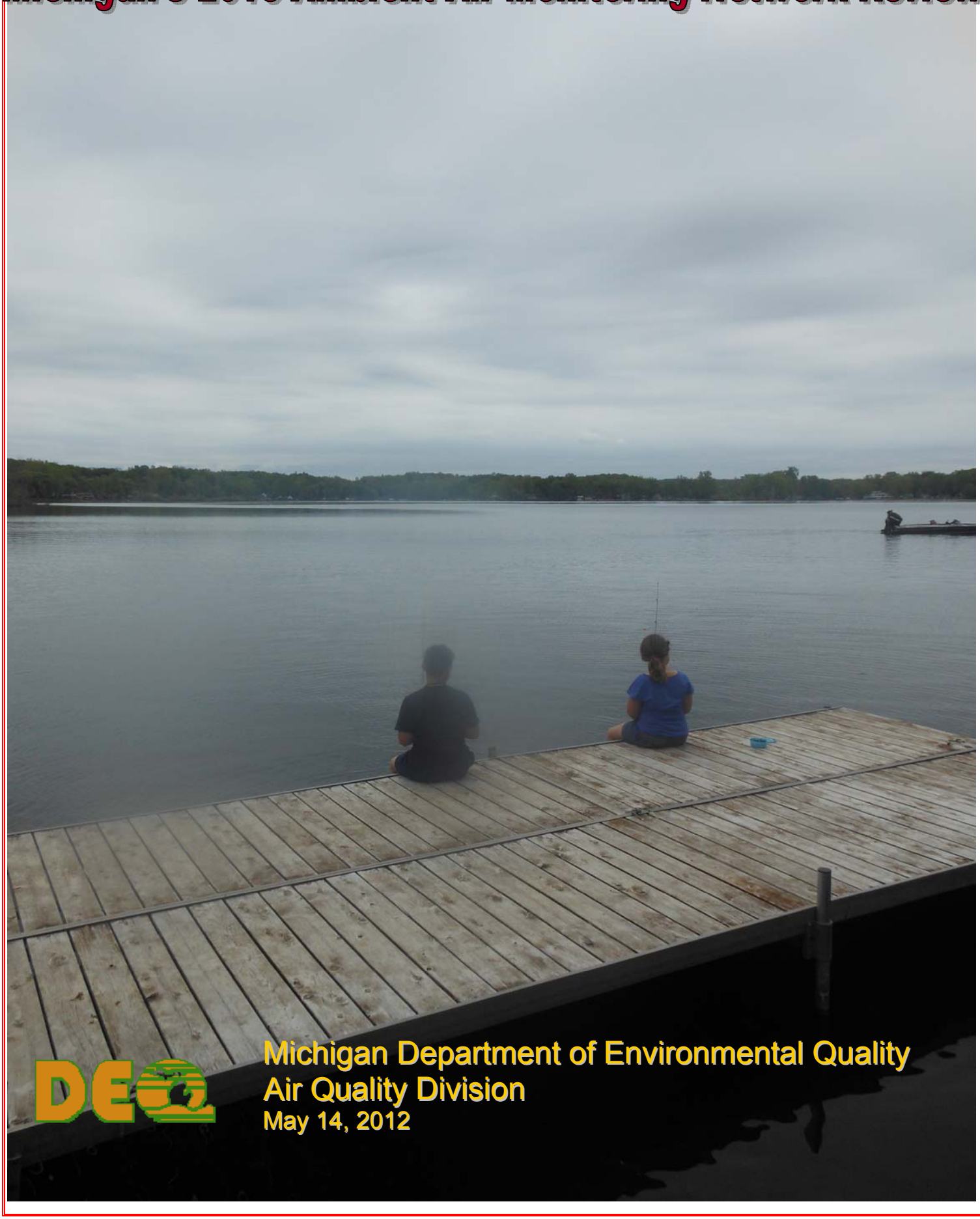
Michigan's 2013 Ambient Air Monitoring Network Review



Michigan Department of Environmental Quality
Air Quality Division
May 14, 2012

Cover picture courtesy of

THE DEPARTMENT OF ENVIRONMENTAL QUALITY PROVIDES EQUAL OPPORTUNITIES FOR EMPLOYMENT AND FOR ACCESS TO MICHIGAN'S NATURAL RESOURCES. STATE AND FEDERAL LAWS PROHIBIT DISCRIMINATION ON THE BASIS OF RACE, COLOR, NATIONAL ORIGIN, RELIGION, DISABILITY, AGE, MARITAL STATUS, OR SEX UNDER THE CIVIL RIGHTS ACT OF 1964 AS AMENDED, MICHIGAN (MI) PA 453 AND MI PA 220, TITLE V OF THE REHABILITATION ACT OF 1973 AS AMENDED, AND THE AMERICANS WITH DISABILITIES ACT. FOR INFORMATION OR ASSISTANCE REGARDING THIS PUBLICATION, CONTACT THE MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY, AIR QUALITY DIVISION, P.O. BOX 30260, LANSING, MI 48909-7760.

Printed by authority of the Michigan Department of Environmental Quality
Current print costs are: $0.46 per page

Michigan Department of Environmental Quality

TABLE OF CONTENTS

Page

Introduction 1
- Federal Changes 1
- Recommendations for Michigan's Air Monitoring Network in 2013 2
- Network Review Goals 3
- Public Comment Process 3

Ambient Air Monitoring Network Requirements 4
- Other Monitoring Network Requirements 6
- Network Review Requirements 7
- Monitor Deployment by Location 8
- Quality Assurance 10

Lead Monitoring Network 11
- Background 11
- The 2008 Lead NAAQS 11
- Point Source-oriented Monitoring 12
- Area Source-oriented Monitoring Network Design 15
- Non-source-oriented / NCore Monitoring Network Design 16
- Lead Co-location Requirements 17
- Waiver(s) From Lead Monitoring 22
- Lead Quality Assurance 22
- Plans for 2013 Lead Monitoring Network 22

NCore Monitoring Network 24
- Network Design 24
- Michigan NCore Sites 24
- NCore Quality Assurance 25
- Plans for 2013 NCore Monitoring Network 25

Ozone Monitoring Network 29
- Ozone Season & Modeling 36
- Ozone Quality Assurance 36
- Plans for the 2013 Ozone Monitoring Network 37

$PM_{2.5}$ FRM Monitoring Network 38
- $PM_{2.5}$ Designations 44
- $PM_{2.5}$ Quality Assurance 45
- Plans for the 2013 $PM_{2.5}$ FRM Monitoring Network 46

Continuous $PM_{2.5}$ Monitoring Network 47
- Filter Dynamic Measurement System (FDMS) Inlets 47
- $PM_{2.5}$ TEOM Quality Assurance 49
- Plans for the 2013 $PM_{2.5}$ TEOM Network 49

Speciated $PM_{2.5}$ Monitoring Network 51
- Continuous Speciation Measurements 51
- Speciation Quality Assurance 51
- Plans for the 2013 $PM_{2.5}$ Speciation Monitoring Network 54

TABLE OF CONTENTS, CONT'D.

Page

PM_{10} Monitoring Network 55
- PM_{10} Quality Assurance 58
- Plans for the 2013 PM_{10} Monitoring Network 58

Carbon Monoxide (CO) Monitoring Network 59
- CO Quality Assurance 59
- Plans for the 2013 CO Monitoring Network 59

Nitrogen Dioxide (NO_2) and NO_Y Monitoring Network 61
- Tier 1: Near Roadway NO_2 Monitors 62
- Tier 2: Area-wide NO_2 Monitors 67
- Tier 3: NO_2 Monitors for Susceptible and Vulnerable Populations 67
- NO_2 Monitoring for NSR 69
- NO_2 and NO_Y Quality Assurance 70
- Plans for the 2013 NO_2 and NO_Y Monitoring Network 70

Sulfur Dioxide (SO_2) Monitoring Network 73
- SO_2 Quality Assurance 76
- Plans for the 2013 SO_2 Monitoring Network 76

Trace Metal Monitoring Network 80
- Trace Metal Quality Assurance 84
- Plans for the 2013 Trace Metal Monitoring Network 84

Volatile Organic Compound (VOC) Monitoring Network 85
- VOC Quality Assurance 85
- Plans for the 2013 VOC Monitoring Network 85

Carbonyl Monitoring Network 87
- Carbonyl Quality Assurance 87
- Plans for the 2013 Carbonyl Monitoring Network 87

Polynuclear Aromatic Hydrocarbon Monitoring Network 89
- PAH Quality Assurance 89
- Plans for the 2013 PAH Monitoring Network 89

Meteorological Measurements 91
- Meteorological Equipment Quality Assurance 91
- Plans for the 2013 Meteorological Monitoring Network 91

Adequacy of Michigan's Monitoring Sites 94

Appendix A: Acronyms and Their Definitions 95

List of Tables

1 Composition of Core-based Statistical Areas in Michigan 5
2 Composition of Micropolitan Statistical Areas in Michigan 6
3 Monitor Distribution Throughout the 2012 Network in Michigan 9
4 Airports to be Monitored for Lead 15
5 CBSAs with More than 500,000 People 17
6 Deployment Schedule for Lead Sites and Calculation of the Total Number of Co-located Lead Sites 18
7 Lead Sites in Operation in 2012 19

TABLE OF CONTENTS, CONT'D.

Page

List of Tables, Continued

8 Proposed Lead Monitoring Network 20
9 Measurements Collected at the Grand Rapids – Monroe St. (260810020) NCore Site .. 26
10 Measurements Collected at the Allen Park (261630001) NCore Site 27
11 NCore Network in Michigan 28
12 SLAMS Minimum Ozone Monitoring Requirements 29
13 Application of the Minimum Ozone Requirements in the October 17, 2006 Final Revision to the Monitoring Regulation to Michigan's Ozone Network 30
14 Michigan's Ozone Monitoring Network 34
15 $PM_{2.5}$ Minimum Monitoring Requirements 38
16 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 39
17 $PM_{2.5}$ FRM Network in Michigan 43
18 Michigan's Continuous $PM_{2.5}$ Monitoring Network 48
19 Michigan's $PM_{2.5}$ Speciation Network 52
20 PM_{10} Minimum Monitoring Requirements (Number of Stations per MSA) 55
21 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 56
22 Michigan's PM_{10} Monitoring Network 57
23 Michigan's CO Monitoring Network 60
24 NO_2 Network Design 62
25 NO_2 and NO_Y Sites in Operation in 2012 71
26 Population Weighted Emission Index Based Monitoring Requirements 73
27 Population Weighted Emissions Index Totals for CBSAs in Michigan 74
28 Michigan's SO_2 Monitoring Network in 2012 77
29 Michigan's Posible SO_2 Monitoring Network in 2013 78
30 Michigan's Trace Metal Monitoring Network in 2012 81
31 Proposed Trace Metal Monitoring Network 82
32 Michigan's VOC Monitoring Network 86
33 Michigan's Carbonyl Monitoring Network 88
34 PAH Network in Michigan 90
35 Meteorological Measurements in Michigan 93

TABLE OF CONTENTS, CONT'D.

Page

List of Figures

1 MSAs in Michigan's Lower Peninsula 4
2 Modeling Isopleths - Mueller Brass Port Huron 12
3 Possible Location #1 for Port Huron Lead Site 13
4 Possible Location #2 for Port Huron Lead Site 13
5 East Jordan Lead Monitoring Site 14
6 Vassar Lead Monitoring Site 14
7 Airport Lead Monitoring Site 16
8 Comparison of Michigan's 2012 and 2013 Lead Monitoring Network 21
9 Michigan's NCore Monitoring Network 28
10 Comparison of 4th Highest 8-Hour Ozone Values Averaged Over Three-Years 2007-2009, 2002-2010 and 2009-2011 31
11 Ozone Design Values 2009 – 2011 Across Region 5 34
12 Michigan's Ozone Network 36
13 Michigan's $PM_{2.5}$ FRM Monitoring Network 44
14 $PM_{2.5}$ Nonattainment Areas 45
15 Michigan's Continuous $PM_{2.5}$ Network 49
16 Michigan's $PM_{2.5}$ Speciation (SASS) Network 53
17 Michigan's PM_{10} Monitoring Network 57
18 Michigan's CO Monitoring Network 60
19 Comparison of Eliza Howell Park Location with other Air Monitoring Stations and Roadway Segments with High Traffic Counts 63
20 Monitoring Station Locations Near and In Eliza Howell Park 64
21 Near Roadway Site #1: 10 meters from I-96 65
22 Near Roadway Site #2: 100 meters from I-96 66
23 Environmental Justice Areas in Michigan 68
24 Environmental Justice Areas in Southeast Michigan 69
25 Michigan's NO_2 and NO_Y Monitoring Network 72
26 Modeling Isopleths SO_2 Monroe Power Plants 75
27 Possilbe Monitoring Site at Sterling State Park View from Site to Source 75
28 Michigan's SO_2 Monitoring Network 79
29 Michigan's Trace Metal Monitoring Network 83
30 Michigan's VOC Monitoring Network 86
31 Michigan's Carbonyl Monitoring Network 88
32 Michigan's PAH Monitoring Network 90

INTRODUCTION:

The purpose of this document is to examine Michigan's ambient air monitoring network in operation during 2012 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 2013 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 Pb, NO_2, SO_2, CO and secondary NAAQS for NO_2 and SO_2. In addition, the NAAQS for ozone, and PM are scheduled for review before the end of 2013.

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. The design of the new NO_2 monitoring network is discussed in this network review. These NO_2 monitors have 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. The changes to the SO_2 monitoring network are discussed in this network review. The changes to the SO_2 network are 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 have 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 will be effective June 4, 2012. The EPA chose to retain the standards, while adding additional monitoring requirements. This will be addressed in the 2013 Annual Network Review.

The MDEQ cannot implement all of the new monitoring requirements described above without new funding and a concomitant reduction in other montioring requirements due to financial and staffing limitations. Although EPA has requested funding to support these endeavors, it is unknown if adequate funds will be made available. As a result, the State and Local air agencies in Region 5 with assistance from the Lake Michigan Air Directors Consortium drafted a proposal to identify which monitoring activities can be implemented and which are too costly. As funding becomes available or as changes to the NAAQS are finalized, the MDEQ may be able to gradually implement more of the requirements.

Recommendations for Michigan's Air Monitoring Network in 2013

The following changes will be made to Michigan's ambient air monitoring network during 2013. If funding cuts occur, additional changes to the network may have to be implemented.

- The following ***new*** lead site may be operational during 2013 contingent upon adequate funding:
    1. Port Huron downwind of Mueller Industries

- During 2013, contingent upon adequate levels of funding, the following CO sites will be operated:

    1. Detroit-Eliza Howell Park Site #1 (261630093) - started October 2011
    2. Detroit -Eliza Howell Park Site #2 (261630094) -started October 2011

- Prior to January 1, 2013 , contingent up on adequate funding, the MDEQ is planning to deploy and operate an SO2 monitor at:
    1. Monroe at Sterling State Park
    2. Lansing (260650012) – started January 2012
    3. Jenison (261390005) – started January 2012
    4. Port Huron (261470005) – started January 2012
- After January 1, 2013 the MDEQ is planning to remove the following monitors:
    1. TSP at Flint (260490021)
    2. Lead at East Jordan (260290011)
    3. Lead at Vassar (261570001)
    4. Lead at Oakland County Airport (261250013) – to be discontinued after July 1, 2012.
- After January 1, 2013 the MDEQ is planning to reduce sampling frequency of the following monitor:
    1. Carbonyl at River Rouge (261630005) from 1:6 to 1:12

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 a press release was issued on May 14, 2012 announcing 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 that 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 were not accepted) and should be sent to:

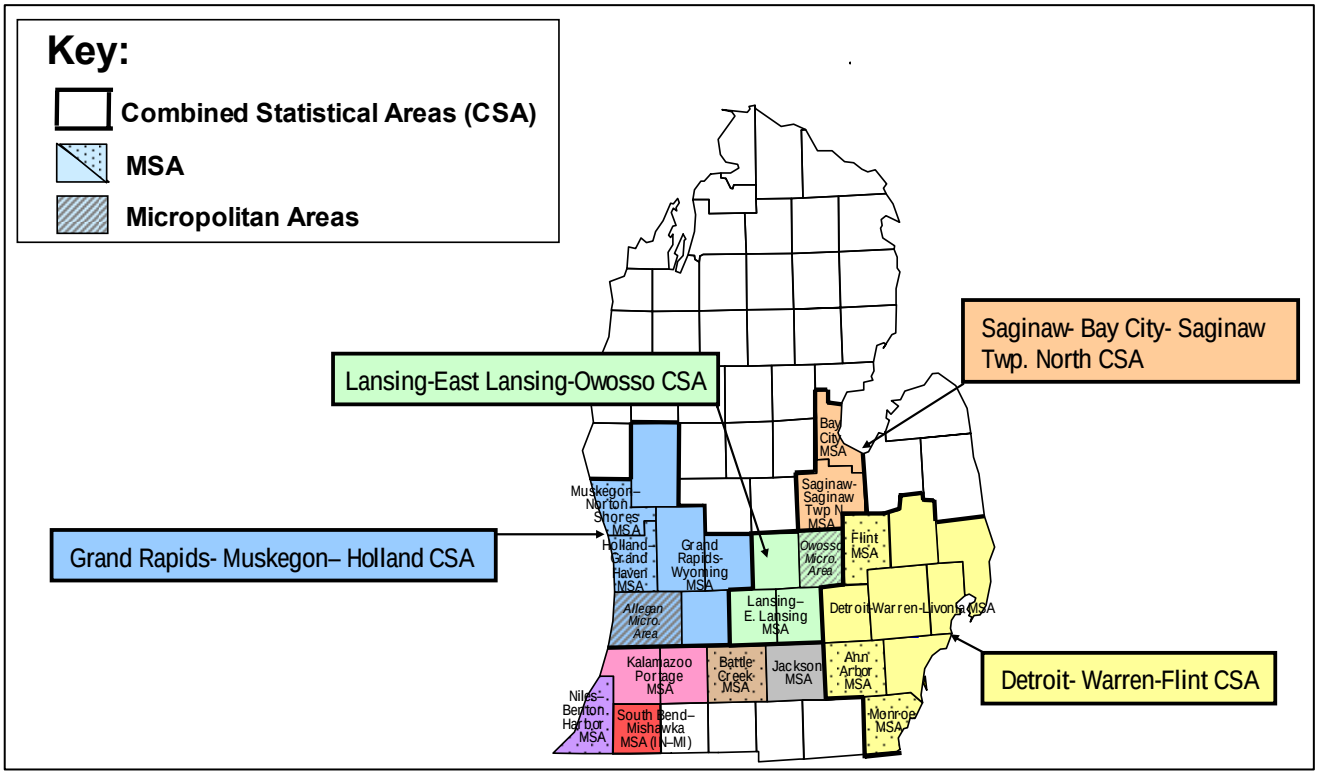
Amy Robinson
MDEQ – Air Quality Division
P.O. Box 30260
Lansing, MI 48909-7760
robinsona1@michigan.gov

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 Mr. Craig Fitzner, AQD, 517-373-7044, fitznerc@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, shown in **Figure 1** have not changed from the 2000 to 2010 census.

FIGURE 1: MSAS IN MICHIGAN'S LOWER PENINSULA



MSAs must have an urban core population totaling at least 50,000 people in the most recent decennial census. The MSAs as so defined are shown in **Figure 1**. MSAs are one or more counties that have a sizeable urban cluster or have 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**. Note: Only those micropolitan areas that are part of larger CSAs are shown in **Figure 1**. The CSA is defined as a geographical area consisting of two or more adjacent Core-Based Statistical Areas (CBSA) with employment interchange of at least 15%. 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 micropolitian areas as a result of the 2010 Census are due to be released in 2013. The areas that will be affected include Midland, Hillsdale, Three Rivers, Ludington, and Whitehall. The possible effects that these changes will have on the ambient air monitoring network will be discussed in the 2014 network review.

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

CORE BASED STATISTICAL AREA	2010 POPULATION	URBAN CORE	CENTRAL METROPOLITAN COUNTIES	OUTLYING METROPOLITAN COUNTIES
Ann Arbor	344,791	Ann Arbor Urbanized Area	Washtenaw	
Battle Creek	136,146	Battle Creek Urban Area	Calhoun	
Bay City	107,771	Bay City Urbanized Area	Bay	
Detroit-Warren-Livonia*	4,296,250	Detroit Urbanized Area	Macomb, Oakland, Wayne	
		Port Huron Urbanized Area	St. Clair	
		Lapeer Urban Cluster		Lapeer
		South Lyon- Howell- Brighton Urbanized Area	Livingston	
Flint	425,790	Flint Urbanized Area	Genesee	
Grand Rapids-Wyoming	774,160	Grand Rapids Urbanized Area	Kent	Barry, Newaygo
		Ionia Urban Cluster		Ionia
Holland-Grand Haven	263,801	Holland Urbanized Area	Ottawa	
Jackson	160,248	Jackson Urbanized Area	Jackson	
Kalamazoo-Portage	326,589	Kalamazoo Urbanized Area	Kalamazoo	
		Paw Paw Urban Cluster		Van Buren
Lansing-East Lansing	464,036	Lansing Urbanized Area	Clinton, Eaton, Ingham	
Monroe	152,021	Monroe Urbanized Area	Monroe	
Muskegon-Norton Shores	172,188	Muskegon Urbanized Area	Muskegon	
Niles-Benton Harbor	156,813	Benton Harbor – St Joseph Urbanized Area	Berrien	
Saginaw-Saginaw Twp. North	200,169	Saginaw Urbanized Area	Saginaw	
South Bend-Mishawaka Indiana-Michigan (IN-MI)	52,293	South Bend, IN-MI Urbanized Area (part)	Cass	

* The Detroit-Warren-Livonia MSA is subdivided into the Detroit-Livonia-Dearborn Metropolitan Division (Wayne Co.) and the Warren-Farmington Hills-Troy Metropolitan Division (Lapeer, Livingston, Macomb, Oakland and St. Clair Counties).

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**.

[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.

TABLE 2: COMPOSITION OF MICROPOLITAN STATISTICAL AREAS IN MICHIGAN

MICROPOLITAN AREA	URBAN CORE	MICROPOLITAN AREA POP[2]	COUNTIES
Traverse City	Traverse City Urban Cluster	143,372	Grand Traverse, Benzie[3], Kalkaska[3], Leelanau[3]
Allegan	Plainwell-Otsego Urban Cluster	111,408	Allegan
Adrian	Adrian Urban Cluster	99,892	Lenawee
Midland	Midland Urban Cluster	83,629	Midland
Mount Pleasant	Mount Pleasant Urban Cluster	70,311	Isabella
Marquette	Marquette Urban Cluster	67,077	Marquette
Sturgis	Sturgis Urban Cluster	61,295	St. Joseph
Cadillac	Cadillac Urban Cluster	47,584	Wexford, Missaukee[3]
Coldwater	Coldwater Urban Cluster	45,248	Branch
Big Rapids	Big rapids Urban Cluster	42,798	Mecosta
Alma	Alma Urban Cluster	42,476	Gratiot
Houghton	Houghton Urban Cluster	38,784	Houghton, Keweenaw[3]
Sault Ste. Marie	Sault Ste. Marie Urban Cluster	38,520	Chippewa
Escanaba	Escanaba Urban Cluster	37,069	Delta
Alpena	Alpena Urban Cluster	29,598	Alpena
Iron Mountain	Iron Mt-Kingsford WI U. Cluster	26,168	Dickinson
Marinette	Marinette WI Menominee	24,029	Menominee

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, $PM_{2.5}$ Speciation, continuous $PM_{2.5}$, 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. Speciated PM coarse will be added at a later date when suitable technology becomes available. A minimum of ten NCore sites nationwide measure lead, but the EPA has proposed that NCore stations house the non-source-oriented lead monitors. 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.

[2] 2010 census data
[3] Outlying Micropolitan County

Network Review Requirements

According to 40 CFR, 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."[4]
- 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 identified previously.
- 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,
- 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.
- 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 whenever possible.

[4] "Environmental Protection Agency Ambient Air Quality Surveillance Regulations." 40 CFR Part 58 Appendix D, October 17, 2006.

Monitor Deployment By Location

Table 3 summarizes the distribution of ambient air monitors by pollutant in operation in Michigan during 2012. The purpose of including information about the shelter type (building or trailer) is to show the possible availability of space for monitors that require a temperature controlled environment. Although most monitors are located at a building, access to the interior for more monitor deployment may not be possible. In these instances where access is not guaranteed, no shelter is shown. 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. This review summarizes the purpose behind the continued operation of each monitor, by pollutant and discusses plans for network operations.

TABLE 3: MONITOR DISTRIBUTION THROUGHOUT THE 2012 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
East Jordan	260290011													Pb & 4				x	
Sault Ste. Marie +	260330901	x	x	x[b]														x	
Rose Lake	260370001	x																	B
Flint	260490021	x	x	x										Mn Only				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			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								x	T
Luna Pier	261150005		x		x														
Muskegon-Green Ck Rd	261210039	x																x	T
Muskegon-Apple St	261210040		x																
Oak Park	261250001	x	x															x	T
Pontiac	261250011																	x	
Rochester	261250012																	x	
Oakland Co Int'l Airport	261250013													Pb Only					
Jenison	261390005	x	x									x						x	T
Port Huron	261470005	x	x	x	x							x						x	T
Seney	261530001	x		x														x	T
Vassar	261570001													Pb & 4					
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															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																
Newberry School	261630038		x	x														x	B
FIA/Ambassador Bridge	261630039		x	x														x	T
Eliza Howell #1	261630093							x		x								x	T
Eliza Howell #2	261630094							x		x								x	T
	Total	27	28	15	8	6	2	2	2	5	2	4	2	12	3	3	2	39	

+ = Tribal monitor
b = BAM Unit
= Site retained, but operating in reduced capacity
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), which covers the operation of the ambient air monitoring network. The AMU also has QAPPs for the $PM_{2.5}$ monitoring program, the NATTS, NCore, and has adopted the EPA's $PM_{2.5}$ Speciation Trends Network (STN) QAPP. 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 of each monitor, 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.

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. The toxics monitors (volatile organic compounds [VOCs], carbonyl compounds, and poly-aromatic hydrocarbons [PAH]) are also audited once a year and hexavalent chromium is 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 to five 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 the 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[5]. 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 admini-strator. These new monitoring stations had to be operational by December 27, 2011.

The EPA added a more stringent monitoring requirement to the federal regulations for a special year long study investigating possible impacts from airports emitting 0.5 tons of lead per year (tpy) or more. Fifteen airports were selected as participants because of the number of piston driven planes using leaded fuel at the facility, the runway configurations and the existence of "ambient air" within 150 meters of a runway. No waivers or appeals were possible for relief from this monitoring requirement. The lead monitors at these 15 airports also had to be operational by December 27, 2011.

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. These monitors needed to be in place by January 1, 2012.

Sampling that is implemented as a result of these changes needs to conform to practices currently in use in the rest of the lead network. Namely, sampling will be conducted on a once every six day schedule and employ a high volume TSP sampler. The filters will be analyzed by the MDEQ laboratory using inductively coupled plasma/mass spectrometry (ICP/MS).

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.

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

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

lead sampling be conducted on a once every six day schedule. The filters are analyzed by the MDEQ laboratory using ICP/MS.

Point Source-oriented Monitoring

For 2013, the only new facility that required an investigation with regards to the lead NAAQS requirements is a second Mueller Industries location in Port Huron. A stack test, prompted an investigating into their lead emissions. Modeling done for this location predicted lead levels over the lead NAAQS. Possible monitoring sites were determined from the modeling isopleths, **Figure 2**. A team from the air monitoring unit went to Port Huron on 4/26/2012 to look into possible monitoring sites and two possible locations were found at Rural St, **Figures 3-4**. MEDQ will endeavor to establish this site by January 1, 2013.

Figure 2: Modeling Isopleths - Mueller Brass Port Huron

Figure 3: Possible Location #1 for Port Huron Lead Site

Figure 4: Possible Location #2 for Port Huron Lead Site

East Jordan Iron Works is located at 301 Spring St in East Jordan, in Charlevoix County. The MDEQ started monitoring in East Jordan on 11/5/2011. **Figure 5** shows the location of the monitoring site. Modeling details are in the 2012 Annual Network Review.

Figure 5: East Jordan Lead Monitoring Site

Metavation Vassar, LLC, formerly known as Grede Foundries is located at 700 E Huron Ave in Vassar in Tuscola County. MDEQ started monitoring in Vassar on 9/30/2011. **Figure 6** shows the location of the monitoring sites. Modeling details are in the 2012 Annual Network Review.

Figure 6: Vassar Lead Monitoring Site

The MDEQ is proposing to shut down the East Jordan and Vassar source-oriented lead monitoring sites, if after one full year of data, there are no 24 hours values over ½ the NAAQS and no 3-month rolling averages over ¼ of the NAAQS. The rational for this can be found in the EPA's technical note on Lead Ambient Air Monitoring Design[6] issues guidance, which states:

> *Clearly, three complete years of monitoring data which demonstrates ambient concentrations are less than 50% of the NAAQS should be sufficient. However, there may be cases where Pb concentrations are so low that just 1 year of data may be sufficient, in the EPA Regional Administrator's judgment, to determine that ambient concentrations are less than 50% of the NAAQS.*

Area Source-oriented Monitoring Network Design

When the EPA proposed revisions to the monitoring requirements for lead, they revisited the level of the threshold for monitoring at airports, suggesting a level of 0.5 tpy. Setting the threshold at this level would trigger monitoring requirements at 58 airports, according to the 2008 NEI. Based on public comments received about using a level of 0.5 tpy, the EPA decided to perform a "special study" to investigate whether lead "emissions from some airports have the potential to cause or contribute to exceedances of the lead NAAQS, and whether lead monitoring at airports is necessary to ensure compliance with the lead NAAQS."[7] **Table 4** lists the airports that are in the "special study." The monitoring site at Oakland County International Airport was established on 7/2/2011, **Figure 7**. The first 8 months of data from this site, indicate values well below ¼ the NAAQS; therefore, the MDEQ is proposing to shut down this monitoring site after one full year of data confirms there are no 3-month rolling averages above ½ the standard.

TABLE 4: AIRPORTS TO BE MONITORED FOR LEAD

Airport	County	State
Merrill Field	Anchorage	AK
Pryor Field Regional	Limestone	AL
Palo Alto Airport of Santa Clara County	Santa Clara	CA
McClellan-Palomar	San Diego	CA
Reid-Hillview	Santa Clara	CA
Gillespie Field	San Diego	CA
San Carlos	San Mateo	CA
Nantucket Memorial	Nantucket	MA
Oakland County International	Oakland	MI
Republic	Suffolk	NY
Brookhaven	Suffolk	NY
Stinson Municipal	Bextar	TX
Northwest Regional	Denton	TX
Harvey Field	Snohomish	WA
Auburn Municipal	King	WA

[6] http://www.epa.gov/ttn/amtic/files/ambient/pb/NetworkDesignQA.pdf/ambient/pb/NetworkDesignQA.pdf
[7] *Federal Register*, December 27, 2010, Volume 75, Page 81130

Figure 7: Airport Lead Monitoring Site

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.

When the monitoring requirements to the lead NAAQS became final on December 14, 2010, the EPA replaced this monitoring requirement with one calling for monitoring at NCore sites in CBSAs with populations greater than 500,000 by January 1, 2012.

According to the 2010 census, there are two CBSAs in Michigan with population levels exceeding 500,000. Both of these CBSAs contain an NCore station as is shown in **Table 5**.

The MDEQ deployed the TSP lead sites to the NCore stations before January 1, 2010 for a variety of reasons:

- The changes in the monitoring regulations did not result in a difference in the network design.
- The MDEQ desired to have a population-oriented lead site near the point source monitoring site in Belding for comparative purposes, so lead was added to the Grand Rapids NCore site (260810020).
- The MDEQ was already collecting trace metals at the Allen Park NCore site (261630001). The addition of lead to the list of elements reported is a minimal expense and will provide comparisons to the other NCore site.

TABLE 5: CBSAS WITH MORE THAN 500,000 PEOPLE[8]

CBSA	2010 Population	Counties	Existing NCore Sites
Detroit-Warren-Livonia Metro Area	4,296,250	Macomb Oakland Wayne Lapeer St Clair Livingston	Allen Park (261630001)
Grand Rapids-Wyoming Metro Area	774,160	Kent Barry Newaygo Ionia	Grand Rapids-Monroe St (260810020)

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 6** 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, MDEQ expects lead impacts in Belding to decrease significantly due to adopted abatement strategies. Mueller Industries increased their stack heights on 1/21/2012. 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 (TSP – Pb), promote comparability with other NATTs sites in the nation (PM_{10} – Pb) 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 also fulfill the 15% co-location requirement for the lead network. The sampling frequency for all of the high volume lead measurements at Dearborn is once every six days. If the MDEQ encounters budgetary problems, the sampling frequency of the PM_{10} and TSP co-located samplers will be reduced from once every six days to once every 12 days as is allowed by EPA. The MDEQ opts to operate co-located samplers on a once every six day schedule to collect more complete data.

[8] 2010 census data.

TABLE 6: DEPLOYMENT SCHEDULE FOR LEAD SITES AND CALCULATION OF THE TOTAL NUMBER OF CO-LOCATED LEAD SITES

Site Name & ID	Site Purpose	2010	2011	2012	2013
Dearborn (261630033)	NATTS; co-located site	operational	operational	operational	operational
Grand Rapids-Monroe St. (260810020)	NCore Non-Source-oriented	operational	operational	operational	operational
Allen Park (261630001)	NCore Non-Source-oriented	operational	operational	operational	operational
Belding (260670003)	Source-oriented	operational	operational	operational	operational
Belding-Reed St (260670002)	Source-oriented		operational	operational	operational
Vassar (261570001)	Source-oriented		operational	operational	discontinue
E Jordan (260290011)	Source-oriented		operational	operational	discontinue
Oakland Co Airport (261250013)	Source-oriented		operational	operational	discontinue
Port Huron	Source-oriented				operational
Total No. Sites		**4**	**8**	**8**	**6**
No. Co-Located Sites Required		**1**	**1**	**1**	**1**

Table 7 summarizes the lead monitoring site information for the sites that were in operation in 2012. **Table 8** shows the proposed new lead network broken down by source-oriented and non-source-oriented sites. **Figure 8** compares monitoring site locations in the 2012 network with those proposed for 2013.

TABLE 7: LEAD SITES IN OPERATION IN 2012

Operating Schedule: 1:6 days

Method: High Volume Sampler & ICAP Spectra

Network as of December, 2011

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	Neighborhood	Ionia	1/1/10	Mueller Industries	0.9 - 1.0
East Jordan	260290011	98 Division St	TSP	45.1602	-85.1277	1:6	max conc	Neighborhood	Charlevoix	11/5/11	East Jordan Ironw orks	0.5 - 1
Vassar	261570001	874 E Huron	TSP	43.3686	-83.5691	1:6	max conc	Neighborhood	Tuscola	9/30/11	Metavation	0.5 - 1
Belding - Reed St	260670002	545 Reed St	TSP	43.101944	-85.22000	1:6	max conc	Neighborhood	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.	Facility Name	Est Emissions Tons/yr
Oakland Co Airport	261250013	6330 N Service Dr, Row U	TSP	42.668056	-83.41000	1:6	max conc	middle	Oakland	7/2/11	Oakland County International Airpor	0.5 - 1

Non-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	-85.67139	1:6	Pop. Exp.	Neighborhood	Kent	1/8/10	GW	774,160
Allen Park	261630001	14700 Goddard	TSP	42.228611	-83.20833	1:6	Pop. Exp.	Neighborhood	Wayne	1/2/10	DWL	4,296,250
Dearborn	261630033	2842 Wyoming	TSP	42.306666	-83.14889	1:6	max conc	Neighborhood	Wayne	6/1/90	DWL	4,296,250
Dearborn	261630033	2842 Wyoming	TSP	42.306666	-83.14889	1:6, co-loc	max conc	Neighborhood	Wayne	6/1/90	DWL	4,296,250
Dearborn	261630033	2842 Wyoming	PM 10	42.306666	-83.14889	1:6	max conc	Neighborhood	Wayne	6/1/90	DWL	4,296,250
Dearborn	261630033	2842 Wyoming	PM 10	42.306666	-83.14889	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

TABLE 8: PROPOSED LEAD MONITORING NETWORK

Operating Schedule: 1:6 days

Method: High Volume Sampler & ICAP Spectra

Proposed 2013 Network

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	Neighborhood	Ionia	1/1/10	Mueller Industries	0.9 - 1.0
Port Huron	26147????		TSP			1:6	max conc	Neighborhood	St. Clair	by 1/1/13	Mueller Industries	0.75
Belding - Reed St	260670002	545 Reed St	TSP	43.101944	-85.22000	1:6	max conc	Neighborhood	Ionia	7/2/11	Mueller Industries	0.9 - 1.0

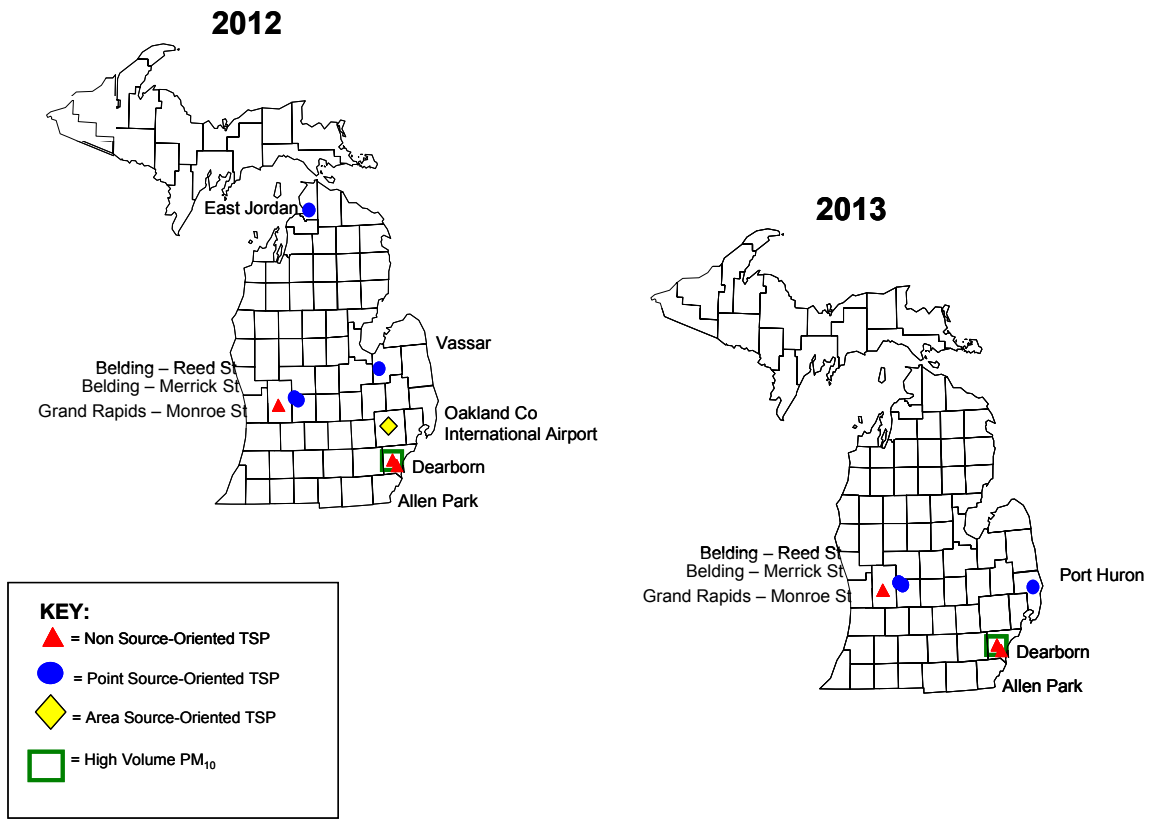
Area Source Oriented Sites

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	-85.67139	1:6	pop. exp.	Neighborhood	Kent	1/8/10	GW	774,160
Allen Park	261630001	14700 Goddard	TSP	42.228611	-83.20833	1:6	pop. exp.	Neighborhood	Wayne	1/2/10	DWL	4,296,250
Dearborn	261630033	2842 Wyoming	TSP	42.306666	-83.14889	1:6	max conc	Neighborhood	Wayne	6/1/90	DWL	4,296,250
Dearborn	261630033	2842 Wyoming	TSP	42.306666	-83.14889	1:6, co-loc	max conc	Neighborhood	Wayne	6/1/90	DWL	4,296,250
Dearborn	261630033	2842 Wyoming	PM 10	42.306666	-83.14889	1:6	max conc	Neighborhood	Wayne	6/1/90	DWL	4,296,250
Dearborn	261630033	2842 Wyoming	PM 10	42.306666	-83.14889	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 8: COMPARISON OF MICHIGAN'S 2012 AND 2013 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. 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 2014.

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 programs that is administered by the EPA. External lead PEP audits are conducted annually by the EPA. For this audit, he 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 collocated lead filter is sent to the EPA Region 9 Lab once per quarter to assess laboratory precision.

Plans for the 2013 Lead Monitoring Network

In 2013, the MDEQ is planning to continue to collect lead measurements using high volume TSP samplers at the NCore sites in:

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

High volume TSP lead measurements will continue to be collected 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 2013.

In 2013, the MDEQ is planning to discontinue source-oriented monitoring for lead at Vassar (261470001) and East Jordan (260290011), if there are no 24 hr values over ½ of the NAAQS and no rolling 3 month averages above ¼ of the NAAQS.

In 2013, the MDEQ is planning to continue lead measurements at:

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

In 2012, the MDEQ is planning on shutting down the area source monitor for lead as long as it is below ½ the standard:

- Oakland County International Airport (261250013)

By January 1, 2013, the MDEQ plans start collecting lead measurements using a high volume TSP sampler at a source-oriented monitoring location near:

- Port Huron, Mueller Industries

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*[9] specifies the minimum parameters that each NCore site must measure:

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

Michigan NCore Sites

The MDEQ's NCore sites are located at the Grand Rapids-Monroe St. station (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 9 and **10** list the parameters measured at Grand Rapids-Monroe St. (260810020) and Allen Park (261630001), respectively. Start dates are also shown.

[9] "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.

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 11**. A map showing the locations of NCore sites is displayed in **Figure 9**.

NCore Quality Assurance

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 2013 NCore Monitoring Network

In 2013, 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)

TABLE 9: 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 SO2	NCore/AQI	Neighborhood	Continuous	API 100 eu/ TECO 43i	UV fluorescence	4/1/08	---	probe height 5 m
NOy	NCore/AQI	Neighborhood	Continuous	TECO 42C	chemiluminescece	4/1/08	---	external converter installed at 10 m probe height 5 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	---	---
$PM_{10-2.5}$ 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
$PM_{10-2.5}$ Speciation	---	---	---	---	---	---	---	EPA to provide details later
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	ESC Data Logger	calculation	1/16/01	---	optional
Barometric Pressure	SLAMS	---	Continuous	R. M. Young	electronic pressure sensor	7/15/93	---	optional
PM10	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 10: 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 SO2	NCore/AQI	Neighborhood	Continuous	API 100 eu / TECO 43 i as	UV fluorescence	4/1/08	---	4 m probe ht
NOy	NCore/AQI	Neighborhood	Continuous	TECO 42C	chemiluminescece	4/1/08	---	external converter installed at 10 m 4 m probe ht
Ozone	NCore/AQI was NAMS	Neighborhood	Continuous	API 400 A	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	---	---
$PM_{10-2.5}$ 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
$PM_{10-2.5}$ Speciation	---	---	---	---	---	---	---	EPA to provide details later
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	ESC Data Logger	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 AE2100	optical absorption	12/19/03	---	Not Req by NCore
PM10 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 11: NCORE NETWORK IN MICHIGAN

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.	Neighborhoo	Kent	1/1/10	GW	774,160
Allen Park	261630001	14700 Goddard	42.22861	-83.2083	Pop. Exp.	Neighborhoo	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 9: MICHIGAN'S NCORE MONITORING NETWORK

OZONE MONITORING NETWORK:

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.[10] Note: background and transport ozone monitors are still required, but are not shown in **Table 12**. MSA boundaries have not been changed as a result of the 2010 Census.

TABLE 12: 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 12** to Michigan's MSAs, population totals and the most recent three-year design values results in a minimum ozone network design summarized in **Table 13**[11]. All monitors in Michigan are within 85% of the ozone NAAQS of 0.075 ppm.

Figure 10 illustrates changes in the three year averages of the fourth highest ozone values, called design values, from 2007 to 2011. When contemplating changes to the ozone network, it is important to consider changes in design values in nonattainment areas. However, the level of the NAAQS may become more stringent, and until we know the impact of these possible changes, the MDEQ is reluctant to alter the ozone network. Individual monitors and attainment status are discussed below.

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

[11] The proposed changes to the ozone NAAQS have changed the data handling procedures. Instead of truncating any numbers to the right of the third decimal place, values are to be rounded. **Table 19** retains the truncation convention because the proposed change hasn't been finalized yet.

Table 13: Application of Minimum Ozone Requirements in the October 17, 2006 Final Revision to the Monitoring Regulation to Michigan's Ozone Network

NAAQS: 0.075 ppm
> = 85% 0.063 ppm

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

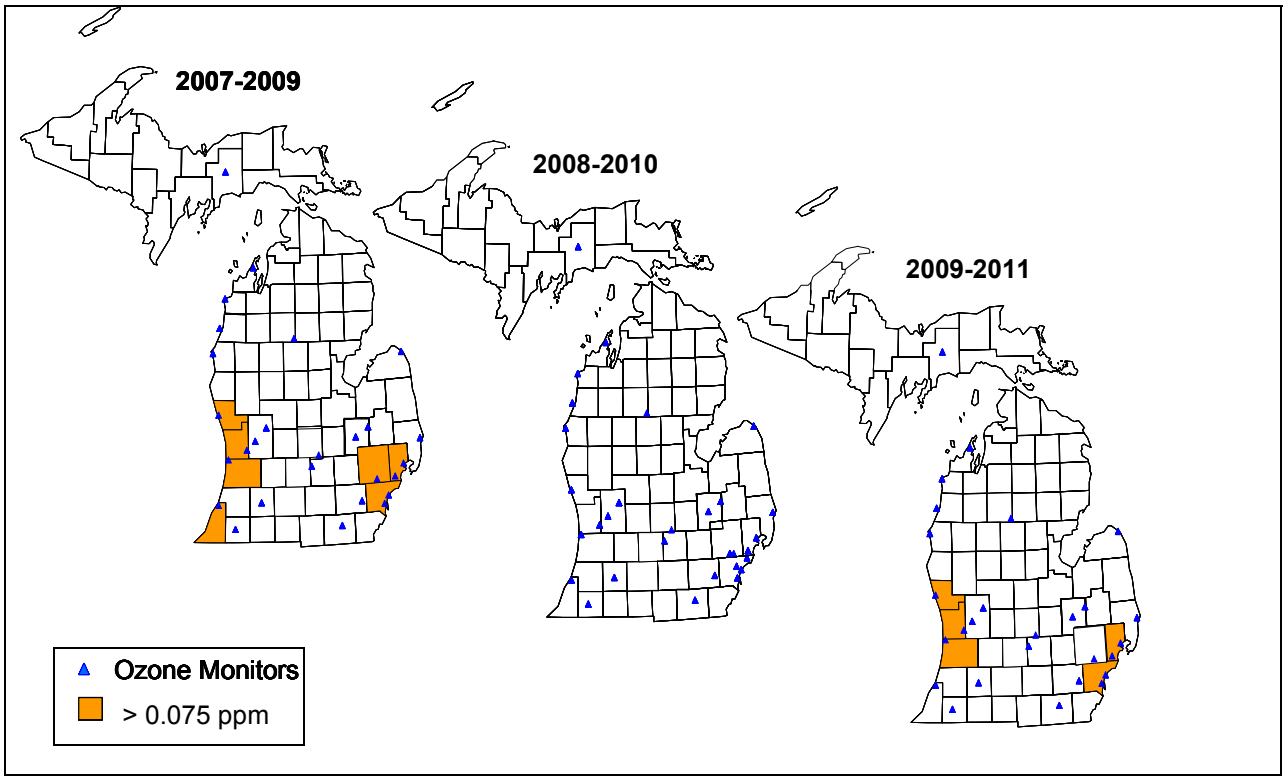
The 3-year O3 average at the MSA Design Value site is shown in bold.

Cells for sites > NAAQS are shaded yellow.

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

CBSA	2010 Population	Counties	Existing Monitors	2009-2011 most recent 3-year O3 design value	Min No monitors Required
Detroit-Warren-Livonia Metro Area	4,296,250	Macomb	New Haven	0.075	**3**
			Warren	0.076	
		Oakland	Oak Park	0.075	
		Wayne	Allen Park	0.069	
			Detroit - E 7 Mile	**0.078**	
		Lapeer	---		
		St Clair	Port Huron	0.074	
		Livingston	---		
Flint Metro Area	425,790	Genesee	Flint	0.069	2
			Otisville	**0.069**	
Monroe Metro Area	152,021	Monroe	---		
Ann Arbor Metro Area	344,791	Washtenaw	Ypsilanti	**0.069**	1
Grand Rapids-Wyoming Metro Area	774,160	Kent	Grand Rapids - Monroe St	0.070	2
			Evans	**0.071**	
		Barry	---		
		Newaygo	---		
		Ionia	---		
Holland-Grand Haven Metro Area	263,801	Ottawa	Jenison	**0.078**	1
Muskegon-Norton Shores Metro Area	172,188	Muskegon	Muskegon - Green Creek Rd	**0.076**	1
Lansing-East Lansing Metro Area	464,036	Clinton	Rose Lake	0.066	2
		Ingham	Lansing	**0.068**	
		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	**0.071**	1
		Van Buren	---		
Niles-Benton Harbor Metro Area	156,813	Berrien	Coloma	**0.075**	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	**0.074**	1
Other areas:	Comments				
	transport site	Lenawee	Tecumseh	0.069	
		Benzie	Frankfort	0.070	
		Huron	Harbor Beach	0.068	
		Allegan	Holland	0.080	
	background site	Missaukee	Houghton lake	0.065	
		Mason	Scottville	0.070	
		Schoolcraft	Seney	0.068	
	tribal site	Manistee	Manistee	0.069	
		Chippewa	Sault Ste. Marie	not enough data	

FIGURE 10: COMPARISON OF 4TH HIGHEST 8-HOUR OZONE VALUES AVERAGED OVER THREE YEARS 2007-2009, 2008-2010 AND 2009-2011



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. This is also true using 2011 ozone data. The location of the maximum ozone concentration has moved about 19 miles closer to the urban center city area, possibly due to changes in the amount, type and location of ozone precursor emissions. Both the New Haven (260990009) and Detroit-E 7 Mile (261630019) sites need to be retained until the location of the design value site stabilizes. 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, so the Warren ozone monitor needs to be retained. The Oak Park (261250001) and Port Huron (261470005) monitors are the only ozone sites in Oakland and St. Clair Counties, respectively.

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 and 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 and 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 and consist of the urban center city site in Lansing (260650012) and the downwind Rose Lake (260370001) 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.

The ozone monitor in Holland (260050003) is in Allegan County and now violating the 0.075 ppm 8-hour ozone NAAQS. Although Allegan County is classified as a micropolitan area and as such, is not required to have a monitor, the current violation status of this monitor suggests that it continue operation. 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 11** comparing ozone concentrations across the region. Holland no longer has the highest design value in the region. In fact there are at least 8 other sites in Region 5 with design values greater than Holland .

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 8 and 14 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 11: OZONE DESIGN VALUES 2009 – 2011 ACROSS REGION 5[12]

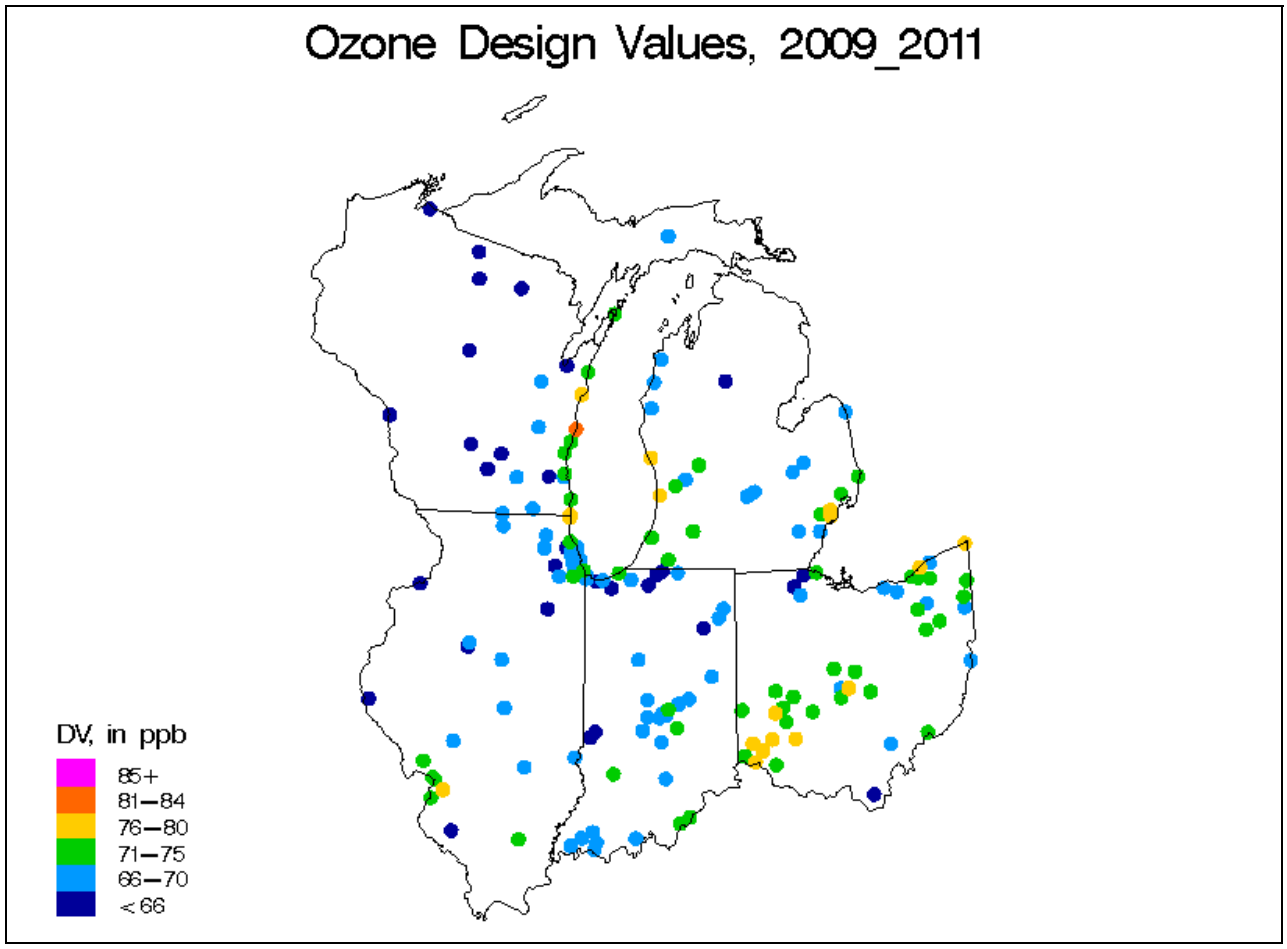


Table 14 summarizes the ozone monitoring site information for sites that were in existence in 2012 and are planned to be operational in 2013. **Figure 12** illustrates the geographical distribution of this network.

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

TABLE 14: 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

Network as of 2012
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***	***774,160***
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	regional	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	Not in CBSA	N/A
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	774,160
Tecumseh	260910007	6792 Raisin Center Highway	41.9956	-83.94667	up wind backgrd	regional	Lenawee	7/6/93	Not in CBSA	N/A
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	Not in CBSA	N/A
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	regional	Ottawa	4/1/89	HGH	263,801
Port Huron	261470005	2525 Dove Rd	42.9533	-82.45639	pop exp	regional	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	nghbrhd	Wayne	4/11/77	DWL	4,296,250

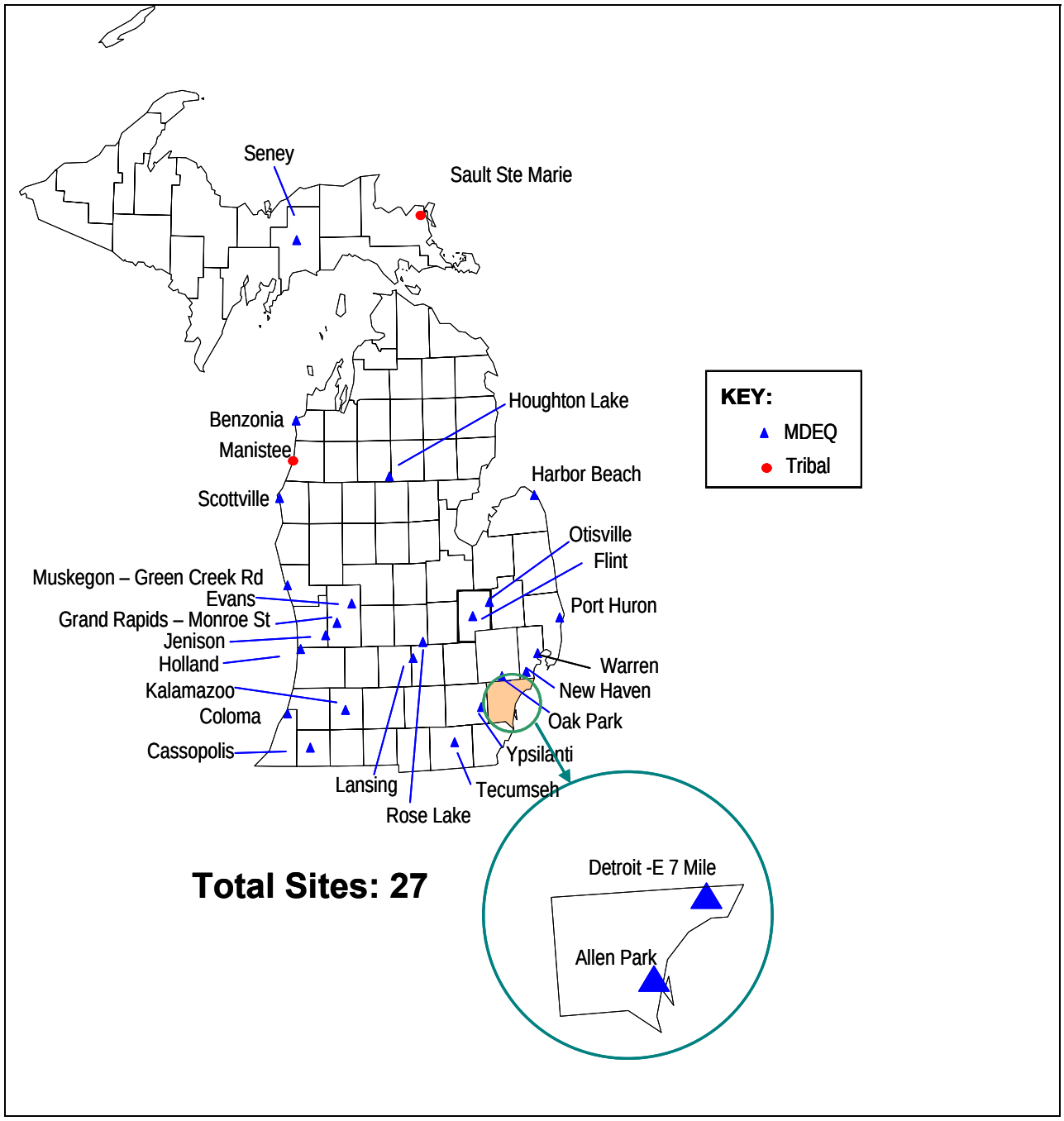
Tribal Stations

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	Not in CBSA	N/A
Sault Ste. Marie	260330901	650 W Easterday Ave	46.4936	-84.3641	transport	regional	Chippewa	1/1/12	Not in CBSA	N/A

[1] **CBSA Key:**

A = Allegan Micropolitan Area
AA = Ann Arbor Metro. 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
MNS = Muskegon-Norton Shores Metro. Area
NBH = Niles-Benton Harbor Metro. Area
SBM= South Bend-Mishawaka Metro. Area (IN/MI)

FIGURE 12: MICHIGAN'S OZONE NETWORK



Ozone Season & Modeling

With the enactment of the 0.075 ppm 8-hour primary NAAQS, the length of the ozone season was modified in some areas. While there were no changes to Michigan's ozone season, which extends from April 1 through September 30, if the EPA promulgates a more stringent ozone standard, the length of Michigan's ozone season may have to be re-evaluated.

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 was 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 2013 Ozone Monitoring Network

Beginning October 1, 2009, the MDEQ began collecting ozone measurements all year at the NCore sites and plans to continue through 2013:

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

To support NSR modeling projects, the MDEQ will continue to collect ozone measurements all year through 2013:

- 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 2013 ozone network; operating April 1 through September 30:

- Holland (260050003)
- Frankfort/Benzonia (260190003)
- Coloma (260210014)
- Cassopolis (260270003)
- Rose Lake (260370001)
- 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 2013:

- Manistee (261050922) (tribal monitor)
- Sault Saint Marie (260330901) (tribal monitor)

$PM_{2.5}$ FRM MONITORING NETWORK:

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 15**.[13] 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 the states in the Midwest show a bias. Therefore, the MDEQ will avoid deploying any continuous monitors that have ARM or FEM status until at least EPA revises the $PM_{2.5}$ NAAQS

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 15: $PM_{2.5}$ 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.

Applying **Table 15** to Michigan's MSAs, population totals and most recent three-year design values results in **Table 16**. Design values that are shown in bold represent the controlling site in each MSA, which is also called the design value site.

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

TABLE 16: 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 15 ug/m3	85% of 35 ug /m3	33-37 = 5% NAAQS
	12.8	30	

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

MSA	2010 Population	Counties	Existing Monitors	2009-2011 most recent 3-year PM2.5 design value (annual)	2009-2011 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	25	3	
		Oakland	Oak Park	9.4	27		
		Wayne	Allen Park	10.6	27		daily
			Detroit-SW HS	10.9	28		
			Detroit - Linwood	10.1	28		
			Detroit - E 7 Mi	10.0	27		
			Livonia	9.5	26		
			Dearborn	**11.5**	**31**		
			Wyandotte	9.5	24		
			Detroit - Newberry	10.3	27		
			Detroit-FIA/Lafayette	10.4	28		daily- special study
		Lapeer	---				
		St Clair	Port Huron	9.3	27		
		Livingston	---				
Flint Metro Area	425,790	Genesee	Flint	**8.7**	**24**	**0**	
Monroe Metro Area	152,021	Monroe	Luna Pier	**9.9**	**25**	**0**	
Ann Arbor Metro Area	344,791	Washtenaw	Ypsilanti	**10.2**	**25**	**0**	
			Ann Arbor (closed)				
Grand Rapids-Wyoming Metro Area	774,160	Kent	GR - Monroe St	**9.5**	**26**	**1**	
			GR - Wealthy St	9.7	25		
		Barry	---				
		Newaygo	---				
		Ionia	---				
Holland-Grand Haven Metro Area	263,801	Ottawa	Jenison	**9.2**	**24**	**0**	
Muskegon-Norton Shores Metro Area	172,188	Muskegon	Muskegon - Apple St	**8.5**	**24**	**0**	
Lansing-East Lansing Metro Area	464,036	Clinton	---				
		Ingham	Lansing	**8.6**	**24**	**0**	
		Eaton	---				
Bay City Metro Area	107,771	Bay	Bay City	**8.0**	**25**	**0**	
Saginaw -Saginaw Tw p N Metro Area	200,169	Saginaw	Saginaw (closed)				
Kalamazoo-Portage Metro Area	326,589	Kalamazoo	Kalamazoo	**9.4**	**24**	**0**	
		Van Buren	---				
Niles-Benton Harbor Metro Area	156,813	Berrien	Coloma	**8.8**	**22**	**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	8.5	25		*micropolitan area*
		Missaukee	Houghton Lake	6.0	18		
		Manistee	Manistee	6.4	20		
		Tecumseh	Lenawee	9.4	25		
		Sault Ste. Marie	Chippewa	not enough data to calculate			

On February 24, 2009, the United States Court of Appeals ordered the EPA to reconsider the annual NAAQS for $PM_{2.5}$.[14] At this time, it is unknown what impact this may have on the design of the ambient monitoring network for $PM_{2.5}$, but if the level of the standard is lowered appreciably, monitoring requirements for MSAs may be altered from the value in the right column to the higher value in the center column of **Table 15.** In addition, the EPA is considering modifying the 24-hr NAAQS to a more stringent level.

[14] American Farm Bureau Federation and National Pork Producers Council v. EPA, United States Court of Appeals for the District of Columbia Circuit Court 2/24/09.

The reduced concentrations of $PM_{2.5}$ measured during 2010 have caused the 2009-2011 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. Although the MDEQ may be able to remove ten $PM_{2.5}$ FRM stations from the fine particulate network, we are reluctant to do so at this time. If the annual or 24-hour $PM_{2.5}$ NAAQS is made more stringent in the near future, monitoring may be required again in these MSAs.

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 conceptual model[15] of $PM_{2.5}$ created by Dr. Jay Turner, describing the nature of $PM_{2.5}$ across the area discusses an urban excess of fine particulate from local sources that impact Dearborn (261630033), Detroit-SWHS (261630015) and Wyandotte (261630036). Both Detroit-SWHS and Wyandotte need to be retained to continue to evaluate the impacts from these local sources. Also, a new international border crossing could be built near Detroit-SWHS and contribute more emissions from motor vehicles, reiterating the need to retain the Detroit-SWHS monitor. Emissions near the Detroit-E 7 Mile site (261630019) could be increasing. So, although only three monitors are required in the Detroit–Warren-Livonia Metropolitan Area, the conceptual model as well as other data analysis results reinforce the importance of retaining a larger network. With the 24-hour values falling at many sites in the Detroit-Warren-Livonia MSA, the monitor at Detroit-FIA/Lafayette street now has the second highest 24-hr values in the MSA. This site needs to be retained as it is a mobile source oriented site, contingent upon retaining site access.

Previously, a co-located sampler was in operation at the Allen Park site (261630001). When Allen Park (261630001) became the NCore site for the Detroit-Warren-Livonia MSA, deck space was at a premium. To make room on the deck, the MDEQ moved the co-located sampler from Allen Park (261630001) to Dearborn (261630033), where the deck was recently enlarged. The co-located monitor at Dearborn (261630033) began operation on January 1, 2010.

The sites at Detroit-Newberry School (261630038) and Detroit–FIA/Lafayette (261630039) are 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, respectively.

Through a cooperative grant project with EPA Region 5 and 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

[15] Turner, Jay R. "A Conceptual Model for Ambient Fine particulate Matter Over Southeast Michigan: High Concentration days. Washington University in St. Louis. Revision 0.1 (First Draft) March 4, 2008.

been reduced, only a single site is required in the Grand Rapids-Wyoming MSA. Both FRM monitors will be retained until possible changes in the NAAQS can be evaluated.

Due to the reduction in fine particulate values, a monitor is no longer required in the Monroe MSA. The Luna Pier site (261150005) is the only $PM_{2.5}$ site in Monroe County, located east of I-75, close to the Ohio border. It was selected to help determine transport into the Detroit MSA. The FRM monitor will be retained until possible changes in the NAAQS can be evaluated.

As shown in **Table 16**, using the most recent three years of data, the Flint (260490021) monitor has an annual and a 24-hour design value equaling 8.7 and 24 $\mu g/m^3$ 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. No changes are suggested at this time because a more stringent standard for fine particulate could occur.

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 because a more stringent standard for fine particulate could occur.

Previously, a single $PM_{2.5}$ FRM monitor was required in the Holland-Grand Haven MSA and Muskegon-Norton Shores MSA. These requirements were fulfilled by the monitor in Jenison (261390005) and by the monitor in Muskegon (261210040), respectively. Recent design values indicate that monitoring is no longer required in these MSAs, but monitoring at these sites will continue in case the NAAQS becomes more stringent.

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 pending a NAAQS revision.

The Saginaw-Saginaw Township North 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) 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 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 5% 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 collocated pair in Sault Ste Marie (260330901).

Table 17 summarizes the $PM_{2.5}$ FRM monitoring site information for sites that existed in 2012 and those that will operate in 2013. **Figure 13** illustrates the geographical distribution of $PM_{2.5}$ FRM monitors.

TABLE 17: $PM_{2.5}$ FRM NETWORK IN MICHIGAN

Operating Schedule: Once every 6 days, once every 3 days or daily see below

Method: Partisol 2025 Rupprecht & Patashnick Samplers

SLAMS Network

Network as of January 2012

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	42.768	-86.14861	1:3	Pop. Exp.	Neighborhood	Allegan	10/31/98	A	111,408
Bay City	260170014	1001 Jennison St	43.571	-83.89083	1:3	Pop. Exp.	Neighborhood	Bay	8/24/00	BC	107,771
Coloma	260210014	4689 Defield Rd., Paw Paw WWTP	42.198	-86.30972	1:3	Transport	Regional	Berrien	11/7/98	NB	156,813
Flint	260490021	Whaley Park, 3610 Iowa St., Flint	43.047	-83.67028	1:3	Pop. Exp.	Neighborhood	Genesee	12/16/98	F	425,790
Lansing	260650012	220 N. Pennsylvania	42.739	-84.53472	1:3	Pop. Exp.	Neighborhood	Ingham	11/7/98	LEL	464,036
Kalamazoo	260770008	Fairgrounds, 1400 Olmstead Rd	42.278	-85.54194	1:3	Pop. Exp.	Neighborhood	Kalamazo	11/19/98	KP	326,589
Grand Rapids-Wealthy St	260810007	507 Wealthy St	42.956	-85.67917	1:3	Pop. Exp.	Neighborhood	Kent	1/1/07	GW	774,160
Grand Rapids - Monroe St	260810020	1179 Monroe St., NW,	42.984	-85.67139	1:3	Pop. Exp.	Neighborhood	Kent	10/23/98	GW	774,160
Tecumseh	260910007	6792 Raisin Center Highway	41.996	-83.94667	1:3	up wind backgrd	regional	Lenawee	7/6/93	Not in CBSA	N/A
New Haven	260990009	57700 Gratiott	42.731	-82.79361	1:3	Pop. Exp. Max. Conc.	Neighborhood	Macomb	12/22/98	DWL	4,296,250
Houghton Lake	261130001	1769 S Jeffs Rd	44.311	-84.89194	1:3	Background	Regional	Missaukee	2/8/03	Not in CBSA	N/A
Luna Pier	261150005	Erie Shooting Club	41.764	-83.47194	1:3	Transport	Regional	Monroe	12/17/99	M	152,021
Muskegon - Apple St	261210040	199 E. Apple	43.233	-86.23861	1:3	Pop. Exp.	Neighborhood	Muskegon	12/18/98	MNS	172,188
Oak Park	261250001	13701 Oak Park Blvd.	42.463	-83.18333	1:3	Pop. Exp.	Urban	Oakland	12/25/98	DWL	4,296,250
Jenison	261390005	6981 28th Ave, Georgetown Twp	42.894	-85.85278	1:3	Pop. Exp.	Neighborhood	Ottawa	11/7/98	HGH	263,801
Port Huron	261470005	2525 Dove Rd.	42.953	-82.45639	1:3	Pop. Exp.	Regional	Saint Clair	2/11/99	DWL	4,296,250
Ypsilanti	261610008	555 Towner Ave	42.241	-83.59972	1:3	Pop. Exp.	Neighborhood	Washtena	8/4/99	AA	344,791
Allen Park	261630001	14700 Goddard	42.229	-83.20833	1:1	Pop. Exp.	Neighborhood	Wayne	5/12/99	DWL	4,296,250
Detroit - SW HS	261630015	SW Highschool, 150 Waterman	42.303	-83.10667	1:3	Pop. Exp. Max. Conc.	Neighborhood	Wayne	2/26/99	DWL	4,296,250
Detroit - Linwood	261630016	2451 Marquette, McMichael School	42.358	-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	42.431	-83.00028	1:3	Pop. Exp.	Neighborhood	Wayne	4/30/00	DWL	4,296,250
Livonia	261630025	38707 Seven Mile Rd	42.423	-83.42639	1:3	Pop. Exp.	Neighborhood	Wayne	8/21/99	DWL	4,296,250
Dearborn	261630033	2842 Wyoming, Salina School	42.307	-83.14889	1:3	Pop. Exp. Max. Conc.	Neighborhood	Wayne	2/5/99	DWL	4,296,250
Wyandotte	261630036	3625 Biddle, Wyandotte	42.187	-83.15404	1:3	Pop. Exp.	Neighborhood	Wayne	2/20/99	DWL	4,296,250
Detroit - Newberry School	261630038	4045 29th St	42.335	-83.1097	1:3	Source Oriented	Neighborhood	Wayne	12/26/05	DWL	4,296,250
Detroit - FIA/Lafayette St	261630039	2000 W Lafayette	42.323	-83.06861	1:1	Source Oriented	Neighborhood	Wayne	8/26/05	DWL	4,296,250

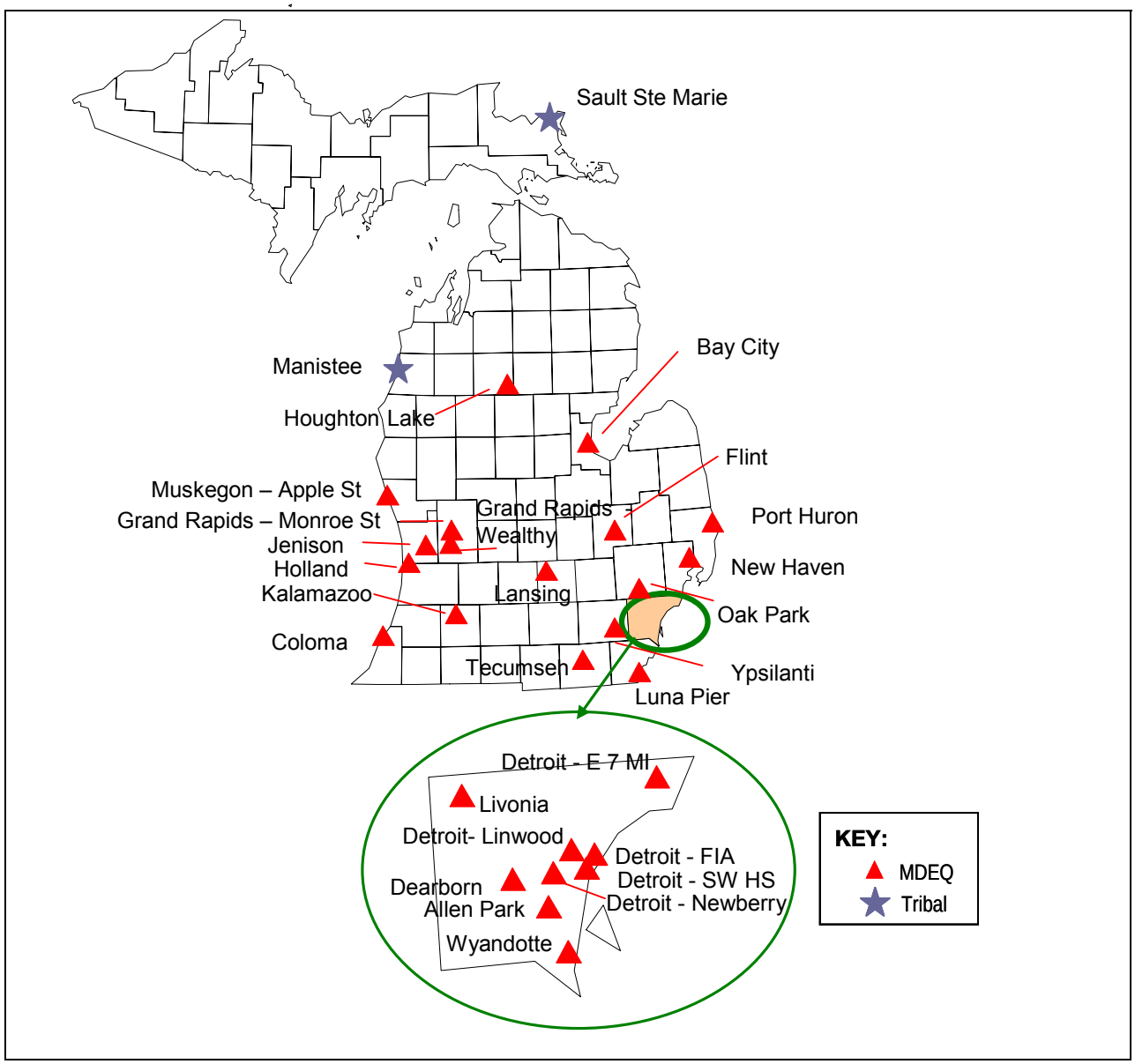
Special Purpose and Tribal $PM_{2.5}$ Monitors in Michigan

Site Name	Monitoring Sites AQS Site ID	Address	Latitude	Longitude	Sampling Frequency	Monitor Type	Purpose	Scale	County	Start Date	CBSA [1]	Pop (2010 Census)
Sault Ste Marie	260330901	650 W Easterday Ave	46.492	-84.36513	1:3	Tribal	Tribal	Regional	Chippewa	1/1/11	Not in CBSA	N/A
Manistee	261010922	3031 Domres Rd	44.307	-86.24268	1:3	Tribal	Tribal	Regional	Manistee	4/2/06	Not in CBSA	N/A

[1] **CBSA Key:**

A = Allegan Micropolitan Area
AA = Ann Arbor Metro. 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)

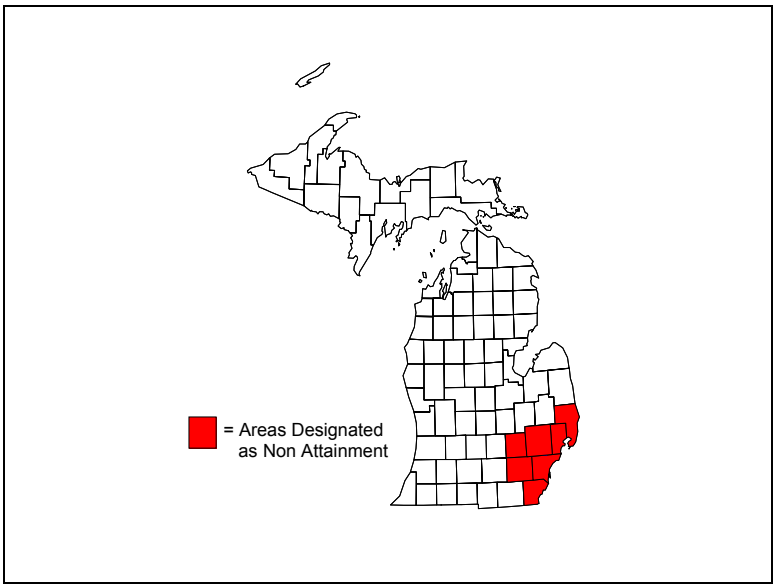
Figure 13: Michigan's $PM_{2.5}$ FRM Monitoring Network



$PM_{2.5}$ Designations

The EPA designated the seven-county area in SE Michigan as nonattainment for both the 24-hour and annual fine particulate NAAQS, as shown in **Figure 14**. The MDEQ has requested that the EPA to redesignate the area to attainment. With completion of the 2011 data, all counties in Michigan are meeting the current $PM_{2.5}$ NAAQS.

FIGURE 14: $PM_{2.5}$ NONATTAINMENT AREAS



$PM_{2.5}$ Quality Assurance

The $PM_{2.5}$ program has separate, 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 4-weeks to ensure the flow rate is meeting the measurement quality objectives. The 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, distances from trees, exhaust vents, and large building. Probe heights and separation distances are also assessed.

Plans for the 2013 $PM_{2.5}$ FRM Monitoring Network

The following $PM_{2.5}$ monitors will be retained as part of the 2013 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 at Grand Rapids - Wealthy St. (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 Luna Pier (261150005) transport
- The one in three day $PM_{2.5}$ FRM monitor in Muskegon – Apple St (261210040)
- 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 Jenison (261390005)
- 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 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-Newberry School (261630038)
- The daily $PM_{2.5}$ FRM monitor at Detroit–FIA/Lafayette (261630039) will continue unless the continuous monitors are needed elsewhere in the network, at which time the frequency will be reduced to one in three day.

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 2013.

- 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 2013.

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 collocated with a continuous $PM_{2.5}$ monitor. The 14 continuous monitors operational in the state exceed the minimum number that are required.

In 2012, the MDEQ operated Rupprecht & Patashnick TEOM samplers to supply continuous fine particulate data at 14 monitoring sites, as shown in **Table 18**. The MDEQ currently is meeting the minimum 50% collocation requirement. **Figure 15** illustrates the geographical distribution of the continuous monitors. In the event that another TEOM needs repair, the unit at Detroit-FIA/Lafayette site will be deployed to the site lacking a functional TEOM. Therefore, incomplete data may be generated at the Detroit-FIA/Lafayette (261630039) site due to repair issues. The MDEQ continues field testing a MetOne Beta Attenuation Monitor (BAM) at Detroit-FIA/Lafayette (261630039) to assess data comparability between the BAM, the TEOM and the FRM. The FRM at Detroit-FIA/Lafayette is operating on a daily basis.

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.

Filter Dynamic Measurement System (FDMS) Inlets

Initially, the MDEQ operated all TEOM units with an inlet temperature of 50°C. Because this high inlet temperature was volatilizing nitrate during the winter months, and due to the EPA's desire to make the continuous data as "FRM-like" as possible, FDMS inlets were installed on the TEOMs during October 2003 and operated until through April 2005, allowing the inlet temperature to be reduced. The data from units with the Filter Dynamic Measurement System (FDMS) inlets showed good correlation with the FRM data during the winter months, but during the summer, the correlation was poor. During summer days with high humidity, condensation occurred in the FDMS lines, interfering with data capture and creating maintenance problems. As a possible solution to both the condensation problem and data comparability issue, the MDEQ proposed to operate the TEOMs with the FDMS inlets during the winter months and without the FDMS inlets during the summer. The MDEQ selected the week of April 1, 2006 to remove the inlets and the week of October 1, 2006 to replace them, corresponding to Michigan's ozone monitoring season. Performance was worse than during the previous year, and was most likely due to a degradation of the nafion driers in the FDMS inlets. In March 2007, the chillers broke on two units and could not be replaced because the instrument manufacturer discontinued the necessary parts in the version of the FDMS units operated by the MDEQ. Rather than buying the version C upgrades to the FDMS units, all FDMS units were removed from the TEOMs in February 2007.

Since that time, the MDEQ has operated 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 18: MICHIGAN'S CONTINUOUS $PM_{2.5}$ MONITORING NETWORK

Operating Schedule: continuous — Network as of January 2012

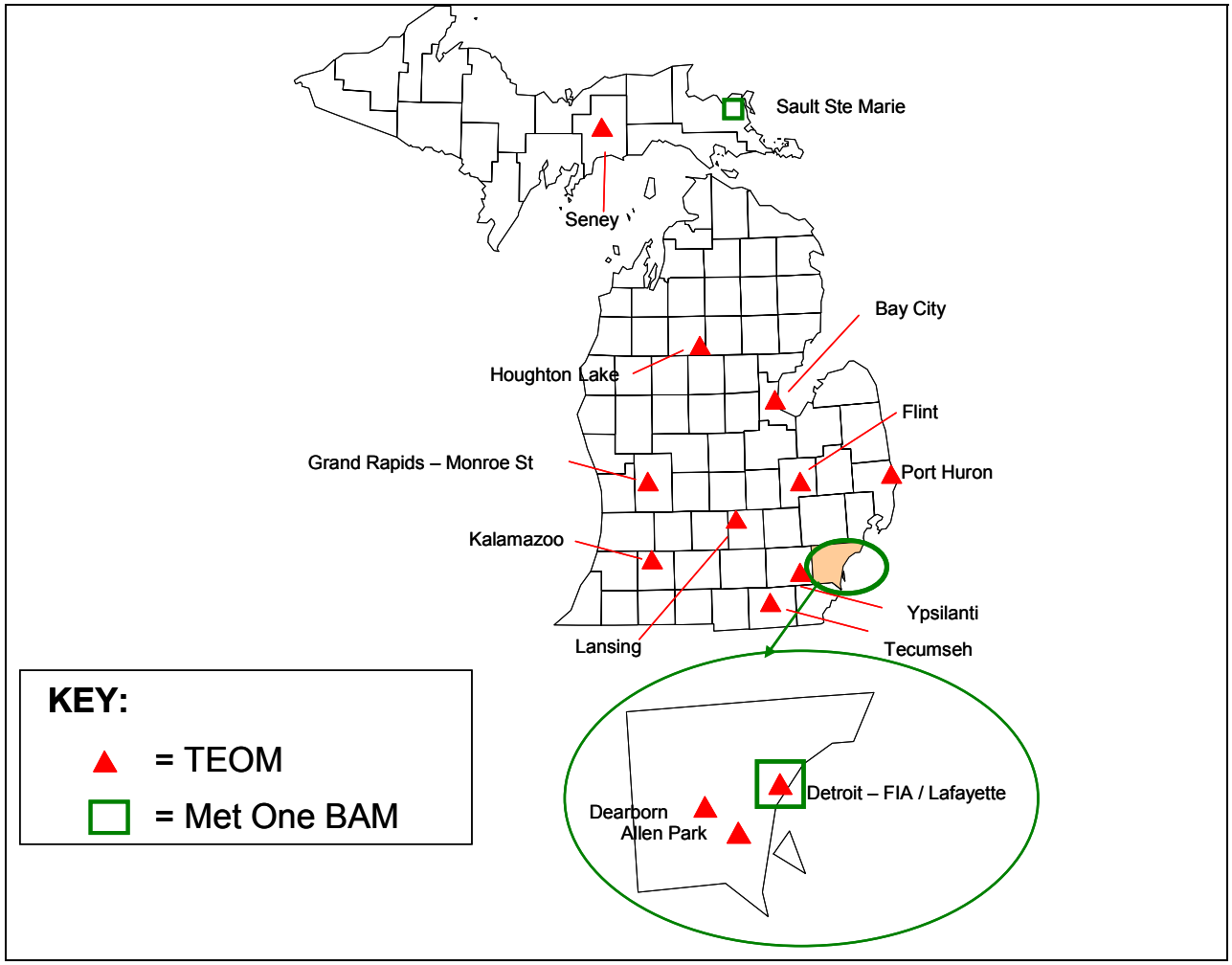
Method: Rupprecht & Patashnick Tapered Element Oscilating Microbalance (TEOMS) Samplers

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	43.571	-83.89083	Pop. Exp.	Neighborhood	Bay	11/19/05	BC	107,771
Flint	260490021	Whaley Park, 3610 Iowa St., Flint	43.047	-83.67028	Pop. Exp.	Neighborhood	Genesee	5/23/02	F	425,790
Lansing	260650012	220 N. Pennsylvania	42.739	-84.53472	Pop. Exp.	Neighborhood	Ingham	12/1/99	LEL	464,036
Kalamazoo	260770008	Fairgrounds, 1400 Olmstead Rd	42.278	-85.54194	Pop. Exp.	Neighborhood	Kalamazoo	8/17/00	KP	326,589
Grand Rapids - Monroe St	260810020	1179 Monroe St., NW,	42.984	-85.67139	Pop. Exp.	Neighborhood	Kent	11/4/99	GW	774,160
Tecumseh	260910007	6792 Raisin Center Highway	41.996	-83.94667	upwind backgrd	regional	Lenawee	6/1/09	Not in CBSA	N/A
Houghton Lake	261130001	1769 S Jeffs Rd	44.311	-84.89194	Background	Regional	Missaukee	10/9/03	Not in CBSA	N/A
Port Huron	261470005	2525 Dove Rd.	42.953	-82.45639	Pop. Exp.	Regional	Saint Clair	9/18/03	DWL	4,296,250
Seney	261530001	Seney Wildlife Refuge, HCR 2 Box 1	46.289	-85.95027	Background	Regional	Schoolcraft	1/1/02	Not in CBSA	N/A
Ypsilanti	261610008	555 Towner Ave	42.241	-83.59972	Pop. Exp.	Neighborhood	Washtenaw	2/24/00	Not in CBSA	N/A
Allen Park	261630001	14700 Goddard	42.229	-83.20833	Pop. Exp.	Neighborhood	Wayne	12/1/00	DWL	4,296,250
Dearborn	261630033	2842 Wyoming, Salina School	42.307	-83.14889	Pop. Exp. Max. Conc.	Neighborhood	Wayne	9/26/03	DWL	4,296,250
Detroit - Newberry School	261630038	4045 29th St	42.335	-83.1097	Source Oriented	Neighborhood	Wayne	1/1/05	DWL	4,296,250
Detroit - FIA/Lafayette St	261630039	2000 W Lafayette	42.323	-83.06861	Source Oriented	Neighborhood	Wayne	8/20/05	DWL	4,296,250
Method:	MetOne Beta Attenuation Monitor (BAM)									
Sault Ste. Marie	260330901	650 W Easterday Ave	46.49366	-84.36416	Tribal	Regional	Chippewa	1/1/2012	Not in CBSA	N/A
Detroit - FIA/Lafayette St	261630039	2000 W Lafayette	42.323	-83.06861	Source Oriented	Neighborhood	Wayne	10/1/09	DWL	4,296,250

[1] **CBSA Key:**

BC = Bay City Metro. Area
DWL= Detroit-Warren-Livonia Metro. Area
F = Flint Metro Area
GW=Grand Rapids-Wyoming Metro. Area
KP= Kalamazoo-Portage Metro. Area
LEL= Lansing-E. Lansing Metro. Area

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



$PM_{2.5}$ TEOM Quality Assurance

The site operator conducts flow checks for precision every four weeks. The 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 2013 $PM_{2.5}$ TEOM Network

No changes to the continuous $PM_{2.5}$ network are anticipated, but if EPA cuts funding, operation of some TEOMs may need to be discontinued in 2013. 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 2013, 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-Newberry (261630038)
- Detroit-FIA/Lafayette (261630039)

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 2013, the MDEQ will run the Met-One Bam at Detroit-FIA/Lafayette (261630039); and to the best of our knowledge, the Inter Tribal Council is planning to continue to operate a $PM_{2.5}$ BAM monitor at Sault Saint 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 has a sampling frequency of once every three days. The speciation network is described in **Table 19**. **Figure 16** illustrates the coverage across Michigan.

To improve the EC and OC data that is collected by the speciation network, the EPA decided to upgrade the carbon channel to URG model 3000 N units, becoming more similar to the IMPROVE network. All upgrades have been accomplished.

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. Two 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.

A continuous EC/OC monitor from Sunset Laboratories is deployed at the Newberry School (261630038) site to determine diurnal variation in elemental carbon and organic carbon. 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. The 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. The audit results are reviewed by the AMU's QA Coordinator. The audit data is also uploaded to the EPA's AQS database using the RTI interface. The EPA periodically conducts technical systems audits and instrument audits for the speciation network. The EPA also conducts audits of RTI National Laboratory, which supplies speciation analysis services for the entire nation.

TABLE 19: MICHIGAN'S $PM_{2.5}$ SPECIATION NETWORK

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

Network as of February, 2012

Method: Met One SASS and two URG 3000 N units to collect organic & elemental carbon at Dearborn & Ypsilanti

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	774,160	
Tecumseh	260910007	6792 Raisin Center Highway	41.996	-83.94667	1:6	upwind backgrd	regional	Lenawee	4/6/08	Not in CBSA	N/A	SPM
Houghton Lake	261130001	1769 S Jeffs Rd	44.311	-84.89194	1:6	Background	Regional	Missaukee	10/9/03	Not in CBSA	N/A	
Luna Pier	261150005	Erie Shooting Club	41.764	-83.47194	1:6	Transport	Regional	Monroe	12/17/99	M	152,021	
Port Huron	261470005	2525 Dove Rd.	42.953	-82.45639	1:6	Pop. Exp.	Regional	Saint Clair	7/5/08	DWL	4,296,250	
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

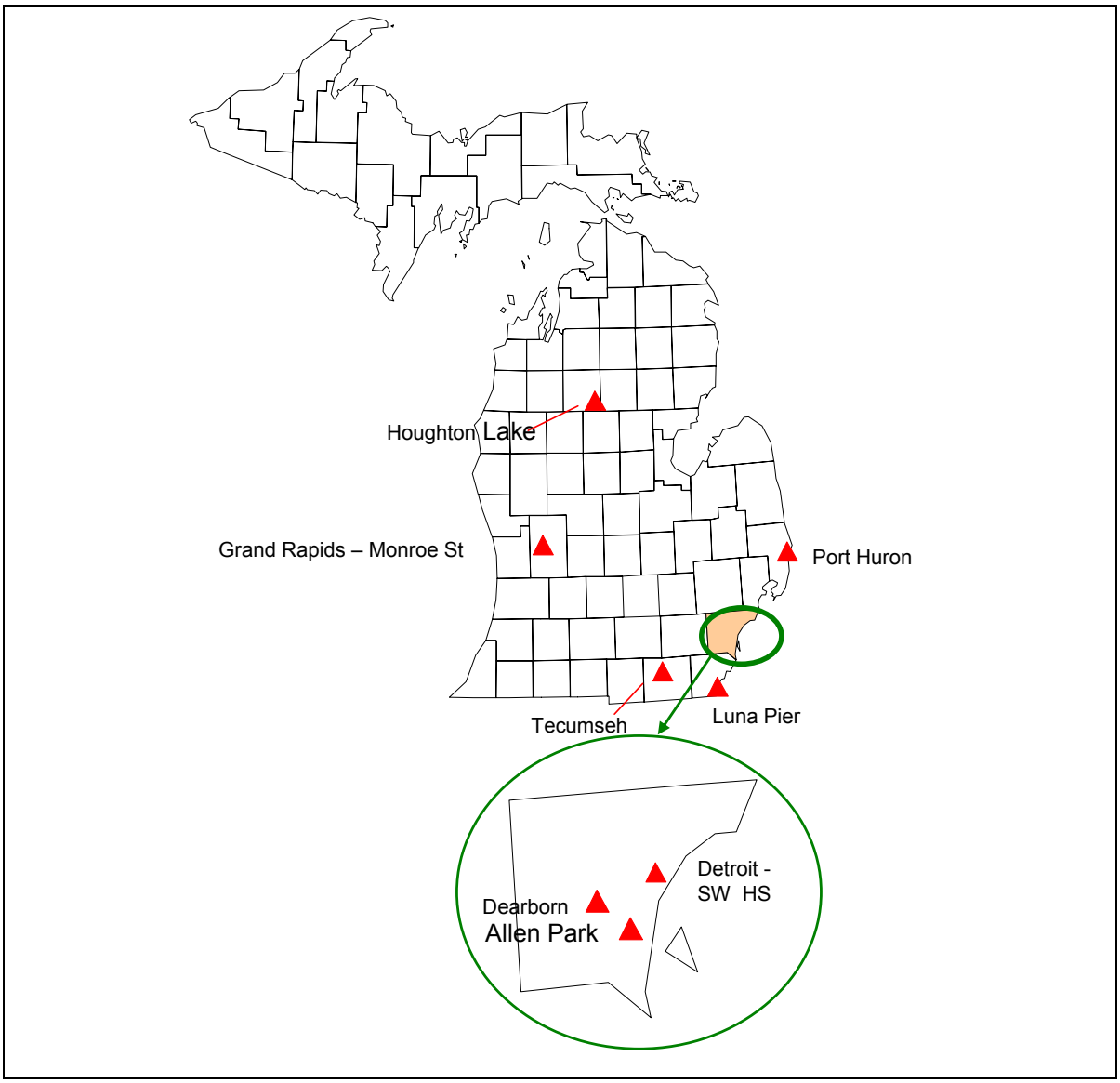
Site Name	Monitoring Sites AQS Site ID	Address	Latitude	Longitude	Sampling Method	Purpose	Scale	County	Start Date	CBSA [1]	Pop (2010 Census)	Comments
Allen Park	261630001	14700 Goddard	42.229	-83.20833	McGee large spot Aethalometer (carbon black)	Pop. Exp.	Neighborhood	Wayne	1/1/04	DWL	4,296,250	
Dearborn	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	Not in CBSA	N/A	SPM
Detroit - Newberry School	261630038	4045 29th St	42.335	-83.1097	Sunset EC/OC	Source Oriented	Neighborhood	Wayne	2/1/05	DWL	4,296,250	
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:**

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

SPM = Special Purpose Monitor

FIGURE 16: MICHIGAN'S $PM_{2.5}$ SPECIATION (SASS) NETWORK



Plans for the 2013 $PM_{2.5}$ Speciation Monitoring Network

During 2013, 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
- Tecumseh (260910007) operating once every six days
- Houghton Lake (261130001) operating once every six days
- Luna Pier (261150005) operating once every six days
- Port Huron (261470005) operating once every six days
- Allen Park (261630001) operating once every three days
- Dearborn (261630033) operating once every six days
- SWHS (261630015) operating once every six days

During 2013, contingent upon adequate levels of funding, Michigan is planning to continue to operate hourly Sunset EC/OC monitors at:

- Dearborn (261630033)
- Detroit - Newberry (261630038)
- Tecumseh (260910007)

During 2013, 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 20**.[16]

TABLE 20: 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 20** to Michigan's urban areas, population totals and historical PM_{10} data results in the design requirements that are shown in **Table 21**.

According to the tables, two to four PM_{10} sites are required in the Detroit-Warren-Livonia Metropolitan Area. Currently, there are three sites in operation, one at Allen Park (261630001), one at Detroit-SWHS (261630015) and 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 are two sites currently in operation in Grand Rapids, one on Wealthy St (260810007) and one on Monroe St. (260810020). Both of these sites are operational at the request of EPA Region 5.

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 after one year has been collected. Decisions about future monitoring for Mn in SE Michigan will be made by the work group.

16 Table D-4 of Appendix D to Part 58.

PM course measurements are required at NCore sites. One acceptable technology is to use two R & P Partisol Plus 2025 units equipped with a $PM_{2.5}$ head and a WINS impactor and the second with a PM_{10} head and a down tube. PM course is determined by subtracting the 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 were deployed to Grand Rapids–Monroe St. (260810020) and Allen Park (261630001).

Table 22 summarizes the PM_{10} monitoring site information for sites. **Figure 17** compares the PM_{10} network in 2012.

TABLE 21: 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				2009-2011		
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	53	low	
			Detroit -SW HS	77	low	
			Dearborn	**96**	low	
			River Rouge	65	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	41		
			GR- Wealthy	**44**	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	---	---		
MSAs with populations greater than 500,000 require at least 1 PM 10 monitor.						

TABLE 22: MICHIGAN'S PM_{10} MONITORING NETWORK

Method: Manual High Volume Sampler (Dearborn also uses a R&P TEOM to make continuous measurements) Propsosed 2013 Network

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	774,160
Grand Rapids - Monroe St	260810020	1179 Monroe NW	42.9842	-85.67139	1:6	High Vol	pop exp	nghbrhd	Kent	3/20/87	GW	774,160
Grand Rapids - Wealthy St	260810007	509 Wealthy	42.9561	-85.67917	1:6	High Vol	pop exp	nghbrhd	Kent	2/3/89	GW	774,160
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	1:6	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**

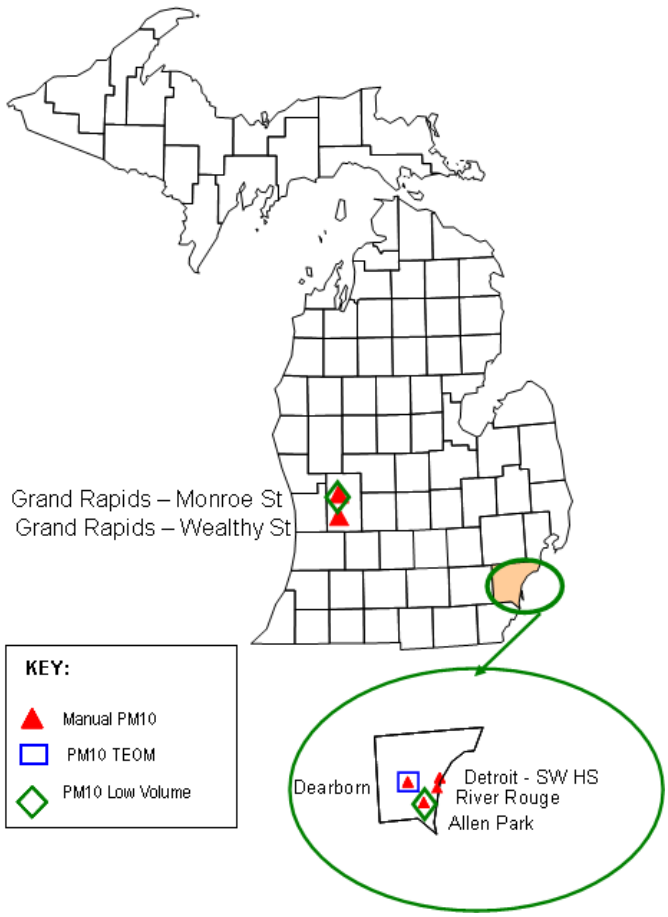
NCore Low Volume PM Coarse Sites

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.

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	774,160
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 17: MICHIGAN'S PM_{10} MONITORING NETWORK



PM_{10} Quality Assurance

The site operator conducts a 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 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.

Plans for the 2013 PM_{10} Monitoring Network

During 2013, contingent upon adequate levels of funding, the MDEQ is planning to operate high volume PM_{10} monitors sampling over 24-hrs at:

- The PM_{10} monitor at Wealthy Street in Grand Rapids (260810007) on a once every six day schedule
- 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) and the co-located PM_{10} monitor on a once every six day schedule.

MDEQ is planning to operate low volume PM_{10} monitors co-located with low volume $PM_{2.5}$ monitors to calculate $PM_{10-2.5}$ 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 PM_{10} monitor at River Rouge (261630005) on a once every six day schedule to support the Manganese Workgroup.
- The special purpose monitor PM_{10} TEOM at Dearborn (261630033) on a 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[17] EPA finaled the new CO NAAQS and retained the level and form of the CO NAAQS but revise the design of the ambient monitoring network for CO to be more focused on heavily travelled 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 already has CO monitors in the two Eliza Howell Near Roadway sites (261630093) and (261630094).

Table 23 summarizes the CO monitoring site information for sites that were in existence in 2012. **Figure 18** 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. The 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. EPA reports the results to AQS.

Plans for the 2013 CO Monitoring Network

During 2013, contingent upon adequate levels of funding, Michigan is planning to continue to operate trace level CO monitors to support NCore operations:

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

During 2013, contingent upon adequate levels of funding, Michigan is planning to continue to operate CO monitors to support the near-roadway network:

- Eliza Howell #1 (261630093)
- Eliza Howell #2 (261630094)

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

TABLE 23: MICHIGAN'S CO MONITORING NETWORK

Operating Schedule: Continuous

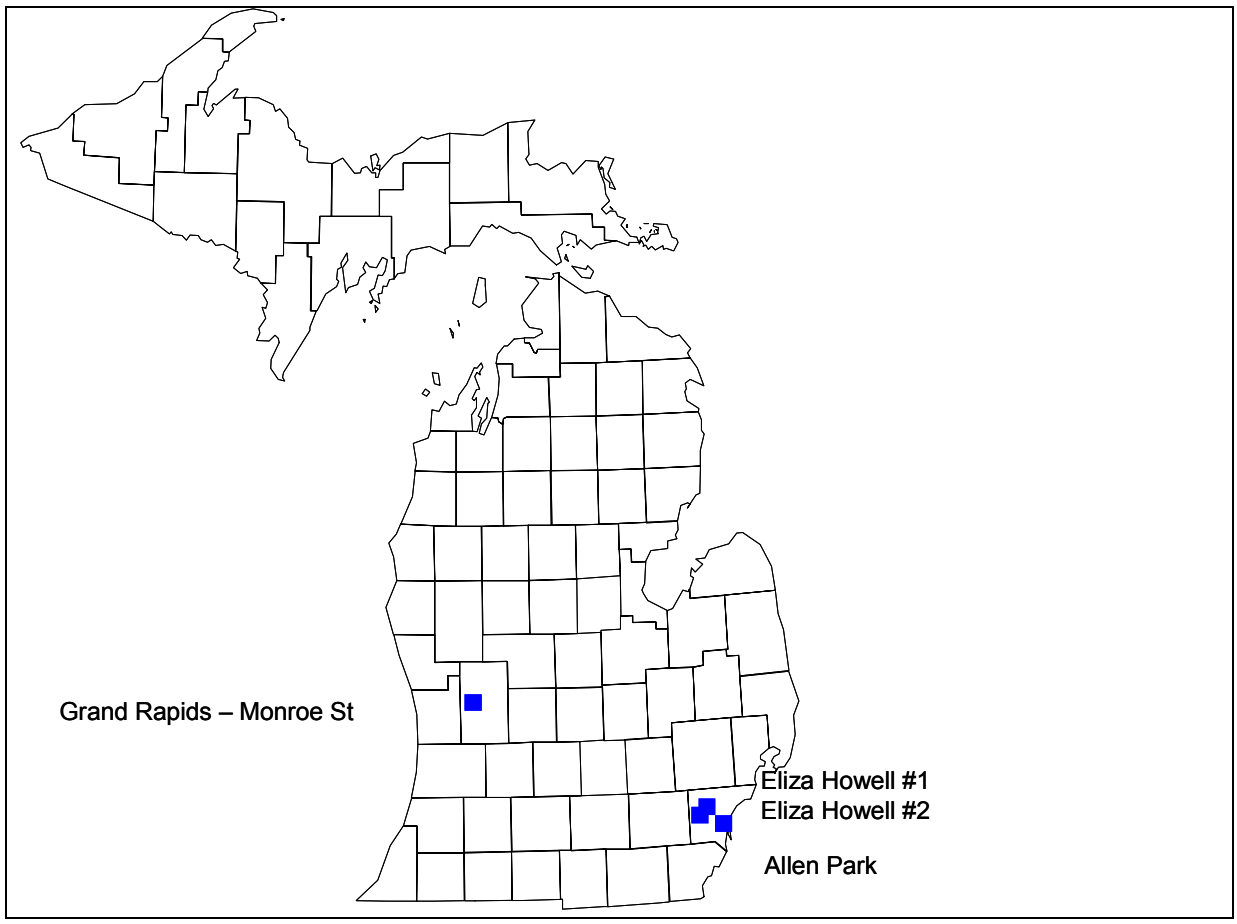
Network as of 2012

Method: Gas Filter Correlation Analyzer- CO & Trace CO

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	4/10/07	GW	774,160
Allen Park	261630001	14700 Goddard	42.2286	-83.208333	trace	pop exp	nghbrhd	Wayne	5/24/07	DWL	4,296,250
Eliza Howell #1	261630093	Service Road I-96 & Telegraph	42.38599	-83.26632	CO	near road	nghbrhd	Wayne	9/1/11	DWL	4,296,250
Elixa Howell #2	261630094	Eliza How ell Park	42.3868	83.270637	CO	near road	nghbrhd	Wayne	9/1/2011	DWL	4,296,250

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

FIGURE 18: 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 then 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[18]. Because of budgetary constraints the EPA has developed a build and hold system for implementing the new monitoring locations. One of the Detroit Area monitors sites is in the first deployment schedule. At this time, the Grand Rapids monitoring site is not listed for deployment by the EPA.

Table 24 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.

Table 24: NO_2 Network Design

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

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	4,296,250	1	1		1	
	Oakland						
	Wayne						
	Lapeer						
	St Clair						
	Livingston						
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	774,160	1				
	Barry						
	Newaygo						
	Ionia						
Holland-Grand Haven Metro Area	Ottawa	263,801					
Muskegon-Norton Shores Metro Area	Muskegon	172,188					
Lansing-East Lansing Metro Area	Clinton	464,036					
	Ingham						
	Eaton						
Bay City Metro Area	Bay	107,771					
Saginaw-Saginaw Twp N Metro Area	Saginaw	200,169					
Kalamazoo-Portage Metro Area	Kalamazoo	326,589					
	Van Buren						
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

The MDEQ had the opportunity to leverage a pre-existing near roadway monitoring network that was established by EPA's Office Research and Development (ORD) and the FHWA as part of a special research project investigating the impact of pollutants from major highways. Phase 1 was performed in Las Vegas. The second phase of the study began in Detroit in September 2010 near the intersection of I-96 and Telegraph Road, as shown in **Figure 19**. Four stations were created: one upwind, one 10 meters from the middle of I-96 and 100 meter and 300 meters from the middle of I-96 were established in the southern portion of the Eliza Howell Park. A map comparing the location of each monitoring shelter with the highway is shown in **Figure 20**.

FIGURE 19: COMPARISON OF ELIZA HOWELL PARK LOCATION WITH OTHER AIR MONITORING STATIONS AND ROADWAY SEGMENTS WITH THE HIGH TRAFFIC COUNTS

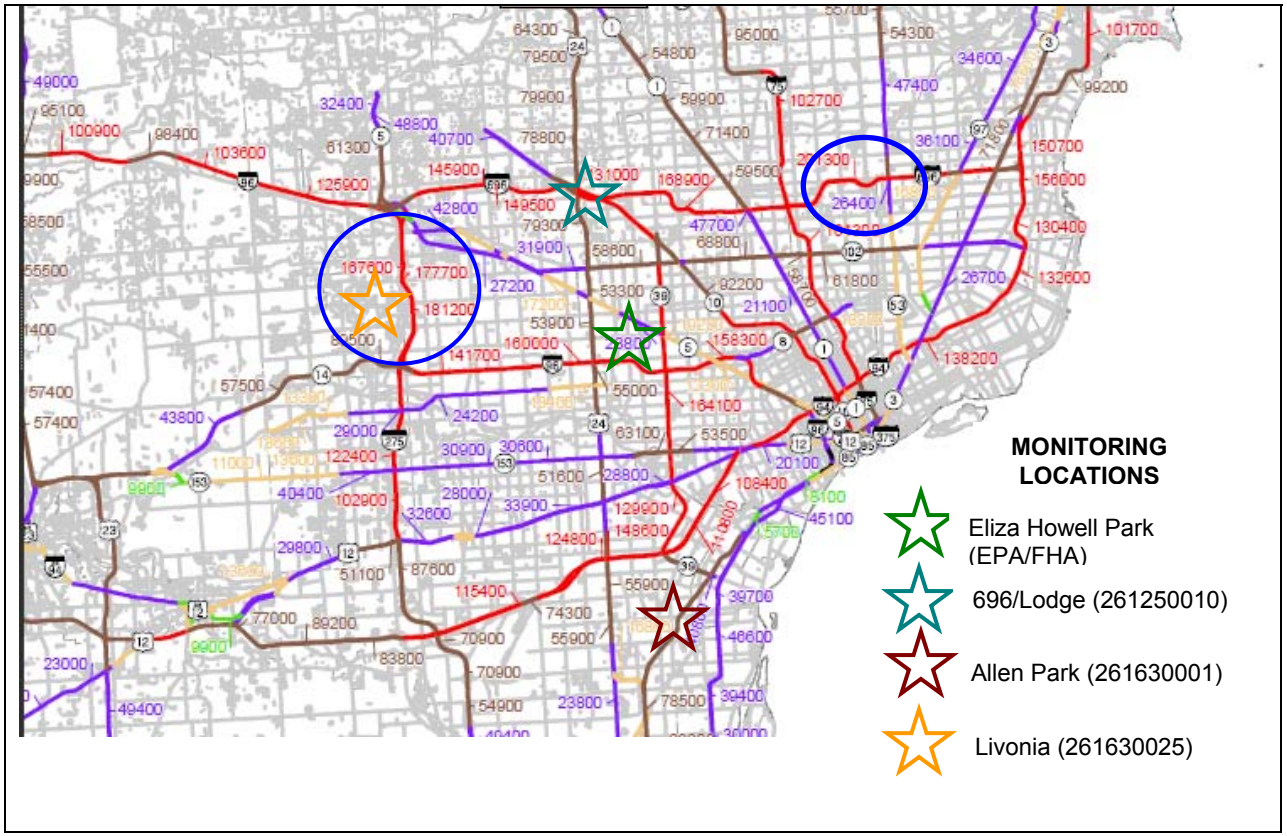
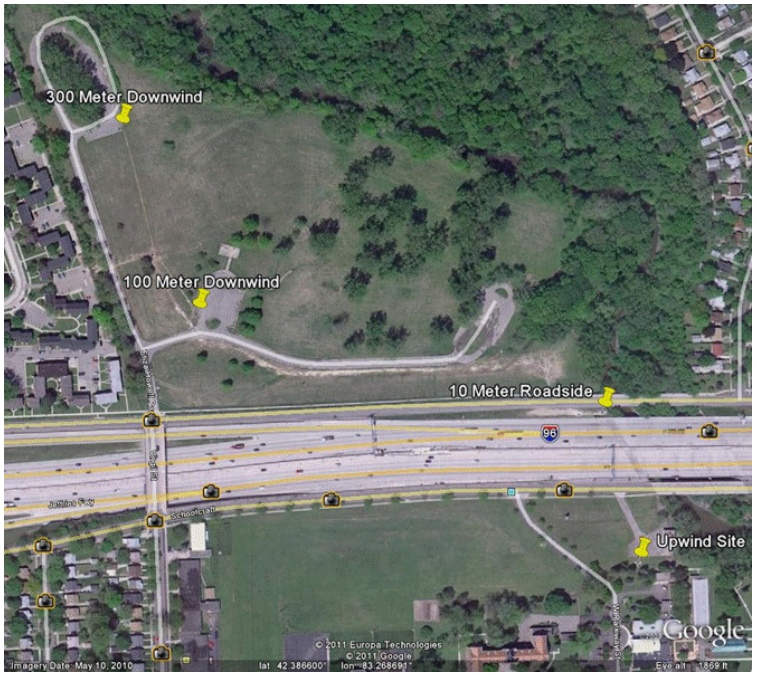


FIGURE 20: MONITORING STATION LOCATIONS NEAR AND IN ELIZA HOWELL PARK



The MDEQ is operating a NO_2 and CO monitors, as well as meteorological equipment, at Site #1, the 10 meter location, and Site #2, the 100 meter location. Photographs of Site #1 are shown in **Figure 21** whereas Site #2 is shown in **Figure 22**.

Figure 21: Near Roadway Site #1: 10 meters from I-96[19]

Although I-96 between Telegraph and the Southfield Freeway does not carry the maximum level of traffic in the Detroit-Warren-Livonia CBSA, there are several advantages to using these stations at Eliza Howell Park to fulfill part of the near road NO_2 monitoring requirements. Leveraging the existing infrastructure built by EPA ORD/FHWA saves resources. Early assumption of operation of Stations 1 and 2 promotes continuity with the existing database already created by EPA ORD, who left in June 2011. Michigan started collecting NO_2 measurements in October 2011. By assuming operation of the stations early, the MDEQ is able to preserve the existing infrastructure and save a substantial amount of funding because the creation of a new near roadway monitoring station will be avoided. Operation and maintenance costs are minimal in comparison to creation of a new station. Adoption of both stations

[19] Distance is measured from the center of the roadway.

will allow further investigations into spatial variability of pollutants in a near roadway environment. Operation of Site #2 allows retention of the power supply into the park and makes sufficient space and power available for researchers for future studies.

Figure 22: Near Roadway Site #2: 100 meters[20] from I-96

[20] Distance is measured from the center of the roadway.

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. An NO_Y is currently operational at the Allen Park NCore site (261630001), which is sandwiched between a residential neighborhood and I-75. Either of these locations would be a suitable area wide monitoring site.

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 through out the nation to meet the environmental justice component of the network design. **Figure 23** shows the locations of environmental justice locations in most of the state. **Figure 24** shows the locations of these areas in southeast Michigan. It should be noted that Eliza Howell #1 (261630093) and Eliza Howell #2 (261630094) are both located in environmental justice areas. Currently, it is the MDEQ's understanding that these monitors will be deployed to existing stations through a cooperative process between state and local air agencies and EPA. However, if it is deemed necessary that NO_2 monitors must be deployed to new locations, the MDEQ lacks adequate resources to do so.

Figure 23: Environmental Justice Areas in Michigan

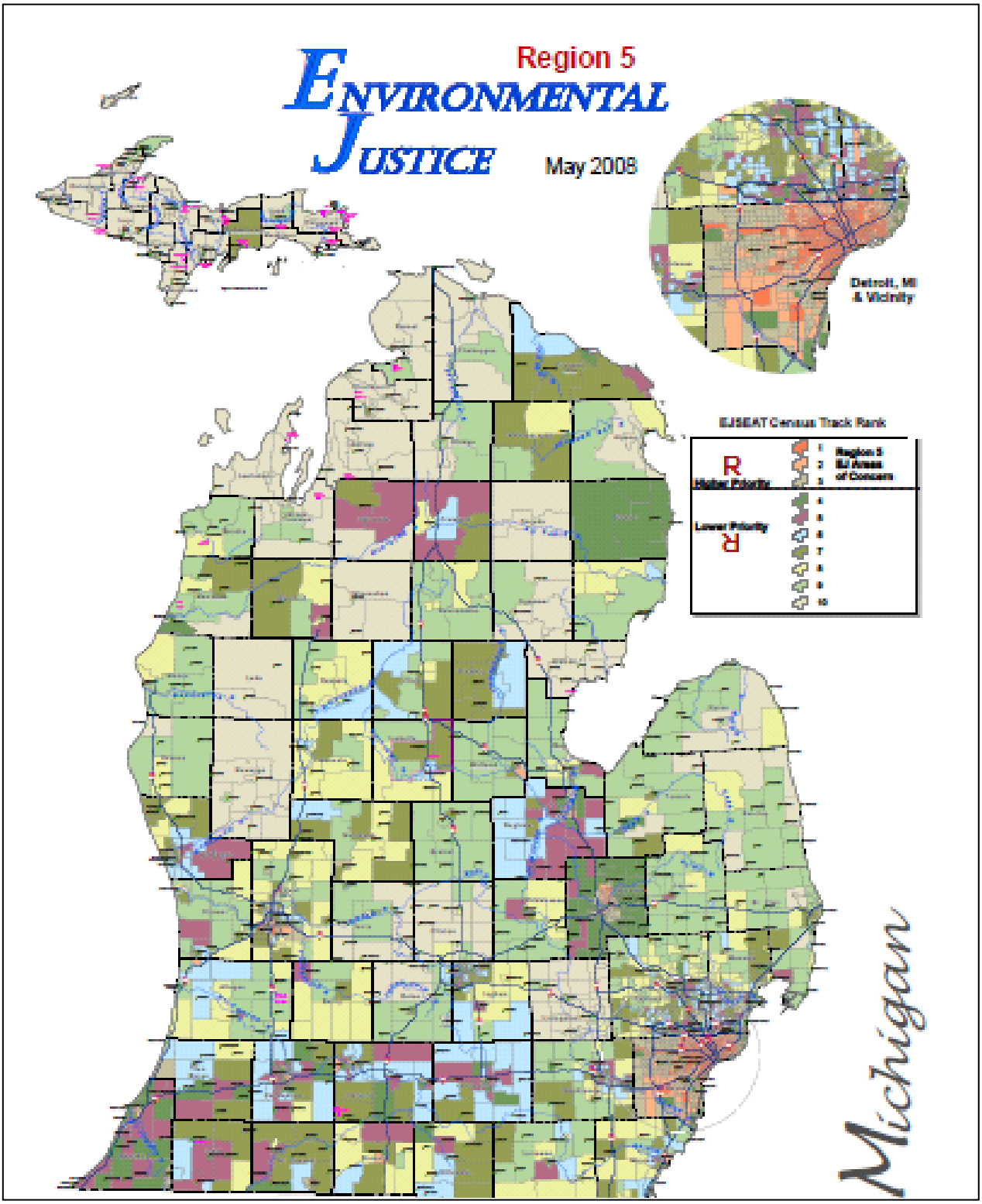
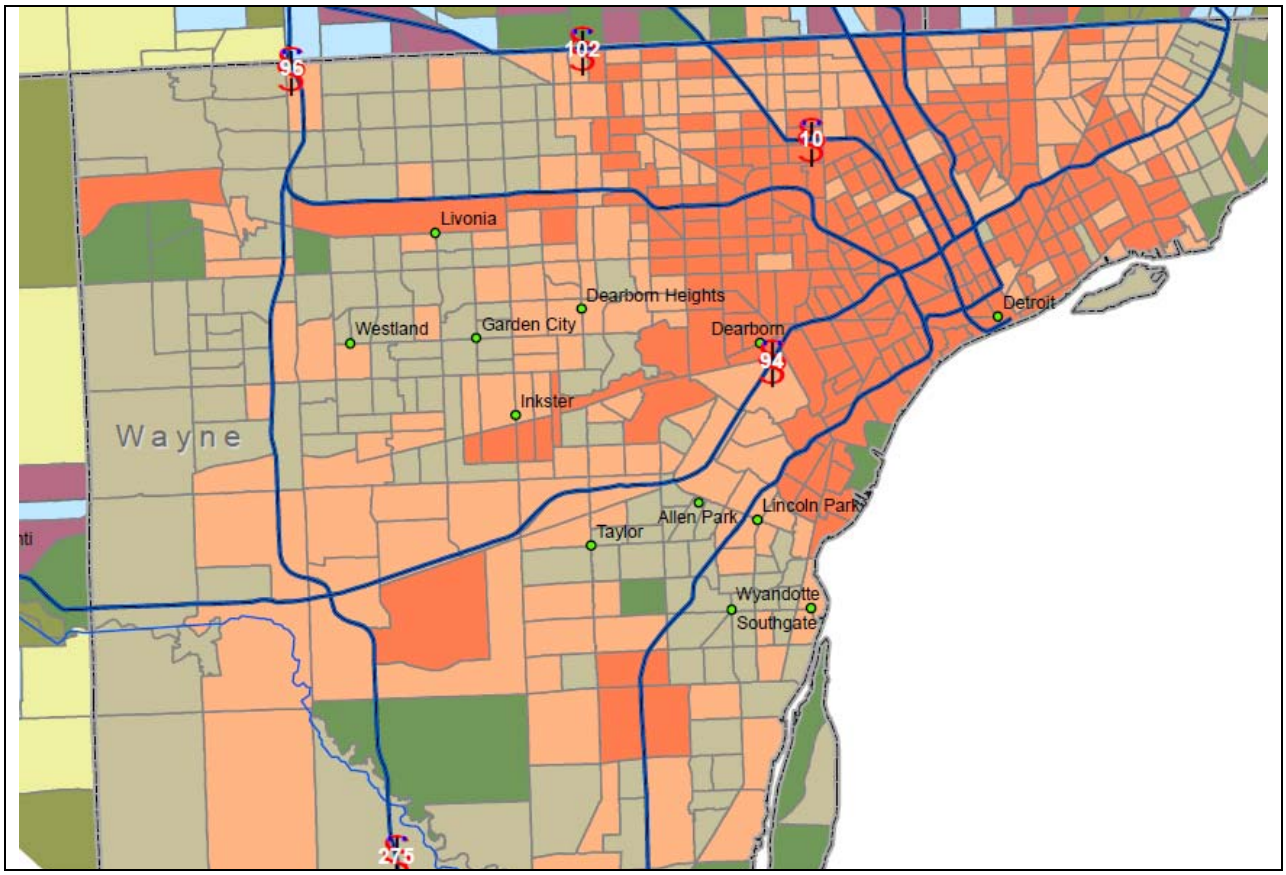


Figure 24: Environmental Justice Areas in Southeast Michigan



NO_2 Monitoring for NSR

Recent modeling projects for new source review have shown that there is a possibility that the new 1-hr NO_2 NAAQS could be violated using the very conservative estimates in the current 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).

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 25 summarizes the NO_2 and NO_Y monitoring site information for sites that are in existence in 2012 and 2013 **Figure 25** compares the NO_2 and NO_Y monitoring network operated by MDEQ in 2012 with the current design.

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 2013 NO_2 and NO_Y Monitoring Network

During 2013 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)

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 (261630001)

TABLE 25: NO_2 AND NO_Y SITES IN OPERATION IN 2012

Operating Schedule: Continuous

Network as of 2012

Method: Chemiluminescense

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	42.984	-85.67139	NOy	pop exp	nghbrhd	Kent	1/1/08	GW	774,160
Allen Park	261630001	14700 Goddard	42.229	-83.20833	NOy	pop exp	nghbrhd	Wayne	1/1/08	DWL	4,296,250

Tier 1: Near Roadway Sites

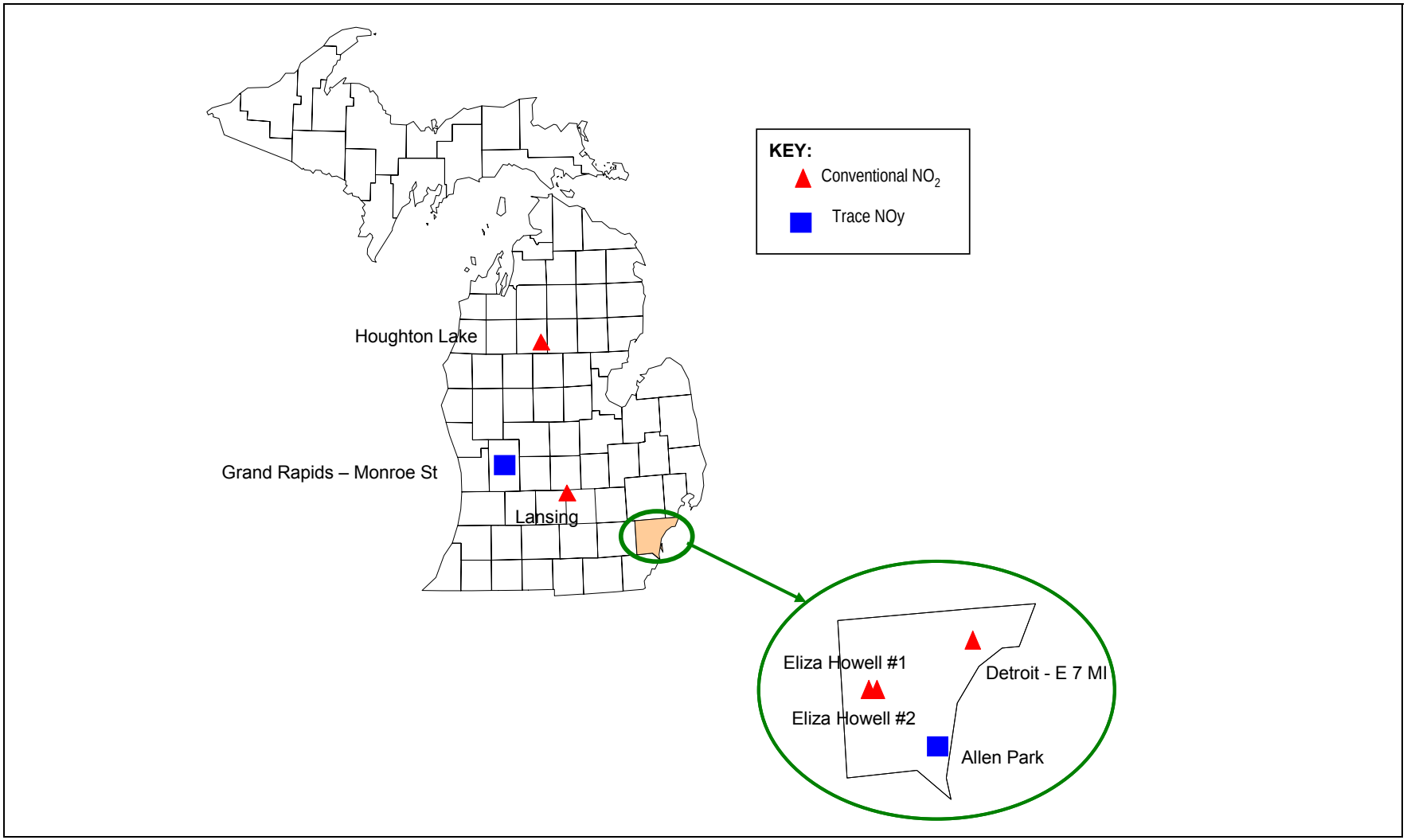
Site Name	Monitoring Sites AQS Site ID	Address	Latitude	Longitude	Measurement	Purpose	Scale	County	Start Date	CBSA [1]	Pop (2010 Census)
Eliza Howell #1	261630093	Service Road I-96 & Telegraph	42.386	-83.26632	NO2	Near Road	nghbrhd	Wayne	9/1/11	DWL	4,296,250
Eliza Howell #2	261630094	Eliza How ell Park	42.3868	83.27064	NO2	Near Road	nghbrhd	Wayne	9/1/11	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	42.431	-83.00028	NO2	pop exp	urban	Wayne	12/1/90	DWL	4,296,250
Lansing	260650012	220 N Pennsylvania	42.739	-84.53472	NO2	pop exp	nghbrhd	Ingham	9/5/80	LEL	464,036
Houghton Lake	261130001	1769 S Jeffs Road	44.311	-84.89194	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 25: 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 can not 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[21].

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

(CBSA population[22]) * (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 26** to determine the number of monitoring sites that are required:

Table 26: 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.

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 26** is applied to the PWEI calculations for the CBSAs in Michigan, the number of monitors that are required is shown in **Table 27**. The data in the table uses the 2010 Census data and the most recent version (2008) of the National Emissions Inventory data.

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

TABLE 27: 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 operates a second monitor at Detroit – SWHS (261630015). Previously, the MDEQ operated an SO_2 monitor at Port Huron (261470005). Now that the NAAQS is lower, there may be a possibility that these SO_2 concentrations could violate the NAAQS. Therefore, the MDEQ redeployed an SO2 monitor to Port Huron (261470005) on 1/1/2012.

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 1/1/2012.

Lastly, the new SO_2 NAAQS requires a monitor in the Monroe metropolitan area due to the influence of the Monroe Power Plant. The plant has very tall stacks and it is unlikely that elevated SO_2 levels would be measured near the facility. Therefore modeling will be performed to identify the location of maximum impact. The only site operated by the MDEQ in Monroe County is at Luna Pier (261150005), which is unsuitable as SO_2 site due to location and lack of

a shelter. The one point of maximum impact, see **Figure 26**, occurs at Sterling State Park. The MDEQ is currently working with the Department of Natural Resources to deploy an SO_2 monitor at the State Park, see **Figure 27**. The MDEQ anticipates starting this site by January 1, 2013.

Figure 26: Modeling Isopleths SO_2 Monroe Power Plant

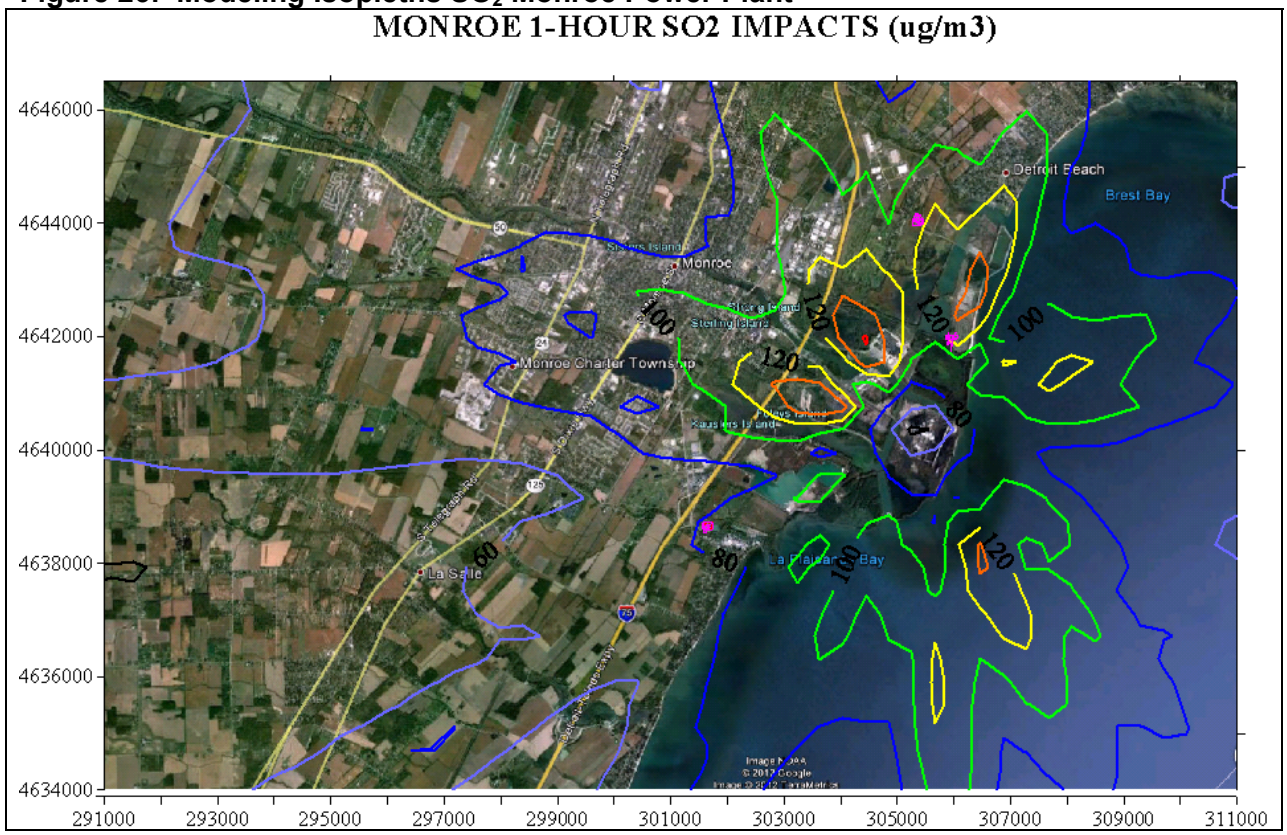


Figure 27: Possible Monitoring Site at Sterling State Park View From Site to Source

Table 28 summarizes the SO_2 monitoring site information for sites that were in existence in 2012, and **Table 29** lists the proposed locations for the new SO_2 monitors. **Figure 38** shows the geographical distribution of SO_2 sites across Michigan.

SO_2 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 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. 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.

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 2013 SO_2 Monitoring Network

During 2013, 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)
- Jenison (261390005) to meet the Holland-Grand Haven CBSA monitoring requirement for SO_2.

The MDEQ will create a new station contingent upon adequate levels of funding and staffing as by January 1, 2012 at:

- Monroe County, Sterling State Park

TABLE 28: MICHIGAN'S SO_2 MONITORING NETWORK IN 2012

Operating Schedule: Continuous
Method: Ultra Violet Stimulated Fluorescence

Network as of January 1, 2012
Former NAMS sites are shown in bold.

Site Name	Monitoring Sites AQS Site ID	Address	Latitude	Longitude	Measurement	Purpose	Scale	County	Start Date	CBSA [1]	Pop (2010 Census)
Port Huron	261470005	2525 Dove Rd.	42.9533	-82.456389	SO2	Max Conc	Regional	Saint Clair	1/1/12	DWL	4,296,250
Detroit - SWHS	**261630015**	**150 Waterman**	42.30278	-83.106667	**SO2**	**max conc**	**nghbrhd**	**Wayne**	**1/1/71**	**DWL**	**4,296,250**
Grand Rapids - Monroe St	260810020	1179 Monroe NW	42.98417	-85.671389	trace	Pop. Exp.	nghbrhd	Kent	1/1/08	GW	774,160
Allen Park	261630001	14700 Goddard	42.2286	-83.208333	trace	Pop. Exp.	nghbrhd	Wayne	1/1/08	DWL	4,296,250
Lansing	260650012	220 N Pennsylvania	42.7386	-84.534722	SO2	Max Conc	nghbrhd	Ingham	1/1/12	LEL	464,036
Jenison	261390005	6981 28th Ave, Georgetown Twp	42.89444	-85.852778	SO2	Max Conc	nghbrhd	Ottawa	1/1/12	HGH	263,801

[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

TABLE 29: MICHIGAN'S POSSIBLE SO_2 MONITORING NETWORK IN 2013

Operating Schedule: Continuous

Method: Ultra Violet Stimulated Fluorescence

Planned network 2013

Former NAMS sites are shown in bold.

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	778,009
Allen Park	261630001	14700 Goddard	42.2286	-83.208333	trace	pop exp	nghbrhd	Wayne	1/1/08	DWL	4,403,437

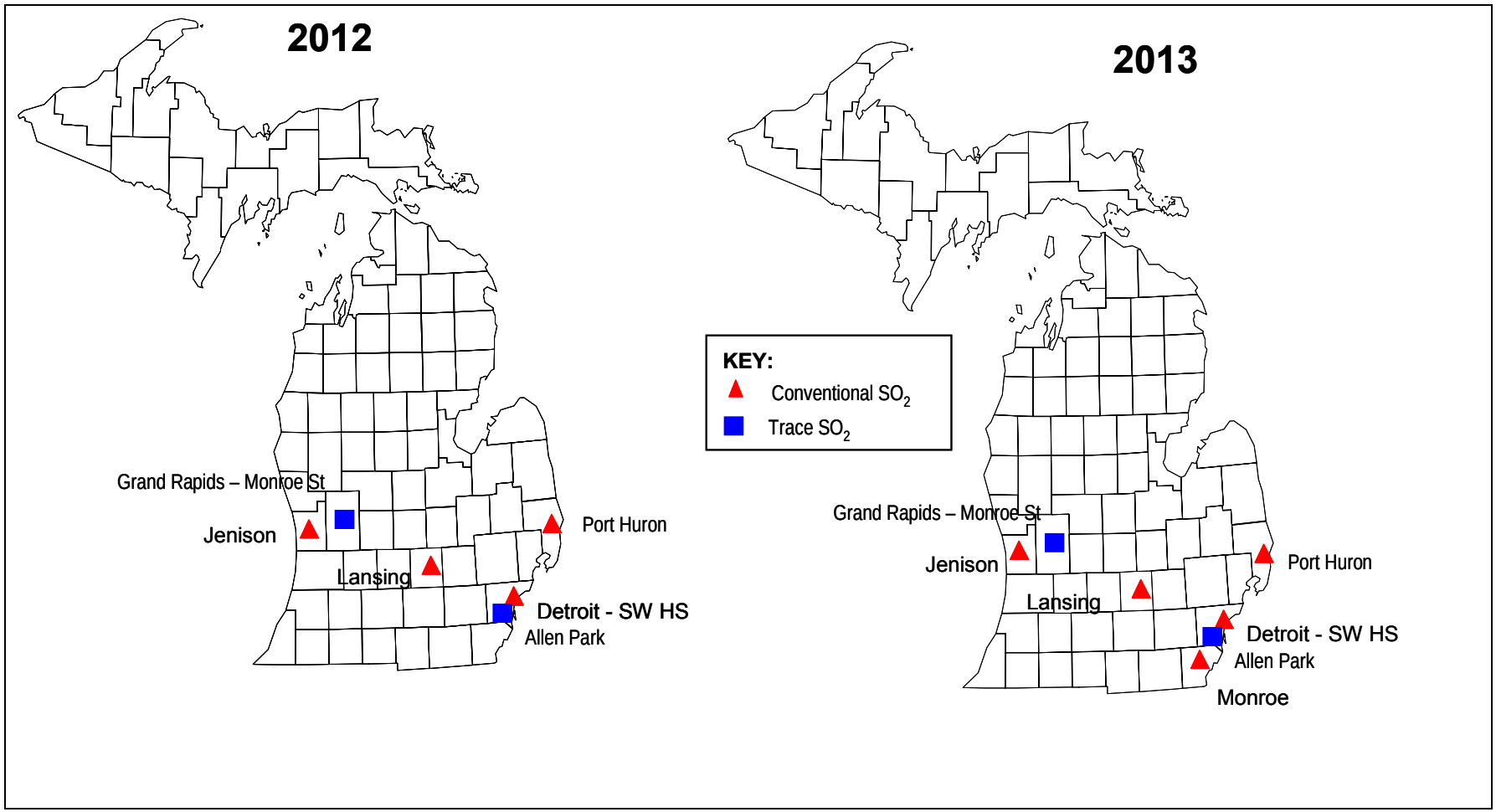
Source-Oriented Sites

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
Monroe	26115????	Unknown	???	???	SO2	Max Conc	Regional	Monroe	before 1/2013	Monroe	152,021
Jenison	261390005	6981 28th Ave, Georgetown Twp	42.8944	-85.852778	SO2	Max Conc	nghbrhd	Ottawa	1/1/12	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	regional	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 shutdown in 2007 restarted in January 2012

FIGURE 28: 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 nine sites that collected TSP samples on a once every six or once every 12 day schedule. 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-orientated 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.

Laboratory analysis for trace metals was limited to only manganese at:

- Flint (260490021)

Since manganese levels are so low at this site, the MDEQ is proposing to shut down TSP monitoring at this site after 2012.

The trace metals sites include:

- Allen Park (261630001)
- Detroit-SWHS (261630015)
- South Delray (261630027)
- River Rouge (261630005)

Lead sites which have additional trace metals include:

- Vassar (261570001)
- East Jordan (260290011)
- Belding – Merrick St (260670003)
- Belding – Reed St (260670002)
- Port Huron – to be established by 2013

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} was initiated at:

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

Table 30 summarizes the trace metal monitoring site information for sites that were in existence in 2011 and operational in 2012. **Table 31** shows the configuration of the 2013 network. **Figure 29** compares the locations of trace metal monitoring sites.

Table 30: Michigan's Trace Metal Monitoring Network in 2012

Operating Schedule: 1:6
Method: TSP: High Volume sampler using glass fiber filter ; Emission Spectra ICAP for lead; ICP MS for remaining metals
PM10: High Volume sampler using quartz filter; Emission Spectra ICAP for lead; ICP MS for remaining metals

Network as of 2012

Monitoring Sites													
Site Name	AQS Site ID	Address	Latitude	Longitude	Sampling Frequency	Elements	Size	Purpose	Scale	County	Date Estab.	CBSA [1]	Pop (2010 Census)
Flint	260490021	Whaley Park, 3610 low a	43.04722	-83.670278	1:6	Mn	TSP	max conc	nghbrhd	Genesee	6/17/92	F	425,790
East Jordan	260290011	98 Division St	45.160238	-85.127767	1:6	Pb, Mn, As, Cd, Ni	TSP	max conc	nghbrhd	Charlevoix	11/5/11	Not in CBSA	N/A
Belding - Reed St	260670002	545 Reed St	43.101944	-85.22000	1:6	Pb, Mn, As, Cd, Ni	TSP	max conc	nghbrhd	Ionia	7/2/11	GW	778,009
Belding - Merrick St	260670003	509 Merrick	43.09984	-85.22163	1:6	Pb, Mn, As, Cd, Ni	TSP	max conc	nghbrhd	Ionia	1/1/10	GW	778,009
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	778,009
Vassar	261570001	874 E. Huron Ave	43.368603	-83.569188	1:6	Pb, Mn, As, Cd, Ni	TSP	max conc	Neighborho	Tuscola	9/30/11	Not in CBSA	N/A
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	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
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, As, Cd, Ni	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, As, Cd, Ni	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	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

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

TABLE 31: PROPOSED 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

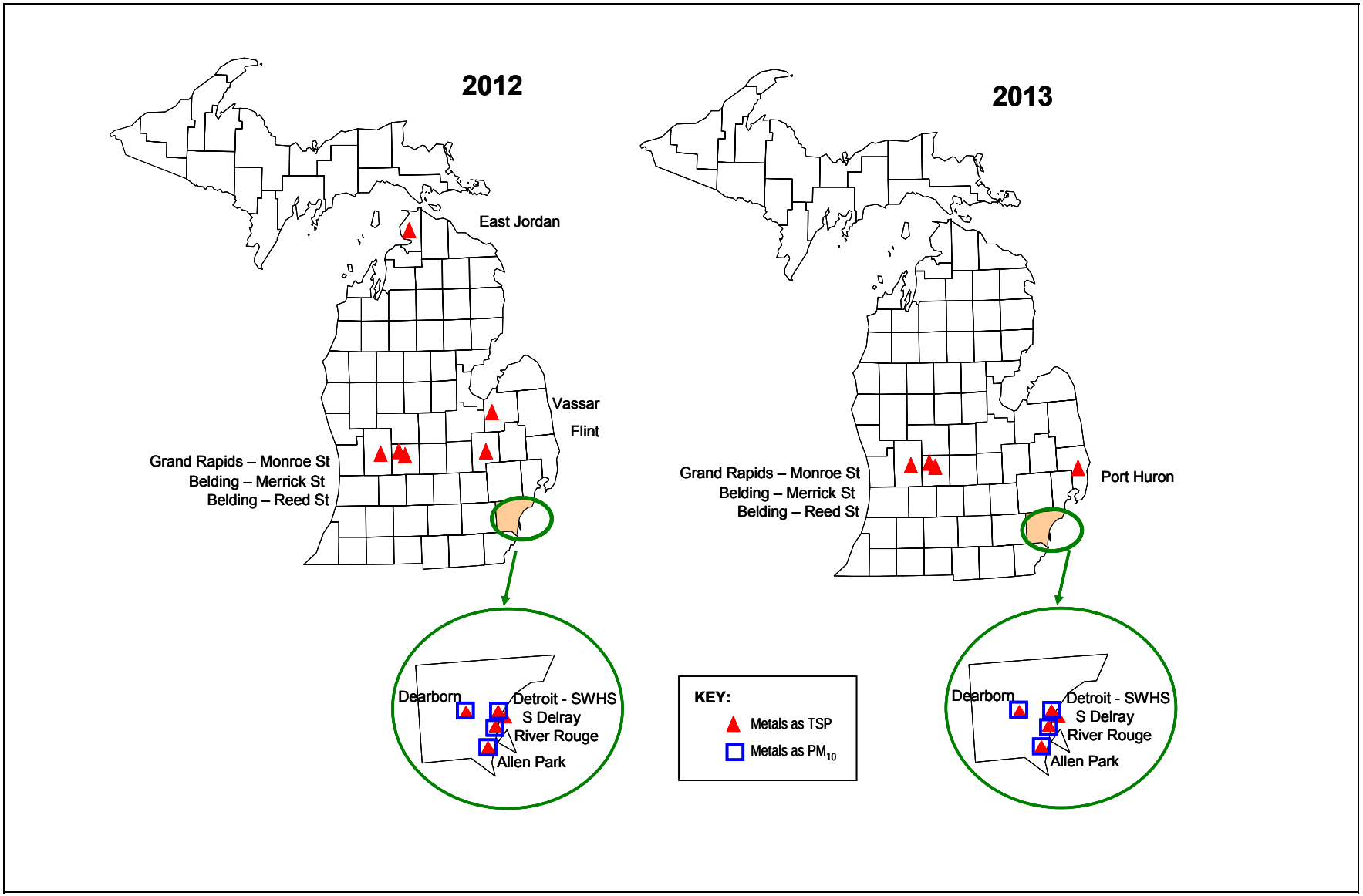
PM10: High Volume sampler using quartz filter; Emission Spectra ICAP for lead; ICP MS for remaining metals

Proposed 2013 Network

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	nghbrhd	Ionia	7/2/11	GW	778,009
Belding - Merrick St	260670003	509 Merrick	43.09984	-85.22163	1:6	Pb, Mn, As, Cd, Ni	TSP	max conc	nghbrhd	Ionia	1/1/10	GW	778,009
Grand Rapids - Monroe	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	778,009
Port Horon	26147????				1:6	Pb, Mn, As, Cd, Ni	TSP	max conc	nghbrhd	Saint Clair	by 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	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
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, As, Cd, Ni	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, As, Cd, Ni	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	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

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

FIGURE 29: MICHIGAN'S TRACE METAL MONITORING NETWORK



Trace Metal 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 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 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. The 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. The 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 six day frequency.

Plans for the 2013 Trace Metal Network:

During 2013, contingent upon adequate levels of funding, MDEQ is planning to continue to collect trace metal measurements, as described for the above elements at:

- Belding – Merrick St. (260670003) - TSP – lead, manganese, nickel, arsenic and cadmium
- Belding – Reed St. (260670002) - TSP – lead, manganese, nickel, arsenic and cadmium
- Grand Rapids-Monroe St. (260810020) - TSP – lead, manganese, nickel, arsenic and cadmium
- Allen Park (261630001) - TSP – lead, 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.

On January 1, 2013, the MDEQ is planning on shutting down the trace metal measurements at

- Flint (260490021)
- Vassar (261570001)
- East Jordan (260290011)

By January 1, 2013, the MDEQ will establish a trace metals site in Port Huron near Mueller Industries, 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 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 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 32 summarizes the VOC monitoring site information for sites that were in existence in 2012 and are continuing operating in 2013. **Figure 30** 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 a national and regional performance test program. 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 2013 VOC Monitoring Network

During 2013 contingent upon adequate levels of funding, the MDEQ is planning to continue to collect VOCs at:

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

TABLE 32: 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)

Network as of 2012

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 30: 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 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. Sampling for carbonyls is performed at River Rouge (261630005) on a once every six day schedule, the MDEQ wishes to change this to once every 12 day sampling. 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 33 summarizes the carbonyl monitoring site information for sites that were in existence in 2012 and are continuing to operate in 2013. **Figure 31** 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.

All carbonyl samples are sent to a National Contract Lab. The National Lab participates in a national 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 2013 Carbonyl Monitoring Network

During 2013, contingent upon adequate levels of funding, Michigan is planning to continue to collect carbonyls at:

- Detroit-SWHS (261630015) once every 12 days
- River Rouge (261630005) once every 12 days, reducing frequency from 1:6 day
- Dearborn NATTS site (261630033) once every six days and precision samples.

TABLE 33: MICHIGAN'S CARBONYL MONITORING NETWORK

Operating Schedule: 1:6 and 1:12

Method: 2,4 dinitrophenyl hydrazine treated silica gel cartridges; HPLC with ultraviolet absorption

Network as of 2012

Site Name	Monitoring Sites 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	1:6 2012, 1:12 2013	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 31: MICHIGAN'S CARBONYL MONITORING NETWORK

POLYNUCLEAR AROMATIC HYDROCARBON 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 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 34 shows the site information for PAH sites that were in operation in 2012 and are currently operating. **Figure 32** shows the locations of sites where PAH monitoring occurs. design.

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 2013 PAH Monitoring Network

During 2013, contingent upon adequate levels of funding, Michigan is planning to continue to collect PAHs on a once every six day sampling frequency at:

- Dearborn (261630033).

TABLE 34: PAH NETWORK IN MICHIGAN

Operating Schedule: 1:6

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

Network as of 2012

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 32: 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 35**. No changes are planned to the meteorological network.

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 the 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 2013 Meteorological Monitoring Network

During 2013, contingent upon adequate levels of funding, Michigan is planning to continue to collect hourly meteorological measurements at:

- Holland (26005003)
- Bay City (260170014)
- Coloma (260210014)
- Cassopolis (260270003)
- East Jordan (260290011)
- 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)
- Muskegon–Green Creek Rd. (261210039)
- Oak Park (261250001)
- Pontiac (261250011)
- Rochester (261250012)
- Jenison (261390005)
- Port Huron (261470005)
- Seney (261530001)

- Ypsilanti (261610008)
- Allen Park (261630001)
- River Rouge (261630005)
- Detroit–SWHS (261630015)
- Detroit–Linwood (261630016)
- Livonia (261630025)
- Detroit-Joy Rd. (261630026)
- Dearborn (261630033)
- Detroit–Newberry School (261630038)
- 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 Saint Marie (260330901)

TABLE 35: 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				
East Jordan	260290011	X	X	X				
Sault Ste Marie +	260330901	X	X	X				
Flint	260490021	X	X	X		X		X
Otisville	260492001	X	X	X				X
Harbor Beach	260630007	X	X	X				X
Belding- Reed St	260670002	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
Evans	260810022	X	X	X				X
Tecumseh	260910007	X	X	X		X		X
New Haven	260990009	X	X	X	X	X	X	X
Sterling Hts/ Freedom Hill	260990021	X	X	X				
Manistee +	261010922	X	X	X		X	X	
Scottville	261050007	X	X	X				X
Houghton Lake	261130001	X	X	X		X		X
Muskegon, Green Ck Rd	261210039	X	X	X				X
Oak Park	261250001	X	X	X				X
Pontiac	261250011	X	X	X				X
Rochester	261250012	X	X	X				X
Jenison	261390005	X	X	X				X
Port Huron	261470005	X	X	X				X
Seney	261530001	X	X	X	X	X	X	X
Ypsilanti	261610008	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	261630025	X	X	X	X	X		X
Detroit - Joy Rd	261630026	X	X	X				X
Dearborn	261630033	X	X	X	X	X		X
Detroit - New berry School	261630038	X	X	X				X
Detroit -FIA/Lafayette	261630039	X	X	X				X
Eliza How ell #1	261630093	X	X	X				
Eliza How ell #2	261630094	X	X	X				

ADEQUACY OF MICHIGAN'S MONITORING SITES:

The suitability of the monitoring sites locations is frequently assessed by the AMU's QA Team and by 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.

The overall design of the regional air monitoring networks will be assessed by the Regional EPA office with assistance from state, local and tribal agencies once every five years. The next regional review is due by July 1, 2015. This review assesses any redundancies of monitors along border areas will be assessed, identifies monitors that are no longer necessary and determines network deficiencies. Preliminary versions of this assessment were reviewed and suggested changes to Michigan's ambient air monitoring network are addressed in various portions of this review.

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