	0.0215	0.0429	0	0	0
1,1-Dichloroethylene	58	0	0	0.0305	0.061	0	0	0
1,2,4-Trichlorobenzene	58	6	0.00371	0.178	0.387	0.0668	0.0468	0.043
1,2,4-Trimethylbenzene	58	58	0.389	0.389	0.0519	2.37	2.34	1.72
1,2-Dichlorobenzene	58	5	0.000611	0.0389	0.084	0.0132	0.0084	0.0078
1,2-Dichloropropane	58	6	0.00163	0.0295	0.0616	0.0185	0.0176	0.0166
1,3,5-Trimethylbenzene	58	58	0.109	0.109	0.0255	0.654	0.551	0.472
1,3-Butadiene	58	58	0.0422	0.0422	0.026	0.158	0.122	0.11
1,3-Dichlorobenzene	58	2	0.000228	0.032	0.0653	0.0078	0.0054	0
1,4-Dichlorobenzene	58	45	0.025	0.0364	0.0782	0.142	0.114	0.092
Acenaphthene (Tsp) Stp	62	53	0.00568	0.0057	0.00017	0.0343	0.0233	0.0201
Acenaphthylene (Tsp) Stp	62	60	0.000728	0.000728	1.12E-05	0.0139	0.0117	0.006
Acetaldehyde	70	70	2.02	2.02	0.0374	5.13	4.75	4.66
Acetone	70	70	3.4	3.4	0.403	16.5	13	12.4
Acetonitrile	58	58	0.497	0.497	0.0745	2.64	1.31	1.27
Acetylene	58	58	0.342	0.342	0.248	1.18	1.1	0.975
Acrolein - Verified	56	0	0			0	0	0
Acrylonitrile	57	5	0.0103	0.0228	0.0279	0.247	0.103	0.102
Anthracene (Tsp) Stp	62	62	0.000429	0.000429	2.85E-05	0.0037	0.003	0.0014
Arsenic (Tsp) Stp	92	91	0.00186	0.00186	4.76E-05	0.0085	0.0061	0.0055
Arsenic Pm10 Lc	93	93	0.00164	0.00164		0.006	0.0052	0.0034

Chemical Name	Num Obs	Obs > MDL	Average (ND=0)	Average (ND=MDL/2)	MDL	Max 1	Max 2	Max 3
Arsenic Pm10 Stp	93	93	0.00166	0.00166	7.41E-05	0.006	0.0053	0.0034
Barium (Tsp) Stp	92	91	0.0241	0.0241	0.00759	0.0892	0.0735	0.0721
Barium Pm10 Lc	93	93	0.0144	0.0144		0.0688	0.0661	0.0332
Barium Pm10 Stp	93	93	0.0146	0.0146	0.00066	0.0679	0.0652	0.0327
Benzaldehyde	70	70	0.407	0.407	0.043	4.6	4.02	3.35
Benzene	58	58	0.678	0.678	0.0324	6.71	1.28	1.13
Benzo[A]Anthracene (Tsp) Stp	62	62	0.000208	0.000208	1.18E-05	0.00232	0.00193	0.0016
Benzo[A]Pyrene (Tsp) Stp	62	62	0.000174	0.000174	1.43E-05	0.0017	0.0014	0.001
Benzo[B]Fluoranthene (Tsp) Stp	60	60	0.000549	0.000549	7.12E-06	0.00564	0.00375	0.0032
Benzo[E]Pyrene (Tsp) Stp	62	62	0.000288	0.000288	5.94E-06	0.00348	0.00162	0.0014
Benzo[G,H,I]Perylene (Tsp) Stp	62	61	0.000224	0.000224	5.71E-06	0.0012	0.00096	0.0009
Benzo[K]Fluoranthene (Tsp) Stp	61	59	0.000146	0.000146	1.26E-05	0.00131	0.00068	0.0006
Beryllium (Tsp) Stp	92	91	8.70E-05	8.70E-05	3.16E-05	0.00038	0.00025	0.0002
Beryllium Pm10 Lc	93	91	2.87E-05	2.93E-05		0.00011	0.00011	0.0001
Beryllium Pm10 Stp	93	93	2.92E-05	2.92E-05	9.69E-06	0.00011	0.00011	0.0001
Bromochloromethane	58	1	0.000228	0.0315	0.0636	0.0132	0	0
Bromodichloromethane	55	0	0	0.0386	0.0771	0	0	0
Bromoform	58	45	0.0116	0.0331	0.196	0.0279	0.0248	0.0217
Bromomethane	58	58	0.0392	0.0392	0.0677	0.205	0.144	0.118
Butyraldehyde	69	69	0.466	0.466	0.0522	1.83	1.81	1.7
Cadmium (Tsp) Stp	92	91	0.000264	0.000264	2.11E-05	0.00183	0.00095	0.0009
Cadmium Pm10 Lc	93	93	0.000194	0.000194		0.00096	0.00094	0.0008
Cadmium Pm10 Stp	93	93	0.000197	0.000197	2.08E-05	0.00098	0.00098	0.0009
Carbon Disulfide	58	58	0.0598	0.0598	0.118	0.299	0.274	0.164
Carbon Tetrachloride	58	58	0.577	0.577	0.103	0.749	0.73	0.723

Chemical Name	Num Obs	Obs > MDL	Average (ND=0)	Average (ND=MDL/2)	MDL	Max 1	Max 2	Max 3
Chlorobenzene	58	52	0.0256	0.0282	0.05	0.423	0.0414	0.0373
Chloroethane	58	46	0.0237	0.0282	0.0438	0.29	0.0995	0.0712
Chloroform	58	58	0.627	0.627	0.0643	1.47	1.39	0.84
Chloromethane	58	58	0.98	0.98	0.0628	1.36	1.32	1.26
Chloroprene	58	0	0	0.0241	0.0483	0	0	0
Chromium (Tsp) Stp	92	91	0.00596	0.00596	0.00167	0.0215	0.0211	0.0203
Chromium Pm10 Lc	93	93	0.00335	0.00335		0.023	0.0216	0.007
Chromium Pm10 Stp	93	93	0.00341	0.00341	0.00225	0.0238	0.0223	0.0073
Chrysene (Tsp) Stp	23	23	0.000759	0.000759	7.69E-06	0.00448	0.00312	0.0027
Cis-1,2-Dichloroethene	58	0	0	0.0275	0.0551	0	0	0
Cis-1,3-Dichloropropene	58	0	0	0.0223	0.0446	0	0	0
Cobalt (Tsp) Stp	92	91	0.00026	0.00026	3.16E-05	0.00056	0.00053	0.0005
Cobalt Pm10 Lc	93	93	0.000158	0.000158		0.00049	0.00046	0.0004
Cobalt Pm10 Stp	93	93	0.00016	0.00016	3.15E-05	0.00051	0.00048	0.0004
Copper (Tsp) Stp	92	91	0.0198	0.0198	0.00168	0.0745	0.0719	0.0695
Copper Pm10 Lc	93	93	0.0205	0.0205		0.148	0.0947	0.0749
Copper Pm10 Stp	93	93	0.0209	0.0209	0.000799	0.151	0.0976	0.0771
Coronene (Tsp) Stp	62	62	0.000104	0.000104	3.68E-06	0.000462	0.000434	0.00043
Crotonaldehyde	42	42	0.278	0.278	0.00851	1.13	0.927	0.911
Dibenzo[A,H]Anthracene (Tsp) Stp	62	38	4.13E-05	4.40E-05	1.38E-05	0.000441	0.000365	0.00027
Dibromochloromethane	58	11	0.00109	0.0579	0.14	0.0111	0.00937	0.00767
Dichlorodifluoromethane	58	58	2.12	2.12	0.0827	2.55	2.54	2.51
Dichloromethane	58	58	2.71	2.71	0.0787	11	8.89	8.27
Ethyl Acrylate	58	0	0	0.0258	0.0516	0	0	0
Ethylbenzene	58	58	0.205	0.205	0.0468	1.11	0.521	0.512
Ethylene Dibromide	58	0	0	0.0517	0.103	0	0	0
Ethylene Dichloride	58	57	0.0725	0.0729	0.0418	0.118	0.117	0.106

Chemical Name	Num Obs	Obs > MDL	Average (ND=0)	Average (ND=MDL/2)	MDL	Max 1	Max 2	Max 3
Ethylene Oxide	57	50	0.223	0.232	0.147	1.05	0.726	0.602
Fluoranthene (Tsp) Stp	62	62	0.00368	0.00368	4.20E-05	0.0183	0.0145	0.0136
Fluorene (Tsp) Stp	62	62	0.00537	0.00537	8.45E-05	0.0274	0.0212	0.0198
Formaldehyde	70	70	3.26	3.26	0.0524	9.15	8.85	8.82
Freon 114	58	58	0.103	0.103	0.101	0.132	0.122	0.121
Hexachlorobutadiene	58	4	0.000736	0.0767	0.167	0.0256	0.00746	0.00533
Hexanaldehyde	67	67	0.2	0.2	0.0109	1.69	1.59	1.28
Indeno[1,2,3-Cd]Pyrene (Tsp) Stp	62	62	0.000231	0.000231	1.15E-05	0.00132	0.00122	0.00104
Iron (Tsp) Stp	92	91	1.27	1.27	0.027	5.7	4.88	3
Iron Pm10 Lc	93	93	0.696	0.696		2.22	1.94	1.8
Iron Pm10 Stp	93	93	0.706	0.706	0.0109	2.32	1.91	1.81
Lead (Tsp) Lc Frm/Fem	92	92	0.0128	0.0128		0.0978	0.0939	0.0516
Lead Pm10 Lc	93	93	0.0108	0.0108		0.11	0.102	0.0539
M/P Xylene	58	58	0.618	0.618	0.0559	3.6	1.78	1.68
Manganese (Tsp) Stp	92	91	0.0774	0.0774	0.000926	0.407	0.324	0.24
Manganese Pm10 Lc	93	93	0.0346	0.0346		0.149	0.126	0.118
Manganese Pm10 Stp	93	93	0.0351	0.0351	0.00037	0.156	0.127	0.119
Methyl Chloroform	58	47	0.0134	0.0208	0.0782	0.0338	0.0284	0.024
Methyl Ethyl Ketone	61	61	0.372	0.372	0.0853	0.746	0.687	0.675
Methyl Isobutyl Ketone	53	52	0.207	0.207	0.0614	0.635	0.586	0.5
Methyl Methacrylate	58	10	0.00439	0.0964	0.228	0.0446	0.0377	0.0373
Methyl Tert-Butyl Ether	58	6	0.00117	0.0217	0.0457	0.0209	0.0126	0.0101
Molybdenum (Tsp) Stp	92	91	0.00413	0.00413	0.000164	0.136	0.128	0.00889
Molybdenum Pm10 Lc	93	93	0.00379	0.00379		0.131	0.122	0.00817
Molybdenum Pm10 Stp	93	93	0.0039	0.0039	0.000293	0.135	0.126	0.0085
Ethylene Oxide	57	50	0.223	0.232	0.147	1.05	0.726	0.602
Naphthalene (Tsp) Stp	62	62	0.0577	0.0577	0.00176	0.152	0.143	0.137

Chemical Name	Num Obs	Obs > MDL	Average (ND=0)	Average (ND=MDL/2)	MDL	Max 1	Max 2	Max 3
Nickel (Tsp) Stp	92	91	0.00272	0.00272	0.000894	0.0268	0.0259	0.00688
Nickel Pm10 Lc	93	93	0.00215	0.00215		0.0298	0.0278	0.00718
Nickel Pm10 Stp	93	93	0.00219	0.00219	0.00144	0.0308	0.0288	0.00713
N-Octane	58	58	0.105	0.105	0.104	0.432	0.265	0.258
O-Xylene	58	58	0.234	0.234	0.069	0.947	0.76	0.677
Perylene (Tsp) Stp	62	38	2.31E-05	2.61E-05	1.56E-05	0.000216	0.000191	0.00015
Phenanthrene (Tsp) Stp	62	62	0.0109	0.0109	0.000176	0.0526	0.0431	0.0391
Propionaldehyde	70	70	0.419	0.419	0.101	1.41	1.35	1.04
Propylene	58	58	0.415	0.415	0.221	1.76	1.6	1.06
Pyrene (Tsp) Stp	62	62	0.00191	0.00191	3.86E-05	0.00861	0.00749	0.00613
Styrene	58	57	0.372	0.373	0.0756	1.98	1.18	1.02
Tert-Amyl Methyl Ether	58	0	0	0.0227	0.0453	0	0	0
Tert-Butyl Ethyl Ether	58	0	0	0.0179	0.0358	0	0	0
Tetrachloroethylene	58	58	0.664	0.664	0.0864	8.55	6.92	2.64
Toluene	58	58	1.01	1.01	0.0698	4.22	3.16	2.8
Trans-1,2-Dichloroethylene	58	15	0.0025	0.0208	0.0493	0.0174	0.0155	0.0139
Trans-1,3-Dichloropropene	58	1	0.000517	0.0333	0.0667	0.03	0	0
Trichloroethylene	58	51	0.0383	0.0414	0.0514	0.155	0.0811	0.0758
Trichlorofluoromethane	58	58	1.19	1.19	0.0728	1.48	1.47	1.47
Valeraldehyde	70	70	0.149	0.149	0.0041	0.768	0.756	0.653
Vanadium (Tsp) Stp	92	91	0.00322	0.00322	6.30E-05	0.0228	0.0226	0.0105
Vanadium Pm10 Lc	93	93	0.00184	0.00184		0.0192	0.0184	0.00349
Vanadium Pm10 Stp	93	93	0.00187	0.00187	4.58E-05	0.0198	0.019	0.00365
Vinyl Chloride	58	5	0.00078	0.0181	0.0371	0.0245	0.0128	0.00332
Zinc (Tsp) Stp	92	91	0.114	0.114	0.00535	1.07	1.04	0.452
Zinc Pm10 Lc	93	93	0.0856	0.0856		1.02	0.883	0.485
Zinc Pm10 Stp	93	93	0.0877	0.0877	0.00226	1.07	0.923	0.488

Detroit-SW (W. Fort St., N. Delray-SWHS) (261630015) 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
1,1,2,2-Tetrachloroethane	28	0	0	0.162	0.323	0	0	0
1,1,2-Trichloroethane	28	0	0	0.0491	0.0981	0	0	0
1,1-Dichloroethane	28	0	0	0.0852	0.17	0	0	0
1,1-Dichloroethylene	28	0	0	0.0784	0.157	0	0	0
1,2,4-Trichlorobenzene	28	0	0	0.698	1.4	0	0	0
1,2,4-Trimethylbenzene	28	1	0.0218	0.171	0.309	0.61	0	0
1,2-Dichlorobenzene	28	0	0	0.185	0.37	0	0	0
1,2-Dichloropropane	28	0	0	0.55	1.1	0	0	0
1,3,5-Trimethylbenzene	28	0	0	0.12	0.24	0	0	0
1,3-Butadiene	28	0	0	0.06	0.12	0	0	0
1,3-Dichlorobenzene	28	0	0	0.143	0.286	0	0	0
1,4-Dichlorobenzene	28	0	0	0.194	0.388	0	0	0
2,2,4-Trimethylpentane	28	1	0.0186	0.0905	0.149	0.52	0	0
Acetaldehyde	30	30	2.72	2.72		4.27	4.26	4.18
Acetone	30	30	2.44	2.44		4.48	3.55	3.51
Acetonitrile	28	21	0.702	0.765	0.503	1.5	1.4	1.2
Acrolein - Unverified	30	28	0.0714	0.0765		0.134	0.114	0.108
Acrylonitrile	28	0	0	0.399	0.798	0	0	0
Arsenic (Tsp) Stp	61	61	0.00172	0.00172	4.54E-05	0.00582	0.00426	0.00322
Benzaldehyde	30	30	0.203	0.203		0.386	0.373	0.359
Benzene	28	25	0.596	0.601	0.0957	1.6	0.94	0.94
Bromodichloromethane	28	0	0	0.075	0.15	0	0	0
Bromoform	28	0	0	0.175	0.35	0	0	0

Chemical Name	Num Obs	Obs > MDL	Average (ND=0)	Average (ND=MDL/2)	MDL	Max 1	Max 2	Max 3
Bromomethane	28	0	0	0.11	0.22	0	0	0
Cadmium (Tsp) Stp	61	61	0.000151	0.000151	2.02E-05	0.00035	0.00034	0.00031
Carbon Tetrachloride	28	0	0	0.115	0.23	0	0	0
Chlorobenzene	28	0	0	0.105	0.209	0	0	0
Chloroethane	28	0	0	0.06	0.12	0	0	0
Chloroform	28	1	0.0204	0.0789	0.121	0.57	0	0
Chloromethane	28	28	1.29	1.29	0.159	1.6	1.5	1.5
Cis-1,2-Dichloroethene	28	0	0	0.0641	0.128	0	0	0
Cis-1,3-Dichloropropene	28	0	0	0.0679	0.136	0	0	0
Crotonaldehyde	30	0	0			0	0	0
Dibromochloromethane	28	0	0	0.148	0.296	0	0	0
Dibromochloromethane	28	0	0	0.148	0.296	0	0	0
Dichlorodifluoromethane	28	27	2.18	2.19	0.25	2.5	2.5	2.5
Dichloromethane	28	11	0.159	0.266	0.349	0.55	0.47	0.43
Ethylbenzene	28	0	0	0.147	0.293	0	0	0
Ethylene Dibromide	28	0	0	0.15	0.3	0	0	0
Ethylene Dichloride	28	0	0	0.0984	0.197	0	0	0
Formaldehyde	30	30	2.27	2.27		5.66	4.43	4.11
Hexanaldehyde	30	30	0.165	0.165		0.352	0.339	0.335
Lead (Tsp) Lc Frm/Fem	61	61	0.00784	0.00784		0.0216	0.0206	0.0205
M/P Xylene	28	6	0.201	0.492	0.739	1.3	1	0.93
Manganese (Tsp) Stp	61	61	0.0501	0.0501	0.000883	0.246	0.177	0.155
Methacrolein	30	30	0.124	0.124		0.442	0.231	0.203
Methyl Chloroform	28	0	0	0.105	0.211	0	0	0
Methyl Ethyl Ketone	28	7	0.386	0.798	1.1	2.5	1.9	1.6

Chemical Name	Num Obs	Obs > MDL	Average (ND=0)	Average (ND=MDL/2)	MDL	Max 1	Max 2	Max 3
Methyl Isobutyl Ketone	28	0	0	0.434	0.868	0	0	0
Methyl Tert-Butyl Ether	28	0	0	0.095	0.19	0	0	0
N-Hexane	28	17	0.758	0.775	0.0872	4.5	2.5	2.5
Nickel (Tsp) Stp	61	61	0.00204	0.00204	0.000852	0.00495	0.00479	0.00468
O-Xylene	28	1	0.0179	0.178	0.332	0.5	0	0
Pm10 Total 0-10um Stp	58	40	16.9	24.5		59	48	47
Propionaldehyde	30	30	0.353	0.353		0.61	0.606	0.576
Styrene	28	3	0.0939	0.439	0.773	0.89	0.88	0.86
Tetrachloroethylene	28	0	0	0.117	0.235	0	0	0
Tolualdehydes	30	18	0.048	0.0801		0.115	0.107	0.105
Toluene	28	25	0.764	0.787	0.445	2.4	1.6	1.4
Trans-1,2-Dichloroethylene	28	0	0	0.075	0.15	0	0	0
Trans-1,3-Dichloropropene	28	0	0	0.0452	0.0905	0	0	0
Trichloroethylene	28	0	0	0.0848	0.17	0	0	0
Trichlorofluoromethane	28	28	1.29	1.29	0.232	1.4	1.4	1.4
Valeraldehyde	30	30	0.223	0.223		0.42	0.39	0.359
Vinyl Chloride	28	0	0	0.065	0.13	0	0	0

Detroit-W. Jefferson, South Delray (261630027) 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
Arsenic (Tsp) Stp	61	61	0.00196	0.00196	4.64E-05	0.00885	0.00454	0.00451
Cadmium (Tsp) Stp	61	61	0.000242	0.000242	2.00E-05	0.00141	0.00073	0.00063
Lead (Tsp) Lc Frm/Fem	61	61	0.0106	0.0106		0.0867	0.0318	0.0225
Manganese (Tsp) Stp	61	61	0.162	0.162	0.000893	0.896	0.584	0.527
Nickel (Tsp) Stp	61	61	0.00236	0.00236	0.000862	0.00848	0.00834	0.00797

Port Huron-Rural St. (261470031), 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
Arsenic (Tsp) Stp	92	92	0.0014	0.0014	4.53E-05	0.00796	0.00607	0.00554
Cadmium (Tsp) Stp	92	92	0.000229	0.000229	2.00E-05	0.00141	0.00114	0.00113
Lead (Tsp) Lc Frm/Fem	92	92	0.0203	0.0203		0.146	0.122	0.120
Manganese (Tsp) Stp	92	92	0.00952	0.00952	0.000882	0.0313	0.0285	0.0276
Nickel (Tsp) Stp	92	92	0.000776	0.000776	0.00085	0.00224	0.00188	0.00187

River Rouge (261630005) 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
Acetaldehyde	31	31	2.58	2.58		6.58	4.61	3.71
Acetone	31	31	2.67	2.67		6.3	4.5	4.34
Acrolein - Unverified	31	30	0.0934	0.0965		0.252	0.196	0.179
Arsenic (Tsp) Stp	61	61	0.00163	0.00163	4.54E-05	0.00851	0.00517	0.00479
Benzaldehyde	31	30	0.175	0.181		0.661	0.318	0.308
Cadmium (Tsp) Stp	61	61	0.000191	0.000191	2.00E-05	0.00049	0.00042	0.00039
Crotonaldehyde	31	0	0			0	0	0
Formaldehyde	31	31	3.37	3.37		7.6	6.65	6.33
Hexanaldehyde	31	31	0.17	0.17		0.515	0.507	0.35

Chemical Name	Num Obs	Obs > MDL	Average (ND=0)	Average (ND=MDL/2)	MDL	Max 1	Max 2	Max 3
Lead (Tsp) Lc Frm/Fem	61	61	0.00592	0.00592		0.014995	0.013	0.0129
Manganese (Tsp) Stp	61	61	0.0318	0.0318	0.000877	0.0873	0.0871	0.0719
Methacrolein	31	31	0.154	0.154		0.444	0.437	0.337
Nickel (Tsp) Stp	61	61	0.00117	0.00117	0.000846	0.00484	0.00312	0.00237
Propionaldehyde	31	31	0.354	0.354		0.734	0.664	0.62
Tolualdehydes	31	20	0.0766	0.119		0.279	0.258	0.209
Valeraldehyde	31	30	0.174	0.18		0.419	0.364	0.355

Belding-Merrick St. (260670003) Concentrations in micrograms per cubic meter (µg/m^3)

Chemical Name	Num Obs	Obs > MDL	Average (ND=0)	Average (ND=MDL/2)	MDL	Max 1	Max 2	Max 3
Arsenic (Tsp) Stp	60	60	0.00159	0.00159	4.62E-05	0.0242	0.00412	0.00396
Cadmium (Tsp) Stp	60	60	9.05E-05	9.05E-05	2.00E-05	0.00071	0.00038	0.00016
Lead (Tsp) Lc Frm/Fem	60	60	0.00396	0.00396		0.0284	0.00929	0.00882
Manganese (Tsp) Stp	60	60	0.0084	0.0084	0.000886	0.0242	0.0227	0.02
Nickel (Tsp) Stp	60	60	0.000605	0.000605	0.000854	0.00152	0.00116	0.00113

NMH 48217 (261630097) Concentrations in micrograms per cubic meter (µg/m^3)

Chemical Name	Num Obs	Obs > MDL	Average (ND=0)	Average (ND=MDL/2)	MDL	Max 1	Max 2	Max 3
Arsenic (Tsp) Stp	61	61	0.00151	0.00151	4.46E-05	0.00867	0.00537	0.00529
Cadmium (Tsp) Stp	61	61	0.000133	0.000133	2.00E-05	0.00041	0.00031	0.00031
Lead (Tsp) Lc Frm/Fem	61	61	0.00509	0.00509		0.0207	0.0179	0.0135
Manganese (Tsp) Stp	61	61	0.0196	0.0196	0.000866	0.0611	0.0445	0.0415
Nickel (Tsp) Stp	61	61	0.00103	0.00103	0.000836	0.00271	0.00237	0.00205

DP4th (261630098) Concentrations in micrograms per cubic meter (µg/m^3)

Chemical Name	Num Obs	Obs > MDL	Average (ND=0)	Average (ND=MDL/2)	MDL	Max 1	Max 2	Max 3
Arsenic (Tsp) Stp	61	61	0.00141	0.00141	4.51E-05	0.00531	0.00304	0.00278

Cadmium (Tsp) Stp	61	61	0.000145	0.000145	2.00E-05	0.00037	0.00034	0.00032
Lead (Tsp) Lc Frm/Fem	61	61	0.00978	0.00978		0.104	0.0525	0.029
Manganese (Tsp) Stp	61	61	0.0435	0.0435	0.000881	0.162	0.102	0.101
Nickel (Tsp) Stp	61	61	0.00193	0.00193	0.000849	0.00527	0.00433	0.00398

Military Park (261630100) 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
Arsenic (Tsp) Stp	61	61	0.0019	0.0019	0.0000452	0.00828	0.00764	0.00587
Cadmium (Tsp) Stp	61	61	0.00021	0.00021	0.00002	0.00073	0.00055	0.00046
Lead (Tsp) Lc Frm/Fem	61	61	0.0156	0.0156		0.0962	0.0796	0.0687
Manganese (Tsp) Stp	61	61	0.0442	0.0442	0.000875	0.153	0.126	0.108
Nickel (Tsp) Stp	61	61	0.0016	0.0016	0.000843	0.00584	0.00344	0.00313

Trinity (261630099) 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
Arsenic (Tsp) Stp	61	61	0.00194	0.00194	4.43E-05	0.00768	0.00575	0.00486
Cadmium (Tsp) Stp	61	61	0.000222	0.000222	2.00E-05	0.00104	0.00053	0.00047
Lead (Tsp) Lc Frm/Fem	61	61	0.0109	0.0109		0.0541	0.0301	0.0276
Manganese (Tsp) Stp	61	61	0.0655	0.0655	0.00087	0.177	0.164	0.14
Nickel (Tsp) Stp	61	61	0.00291	0.00291	0.000839	0.00985	0.00799	0.00717

APPENDIX B-2 Data Tables

Allen Park (261630001), 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
Aluminum Pm2.5 Lc	118	87	0.026	0.026	0.0229	0.533	0.135	0.112
Ammonium Ion Pm2.5 Lc	119	119	0.52	0.52	0.0129	3.73	3	2.18
Antimony Pm2.5 Lc	118	68	0.00529	0.00529	0.016	0.0313	0.0248	0.0241
Arsenic Pm2.5 Lc	118	37	2.52E-05	3.07E-05	0.0001	0.00028	0.00027	0.00026
Barium Pm2.5 Lc	118	73	0.0147	0.0148	0.0283	0.47	0.0795	0.0505
Bromine Pm2.5 Lc	118	38	0.000544	0.000589	0.000136	0.00708	0.00637	0.00555
Cadmium Pm2.5 Lc	118	68	0.00401	0.00407	0.0137	0.0274	0.0235	0.0198
Calcium Pm2.5 Lc	118	118	0.0616	0.0616	0.00981	0.377	0.301	0.299
Cerium Pm2.5 Lc	118	55	0.00766	0.00766	0.0361	0.0499	0.0463	0.0462
Cesium Pm2.5 Lc	118	58	0.00703	0.00703	0.0271	0.047	0.0396	0.0388
Chlorine Pm2.5 Lc	119	118	0.108	0.108	0.0251	2.53	0.652	0.635
Chromium Pm2.5 Lc	118	100	0.0232	0.0232	0.00394	1.96	0.0584	0.0442
Cobalt Pm2.5 Lc	118	90	0.00218	0.00218	0.00228	0.0164	0.0147	0.0106
Copper Pm2.5 Lc	118	32	0.000253	0.000253	0.00157	0.0033	0.00319	0.00186
Ec Csn_Rev Unadjusted Pm2.5 Lc Tot	118	97	0.00767	0.00767	0.00421	0.283	0.0257	0.0256
Indium Pm2.5 Lc	121	121	0.416	0.416	0.00032	2.25	1.58	1.17
Iron Pm2.5 Lc	118	71	0.00504	0.00504	0.0147	0.0296	0.0268	0.0268
Lead Pm2.5 Lc	118	118	0.0704	0.0704	0.00845	0.229	0.221	0.218
Magnesium Pm2.5 Lc	118	90	0.00407	0.00407	0.00659	0.0164	0.0162	0.0146
Manganese Pm2.5 Lc	118	62	0.0225	0.0265	0.045	0.81	0.106	0.101
Nickel Pm2.5 Lc	118	91	0.00254	0.00254	0.00296	0.0136	0.00949	0.00918
Oc Csn_Rev Unadjusted Pm2.5 Lc Tot	118	92	0.000894	0.000894	0.00122	0.00539	0.0042	0.00402

Chemical Name	Num Obs	Obs > MDL	Average (ND=0)	Average (ND= MDL/2)	MDL	Max 1	Max 2	Max 3
Phosphorus Pm2.5 Lc	121	121	1.99	1.99	0.643	10.7	5.1	4.3
Potassium Ion Pm2.5 Lc	118	101	0.000149	0.000261	0.00196	0.00439	0.00306	0.00217
Potassium Pm2.5 Lc	119	118	0.109	0.109	0.0129	8.82	0.307	0.287
Rubidium Pm2.5 Lc	118	118	0.129	0.129	0.00539	8.59	0.404	0.332
Selenium Pm2.5 Lc	118	61	0.000944	0.000956	0.00315	0.00502	0.00499	0.00491
Silicon Pm2.5 Lc	118	75	0.00126	0.00126	0.00244	0.012	0.00633	0.00502
Silver Pm2.5 Lc	118	116	0.0582	0.0582	0.0136	0.301	0.252	0.248
Sodium Ion Pm2.5 Lc	119	119	0.035	0.035	0.014	0.466	0.406	0.221
Sodium Pm2.5 Lc	118	85	0.0355	0.0355	0.0801	0.223	0.158	0.134
Strontium Pm2.5 Lc	118	79	0.00307	0.0031	0.00292	0.205	0.0111	0.00886
Sulfate Pm2.5 Lc	119	118	1.01	1.01	0.0294	8.11	4.75	2.31
Sulfur Pm2.5 Lc	118	117	0.357	0.357	0.00104	2.5	1.65	0.908
Tin Pm2.5 Lc	118	69	0.00542	0.00542	0.0155	0.023	0.0222	0.022
Titanium Pm2.5 Lc	118	106	0.00337	0.00337	0.00291	0.0453	0.00961	0.00933
Total Nitrate Pm2.5 Lc	119	118	1.53	1.53	0.0383	11.7	9.05	6.89
Vanadium Pm2.5 Lc	118	43	0.000244	0.00048	0.000708	0.00273	0.00228	0.00212
Zinc Pm2.5 Lc	118	118	0.0138	0.0138	0.00172	0.0894	0.0473	0.0391
Zirconium Pm2.5 Lc	118	65	0.00436	0.00436	0.014	0.0306	0.0259	0.0231

Dearborn (261630033), Speciated $PM_{2.5}$ ($\mu g/m^3$)

Chemical Name	Num Obs	Obs > MDL	Average (ND=0)	Average (ND=MDL/2)	MDL	Max 1	Max 2	Max 3
Aluminum Pm2.5 Lc	60	40	0.0218	0.0218	0.0228	0.122	0.0904	0.0856
Ammonium Ion Pm2.5 Lc	60	60	0.53	0.53	0.0129	3.56	2.32	2.28
Antimony Pm2.5 Lc	60	28	0.00281	0.00281	0.016	0.0256	0.0192	0.0107
Arsenic Pm2.5 Lc	60	16	7.57E-05	8.15E-05	0.0001	0.00337	0.00033	0.00028
Barium Pm2.5 Lc	60	30	0.00856	0.00856	0.0283	0.0441	0.0382	0.0356
Bromine Pm2.5 Lc	60	20	0.000705	0.000752	0.000135	0.00614	0.00587	0.00444
Cadmium Pm2.5 Lc	60	27	0.00352	0.00352	0.0138	0.0218	0.0212	0.0149
Calcium Pm2.5 Lc	60	60	0.0936	0.0936	0.00978	0.369	0.355	0.286
Cerium Pm2.5 Lc	60	37	0.0118	0.0118	0.0363	0.0475	0.044	0.0433
Cesium Pm2.5 Lc	60	33	0.00668	0.00668	0.027	0.0376	0.0331	0.0264
Chlorine Pm2.5 Lc	60	60	0.179	0.179	0.0251	2.56	0.523	0.49
Chromium Pm2.5 Lc	60	54	0.0261	0.0261	0.00393	0.204	0.163	0.131
Cobalt Pm2.5 Lc	59	48	0.00483	0.00483	0.00228	0.122	0.0268	0.0183
Copper Pm2.5 Lc	59	22	0.000411	0.000411	0.00159	0.00422	0.00255	0.00217
Ec Csn_Rev Unadjusted Pm2.5 Lc Tot	59	58	0.0135	0.0135	0.00424	0.0838	0.0492	0.0479
Indium Pm2.5 Lc	61	60	0.55	0.55	0.00032	1.72	1.5	1.37
Iron Pm2.5 Lc	60	33	0.00415	0.00415	0.0148	0.0267	0.0207	0.017
Lead Pm2.5 Lc	59	58	0.285	0.285	0.00843	3.29	1.75	0.781
Magnesium Pm2.5 Lc	60	51	0.00777	0.00777	0.0066	0.116	0.0439	0.0159
Manganese Pm2.5 Lc	60	50	0.00576	0.00576	0.00297	0.0233	0.0222	0.0181
Nickel Pm2.5 Lc	59	47	0.00238	0.00238	0.00122	0.0587	0.00641	0.0059
Oc Csn_Rev Unadjusted Pm2.5 Lc Tot	61	61	2.32	2.32	0.643	4.87	4.59	4.17
Phosphorus Pm2.5 Lc	60	54	0.00049	0.000556	0.00196	0.00649	0.00473	0.00431
Potassium Ion Pm2.5 Lc	60	58	0.0445	0.0445	0.0129	0.221	0.18	0.174
Potassium Pm2.5 Lc	60	60	0.0611	0.0611	0.00544	0.207	0.194	0.192

Chemical Name	Num Obs	Obs > MDL	Average (ND=0)	Average (ND=MDL/2)	MDL	Max 1	Max 2	Max 3
Rubidium Pm2.5 Lc	60	25	0.00065	0.000699	0.00316	0.00385	0.00373	0.00356
Selenium Pm2.5 Lc	60	41	0.00124	0.00124	0.00243	0.0116	0.00523	0.00522
Silicon Pm2.5 Lc	60	59	0.0616	0.0616	0.0138	0.234	0.226	0.172
Silver Pm2.5 Lc	60	30	0.00463	0.00463	0.0129	0.0238	0.0214	0.0213
Sodium Ion Pm2.5 Lc	60	60	0.0492	0.0492	0.0141	0.25	0.218	0.168
Sodium Pm2.5 Lc	60	45	0.0618	0.0626	0.0805	0.488	0.223	0.173
Strontium Pm2.5 Lc	60	39	0.00105	0.00105	0.00291	0.00358	0.00358	0.00349
Sulfate Pm2.5 Lc	60	60	1.08	1.08	0.0294	2.94	2.22	2.19
Sulfur Pm2.5 Lc	60	59	0.37	0.37	0.00105	1.1	0.855	0.785
Tin Pm2.5 Lc	60	28	0.00488	0.00488	0.0155	0.0501	0.0253	0.0199
Titanium Pm2.5 Lc	60	49	0.00269	0.0027	0.00292	0.0112	0.00743	0.00734
Total Nitrate Pm2.5 Lc	60	59	1.43	1.43	0.0386	11.8	7.03	6.78
Vanadium Pm2.5 Lc	60	26	0.000628	0.000826	0.000713	0.0178	0.00211	0.00204
Zinc Pm2.5 Lc	60	59	0.0506	0.0506	0.00172	0.654	0.271	0.268
Zirconium Pm2.5 Lc	60	28	0.00352	0.00352	0.0139	0.0213	0.0181	0.0139

Detroit-SW, (W Fort St., N. Delray-SWHS) (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
Aluminum Pm2.5 Lc	59	47	0.0402	0.0402	0.023	0.254	0.24	0.141
Ammonium Ion Pm2.5 Lc	59	59	0.552	0.552	0.0129	4.2	2.32	2.31
Antimony Pm2.5 Lc	59	38	0.0068	0.0068	0.0159	0.0329	0.0325	0.0323
Arsenic Pm2.5 Lc	59	18	1.42E-05	1.76E-05	0.0001	0.00022	0.00007	0.00006
Barium Pm2.5 Lc	59	38	0.0108	0.0108	0.0284	0.0572	0.0477	0.0373
Bromine Pm2.5 Lc	59	28	0.000913	0.000957	0.000136	0.00513	0.00448	0.00418
Cadmium Pm2.5 Lc	59	32	0.00382	0.00382	0.0137	0.0215	0.0187	0.0177
Calcium Pm2.5 Lc	59	59	0.204	0.204	0.00984	1.87	1.55	1.35
Cerium Pm2.5 Lc	59	32	0.00873	0.00873	0.0362	0.0527	0.0333	0.0321
Cesium Pm2.5 Lc	59	31	0.00816	0.00816	0.0271	0.0596	0.0355	0.032
Chloride Pm2.5 Lc	59	59	0.198	0.198	0.0254	1.48	1.04	0.928
Chlorine Pm2.5 Lc	59	54	0.0285	0.0285	0.00391	0.561	0.157	0.136
Chromium Pm2.5 Lc	59	42	0.00171	0.00173	0.00229	0.0139	0.00851	0.0078
Cobalt Pm2.5 Lc	59	18	0.000167	0.000178	0.00158	0.00136	0.00116	0.00113
Copper Pm2.5 Lc	59	59	0.0123	0.0123	0.00423	0.0658	0.0288	0.0277
Ec Csn_Rev Unadjusted Pm2.5 Lc Tot	58	58	0.526	0.526	0.00032	1.19	1.12	1.11
Indium Pm2.5 Lc	59	35	0.00463	0.00463	0.0148	0.0229	0.0163	0.0162
Iron Pm2.5 Lc	59	59	0.133	0.133	0.00846	0.627	0.535	0.411
Lead Pm2.5 Lc	59	49	0.00558	0.00558	0.0066	0.0255	0.0214	0.0203
Magnesium Pm2.5 Lc	59	37	0.0266	0.0295	0.045	0.223	0.223	0.12
Manganese Pm2.5 Lc	59	49	0.00476	0.00476	0.00298	0.0249	0.0245	0.0204
Nickel Pm2.5 Lc	59	44	0.000964	0.000964	0.00122	0.00654	0.00385	0.00286
Oc Csn_Rev Unadjusted Pm2.5 Lc Tot	58	58	2.26	2.26	0.644	4.92	4.38	4.32
Phosphorus Pm2.5 Lc	59	54	0.000357	0.000409	0.00196	0.00577	0.00375	0.00206

Chemical Name	Num Obs	Obs > MDL	Average (ND=0)	Average (ND=MDL/2)	MDL	Max 1	Max 2	Max 3
Potassium Ion Pm2.5 Lc	59	59	0.0374	0.0374	0.0129	0.214	0.168	0.135
Potassium Pm2.5 Lc	59	59	0.0658	0.0658	0.00541	0.379	0.19	0.189
Rubidium Pm2.5 Lc	59	29	0.000877	0.000877	0.00316	0.00558	0.00504	0.00461
Selenium Pm2.5 Lc	59	39	0.00114	0.00114	0.00244	0.00553	0.00482	0.00453
Silicon Pm2.5 Lc	59	59	0.129	0.129	0.0136	0.92	0.916	0.522
Silver Pm2.5 Lc	59	29	0.00362	0.00362	0.0128	0.0216	0.0159	0.0146
Sodium Ion Pm2.5 Lc	59	59	0.0279	0.0279	0.0141	0.125	0.0839	0.0709
Sodium Pm2.5 Lc	59	42	0.0426	0.0426	0.0803	0.42	0.171	0.163
Strontium Pm2.5 Lc	59	37	0.00191	0.00191	0.00292	0.0109	0.00845	0.00778
Sulfate Pm2.5 Lc	59	59	1.11	1.11	0.0294	2.91	2.43	2.29
Sulfur Pm2.5 Lc	59	59	0.401	0.401	0.00105	1.01	0.988	0.925
Tin Pm2.5 Lc	59	35	0.00486	0.00486	0.0156	0.0311	0.0199	0.0192
Titanium Pm2.5 Lc	59	47	0.00399	0.00399	0.00292	0.0258	0.0209	0.0117
Total Nitrate Pm2.5 Lc	59	59	1.37	1.37	0.0385	11.6	6.67	6.18
Vanadium Pm2.5 Lc	59	29	0.000383	0.000573	0.000718	0.00234	0.00177	0.00151
Zinc Pm2.5 Lc	59	59	0.0201	0.0201	0.00172	0.0995	0.0646	0.0638
Zirconium Pm2.5 Lc	59	30	0.00324	0.00324	0.014	0.0172	0.0142	0.0141

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
Aluminum Pm2.5 Lc	121	66	0.0146	0.0146	0.0322	0.146	0.142	0.134
Ammonium Ion Pm2.5 Lc	121	120	0.686	0.686	0.00692	4.44	4.23	3.56
Antimony Pm2.5 Lc	121	69	0.00517	0.00517	0.0388	0.0333	0.0289	0.0256
Arsenic Pm2.5 Lc	121	56	0.0000193	0.000165	0.00186	0.00011	0.00011	0.00011
Barium Pm2.5 Lc	121	71	0.0111	0.0111	0.0801	0.132	0.0759	0.0643
Bromine Pm2.5 Lc	121	27	0.000379	0.00215	0.00454	0.00651	0.00518	0.00514
Cadmium Pm2.5 Lc	121	70	0.00465	0.00465	0.0158	0.0248	0.0246	0.0242
Calcium Pm2.5 Lc	121	121	0.0298	0.0298	0.00885	0.162	0.0926	0.0876
Cerium Pm2.5 Lc	121	61	0.0119	0.0119	0.0954	0.0644	0.0593	0.0583
Cesium Pm2.5 Lc	114	65	0.00807	0.00807	0.0271	0.053	0.0373	0.0369
Chloride Pm2.5 Lc	113	113	0.116	0.116	0.0249	4.3	0.279	0.267
Chlorine Pm2.5 Lc	114	89	0.0319	0.0319	0.00389	3.04	0.242	0.0271
Chromium Pm2.5 Lc	111	81	0.00167	0.00167	0.00229	0.0172	0.0106	0.00803
Cobalt Pm2.5 Lc	111	35	0.000269	0.000269	0.00158	0.00383	0.00309	0.0024
Copper Pm2.5 Lc	111	91	0.00706	0.00706	0.0041	0.366	0.0705	0.0195
Ec Csn_Rev Unadjusted Pm2.5 Lc Tot	111	111	0.386	0.386	0.00032	1.55	1.53	1.15
Indium Pm2.5 Lc	114	64	0.00533	0.00541	0.0146	0.0237	0.0228	0.0222
Iron Pm2.5 Lc	111	111	0.0553	0.0553	0.00839	0.191	0.172	0.15
Lead Pm2.5 Lc	114	70	0.00356	0.00356	0.00659	0.0334	0.0169	0.0149
Magnesium Pm2.5 Lc	114	61	0.0275	0.0322	0.0452	1.21	0.108	0.0932
Manganese Pm2.5 Lc	114	86	0.00221	0.00221	0.00296	0.0127	0.00965	0.00842
Nickel Pm2.5 Lc	111	86	0.000768	0.000773	0.00121	0.00411	0.00348	0.00288
Oc Csn_Rev Unadjusted Pm2.5 Lc Tot	111	111	2.17	2.17	0.638	8.59	5.98	5.75
Phosphorus Pm2.5 Lc	114	101	0.000265	0.000338	0.00203	0.00679	0.00611	0.0046

Chemical Name	Num Obs	Obs > MDL	Average (ND=0)	Average (ND=MDL/2)	MDL	Max 1	Max 2	Max 3
Potassium Ion Pm2.5 Lc	113	113	0.173	0.173	0.0129	14.4	0.776	0.284
Potassium Pm2.5 Lc	114	114	0.166	0.166	0.00544	11.9	0.747	0.357
Rubidium Pm2.5 Lc	114	65	0.00117	0.00117	0.00317	0.00874	0.00854	0.00628
Selenium Pm2.5 Lc	114	70	0.00088	0.00088	0.00247	0.00495	0.00454	0.00406
Silicon Pm2.5 Lc	114	101	0.0376	0.0376	0.0139	0.231	0.221	0.131
Silver Pm2.5 Lc	114	69	0.00419	0.00419	0.0128	0.0259	0.0225	0.0221
Sodium Ion Pm2.5 Lc	113	112	0.0193	0.0193	0.014	0.0892	0.0844	0.0754
Sodium Pm2.5 Lc	114	82	0.0362	0.0362	0.0791	0.29	0.213	0.143
Strontium Pm2.5 Lc	114	76	0.00346	0.00346	0.00292	0.244	0.00847	0.00608
Sulfate Pm2.5 Lc	113	113	0.982	0.982	0.0292	13.1	3.57	2.5
Sulfur Pm2.5 Lc	114	114	0.331	0.331	0.00102	3.63	1.23	0.95
Tin Pm2.5 Lc	114	58	0.00498	0.00498	0.0155	0.029	0.0249	0.0236
Titanium Pm2.5 Lc	114	98	0.00387	0.00387	0.00292	0.0572	0.0199	0.0172
Total Nitrate Pm2.5 Lc	113	113	1.44	1.44	0.0388	7.89	6.65	6.26
Vanadium Pm2.5 Lc	114	25	0.000113	0.000382	0.000697	0.00346	0.00144	0.00102
Zinc Pm2.5 Lc	114	114	0.0153	0.0153	0.00173	0.416	0.0414	0.0359
Zirconium Pm2.5 Lc	114	64	0.00401	0.00401	0.014	0.027	0.0227	0.0165

APPENDIX C - SUMMARY

Appendix C summarizes the development of the 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 the inceptions of the CAA.

National Ambient Air Quality Standards (NAAQS)

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 the 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 the 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, NO_2, PM, O_3, and SO_2. **Table C1.1** lists the primary and secondary NAAQS, averaging time and concentration level for each criteria pollutant in effect in 2018. The concentrations are listed as parts per million (ppm), micrograms per cubic meter ($\mu g/m^3$), and/or milligrams per cubic meter (mg/m^3).

Table C1.1:

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 three 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 98th 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 98th 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 4th highest daily maximum 8-hour average concentration is less than or equal to 0.070 ppm.
SO_2	To determine compliance, the 99th 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 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[14] 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 review to the USEPA in July.

[14] Most recent Network Reviews

Types of Monitors

Federal Reference Method (FRM): method of sampling and analyzing the ambient air for an air pollutant that USEPA uses as the "gold standard" for measuring that pollutant. FRM monitors are used to designate attainment/nonattainment areas. The gaseous pollutants CO, NO_2, O_3, and SO_2 are measured with continuous FRM monitors that provide real-time hourly data. The FRM for PM and Pb requires a filter 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.

EC/OC instruments measure elemental carbon using pyrolysis coupled with a nondispersive infrared detector to separate the elemental and organic carbon fractions.

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 MIair website.

TEOM: tapered element oscillating monitors (TEOMs) are continuous PM monitor that is used only for real-time data indications since they are not FEMs and cannot be used for attainment/nonattainment designations.

BAM: Beta attenuation monitors (BAMs) are real-time, continuous PM2.5 monitor that is FEM, thus can be used for attainment/nonattainment designation.

T640: A continuous PM2.5 monitor that uses a light scattering technique to measure particulates. This FEM method can be used for attainment/nonattainment designation.

T640X: A continuous monitor that measures PM2.5, 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 located in urban, commercial, and residential areas where people are exposed to $PM_{2.5}$.

Chemical Speciation Monitoring: Speciated 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, 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: ozone, SO2 (trace), CO (trace), NOY (reactive oxides of nitrogen), PM2.5 FRM, continuous PM2.5, speciated PM2.5, wind speed, wind direction, relative humidity, and ambient temperature. In addition, filter-based measurements are required for PM coarse (PM10-2.5) on a once every three-day sampling frequency. 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-road 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.

Population-Oriented Monitors: Monitors that are located in an area where many people live, also considered ambient air.

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

Source-Oriented/Point-Source Monitors: Monitors that are located near a specific emissions source (e.g., 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: Measures air pollution concentrations in more populated urban areas.

Quality Assurance

The AQD's Air Monitoring Unit (AMU) ensures that all data collected and reported is of high quality and meets federal requirements. The AMU 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 Code of Federal Regulations (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 AMU'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. The USEPA 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 evaluation samples.

Historical NAAQS Changes

CO

1971 1-hour: Second highest average does not exceed 35 in a year

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

Lead

1978 Calendar quarter values averaged does not exceed 1.5 µg/m^3

2008 3-month values averaged does not exceed 0.15 µg/m^3

NO_2

1971 Annual average of 53 ppb or less

2010 98th percentile of the 1-hour concentration averaged over 3 yrs. is 100 ppb or less

Ozone

1971 Total photochemical oxidants: 1-hour max of 0.08 ppm not exceeded once per yr

1979 1-hour: 1-hour maximum concentration is 0.12 ppm one or less hour per yr

1997 8-hour: 4th highest daily maximum 8-hour concentration averaged over 3 yrs. is 0.08 ppm or less

2008 8-hour: 4th highest daily maximum 8-hour concentration averaged over 3 yrs. is 0.075 ppm or less

2015 8-hour: 4th highest daily maximum 8-hour concentration averaged over 3 yrs. is 0.070 ppm or less

PM

1971 TSP: 24-hour average not to exceed 260 µg/m^3 more than once per yr
Annual geometric mean of 75 µg/m^3

1987 PM_{10}: Indicator for PM changed from TSP to PM10
24-hour average not to exceed 150 µg/m^3 more than once per yr over a 3-yr period
Annual mean of 50 µg/m^3 or less average over 3 yrs.

1997 $PM_{2.5}$: Annual mean of 15.0 µg/m^3 or less average over 3 yrs.
98th percentile of 24-hour average of 65 µg/m^3 or less averaged over 3 yrs.

2006 PM_{10}: Annual average revoked
24-hour average retained

$PM_{2.5}$: Annual mean retained
98th percentile of 24-hour average of 35 µg/m^3 or less averaged over 3 yrs.

2012 $PM_{2.5}$: Annual mean of 12.0 µg/m^3 or less average over 3 yrs.

SO_2

1971 24-Hour concentration of 0.14 ppm not exceeded more than once per year

Annual average of 0.03 ppm or less.

2010 1-hour average of 99th percentile is 75 ppb or less, averaged over 3 yrs.
Previous standards revoked

APPENDIX D: ACRONYMS AND THEIR DEFINITIONS

$>$	Greater than
$<$	Less than
$\geq$	Greater than or equal to
$\leq$	Less than or equal to
%	Percent
$\mu g/m^3$	Micrograms per cubic meter
µm	Micrometer
AIRS ID	Aerometric Information Retrieval System Identification Number
AMU	Air Monitoring Unit
AQD	Air Quality Division
AQES	Air Quality Evaluation Section
AQI	Air Quality Index
AQS	Air Quality System (EPA air monitoring data archive)
As	Arsenic
BAM	Beta Attenuation Monitor (hourly $PM_{2.5}$ measurement monitor)
BC	Black Carbon
BTEX	Benzene, Toluene, Ethylbenzene and Xylene
CAA	Clean Air Act
CBSA	Core-Based Statistical Area
Cd	Cadmium
CFR	Code of Federal Regulations
CO	Carbon monoxide
CSA	Consolidated Statistical Area
DW	Downwind
EC/OC	Elemental carbon/Organic carbon
EGLE	Michigan Department of Environment, Great Lakes and Energy
FDMS	Filter Dynamic Measurement System
FEM	Federal Equivalent Method
FIA	Family Independence Agency
FR	Federal Register
FRM	Federal Reference Method
GHIB	Gordie Howe International Bridge
HAP	Hazardous Air Pollutant
hr	Hour
Lc	Local Conditions

MASN .... Michigan Air Sampling Network
MDL .... Method Detection Limit
mg/m^3 .... Milligrams per meter cubed
MI .... Michigan
MiSA .... Micropolitan Statistical Area
Mn .... Manganese
MSA .... Metropolitan Statistical Area
NAAQS .... National Ambient Air Quality Standard
NAMS .... National Air Monitoring Station
NATTS .... National Air Toxics Trend Sites
NCore .... National Core Monitoring Sites
ND .... Non-detect
NEI .... National Emission Inventory
Ni .... Nickel
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 Road
O_3 .... Ozone
Obs/OBS .... Observations
PAMS .... Photochemical Assessment Monitoring Station
PAH .... Polynuclear Aromatic Hydrocarbon
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 = mg/kg, mg/L, µg/g (1 ppm = 1,000 ppb)
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 .... Southwestern High School
TAC.................... Toxic Air Contaminant
TEOM................ Tapered element oscillating microbalance (hourly $PM_{2.5}$ measurement monitor)
tpy .... Ton per year
TRI .... Toxic Release Inventory
TSA .... Technical Systems Audit
TSP..................... Total Suspended Particulate
US .... United States
USEPA............... United States Environmental Protection Agency
UV...................... Ultra-violet
VOC .... Volatile Organic Compounds

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