Michigan's 2017 Ambient Air Monitoring Network Review

Michigan Department of Environmental Quality
Air Quality Division
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Introduction:

The purpose of this document is to examine Michigan's ambient air monitoring network in operation during 2016 and recommend changes based on monitor history, population distribution, and modifications to federal monitoring requirements under the Clean Air Act (CAA), 40 Code of Federal Regulations (CFR) Part 58. Recommended changes to this network will be implemented during the 2017 calendar year, contingent upon adequate levels of funding.

Federal Changes

There have been a number of changes at the federal level that have impacted the design of Michigan's monitoring network. These changes include revisions to the National Ambient Air Quality Standard (NAAQS) for Ozone, Particulate Matter (PM), Pb, NO_2, SO_2, CO and secondary NAAQS for NO_2 and SO_2. In addition, there were changes in the ambient air monitoring rules.

On November 12, 2008, the U.S. Environmental Protection Agency (EPA) modified the lead NAAQS by reducing the level of the standard from a maximum quarterly average of 1.5 micrograms per cubic meter ($\mu g/m^3$) to 0.15 $\mu g/m^3$, as a three-month rolling average.

On February 9, 2010, the EPA changed the NO_2 NAAQS and required the deployment of a two-tiered NO_2 monitoring network consisting of near-roadway and community monitors. Design of the new NO_2 monitoring network is discussed in this network review. These NO_2 monitors had a deployment deadline of January 1, 2013.

On November 16, 2009, the EPA proposed to modify the SO_2 NAAQS and proposed the creation of a two-tier monitoring network based on SO_2 emissions, requiring a total of 12 SO_2 stations in Michigan. The SO_2 NAAQS became final on August 23, 2010. The network design was modified to a single tier requiring a total of five SO_2 monitors in Michigan. Changes to the SO_2 monitoring network are discussed in this network review. Changes to the SO_2 network were required to be implemented before January 1, 2013.

On August 13, 2011, the EPA proposed to retain the CO NAAQS level while adding additional monitoring requirements. The EPA proposed that CO monitors be added to the near-roadway sites. These CO monitors had a deployment deadline of January 1, 2014.

A secondary NAAQS for NO_2 and SO_2 was proposed on February 12, 2010 and the final rule was effective June 4, 2012. The EPA chose to retain the standards while adding additional monitoring requirements.

On January 15, 2013, the PM NAAQS was revised and the EPA lowered the $PM_{2.5}$ annual average to 12.0 $\mu g/m^3$.

On October 26, 2015, the Ozone NAAQS was revised and the EPA strengthened the Ozone 8-hr standard to 0.070 ppm.

On April 27, 2016, the EPA finalized revisions to the CFR Part 48 which contain the ambient air monitoring requirements for criteria pollutants.

On May 16, 2016, the EPA signed a proposed rule to remove the requirement of Tier III Near Road NO_2 Monitors.

Recommendations for Michigan's Air Monitoring Network in 2017

The following changes will be made to Michigan's ambient air monitoring network during 2017. If funding cuts occur, additional changes to the network may have to be implemented.

After July 1, 2016, the MDEQ is planning to add the following air monitoring site:

- Site located in 48217 parameters will be determined by citizen workgroup

After September 30, 2016, the MDEQ is losing site access at the following air monitoring site:

- Rose Lake (260370001) will be moved to new location

After January 1, 2017, the MDEQ is proposing to change sampling frequency at the following $PM_{2.5}$ FRM site:

- FIA (261630039) reduce from daily to 1:3

Network Review Goals

The Michigan Ambient Air Monitoring Network Review will describe the ambient air monitoring network, show how the network meets the EPA's monitoring regulations, discuss the public comment procedure, summarize recent changes to the network and address potential impacts of other actions in greater detail. All discussions of air monitors reference a unique nine-digit site identification code to remove all ambiguity regarding the monitor location.

Public Comment Process

The EPA requires that the MDEQ document the process for obtaining public comments and include any comments received through the public notification process. As such, the DEQ Calendar issued on May 16, 2016, announced that this network review document was placed on the Air Quality Division (AQD) section of the MDEQ Internet homepage to solicit comments from the general public and stakeholders. Reviewers are given 30 calendar days from the date the draft network review report is posted to provide written comments. Written comments are accepted either by e-mail or by parcel post (verbal comments are not accepted) and should be sent to:

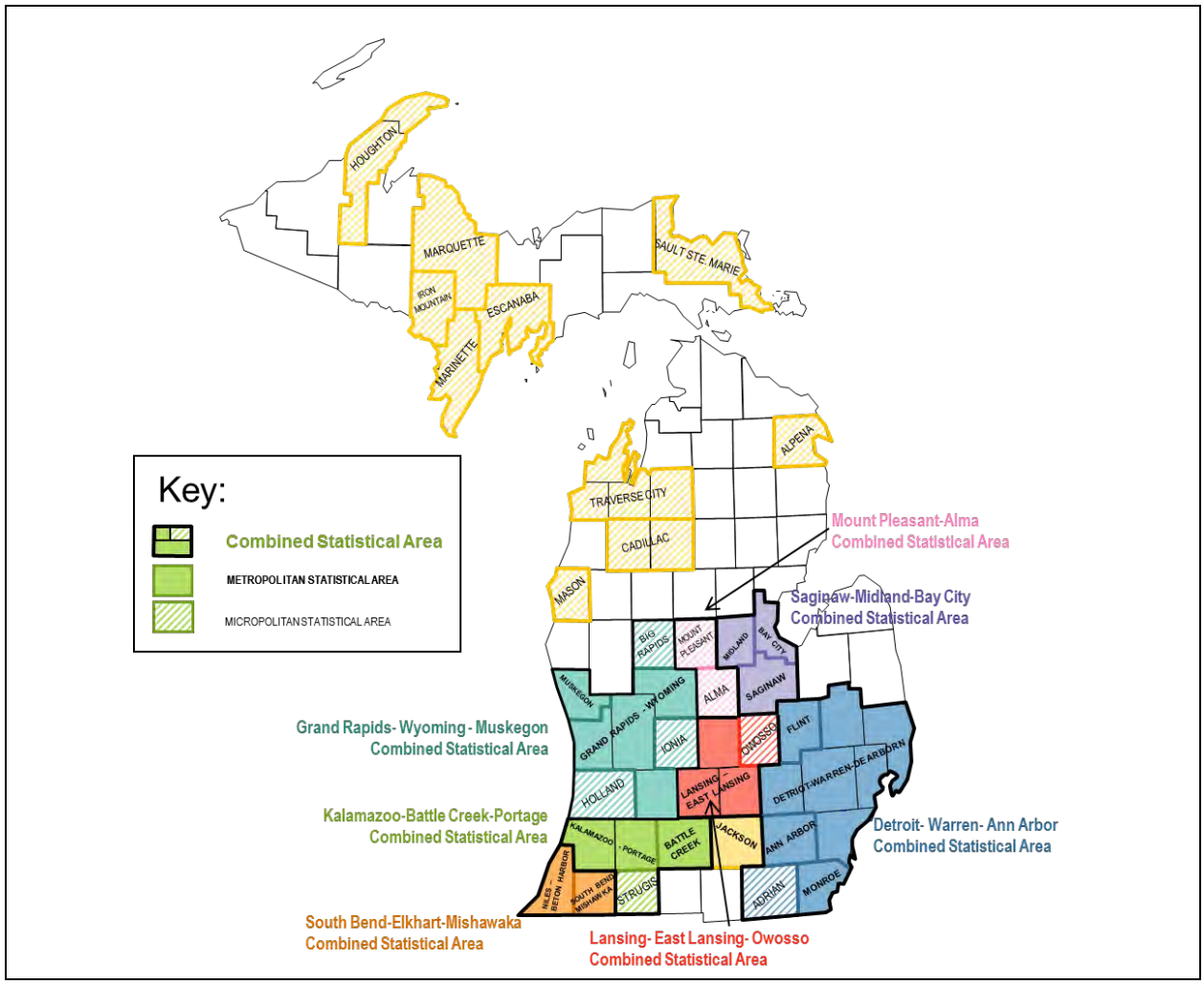
Ms. Amy Robinson
MDEQ – Air Quality Division
P.O. Box 30260
Lansing, MI 48909-7760
robinsona1@michigan.gov

All written comments that are received will be organized by topic, summarized, and addressed in the final version of the Michigan Ambient Air Monitoring Network Review. The final document will be placed on the AQD section of the MDEQ Internet homepage and sent to EPA Region 5 for approval. Hardcopies of the final version will be available for inspection free of charge at the MDEQ AQD offices located in Lansing (525 West Allegan Street) or Detroit (3058 West Grand Boulevard, Suite 2-300). Requests for hard copies of the plan may incur a nominal fee to cover copying and/or mailing costs. These requests should be directed to Ms. Amy Robinson, AQD, 517-284-6758, robinsona1@michigan.gov.

Ambient Air Monitoring Network Requirements:

The minimum network design criteria for ozone, $PM_{2.5}$ (particulate matter with an aerodynamic diameter less than or equal to [≤] 2.5 micrometers) and PM_{10} (≤10 micrometers) are based on the 2000 Metropolitan Statistical Area (MSA) geographical borders, population totals, and historical concentrations. The MSA outlines for Michigan's Lower Peninsula are shown in **Figure 1**.

FIGURE 1: MSAS IN MICHIGAN'S LOWER PENINSULA



To be classified as an MSA, an area must have an urban core population totaling at least 50,000 people in the most recent decennial census. Micropolitan statistical areas contain an urban core of at least 10,000 (but less than 50,000). MSAs that consist of one or more counties, have a sizeable urban cluster or a high level of commuting, to or from an urban cluster. MSAs and/or micropolitan areas are grouped to form consolidated statistical areas (CSAs), also shown in **Figure 1**. A CBSA is defined as an entity consisting of the county or counties associated with at least one urbanized area/urban cluster of at least 10,000 in population, plus adjacent counties having a high degree of social and economic integration. Changes to the metropolitan and micropolitan areas as a result of the 2010 Census were released in 2013. The areas affected

include Midland, Hillsdale, Three Rivers, Ludington, and Whitehall. However, the remainder of MSAs in the state were unaffected by the 2010 census.

The specific counties that make up each MSA or micropolitan area in Michigan are listed in **Table 1**.[1] These geographical areas, coupled with their population totals and historical ambient monitoring data, were used to develop the minimum monitoring network design for ozone, $PM_{2.5}$, and PM_{10}. **Table 1** shows the 2010 population totals.

Table 1: Composition of Core-Based Statistical Areas in Michigan

Combined Statistical Area	2010 Census	Core Based Statistical Area	2010 Census	County
Detroit-Warren-Ann Arbor CSA	5,348,744	Detroit-Warren-Dearborn MSA	4,296,250	Wayne
				Oakland
				Macomb
				Livingston
				St. Clair
				Lapeer
		Flint MSA	425,790	Genesee
		Ann Arbor MSA	334,791	Washtenaw
		Monroe MSA	152,021	Monroe
		Adrain Micropolitan	99,892	Lenawee
Grand Rapids-Wyoming-Muskegon CSA	1,379,237	Grand Rapids-Wyoming MSA	988,938	Kent
				Ottawa
				Montcalm
				Barry
		Muskegon MSA	172,188	Muskegon
		Holland Micropolitan	111,408	Allegan
		Ionia Micropolitan	63,905	Ionia
		Big Rapids Micropolitan	42,798	Mecosta
Lansing-East Lansing-Owosso CSA	534,684	Lansing-East Lansing MSA	464,036	Ingham
				Eaton
				Clinton
		Owosso Micropolitan	70,648	Shiawassee
Kalamazoo-Battle Creek-Portage CSA	524,030	Kalamazoo-Portage MSA	326,589	Kalamazoo
				Van Buren
		Battle Creek MSA	136,146	Calhoun
		Sturgis Micropolitan	61,295	St. Joseph
Saginaw-Midland-Bay City CSA	391,569	Saginaw MSA	200,169	Saginaw
		Bay City MSA	107,771	Bay
		Midland MSA	83,629	Midland
South Bend-Elkhart-Mishawaka, IN-MI CSA	720,643	South Bend-Mishawaka, IN-MI MSA	319,224	St Joseph, IN
				Cass
		Elkhart-Goshen, IN MSA	197,559	Elkhart, IN
		Niles-Benton Harbor MSA	156,813	Berrien
		Plymouth, IN Micropolitan	47,051	Marshall, IN
Mount Pleasant-Alma CSA	112,787	Mount Pleasant MSA	70,311	Isabella
		Alama Micropolitan	42,476	Gratiot
none		Jackson MSA	160,248	Jackson

[1] Metropolitan and Micropolitan Statistical Areas: April 1, 2000 to July 1, 2009 (CBSA-EST2009-1) Source U. S. Census Bureau, Population Release Date March 2010.

Some proposed monitoring requirements are based on micropolitan statistical areas with an *urban cluster* of at least 10,000 but less than 50,000 people. The total population in micropolitan areas in Michigan is shown in **Table 2**.

Table 2: Composition of Micropolitan Statistical Areas in Michigan

Micropolitan Areas	Principal Cities	Counties	Population 2010 Census
Adrian Micropolitan Area	Adrian	Lenawee	99,892
Alma Micropolitan Area	Alma	Gratiot	42,476
Alpena Micropolitan Area	Alpena	Alpena	29,598
Big Rapids Micropolitan Area	Big Rapids	Mecosta	42,798
Cadillac Micropolitan Area	Cadillac	Missaukee, Wexford	47,584
Coldwater Micropolitan Area	Coldwater	Branch	45,248
Escanaba Micropolitan Area	Escanaba	Delta	37,069
Hillsdale Micropolitan Area	Hillsdale	Hillsdale	46,229
Holland Micropolitan Area**	Holland (pt.)	Allegan	111,408
Houghton Micropolitan Area	Houghton	Houghton, Keweenaw	38,784
Ionia Micropolitan Area	Ionia	Ionia	63,941
Iron Mountain Micropolitan Area	Iron Mountain, MI	Dickinson, MI; Florence, WI	26,168
Ludington Micropolitan Area	Ludington	Mason	28,680
Marinette Micropolitan Area	Marinette, WI	Menominee, MI; Marinette, WI	24,029
Marquette Micropolitan Area	Marquette	Marquette	67,077
Mount Pleasant Micropolitan Area	Mount Pleasant	Isabella	70,311
Owosso Micropolitan Area	Owosso	Shiawassee	69,232
Sault Ste. Marie Micropolitan Area	Sault Ste. Marie	Chippewa	38,520
Sturgis Micropolitan Area	Sturgis	St. Joseph	61,295
Traverse City Micropolitan Area	Traverse City	Benzie, Grand Traverse, Kalkaska, Leelanau	143,372

Other Monitoring Network Requirements

National Core (NCore) sites provide a full suite of measurements at one location. NCore stations collect the following measurements: ozone, SO_2 (trace), CO (trace), NO_Y, $PM_{2.5}$ FRM, continuous $PM_{2.5}$, speciated $PM_{2.5}$, wind speed, wind direction, relative humidity, and ambient temperature. In addition, filter-based measurements are required for PM coarse ($PM_{10-2.5}$) on a once every three day sampling frequency. Previously, a minimum of ten NCore sites nationwide measure lead, however this requirement was removed in 2016. The NCore stations in Michigan, located at Grand Rapids – Monroe St (260810020) and Allen Park (261630001) became operational January 1, 2010, one full year ahead of schedule.

State and Local Air Monitoring Stations (SLAMS) monitors will supplement the network and improve spatial coverage. Specific network design criteria are contained in the monitoring regulations that describe the SLAMS monitoring networks for criteria pollutants. These requirements are discussed in detail in the remainder of this review.

Network Review Requirements

According to 40 CFR 58.10, an air monitoring network review should:

- Be conducted at least once a year,
- Determine if the system meets the monitoring objectives stated in Appendix D of 40 CFR, Part 58 "Network Design Criteria for Ambient Air Quality Monitoring,"[2]
- Determine if the system meets the appropriate spatial scales and monitoring objectives, population-driven requirements, and the minimum number of stations that are required based on the likelihood of exceeding the NAAQS,
- Identify needed modifications to the network including termination and relocation of unnecessary stations,
- Identify any new stations that are necessary,
- Correct any inadequacies previously identified,
- Be used as a starting point for five-year regional assessments,

Elements that must be included in the network review are:

- the EPA's Air Quality System (AQS) site identification number,
- site locations including coordinates and street address,
- sampling and analysis methods, including parameter codes
- operating schedule,
- monitoring objective and spatial scales,
- identification of those sites that are suitable and not suitable for comparison to the NAAQS (for $PM_{2.5}$ only),
- the MSA, CBSA, or CSA represented by each monitor,
- evidence that the siting and operation of the monitor meets 40 CFR Part 58, Appendices A (quality assurance requirements), C (ambient air quality monitoring), D (network design criteria) and E (probe and monitoring path siting criteria).

For Michigan, the site-specific data is summarized in various tables throughout the review.

The modifications to the network should address:
`

- new census data,
- changes in air quality levels, and;
- changes in emission patterns.

The time frame for implementation of modifications is one year from the time of the previous network review. Changes will be made on a calendar year basis whenever possible.

[2] "Environmental Protection Agency Ambient Air Quality Surveillance Regulations." 40 CFR Part 58 Appendix D, April 27, 2016.

Monitor Deployment By Location

Table 3 summarizes the distribution of ambient air monitors by pollutant in operation in Michigan during 2016. The distinction is made between building and trailer to indicate differences in floor space and temperature control, information useful in planning deployment of new monitors.

TABLE 3: MONITOR DISTRIBUTION THROUGHOUT THE 2016 NETWORK IN MICHIGAN

Site Name	AQS ID	O_3	$PM_{2.5}$	$PM_{2.5}$ TEOM	Speciation	PM_{10}	PM Coarse	CO	trace CO	NO_2	NOy	SO_2	trace SO2	Metals (TSP)	VOCs	Carbonyls	PAHs	Meteorological	Building/Trailer
Holland	260050003	x	x															x	T
Bay City	260170014		x	x														x	T
Benzonia (Frankfort)	260190003	x																	T
Coloma	260210014	x	x															x	T
Cassopolis	260270003	x																x	B
Sault Ste. Marie +	260330901	x	x	x[b]														x	
Rose Lake	260370001	x																	B
Flint	260490021	x	x	x														x	T
Otisville	260492001	x																x	T
Harbor Beach	260630007	x																x	T
Belding - Reed St	260670002													Pb & 4				x	B
Belding - Merrick St	260670003													Pb & 4					
Lansing	260650012	x	x	x						x		x						x	T
Kalamazoo	260770008	x	x	x														x	T
Gr.Rapids-Wealthy St	260810007		x																
Gr.Rapids-Monroe St.	260810020	x	x	x	x	x	x		x		x		x	Pb & 4				x	T
Evans	260810022	x																x	T
Tecumseh	260910007	x	x	x	x													x	T
New Haven	260990009	x	x															x	T
Sterling Hts/Freedom Hill	260990021																	x	
Warren	260991003	x																	T
Manistee +	261010922	x	x															x	B
Scottville	261050007	x																x	T
Houghton Lake	261130001	x	x	x						x								x	T
Sterling State Park	261150006		x									x						x	T
Muskegon-Green Ck Rd	261210039	x																x	T
Oak Park	261250001	x	x															x	T
Pontiac	261250011																	x	
Rochester	261250012																	x	
Jenison	261390005	x																x	T
West Olive	261390011											x						x	T
Port Huron	261470005	x	x	x								x						x	T
Port Huron Rural St	261470031													Pb & 4					
Seney	261530001	x		x														x	T
Ypsilanti	261610008	x	x	x														x	T
Allen Park	261630001	x	x	x	x	x	x		x		x		x	Pb & 4				x	T
River Rouge	261630005					x								4		x		x	T
Fort St (SW HS)-Detroit	261630015		x		x	x						x		4	x	x		x	B
Linwood	261630016		x																B
E. 7 Mile - Detroit	261630019	x	x							x								x	B
Livonia	261630025		x																
Livonia Near Road	261630095		x	x[b]				x		x								x	T
Joy Rd - Detroit	261630026																	x	
S Delray/ Jefferson	261630027													4					T
Dearborn	261630033		x	x	x	x								x	x	x	x	x	B
Wyandotte	261630036		x																
FIA/Ambassador Bridge	261630039		x	x														x	T
Eliza Howell #1	261630093			x[b]				x		x								x	T
Eliza Howell #2	261630094							x		x								x	T
	Total	27	26	16	5	5	2	3	2	6	2	5	2	9	2	3	1	39	

+ = Tribal monitor
b = BAM Unit
4 = Metals suite reduced to Mn, As, Cd, Ni

Quality Assurance (QA)

The MDEQ has an approved Quality Management Plan (QMP). In turn, the Air Monitoring Unit (AMU) has a Quality Assurance Project Plan (QAPP), that covers the operation of the ambient air network. The QAPP addresses criteria pollutants, air toxics, metals, and particulates including the EPA $PM_{2.5}$ Speciation Trends Network (STN). Separate QAPPs exist for the National Air Toxics Trend Site (NATTS) and National Core Monitoring sites (NCore). Special purpose monitoring projects also have dedicated QAPPs. Lastly, the AMU has approved standard operating procedures, standardized forms and documentation policies, and a robust audit and assessment program to ensure high data quality.

As part of the network review process, it is important to ensure that each monitor meets the specific requirements in 40 CFR Part 58, Appendix A governing proper calibration and operation, proper probe height and monitor path length. In addition, the site itself must meet specific criteria governing distances from large trees and buildings, exhaust vents, highways, etc. To address the adequacy of these operational parameters, various types of audits are performed.

The Environmental Protection Agency (EPA) finalized revisions to the ambient air monitoring requirements for criteria pollutants which were published in the Federal Register on March 27, 2016 and became effective on April 27, 2016. The MDEQ has implemented most of these changes and is working towards procuring the equipment to fully implement the requirement for conducting lower level annual audit points for the gaseous monitors.

Audits are conducted by the AMU's Quality Assurance (QA) Team, which has a separate reporting line of supervision. The audits are conducted on the particulate-based monitors every six months ($PM_{2.5}$ FRM, continuous $PM_{2.5}$ TEOM, BAM, $PM_{2.5}$ Speciation, High Volume TSP [total suspended particulate], and PM_{10}) and the gaseous monitors (CO, SO_2, ozone, and NO_2) at least once a year. All audit results are reported to AQS quarterly. The toxics monitors (volatile organic compounds [VOCs], carbonyl compounds, and poly-aromatic hydrocarbons [PAH]) are also audited once a year and the aethalometers are audited every six months by the QA Team. These audits are conducted with independent equipment and gases, which are only used for quality assurance. The AMU's QA Coordinator reviews the results from all audits.

External audits are conducted annually by the EPA. The EPA conducts Performance Evaluation Program (PEP) audits for $PM_{2.5}$ samplers (eight sites a year) and National Performance Audit Program (NPAP) for the gaseous monitors (20% of the sites per year) using a Thru-the-Probe audit system. The EPA also conducts program-wide Technical Systems Audits 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 air toxics (VOCs and carbonyls) and metals through the use of performance evaluation samples. The concentrations of audit samples are unknown to both the AQD staff and the MDEQ Environmental Laboratory staff.

Lead Monitoring Network:

Background

On December 14, 2010, the EPA revised the ambient monitoring requirements to better address possible exposures to lead[3]. On January 5, 2015, the EPA proposed to retain the current standard. Monitoring is required for point sources that emit 0.5 tons of lead per year or more, if modeling indicates that the maximum concentration is more than half of the level of the air quality standard. If modeling indicates that there is little likelihood of violating the NAAQS, a waiver from monitoring may be obtained from the regional administrator.

The final component of the 2010 revisions to the monitoring regulations includes the addition of population-oriented lead monitors at NCore stations that are located in CBSAs with populations greater than 500,000. In the final monitoring regulations of 2016, the EPA has removed lead monitoring requirement at NCore sites, provided the sites are attaining the standard. At this time, the MDEQ has determined to best meet the needs of our citizens, we will continue to monitor for lead at our NCore sites.

To place these new monitoring requirements into context, the 2008 lead NAAQS is reviewed below as are changes already implemented in the lead network.

The 2008 Lead NAAQS

The 2008 lead NAAQS reduced the level of the standard from a maximum quarterly average of 1.5 ug/m^3 to 0.15 ug/m^3 as a rolling three-month average. To determine if the primary NAAQS is met, the maximum three-month average within a three-year period is compared to the level of 0.15 ug/m^3.

In addition to changing the level and form of the standard, the 2008 NAAQS also changed monitoring requirements. The EPA required that ambient monitoring be performed downwind of point sources emitting one ton or more per year of lead, unless modeling proved that the sources didn't pose a health risk. In 2010, the new per ton threshold was reduced to 0.5 ton/year.

The NAAQS retained the TSP size fraction of lead, but acknowledged that agencies may, under certain conditions, measure lead as PM_{10} if low volume sampling devices are used. Currently, the MDEQ is using high volume TSP samplers to measure lead and will continue to do so for compliance with the NAAQS and consistency with historical data. The NAAQS requires that lead sampling be conducted on a once every six day schedule, the MDEQ follows the EPA sampling schedule that is published yearly on the EPA website at https://www3.epa.gov/ttnamti1/calendar.html. These filters are analyzed by the MDEQ laboratory using ICP/MS.

[3] "Environmental Protection Agency National Ambient Air Quality Standards for Lead; Final Rule." 40 CFR parts 50, 51, 53 and 58, November 12, 2008.

Point Source-oriented Monitoring

For 2017, there are no new facilities that need to be investigated with regards to the lead NAAQS requirements. However, there are some issues that need to be discussed. First, the MDEQ is in the process of petitioning for attainment status for the lead nonattainment area in Belding, Michigan. The Reed St. monitor (260670002) demonstrated attainment in September 2014.

Non-source-oriented/NCore Monitoring Network Design

According to the November 12, 2008 lead NAAQS, each core based statistical area (CBSA) with a population equaling or exceeding 500,000 people shall have a lead monitoring station to measure neighborhood scale lead in the urban area. The EPA has now reversed this with the 2016 monitoring regulation changes. The MDEQ has decided retaining the lead monitoring at MDEQ's NCore sites is in the best interest of the citizens we serve.

Lead Co-location Requirements

If a primary quality assurance organization (PQAO) has a mixture of source and non-source-oriented lead sites, the number of co-located lead sites is equal to 15% of the total number of these lead sites**. Table 4** described the deployment schedule for various components of the lead network and shows the calculations for determining the number of co-located lead sites that are required.

As shown by the table, only one co-located monitoring station is required under any of the scenarios for Michigan's lead network. Currently, the co-located site is at Dearborn. According to the *Federal Register,* the co-located site should be at the location with the highest lead concentrations, which would be at Belding (260670003). However, this is impossible because the station occupies a minimal footprint located in the right of way of the road. In addition, the MDEQ expects lead impacts in Belding to decrease significantly due to adopted abatement strategies. For these reasons, the MDEQ seeks a waiver from the co-location requirement at Belding from the Regional Administrator.

The MDEQ prefers to leave the co-located lead site at the National Air Toxics Trend Site (NATTS) at Dearborn (261630033), which is located close to many industrial processes including a steel mill, a rail yard and an incinerator. The station is sited at Salina School. Typically, NATTS sites determine lead as PM_{10} using a high volume sampler and thus do not meet the monitoring requirements, which specify the use of a high volume TSP sampler or a low volume PM_{10} sampler under certain instances. However, the MDEQ opted to collect co-located lead measurements as both TSP and PM_{10} at the Dearborn site to continue generating trend data, promote comparability with other NATTS sites in the nation and to determine precision for both size fractions. In addition, a Met One SASS monitor supports the measurement of lead as $PM_{2.5}$, rounding out the suite of various particle sizes. As long as the total number of lead sites in Michigan is less than ten, the co-located TSP samplers at Dearborn would fulfill the 15% co-location requirement for the lead network.

TABLE 4: DEPLOYMENT SCHEDULE FOR LEAD SITES AND CALCULATION OF THE TOTAL NUMBER OF CO-LOCATED LEAD SITES

Site Name & ID	Site Purpose	2013	2014	2015	2016	2017
Dearborn (261630033)	NATTS; co-located site	operational	operational	operational	operational	operational
Grand Rapids-Monroe St. (260810020)	NCore Non-Source-oriented	operational	operational	operational	operational	operational
Allen Park (261630001)	NCore Non-Source-oriented	operational	operational	operational	operational	operational
Belding (260670003)	Source-oriented	operational	operational	operational	operational	operational
Belding-Reed St (260670002)	Source-oriented	operational	operational	operational	operational	operational
Vassar (261570001)	Source-oriented	operational	operational	discontinued	discontinued	discontinued
E Jordan (260290011)	Source-oriented	discontinued	discontinued	discontinued	discontinued	discontinued
Oakland Co Airport (261250013)	Source-oriented	discontinued	discontinued	discontinued	discontinued	discontinued
Port Huron, Rural St. (261470031)	Source-oriented	operational	operational	operational	operational	operational
Total No. Sites		**7**	**7**	**6**	**6**	**6**
No. Co-Located Sites Required		**1**	**1**	**1**	**1**	**1**

Table 5 summarizes the lead monitoring site information for the Michigan lead network. **Figure 2** shows monitoring site locations in the 2016 and 2017 network.

TABLE 5: MICHIGAN'S LEAD MONITORING NETWORK

Operating Schedule: 1:6 days

Method: High Volume Sampler & ICAP Spectra; Method Code 108

Point Source Oriented Sites

Monitoring Sites												
Site Name	AQS Site ID	Address	Part. Size	Latitude	Longitude	Sampling Frequency	Purpose	Scale	County	Date Estab.	Facility Name	Est Emissions Tons/yr
Belding - Merrick St	260670003	509 Merrick	TSP	43.09984	-85.22163	1:6	max conc	Micro	Ionia	1/1/10	Mueller Industries	0.9 - 1.0
Port Huron	261470031	324 Rural St	TSP	42.98209	-82.449233	1:6	max conc	Micro	St. Clair	1/1/13	Mueller Industries	0.75
Belding - Reed St	260670002	545 Reed St	TSP	43.101944	-85.22000	1:6	max conc	Middle	Ionia	7/2/11	Mueller Industries	0.9 - 1.0

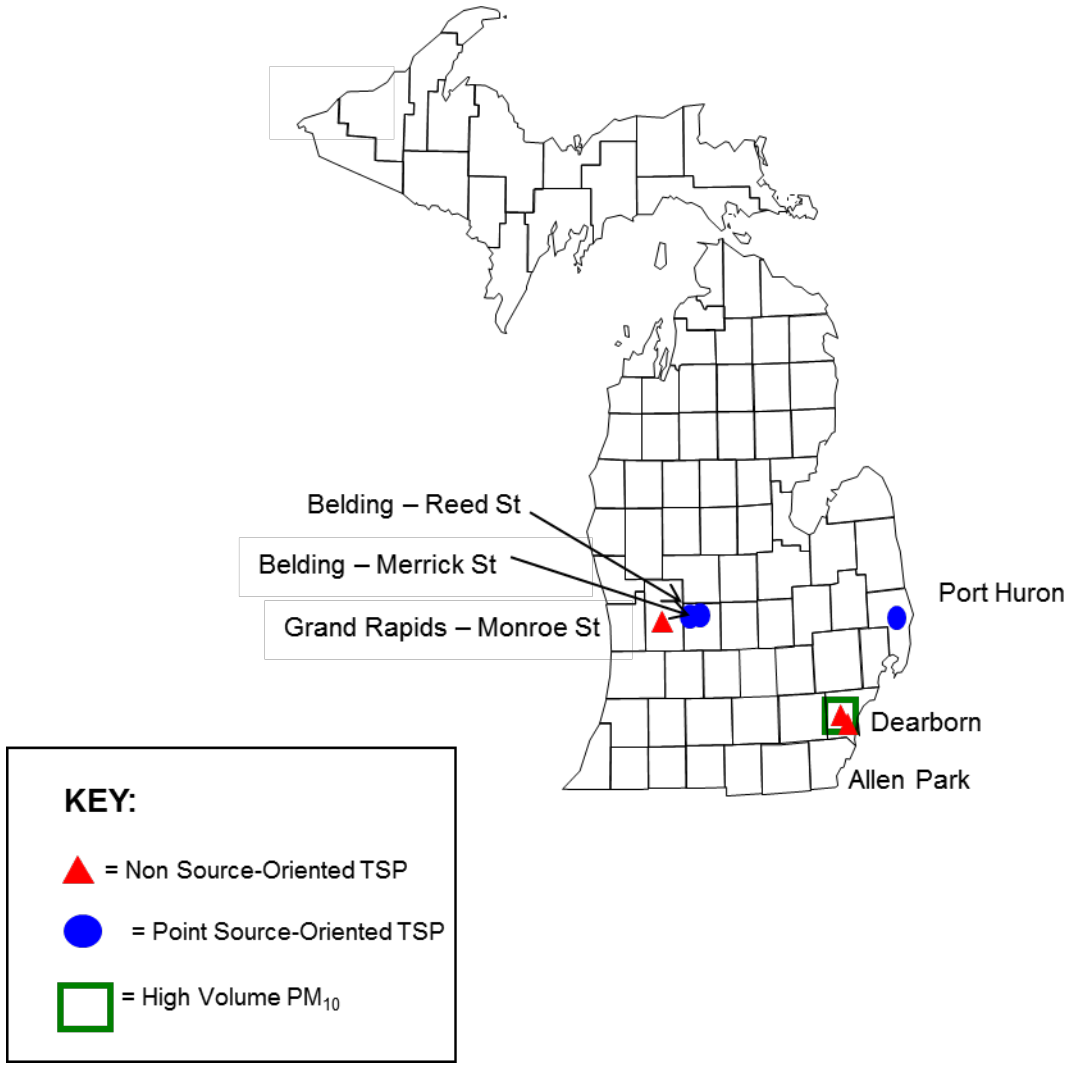
Area Source Oriented Sites

Monitoring Sites												
Site Name	AQS Site ID	Address	Part. Size	Latitude	Longitude	Sampling Frequency	Purpose	Scale	County	Date Estab.	CBSA [1]	Pop (2010 Census)
Grand Rapids - Monroe St	260810020	1179 Monroe St., NW,	TSP	42.984167	-85.671389	1:6	pop. exp.	Neighborhood	Kent	1/8/10	GW	988,938
Allen Park	261630001	14700 Goddard	TSP	42.228611	-83.208333	1:6	pop. exp.	Neighborhood	Wayne	1/2/10	DWL	4,296,250
Dearborn	261630033	2842 Wyoming	TSP	42.306666	-83.148889	1:6	max conc	Neighborhood	Wayne	6/1/90	DWL	4,296,250
Dearborn	261630033	2842 Wyoming	TSP	42.306666	-83.148889	1:6, co-loc	max conc	Neighborhood	Wayne	6/1/90	DWL	4,296,250
Dearborn	261630033	2842 Wyoming	PM 10	42.306666	-83.148889	1:6	max conc	Neighborhood	Wayne	6/1/90	DWL	4,296,250
Dearborn	261630033	2842 Wyoming	PM 10	42.306666	-83.148889	1:6, co-loc	max conc	Neighborhood	Wayne	6/1/90	DWL	4,296,250

[1] **CBSA Key:**

DWL = Detroit-Warren-Livonia Core Based Statistical Area
GW = Grand Rapids-Wyoming Core Based Statistical Area

FIGURE 2: MICHIGAN'S LEAD MONITORING NETWORK



Waiver(s) From Lead Monitoring

In the Network Review that was due July 1, 2009, waivers from monitoring were sought for point sources where modeling indicated there was little likelihood to violate the NAAQS. These waivers were renewed again in July 2014. According to the waiver process, new waivers from monitoring for these sources need to be applied for five years after the first waiver was obtained. Therefore, the MDEQ will seek a waiver renewal in July 2019.

Lead Quality Assurance (QA)

The site operator conducts a precision flow check each month. The flow check values are sent to the QA coordinator each quarter. An independent audit is conducted by a member of the AMU's QA Team every six months. The auditor is in a separate line of reporting authority from the site operator and uses independent, dedicated equipment to perform the flow rate audit. The auditor also assesses the condition of the monitor and siting criteria. The QA Coordinator reviews all audit results, and hard copies are retained in the QA files. The audit results are uploaded to the EPA's AQS database each quarter.

The MDEQ Laboratory participates in an external performance testing program that is administered by the EPA. External lead PEP audits are conducted annually by the EPA. For this audit, the EPA sends a filter strip that is spiked with a known concentration of lead. The laboratory reports the result to the EPA and it is compared to the "true" value. A co-located lead filter is sent to the EPA Region 9 lab once per quarter to assess laboratory precision.

Plans for the 2017 Lead Monitoring Network

In 2017, the MDEQ is planning to continue to collect high volume TSP lead measurements at the NATTS site:

- Dearborn NATTS site (261630033)
- Co-located Dearborn NATTS (261630033)

The MDEQ is also planning to continue the collection of co-located PM_{10} lead at the Dearborn (261630033) NATTS site during 2017.

In 2017, the MDEQ is planning to continue lead source oriented measurements at:

- Belding–Reed St. (260670002) TSP lead monitoring
- Port Huron (261470031) TSP lead monitoring
- Belding–Merrick St. (260670003) TSP lead monitoring

In 2017, the MDEQ is planning to continue collecting lead measurements using high volume TSP samplers at the NCore sites in:

- Grand Rapids–Monroe St. (260810020)
- Allen Park (261630001)

NCore Monitoring Network:

The purpose of the NCore stations is to collect a variety of air quality measurements that can be used to provide an integrated approach to air quality management. Collection of a suite of measurements at a single site improves our understanding of how concentrations of various pollutants are inter-related and can evaluate the effectiveness of control programs. Data from NCore sites is also used for the determination of air quality trends, for model evaluation and for attainment purposes. Reference or equivalent methods must be used.

Network Design

Neighborhood and urban scale measurements are to be made at one NCore site per state. Some states, including Michigan, have more than one major population center or multiple airsheds with unique characteristics, so two to three NCore stations are required to adequately characterize air quality. Sampling at NCore sites should use a spatial scale of neighborhood (up to 4 km) or urban (4 km to 50 km).

There are a limited number of rural NCore stations. These NCore sites are located away from the influences of major sources, are sited in areas of relatively homogeneous geography, and should sample on a regional scale or larger. There are no rural NCore sites in Michigan.

Whether urban or rural, the *Federal Register*[4] specifies the minimum parameters that each NCore site must measure:

- Continuous $PM_{2.5}$
- 24-hr $PM_{2.5}$
- Speciated $PM_{2.5}$
- $PM_{10-2.5}$
- Ozone
- SO_2
- CO
- NO/NO_Y
- Wind speed
- Wind direction
- Relative humidity
- Outdoor temperature
- Lead (2016 discontinued)

Michigan NCore Sites

The MDEQ's NCore sites are located at Grand Rapids-Monroe St. (260810020) in the Grand Rapids-Wyoming CBSA and at Allen Park (261630001) in the Detroit-Warren-Livonia CBSA. Details were provided in the 2010 Network Review.

Tables 6 and **7** list the parameters measured at Grand Rapids-Monroe St. (260810020) and Allen Park (261630001), respectively. Start dates are also shown.

[4] "Environmental Protection Agency National Ambient Air Quality Standards for Lead; Final Rule." 40 CFR Parts 50, 51, 53 and 58, November 12, 2008.

The speciation samplers at the MDEQ NCore stations sample on a once every three day sampling schedule to meet the NCore monitoring requirements. The EPA sampling schedule is followed.

Low volume PM_{10} was added to the Grand Rapids–Monroe St. (260810020) site on January 14, 2010 and was added to the Allen Park (261630001) site on January 8, 2010. Lead was added to both sites in January 2010. Humidity was added to the Grand Rapids–Monroe St. (260810020) NCore station on March 3, 2010.

Site specific data for Michigan's NCore network is summarized in **Table 8**. A map showing the locations of NCore sites is displayed in **Figure 3**.

NCore Quality Assurance

The MDEQ's NCore stations contain a variety of monitors that are required to meet the federal requirements for NCore stations. Quality assurance is discussed for each type of monitor in the appropriate section of the network review.

Plans for 2017 NCore Monitoring Network

In 2017, the MDEQ is planning to continue to collect the measurements required for the NCore program at the following sites:

- Grand Rapids–Monroe St. (260810020)
- Allen Park (261630001)
- Lead monitoring will be continued at both sites, even though it is no longer required

TABLE 6: MEASUREMENTS COLLECTED AT THE GRAND RAPIDS - MONROE ST. (260810020) NCORE SITE

PARAMETER	DESIGNATION	SPATIAL SCALE	SAMPLING FREQUENCY	INSTRUMENT TYPE	METHOD	EXISTING MONITOR START UP DATE	NEW MONITOR ANTICIPATED START UP DATE	COMMENTS
$PM_{2.5}$ continuous	NCore/AQI	Neighborhood	Continuous	R & P TEOM 1400 a	tapered element oscillating microbalance	11/4/99	---	***DOES NOT meet FEM or ARM requirements***
$PM_{2.5}$ FRM mass	NCore	Neighborhood	1:3 days	R & P Partisol plus 2025	manual collection, gravimetric analysis	10/23/98	---	---
$PM_{2.5}$ Speciation	NCore	Neighborhood	1:3 days	Met One SASS + URG 3000N	manual collection, laboratory analysis*	6/1/02 at 1:6 sampling frequency	---	Freq. changed to 1:3 on 1/1/2011
Trace CO	NCore/AQI	Neighborhood	Continuous	API 300 eu/ TECO 48 i	non-dispersive infra red	4/25/07	---	probe height 5 m
Trace SO_2	NCore/AQI	Neighborhood	Continuous	API 100 eu/ TECO 43i	UV fluorescence	4/1/08	---	probe height 5 m
NO_y	NCore/AQI	Neighborhood	Continuous	TECO 42C	chemiluminescece	4/1/08	---	external converter installed at 10 m
Ozone	NCore/AQI was NAMS	Neighborhood	Continuous	API 400 A1E	UV absorption	4/24/80	---	Year round
Lead	Non source	Neighborhood	1:6 days	General Metal Works Hi Vol filter based	manual collection, ICP/MS analysis	1/8/10	---	Will continue, not required
$PM_{10-2.5}$ mass	NCore	Neighborhood	1:3 days	R & P Partisol plus 2025	manual collection, gravimetric analysis	7/16/10	---	---
$PM_{10-2.5}$ Continuous	---	---	---	---	---	---	---	Not planned
WS	NCore	---	Continuous	R. M. Young Prop. Anemom. & vane	vector summation	1/1/88	---	At 10 m
WD	NCore	---	Continuous	R. M. Young Prop. Anemom. & vane	vector summation	1/1/88	---	At 10 m
Relative Humidity	NCore	---	Continuous	R. M. Young	resistance hygrometer	3/3/10	---	> 4 m
Outdoor Temperature	NCore	---	Continuous	R. M. Young	thermometer	7/15/93	---	> 4 m
Sigma Theta	SLAMS	---	Continuous	R. M. Young Prop. Anemom. & vane	calculation	1/16/01	---	Optional
Barometric Pressure	SLAMS	---	Continuous	R. M. Young	electronic pressure sensor	7/15/93	---	Optional
PM_{10} Hi-vol	SLAMS	Neighborhood	1:6 days	Hi-vol	manual collection, gravimetric analysis	1/1/85	---	---

* Laboratory analysis consists of ion chromatography, X-Ray Fluorescence (XRF) and thermal optical analysis for ions, trace metals and forms of carbon, respectively.

TABLE 7: MEASUREMENTS COLLECTED AT THE ALLEN PARK (261630001) NCORE SITE

PARAMETER	DESIGNATION	SPATIAL SCALE	SAMPLING FREQUENCY	INSTRUMENT TYPE	METHOD	EXISTING MONITOR START UP DATE	NEW MONITOR ANTICIPATED START UP DATE	COMMENTS
$PM_{2.5}$ continuous	NCore/AQI	Neighborhood	Continuous	R & P TEOM 1400 a	tapered element oscillating microbalance	2/1/01	---	***DOES NOT meet FEM or ARM requirements***
$PM_{2.5}$ FRM mass	NCore	Neighborhood	1:1 day	R & P Partisol plus 2025	manual collection, gravimetric analysis	5/12/99	---	---
$PM_{2.5}$ Speciation	NCore	Neighborhood	1:3 day	Met One Super SASS + URG 3000N + IMPROVE carbon channel	manual collection, laboratory analysis*	12/1/00	---	---
Trace CO	NCore/AQI	Neighborhood	Continuous	API 300 eu/ TECO 48 i	non-dispersive infra red	6/1/07	---	4 m probe ht
Trace SO_2	NCore/AQI	Neighborhood	Continuous	API 100 eu / TECO 43 i as	UV fluorescence	4/1/08	---	4 m probe ht
NO_y	NCore/AQI	Neighborhood	Continuous	TECO 42C	chemiluminescece	4/1/08	---	external converter installed at 10 m
Ozone	NCore/AQI was NAMS	Neighborhood	Continuous	API 400 E	UV absorption	1/1/80	---	Year round 4 m probe ht
Lead	Non source	Neighborhood	1:6 days	General Metal Works Hi Vol filter based	manual collection, ICP/MS analysis	3/2/01 to 3/31/07; 1/2/10	---	Will continue, not required
$PM_{10-2.5}$ mass	NCore	Neighborhood	1:3 days	R & P Partisol plus 2025	manual collection, gravimetric analysis	7/16/10	---	---
$PM_{10-2.5}$ Continuous	---	---	---	---	---	---	---	Not planned
WS	NCore	---	Continuous	R. M. Young Prop. Anemom. & vane	vector summation	10/18/81	---	At 10 m
WD	NCore	---	Continuous	R. M. Young Prop. Anemom. & vane	vector summation	10/18/81	---	At 10 m
Relative Humidity	NCore	---	Continuous	R. M. Young	resistance hygrometer	1/1/00	---	> 4 m
Outdoor Temperature	NCore	---	Continuous	R. M. Young	thermometer	1/1/00	---	> 4 m
Sigma Theta	SLAMS	---	Continuous	R. M. Young Prop. Anemom. & vane	calculation	9/1/01	---	Optional
Barometric Pressure	SLAMS	---	Continuous	R. M. Young	electronic pressure sensor	1/5/71	---	Optional
Black Carbon	SLAMS	---	Continuous	Magee large spot AE21	optical absorption	12/19/03	---	Not Req by NCore
PM_{10} Hi-vol	Was NAMS	Neighborhood	1:6 days	Hi-vol	manual collection, gravimetric analysis	9/12/87	---	---

* Laboratory analysis consists of ion chromatography, X-Ray Fluorescence (XRF) and thermal optical analysis for ions, trace metals and forms of carbon, respectively.

TABLE 8: MICHIGAN'S NCORE MONITORING NETWORK

Monitoring Sites										
Site Name	AQS Site ID	Address	Latitude	Longitude	Purpose	Scale	County	Date Estab.	CBSA[1]	Pop (2010 Census)
Grand Rapids - Monroe St	260810020	1179 Monroe St., NW,	42.98417	-85.6714	Pop. Exp.	Neighborhood	Kent	1/1/10	GW	988,938
Allen Park	261630001	14700 Goddard	42.22861	-83.2083	Pop. Exp.	Neighborhood	Wayne	1/1/10	DWL	4,296,250

[1] **CBSA Key:**

DWL = Detroit-Warren-Livonia Core Based Statistical Area
GW = Grand Rapids-Wyoming Core Based Statistical Area

FIGURE 3: MICHIGAN'S NCORE MONITORING NETWORK

Ozone Monitoring Network:

On October 26, 2015, the EPA revised the Ozone NAAQS, lowering the standard to 0.070 ppm and extending the ozone season in many areas, including Michigan, from March 1st to October 31st. The MDEQ will extend the ozone season starting in 2017.

As a result of the October 17, 2006 monitoring regulations, the minimum number of required ozone sites in an MSA were changed. In addition, due to the 2000 census, MSA boundaries were modified and population totals tied to measurements of ambient air quality were increased. A monitor with a design value (using the most recent three years of data) that is ≥ 85% of the ozone NAAQS has a higher probability of violating the standard. Therefore, the EPA requires more monitors in these MSAs. In other instances, the number of monitors may be reduced if the design value is greater than 115% of the NAAQS.[5] Note: background and transport ozone monitors are still required, but are not shown in **Table 9**.

TABLE 9: SLAMS MINIMUM OZONE MONITORING REQUIREMENTS

MSA POPULATION[1,2]	MOST RECENT THREE-YEAR DESIGN VALUE CONCENTRATIONS ≥ 85% OF ANY OZONE NAAQS[3]	MOST RECENT THREE-YEAR DESIGN VALUE CONCENTRATIONS < 85% OF ANY OZONE NAAQS[3,4]
> 10 million	4	2
4 - 10 million	3	1
350,000 - < 4 million	2	1
50,000 - < 350,000[5]	1	0

[1] Minimum monitoring requirements apply to the MSA.
[2] Population based on the latest available census figures.
[3] The ozone NAAQS levels and forms are defined in 40 CFR Part 50.
[4] These minimum monitoring requirements apply in the absence of a design value.
[5] MSA must contain an urbanized area of 50,000 or more population.

Applying the requirements described in **Table 9** to Michigan's MSAs, population totals and the most recent 3-year design values results in a minimum ozone network design summarized in **Table 10**. All monitors in Michigan are within 85% of the ozone NAAQS of 0.070 ppm.

Figure 4 illustrates changes in the 3-year averages of the fourth highest ozone values, called design values, from 2011 to 2015. When contemplating changes to the ozone network, it is important to consider changes in design values in nonattainment areas. In 2015, the EPA lowered the ozone NAAQS to 0.070 ppm. The design values for 2011-2013 and 2012-2014 are compared to the old standard of 0.075 ppm, which was in effect in those years. The design value for 2013-2015 is compared to the new standard of 0.070 ppm. It is important to note, that for 2013-2015 all counties in Michigan were meeting the 0.075 ppm standard.

[5] Table D-2 of Appendix D to Part 58.

Table 10: Application of Minimum Ozone Requirements in the October 17, 2006 Final Revision to the Monitoring Regulation to Michigan's Ozone Network

Table 10: Application of Minimum Ozone Monitoring Requirements in the October 17, 2006 Final Revision to the Monitoring Regulation to Michigan's Ozone Network

NAAQS: 0.070 ppm

> = 85% 0.059 ppm

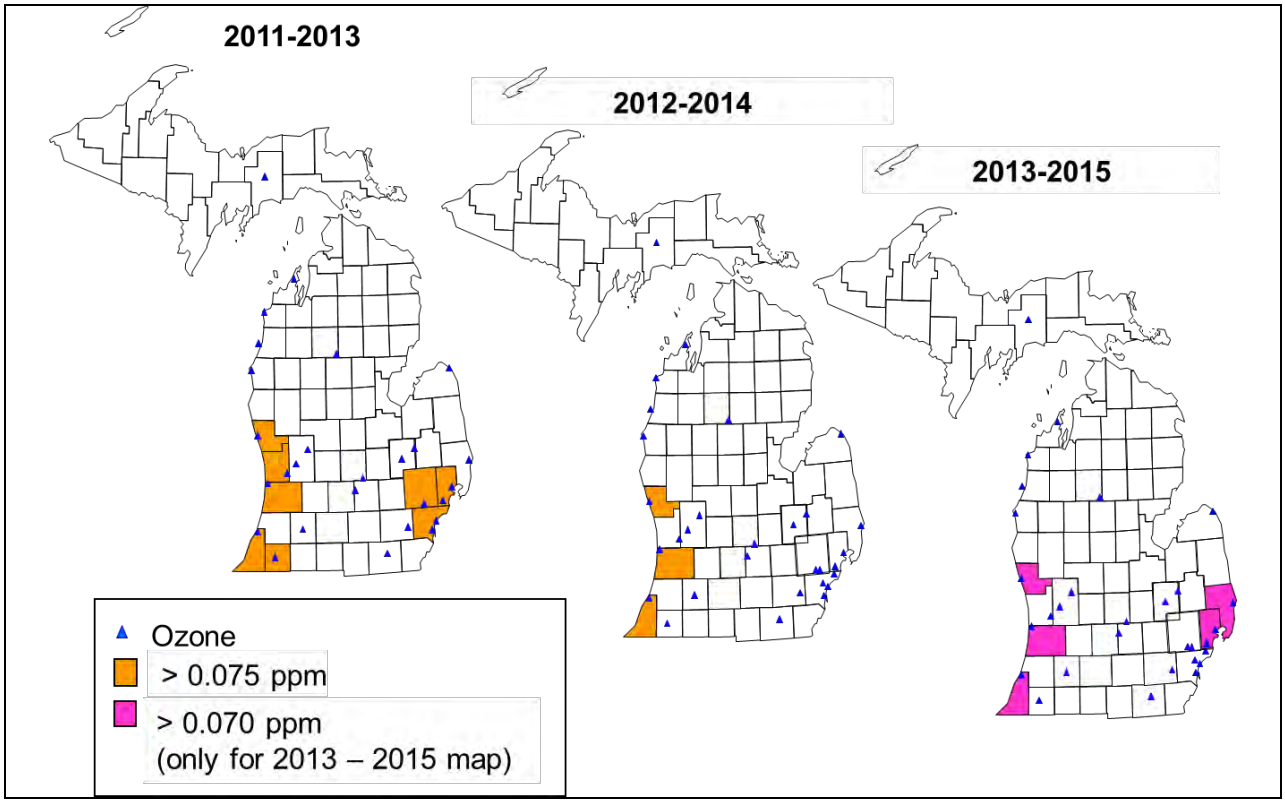
Decimals to the right of the third decimal place are truncated.

The 3-year O3 average at the MSA Design Value site is shown in bold.

Values for sites >= 85% NAAQS are in red.

CBSA	2010 Population	Counties	Existing Monitors	2013-2015 most recent 3-year O3 design value	Min No monitors Required
Detroit-Warren-Livonia Metro Area	4,296,250	Macomb	New Haven	0.071	**3**
			Warren	0.066	
		Oakland	Oak Park	0.066	
		Wayne	Allen Park	0.064	
			Detroit - E 7 Mile	0.070	
		Lapeer	---		
		St Clair	Port Huron	**0.072**	
		Livingston	---		
Flint Metro Area	425,790	Genesee	Flint	0.066	2
			Otisville	**0.067**	
Monroe Metro Area	152,021	Monroe	---		
Ann Arbor Metro Area	344,791	Washtenaw	Ypsilanti	**0.066**	1
Grand Rapids-Wyoming Metro Area	774,160	Kent	Grand Rapids - Monroe St	**0.067**	2
			Evans	0.067	
		Barry	---		
		Newaygo	---		
		Ionia	---		
Holland-Grand Haven Metro Area	263,801	Ottawa	Jenison	**0.068**	1
Muskegon-Norton Shores Metro Area	172,188	Muskegon	Muskegon - Green Creek Rd	**0.074**	1
Lansing-East Lansing Metro Area	464,036	Clinton	Rose Lake	0.064	2
		Ingham	Lansing	**0.065**	
		Eaton	---		
Bay City Metro Area	107,771	Bay	---		
Saginaw-Saginaw Twp N Metro Area	200,169	Saginaw	---		
Kalamazoo-Portage Metro Area	326,589	Kalamazoo	Kalamazoo	**0.067**	1
		Van Buren	---		
Niles-Benton Harbor Metro Area	156,813	Berrien	Coloma	**0.073**	1
Jackson Metro Area	160,248	Jackson	---		
Battle Creek Metro Area	136,146	Calhoun	---		
South Bend Mishawaka Metro Area IN/MI	52,293	Cass	Cassopolis	**0.068**	1
Other areas:	Comments				
	transport site	Lenawee	Tecumseh	0.065	
		Benzie	Frankfort	0.068	
		Huron	Harbor Beach	0.065	
		Allegan	Holland	0.075	
	background site	Missaukee	Houghton lake	0.064	
		Mason	Scottville	0.068	
		Schoolcraft	Seney	0.068	
	tribal site	Manistee	Manistee	0.067	
		Chippewa	Sault Ste. Marie	0.059	

FIGURE 4: COMPARISON OF 4TH HIGHEST 8-HOUR OZONE VALUES AVERAGED OVER THREE YEARS 2011-2013, 2012-2014 AND 2013-2015



In southeast Michigan, New Haven (260990009) has been the design value site for many years, measuring maximum ozone concentrations downwind from Detroit. However, in 2009, the Detroit-E 7 Mile (261630019) location became the new design value site for the Detroit-Warren-Livonia MSA. The 2013-2015 data shows Port Huron (261470005) to be the design value site. The location of the maximum ozone concentration has moved in recent years, possibly due to changes in the amount, type and location of ozone precursor emissions. Allen Park (261630001) is upwind of the central business district and is an NCore site for the Detroit-Warren-Livonia MSA. As such, the MDEQ is required to measure ozone over the entire year at the Allen Park (261630001) site, instead of only during the April through September ozone season in Michigan. Although three ozone sites have been identified for the Detroit-Warren-Livonia MSA, EPA Regional staff have indicated that Warren (260991003) may be becoming the new design value site for that area. The Oak Park (261250001) and Port Huron (261470005) monitors are the only ozone sites in Oakland and St. Clair Counties, respectively. All monitors in Southeast Michigan, except for Port Huron (261470005) and New Haven (260990009) are meeting the current ozone standard of 0.070 ppm.

Two monitors are required in the Ann Arbor MSA and consist of the Ypsilanti monitor (261610008) and the downwind monitor in Oak Park (261250001). The urban center city location coupled with a downwind maximum concentration site is a carry-over from the defunct NAMS network. There is not sufficient space in Washtenaw County to site a downwind monitor to measure maximum ozone concentrations, so Oakland County houses the downwind site although it is outside of the boundary of the Ann Arbor MSA. The upwind/downwind configuration will be retained wherever possible to preserve historical trend data.

Two monitors are required in the Flint MSA; they consist of the urban center city site in Flint (260490021) and the downwind site at Otisville (260492001).

Two ozone monitors are also required in the Grand Rapids-Wyoming MSA. They consist of the urban center city site in Grand Rapids on Monroe St. (260810020) and the downwind site at Evans (260810022).

Two monitors are required in the Lansing-East Lansing MSA consisting of the urban center city site in Lansing (260650012) and the downwind Rose Lake (260370001) location. The MDEQ will be losing site access at the current Rose Lake site, currently we are working with the Michigan Department of Natural Resources (MDNR) to move the site 0.5 miles down the road to another MDNR location. The MDEQ will get approval from the Region before finalizing the new site location.

A single ozone monitor is required in the MSAs of Holland-Grand Haven, Muskegon-Norton Shores, Kalamazoo-Portage, Niles-Benton Harbor, and South Bend-Mishawaka. The Jenison (261390005), Muskegon–Green Creek Rd. (261210039), Kalamazoo (260770008), Coloma (260210014) and Cassopolis (260270003) monitors fulfill these requirements, respectively. Coloma (260210014) and Muskegon-Green Creek Rd. (261210039) are violating the 0.070 ppm 8-hour ozone NAAQS.

The ozone monitor in Holland (260050003) is in Allegan County and is violating the 0.070 ppm 8-hour ozone NAAQS. This site continually measures the highest ozone values in the state and had historically been the highest in the region.

The Lake Michigan Air Directors Consortium (LADCO) created the map shown in **Figure 5** comparing ozone concentrations across the region.

Tecumseh (260910007) measures ozone transport into southeast Michigan and is required by Michigan's maintenance plan. Harbor Beach (260630007) measures transport out of southeast Michigan under southwesterly winds. Scottville (261050007) and Benzonia (260190003) are sited to measure transport of ozone along Lake Michigan and have been in operation for 18 and 24 years, respectively. These two sites are also an important part of Michigan's maintenance plan. Houghton Lake (261130001) and Seney (261530001) measure background ozone levels in the Lower and Upper Peninsulas, respectively.

To the best of our knowledge, the tribal ozone sites in Manistee (261010922) and in Sault Ste Marie (260330901) will continue to operate.

FIGURE 5: OZONE DESIGN VALUES 2013 – 2015[6]

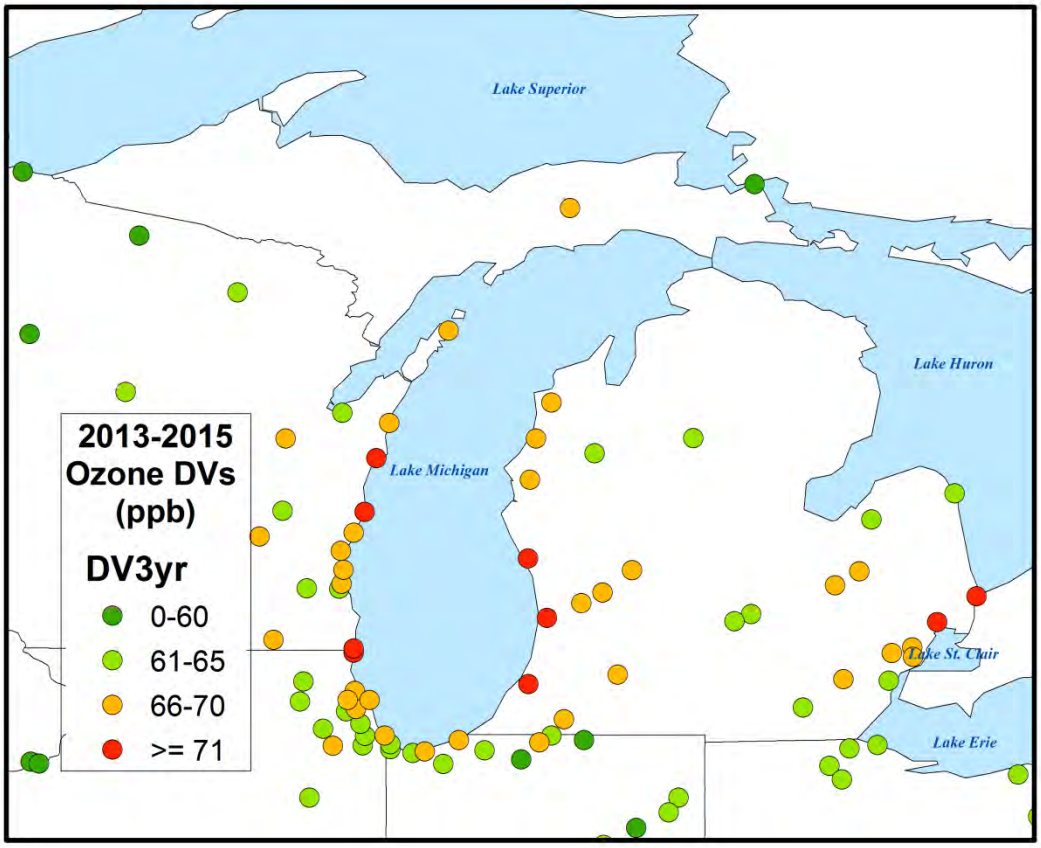


Table 11 summarizes the ozone monitoring site information for sites that were in existence in 2016 and are planned to be operational in 2017. **Figure 6** illustrates the geographical distribution of this network.

[6] Map provided by D. Kenski, Lake Michigan Air Directors Consortium

TABLE 11: MICHIGAN'S OZONE MONITORING NETWORK

Operating Schedule Hourly, April 1 to September 30; *NCore operate hourly all year*
Houghton Lake and Lansing operate hourly all year
Method: Ultra Violet Absorption Continuous Monitor; Method Code 087

Former NAMS sites are shown in bold.

SLAMS Stations

NCore sites are shown in italics

Monitoring Sites										
Site Name	AQS Site ID	Address	Latitude	Longitude	Purpose	Scale	County	Start Date	CBSA [1]	Pop (2010 Census)
Rose Lake	**260370001**	**8562 E Stoll Rd**	42.7983	-84.39389	**max conc**	**urban**	**Clinton**	**6/7/79**	**LEL**	**464,036**
Flint	**260490021**	**Whaley Park, 3610 Iowa**	43.0472	-83.67028	**pop exp**	**nghbrhd**	**Genesee**	**6/16/92**	**F**	**425,790**
Otisville	**260492001**	**G11107 Washburn Rd**	43.1683	-83.46167	**max conc**	**urban**	**Genesee**	**5/13/80**	**F**	**425,790**
Lansing	**260650012**	**220 N Pennsylvania**	42.7386	-84.53472	**pop exp**	**nghbrhd**	**Ingham**	**9/5/80**	**LEL**	**464,036**
GR - Monroe St	***260810020***	***1179 Monroe NW***	*42.9842*	*-85.6714*	***pop exp***	***nghbrhd***	***Kent***	***4/24/80***	***GW***	***988,938***
Warren	**260991003**	**29900 Hoover**	42.5133	-83.00611	**max conc**	**urban**	**Macomb**	**1/1/77**	**DWL**	**4,296,250**
Holland	260050003	966 W 32nd St	42.7678	-86.14861	max conc	urban	Allegan	8/25/92	A	111,408
Frankfort / Benzonia	260190003	West St., Benzonia Twp.	44.61694	-86.10944	max conc	regional	Benzie	7/28/92	TC	143,372
Coloma	260210014	Paw Paw WWTP, 4689 Defield Rd.,Coloma	42.1978	-86.30972	max conc	regional	Berrien	8/3/92	NBH	156,813
Cassopolis	260270003	Ross Beatty High School, 22721 Diamond	41.8956	-86.00167	pop exp	urban	Cass	5/16/91	SBM	52,293
Harbor Beach	260630007	1172 S. M 25, Sand Beach Twp.	43.8364	-82.64306	backgrd	regional	Huron	4/1/94	Not in CBSA	N/A
Kalamazoo	260770008	Fairgrounds, 2500 Lake St	42.2781	-85.54194	pop exp	nghbrhd	Kalamazoo	6/1/92	KP	326,589
Evans	260810022	10300 14 Mile Road, NE	43.1767	-85.41667	max conc	urban	Kent	4/1/99	GW	988,938
Tecumseh	260910007	6792 Raisin Center Highway	41.9956	-83.94667	up wind backgrd	regional	Lenawee	7/6/93	AL	99,892
New Haven	260990009	57700 Gratiott	42.7314	-82.79361	max conc	urban	Macomb	7/14/80	DWL	4,296,250
Houghton Lake	261130001	1769 S Jeffs Road	44.3106	-84.89194	background	regional	Missaukee	4/1/98	Not in CBSA	N/A
Scottville	261050007	525 W US 10	43.9533	-86.29444	max conc	regional	Mason	4/1/98	L	28,680
Muskegon - Green Ck	261210039	1340 Green Creek Road	43.2781	-86.31111	pop exp	regional	Muskegon	5/1/91	MNS	172,188
Oak Park	261250001	13701 Oak Park Blvd.	42.4631	-83.18333	pop exp	urban	Oakland	1/9/81	DWL	4,296,250
Jenison	261390005	6981 28Th Ave. Georgetown Twp.	42.8944	-85.85278	pop exp	urban	Ottawa	4/1/89	HGH	263,801
Port Huron	261470005	2525 Dove Rd	42.9533	-82.45639	pop exp	urban	Saint Clair	2/28/81	DWL	4,296,250
Seney	261530001	Seney Wildlife Refuge, HCR 2 Box 1	46.2889	-85.95027	bkgrd	regional	Schoolcraft	1/15/02	Not in CBSA	N/A
Ypsilanti	261610008	555 Towner Ave	42.2406	-83.59972	pop exp	nghbrhd	Washtenaw	4/1/00	AA	344,791
Allen Park	*261630001*	*14700 Goddard*	*42.2286*	*-83.2083*	*pop exp*	*nghbrhd*	*Wayne*	*1/1/80*	*DWL*	*4,296,250*
Detroit - E 7 Mile	261630019	11600 East Seven Mile Road	42.4308	-83.00028	max conc	urban	Wayne	4/11/77	DWL	4,296,250

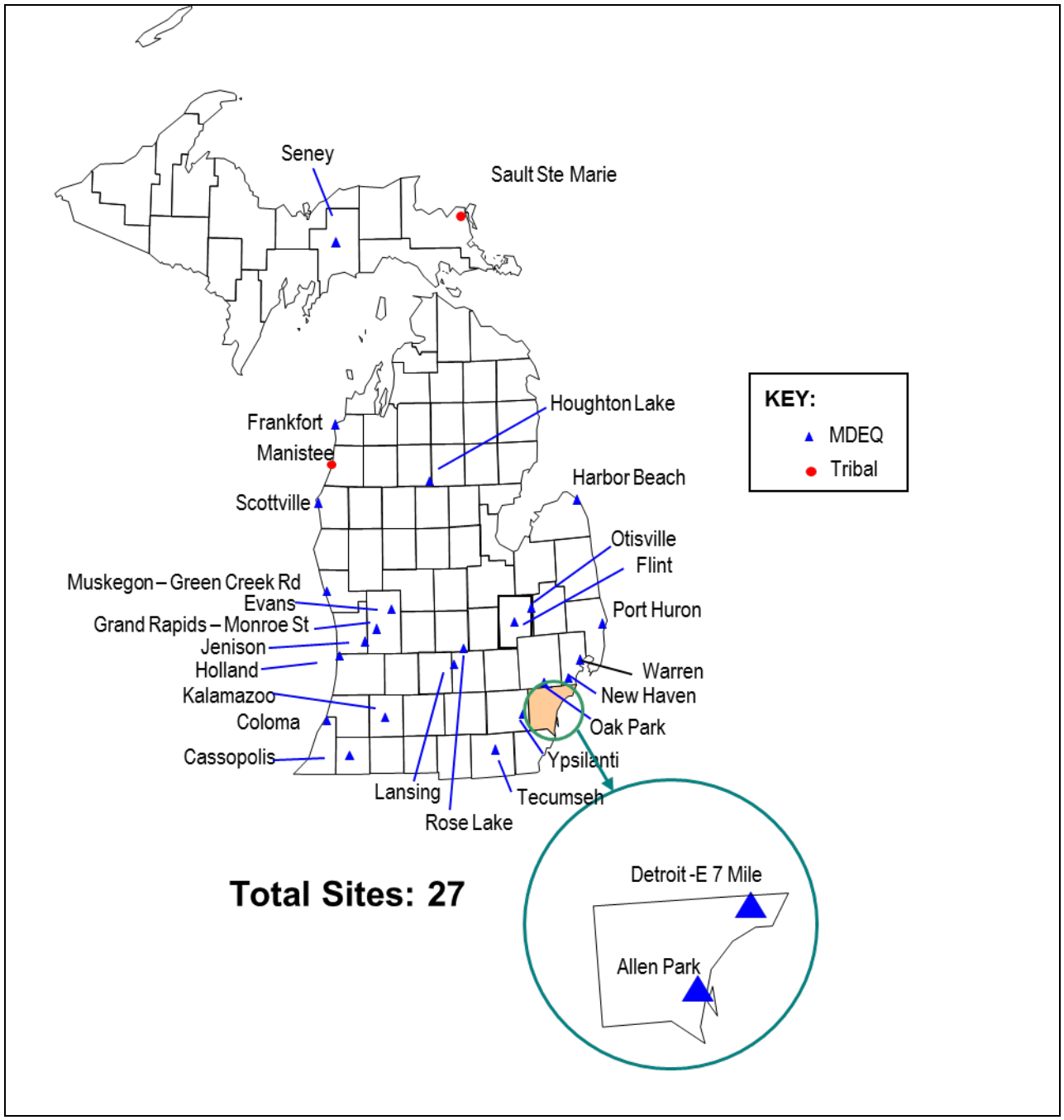
Tribal Stations

Monitoring Sites										
Site Name	AIRS Site ID	Address	Latitude	Longitude	Purpose	Scale	County	Start Date	CBSA [1]	Pop (2010 Census)
Manistee	261010922	3031 Domres Rd	44.307	-86.24268	transport	regional	Manistee	4/1/06	SSM	38,520
Sault Ste. Marie	260330901	650 W Easterday Ave	46.4936	-84.3641	transport	nghbrhd	Chippewa	1/1/12	Not in CBSA	N/A

[1] **CBSA Key:**

A = Allegan Micropolitan Area
AA = Ann Arbor Metro. Area
AL= Adrian Micropolitan Area
DWL= Detroit-Warren-Livonia Metro. Area
F = Flint Metro Area
GW=Grand Rapids-Wyoming Metro. Area
HGH = Holland-Grand Haven Metro. Area
KP= Kalamazoo-Portage Metro. Area
L= Ludington Micropolitan Area
LEL= Lansing-E. Lansing Metro. Area
MNS = Muskegon-Norton Shores Metro. Area
NBH = Niles-Benton Harbor Metro. Area
SSM= Sault Ste Marie Micropolitan Area

FIGURE 6: MICHIGAN'S OZONE NETWORK



Ozone Season & Modeling

With the enactment of the 0.070 ppm 8-hour primary NAAQS, the length of the ozone season was modified Michigan. The new ozone NAAQS final rule extends the ozone season in Michigan from March 1st through October 31st . This new season will start with the 2017 ozone season.

With the new 1-hour NO_2 NAAQS, modeling conducted as part of the permitting process for new source review (NSR) has indicated that many facilities in Michigan could violate the standard. More refined modeling is an option using the Ozone Limiting Method or Plume Volume Molar Ratio Method (PVMRM), but more site-specific 1-hour NO_2 background levels, as well as year around ozone values, are necessary. Specifically, modeling staff need five years of both ozone and NO_2 data collected in small cities, urban and rural areas. While Allen Park (2616309001) and Grand Rapids–Monroe St. (260810020) generate ozone values in urban areas throughout the year, levels in smaller cities and rural areas were not available. Therefore, beginning October 1, 2010, the MDEQ began to monitor for ozone throughout the year at the Lansing (260650012) and Houghton Lake (261130001) stations. The collection of additional NO_2 data to support NSR modeling is discussed in the NO_2 section.

Ozone Quality Assurance

Site operators conduct precision checks on the monitors every two weeks. The results of the precision checks are sent to the QA Coordinator for review each quarter. Each ozone monitor is also audited annually by the AMU's QA Team. The audit utilizes a dedicated ozone photometer to assess the accuracy of the station monitor. The auditor also assesses the monitoring system (inspecting the sample line, filters, and the inlet probe), siting, and documentation of precision checks. The results of the ozone audits and precision checks indicate whether the monitor is meeting the measurement quality objectives. The AMU uploads the results of the precision checks and audits to the EPA's AQS database each quarter. The QA Coordinator reviews all audits and hard copies are retained in the QA files.

The EPA conducts thru-the-probe audits of 20% of the MDEQ's ozone monitors each year. The audit consists of delivering four levels of ozone to the station monitor through the probe. The percent difference that is measured by the auditor's monitor is compared to the station monitor. The auditor also assesses station and monitoring siting criteria. The EPA auditor provides the AMU with a copy of the audit results and uploads the audit data to AQS.

Plans for the 2017 Ozone Monitoring Network

Beginning October 1, 2009, the MDEQ began collecting ozone measurements all year at the NCore sites and plans to continue through 2017:

- Grand Rapids–Monroe St. (260810020)
- Allen Park (261630001).

To support NSR modeling projects, the MDEQ will continue to collect ozone measurements all year through 2017:

- Lansing (260650012)
- Houghton Lake (261130001) (special purpose monitor)

The current ozone network meets the minimum design specifications in 40 CFR Part 58. No ozone site reductions are planned at this time. The following monitors are planned to be retained as part of the 2017 ozone network; operating March 1st through October 31st:

- Holland (260050003)
- Frankfort/Benzonia (260190003)
- Coloma (260210014)
- Cassopolis (260270003)
- Rose Lake (260370001) will need to be moved at end of 2016
- Flint (260490021)
- Otisville (260492001)
- Harbor Beach (260630007) (downwind monitor)
- Kalamazoo (260770008)
- Evans (260810022)
- Tecumseh (260910007) (background monitor)
- New Haven (260990009)
- Warren (260991003)
- Scottville (261050007)
- Muskegon–Green Creek Rd. (261210039)
- Oak Park (261250001)
- Jenison (261390005)
- Port Huron (261470005)
- Seney (261530001)
- Ypsilanti (261610008)
- Detroit-E 7 Mile (261630019)

To the best of our knowledge, these tribal monitors will also continue to operate in 2017:

- Manistee (261050922) (tribal monitor)
- Sault Ste. Marie (260330901) (tribal monitor)

$PM_{2.5}$ FRM Monitoring Network:

The January 15, 2013 revision to the PM NAAQS lowered the $PM_{2.5}$ annual average from 15.0 $\mu g/m^3$ to 12.0 $\mu g/m^3$. All sites in Michigan are currently meeting this standard.

The October 17, 2006 changes to the monitoring regulations impacted the minimum number of $PM_{2.5}$ sites in an MSA, as shown in **Table 13**.[7] In addition to these minimum requirements, background and transport monitors are required.

Although speciation monitoring is required, details specifying the exact number of sites and their sampling frequency were not stated in the October 17, 2006 regulations. However, the continued operation of the speciation trends site Allen Park (261630001) on a once every three day sampling schedule is required.

The regulations also allow states to discontinue FRM monitors if they can operate continuous samplers in a way that qualifies them to be Approved Regional Method (ARM) or Federal Equivalent Method (FEM) samplers. Due to the high levels of nitrate and humidity in the Midwest, the continuous monitors used by the MDEQ (TEOMs), as well of many of the other monitors operated by states in the Midwest show a bias. Therefore, the MDEQ will avoid deploying any continuous monitors that have ARM or FEM status.

Michigan does not spatially average $PM_{2.5}$ values from multiple sites to determine attainment with the annual $PM_{2.5}$ NAAQS. Therefore, if a $PM_{2.5}$ monitor that is violating the NAAQS must be removed due to loss of access or funding, a replacement site need not be found, if the annual and/or 24-hour design value site(s) in that MSA are still operational. The attainment status of the area is dependent upon the design value sites.

TABLE 12: $PM_{2.5}$ MINIMUM MONITORING REQUIREMENTS

MSA POPULATION[1,2]	MOST RECENT THREE-YEAR DESIGN VALUE CONCENTRATIONS ≥ 85% OF ANY $PM_{2.5}$ NAAQS[3]	MOST RECENT THREE-YEAR DESIGN VALUE CONCENTRATIONS < 85% OF ANY $PM_{2.5}$ NAAQS[3,4]
> 1,000,000	3	2
500,000 – < 1,000,000	2	1
50,000 - ≤ 500,000[5]	1	0

[1] Minimum monitoring requirements apply to the MSA.
[2] Population based on the latest available census figures.
[3] The $PM_{2.5}$ NAAQS levels and forms are defined in 40 CFR Part 50.
[4] These minimum monitoring requirements apply in the absence of a design value.
[5] MSA must contain an urbanized area of 50,000 or more.

The regulations also state that any FRM monitors that are within ± 5% of the level of the 24-hour NAAQS must sample on a daily sampling frequency. The monitoring regulations also state that 50% of all required FRM sites must co-locate continuous $PM_{2.5}$ measurements.

In 2016, the MDEQ changed all FRM monitors to very sharp cut cyclones. The change outs were made in April and May of 2016. This changed the method code from 118 to 142. The dates of each instrument conversion can be determined by the data in the EPA AQS database.

Applying **Table 12** to Michigan's MSAs, population totals and most recent three-year design values results in **Table 13**. Design values that are shown in bold represent the controlling site in each MSA, which is also called the design value site.

[7] Table D-5 of Appendix D to Part 58.

TABLE 13: APPLICATION OF THE MINIMUM $PM_{2.5}$ MONITORING REQUIREMENTS IN THE OCTOBER 17, 2006 FINAL REVISION TO THE MONITORING REGULATION TO MICHIGAN'S $PM_{2.5}$ FRM NETWORK

The annual avg & 24-hr avg are rounded to 1 and 0 decimal points respectively.

annual	24-hr	**5% of the 24-Hr NAAQS**
85% of 12 ug/m3	85% of 35 ug /m3	33-37 = 5% NAAQS
10.2	30	

The 3-year PM2.5 average at MSA Design Value site is shown in bold.

MSA	2010 Population	Counties	Existing Monitors	2013-2015 most recent 3-year PM2.5 design value (annual)	2013-2015 most recent 3-year PM2.5 design value (24-Hr)	Min No monitors Required	Comments
Detroit-Warren-Livonia Metro Area	4,296,250	Macomb	New Haven	9.0	26	3	
		Oakland	Oak Park	9.0	24		
		Wayne	Allen Park	9.8	24		daily
			Detroit-SW HS	10.8	24		
			Detroit - Linwood	9.6	24		
			Detroit - E 7 Mi	9.4	23		
			Livonia	9.3	24		
			Dearborn	**11.4**	**26**		
			Wyandotte	8.8	21		
			Detroit-FIA/Lafayette	9.4	23		daily- special study
			Livonia Near Road	nough data to calculate			
		Lapeer	---				
		St Clair	Port Huron	9.1	24		
		Livingston	---				
Flint Metro Area	425,790	Genesee	Flint	**8.2**	**21**	**0**	
Monroe Metro Area	152,021	Monroe	Sterling State Park	**9.0**	**23**	**0**	
Ann Arbor Metro Area	344,791	Washtenaw	Ypsilanti	**9.3**	**23**	**0**	
Grand Rapids-Wyoming Metro Area	774,160	Kent	GR - Monroe St	9.1	22	**1**	
			GR - Wealthy St	**9.4**	**23**		
		Barry	---				
		Newaygo	---				
		Ionia	---				
Holland-Grand Haven Metro Area	263,801	Ottawa	Jenison (closed)			**0**	
Muskegon-Norton Shores Metro Area	172,188	Muskegon	Muskegon - Apple St (closed)			**0**	
Lansing-East Lansing Metro Area	464,036	Clinton	---				
		Ingham	Lansing	**8.5**	**21**	**0**	
		Eaton	---				
Bay City Metro Area	107,771	Bay	Bay City	**7.8**	**20**	**0**	
Kalamazoo-Portage Metro Area	326,589	Kalamazoo	Kalamazoo	**9.2**	**21**	**0**	
		Van Buren	---				
Niles-Benton Harbor Metro Area	156,813	Berrien	Coloma	**8.3**	**19**	**0**	
Jackson Metro Area	160,248	Jackson	---				
Battle Creek Metro Area	136,146	Calhoun	---				
South Bend-Mishaw aka Metro Area IN/MI	52,293	Cass	---				
Other areas							
		Allegan	Holland	8.1	21		*micropolitan area*
		Missaukee	Houghton Lake	5.6	17		
		Manistee	Manistee	6.3	18		
		Tecumseh	Lenawee	8.4	22		
		Sault Ste. Marie	Chippewa	6.2	15		

The reduced concentrations of $PM_{2.5}$ measured since 2010 have caused the 2013-2015 design values to drop markedly in many MSAs. The minimum number of monitoring sites in Monroe, Ann Arbor, Holland-Grand Haven, Muskegon-Norton Shores, Lansing-East Lansing, Bay City, Kalamazoo-Portage, Flint and Niles-Benton Harbor has fallen from one site to zero sites. Using the most recent data, only a single site is required in the Grand Rapids-Wyoming MSA, instead of two.

Only three $PM_{2.5}$ FRM monitors are required in the Detroit-Warren-Livonia MSA. Dearborn (261630033) has historically been the highest annual design value site. Allen Park (261630001)

is the population-oriented trend site, and as such, is also required to collect speciated $PM_{2.5}$ samples on a once every three day schedule.

The Wyandotte site (261630036) has the lowest design values in Wayne County.
The Linwood site (261630016) is also located in Wayne County between the Dearborn (261630033) and E 7 Mile (261630019) sites. The MDEQ will continue to operate these sites.

The Detroit-SWHS site (261630015) is the second highest site in the Detroit-Warren-Livonia MSA. Also, there are plans to make a second International crossing near this site. The MDEQ will continue to operate this site.

Detroit–FIA/Lafayette (261630039) was a special purpose monitors that have been located to measure impacts from diesel powered mobile sources and from the international border crossing at the Ambassador Bridge. The MDEQ will continue to operate this site, however since there is no longer a co-located continuous Beta-Attenuation Monitor (BAM) located at the site the MDEQ would like to decrease the frequency from daily to 1:3 day sampling.

The E 7 Mile site (261630019) is near the border of Wayne and Macomb Counties. The MDEQ will continue to operate this site.

The sites at New Haven (260990009) and Oak Park (261250001) are the only sites in Macomb and Oakland Counties, respectively. The MDEQ will continue to operate these.

The Livonia site (261630025) and the Livonia Near Road site (261630095) are in western Wayne County. The MDEQ will continue to operate these sites.

Through a cooperative grant project with EPA Region 5 and the EPA's Office of Research and Development (ORD), the MDEQ deployed a special purpose $PM_{2.5}$ FRM sampler to Tecumseh (260910007) in Lenawee County on April 1, 2008. Other special measurements that were added to the Tecumseh site include $PM_{2.5}$ speciation and continuous EC/OC. The MDEQ will continue to collect FRM measurements at Tecumseh as the upwind background site near the Detroit-Warren-Livonia MSA.

In the past, two monitors were required in the Grand Rapids-Wyoming MSA, the site at Monroe St. (260810020) and at Wealthy St. in Wyoming (260810007). Now that the design value has been reduced, only a single site is required in the Grand Rapids-Wyoming MSA. The Grand Rapids – Monroe St (260810020) is an NCore site and is therefore, required to retain the $PM_{2.5}$ monitor. At this time, MDEQ will continue to operate both monitors.

Due to the reduction in fine particulate values, a monitor is no longer required in the Monroe MSA. The Sterling State Park site (261150006) is in Monroe County and the MDEQ will continue to operate it.

As shown in **Table 13**, using the most recent three years of data, the Flint (260490021) monitor has an annual and a 24-hour design value equaling 8.2 and 21 $\mu g/m^3$, respectively. Both of these values are less than 85% of their respective NAAQS. Therefore, a $PM_{2.5}$ monitoring site is no longer required in the Flint MSA, but no changes are suggested at this time.

Fine particulate concentrations have dropped below 85% of the level of the NAAQS in the Ann Arbor MSA, so a monitor is no longer required. The Ypsilanti site (261610008) is located in a ZIP code with some of the highest incidences of asthma in Michigan. A co-located monitor is also located at this site to determine precision. No changes are suggested at this time.

The annual and 24-hour $PM_{2.5}$ design values at the Lansing monitor (260650012) are no longer greater than 85% of the NAAQS, indicating that monitoring is no longer required. The MDEQ will continue to operate the monitor.

The Saginaw MSA is required to have a $PM_{2.5}$ FRM site. The EPA Regional Administrator granted a waiver allowing for the Bay City site (260170014) to fulfill this requirement. The 24-hour $PM_{2.5}$ design value of the monitor in Bay City is less than 85% of the NAAQS, indicating that monitoring is no longer required. The MDEQ will continue to operate the monitor.

The Kalamazoo monitor (260770008) fulfilled the requirement that the Kalamazoo-Portage MSA have one FRM sampler. Both the most recent 24-hour and annual design value at the Kalamazoo monitor are now less than 85% of the respective NAAQS, indicating that one site is no longer necessary in this MSA. However, the MDEQ will continue to operate the monitor.

Coloma (260210014) fulfilled the requirement for the Niles-Benton Harbor MSA. The 24-hour $PM_{2.5}$ design value at this site is no longer greater than 85% of the NAAQS, indicating that a monitor is no longer required, but the MDEQ will continue to operate the monitor.

The $PM_{2.5}$ monitor in Holland (260050003) in Allegan County is a micropolitan area. The monitor's design value is no longer within 85% of the NAAQS. Now that concentrations have fallen, it may be possible to discontinue monitoring at Holland, but the MDEQ will continue to operate the monitor.

Houghton Lake (261130001) is the background $PM_{2.5}$ FRM site in Michigan.

There are two tribal $PM_{2.5}$ monitoring sites located in Michigan, one in Manistee (261010922) and a co-located pair in Sault Ste. Marie (260330901)

Table 14 summarizes the $PM_{2.5}$ FRM monitoring site information for 2016 and 2017. **Figure 7** illustrate the geographical distribution of $PM_{2.5}$ FRM monitors for 2016 and 2017.

TABLE 14: MICHIGAN'S $PM_{2.5}$ FRM NETWORK

SLAMS Network

Operating Schedule: Once every 6 days, once every 3 days or daily see below.
Method: Partisol 2025 Rupprecht & Patashnick Samplers; Method Code 142

Site Name	Monitoring Sites AQS Site ID	Address	Latitude	Longitude	Sampling Frequency	Purpose	Scale	County	Start Date	CBSA [1]	Pop (2010 Census)
Holland	260050003	966 W. 32nd, Holland	42.767778	-86.148611	1:3	Pop. Exp.	Neighborhood	Allegan	10/31/98	A	111,408
Bay City	260170014	1001 Jennison St	43.571389	-83.890833	1:3	Pop. Exp.	Neighborhood	Bay	8/24/00	BC	107,771
Coloma	260210014	4689 Defield Rd., Paw Paw WWTP	42.197778	-86.309722	1:3	Transport	Regional	Berrien	11/7/98	NB	156,813
Flint	260490021	Whaley Park, 3610 Iowa St., Flint	43.04722	-83.670278	1:3	Pop. Exp.	Neighborhood	Genesee	12/16/98	F	425,790
Lansing	260650012	220 N. Pennsylvania	42.738611	-84.534722	1:3	Pop. Exp.	Neighborhood	Ingham	11/7/98	LEL	464,036
Kalamazoo	260770008	Fairgrounds, 1400 Olmstead Rd	42.278056	-85.541944	1:3	Pop. Exp.	Neighborhood	Kalamazoo	11/19/98	KP	326,589
Grand Rapids-Wealthy St	260810007	507 Wealthy St	42.956111	-85.679167	1:3	Pop. Exp.	Neighborhood	Kent	1/1/07	GW	988,938
Grand Rapids - Monroe St	260810020	1179 Monroe St., NW,	42.984167	-85.671389	1:3	Pop. Exp.	Neighborhood	Kent	10/23/98	GW	988,938
Tecumseh	260910007	6792 Raisin Center Highway	41.995556	-83.946667	1:3	upwind backgrd	Regional	Lenawee	7/6/93	AL	99,892
New Haven	260990009	57700 Gratiott	42.731389	-82.793611	1:3	Pop. Exp. Max. Conc.	Neighborhood	Macomb	12/22/98	DWL	4,296,250
Houghton Lake	261130001	1769 S Jeffs Rd	44.310556	-84.891944	1:3	Background	Regional	Missaukee	2/8/03	Not in CBSA	N/A
Sterling State Park	261150006	2800 Sate Park Rd.	41.9236	-83.345858	1:3	Transport	Regional	Monroe	8/8/13	M	152,021
Oak Park	261250001	13701 Oak Park Blvd.	42.463056	-83.183333	1:3	Pop. Exp.	Neighborhood	Oakland	12/25/98	DWL	4,296,250
Port Huron	261470005	2525 Dove Rd.	42.953333	-82.456389	1:3	Pop. Exp.	Urban	Saint Clair	2/11/99	DWL	4,296,250
Ypsilanti	261610008	555 Towner Ave	42.240556	-83.599722	1:3	Pop. Exp.	Neighborhood	Washtenaw	8/4/99	AA	344,791
Allen Park	261630001	14700 Goddard	42.228611	-83.208333	1:1	Pop. Exp.	Neighborhood	Wayne	5/12/99	DWL	4,296,250
Detroit - SW HS	261630015	SW Highschool, 150 Waterman	42.302778	-83.106667	1:3	Pop. Exp. Max. Conc.	Neighborhood	Wayne	2/26/99	DWL	4,296,250
Detroit - Linwood	261630016	2451 Marquette, McMichael School	42.3578	-83.09617	1:3	Pop. Exp.	Neighborhood	Wayne	5/12/99	DWL	4,296,250
Detroit - E 7 Mile	261630019	11600 E. 7 Mile, Osborne School	42.430833	-83.000278	1:3	Pop. Exp.	Neighborhood	Wayne	4/30/00	DWL	4,296,250
Livonia	261630025	38707 Seven Mile Rd	42.423055	-83.426389	1:3	Pop. Exp.	Neighborhood	Wayne	8/21/99	DWL	4,296,250
Livonia Near Road	261630095	18790 Haggerty Rd	42.421494	-83.425168	1:3	Near Road	Micro	Wayne	1/1/15	DWL	4,296,250
Dearborn	261630033	2842 Wyoming, Salina School	42.306666	-83.148889	1:3	Pop. Exp. Max. Conc.	Neighborhood	Wayne	2/5/99	DWL	4,296,250
Wyandotte	261630036	3625 Biddle, Wyandotte	42.18728	-83.15404	1:3	Pop. Exp.	Urban	Wayne	2/20/99	DWL	4,296,250
Detroit - FIA/Lafayette St	261630039	2000 W Lafayette	42.323333	-83.068611	1:1, 1:3 for 2017	Source Oriented	Neighborhood	Wayne	8/26/05	DWL	4,296,250

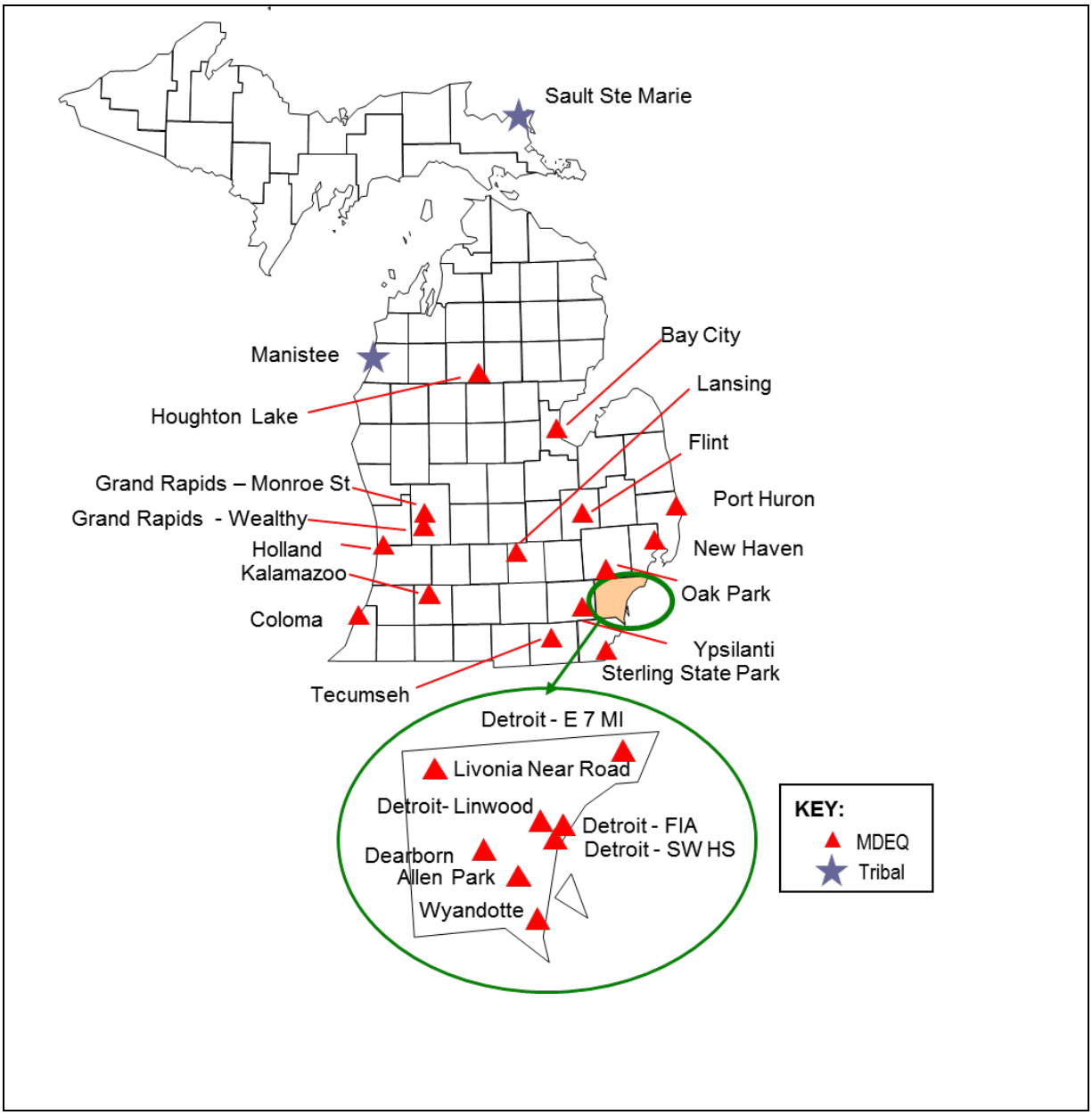
Special Purpose and Tribal $PM_{2.5}$ Monitors in Michigan

Site Name	Monitoring Sites AQS Site ID	Address	Latitude	Longitude	Sampling Frequency	Purpose	Scale	County	Start Date	CBSA [1]	Pop (2010 Census)
Sault Ste Marie	260330901	650 W Easterday Ave	46.49173	-84.36513	1:3	Tribal	Neighborhood	Chippewa	1/1/11	SSM	38,520
Manistee	261010922	3031 Domres Rd	44.307	-86.24268	1:3	Tribal	Regional	Manistee	4/2/06	Not in CBSA	N/A

[1] **CBSA Key:**

A = Allegan Micropolitan Area
AA = Ann Arbor Metro. Area
AL= Adrian Micropolitan Area
DWL= Detroit-Warren-Livonia Metro. Area
F = Flint Metro Area
GW=Grand Rapids-Wyoming Metro. Area
HGH = Holland-Grand Haven Metro. Area
KP= Kalamazoo-Portage Metro. Area
LEL= Lansing-E. Lansing Metro. Area
M = Monroe Metro. Area
MNS = Muskegon-Norton Shores Metro. Area
NBH = Niles-Benton Harbor Metro. Area
SBM= South Bend-Mishawaka Metro. Area (IN/MI)
SSM= Sault Ste. Marie Micropolitan Area

Figure 7: Michigan's $PM_{2.5}$ FRM Monitoring Network



$PM_{2.5}$ Quality Assurance

The $PM_{2.5}$ program has a fully approved Quality Assurance Project Plan (QAPP). The MDEQ operates four co-located $PM_{2.5}$ FRM samplers, meeting the precision monitoring requirement of 15%. The sampling frequency of the precision samplers at Grand Rapids–Monroe St. (260810020), Kalamazoo (260770008), Ypsilanti (261610008), and Dearborn (261630033) is once every six days. In addition, a tribal co-located FRM is operated in Sault Ste. Marie (260330901).

The MDEQ's station operators conduct flow checks every four-weeks to ensure the flow rate is meeting the measurement quality objectives. Results from these flow checks are submitted to the $PM_{2.5}$ auditor each month for review. Every six months, each $PM_{2.5}$ sampler is audited by a member of the AMU's QA Team. The auditor has a separate line of supervision from the site operator and uses dedicated equipment for audits. The audit assesses the accuracy of the flow, as well as the monitor sampling and siting criteria. Every flow audit is reviewed by the QA Coordinator, copies are retained in the QA files, and the audits are uploaded to the EPA's AQS database. The AMU's auditor also performs a systems audit for each sampler. The systems audit evaluates the siting criteria, condition of the sampling site/station, and other parameters. Copies of the systems audit forms are reviewed by the QA Coordinator and are retained in the QA central files.

The MDEQ participates in the EPA's Performance Evaluation Program (PEP) audits at eight sites each year. The EPA auditor sets up a $PM_{2.5}$ monitor to run side-by-side with the station $PM_{2.5}$ sampler on a run day. The filter from the PEP audit is sent to an independent laboratory for analysis. Once the MDEQ filter weight is entered into the EPA's AQS database, the audit filter weight is entered by the EPA whereby the concentrations are compared between the PEP audit filter and the station filter. The EPA auditor also assesses the station and monitor siting criteria to evaluate adequacy of the location, including distances from trees, exhaust vents, and large buildings. Probe heights and separation distances are also assessed.

Plans for the 2017 $PM_{2.5}$ FRM Monitoring Network

The following $PM_{2.5}$ monitors will be retained as part of the 2017 network:

- The one in three day $PM_{2.5}$ FRM monitor in Holland (260050003)
- The one in three day $PM_{2.5}$ FRM monitor in Bay City (260170014)
- The one in three day $PM_{2.5}$ FRM monitor in Coloma (260210014) transport
- The one in three day $PM_{2.5}$ FRM monitor in Flint (260490021)
- The one in three day $PM_{2.5}$ FRM monitor in Lansing (260650012)
- The one in three day $PM_{2.5}$ FRM monitor in Kalamazoo (260770008)
- The one in three day $PM_{2.5}$ FRM monitor in Grand Rapids-Wealthy (260810007)
- The one in three day $PM_{2.5}$ FRM monitor in Grand Rapids-Monroe St. (260810020)
- The one in three day $PM_{2.5}$ FRM monitor in Tecumseh (260910007)
- The one in three day $PM_{2.5}$ FRM monitor in New Haven (260990009)
- The one in three day $PM_{2.5}$ FRM monitor in Houghton Lake (261130001) background
- The one in three day $PM_{2.5}$ FRM monitor in Sterling State Park (261150006)
- The one in three day $PM_{2.5}$ FRM monitor in Oak Park (261250001)
- The one in three day $PM_{2.5}$ FRM monitor in Port Huron (261470005)
- The one in three day $PM_{2.5}$ FRM monitor in Ypsilanti (261610008)
- The daily $PM_{2.5}$ FRM monitor in Allen Park (261630001)
- The one in three day $PM_{2.5}$ FRM monitor at Detroit-SWHS (261630015)
- The one in three day $PM_{2.5}$ FRM monitor at Detroit-Linwood (261630016)
- The one in three day $PM_{2.5}$ FRM monitor at Detroit-E 7 Mile (261630019)
- The one in three day $PM_{2.5}$ FRM monitor in Livonia (261630025)
- The one in three day $PM_{2.5}$ FRM monitor at Livonia-Near Road (261630095)
- The one in three day $PM_{2.5}$ FRM monitor in Dearborn (261630033)
- The one in three day $PM_{2.5}$ FRM monitor in Wyandotte (261630036)
- The one in three day $PM_{2.5}$ FRM monitor at Detroit–FIA (261630039)

The following precision monitors will continue operation contingent upon adequate funding:

- The one in six day $PM_{2.5}$ FRM monitor in Kalamazoo (260770008).
- The one in six day $PM_{2.5}$ FRM monitor at Grand Rapids-Monroe St. (260810020).
- The one in six day $PM_{2.5}$ FRM monitor in Ypsilanti (261610008).
- The one in six day $PM_{2.5}$ FRM monitor in Dearborn (261630033).

To the best of our knowledge, the following tribal FRM monitors will continue operation:

- A one in three day $PM_{2.5}$ FRM tribal monitoring site in Manistee (261010922), contingent upon the Little River Band of Ottawa Indians' plans for 2017.
- A one in three day $PM_{2.5}$ FRM tribal monitoring site in Sault Ste. Marie (260330901), and a co-located one in six day precision monitor, contingent upon the Inter-Tribal Council's plans for 2017.

Continuous $PM_{2.5}$ Monitoring Network:

According to the October 17, 2006 changes to the monitoring regulations, 50% of the minimum number of required FRM sites must be co-located with a continuous $PM_{2.5}$ monitor. The 13 continuous monitors operational in the state exceed the minimum number that are required.

In 2015, the MDEQ operated Rupprecht & Patashnick TEOM samplers to supply continuous fine particulate data at 13 monitoring sites, as shown in **Table 15**. The MDEQ currently is meeting the minimum 50% co-location requirement. **Figure 8** illustrates the geographical distribution of the continuous monitoring network. The MDEQ is moving the MetOne Beta Attenuation Monitor (BAM) from Detroit-FIA/Lafayette (261630039) to the Eliza Howell Near Road site (261630093) to support the Community Scale Air Toxics Air Monitoring Grant received in 2015. A second BAM will be installed at the Livonia Near Road Site (261930095) as part of this grant also. Both of these BAM monitors will be listed as Special Purpose Monitors.

Michigan's NCore stations are required to operate continuous $PM_{2.5}$ samplers. Both Grand Rapids–Monroe St. (260810020) and Allen Park (261630001) currently have $PM_{2.5}$ TEOMs, meeting the requirement for continuous $PM_{2.5}$ measurements.

The MetOne BAM operated by the Inter-Tribal Council, Sault Ste. Marie (2960330901) is currently operated in a non-regulatory mode and as such should not be used to compare to the NAAQS.

The MDEQ operates the TEOMs from April through September with an inlet temperature of 50°C. Once the ozone season is over, starting October 1, the MDEQ reduces the inlet temperature to 30°C in the winter months to minimize loss of nitrates. Operating the TEOMs in this way maximizes comparability with the FRMs. The $PM_{2.5}$ TEOM sites operate to support AIRNOW real time data reporting and to provide adequate spatial coverage. This will continue as long as adequate levels of funding are received.

TABLE 15: MICHIGAN'S CONTINUOUS $PM_{2.5}$ MONITORING NETWORK

Operating Schedule: continuous

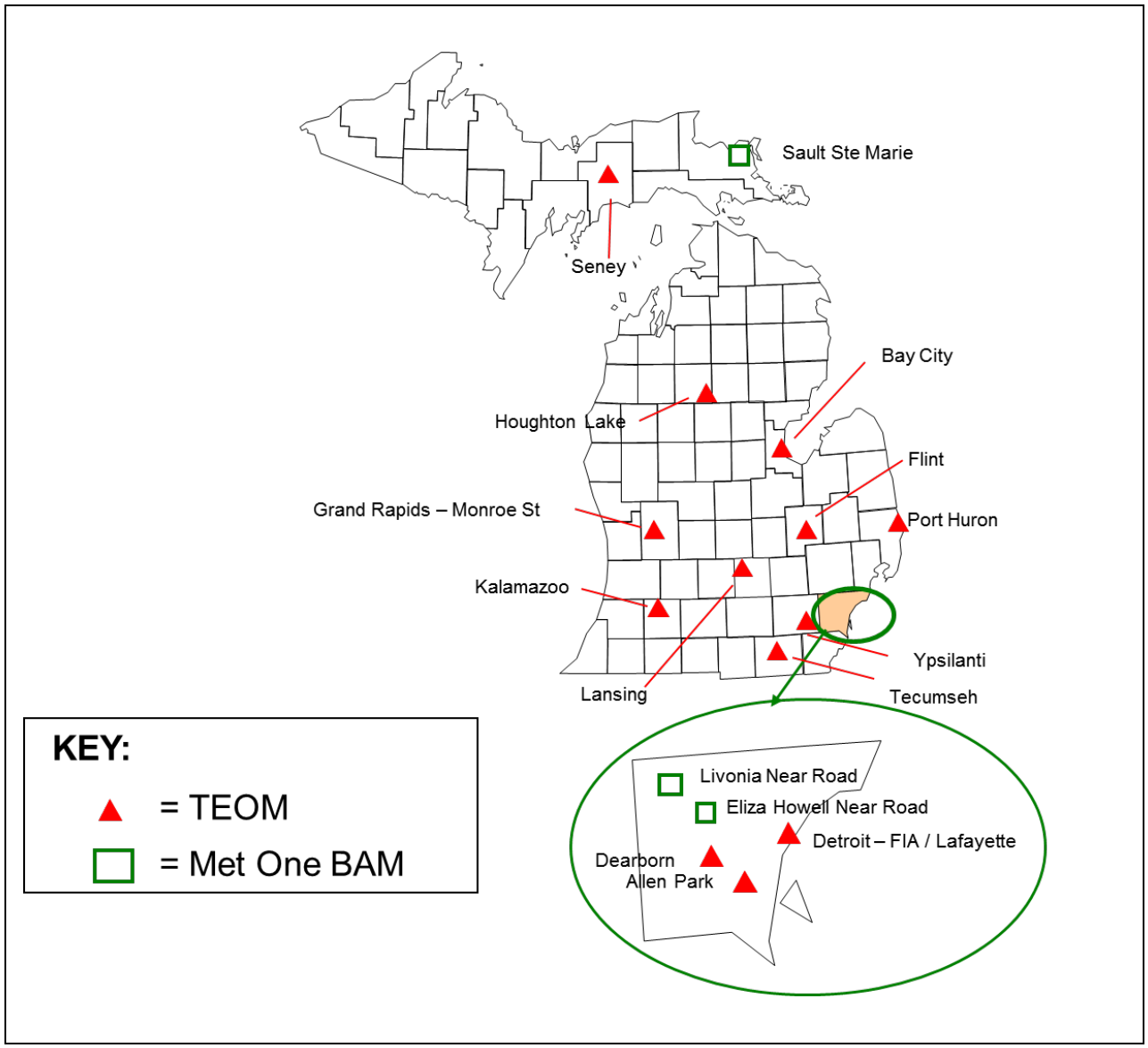
Method: Rupprecht & Patashnick Tapered Element Oscilating Microbalance (TEOMS) Samplers; Method Codes 701/703

Site Name	Monitoring Sites AQS Site ID	Address	Latitude	Longitude	Purpose	Scale	County	Start Date	CBSA [1]	Pop (2010 Census)
Bay City	260170014	1001 Jennison St	43.571389	-83.890833	Pop. Exp.	Neighborhood	Bay	11/19/05	BC	107,771
Flint	260490021	Whaley Park, 3610 low a St., Flint	43.04722	-83.670278	Pop. Exp.	Neighborhood	Genesee	5/23/02	F	425,790
Lansing	260650012	220 N. Pennsylvania	42.738611	-84.534722	Pop. Exp.	Neighborhood	Ingham	12/1/99	LEL	464,036
Kalamazoo	260770008	Fairgrounds, 1400 Olmstead Rd	42.278056	-85.541944	Pop. Exp.	Neighborhood	Kalamazoo	8/17/00	KP	326,589
Grand Rapids - Monroe St	260810020	1179 Monroe St., NW,	42.984167	-85.671389	Pop. Exp.	Neighborhood	Kent	11/4/99	GW	988,938
Tecumseh	260910007	6792 Raisin Center Highw ay	41.995556	-83.946667	up w ind backgrd	regional	Lenaw ee	6/1/09	AL	99,892
Houghton Lake	261130001	1769 S Jeffs Rd	44.310556	-84.891944	Background	Regional	Missaukee	10/9/03	Not in CBSA	N/A
Port Huron	261470005	2525 Dove Rd.	42.953333	-82.456389	Pop. Exp.	Urban	Saint Clair	9/18/03	DWL	4,296,250
Seney	261530001	Seney Wildlife Refuge, HCR 2 Box 1	46.28888	-85.95027	Background	Regional	Schoolcraft	1/1/02	Not in CBSA	N/A
Ypsilanti	261610008	555 Tow ner Ave	42.240556	-83.599722	Pop. Exp.	Neighborhood	Washtenaw	2/24/00	AA	344,791
Allen Park	261630001	14700 Goddard	42.228611	-83.208333	Pop. Exp.	Neighborhood	Wayne	12/1/00	DWL	4,296,250
Dearborn	261630033	2842 Wyoming, Salina School	42.306666	-83.148889	Pop. Exp. Max. Conc.	Neighborhood	Wayne	9/26/03	DWL	4,296,250
Detroit - FIA/Lafayette St	261630039	2000 W Lafayette	42.323333	-83.068611	Source Oriented	Neighborhood	Wayne	8/20/05	DWL	4,296,250
Method:	MetOne Beta Attenuation Monitor (BAM); Method Code 170									
Sault Ste. Marie	260330901	650 W Easterday Ave	46.49366	-84.36416	Tribal	Neighborhood	Chippew a	1/1/2012	SSM	38,520
Eliza How ell Near Road	261630093	Service Road I-96 & Telegraph	42.38599	-83.26632	Near Road - SPM	Microscale	Wayne	9/1/11	DWL	4,296,250
Livonia Near Road	261630095	18790 Haggerty Raod	42.421494	-83.425168	Near Road - SPM	Microscale	Wayne	1/1/15	DWL	4,296,250

[1] **CBSA Key:**

AA= Ann Arbor Metro. Area
AL= Adrian Micropolitan Area
BC = Bay City Metro. Area
DWL= Detroit-Warren-Livonia Metro. Area
F = Flint Metro Area
F = Flint Metro Area
GW=Grand Rapids-Wyoming Metro. Area
KP= Kalamazoo-Portage Metro. Area
LEL= Lansing-E. Lansing Metro. Area
SSM= Sault Ste Marie Micropolitan Area

FIGURE 8: MICHIGAN'S CONTINUOUS $PM_{2.5}$ NETWORK



$PM_{2.5}$ TEOM Quality Assurance

The site operator conducts flow checks for precision every four weeks. Results from the precision checks are sent to the auditor for review each month. An independent flow rate audit is conducted by a member of the AMU's QA Team every six months. During the flow rate audit, the auditor assesses the condition of the station, sample probe, and siting criteria. The QA Coordinator reviews all audit results and hard copies of the results are retained in the QA files.

Plans for the 2017 $PM_{2.5}$ TEOM Network

There are no changes planned for the $PM_{2.5}$ TEOM network, but if the EPA cuts funding, operation of some additional TEOMs may need to be discontinued in 2017. Continued operation of the $PM_{2.5}$ TEOMs at Dearborn (261630033), Allen Park (261630001), and Grand Rapids-Monroe St. (260610020) will be given the highest priority. The Dearborn (261630033) monitor measures the highest concentrations of $PM_{2.5}$ in Michigan and is needed for the development of attainment strategies, AIRNOW reporting, diurnal profiling and estimation of risk. The Allen Park (261630001) monitor is needed to provide a counterpoint to the measurements taken at Dearborn. Allen Park is a population-oriented site designated as the trend site for Michigan. Dearborn is the maximum concentration site, so comparisons between these sites are important to characterize point source impacts on ambient air quality. Also, the $PM_{2.5}$ TEOMs at Grand Rapids-Monroe St. (260810020) and Allen Park (261630001) need to continue operation due to the NCore requirement for continuous fine particulate measurements.

During 2017, contingent upon adequate levels of funding, Michigan is planning to continue to operate $PM_{2.5}$ TEOM monitors at:

- Bay City (260170014)
- Flint (260490021)
- Lansing (260650012)
- Kalamazoo (260770008)
- Grand Rapids–Monroe St. (260810020)
- Tecumseh (260910007)
- Houghton Lake (261130001)
- Port Huron (261470005)
- Seney (261530001)
- Ypsilanti (261610008)
- Allen Park (261630001)
- Dearborn (261630033)
- Detroit–FIA/Lafayette (261630039)
- Eliza Howell Near Road (261630093) Special Purpose BAM
- Livonia Near Road (261630095) Special Purpose BAM

Considering the cost of replacement parts, age of the equipment and the frequency of repairs, if any TEOM monitors would need to be shut down, the highest priority would be given to retaining the Grand Rapids–Monroe St. (260810020), Allen Park (261630001) NCore and Dearborn $PM_{2.5}$ TEOMs .

During 2017, to the best of our knowledge, the Inter-Tribal Council is planning to continue to operate a $PM_{2.5}$ BAM monitor at Sault Ste. Marie (260330901).

Speciated $PM_{2.5}$ Monitoring Network:

Continued operation of the speciation trend site network is required on a national level and these sites sample on an sampling frequency of once every three days. The speciated trend site in Michigan is located at Allen Park (261630001). All remaining supplemental speciation sites operate on a once every six day schedule, except for the NCore site at Grand Rapids–Monroe St. (260810020), which also has a sampling frequency of once every three days. The speciation network is described in **Table 16**. **Figure 9** illustrates the current coverage across Michigan.

Note that Allen Park (261630001) contains a suite of carbon channel samplers: an IMPROVE, a Met One SASS and an URG 3000 N. The MDEQ will continue to operate the three different carbon samplers to support EPA OAQPS inter-sampler comparability studies.

Continuous Speciation Measurements

In addition to the speciated measurements integrated over a 24-hour time period described above, Michigan operates continuous monitors for carbon black and EC/OC. Large spot aethalometers from Magee Scientific operate at Dearborn (261630033) and Allen Park (261630001). These units measure carbon black, which is very similar to and correlates well with elemental carbon. As part of the CSATAM 2015 grant, three new aethalometers were purchased from Magee Scientific. These were installed in 2016 as Special Purpose Monitors at Eliza Howell Near Road (261630093), Eliza Howell Downwind (261630094), and Livonia Near Road (261630095).

A continuous EC/OC monitor from Sunset Laboratories was deployed at the Detroit-Newberry site (261630038) site to determine diurnal variation in elemental carbon and organic carbon. This EC/OC is currently on reserve as a backup due to the loss of site access at Detroit Newberry. To help in the development of attainment strategies, the Southeast Michigan Council of Governments purchased a second Sunset EC/OC unit that is deployed at Dearborn (261630033). Last, an additional EC/OC unit is deployed at Tecumseh (260910007) to characterize levels upwind from Detroit.

Speciation Quality Assurance

The MDEQ has adopted and follows the EPA's QAPP for the speciation trends network. The site operator conducts flow checks for precision every four weeks. Results from the precision checks are sent to the auditor for review each month. The QA team conducts flow rate audits on the $PM_{2.5}$ speciation monitors every six months. The auditor also assesses the monitoring station and siting criteria to ensure it continues to meet the measurement quality objectives. Audit results are reviewed by the AMU's QA Coordinator. Audit data is also uploaded to the EPA's AQS database using the national contract labs interface. The EPA periodically conducts technical systems audits and instrument audits for the speciation network. The EPA also conducts audits of national contract lab, which supplies speciation analysis services for the entire nation.

TABLE 16: MICHIGAN'S $PM_{2.5}$ SPECIATION NETWORK

Current Speciation Sites

Operating Schedule: Once Every 3 days (Allen Park), once every 6 days all others

Method: Met One SASS and URG 3000 N units to collect organic & elemental carbon; Method Code 811 (SASS) Method Code 839/840 URG

Site Name	Monitoring Sites AQS Site ID	Address	Latitude	Longitude	Sampling Frequency	Purpose	Scale	County	Start Date	CBSA [1]	Pop (2010 Census)	Comments
Grand Rapids - Monroe St	260810020	1179 Monroe St., NW,	42.984	-85.67139	1:3	Pop. Exp.	Neighborhood	Kent	11/4/99	GW	988,938	
Tecumseh	260910007	6792 Raisin Center Highway	41.996	-83.94667	1:6	upwind backgrd	regional	Lenawee	4/6/08	AL	99,892	SPM
Allen Park	261630001	14700 Goddard	42.229	-83.20833	1:3	Pop. Exp.	Neighborhood	Wayne	12/1/00	DWL	4,296,250	
Detroit - SW HS	261630015	SW Highschool, 150 Waterman St	42.303	-83.10667	1:6	Pop. Exp. Max. Conc.	Neighborhood	Wayne	11/2/08	DWL	4,296,250	
Dearborn	261630033	2842 Wyoming, Salina School	42.307	-83.14889	1:6	Pop. Exp. Max. Conc.	Neighborhood	Wayne	9/26/03	DWL	4,296,250	

Continuous Speciation Measurements

Method: MaGee Aethalometer; Method Code 861 and Sunsent Labs EC/OC Instrument; Method Code 867

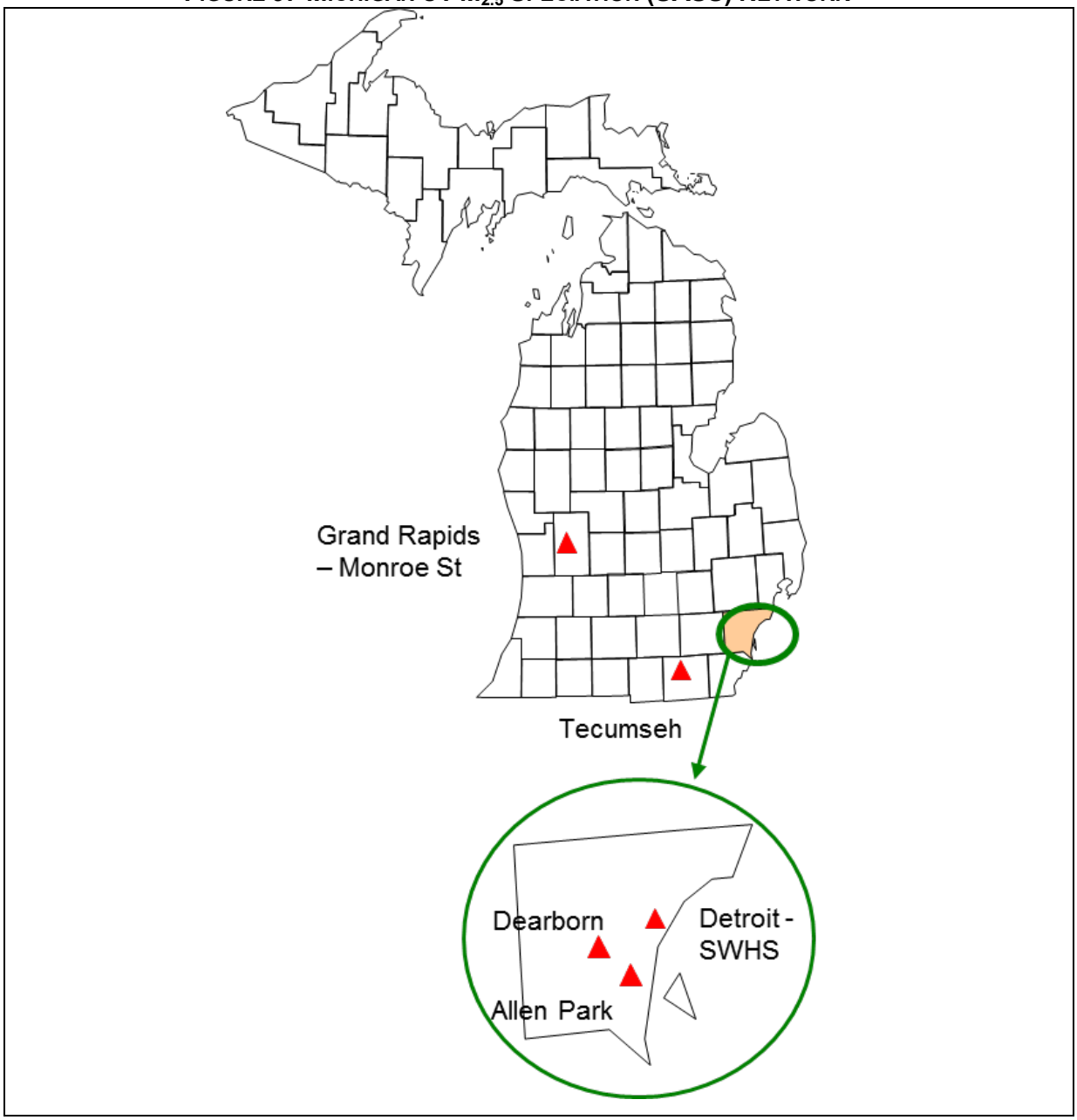
Site Name	Monitoring Sites AQS Site ID	Address	Latitude	Longitude	Sampling Method	Purpose	Scale	County	Start Date	CBSA [1]	Pop (2010 Census)	Comments
Allen Park	261630001	14700 Goddard	42.229	-83.20833	McGee large spot Aethalometer (carbon black)	Pop. Exp.	Neighborhood	Wayne	1/1/04	DWL	4,296,250	
Dearborn	261630033	2842 Wyoming, Salina School	42.307	-83.14889	McGee large spot Aethalometer (carbon black)	Pop. Exp. Max. Conc.	Neighborhood	Wayne	12/19/03	DWL	4,296,250	
Tecumseh	260910007	6792 Raisin Center Highway	41.996	-83.94667	Sunset EC/OC	upwind backgrd	regional	Lenawee	3/31/08	AL	99,892	SPM
Dearborn	261630033	2842 Wyoming, Salina School	42.307	-83.14889	Sunset EC/OC	Pop. Exp. Max. Conc.	Neighborhood	Wayne	6/11/07	DWL	4,296,250	

[1] CBSA Key:

AL= Adrian Micropolitan Area
DWL= Detroit-Warren-Livonia Metro. Area
GW=Grand Rapids-Wyoming Metro. Area
M = Monroe Metro. Area

SPM = Special Purpose Monitor

FIGURE 9: MICHIGAN'S $PM_{2.5}$ SPECIATION (SASS) NETWORK



Plans for the 2017 $PM_{2.5}$ Speciation Monitoring Network

During 2017, contingent upon adequate levels of funding, Michigan is planning to continue to operate 24-hour $PM_{2.5}$ SASS speciation monitors at:

- Grand Rapids-Monroe St. (260810020) operating once every three days
- Allen Park (261630001) operating once every three days
- Dearborn (261630033) operating once every six days
- Tecumseh (260910007) operating once every six days
- SWHS (261630015) operating once every six days

During 2017, contingent upon adequate levels of funding, Michigan is planning to continue to operate hourly Sunset EC/OC monitors at:

- Dearborn (261630033)
- Tecumseh (260910007)

During 2017, contingent upon adequate levels of funding, Michigan is planning to continue to operate hourly Magee aethalometer monitors at:

- Dearborn (261630033)
- Allen Park (261630001)

PM_{10} Monitoring Network:

The October 17, 2006 monitoring regulations modified the minimum number of PM_{10} samplers required in MSAs. Since then, further revisions have occurred, relaxing the numbers of sites required in high population areas with low concentrations of PM_{10}, as shown in **Table 17**.[8]

TABLE 17: PM_{10} MINIMUM MONITORING REQUIREMENTS (NUMBER OF STATIONS PER MSA)[1]

POPULATION CATEGORY	HIGH CONCENTRATION[2]	MEDIUM CONCENTRATION[3]	LOW CONCENTRATION[4, 5]
> 1,000,000	6-10	4-8	2-4
500,000 – 1,000,000	4-8	2-4	1-2
250,000 – 500,000	3-4	1-2	0-1
100,000 – 250,000	1-2	0-1	0

[1] Selection of urban areas and actual numbers of stations per area within the ranges shown in this table will be jointly determined by EPA and the State Agency.
[2] High concentration areas are those for which ambient PM_{10} data show ambient concentrations exceeding the PM_{10} NAAQS by 20% or more.
[3] Medium concentration areas are those for which ambient PM_{10} data show ambient concentrations exceeding 80% of the PM_{10} NAAQS.
[4] Low concentration areas are those for which ambient PM_{10} data show ambient concentrations < 80% of the PM_{10} NAAQS.
[5] These minimum monitoring requirements apply in the absence of a design value.

Applying **Table 17** to Michigan's urban areas, population totals and historical PM_{10} data results in the design requirements that are shown in **Table 18**.

According to the tables, two to four PM_{10} sites are required in the Detroit-Warren-Livonia Metropolitan Area. Currently, there are four sites in operation; one at Allen Park (261630001), one at Detroit-SWHS (261630015), one at River Rouge (261630005) and a co-located pair the design value site at Dearborn (261630033).

The PM_{10} monitoring requirements specify that one to two PM_{10} sites are required in the Grand Rapids-Wyoming MSA. There is one site currently in operation at Grand Rapids, Monroe St. (260810020).

According to the requirements, either no or one PM_{10} monitors are required in the Flint MSA. In 2006, the MDEQ operated a PM_{10} sampler in Flint (260490021) but as a result of budget cuts, PM_{10} sampling was discontinued on April 1, 2007.

As part of a special study investigating the concentrations of manganese (Mn) in the Detroit urban area, a PM_{10} high volume unit started sampling at River Rouge (261630005) on January 25, 2009. The PM_{10} filters at River Rouge (261630005), Allen Park (261630001), Detroit-SWHS (261630015) and Dearborn (261630033) are analyzed for Mn and compared with the TSP concentrations of Mn. An added benefit of this study is the collection of levels of PM_{10} at River Rouge (261630005). The Manganese Work Group will be analyzing the data on a yearly basis. Decisions about future monitoring for Mn in southeast Michigan will be made by the work group.

PM coarse measurements are required at NCore sites. One acceptable technology is to use two R & P Partisol Plus 2025 units, one equipped with a $PM_{2.5}$ head and a very sharp cut cyclone and the second with a PM_{10} head and a down tube. PM coarse is determined by subtracting the

[8] Table D-4 of Appendix D to Part 58.

fine particulate from the PM_{10}. Therefore, to meet the NCore requirements, a Partisol sampler equipped with a PM_{10} head and a down tube was deployed to Grand Rapids–Monroe St. (260810020) and Allen Park (261630001).

Table 19 summarizes the PM_{10} monitoring site information for sites in operation in 2016 and 2017. **Figure 10** shows the PM_{10} monitoring locations for 2016 and 2017.

TABLE 18: APPLICATION OF THE MINIMUM PM_{10} MONITORING REGULATIONS IN THE APRIL 30, 2007 CORRECTION TO THE OCTOBER 17, 2006 FINAL REVISION TO THE MONITORING REGULATION TO MICHIGAN'S PM_{10} NETWORK

Design value sites are in bold				2012-2014		
MSA	**2010 Population**	**Counties**	**Existing Monitors**	**most recent 3-year PM10 design value (24-Hr)**	**Conc. Class.**	**Min No monitors Required**
Detroit-Warren-Livonia Metro Area	4,296,250	Macomb	---	---		2-4
		Oakland	---	---		
		Wayne	Allen Park	31	low	
			Detroit -SW HS	43	low	
			Dearborn	**52**	low	
			River Rouge	42	low	
		Lapeer	---	---		
		St Clair	---	---		
		Livingston	---	---		
Flint Metro Area	425,790	Genesee	Flint	---	low	0 -1
Monroe Metro Area	152,021	Monroe	---	---		
Ann Arbor Metro Area	344,791	Washtenaw	---	---		
Grand Rapids-Wyoming Metro Area	774,160	Kent	GR - Monroe St	closed		
			GR- Wealthy	**28**	low	1-2
		Barry	---	---		
		Newaygo	---	---		
		Ionia	---	---		
Holland-Grand Haven Metro Area	263,801	Ottawa	---	---		
Muskegon-Norton Shores Metro Area	172,188	Muskegon	---	---		
Lansing-East Lansing Metro Area	464,036	Clinton	---	---		
		Ingham	---	---		
		Eaton	---	---		
Bay City Metro Area	107,771	Bay	---	---		
Saginaw-Saginaw Twp N Metro Area	200,169	Saginaw	---	---		
Kalamazoo-Portage Metro Area	326,589	Kalamazoo	---	---		
		Van Buren	---	---		
Niles-Benton Harbor Metro Area	156,813	Berrien	---	---		
Jackson Metro Area	160,248	Jackson	---	---		
Battle Creek Metro Area	136,146	Calhoun	---	---		
South Bend-Mishawaka Metro Area IN/IM	52,293	Cass	---	---		
Not in CBSA	N/A	Tuscola	Vassar	closed		0
MSAs with populations greater than 500,000 require at least 1 PM 10 monitor.						

TABLE 19: MICHIGAN'S PM_{10} MONITORING NETWORK

Method: Manual High Volume Sampler; Method Code 109 (Dearborn also uses a R&P TEOM to make continuous measurements; Method Code 079)

Site Name	Monitoring Sites AQS Site ID	Address	Latitude	Longitude	Sampling Frequency	Monitor Type	Purpose	Scale	County	Start Date	CBSA [1]	Pop (2010 Census)
Allen Park	261630001	14700 Goddard	42.2286	-83.20833	1:6	High Vol	pop exp	nghbrhd	Wayne	9/12/87	DWL	4,296,250
Detroit - SWHS	261630015	150 Waterman	42.3028	-83.10667	1:6	High Vol	max conc	nghbrhd	Wayne	3/27/87	DWL	4,296,250
Dearborn	261630033	2842 Wyoming	42.3067	-83.14889	1:6	High Vol	max conc	nghbrhd	Wayne	6/12/90	DWL	4,296,250
Grand Rapids - Monroe St	260810020	1179 Monroe NW	42.9842	-85.67139	1:6	High Vol	pop exp	nghbrhd	Kent	3/20/87	GW	988,938
River Rouge	261630005	315 Genesee	42.2672	-83.13222	1:6	High Vol	pop exp	nghbrhd	Wayne	1/25/09	DWL	4,296,250
Dearborn	261630033	2842 Wyoming	42.3067	-83.14889	1:12	High Vol for precision	max conc	nghbrhd	Wayne	6/12/90	DWL	4,296,250
Dearborn	261630033 continuous	2842 Wyoming	42.3067	-83.14889	continuous	R&P PM10 TEOM	max conc	nghbrhd	Wayne	4/1/00	DWL	4,296,250

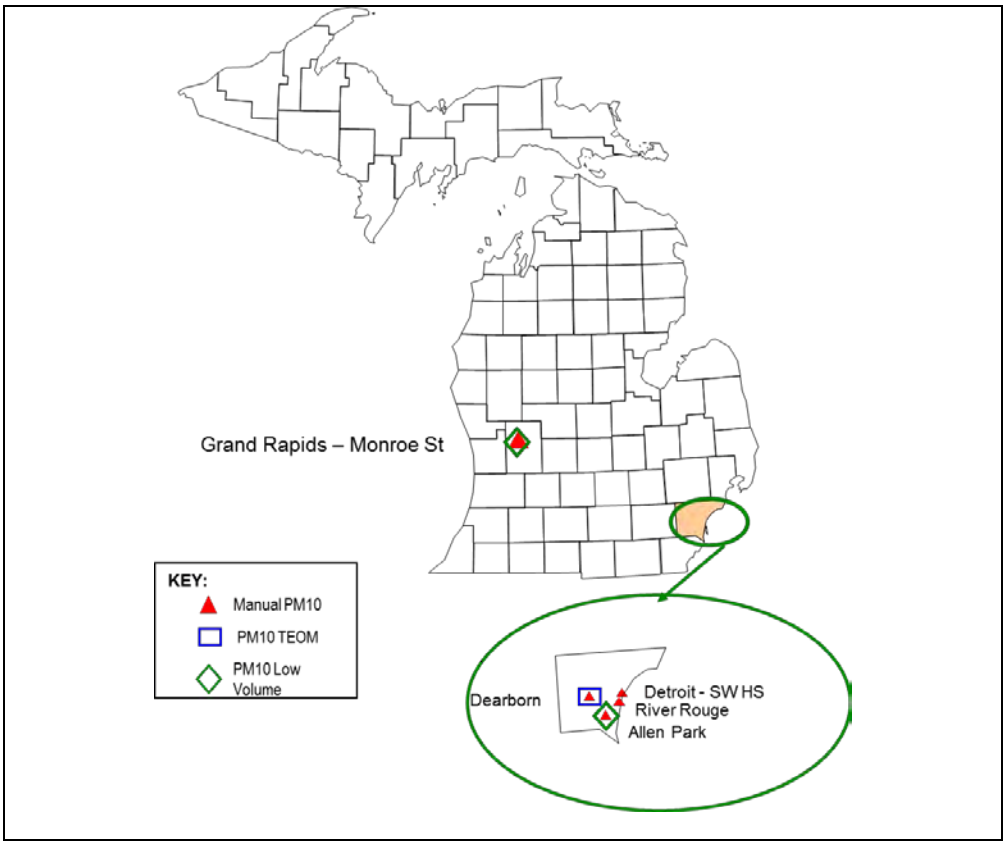
NCore Low Volume PM Coarse Sites

Method: Low volume Partisol 2025 Sampler with down tube and PM_{10} head co-loctaed with low volume Partisol 2025 $PM_{2.5}$ Sampler. PM_{coarse} determined by difference. Method Code 127 (PM_{10}) and Method Code 118 ($PM_{2.5}$)

Site Name	Monitoring Sites AQS Site ID	Address	Latitude	Longitude	Sampling Frequency	Monitor Type	Purpose	Scale	County	Start Date	CBSA [1]	Pop (2010 Census)
Grand Rapids - Monroe St	260810020	1179 Monroe NW	42.9842	-85.67139	1:6	Low Vol Partisol	pop exp	nghbrhd	Kent	7/16/11	GW	988,938
Allen Park	261630001	14700 Goddard	42.2286	-83.20833	1:6	Low Vol Partisol	pop exp	nghbrhd	Wayne	7/16/11	DWL	4,296,250

[1] **CBSA Key:** DWL= Detroit-Warren-Livonia Metro. Area
GW=Grand Rapids-Wyoming Metro. Area

FIGURE 10: MICHIGAN'S PM_{10} MONITORING NETWORK



PM_{10} Quality Assurance

The site operator conducts a flow check once a month. Flow check values are sent to the QA Coordinator each quarter. An independent audit is conducted by a member of the AMU's QA Team every six months. The auditor is in a separate line of reporting authority from the site operator and uses independent dedicated equipment to perform the flow rate audit. The auditor also assesses the condition of the monitor and siting criteria. The QA Coordinator reviews all audit results, and hard copies are retained in the QA files. Audit results are uploaded to the EPA's AQS database each quarter.

Plans for the 2017 PM_{10} Monitoring Network

During 2017, contingent upon adequate levels of funding, the MDEQ is planning to operate high volume PM_{10} monitors sampling over 24-hours at:

- The PM_{10} monitor at Monroe Street in Grand Rapids (260810020) on a once every six day schedule
- The PM_{10} monitor in Allen Park (261630001) on a once every six day schedule
- The PM_{10} monitor in Detroit–SWHS (261630015) on a once every six day schedule
- The PM_{10} monitor in Dearborn (261630033) on a once every six day schedule
- The PM_{10} co-located monitor in Dearborn (261630033) on a once every twelve day schedule
- The PM_{10} monitor at River Rouge (261630005) on a once every six day schedule

The MDEQ is planning to operate low volume PM_{10} monitors co-located with low volume $PM_{2.5}$ monitors to calculate $PM_{10\text{-}2.5}$ at the following NCore sites:

- The low volume PM_{10} monitor at Monroe St. in Grand Rapids (260810020) on a once every six day schedule.
- The low volume PM_{10} monitor at Allen Park (261630001) on a once every six day schedule.

The MDEQ also planning to operate:

- The special purpose monitor PM_{10} TEOM at Dearborn (261630033) on an hourly schedule.

Carbon Monoxide (CO) Monitoring Network:

Prior to the latest CO NAAQS review, the MDEQ operated trace CO monitors at Grand Rapids–Monroe St. (260810020) and Allen Park (261630001) as part of NCore.

On Aug 31, 2011,[9] the EPA finalized the new CO NAAQS and retained the level and form of the CO NAAQS but revised the design of the ambient monitoring network for CO to be more focused on heavily traveled urban roads. In the rule, CBSAs with population totals equal to or greater than one million people would be required to add CO monitors to near-roadway monitoring stations that are required in the NO_2 network design. The MDEQ has CO monitors in the two Eliza Howell near-roadway sites (261630093) and (261630094) and the Livonia Near Road (261630095) site.

Table 20 summarizes the CO monitoring site information for sites that were in existence in 2015. **Figure 11** shows the distribution of CO monitors across the state of Michigan.

CO Quality Assurance

The site operator performs a precision check of the analyzer every two weeks. Results of precision checks are sent to the QA Coordinator each quarter. Each monitor is audited annually by the AMU's QA Team. The auditor has a separate reporting line of authority from the site operator. The auditor utilizes dedicated gas calibrator and calibration gases that are only for audits. The independent audit challenges the accuracy of the station monitor. The auditor also assesses the monitoring system (inspecting the sample line, filters, and inlet probe), siting, and documentation of precision checks. Results of the audits and precision checks indicate whether the monitor is meeting the measurement quality objectives. The AMU uploads the results of the precision checks and audits to the EPA's AQS database each quarter. The QA Coordinator reviews all audit results, and hard copies are retained in the QA files.

External audits are conducted by the EPA's thru-the-probe audit procedure for regular and trace level CO monitors. The EPA reports the results to AQS.

Plans for the 2017 CO Monitoring Network

During 2017, contingent upon adequate levels of funding, Michigan plans to continue to operate trace level CO monitors to support NCore operations:

- Grand Rapids-Monroe St. (26810020)
- Allen Park (261630001)

During 2017, contingent upon adequate levels of funding, Michigan plans to continue to operate CO monitors to support the near-roadway network:

- Eliza Howell #1 (261630093)
- Eliza Howell #2 (261630094)
- Livonia Near Road (261630095)

[9] Environmental Protection Agency, "National Ambient Air Quality Standards for Carbon Monoxide," 40 CFR parts 50, 53 and 58, proposed rule January 28, 2011.

TABLE 20: MICHIGAN'S CO MONITORING NETWORK

Operating Schedule: Continuous

Method: Gas Filter Correlation Analyzer- CO; Method Code 054 and Trace CO; Method Code 093

Site Name	Monitoring Sites AQS Site ID	Address	Latitude	Longitude	Measurement	Purpose	Scale	County	Start Date	CBSA [1]	Pop (2010 Census)
Grand Rapids - Monroe St	260810020	1179 Monroe NW	42.98417	-85.671389	trace	pop exp	nghbrhd	Kent	1/1/08	GW	998,938
Allen Park	261630001	14700 Goddard	42.22861	-83.208333	trace	pop exp	nghbrhd	Wayne	1/1/08	DWL	4,296,250

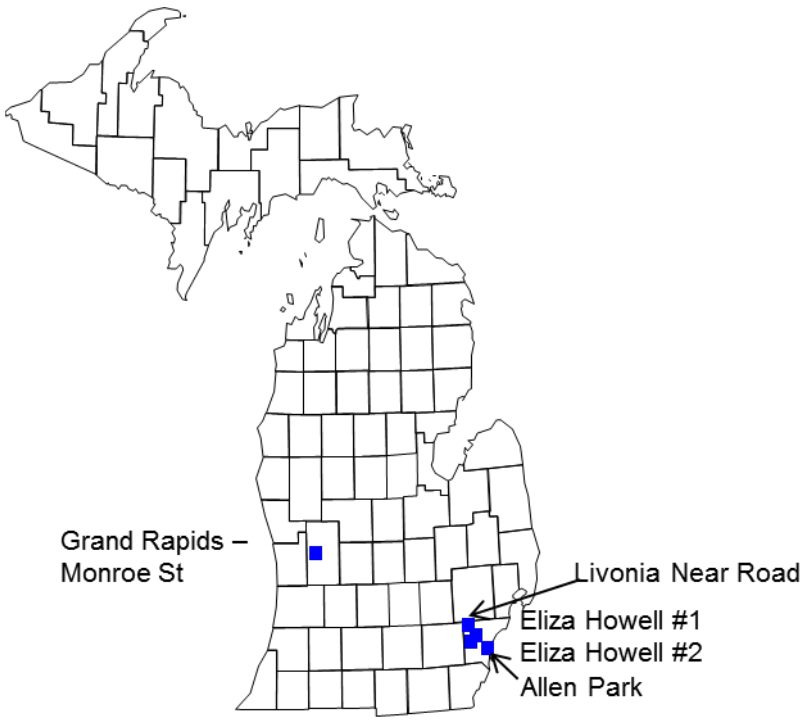
Near Roadway Sites

Site Name	Monitoring Sites AQS Site ID	Address	Latitude	Longitude	Measurement	Purpose	Scale	County	Start Date	CBSA [1]	Pop (2010 Census)
Eliza Howell #1	261630093	Service Road I-96 & Telegraph	42.38599	-83.26632	CO	Near Road	micro	Wayne	9/1/11	DWL	4,296,250
Eliza Howell #2	261630094	Eliza How ell Park	42.3868	-83.270637	CO	Near Road	middle	Wayne	9/1/11	DWL	4,296,250
Livonia Near Road	261630095	18790 Haggerty Road	42.42149	-83.425168	CO	Near Road	micro	Wayne	1/1/15	DWL	4,296,250

[1] **CBSA Key:**

DWL= Detroit-Warren-Livonia Metro. Area GW=Grand Rapids-Wyoming Metro. Area

FIGURE 11: MICHIGAN'S CO MONITORING NETWORK



Nitrogen Dioxide (NO_2) and NO_Y Monitoring Network:

On February 9, 2010, the EPA modified the NO_2 NAAQS. Prior to this date, there was a single form of the standard; the annual average concentration of NO_2 could not be greater than 53 parts per billion (ppb). The EPA has added an hourly level of 100 ppb to the NAAQS.

Along with modifications to the standard, changes to the design of the ambient monitoring network also occurred. A three-tiered monitoring network for NO_2 will focus on near roadway monitoring as well as monitoring at ambient locations. The minimally required components of the network are:

Tier 1: Near Roadway Monitors

1. Every CBSA with a population greater than or equal to 500,000 people must have a microscale NO_2 monitor located within 50 meters of a major roadway.

2. An additional near-roadway site is required in CBSAs with populations of 2,500,000 or more.

3. An additional near-roadway site is required for any roadway segment with 250,000 or more annual average daily traffic (AADT) totals.

Tier 2: Area-wide Monitors

1. One NO_2 monitor in every CBSA with a population equal to or greater than 1,000,000 people. This monitor should be located in an area with an expected high concentration of NO_2 and should use a neighborhood or larger scale. Emission inventory data should be used to make this selection.

Tier 3: Regional Administrator Required Monitors

1. The EPA Administrator must require a minimum of 40 NO_2 monitors nationwide in locations with "susceptible and vulnerable" populations.

The network design described above shall use the latest available Census figures. The new monitoring stations must be deployed and operational by January 1, 2013[10]. Because of budgetary constraints, the EPA has developed a build-and-hold system for implementing the new monitoring locations. Two Detroit near-road monitoring sites have been deployed. In addition, the MDEQ operates the community scale NO_2 monitor at its Detroit E 7 Mile (261630019) site. At this time, the EPA has proposed a new rule which eliminates the third phase of the near road sites. If finalized as proposed, this could remove the requirement for a near road site in Grand Rapids.

Table 21 summarizes the monitoring requirements for NO_2 according to the various tiers for all CBSAs in Michigan. As shown by the table, one monitor is required in Grand Rapids-Wyoming MSA and three monitors are required in the Detroit-Warren-Livonia MSA.

[10] "Primary National Ambient Air Quality Standards for Nitrogen Dioxide", EPA, 40 CFR Parts 50 and 58. February 9, 2010.

Table 21: NO_2 Network

MSA	Counties	2010 Population	Near Roadway Monitors Req'd	Additional Near Roadway Site	250,000 AADT?	Community Wide Monitor	EJ Monitor
Detroit-Warren-Livonia Metro Area	Macomb Oakland Wayne Lapeer St Clair Livingston	4,296,250	1	1		1	
Flint Metro Area	Genesee	425,790					
Monroe Metro Area	Monroe	152,021					
Ann Arbor Metro Area	Washtenaw	344,791					
Grand Rapids-Wyoming Metro Area	Kent Barry Newaygo Ionia	988,938	1				
Holland-Grand Haven Metro Area	Ottawa	263,801					
Muskegon-Norton Shores Metro Area	Muskegon	172,188					
Lansing-East Lansing Metro Area	Clinton Ingham Eaton	464,036					
Bay City Metro Area	Bay	107,771					
Saginaw-Saginaw Twp N Metro Area	Saginaw	200,169					
Kalamazoo-Portage Metro Area	Kalamazoo Van Buren	326,589					
Niles-Benton Harbor Metro Area	Berrien	156,813					
Jackson Metro Area	Jackson	160,248					
Battle Creek Metro Area	Calhoun	136,146					
South Bend Mishawaka Metro Area IN/MI	Cass	52,293					

Tier 1: Near Roadway NO_2 Monitors – Phase 2

The second near-roadway site for the Detroit-Warren-Livonia MSA was due by January 1, 2015. The Livonia Near Road site (261630095) was established in December 2014 and was operational by January 1, 2015. This is the heaviest traveled traffic segment in the Detroit-Warren-Livonia MSA, see yellow star on **Figure 12**. The new monitoring site can be seen in **Figure 13**.

FIGURE 12: COMPARISON OF ELIZA HOWELL PARK LOCATION WITH OTHER AIR MONITORING STATIONS AND ROADWAY SEGMENTS WITH THE HIGH TRAFFIC COUNTS

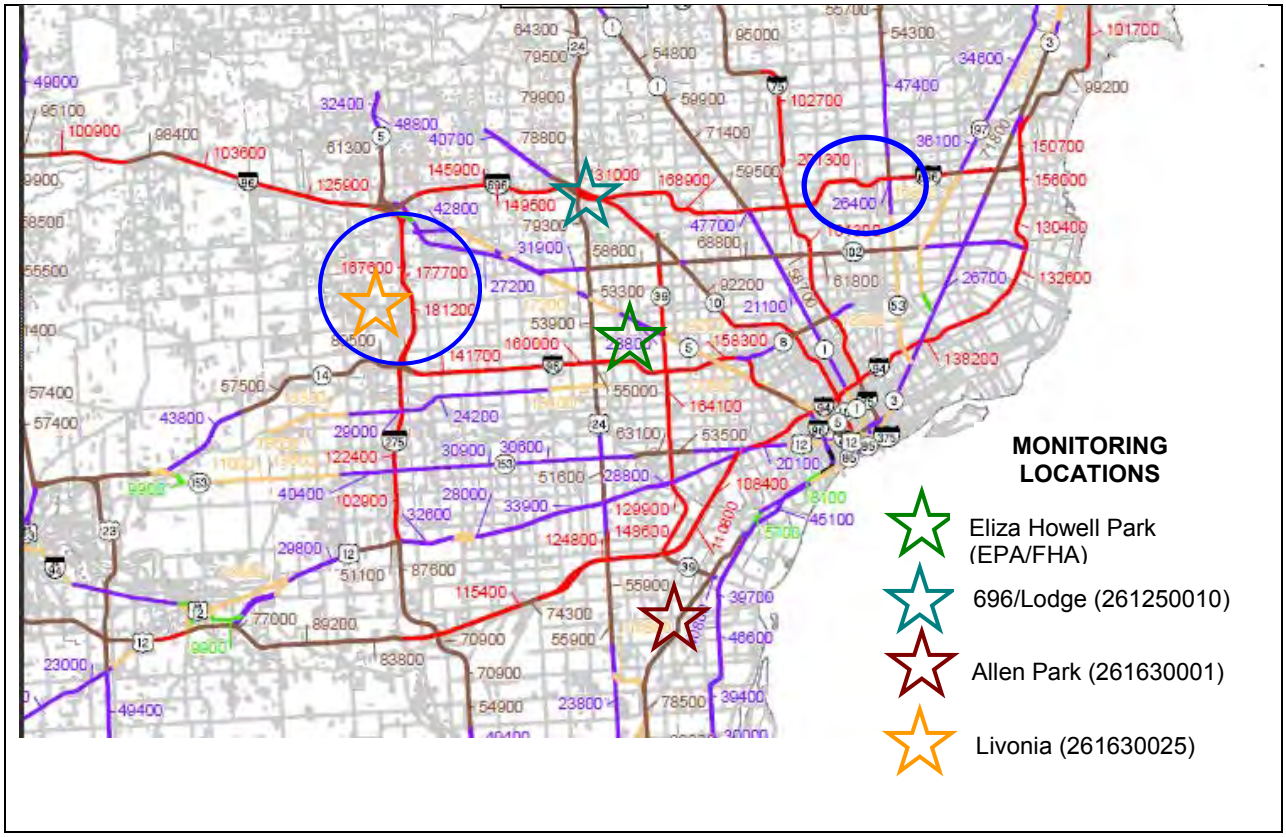


FIGURE 13: LIVONIA NEAR ROAD MONITORING SITE

Tier 2: Area-wide NO_2 Monitors

Area-wide monitoring is required in every CBSA with 1,000,000 or more people. The Detroit-Warren-Livonia CBSA is the only CBSA having this requirement in Michigan. The MDEQ is currently operating an NO_2 monitor at the Detroit-E 7 Mile site (261630019) in northeast Detroit, which is downwind from the urban core and located in a residential neighborhood expected to have high NO_2 levels.

Tier 3: NO_2 Monitors for Susceptible and Vulnerable Populations

The final tier of the new NO_2 monitoring network could include an environmental justice component as determined by the EPA Administrator. Forty additional monitoring sites will be deployed throughout the nation to meet the environmental justice component of the network design. At this time, the MDEQ is not planning on deploying any of these monitors.

NO_2 Monitoring for NSR

Recent modeling projects for new source review have shown that there is a possibility that the new 1-hour NO_2 NAAQS could be violated using current modeling techniques. More refined modeling that would provide a more accurate picture of the impact from new sources could be performed; however, the MDEQ lacked ambient data required for use in the models. At least five years of NO_2 data are required in both urban and rural locations. Therefore, on July 1, 2010, the MDEQ began collecting NO_2 measurements at Houghton Lake (261130001) and at Lansing (260650012).

NO_Y Monitoring

Trace NO_Y monitors for the NCore sites at Grand Rapids–Monroe St. (260810020) and Allen Park (261630001) have been operational since December 2007.

Table 22 summarizes the NO_2 and NO_Y monitoring site information for sites that are in existence in 2016 and 2017. **Figure 14** shows the NO_2 and NO_Y monitoring network operated by the MDEQ in 2016 and 2017.

NO_2 and NO_Y Quality Assurance

The site operator performs a precision check of the analyzer every two weeks. The precision checks are sent to the QA Coordinator each month. Each monitor is audited annually by the AMU's QA Team, which has a separate reporting line of authority from the site operator. The auditor utilizes dedicated gas calibrator and calibration gases that are only for audits. The independent audit challenges the accuracy of the station monitor. The auditor also assesses the monitoring system (inspecting the sample line, filters, and inlet probe), siting, and documentation of precision checks. The results of the audits and precision checks indicate whether the monitor is meeting the measurement quality objectives. The AMU uploads the precision check results and audit results to the EPA's AQS database each quarter. The QA Coordinator reviews all audit results, and hard copies are retained in the QA files.

For conventional (non-trace level) NO_2 monitors, the EPA conducts thru-the-probe audits at 20% of the monitors each year. The audit consists of delivering four levels of calibration gas to the station monitor through the probe. At this time, the EPA is not conducting thru-the-probe audits for the NO_Y monitors.

Plans for the 2017 NO_2 and NO_Y Monitoring Network

During 2017 contingent upon adequate levels of funding, the MDEQ is planning to operate NO_2 at:

- Lansing (260650012)
- Houghton Lake (261130001)
- Detroit-E 7 Mile (261630019)
- Site #1 Eliza Howell Park (261630093)
- Site #2 Eliza Howell Park (261630094)
- Livonia Near Road (261630095)

Also contingent upon adequate funding, the MDEQ will continue to operate trace level NO_Y monitors at the NCore sites:

- Grand Rapids–Monroe St. site (26810020)
- Allen Park site (26163000)

TABLE 22: MICHIGAN'S NO_2 AND NO_Y MONITORING NETWORK

Operating Schedule: Continuous
Method: Chemiluminescense, Method Code 074 (NO_x) and Method Code 075 (NO_y)

NCore Sites

Site Name	Monitoring Sites AQS Site ID	Address	Latitude	Longitude	Measurement	Purpose	Scale	County	Start Date	CBSA [1]	Pop (2010 Census)
Grand Rapids - Monroe St	260810020	1179 Monroe NW	42.984167	-85.671389	NOy	pop exp	nghbrhd	Kent	1/1/08	GW	988,938
Allen Park	261630001	14700 Goddard	42.228611	-83.208333	NOy	pop exp	nghbrhd	Wayne	1/1/08	DWL	4,296,250

Tier 1: Near Roadway Sites 2015

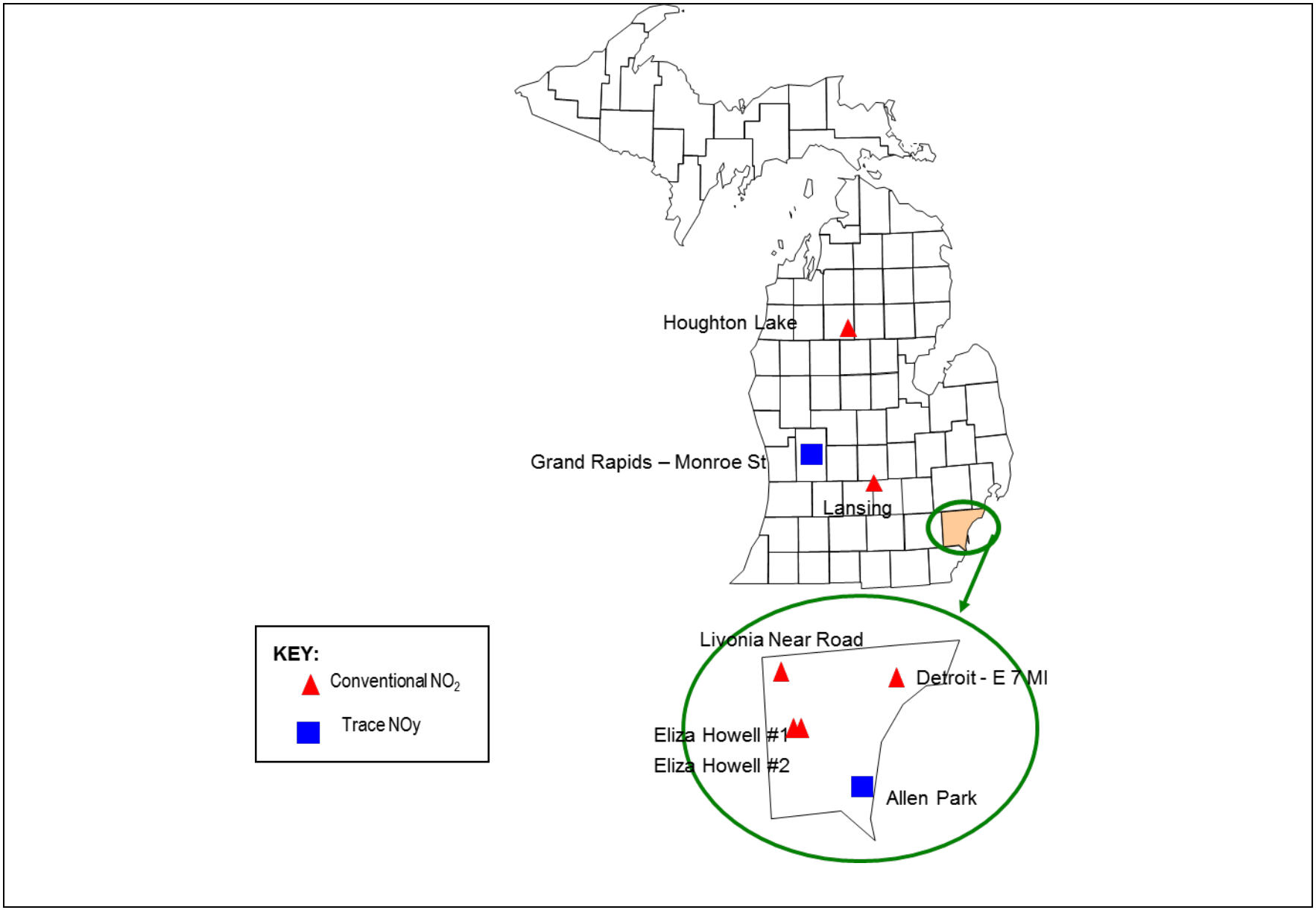
Site Name	Monitoring Sites AQS Site ID	Address	Latitude	Longitude	Measurement	Purpose	Scale	County	Start Date	CBSA [1]	Pop (2010 Census)
Eliza Howell #1	261630093	Service Road I-96 & Telegraph	42.38599	-83.26632	NO2	Near Road	micro	Wayne	9/1/11	DWL	4,296,250
Eliza Howell #2	261630094	Eliza How ell Park	42.386803	-83.270637	NO2	Near Road	middle	Wayne	9/1/11	DWL	4,296,250
Livonia Near Road	261630095	18790 Haggerty Raod	42.421494	-83.425168	NO2	Near Road	micro	Wayne	1/1/15	DWL	4,296,250

Tier 2: Community Sites

Site Name	Monitoring Sites AQS Site ID	Address	Latitude	Longitude	Measurement	Purpose	Scale	County	Start Date	CBSA [1]	Pop (2010 Census)
Detroit - E 7 Mile	261630019	11600 East Seven Mile Road	42.430833	-83.000278	NO2	pop exp	urban	Wayne	12/1/90	DWL	4,296,250
Lansing	260650012	220 N Pennsylvania	42.738611	-84.534722	NO2	pop exp	nghbrhd	Ingham	9/5/80	LEL	464,036
Houghton Lake	261130001	1769 S Jeffs Road	44.310556	-84.891944	NO2	background	regional	Missaukee	4/1/98	Not in CBSA	N/A

[1] **CBSA Key:** DWL= Detroit-Warren-Livonia Metro. Area
GW=Grand Rapids-Wyoming Metro. Area
LEL= Lansing-East Lansing Metro. Area

FIGURE 14: MICHIGAN'S NO_2 AND NO_Y MONITORING NETWORK



Sulfur Dioxide (SO_2) Monitoring Network:

On June 2, 2010, the EPA made the SO_2 NAAQS more stringent by changing the current standard from a 24-hour and an annual average to an hourly measurement that cannot exceed 75 ppb. The form of the standard is now a 99th percentile form averaged over three years. The secondary standard has not been changed[11].

To design a monitoring network, the EPA created the Population Weighted Emissions Index (PWEI) that is calculated by:

(CBSA population[12]) * (total SO_2 emissions in that CBSA in tpy) / 1,0000,000 = PWEI

The PWEI value for each CBSA is compared to the threshold values shown in **Table 23** to determine the number of monitoring sites that are required:

Table 23: Population Weighted Emission Index Based Monitoring Requirements

Population Weighted Emissions Index Value	Number of Sites
Greater than or equal to 1,000,000	3
Greater 100,000 but less than 1,000,000	2
Greater than 5,000	1

The PWEI monitors serve a variety of purposes including assessing population exposure, determining trends and transport as well as ascertaining background levels.

The EPA allows agencies to count the NCore SO_2 monitors as part of these new requirements. Also, because the new SO_2 monitors are not single source-oriented, existing infrastructure can be used to select locations for expansion of the SO_2 network.

If **Table 23** is applied to the PWEI calculations for the CBSAs in Michigan, the number of monitors that are required is shown in **Table 24**. The data in the table uses the 2010 Census data and the most recent version (2008) of the National Emissions Inventory data.

[11] Primary National Ambient Air Quality Standards for Sulfur Dioxide; Final Rule, 75 *Federal Register* 35520 (June 22, 2010).
[12] According to the latest Census Bureau estimates

TABLE 24: POPULATION WEIGHTED EMISSIONS INDEX TOTALS FOR CBSAS IN MICHIGAN

MSA	Counties	2008 NEI Download: Total County SO_2 Emissions, tpy	2008 NEI SO_2 Total Emissions, tpy	2010 Population	2008/2010 NEI PWEI	Monitors Required 2008 EI & 2010 Census
Detroit-Warren-Livonia Metro Area	Macomb	1,367.46	124,738	4,296,250	535,905	2
	Oakland	2,780.69				
	Wayne	55,790.51				
	Lapeer	152.87				
	St Clair	64,388.92				
	Livingston	257.45				
Flint Metro Area	Genesee	538.38	538	425,790	229	0
Monroe Metro Area	Monroe	135,799.72	135,800	152,021	20,644	1
Ann Arbor Metro Area	Washtenaw	530.36	530	344,791	183	0
Grand Rapids-Wyoming Metro Area	Kent	1,539.62	1,843	774,160	1,427	0
	Barry	116.40				
	Newaygo	75.23				
	Ionia	111.60				
Holland-Grand Haven Metro Area	Ottawa	39,664.67	39,665	263,801	10,464	1
Muskegon-Norton Shores Metro Area	Muskegon	11,611.80	11,612	172,188	1,999	0
Lansing-East Lansing Metro Area	Clinton	141.76	14,184	464,036	6,582	1
	Ingham	10,546.34				
	Eaton	3,496.12				
Bay City Metro Area	Bay	19,073.08	19,073	107,771	2,056	0
Saginaw-Saginaw Twp N Metro Area	Saginaw	821.42	821	200,169	164	0
Kalamazoo-Portage Metro Area	Kalamazoo	1,672.04	1,810	326,589	591	0
	Van Buren	138.04				
Niles-Benton Harbor Metro Area	Berrien	384.68	385	156,813	60	0
Jackson Metro Area	Jackson	293.11	293	160,248	47	0
Battle Creek Metro Area	Calhoun	666.26	666	136,146	91	0
South Bend Mishawaka Metro Area IN/MI	Cass	98.09	98	52,293	5	0

Based on the 2008 emissions data and 2010 population estimates, the Detroit-Warren-Livonia CBSA needs two SO_2 monitoring sites, while the Holland-Grand Haven Metropolitan Area, Lansing-East Lansing Metropolitan Area, and Monroe Metropolitan Area each need a single SO_2 monitoring site.

The NCore trace level SO_2 monitor at Allen Park (261630001) fulfills the requirement for one of the SO_2 monitors required in the Detroit-Warren-Livonia CBSA. The MDEQ also monitors at Detroit–SWHS (261630015) and Port Huron (261470005).

The MDEQ deployed the Sterling State Park (261150006) site on January 1, 2013 to fulfill the requirement for the Monroe Metropolitan Area.

The MDEQ deployed SO_2 monitors in the Holland-Grand Haven Metropolitan Area at the Jenison site (261390005) in Ottawa County and in the Lansing-East Lansing Metropolitan Area at the Lansing site (260650012) in Ingham County, on January 1, 2012. The MDEQ and Region 5 have come to the conclusion that the Jenison site (261390005) is not sited close enough to pick up the power plant in West Olive, therefore the MDEQ shut down the Jenison SO_2 monitor at the end of 2013. In December 2014, the MDEQ set up a new monitoring site in West Olive (261390011) to address the power plant emission . **Figure 15** shows the new site location.

Figure 15: West Olive Monitoring Site

Table 25 summarizes the SO_2 monitoring site information for 2016 and 2017. **Figure 16** shows the geographical distribution of SO_2 sites across Michigan.

SO_2 Monitoring and Modeling Requirements

With the revision to the SO_2 NAAQS in 2010 federal regulations also changed for both monitoring and modeling SO_2 emissions. The USEPA established a three tiered process for assessing the attainment status of the ambient air near large sources emitting SO_2. States were first required to establish monitoring stations in areas with high population levels and high emission levels. Existing monitors in Detroit and Lansing, and new monitors in West Olive and Monroe met this obligation for assessment. Of these four areas, only a small region in eastern Wayne County was found to have levels of SO_2 exceeding the health-based standard. This area was designated by the USEPA as nonattainment. The MDEQ has completed an attainment plan that will bring the area into compliance with the NAAQS.

The second tier requires States to conduct either monitoring or modeling for sources emitting over 16,000 tons per year. The MDEQ identified six areas meeting this criteria. Modeling has been completed for sources in St. Clair, Eaton, Ingham, Marquette, Ottawa, Bay and Monroe Counties. The USEPA reviewed the modeling and intends to designate a small portion of St. Clair County as nonattainment. The other areas will be designated attainment/unclassifiable in July 2016. Control strategies will be developed for the sources in St. Clair County and the attainment plan will be incorporated into the Michigan State Implementation Plan (SIP). DTE

Energy has informed the MDEQ that will be installing two SO_2 special purpose monitoring stations in St. Clair County to provide additional SO2 and meteorological data to aid future SIP development.

The third tier involves modeling of SO_2 source emissions greater than 2000 tons per year. This current modeling project will be completed for submittal to the USEPA by the end of 2016.

The necessity of taking a combination monitoring/modeling approach to assessment for SO_2 was borne out of the fact that monitoring could not cover every wind scenario at each large emission source nationwide and States could not bear the large associated expenses of establishing enough new monitoring sites to adequately characterize the SO_2 pollutant levels in ambient air. Assessment is enhanced with additional modeling, a less expensive methodology, which helps to inform planners about the degree of the problem to solve and also the effectiveness of different proposed control options.

The MDEQ continues to identify strategies to reduce SO_2 pollutant levels through collaboration with Michigan industry, as well as local and federal partners.

SO_2 Quality Assurance

The site operator performs a precision check of the analyzer every two weeks. Precision checks are sent to the QA Coordinator each quarter. Each monitor is audited annually by the AMU's QA Team, which has a separate reporting line of authority from the site operator. The auditor utilizes dedicated gas calibrator and calibration gases that are only for audits. The independent audit challenges the accuracy of the station monitor. The auditor also assesses the monitoring system (inspecting the sample line, filters, and inlet probe), siting, and documentation of precision checks. Results of the audits and precision checks indicate whether the monitor is meeting the measurement quality objectives. The AMU uploads the precision check results and audit results to the EPA's AQS database each quarter. The QA Coordinator reviews all audit results, and hard copies are retained in the QA files.

The EPA conducts thru-the-probe audits on 20% of the SO_2 monitors each year. The audit consists of delivering four levels of calibration gas to the station monitor through the probe. The EPA reports the audit results to AQS.

Plans for the 2017 SO_2 Monitoring Network

During 2017, contingent upon adequate levels of funding, the MDEQ is planning to continue to operate an SO_2 monitor at:

- Detroit-SWHS (261630015)
- Grand Rapids–Monroe St. (260810020)
- Allen Park (261630001)
- Lansing (260650012)
- Port Huron (261470005)
- Sterling State Park (261150006)
- West Olive (261390011)

TABLE 25: MICHIGAN'S SO_2 MONITORING NETWORK

Operating Schedule: Continuous
Method: Ultra Violet Stimulated Fluorescence; Method Code 060 (SO_2) and Method Code 600 (trace SO_2)

NCore Sites

Site Name	Monitoring Sites AQS Site ID	Address	Latitude	Longitude	Measurement	Purpose	Scale	County	Start Date	CBSA [1]	Pop (2010 Census)
Grand Rapids - Monroe St	260810020	1179 Monroe NW	42.9842	-85.671389	trace	pop exp	nghbrhd	Kent	1/1/08	GW	988,938
Allen Park	261630001	14700 Goddard	42.2286	-83.208333	trace	pop exp	nghbrhd	Wayne	1/1/08	DWL	4,403,437

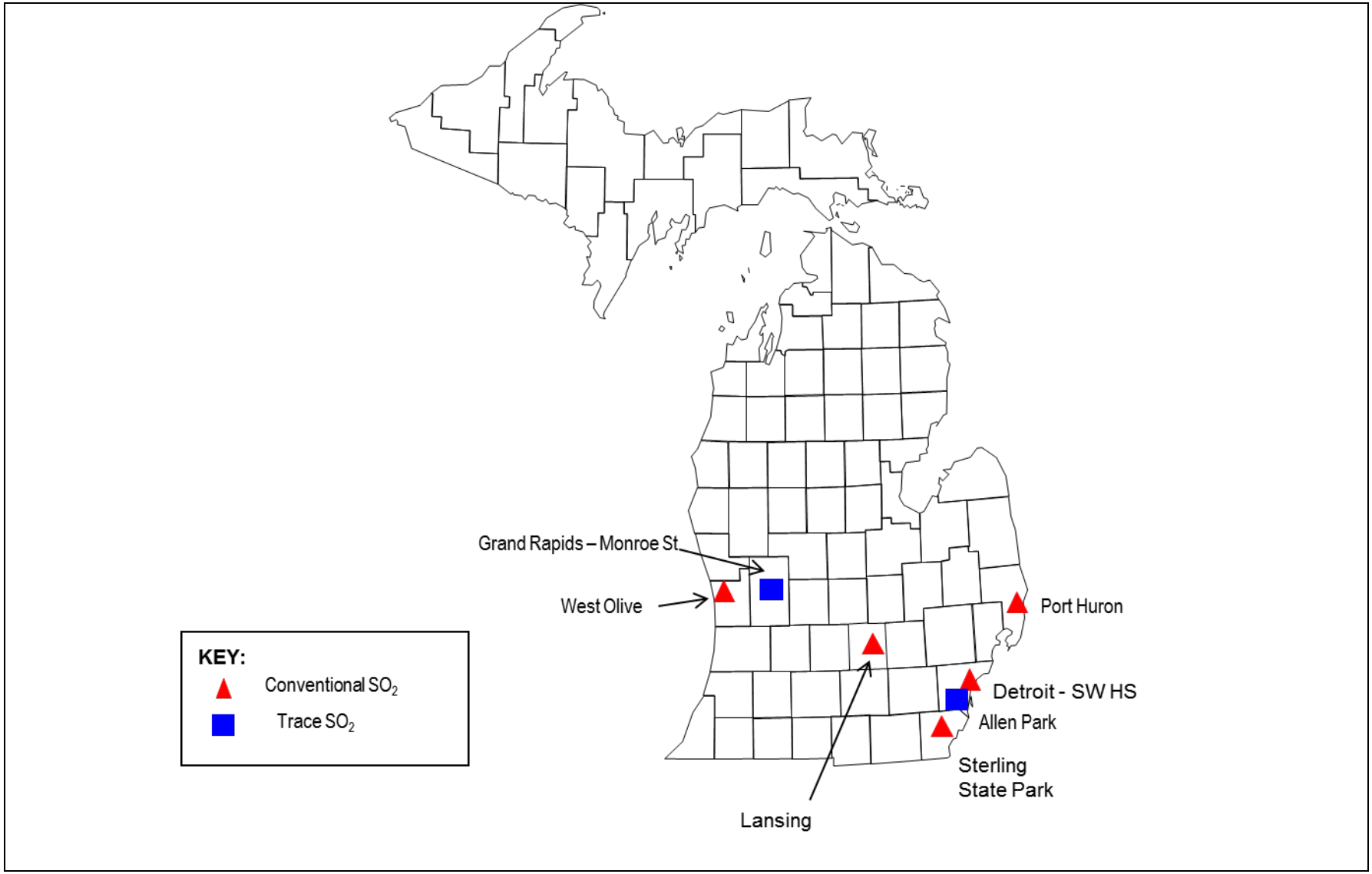
Source-Oriented Sites

Site Name	Monitoring Sites AQS Site ID	Address	Latitude	Longitude	Measurement	Purpose	Scale	County	Start Date	CBSA [1]	Pop (2010 Census)
Lansing	260650012	220 N Pennsylvania	42.7386	-84.534722	SO2	Max Conc	nghbrhd	Ingham	1/1/12	LEL	464,036
Sterling Sate Park	261150006	2800 State Park Road	41.9236	-83.345858	SO2	Max Conc	nghbrhd	Monroe	1/1/13	Monroe	152,021
West Olive	261390011	8578 Hiaw atha Dr.	42.9231	-86.194604	SO2	Max Conc	nghbrhd	Ottaw a	1/1/15	HGH	263,801
Detroit - SW HS	261630015	150 Waterman	42.3028	-83.106667	SO2	Max Conc	nghbrhd	Wayne	1/1/71	DWL	4,403,437
Port Huron	261470005	2525 Dove Rd	42.9533	-82.456389	SO2	Max Conc	urban	Saint Clair	2/28/81*	DWL	4,296,250

[1] **CBSA Key:**
DWL= Detroit-Warren-Livonia Metro. Area
GW=Grand Rapids-Wyoming Metro. Area
LEL= Lansing-East Lansing Metro. Area
HGH= Holland-Grand Haven Metro. Area
Monroe= Monroe Urbanized Area

* Monitor shutdow n in 2007 restarted in January 2012

FIGURE 16: MICHIGAN'S SO_2 MONITORING NETWORK



Trace Metal Monitoring Network:

Since 1981, monitoring for trace metals as TSP has been conducted as part of the Michigan Toxics Air Monitoring Program (MITAMP). Over the years, the program gradually expanded to eight sites that collected TSP samples on a once every six or once every 12 day schedule. The trace metals network follows the sampling calendar published by the EPA. The samples were analyzed for trace levels of metals. The suite of elements has been modified over the years, with the most recent list including manganese, arsenic, cadmium, and nickel at all sites. Lead is monitored at source-oriented sites and at NCore sites, as discussed in the lead section of this report. The Dearborn NATTS Site (261630033) has a more extensive metals list, which includes: beryllium, vanadium, chromium, manganese, nickel, cobalt, copper, zinc, arsenic, molybdenum, cadmium, barium, lead, and iron.

The trace metals sites include:

- Allen Park (261630001)
- Detroit-SWHS (261630015)
- S Delray-Jefferson (261630027)
- River Rouge (261630005)
- Dearborn (261630033)

Lead sites that have additional trace metals include:

- Belding-Merrick St. (260670003)
- Belding-Reed St. (260670002)
- Port Huron (261470031)

Trace metals as PM_{10} are determined as part of the NATTS program at Dearborn (261630033). To promote comparability with the TSP-size trace metals collected at other monitoring stations, and to assess both inter-sampler precision and method precision, co-located PM_{10} and TSP trace metals are also collected at Dearborn.

To provide data for an internal manganese work group, PM_{10} metals sampling was initiated at River Rouge (261630005) on January 25, 2009. PM_{10} filters collected at Allen Park (261630001) and Detroit-SWHS (261630015) were also analyzed for manganese starting January 25, 2009.

Laboratory analysis for manganese as PM_{10} include:

- Allen Park (261630001)
- Detroit-SWHS (261630015)
- River Rouge (261630005)
- Dearborn (261630033)

Table 26 summarizes the trace metal monitoring site information. **Figure 17** compares the locations of trace metal monitoring sites.

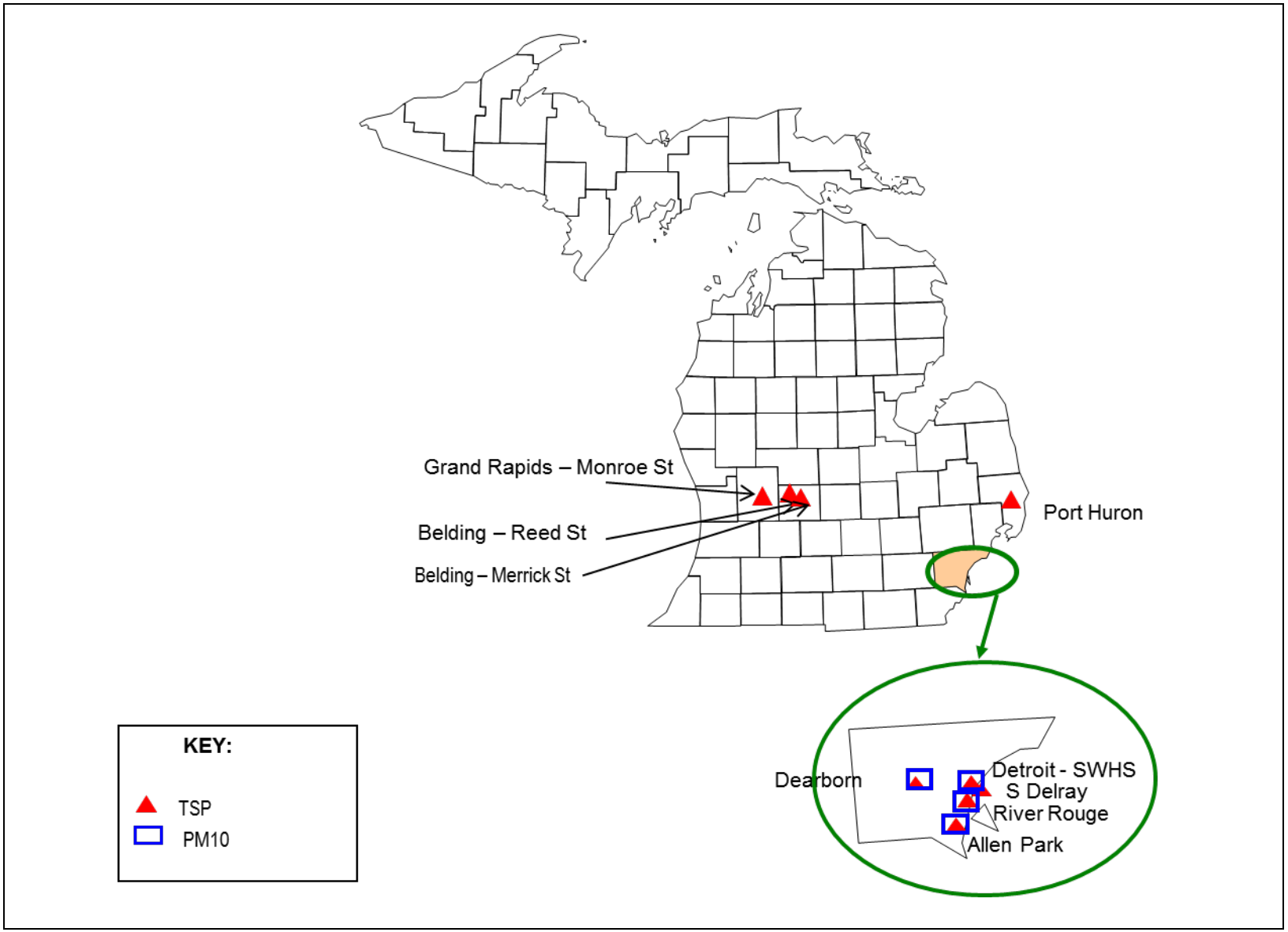
Table 26: Michigan's Trace Metal Monitoring Network

Operating Schedule: 1:6
Method: TSP: High Volume sampler using glass fiber filter ; Emission Spectra ICAP for lead; ICP MS for remaining metals; Method Code 108 (090 for Iron)
PM10: High Volume sampler using quartz filter; Emission Spectra ICAP for lead; ICP MS for remaining metals; Method Code 109

Monitoring Sites													
Site Name	AQS Site ID	Address	Latitude	Longitude	Sampling Frequency	Elements	Size	Purpose	Scale	County	Date Estab.	CBSA [1]	Pop (2010 Census)
Belding - Reed St	260670002	545 Reed St	43.101944	-85.22000	1:6	Pb, Mn, As, Cd, Ni	TSP	max conc	middle	Ionia	7/2/11	GW	988,938
Belding - Merrick St	260670003	509 Merrick	43.09984	-85.22163	1:6	Pb, Mn, As, Cd, Ni	TSP	max conc	micro	Ionia	1/1/10	GW	988,938
Grand Rapids - Monroe St	260810020	1179 Monroe St NW	42.984167	-85.671389	1:6	Pb, Mn, As, Cd, Ni	TSP	pop exp	nghbrhd	Kent	1/8/10	GW	988,938
Port Huron	261470031	324 Rural St	42.98209	-82.449233	1:6	Mn, As, Cd, Ni	TSP	max conc	micro	Saint Clair	1/1/13	DWL	4,296,250
Allen Park	261630001	14700 Goddard	42.228611	-83.208333	1:6	Mn, As, Cd, Ni	TSP	pop exp	nghbrhd	Wayne	5/1/99	DWL	4,296,250
Dearborn	261630033	2842 Wyoming	42.306666	-83.148889	1:6	Be, V, Cr, Mn, Co, Ni, Cu, Zn, As, Mo, Cd, Ba, Pb, Fe	TSP	max conc	nghbrhd	Wayne	6/1/90	DWL	4,296,250
River Rouge	261630005	315 Genesee	42.267222	-83.132222	1:6	Mn, As, Cd, Ni	TSP	max conc	nghbrhd	Wayne	1/1/94	DWL	4,296,250
Detroit - SW HS	261630015	150 Waterman	42.302778	-83.106667	1:6	Mn, As, Cd, Ni	TSP	pop exp	nghbrhd	Wayne	2/26/99	DWL	4,296,250
S Delray	261630027	7701 W Jefferson	42.292222	-83.106944	1:6	Mn, As, Cd, Ni	TSP	max conc	nghbrhd	Wayne	10/6/04	DWL	4,296,250
Dearborn - Co-located	261630033	2842 Wyoming	42.306666	-83.148889	1:12	Be, V, Cr, Mn, Co, Ni, Cu, Zn, As, Mo, Cd, Ba, Pb, Fe	TSP	max conc	nghbrhd	Wayne	6/1/90	DWL	4,296,250
Allen Park	261630001	14700 Goddard	42.228611	-83.208333	1:6	Mn, As, Cd, Ni	PM 10	pop exp	nghbrhd	Wayne	1/25/09	DWL	4,296,250
River Rouge	261630005	315 Genesee	42.267222	-83.132222	1:6	Mn	PM 10	max conc	nghbrhd	Wayne	1/25/09	DWL	4,296,250
Detroit - SW HS	261630015	150 Waterman	42.302778	-83.106667	1:6	Mn	PM 10	pop exp	nghbrhd	Wayne	1/25/09	DWL	4,296,250
Dearborn	261630033	2842 Wyoming	42.306666	-83.148889	1:6	Be, V, Cr, Mn, Co, Ni, Cu, Zn, As, Mo, Cd, Ba, Pb, Fe	PM 10	max conc	nghbrhd	Wayne	6/1/90	DWL	4,296,250
Dearborn - Co-located	261630033	2842 Wyoming	42.306666	-83.148889	1:12	Be, V, Cr, Mn, Co, Ni, Cu, Zn, As, Mo, Cd, Ba, Pb, Fe	PM 10	max conc	nghbrhd	Wayne	6/1/90	DWL	4,296,250

[1] **CBSA Key:** DWL= Detroit-Warren-Livonia Metro. Area GW = Grand Rapids- Weyoming Metro Area

FIGURE 17: MICHIGAN'S TRACE METAL MONITORING NETWORK



Trace Metal Quality Assurance

The site operator conducts a precision flow check once a month. Flow check values are sent to the QA Coordinator each quarter. An independent audit is conducted by a member of the AMU's QA Team every six months. The auditor is in a separate line of reporting authority from the site operator and uses independent, dedicated equipment to perform the flow rate audit. The auditor also assesses the condition of the monitor and siting criteria. The QA Coordinator reviews all audit results, and hard copies are retained in the QA files. Audit results are uploaded to the EPA's AQS database each quarter.

The MDEQ Laboratory participates in two types of external performance testing programs. A nationally-based audit program sends a sample that has a known concentration of metals spiked onto a filter. The lab analyzes the filter in the same fashion as the routine samples. Results are compared to a "true" value and tabulated for all participants in the program. The MDEQ Laboratory also receives regional round robin audits. The regional audit sample is collected by running an ambient air monitor for 24 hours. The filter is cut into strips and sent to several laboratories. Results for the participating laboratories are compared to each other since a "true" value is not known.

Precision samples for both PM_{10} and TSP-sized trace metals are collected at Dearborn (261630033) on a once every 12 day frequency.

Plans for the 2017 Trace Metal Network:

During 2017, contingent upon adequate levels of funding, the MDEQ plans to continue to collecting trace metal measurements, as described for the above elements at:

- Belding-Reed St. (260670002) - TSP – lead, manganese, nickel, arsenic and cadmium
- Belding-Merrick St. (260670003) - TSP – lead, manganese, nickel, arsenic and cadmium
- Grand Rapids-Monroe St. (260810020) - TSP – manganese, nickel, arsenic and cadmium
- Allen Park (261630001) - TSP – manganese, nickel, arsenic and cadmium; for PM_{10} manganese, nickel, arsenic and cadmium
- Detroit-SWHS (261630015) - TSP - manganese, nickel, arsenic and cadmium; for PM_{10} manganese, nickel, arsenic and cadmium
- South Delray (261630027) - TSP – manganese, nickel, arsenic and cadmium only
- River Rouge (261630005) - TSP - manganese, nickel, arsenic and cadmium; for PM_{10} manganese, nickel, arsenic and cadmium
- Dearborn NATTS site (261630033) for both PM_{10} and TSP – metals reported include manganese, nickel, arsenic, cadmium, lead, beryllium, vanadium, chromium, cobalt, copper, zinc, molybdenum, barium and iron.
- Port Huron (261470031) - TSP – lead, manganese, nickel, arsenic and cadmium.

Volatile Organic Compound (VOC) Monitoring Network:

The collection of more than 50 VOCs per sample began at various sites in 1990 as part of the MITAMP air toxics network. Either a once every six day or once every 12 day sampling frequency has been used depending on the site and budget status. The VOC network follows the sampling calendar published by the EPA. The Detroit-SWHS (261630005) site in Detroit has been the trend site and has collected VOC samples every year since 1993. The determination of VOC samples on a one every six day sampling frequency using Method TO-15 is required for the NATTS site at Dearborn (261630033). A minimum of six precision samples per year are also collected at Dearborn (261630033) as part of the NATTS program.

Table 27 summarizes the VOC monitoring site information. **Figure 18** illustrates the geographical distribution of VOC monitors in Michigan.

VOC Quality Assurance

Once a year, the QA Team conducts a thru-the-probe audit using a known concentration of specialized calibration gas. The gas is sent through the station sample probe and collected into a clean, evacuated 6-liter Summa canister over a 24-hour period, and analyzed using EPA Method TO-15. The results are compared to the auditor's target concentration. Once a year, the QA Team also conducts a zero air check on the sampler by running VOC-free air through the probe and into an air canister for 24 hours. The auditor assesses the sampling configuration, including the condition and height of probe and siting criteria.

The MDEQ Laboratory also participates in both national and regional performance test programs. The national program sends a spiked sample of known compounds and concentrations to the laboratory. The results from state laboratories are compared to the "true" value. The regional performance test audit is produced by a multi-sampling unit that collects actual ambient air. The results from the participating laboratories are compared to each other since a "true" value is not known. The QA Coordinator receives, reviews, and retains copies of all performance test audit samples.

Performance evaluation samples containing known levels of various VOCs are analyzed by the MDEQ Laboratory. The MDEQ Laboratory also participates in regional round robin samples.

Plans for the 2017 VOC Monitoring Network

During 2017, contingent upon adequate levels of funding, the MDEQ plans to continue collecting VOCs at:

- Detroit-SWHS (261630015) once every 12 days.
- Dearborn NATTS site (261630033) once every six days and precision samples.

TABLE 27: MICHIGAN'S VOC MONITORING NETWORK

Operating Schedule: 1:6 and 1:12
Method: Stainless Steel Pressurized Canister Sampler; Gas Chromatograph/ Mass Spectrometer (24-hr samples); Method Code 110

Monitoring Sites											
Site Name	AQS Site ID	Address	Latitude	Longitude	Sampling Frequency	Purpose	Scale	County	Date Estab.	CBSA [1]	Pop (2010 Census)
Detroit - SWHS	261630015	150 Waterman	42.302778	-83.106667	1:12	pop exp	nghbrhd	Wayne	2/26/99	DWL	4,296,250
Dearborn	261630033	2842 Wyoming	42.306666	-83.148889	1:6	max conc	nghbrhd	Wayne	6/1/90	DWL	4,296,250

[1] **CBSA Key:** DWL= Detroit-Warren-Livonia Metro. Area

FIGURE 18: MICHIGAN'S VOC MONITORING NETWORK

Carbonyl Monitoring Network:

The collection of carbonyl compounds, including formaldehyde and acetaldehyde as part of MITAMP, began at various sites in 1995. Either a once every six day or once every 12 day sampling frequency has been used depending on the site and budget status. The carbonyl network follows the sampling calendar published by the EPA. The Detroit-SWHS (261630005) site in Detroit has been the trend site and has collected carbonyl samples every year since 1995.

Levels of formaldehyde in southeast Michigan are very heterogeneous, unlike other areas of the United States. Historical concentrations at River Rouge (261630005) are elevated, so the continuation of this monitor is important for the characterization of risk and for the determination of trends, this runs on a once every 12 day schedule. Detroit-SWHS (261630015) is the MDEQ's air toxic trend site, so monitoring has continued on a once every 12 day schedule. Monitoring for carbonyl compounds on a one in six day frequency using Method TO-11A is required at the Dearborn NATTS site (261630033). Also, as a part of NATTS, six precision samples for carbonyls are collected every year.

Table 28 summarizes the carbonyl monitoring site information for sites that were in existence in 2016 and will be added in 2017. **Figure 19** shows the distribution of carbonyl samplers across Michigan.

Carbonyl Quality Assurance

Once a year, the QA Team conducts a thru-the-probe audit using a known concentration of specialized calibration gas. The gas is sent through the station sample probe and collected on a dinitrophenyl hydrazine (DNPH) cartridge over a 24-hour period, and analyzed using EPA Method TO-11A. The laboratory result is compared to the auditor's target concentration. The QA Team also conducts a zero air check of the sampler once a year by sending carbonyl-free air through the probe and into the sampler for 24 hours. The auditor assesses the sampling configuration, including the condition and height of probe and siting criteria.

The carbonyl samples are sent to two different labs. NATTS samples go to a National Contract Lab. The National Lab participates in a national performance test program. The lab where the Detroit-SWHS and River Rouge samples go is also required to participate in the NATTS performance test program. The national contractor sends a spiked sample of known compounds and concentrations to the laboratory. The results are compared to the "true" value. The regional performance test audit is produced by a multi-sampling unit that collects actual ambient air. The results from the participating laboratories are compared to each other since a "true" value is not known. The QA Coordinator receives, reviews, and retains copies of all performance test audit samples.

Plans for the 2017 Carbonyl Monitoring Network

During 2017, contingent upon adequate levels of funding, Michigan plans to continue collecting carbonyls at:

- Detroit-SWHS (261630015) once every 12 days
- River Rouge (261630005) once every 12 days
- Dearborn NATTS site (261630033) once every six days and precision samples.

TABLE 28: MICHIGAN'S CARBONYL MONITORING NETWORK

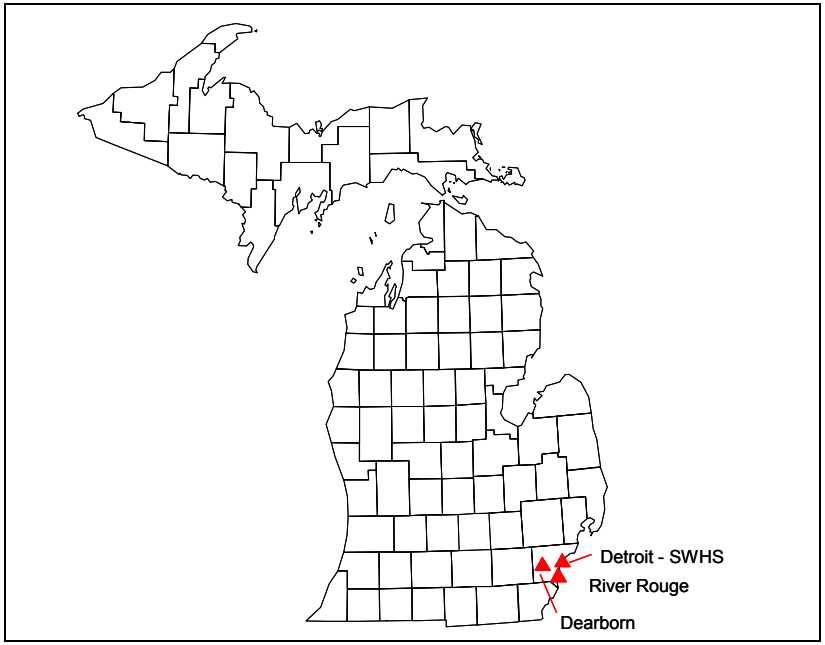
Operating Schedule: 1:6 and 1:12

Method: 2,4 dinitrophenyl hydrazine treated silica gel cartridges; HPLC w ith ultraviolet absorption; Method Code 202

Monitoring Sites											
Site Name	AQS Site ID	Address	Latitude	Longitude	Sampling Frequency	Purpose	Scale	County	Date Estab.	CBSA [1]	Pop (2010 Census)
Dearborn	261630033	2842 Wyoming	42.306666	-83.148889	1:6	max conc	nghbrhd	Wayne	6/1/90	DWL	4,296,250
River Rouge	261630005	315 Genesee	42.267222	-83.132222	1:12	max conc	nghbrhd	Wayne	1/1/94	DWL	4,296,250
Detroit - SWHS	261630015	150 Waterman	42.302778	-83.106667	1:12	pop exp	nghbrhd	Wayne	2/26/99	DWL	4,296,250

[1] **CBSA Key:** DWL= Detroit-Warren-Livonia Metro. Area

FIGURE 19: MICHIGAN'S CARBONYL MONITORING NETWORK



Polynuclear Aromatic Hydrocarbons (PAHs) Monitoring Network:

As part of the EPA's desire to augment the NATTS, PAHs were added to the Dearborn site on April 6, 2008. Samples are collected on a once every six day sampling schedule using an Anderson PS-1 sampler. The PAH network follows the sampling calendar published by the EPA. The sampler contains a glass thimble filled with prepared polyurethane foam plugs that surround XAD-2 resin. Volatile PAHs are absorbed into the foam and XAD-2 resin. Particle bound PAHs are trapped on a filter that precedes the thimble. A second sampler was deployed to the Dearborn site so that six precision samples can be collected each year, conforming to the EPA's co-location criteria.

The media is sent to the national contract laboratory, Eastern Research Group (ERG), where it is extracted and analyzed according to ASTM test method D 6209, which is equivalent to EPA method TO-13A.

Table 29 shows the site information for PAH sites that were in operation in 2016 and are currently operating. **Figure 20** shows the locations of sites where PAH monitoring occurs.

PAH Quality Assurance

The site operator conducts a precision flow check once a month. The flow check values are sent to the QA Coordinator each quarter. An independent audit is conducted by a member of the AMU's QA Team once a year. The auditor is in a separate line of reporting authority from the site operator and uses independent, dedicated equipment to perform the flow rate audit. The auditor also assesses the condition of the monitor and siting criteria. The QA Coordinator reviews all audit results, and hard copies are retained in the QA files.

Plans for the 2017 PAH Monitoring Network

During 2017, contingent upon adequate levels of funding, Michigan plans to continue collecting PAHs at:

- Dearborn (261630033) – once every six days and precision samples

TABLE 29: MICHIGAN'S PAH MONITORING NETWORK

Operating Schedule: 1:6

Method: Polyurethane foam plugs and XAD-2 resin with gas chromatography mass spectrometry; Method Code 118

Monitoring Sites											
Site Name	AQS Site ID	Address	Latitude	Longitude	Sampling Frequency	Purpose	Scale	County	Date Estab.	CBSA [1]	Pop (2010 Census)
Dearborn	261630033	2842 Wyoming	42.30667	-83.1489	1:6	max conc	nghbrhd	Wayne	6/1/90	DWL	4,296,250

[1] **CBSA Key:** DWL= Detroit-Warren-Livonia Metro. Area

FIGURE 20: MICHIGAN'S PAH MONITORING NETWORK

Meteorological Measurements:

Various meteorological measurements have been added to supplement the ambient monitoring network and enhance data analysis activities. A description of the types of meteorological measurements that are made at each site is provided in **Table 30**. The MDEQ is not planning any changes to the meteorological measurements.

Meteorological Equipment Quality Assurance

On an annual basis, an Equipment Technician conducts a multi-speed and directional certification of the propeller anemometer and vane systems. The QA Team staff or Senior Environmental Technician performs a "sun shot" to check the true north orientation of the anemometer and vane system at the station.

An independent audit is conducted by the QA Team to assess the accuracy of the indoor and outdoor temperature, barometric pressure, and relative humidity measurements at the site. The comparison is done between the station's measurements and the auditor's certified thermometer, barometer, and hygrometer to ensure quality objectives are being met. The QA Coordinator reviews the results of both the wind speed and wind direction certifications as well as the independent audits. Hard copies of all assessments are retained in the QA file system.

Plans for the 2017 Meteorological Monitoring Network

During 2017, contingent upon adequate levels of funding, Michigan plans to continue collecting hourly meteorological measurements at:

- Holland (26005003)
- Bay City (260170014)
- Coloma (260210014)
- Cassopolis (260270003)
- Flint (260490021)
- Otisville (260492001)
- Harbor Beach (260630007)
- Belding-Reed St. (260670002)
- Lansing (260650012)
- Kalamazoo (260770008)
- Grand Rapids–Monroe St. (260810020)
- Evans (280810022)
- Tecumseh (260910007)
- New Haven (260990009)
- Sterling Heights/Freedom Hill (260990021)
- Scottville (261050007)
- Houghton Lake (261130001)
- Sterling St Park–Monroe (261150006)
- Muskegon–Green Creek Rd. (261210039)
- Oak Park (261250001)
- Pontiac (261250011)
- Rochester (261250012)
- Jenison (261390005)
- West Olive (261390011)
- Port Huron (261470005)

- Seney (261530001)
- Ypsilanti (261610008)
- Allen Park (261630001)
- River Rouge (261630005)
- Detroit–SWHS (261630015)
- Detroit – E 7 Mile (261630019)
- Livonia Near Road (261630095)
- Detroit-Joy Rd. (261630026)
- Dearborn (261630033)
- Detroit–FIA/Lafayette (261630039)
- Eliza Howell #1 (261630093)
- Eliza Howell #2 (261630094)

To the best of our knowledge, the following tribal meteorological equipment monitor will continue operation:

- Manistee (261010922)
- Sault Ste. Marie (260330901)

TABLE 30: METEOROLOGICAL MEASUREMENTS IN MICHIGAN

Site Name	AQS ID	WS	WD	Temperature	Rel. Humidity	Barom. Pressure	Solar Radiation	Sigma Theta
Holland	260050003	x	x	x	x	x	x	x
Bay City	260170014	x	x	x				x
Coloma	260210014	x	x	x				x
Cassopolis	260270003	x	x	x				x
Sault Ste Marie +	260330901	x	x	x		x		x
Flint	260490021	x	x	x		x		x
Otisville	260492001	x	x	x		x		x
Harbor Beach	260630007	x	x	x				x
Belding- Reed St	260670002	x	x	x		x		x
Lansing	260650012	x	x	x		x		x
Kalamazoo	260770008	x	x	x				x
Grand Rapids - Monroe St	260810020	x	x	x	x	x		x
Evans	260810022	x	x	x				x
Tecumseh	260910007	x	x	x		x		x
New Haven	260990009	x	x	x	x		x	x
Sterling Hts/ Freedom Hill	260990021	x	x	x				x
Manistee +	261010922	x	x	x		x	x	x
Scottville	261050007	x	x	x				x
Houghton Lake	261130001	x	x	x		x		x
Sterling St Park - Monroe	261150006	x	x	x				x
Muskegon, Green Ck Rd	261210039	x	x	x				x
Oak Park	261250001	x	x	x		x		x
Pontiac	261250011	x	x	x				x
Rochester	261250012	x	x	x				x
Jenison	261390005	x	x	x				x
West Olive	261390011	x	x	x				x
Port Huron	261470005	x	x	x		x		x
Seney	261530001	x	x	x	x	x	x	x
Ypsilanti	261610008	x	x	x		x		x
Allen Park	261630001	x	x	x	x	x		x
River Rouge	261630005	x	x	x				x
Detroit - SW HS	261630015	x	x	x	x	x		x
Detroit - E 7 Mi	261630019	x	x	x	x	x		x
Livonia Near Road	261630095	x	x	x	x	x		x
Detroit - Joy Rd	261630026	x	x	x				x
Dearborn	261630033	x	x	x	x	x		x
Detroit -FIA/Lafayette	261630039	x	x	x				x
Eliza How ell #1	261630093	x	x	x				x
Eliza How ell #2	261630094	x	x	x	x	x		x

Special Purpose Monitors

The MDEQ is currently working on two special projects. The first project is a Community Scale Air Toxics Ambient Monitoring (CSATAM) grant. In 2015, the MDEQ applied for a CSATAM grant to study near roadway emissions at three sites in Detroit: Eliza Howell Near Road (261630093), Eliza Howell Downwind (261630094), and Livonia Near Road (261630095). The grant involves two years of monitoring at these sites, with an intensive three month period where additional samples and increased sampling frequency will be employed. The additional instruments that will be deployed at these sites are listed in **Table 31**. These instruments are currently being installed and tested, the MDEQ is working for a start date of June 1, 2016, for year round instruments. The intensive three month sampling period will allow for the analysis of toxic compounds that are more labor intensive to collect. The schedule for the intensive period has been delayed due to road construction at the Livonia Near Road site. A new schedule will be developed in late 2016, with sampling schedule sometime during the late spring to early summer of 2017.

The second special purpose monitoring project, resulted from a request from community members in the Detroit 48217 neighborhood for an air monitoring station in their neighborhood. The 48217 community has many industrial sources located in and around it. As such, the MDEQ has agreed to place an air monitoring station in their community. Currently, the MDEQ is negotiating for access to place an air monitoring trailer. At the same time the citizens group that requested the monitoring is working on a list of air pollutants to be monitored. The site will include a SO2 monitor and may include VOCs, carbonyls, PAHs, also well as meteorological measurements. The MDEQ is working towards a start date of July 1, 2016, for this site.

Table 31: Additional Instruments Placed at Near Road Sites for CSATAM Study

Site	Insturment	Sampling Frequency	Sampling Duration
Eliza Howell Near Road (261630093)	Ozone	Hourly	2 years
	BAM	Hourly	2 years
	BTEX	Hourly	2 years
	Ultrafine	Hourly	2 years; will rotate between sites during intensive
	Aethalometer	Hourly	2 years
	TSP Metals	24-hr, every other day	3 month intensive
	Carbonyls	24-hr, every other day	3 month intensive
	XACT	Hourly	3 month intensive; rotating between all sites (one month each site)
Eliza Howell Down Wind (261630094)	Ozone	Hourly	2 years
	BTEX	Hourly	2 years
	Aethalometer	Hourly	2 years
	TSP Metals	24-hr, every other day	3 month intensive
	Carbonyls	24-hr, every other day	3 month intensive
	XACT	Hourly	3 month intensive; rotating between all sites (one month each site)
	Ultrafine	Hourly	3 month intensive; rotating between all sites (one month each site)
Livoinia Near Road (26630095)	Ozone	Hourly	2 years
	BAM	Hourly	2 years
	BTEX	Hourly	2 years
	Aethalometer	Hourly	2 years
	TSP Metals	24-hr, every other day	3 month intensive
	Carbonyls	24-hr, every other day	3 month intensive
	XACT	Hourly	3 month intensive; rotating between all sites (one month each site)
	Ultrafine	Hourly	3 month intensive; rotating between all sites (one month each site)

Adequacy of Michigan's Monitoring Sites:

The suitability of monitoring site locations is frequently assessed by the AMU's QA Team and the EPA. The EPA assesses the adequacy of the stations during $PM_{2.5}$ PEP audits, gaseous NPAP audits, and systems audits. The results indicate that the stations are properly sited, which includes distances away from obstructions, large trees, and set-backs from roadways. Suitability of probe heights and separation distances are assessed both by MDEQ and EPA auditors. If any issues are found during the audits, the MDEQ works with EPA Region 5 to correct them during the audit follow-up process.

In 2015, as required by 40CFR Part 58.10(d), a regional assessment of air quality monitoring for criteria pollutants was performed to provide the state and local networks with information on (1) whether their networks still meet the monitoring objectives, (2) whether new sites are needed, (3) whether existing sites are no longer needed, and (4) whether new technologies are appropriate for incorporating into the network. The recommendations in the assessment are nonbinding and are intended to help inform the state and local agencies of the relative strengths and weaknesses of their networks. LADCO oversaw the process and all States in Region 5 worked together to produce one document, which can be reviewed here: http://www.ladco.org/reports/general/Regional_Network_Assessment/exec_summary_for_net_assess_3.pdf. No changes to the Michigan Network will be made as a result of this assessment.

The Dearborn NATTS Site (261630033) has an issue with a tree dripline being too close to some of the monitors located on the sampler deck. The tree is located on private property, and therefore the MDEQ has no authority to remove the tree. The MDEQ is currently investigating ways to rearrange the site, so that the tree dripline will no longer be an issue.

Table 32 Summarizes the various monitoring waivers the MDEQ has requested.

TABLE 32: SUMMARY OF WAIVERS FOR MICHIGAN'S MONITORING NETWORK

Type of Wavier	Explanation
Ozone Monitor	The Ann Arbor MSA does not have enough space for the downwind monitor in Washtenaw County, therefore the MDEQ requests to place it in Oakland County
Lead Co-location	There is not a large enough foot print at the Belding monitoring sites to co-locate a lead monitor. Therefore, the MDEQ requests to leave the lead co-location at Dearborn. Originally requested in 2010.
Lead Monitoring	Request to waive lead monitoring at Consumer's JH Campbell plant. Modeling shows low impact. Originally requested in 2009 and re-submitted in 2014. Needs to be renewed every 5 years.
Lead Monitoring	Request to waive lead monitoring at St. Mary's Cement plant. Modeling shows low impact. Originally requested in 2009 and re-submitted in 2014. Needs to be renewed every 5 years.
Lead Monitoring	Request to waive lead monitoring at Consumer's Karn-Weadock plant. Modeling shows low impact. Originally requested in 2011 and re-submitted in 2016. Needs to be renewed every 5 years.
Tree Line	At the Dearborn NATTS, there is a tree on personal property that is getting close to the drip line limit. The MDEQ has a waiver request pending.

Appendix A: Acronyms and Their Definitions:

>	Greater than
<	Less than
≥	Greater than or equal to
≤	Less than or equal to
%	Percent
$\mu g/m^3$	Micrograms per cubic meter
AERMOD	AMS/EPA Regulatory Model
AMU	Air Monitoring Unit
AQD	Air Quality Division
AQS	Air Quality System (EPA air monitoring data archive)
ARM	Approved regional method
BAM	Beta Attenuation Monitor (hourly $PM_{2.5}$ measurement monitor)
CAA	Clean Air Act
CASTNET	Clean Air Status and Trends Network
CBSA	Core-Based Statistical Area
CFR	Code of Federal Regulations
CO	Carbon monoxide
CSA	Consolidated Statistical Area
DNPH	2,4 -di nitrophenyl hydrazine – this is the derivatizing agent on the cartridges used to collect carbonyl samples
DPW	Department of Public Works
EC	Elemental carbon
EPA	U.S. Environmental Protection Agency
FDMS	Filter Dynamic Measurement System
FEM	Federal Equivalent Method
FIA	Family Independence Agency
FRM	Federal Reference Method
GC	Gas chromatograph (instrument providing VOC measurements)
GFIs	Ground fault circuit interrupters
hr	Hour
IN-MI	Indiana-Michigan
LADCO	Lake Michigan Air Directors Consortium
DEQ	Michigan Department of Environmental Quality
MITAMP	Michigan Toxics Air Monitoring Program
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
NEI	National Emission Inventory
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
OAQPS	Office of Air Quality and Planning and Standards (EPA)
OC	Organic carbon
OTAQ	Office of Transportation and Air Quality (EPA)
PAH	Polynuclear Aromatic Hydrocarbon
PAMS	Photochemical Assessment Monitoring Station

Appendix A: Acronyms and Their Definitions, Continued

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 $PM_{2.5}$
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
RTI	Research Triangle Institute (national contract laboratory for speciated $PM_{2.5}$)
SLAMS	State and Local Air Monitoring Station
SO_2	Sulfur dioxide
STAG	State Air Grant (federal)
STN	Speciation Trend Network ($PM_{2.5}$)
TEOM	Tapered element oscillating microbalance (hourly $PM_{2.5}$ measurement monitor)
tpy	ton per year
TRI	Toxic Release Inventory
TSP	Total Suspended Particulate
U of M	University of Michigan
U.S.	United States
VOC	Volatile organic compounds

Appendix B: Summary of Comments Received and Replies

As part of the network review process, the EPA requires that the MDEQ solicit public comments. MDEQ made the draft 2017 Network Review available for public review by posting the document on its air quality homepage. To ensure that public was aware that the document was open for comment, the 30-day public comment period was announced in the DEQ Calendar on May 16, 2016.

The MDEQ received two comments to the network review. One comments spoke to the need to monitor in Marquette County, near a mining facility. The other comments spoke to the need to improved SO_2 data in St. Clair County and the need for meteorological data at the MDEQ Warren site.

Comment 1:

The first commenter suggested that air monitoring should be conducted in Marquette County to determine the impact that emissions form mining operations have upon air quality.

Response 1:

The emissions from mining operations to which the commenter refers have undergone review as part of MDEQ's air quality permitting program. This review did not find that these emissions would have an adverse impact upon local air quality. In addition, because of the relatively small population in Marquette County, EPA regulations do not require that MDEQ conduct air monitoring. Given limited time and resources, the MDEQ does not have the ability to carry out air monitoring in Marquette County without a regulatory mandate.

Previous monitoring performed by the Superior Watershed Partnership and Land Trust (SWP) from May 2013 to May 2014 showed that all metal concentrations obtained are below their acute screening levels that are protective for short-term adverse health effects, and are not associated with an health risk to the public. The MDEQ air toxics unit performed a health effects screening of the data collected, the final report is located at the end of Appendix B starting on page 86.

Comment 2:

The commenter suggested that additional SO2 monitoring would be beneficial in St. Clair County for the development of the SO2 nonattainment area State Implementation Plan (SIP). The commenter volunteered to install and operate two SO2 stations for this purpose. The commenter also state that collecting meteorological data at the DEQ Warren site would benefit possible future ozone nonattainment SIP planning.

Response 2:

The MDEQ agrees with both comments that the commenter voiced. The MDEQ is supportive of deploying the two SO2 monitoring sites near Belle River and St. Clair power plants in St. Clair County. The MDEQ appreciates willingness of the commenter to follow the USEPA ambient air monitoring regulations so that the data from these monitors can be added to the EPA AQS data base and agrees that these monitors should be designated as 'special purpose monitors'.

As for adding meteorological data to the Warren monitoring site, the MDEQ agrees that this would be beneficial for any future SIP development. However, there are power lines near the

monitoring trailer that make the addition of meteorological data impossible, as can be seen in the pictures below.

Methods for Health Effects Screening of Big Bay Metals Air Monitoring Data

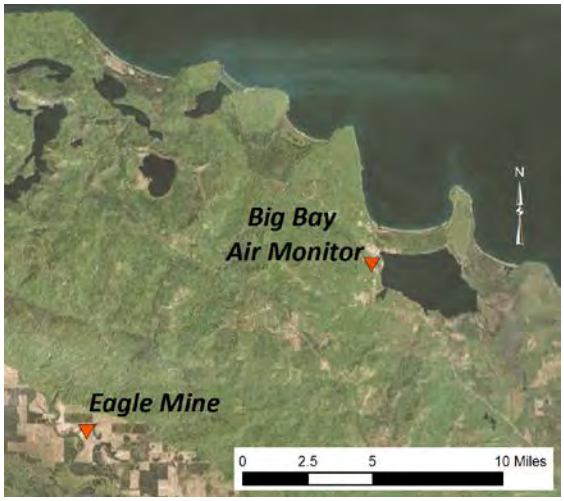
By Mike Depa and Dr. Keisha Williams October 13, 2014
Michigan Department of Environmental Quality, Air Quality Division

Abstract

The Superior Watershed Partnership and Land Trust (SWP) collected four, 24-hr air samples from May 2013 to May 2014 in Big Bay, Michigan. The Michigan Department of Environmental Quality (MDEQ) was asked by SWP to compare the resulting air metal concentrations to appropriate health protective benchmarks in order to characterize the public health significance of the measured levels. MDEQ Air Quality Division's health-based screening levels (SLs) are intended for use in the permitting process, but they can also be used (with caution) in interpreting the public health significance of ambient air monitoring data. All metal concentrations were below their respective short-term SLs. Although the data thus far are very limited for assessment of long-term public health concerns, the average metal concentrations were compared to long-term health based screening levels. Only arsenic was found to be higher than the long-term SL of a 1-in-100,000 lifetime cancer risk, due to one particularly high sample. Future arsenic air monitoring results would help characterize long-term exposure and potential health impacts.

This report is intended to help interpret the results of recent Superior Watershed Partnership (SWP) monitoring of metals in the ambient air near Big Bay, MI as well as provide a method which with to evaluate future monitoring results. The Big Bay air monitor[13] is located approximately 13 miles northeast of the Eagle Mine (see Figure 1). The potential health risk from exposure is characterized by comparing the measured air concentrations to health-based screening levels (SLs) typically used by Michigan Department of Environmental Quality (MDEQ) Air Quality Division (AQD) to evaluate the acceptability of industrial facility emissions of toxic air contaminants (TACs). During the permitting process, SLs provide a regulatory basis for legally requiring a facility to limit their emissions of pollutants so that public health is protected. It should be noted that no attempt was made by MDEQ to determine the quality of air sampling methods employed by SWP. At MDEQ air monitoring sites, a rigorous quality assurance and quality control (QA/QC) program is used. The MDEQ, as well as the U.S. Environmental Protection Agency (EPA) audit the monitoring network annually using various methods including inspecting the QA/QC records, and site inspections. Field and laboratory sampling QA/QC protocols also include analyzing sampling and field blanks to assess the monitoring equipment and procedure for chemical contamination.

Figure 1. Big Bay Air Monitor Location



[13] Behind Cram's General Store, Box 370 Country Road 550, Big Bay, MI 49855 (46.811802, -87.730272)

The MDEQ-AQD uses a variety of sources for acute and chronic SLs. The National Ambient Air Quality Standards (NAAQS) are the best source for evaluating ambient air concentrations of the six criteria air pollutants. Elemental lead is the only metal among the criteria pollutants, and as such it has a NAAQS. A good source of benchmarks for evaluating ambient air levels of non-criteria pollutants (i.e., the air toxics), is AQD's Initial Threshold Screening Levels (ITSLs) for non-cancer effects, and the Initial Risk Screening Levels (IRSLs) and Secondary Risk Screening Levels (SRSLs) for cancer effects. These SLs take into account that some people are more sensitive to chemical exposures, such as children, the elderly, pregnant women, and people with pre-existing health conditions. Each SL for a particular TAC has an averaging time. The ITSLs represent a continuous air concentration over the averaging time for which adverse health effects are unlikely to occur. The Initial Risk Screening Level (IRSL) is a concentration that represents a probability of cancer risk over a lifetime (at 70 years) of continuous exposure. The IRSL is defined in Michigan's Air Pollution Control Rules as the "upper-bound lifetime cancer risk of 1-in-1,000,000." IRSLs are used to evaluate emissions from a single source at an industrial facility. A Secondary Risk Screening Level (SRSL) is also used in Michigan's air permitting program; however, SRSLs are defined as the "upper-bound lifetime cancer risk of 1-in-100,000." SRSLs are used to evaluate the resulting air impacts from all sources of a TAC from a particular facility. In other words, both IRSLs and SRSLs are considered concentrations that represent acceptable levels of cancer risk, however, IRSLs are applicable to one source at a facility and SRSLs are applicable to all sources of the TAC from a facility. When evaluating ambient air monitoring data, the SRSL better represents an acceptable level of risk because the air sample represents a mixture from all sources emitting that pollutant into the air.

If MDEQ-AQD has not established a SL for a particular substance, SLs from other state and national organizations are used; however, the basis for the SL is evaluated so that these SLs are based on the best available scientific evidence with which to establish an acceptable level of safety. Selection of the acute benchmark was based on a general hierarchy of sources: AQD ITSL with short averaging time > Agency for Toxic Substances and Disease Registry (ATSDR) Minimal Risk Level (MRL) > California Office of Environmental Health Hazard Assessment (Cal OEHHA) Reference Exposure Level (REL) > U.S. Environmental Protection Agency (EPA) Acute Exposure Guidance Level (AEGL) > Texas Commission of Environmental Quality (TCEQ) Air Monitoring Reference Value (AMRV) > 1% of American Conference of Governmental and Industrial Hygienists (ACGIH) Threshold Limit Value (TLV) (See Appendix A for details about acute health benchmarks).

Three laboratory reports from Eastern Research Group were forwarded to MDEQ-AQD. The reports provided the air concentrations from the Big Bay monitor. Various metals concentrations within the PM10 particle size fraction were reported, as well as quality control data. PM10 is the particulate matter that has an aerodynamic diameter of less than or equal to 10 micrometers (µm). Particles of this size are considered respirable, meaning they are small enough to reach the thoracic areas of the respiratory tract. According to the 2014 Work Plan[14], ambient air samples are to be collected at the Big Bay air monitor and analyzed for metals on a quarterly basis (once every 3 months). However, the available sample frequency appears to be once every 4 to 5 months at first, then quarterly thereafter. The air was sampled for 24-hr per day ("daily") on the

[14] 2014 Work Plan for the Community Environmental Monitoring Program of the Eagle Mine. December 31, 2013. http://www.cempmonitoring.com/wp-content/uploads/2012/10/CEMP-2014-Work-Plan-FINAL.pdf

following days: 5/9/2013, 9/1/2013, 2/16/2014 and 5/11/2014. Table 1 below shows the analytical results of the air monitoring for metals and the best available acute and chronic human health-based SLs. Each individual sample result provides a snapshot of ambient air which may serve as a surrogate for potential short-term public exposure levels. These daily levels can be assessed using health-based SLs specifically designed to provide protection from acute health effects (i.e., those health effects that occur over short time periods after relatively short exposures). An annual average air concentration for individual metals can also be calculated from the 4 sample results that exist at this time. However, because of the relatively infrequent sampling, the average concentration of a particular metal should be interpreted with great care, because it may not accurately reflect chronic exposures. The quarterly sampling frequency does not represent a robust exposure assessment and makes it difficult to estimate long-term (i.e., chronic) continuous exposure.

Table 1. Measured Metals Air Concentrations and Health-Based Screening Levels

Metal	Date of Sample Collection				Arithmetic Average ng/m³ *	Acute Screening Level ng/m³	Chronic Screening Level ng/m³
	5/9/13	9/1/13	2/16/14	5/11/14			
Aluminum				128		10,000	
Antimony	0.393	0.23	0.138	0.353	0.279	200	
Arsenic	8.53	0.311	0.065	0.381	2.322	15	2 (SRSL)
Barium	49.4	39.5	39.1	46.5	43.63	5,000	
Beryllium	0.039	0.0009	0.002	0.008	0.013	20	4 (SRSL)
Cadmium	0.164	0.052	0.177	0.083	0.119	41,000	6 (SRSL)
Calcium				474			
Chromium	46.2	38.8	34.7	39	39.7	**	**
Cobalt	0.666	0.065	0.022	0.101	0.214	200	
Copper	173	24.1	192	45.3	108.6	2,000	
Iron				187			
Lead	4.88	0.712	0.619	1.17	1.85	500	150 (NAAQS)
Magnesium	653	58.7	70.5	141	230.8	100,000	
Manganese	52.7	3.38	1.12	8.27	16.4	170	300 (ITSL)
Mercury	0.023	0.008	0.02	0.01	0.016		
Molybdenum				0.237		30,000	
Nickel	2.76	0.72	0.898	1.1	1.37	200	42 (SRSL)
Rubidium				0.033			
Selenium	0.612	0.186	0.045	0.29	0.283	2,000	
Strontium				1.68		2,000,000	
Thallium				0.007		200	
Thorium				0.013			
Uranium				0.015		2,000	
Zinc	65	19.4	19	29.6	33.3	50,000	

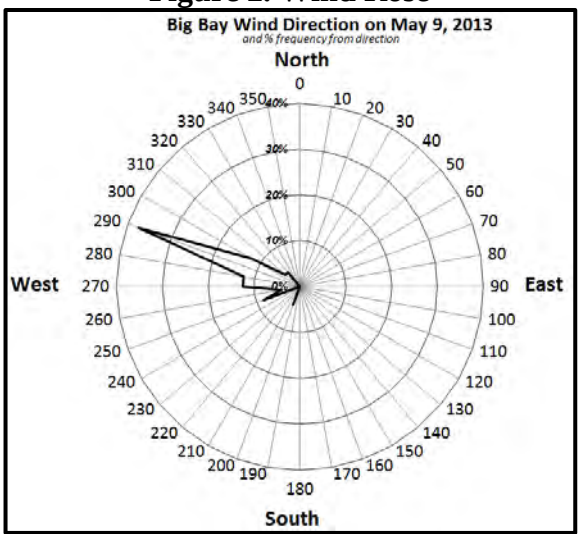
* air concentration of ng/m³ or nanograms per cubic meter

** Elemental chromium (Cr^0), trivalent chromium (Cr^{+3}) and hexavalent chromium (Cr^{+6}) have very different toxicity and health effects. In order to evaluate the potential health effects of chromium, each type of chromium would have to be quantitated.

Monitored concentrations above a screening level should not be viewed as an imminent health threat or an unacceptable level of health risk. Rather, if a measured air concentration of a

particular substance exceeds its screening level, then the data and health concerns should be further evaluated. All of the individual daily (24-hr) samples taken at the Big Bay monitor were below the acute health screening levels. Short-term health effects from air concentrations of metals are unlikely to occur. All of the average concentrations are below the chronic screening level with the exception of arsenic. It should be noted that the metal concentrations from the sample taken on May 9, 2013 are relatively high compared to the subsequent three samples. Sometimes earth moving activities close to the monitor or high winds can cause a temporary increase in particulate matter resulting in increased metals concentrations that are naturally part of the soil. For example, the arsenic concentration on 5/9/13 was measured as 8.5 ng/m^3, which is roughly 34 times higher than the average of the next three samples [next 3 sample average = 0.25 ng/m^3 = (0.311+0.065+0.381)/3].

Figure 2. Wind Rose



Note that the sample collected on May 9, 2013 had wind direction primarily from the Northwest (see Figure 2). The 8.5 ng/m^3 arsenic level is about 2 to 3 times higher than the maximum observed at a comparable rural site in Merritt, Michigan (Missaukee County) (See Table 2). However, at the AQD's Merritt monitor a different size fraction of particulate matter was used, i.e., Total Suspended Particulates (TSP). TSP includes larger particles than the PM10 size. PM10 is contained within the TSP fraction, so TSP can be used as a rough approximation for this comparison. The value of 8.5 ng/m^3 is similar to the highest values recorded at AQD's Dearborn monitoring site during the early to mid- 2000's. The Dearborn monitor is impacted by many industrial facilities, including a steel mill that is about 1 mile upwind.

Table 2. Air Monitoring Data for Arsenic in 2 Locations in Michigan*

Merritt Arsenic Concentrations (ng/m^3)

Year	Metal (size)	Highest 24 hr.	Annual Average
2002	Arsenic (TSP)	2.27	0.63
2003	Arsenic (TSP)	2.44	0.70
2004	Arsenic (TSP)	1.84	0.55
2005	Arsenic (TSP)	2.23	0.66
2006	Arsenic (TSP)	2.03	0.54
2007	Arsenic (TSP)	1.14	0.35
2010	Arsenic (PM 2.5)	3.50	0.30
2011	Arsenic (PM 2.5)	2.97	0.37
2012	Arsenic (PM 2.5)	2.55	0.44
2013	Arsenic (PM 2.5)	3.03	0.39

Dearborn Arsenic Concentrations (ng/m^3)

Year	Parameter	Highest 24 hr.	Annual Average
2004	Arsenic PM10	45.5	5.53
2005	Arsenic PM10	6.32	1.19
2006	Arsenic PM10	87.4	9.59
2007	Arsenic PM10	7.02	1.09
2008	Arsenic PM10	7.23	1.16
2009	Arsenic PM10	5.09	0.91
2010	Arsenic PM10	6.80	1.36
2011	Arsenic PM10	4.05	0.86
2012	Arsenic PM10	5.34	0.86
2013	Arsenic PM10	3.44	0.79

*Data obtained from MDEQ AQD Monitoring Database

In more recent years, the Dearborn air monitor has been recording lower arsenic values than 8.5 ng/m³. Extra scrutiny is warranted in the interpretation of the arsenic average concentration of 2.3 ng/m^3 because the one sample taken in May 2013 causes the average to be slightly higher than the chronic screening level of 2 ng/m^3. It would be appropriate to consider if the sampling equipment was operating properly on 5/9/13. Additional sampling results will help to determine if the 5/9/13 sample is representative of ambient air in Big Bay or if the more recent lower air concentrations of arsenic better represent typical arsenic air concentrations.

In conclusion, all the metal concentrations obtained from the 4 samples are below their acute screening levels that are protective for short-term adverse health effects, and are not associated with an increased health risk to the public. The four-sample average arsenic concentration was found to be above the SRSL, yet it is still in range of concentrations that EPA associates with acceptable cancer risk. U.S. EPA has made case-specific determinations such as the 1989 Benzene National Emission Standard for Hazardous Air Pollutants (NESHAP) that set an upper limit of acceptability of 1 in 10,000 lifetime cancer risk for highly exposed individuals. Using this upper limit of acceptability of 1-in-10,000 for lifetime cancer risk for arsenic would result in a screening level of 20 ng/m³. This screening level for arsenic, however, is not designed to be a definitive tool for determining risk since actual exposure concentrations may not be represented by the ambient air at the Big Bay monitor. The current sampling frequency lacks the level of refinement which would enable a more accurate assessment of the exposures found throughout the year. Consequently, the results should not be used as absolute measures to determine whether risks are acceptable. Rather, they should be used to focus or target further measurement and assessment activities. Finally, given the limited number of samples collected so far, more monitoring is needed to determine if the relatively high arsenic concentration on May 9, 2013 is representative of a normal high value.

Appendix C: Written Comments Received

Comment 1:

-----Original Message-----
From: annesheret@gmail.com [mailto:annesheret@gmail.com]
Sent: Saturday, May 28, 2016 7:43 AM
To: Tommasulo, Karen (DEQ)
Subject: Air quality

I would like to have the DEQ review the air in Upper Peninsula in the area most affected by the emissions from Eagle Mine. They were originally supposed to have a filter on their stack and then were given permission to remove it. There are all sorts of poisonous and possibly radioactive particles , heavy metals etc, coming out of that stack and being carried by the wind to all of us lucky residents. Would an air testing unit that functions all the time or every day not be a good idea? I am told they go outside and view the stack once a day.
Please enter this as a public comment for the upcoming meeting in Lansing about the proposed air quality rule changes.
Thank you.

Annely

Comment 2:

See letter from DTE Energy on following pages.

DTE Energy
One Energy Plaza, Detroit MI 48226-1221

DTE Energy

dteenergy.com

June 15, 2016

Ms. Amy Robinson
MDEQ – Air Quality Division
P.O. Box 30260
Lansing, MI 48909-7760
robinsona1@michigan.gov

Subject: **DTE Energy Comments on the Draft 2017 Michigan Ambient Air Monitoring Network Review**

Dear Ms. Robinson:

DTE Energy is pleased to submit the following comments regarding the Draft 2017 Michigan Ambient Air Quality Monitoring Network Review. We are supportive of your efforts to meet the air quality monitoring requirements mandated in EPA's regulations, especially with the uncertain Federal and State funding for this program.

DTE Energy supports the proposed changes in the draft air quality monitoring network plan for 2017. However, DTE Energy has one extremely important comment regarding the network plan. It involves the State's SO_2 monitoring plan, especially how it will be used to develop a State Implementation Plan (SIP) for St. Clair County's SO_2 nonattainment area.

Last year, DTE Energy developed a modeling protocol for Belle River and St. Clair power plants to project the attainment status of St. Clair County. This analysis was undertaken to speed up the designation of areas where large SO_2 sources are located, which was mandated by an EPA lawsuit settlement with a number of environmental organizations. The outcome of this modeling analysis was predicted excursions of the 2010 1-hour SO_2 NAAQS in most of the southern half of St. Clair County. The State of Michigan sent a designation recommendation to EPA, in September 2016, that a portion of St. Clair County (generally all of it south of Port Huron) be designated nonattainment

for this NAAQS. EPA agreed with the State's recommendation, and we anticipate that EPA will finalize this designation on July 2, 2016.

DTE Energy is concerned that the modeling analysis that forms the basis for this designation is overly conservative in many aspects of the impact analysis. The problems encountered in the dispersion modeling analysis included:

1. The only NWS surface data site in St. Clair County, St. Clair County International Airport (Port Huron), did not have processed 1-minute wind data leading to an unacceptable number of hours with calm or missing data
    a. The remedy chosen involved using Oakland County International Airport (Pontiac), which has 1-minute wind data and less calm and missing data, but is much further away from the DTE power plants
2. The SO_2 monitoring site that was used to calculate a background concentration (Port Huron) was impacted by Canadian refineries, in Sarnia, and two other SO_2 sources that have switched to lower sulfur fuels
    a. Wind direction data were used to eliminate hours when high SO_2 concentrations were measured at the Port Huron monitor that indicated a modeled US source, or a Canadian refinery source, was likely impacting the monitor
    b. The calculated SO_2 background concentration was 15 parts per billion (ppb)

DTE staff is concerned that the remedy chosen for both of these situations will lead to more stringent SO_2 limits for these two power plants than is necessary to bring future high SO_2 impacts below the NAAQS. Therefore, DTE Energy is in the process of installing two new air quality monitoring sites, with collocated meteorological towers to provide more representative SO_2 concentration and surface meteorological data, for the upcoming SIP development. The two locations for these monitoring sites are very close to the locations where the dispersion modeling predicted the highest 99th percentile SO_2 impacts (design impact) from both of these power plants. The first site (Belle River Power Plant's eastern berm) is close to the predicted design impact when past actual plant data were modeled. The second site (Belle River Compressor Station) is very close to the location where the dispersion model predicts the design impact when allowable SO_2 emission rates were modeled. DTE Energy staff met with Michigan Department of Environmental Quality's Air Quality Division (MDEQ-AQD) staff to present this plan last fall, with very positive feedback on the plan. A figure with the location of these two new monitoring sites is provided in Attachment 1 to this letter.

DTE Energy has hired Montrose Environmental (Enviroplan, Inc.) to install, operate and perform required quality assurance (QA) and data handling procedures to be able to

use this data in developing the future SIP. We recommend that these sites should be considered "special purpose monitors", and that the data be forwarded into EPA's Air Quality System (AQS) data base. DTE Energy anticipates that there may be MDEQ-AQD, or USEPA, independent QA checks to qualify the data for inclusion in AQS.

Another concern that we have is with the lack of wind data at the Warren monitoring site. This site may be the location that determines the design value for the 2015 ozone NAAQS using 2014-2016 data. If possible, maybe a meteorological tower can be relocated from one of the sites where only weather data are currently monitored. This could be instrumental in having the best possible understanding of which sources contribute to the highest 8-hour ozone concentrations in southeast Michigan.

Thank you for the opportunity to review this important document. The MDEQ-AQD staff should be commended for the quality of this draft monitoring plan.

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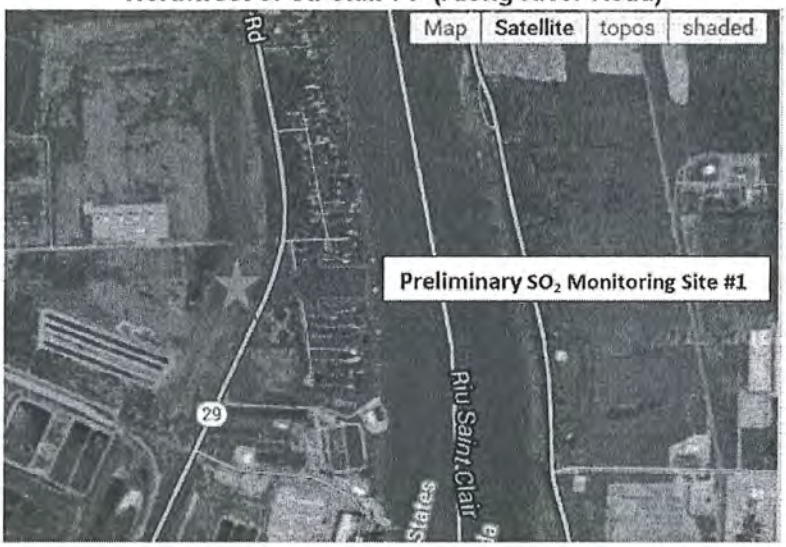
Attachment 1

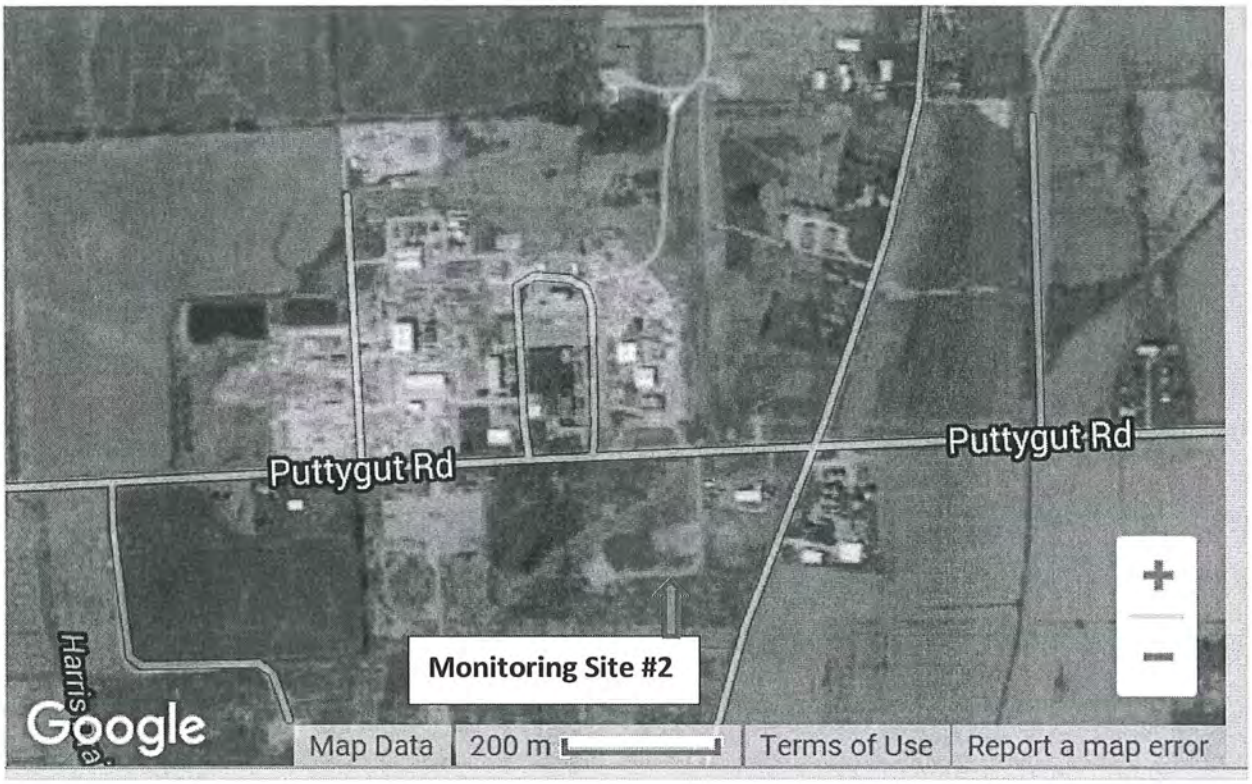
Proposed New Air Monitoring Sites in St. Clair County
Monitoring Site #1
Belle River Power Plant East Berm
(Just west of M-29)

Primary New SO_2 / Meteorological Monitoring Site at Belle River Power Plant

DTE Energy

Northwest of St. Clair PP (Along River Road)



Attachment 1

Proposed New Air Monitoring Sites in St. Clair County
Monitoring Site #2
Belle River Compressor Station
(Just southwest of Puttygut Road – Indian Trail Intersection)