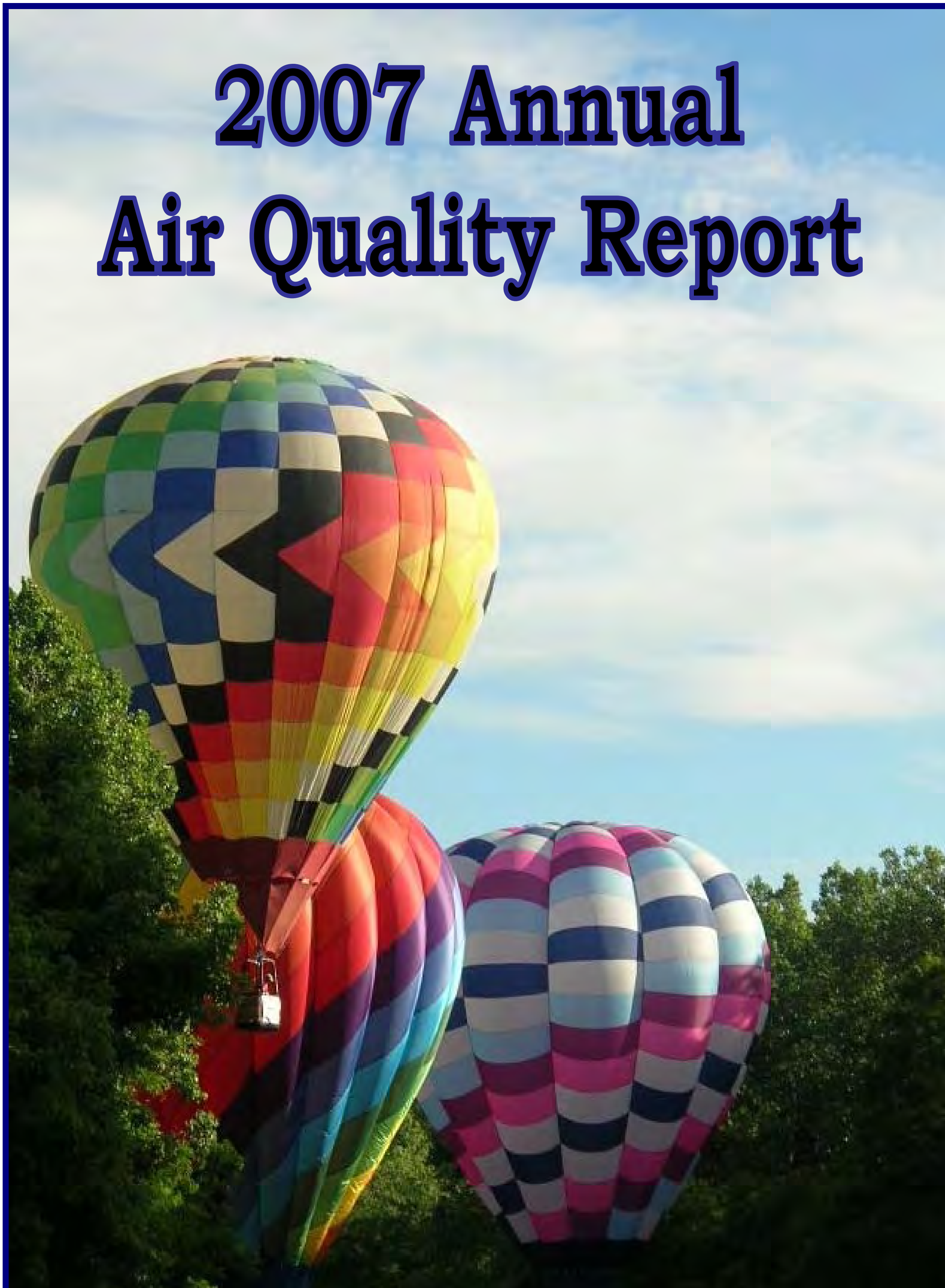
2007 Annual Air Quality Report

Michigan



Air Quality Division

Michigan Department of Environmental Quality

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MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY

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2007
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Cover Photo: Battle Creek Hot Air Jubilee, Calhoun County located in Southwest Michigan. Photo courtesy of Sheila Blais, AQD.

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EXECUTIVE SUMMARY

The federal Clean Air Act (CAA) requires the U.S. Environmental Protection Agency (EPA) to establish National Ambient Air Quality Standards (NAAQS) for the six criteria pollutants considered harmful to the public and the environment. These standards define the maximum permissible concentration of criteria pollutants in the air. Other hazardous air pollutants that can affect human health or the environment are called "air toxics."[1]

One or more NAAQS have been established for the six criteria pollutants that are monitored by the Michigan Department of Environmental Quality's (MDEQ's) Air Quality Division (AQD). These criteria pollutants are carbon monoxide (CO), lead (Pb), nitrogen dioxide (NO_2), ozone (O_3), particulate matter (PM) less than or equal to ($\leq$) 10 or 2.5 microns in diameter (PM_{10} and $PM_{2.5}$, respectively), and sulfur dioxide (SO_2) (discussed in **Chapter 2**). The AQD also monitors for air toxics (discussed in **Chapter 3**). The purpose of this report is to provide a summary of the 2007 air quality data, which includes air quality trends, updates on Michigan's monitoring network, the air toxics monitoring program, and other programs (such as MIair discussed in **Chapter 4**). These programs provide important details on how the staff of the MDEQ and Michigan citizens can work together to help keep Michigan's air clean.[2]

Effective December 18, 2006, the EPA amended the federal ambient air monitoring regulations that changed the requirements of Michigan's existing monitoring network and required the MDEQ to annually review its air monitoring network. Basically, the amended monitoring requirements increased the frequency of $PM_{2.5}$ sampling and will establish 75 National Core (NCORE) monitoring stations, which will be multi-pollutant in nature, around the country beginning in 2011. In addition, the finalized rules require the MDEQ to annually review its air monitoring network to ensure that the objectives laid out by the EPA, in 40 Code of Federal Regulation (CFR) Part 58 and elsewhere, are being met. Copies of this year's network review are available on the AQD's website at http://www.michigan.gov/deqair by clicking on "air monitoring," and "reports and data summaries."

For 2007, cuts to the MDEQ's air monitoring network were made as the result of budget cuts. Those monitors eliminated are discussed by criteria pollutant in **Chapter 2**. Essential monitors were retained, such as those in nonattainment areas or areas likely to become designated as nonattainment, required by network design specification, that address general public health issues, deposition and national trends, and those that are needed to collect background data.

For the criteria pollutants CO, Pb, NO_2 and SO_2, all of Michigan has continued to stay in attainment with levels well below their NAAQS. For $PM_{2.5}$ and O_3, Michigan's levels have continued to decline and air monitoring data had shown that many of these areas were meeting attainment. However, on October 17, 2006, new PM NAAQS were adopted to address fine ($PM_{2.5}$) and coarse (PM_{10}) particulates. These changes included lowering the daily $PM_{2.5}$ standard from 65 micrograms per cubic meter ($\mu g/m^3$) to 35 $\mu g/m^3$ and revoking the annual PM_{10} NAAQS. No changes were made to the annual $PM_{2.5}$ NAAQS and the daily PM_{10} NAAQS. The new standards, MDEQ's recommendations, and more are discussed in **Chapter 2.5**.

Also in 2007, the EPA began work to revise the ozone NAAQS as well. The EPA's proposal retained the 8-hour averaging time of the current NAAQS, but lowered the leveling of the standard to 0.075 parts per million (ppm). Information on the impact of this new NAAQS on Michigan is discussed in **Chapter 2.4** and more information can be found at http://www.michigan.gov/deqair under "assessment and planning," "attainment/ nonattainment information," and "ozone."

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[1] A fact sheet entitled What is an Air Contaminant/Pollutant? is available on the MDEQ's website at http://www.deq.state.mi.us/documents/deq-ead-caap-airconfs.pdf.

[2] On-line information about criteria pollutants and air toxics, along with this and previous annual air quality reports, are available via the AQD's website at http://www.michigan.gov/deqair under "Spotlight."

CHAPTER 1: BACKGROUND INFORMATION

This chapter provides a summary on the development of the NAAQS and how compliance with these standards is determined. Also included is an overview of Michigan's air sampling network, a description of the metropolitan statistical areas and their use, and the variety of monitoring techniques and requirements used to ensure quality assurance of the data.

NAAQS:

Under Section 109 of the CAA, the EPA establishes a primary and secondary NAAQS for each pollutant for which air quality criteria have been issued. The primary standard is designed to protect the public health with an adequate margin of safety, including the health of the most susceptible individuals in a population, such as children, the elderly, and those with chronic respiratory ailments. Factors in selecting the margin of safety for the primary standard include the nature and severity of the health effects involved and the size of the sensitive population at risk. Air quality conditions described by the secondary standard may be the same as the primary standard or they can be more stringent. Secondary standards are chosen to protect public welfare (personal comfort and well-being) and the environment by limiting economic damage, and visibility and climatic factors, as well as the harmful effects on soil, water, crops, vegetation, wildlife, and buildings. In addition, the NAAQS have various averaging times to address health impacts. Short averaging times reflect the potential for acute (short-term, immediate) effects, whereas long-term averaging times are designed to protect against chronic (long-term) effects.

NAAQS have been established for CO, Pb, NO_2, O_3, PM_{10} and $PM_{2.5}$, and SO_2. **Table 1-1** lists the primary and secondary NAAQS, averaging time, and concentration level for each criteria pollutant in effect at the end of 2007. The concentrations are listed as parts per million (ppm), microgram per cubic meter ($\mu g/m^3$), and/or milligram per cubic meter (mg/m^3).

Table 1-1: NAAQS in Effect During 2007 for the Criteria Pollutants

CRITERIA POLLUTANT	PRIMARY (HEALTH RELATED)		SECONDARY (WELFARE RELATED)	
	Type of Average	**Standard Level Concentration**	**Type of Average**	**Standard Level Concentration**
CO	8-hour	9 ppm (10 mg/m^3)	No Secondary Standard	
	1-hour	35 ppm (40 mg/m^3)		
Pb [3]	Maximum Quarterly Average	1.5 $\mu g/m^3$	Same as Primary Standard	
NO_2	Annual Arithmetic Mean	0.053 ppm (100 $\mu g/m^3$)	Same as Primary Standard	
O_3	4th Highest 8-Hr Daily Maximum	0.08 ppm (157 $\mu g/m^3$)	Same as Primary Standard	
PM_{10}	24-hour	150 $\mu g/m^3$	Same as Primary Standard	
$PM_{2.5}$	Annual Arithmetic Mean	15 $\mu g/m^3$	Same as Primary Standard	
	98th percentile 24-hour	35 $\mu g/m^3$		
SO_2	Annual Arithmetic Mean	0.03 ppm (80 $\mu g/m^3$)	3-hour	0.5 ppm (1300 $\mu g/m^3$)
	24-hour	0.14 ppm (365 $\mu g/m^3$)		

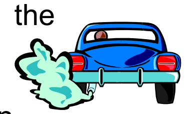
To demonstrate compliance with the NAAQS, the EPA has defined specific criteria for each pollutant, which is summarized in **Table 1-2**.

[3] At press time, the level of the Pb NAAQS was being reviewed by the EPA.

Table 1-2: Criteria for the Determination of Compliance with the NAAQS

POLLUTANT	CRITERIA FOR COMPLIANCE
CO	Compliance with the CO standard is met when the 35 ppm 1-hour average standard and/or the 9 ppm 8-hour average standard is not exceeded more than once per year. An 8-hour average is considered valid if at least 75% for the hourly averages are available. In the event that 6 or 7-hourly averages are available, the 8-hour average is estimated on the basis of the average concentration for that time period.
Pb	Daily values are collected for three consecutive months (by calendar quarter), averaged, and then compared to the 1.5 $\mu g/m^3$ standard.
NO_2	Compliance is met when the annual arithmetic mean concentration does not exceed the 0.053 ppm standard, and is based on hourly data that are 75% complete for each calendar quarter.
O_3	The 8-hour O_3 primary and secondary standards are met when the three-year average of the 4th highest daily maximum 8-hr average concentration is less than or equal to 0.08 ppm.
PM	**PM_{10}:** The 24-hour PM_{10} primary and secondary standards are met when the expected number of days per calendar year above 150 $\mu g/m^3$ is equal or less than one.
	$PM_{2.5}$: The $PM_{2.5}$ annual and secondary standards are met when the annual arithmetic mean concentration is less than or equal to 15 $\mu g/m^3$. The 24-hour $PM_{2.5}$ primary and secondary standards are met when the three-year average of the 98^{th} percentile 24-hour concentration is less than or equal to 35 $\mu g/m^3$.
SO_2	To determine compliance, the annual average concentration shall not exceed 0.03 ppm, the 24-hour average concentration shall not exceed 0.14 ppm more than once per calendar year, and the three-hour average concentration shall not exceed 0.5 ppm more than once per calendar year. The respective averages shall be based upon hourly data that is at least 75% complete.

There are many types of emissions and emission sources that generate air pollutants. A variety of these sources directly emit CO, Pb, NO_2, and SO_2. PM can also be directly emitted, or it can be formed when emissions of nitrogen oxides (NO_X), sulfur oxides, ammonia, volatile organic compounds (VOCs), and other gases react in the atmosphere. The weather also plays an important role in the creation and distribution of the criteria pollutants. For example, O_3 is not directly emitted from any source, but is formed when NO_X and VOCs react in the presence of hot summertime sunlight, which can be transported hundreds of miles away. NO_2 and SO_2 can react with other substances in the atmosphere to form acidic products that, depending on the weather, are deposited in the form of rain (acid rain), fog or snow. During the winter, CO levels typically peak as the cold temperature affects fuel combustion and emission control devices in vehicles.



These criteria pollutants cause adverse effects to individuals with compromised health conditions and can also have adverse effects to healthy individuals who regularly exercise or work outside. Information on the elements, their effects, and the types of sources that generate the criteria pollutants are discussed in **Table 1-3**.

Table 1-3: Information on the Type of Sources and Effects Resulting from Exposure to Criteria Pollutants

CRITERIA POLLUTANT	ELEMENTS	TYPES OF SOURCE	HEALTH AND ENVIRONMENTAL EFFECTS	POPULATION MOST AT RISK
CO	CO is a colorless, odorless, and poisonous gas created when fuel doesn't burn completely. CO levels peak during colder months primarily due to the cold temperatures that affect the combustion efficiencies of engines.	Primary sources for outdoor exposure are the exhaust from automobiles, industrial processes (such as metals processing and chemical manufacturing), non-transportation fuel combustion, and natural sources such as forest fires. Indoor exposure sources are wood stoves, gas ranges with continuous pilot flame ignition, unvented gas or kerosene space heaters, and cigarette smoke.	CO enters the bloodstream through the lungs where it displaces oxygen delivered to the body's organs and tissues. Elevated levels can cause visual impairment, interfere with mental acuity by reducing learning ability and manual dexterity, and can decrease work performance in the completion of complex tasks. CO also alters atmospheric photochemistry which contributes to the formation of smog (ground-level O_3), which can trigger serious respiratory problems.	Those who suffer from cardiovascular (heart and respiratory) disease are most at risk. Individuals with angina and peripheral vascular disease are especially at risk as their circulatory systems are already compromised and less efficient at carrying oxygen. However, high CO pollution levels can also affect healthy people.
Pb	Pb is a highly toxic metal found in coal, oil, and waste oil. It is also found in municipal solid waste and sewage sludge incineration and may be released to the atmosphere during their combustion.	With the phase-out of leaded gasoline in the 1970s, the major sources of Pb emissions are industrial and combustion sources. The highest air concentrations of Pb are found in the vicinity of smelters and battery manufacturers (Pb acid batteries, Pb oxide/pigments). Other industrial sources include Pb glass, portland cement, and solder production.	Exposure to Pb occurs through the inhalation or ingestion of lead in food, water, soil, or dust particles. Pb primarily accumulates in the blood, bones, and soft tissues of the body, and can adversely affect the kidneys, liver, nervous system, and other organs. Pb can enter water systems through runoff and from sewage and industrial waste streams. Elevated levels in the water can cause reproductive damage in some aquatic life and cause blood and neurological changes in fish and other animals. Airborne Pb can also inhibit plant growth, effect plant species diversity, and affect the microbial ecology of bacteria and fungi of soils.	Fetuses and children are most at risk as low levels of Pb exposure may cause central nervous system damage. Excessive Pb exposures during the child's first years of life have been associated with lower IQ scores and neurological impairment (such as seizures, mental retardation, and behavioral disorders). Even at low doses, Pb exposure is associated with changes in fundamental enzymatic, metabolic, and homeostatic mechanisms in the human body and Pb may be a factor in high blood pressure and subsequent heart disease.

Table 1-3: Information on the Type of Sources and Effects Resulting from Exposure to Criteria Pollutants

CRITERIA POLLUTANT	ELEMENTS	TYPES OF SOURCE	HEALTH AND ENVIRONMENTAL EFFECTS	POPULATION MOST AT RISK
NO_2	NO_2 is a reddish-brown, highly reactive gas that is formed through the oxidation of nitric oxide (NO). Upon dilution it becomes yellow or invisible. High concentrations produce a pungent odor and lower levels have an odor similar to bleach. NO_X is the term used to describe the sum of NO, NO_2, and other nitrogen oxides. NO_X can lead to the formation of O_3 and NO_2 and can react with other substances in the atmosphere to form acidic products that are deposited in rain (acid rain), fog, snow, or as PM.	A variety of NO_X compounds and their transformation products occur both naturally and as a result of human activities. Natural sources of NO_X are lightning, biological and abiological processes in soil, and stratospheric intrusion. Ammonia and other nitrogen compounds produced naturally are important in the cycling of nitrogen through the ecosystem. The major sources of man-made (anthropogenic) NO_X emissions, which account for a large majority of all nitrogen inputs to the environment, come from high-temperature combustion processes (such as those occurring in automobiles and power plants). Home heaters and gas stoves also produce substantial amounts of NO_2 in indoor settings.	Exposure to NO_2 occurs through the respiratory system, irritating the lungs. Short-term NO_2 exposures (i.e., less than 3 hours) include cough and changes in airway responsiveness and pulmonary function. Evidence suggests that long-term exposures to NO_2 may lead to increased susceptibility to respiratory infection and may cause structural alterations in the lungs. Exercise increases the ventilation rate and hence exposure to NO_2. Nitrate particles and NO_2 can block the transmission of light, thus causing visibility impairment. Deposition of nitrogen can lead to fertilization, eutrophication, or acidification of terrestrial, wetland, and aquatic systems.	Individuals with preexisting respiratory illnesses and asthmatics are more sensitive to the effects of NO_2 than the general population. Short-term NO_2 exposure can increase respiratory illnesses in children.
O_3	Ground-level O_3 is created by photochemical reactions involving NO_X and VOCs in the presence of sunlight. These reactions usually occur during the hot summer months as ultraviolet radiation from the sun initiates a sequence of photolytical reactions. O_3 is also a key ingredient of urban smog.	Major sources of NO_X and VOCs are engine exhaust, emissions from industrial facilities, combustion from power plants, gasoline vapors, chemical solvents, and biogenic emissions from natural sources. Ground-level O_3 can also be transported hundreds of miles under favorable meteorological conditions. As a result, the long-range transport of air pollutants impacts the air quality of regions downwind from the actual area of formation.	Elevated O_3 exposure can irritate a person's airways, reduce lung function, aggravate asthma and chronic lung diseases like emphysema and bronchitis, and inflame and damage the cells lining the lungs. Other effects include increased respiratory related hospital admissions with symptoms such as chest pain, shortness of breath, throat irritation, and cough. O_3 may also reduce the immune system's ability to fight off bacterial infections in the respiratory system, and long-term, repeated exposure may cause permanent lung damage. O_3 also impacts vegetation and the forest ecosystem, including agricultural crop and forest yield reductions, diminished resistance to pest and pathogens, and reduced survivability of tree seedlings.	Individuals most susceptible to the effects of O_3 exposure include those with a pre-existing or chronic respiratory disease, children who are active outdoors, and adults who actively exercise or work outdoors.

Table 1-3: Information on the Type of Sources and Effects Resulting from Exposure to Criteria Pollutants

CRITERIA POLLUTANT	ELEMENTS	TYPES OF SOURCE	HEALTH AND ENVIRONMENTAL EFFECTS	POPULATION MOST AT RISK
PM	PM is a general term used for a mixture of solid particles and liquid droplets found in the air which is further categorized according to size. Large particles with diameters of less than 50 micrometers (μm) are classified as total suspended particulates (TSP). PM_{10} are "coarse particles" less than 10 μm in diameter (about one-seventh the diameter of a human hair) and $PM_{2.5}$ are much smaller "fine particles" equal to or less than 2.5 μm in diameter.	PM can be emitted directly (primary) or may form in the atmosphere (secondary). Most man-made particulate emissions are classified as TSP. PM_{10} consists of primary particles that can originate from power plants, various manufacturing processes, wood stoves and fireplaces, agriculture and forestry practices, fugitive dust sources (road dust and wind blown soil), and forest fires. $PM_{2.5}$ can come directly from primary particle emissions or through secondary reactions that include VOCs, SO_2, and NO_X emissions originating from power plants, motor vehicles (especially diesel trucks and buses), industrial facilities, and other types of combustion sources.	Exposure to PM affects breathing and the cellular defenses of the lungs, aggravates existing respiratory and cardiovascular ailments, and has been linked with heart and lung disease. Particle size is the major factor that determines which particles will enter the lungs and how deeply the particles will penetrate. In addition to health problems, PM is the major cause of reduced visibility in many parts of the U.S., with $PM_{2.5}$ considered to be one of the primary visibility-reducing components of urban and regional haze. Airborne particles can also impact vegetation ecosystems and can cause damage to paints, building materials and/or surfaces. Deposition of acid aerosols and salts may increase corrosion of metals and impact plant tissue by corroding leaf surfaces and interfering with plant metabolism.	$PM_{2.5}$ has been more clearly linked to the most serious health effects. People with heart or lung disease, the elderly, and children are at highest risk from exposure to PM.
SO_2	SO_2 is a colorless gas formed by the burning of sulfur-containing material, is odorless at typical ambient concentrations, and can react with other atmospheric chemicals to form sulfuric acid. When sulfur-bearing fuel is combusted, the sulfur is oxidized to form SO_2 which then reacts with other pollutants to form aerosols. In liquid form, it is found in clouds, fog, rain, aerosol particles, and in surface films on these particles. SO_2 is also a major precursor to $PM_{2.5}$.	Coal-burning power plants are the largest source of SO_2 emissions. SO_2 is also emitted from smelters, petroleum refineries, pulp and paper mills, transportation sources, and steel mills. Other sources include residential, commercial, and industrial space heating. Where SO_2 is emitted, PM is often emitted too.	Exposure to elevated levels of SO_2 aggravates existing cardiovascular and pulmonary disease. SO_2 and PM together may cause respiratory illness, alteration in the body's defense and clearance mechanisms, and aggravation of existing cardiovascular disease. SO_2 and NO_X together are the major precursors to acid rain, which is associated with the acidification of soils, lakes, and streams and accelerated corrosion of buildings and monuments.	Asthmatics, children, and the elderly are especially sensitive to SO_2 exposure. Asthmatics receiving short-term exposures during moderate exertion may experience reduced lung function and symptoms such as wheezing, chest tightness, or shortness of breath. Depending upon the concentration, SO_2 may also cause symptoms in people who do not have asthma.

MICHIGAN AIR SAMPLING NETWORK:

The Michigan Air Sampling Network (MASN) is operated by the MDEQ's AQD, along with other governmental agencies. For instance, the monitors in and around Sault Ste. Marie are managed and owned by the Inter-Tribal Council of MI, Inc.; the O_3 monitor in Leelanau County (Peshawbestown) is owned and managed by the Grand Traverse Band of Ottawa and Chippewa Indians; and the Manistee County site is handled by the Little River Band of Ottawa Indians. **Figure 1-1** shows the 2007 MASN monitoring sites.

FIGURE 1-1: 2007 MASN MONITORING SITES

The MASN consists of federal reference method (FRM) monitors that enable continuous monitoring for the gaseous pollutants (O_3, CO, NO_2, and SO_2), PM monitors that measure PM concentrations over a 24-hour time period, and high volume samplers for Pb. In addition, continuous $PM_{2.5}$ and PM_{10} monitors are used to provide real time hourly data, and $PM_{2.5}$ chemical speciation monitors determine the chemical composition of $PM_{2.5}$ and help characterize background levels. The MASN data is also used to provide timely reporting to the MDEQ's air quality reporting webpage MIair (discussed in **Chapter 4**). The types of monitoring conducted in 2007 and the MASN locations are shown in **Table 1-4**. **NOTE:** The three Inter-Tribal sites in the Upper Peninsula, Sault Ste. Marie - Easterday and Marquette Avenue, along with Bay Mills are not included in **Table 1-4** as they are no longer overseen by the AQD.

Table 1-4: MASN Stations and Monitoring Conducted in 2007

AIRS ID	SITE NAME	CO	Pb	NO	O_3	PM_{10}	$PM_{2.5}$	SO_2	VOC	Carbonyl Aldehydes / Ketone	Trace Metals
260050003	Holland				√		√■*				
260170014	Bay City						√■				
260190003	Benzonia				√						
260210014	Coloma				√		√				
260270003	Cassopolis				√						
260370001	Rose Lake				√						
260490021	Flint		√&		√	√&	√■	√&			√ #
260492001	Otisville				√						
260630007	Harbor Beach				√						
260650012	Lansing				√		√■				
260770008	Kalamazoo				√		√■*				
260810007	Grand Rapids – Wealthy					√					
260810020	Grand Rapids – Monroe	√	√&	√&	√	√	√■*	√&	√&		√&
260810022	Evans				√						
260890001	+Peshawbestown				√						
260910007	Tecumseh				√						
260990009	New Haven				√		√				
260991003	Warren	√&			√			√&			
261010922	++Manistee				√		√				
261050007	Scottville				√						
261130001	Houghton Lake		√&		√		√■*		√&		√&
261150005	Luna Pier						√*				
261210039	Muskegon – Green Creek				√						
261210040	Muskegon – Apple Ave						√				
261250001	Oak Park	√&			√		√				
261390005	Jenison				√		√				
261470005	Port Huron				√		√■	√&			
261530001	Seney Nat'l Wildlife Refuge				√		■				
261610008	Ypsilanti		√&		√		√■*		√&	√&	√&
261630001	Allen Park	√	√&		√	√	√■*				√@
261630005	River Rouge		√&							√	√@
261630015	Detroit – W. Fort		√&		√&	√	√	√	√	√	√@
261630016	Detroit – Linwood	√&		√&	√&		√	√&			
261630019	Detroit – E. Seven Mile		√&	√	√		√	√&			√&
261630025	Livonia	√&					√				
261630027	Detroit – W. Jefferson		√&								√@
261630033	Dearborn		√			√■	√■*		√	√	√
261630036	Wyandotte						√				
261630038	Detroit – Newberry						√■				
261630039	Detroit – W. Lafayette						√■				

√ data collected
* $PM_{2.5}$ chemical speciation monitor
■ TEOM monitor
Mn only, as of 4/1/2007

\+ Managed by Grand Traverse Band of Ottawa & Chippewa Indians
++ Managed by Little River Band of Ottawa Indians
@ Mn, As, Cd and Ni, as of 4/1/2007
& Shutdown 4/1/2007

Since the concentration of a given air contaminant at a particular time and place is highly dependent on meteorological conditions, wind speed and direction instruments, barometric pressure, solar radiation, and relative humidity are also monitored at some of these locations. **Table 1-5** lists those MASN locations and the type of meteorological data collected in 2007.

Table 1-5: 2007 Meteorological Data Collected at the MASN Stations

AIRS ID	SITE NAME	RESULTANT SPEED	RESULTANT DIRECTION	TEMPERATURE	RELATIVE HUMIDITY	SOLAR RADIATION	BAROMETRIC PRESSURE
260050003	Holland	√	√	√	√	√	√
260170014	Bay City	√	√	√			
260210014	Coloma	√	√	√			
260270003	Cassopolis	√	√	√			
260490021	Flint	√	√	√			√
260492001	Otisville	√	√	√			
260630007	Harbor Beach	√	√	√			
260650012	Lansing	√	√	√			√
260770008	Kalamazoo	√	√	√			
260810020	Grand Rapids - Monroe	√	√	√			√
260810022	Evans	√	√	√			
260890001	Peshawbestown	√	√	√			
260910007	Tecumseh	√	√	√			√
260990009	New Haven	√	√	√	√	√	
261010922	Manistee	√	√	√		√	√
261050007	Scottville	√	√	√			
261130001	Houghton Lake	√	√	√			√
261210039	Muskegon – Green Creek	√	√	√			
261250001	Oak Park	√	√	√			√
261390005	Jenison	√	√	√			
261470005	Port Huron	√	√	√			
261530001	Seney Nat'l Wildlife Refuge	√	√	√	√	√	√
261610008	Ypsilanti	√	√	√			√
261630001	Allen Park	√	√	√	√		√
261630005	River Rouge	√	√	√			
261630015	Detroit - W. Fort	√	√	√	√		√
261630019	Detroit - E. Seven Mile	√	√	√	√		√
261630025	Livonia	√	√	√	√		√
261630033	Dearborn	√	√	√	√		√
261630038	Newberry	√	√	√			
261630039	W. Lafayette	√	√	√			

The MASN is designed to meet EPA's national ambient air quality monitoring requirements, is used to measure and determine what areas are meeting the NAAQS for the six criteria pollutants, and to provide real-time air quality measurements for MIair (see **Chapter 4**). In 2006, EPA amended its air monitoring requirements to include more co-located monitors.[4] The amended air monitoring requirements will also add National Core (NCORE) sites that will be multi-pollutant in nature which will

[4] Information on the MASN can be found at http://www.michigan.gov/deqair under the heading "Air Monitoring."

enhance the understanding of how pollution travels. Information on the effects of the 2006 amended monitoring requirements is discussed by criteria pollutant in **Chapter 2**.[5]

As part of the EPA's grant to the MDEQ, the AQD provides an annual review of the MASN monitoring data collected from the previous year and recommends any network changes. These recommendations are based on each monitor's exceedance history, changes in population distribution, and modifications to federal monitoring requirements under the CAA. Under the newly amended air monitoring regulations (beginning in 2007), states are required to solicit public comment on their future air monitoring network design prior to submitting the annual review to EPA.

METROPOLITAN STATISTICAL AREAS:

Michigan is divided into geographical planning units called Metropolitan Statistical Areas or MSAs, Micropolitan Statistical Areas (MiSAs), and Combined Statistical Areas (CSAs).[6] Both MSAs and MiSAs are defined in terms of whole counties. If specified criteria are met, adjacent MSAs and MiSAs, in various combinations, may become the components of complementary areas called CSAs. CSAs can be characterized as representing larger regions that reflect broader social and economic interactions, such as wholesaling, commodity distribution, and weekend recreation activities, and are likely to be of considerable interest to regional authorities and the private sector.

The two largest CSAs are in Southeast Michigan and West Michigan. The following **Tables 1-6** through **1-9** show all of Michigan's CSA's broken down to include the MSA/MiSA and their counties:

Table 1-6: Detroit-Warren-Flint CSA

Ann Arbor MSA	Detroit-Warren-Livonia MSA	Flint MSA	Monroe MSA
Washtenaw Co.	Lapeer, Livingston, Macomb, Oakland, St. Clair, & Wayne Co.	Genesee Co.	Monroe Co.

Table 1-7: Grand Rapids-Muskegon-Holland CSA

Grand Rapids-Wyoming MSA	Muskegon-Norton Shores MSA	Holland-Grand Haven MSA	Allegan MiSA
Kent, Barry, Ionia, & Newaygo Co.	Muskegon Co.	Ottawa Co.	Allegan Co.

Table 1-8: Lansing-East Lansing-Owosso CSA

Lansing-East Lansing MSA	Owosso MiSA
Clinton, Eaton, & Ingham Co.	Shiawassee Co.

Table 1-9: Saginaw-Bay City-Saginaw Twp. North CSA

Bay City MSA	Saginaw-Saginaw Twp. North MSA
Bay Co.	Saginaw Co.

Those MSAs and MiSAs that are not part of any CSA are shown in **Tables 1-10** and **1-11**:

Table 1-10: Additional Michigan MSAs

Battle Creek MSA	Jackson MSA	Kalamazoo-Portage MSA	Niles-Benton Harbor MSA	South Bend-Mishawaka (IN-MI) MSA
Calhoun Co.	Jackson Co.	Kalamazoo & Van Buren Co.	Berrien Co.	Cass Co. (MI)

[5] Complete information about the national air monitoring network is available at http://www.epa.gov/ttn/amtic/.
[6] These areas are established by the U.S. Office of Management and Budget.

Table 1-11: Other Michigan MiSAs

Alma MiSA Gratiot Co.	Alpena MiSA Alpena Co.	Big Rapids MiSA Mecosta Co.	Cadillac MiSA Missaukee & Wexford Co.	Coldwater MiSA Branch Co.
Escanaba MiSA Delta Co.	Houghton MiSA Houghton & Keweenaw Co.	Iron Mountain (MI-WI) MiSA Dickinson Co. (MI)	Marinette WI-MI MiSA Menominee Co. (MI)	Marquette MiSA Marquette Co.
Midland MiSA Midland Co.	Mount Pleasant MiSA Isabella Co.	Sault Ste. Marie MiSA Chippewa Co.	Sturgis MiSA St. Joseph Co.	Traverse City MiSA Benzie, Grand Traverse, Kalkaska, & Leelanau Co.

The EPA has usually relied upon MSA boundaries when designating nonattainment areas for air pollutants relative to NAAQS. The monitoring network assists in determining nonattainment/ attainment status in these MSAs for each of the criteria pollutants (also discussed in **Chapter 2**).

AQD MONITORING TECHNIQUES:

The AQD follows a quality system to ensure that the monitoring data that is collected and reported is valid and accurate. Precision (the repeatability of a measurement) and accuracy (the closeness of the measurement to a true value) are the two primary components of the quality system for ensuring accurate data. Additional information on the AQD's precision and accuracy procedures along with their 2007measurement reports are available in **Appendix B**.

CHAPTER 2: CRITERIA POLLUTANTS MONITORED IN MICHIGAN

Chapter 2 provides information on each of the six criteria pollutants that include state source information, Michigan's monitoring requirements for 2007, attainment/nonattainment status, monitoring site locations (each map will show all the monitors active in 2007), and air quality trends from 1998-2007 broken down by location (only sites that have one complete year of data will be included in the trend figures).[7] The actual 2007 data for each criteria pollutant is available in **Appendix A**. For 2007, some monitors were eliminated as the result of budget cuts and those monitors deemed essential were retained. Essential monitors included those in nonattainment areas or areas likely to become designated as nonattainment, required by network design specification, which address general public health issues, deposition and national trends, and those that are needed to collect background data. The criteria pollutant subsections include:

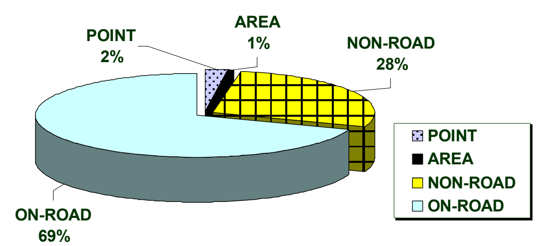
- **Chapter 2.1**: Carbon Monoxide (CO)
- **Chapter 2.2**: Lead (Pb)
- **Chapter 2.3**: Nitrogen Dioxide (NO_2)
- **Chapter 2.4**: Ozone (O_3)
- **Chapter 2.5**: Particulate Matter (PM_{10}, $PM_{2.5}$, and $PM_{2.5}$ Chemical Speciation)
- **Chapter 2.6**: Sulfur Dioxide (SO_2)

CHAPTER 2.1: CARBON MONOXIDE (CO)

Utilizing the EPA's 2002 emissions inventory (EI) data, **Figure 2.1-1** shows that Michigan's on-road motor vehicle sources account for 69% of the state's CO emissions. On-road sources include diesel, heavy/light-duty gas trucks and vehicles, and motorcycles.

Michigan's non-road sources contribute 28% of the CO emissions. These sources include aircraft, marine vessels, non-road two and four stroke engines, railroads, and others.

Figure 2.1-1: Percentage of CO Emissions in Michigan By Source Type (EPA 2002 Emissions Inventory Data)



CO emissions from Michigan's industries (point sources) account for only 2%. For the Detroit-Ann Arbor area, combustion from coal-fired power plants, industrial, commercial, and residential sources, as well as iron, steel manufacturing, and foundries were the leading point sources of CO.

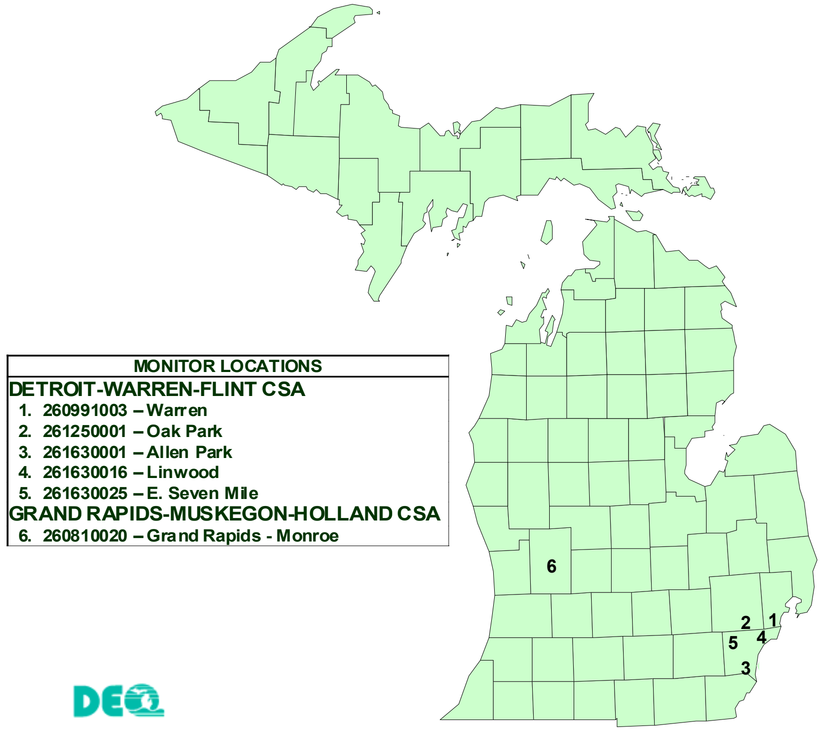
Michigan's CO emission totals are estimated to be 20% less than what the emissions were in 1990 and historically, Michigan has had better air quality when compared to nationwide trend site averages.[8] As of August 30, 1999, all areas in Michigan have been designated as attainment for CO and no monitoring needs to be performed for attainment purposes. Starting in 2007, under the 2006 amended air quality monitoring regulations, CO monitoring will no longer be required. However, trace CO monitoring will be required at the new NCORE stations.

CO MONITORING IN MICHIGAN:

For 2007, as shown in **Figure 2.1-2**, there were a total of six CO monitors in operation. However, due to budget cuts, four CO monitors were shut down in April 2007. The CO monitors in Southeast Michigan's Allen Park and West Michigan's Grand Rapids-Monroe Street were retained in preparation for the NCORE network.

[7] The air quality trends are based on actual statewide monitored readings which are also listed in EPA's Air Quality Subsystem Quick Look Report Data.
[8] Information on Nationwide Air Quality Trends is available at: http://www.epa.gov/airtrends/carbon.html.

FIGURE 2.1-2: CO MONITORS ACTIVE IN 2007



CO TRENDS BY LOCATION:

For trend purposes, only the Allen Park and Grand Rapids CO monitors are shown in **Figures 2.1-3** and **2.1-4**, as these are the only two monitors which contain a full year of 2007 data.

Figure 2.1-3 provides the maximum 2nd highest 1-hour CO level trends for Michigan from 1998-2007, which demonstrates that there have not been any exceedances of the 1-hour CO NAAQS.

Figure 2.1-3: CO Levels in MI from 1998-2007 (2nd Highest 1-Hr Maximum Values)

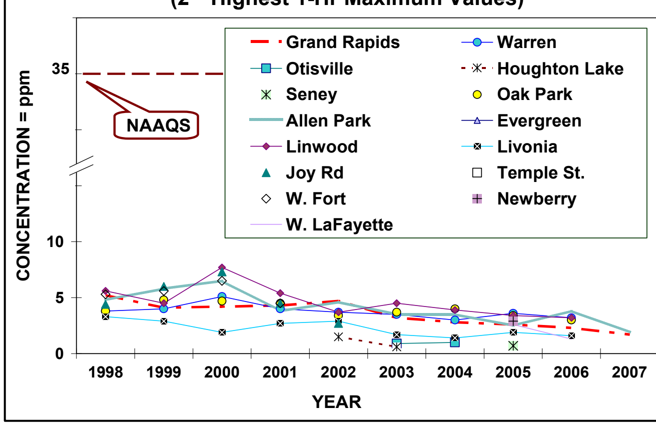


Figure 2.1-4: CO Levels in MI from 1998-2007 (2nd Highest 8-Hr Maximum Values)

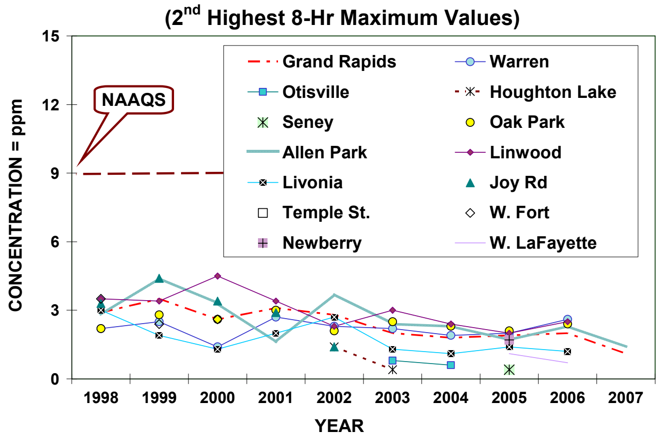
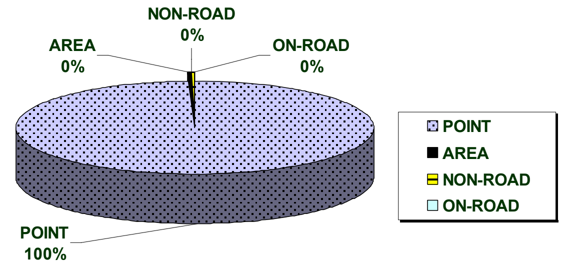


Figure 2.1-4 provides the 2nd highest 8-hour CO maximum values for Michigan's CO sites. In 2007, CO values continue to remain well below the standard and Michigan did not experience any exceedances of the NAAQS.

CHAPTER 2.2: LEAD (PB)

Ambient Pb levels in Michigan continue to be well below the Pb NAAQS of 1.5 µg/m^3. **Figure 2.2-1** shows that point sources such as non-ferrous smelters and battery plants contribute almost all of Michigan's overall Pb emissions. However, there was no point source monitoring for Pb conducted in 2007.

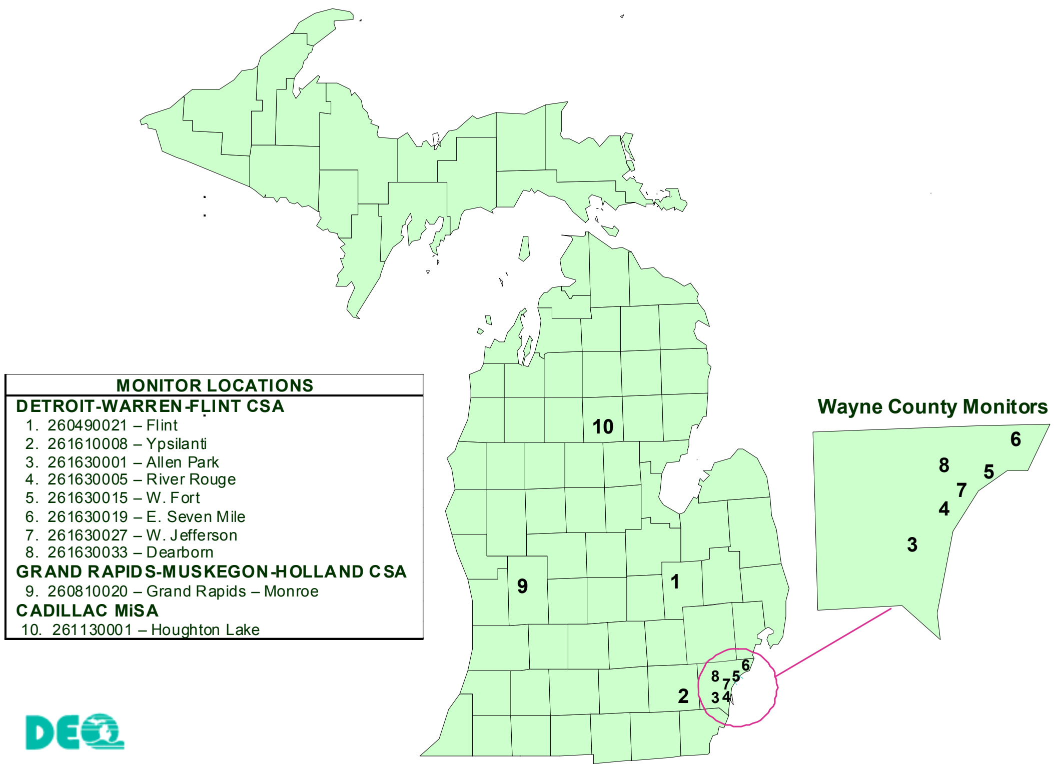
Figure 2.2-1: Percentage of Pb Emissions in Michigan By Source Type (EPA 2002 Emissions Inventory Data)



PB MONITORING IN MICHIGAN:

Figure 2.2-2 shows that there were 10 Michigan sites monitoring for Pb during 2007. In April 2007, nine of the Pb sites were shut down due to budget cuts. Dearborn, the only Michigan monitoring site that collected a full year of Pb measurements for 2007, is part of the National Air Toxics Trend Sites (NATTS) program, which is funded through a different grant source. The Dearborn NATTS site monitors Pb and other trace metals, both as total suspended particulate (TSP) and PM_{10}, will continue to help maintain continuity with Michigan's historical database and to provide a full suite of trace metal measurements by various size fractions ($PM_{2.5}$, PM_{10}, TSP). Pb measurements as $PM_{2.5}$ are also made throughout the $PM_{2.5}$ speciation network (discussed in **Chapter 2.5**).

FIGURE 2.2-2: Pb MONITORS ACTIVE IN 2007



It is important to note that the 2006 amended monitoring requirements de-emphasized Pb monitoring and under the NCORE network, there will only be ten sites nationally that will be required to measure Pb. If EPA adopts a more stringent form of the NAAQS in 2008-2009, or if budget concerns arise, Michigan's Pb monitoring network may need to be modified.

PB TRENDS BY LOCATION:

Pb levels in Michigan have remained far below the NAAQS over the past decade. Due to the very low Pb levels, **Figures 2.2-3** and **2.2-4** have been enlarged and the scale divided to show the actual Pb levels. For trend purposes, only the Dearborn site is shown in these figures, as it was the only site in 2007 with one year's worth of Pb data.

For the years 1998-2007, **Figure 2.2-3** shows the trend sites in Southeast Michigan that are located within the Detroit-Warren-Flint CSA. **NOTE**: The spike at Detroit's Fort Street in 2006 was investigated and confirmed as accurate, although no known reason was found.

Figure 2.2-4 (below) includes the remainder of Michigan's monitoring sites, from 1997-2006, located in the Grand Rapids-Muskegon-Holland CSA and Northern Michigan. **NOTE:** As discussed previously, no Pb monitoring was conducted in these areas during 2007. As shown, all Pb levels have always been far below the quarterly Pb NAAQS of 1.5 µg/m^3.

Figure 2.2-3: Pb Levels in MI's Detroit-Warren-Flint CSA from 1998-2007 (Maximum Quarterly Values)

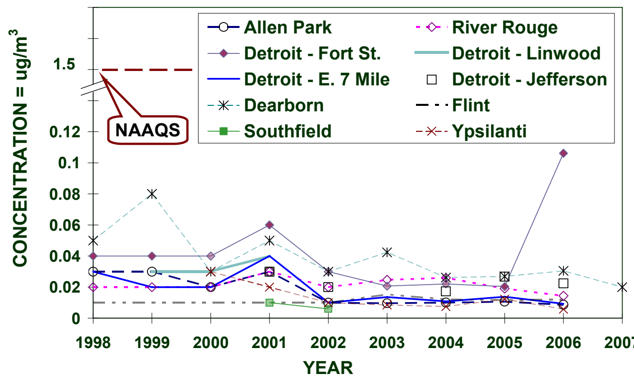
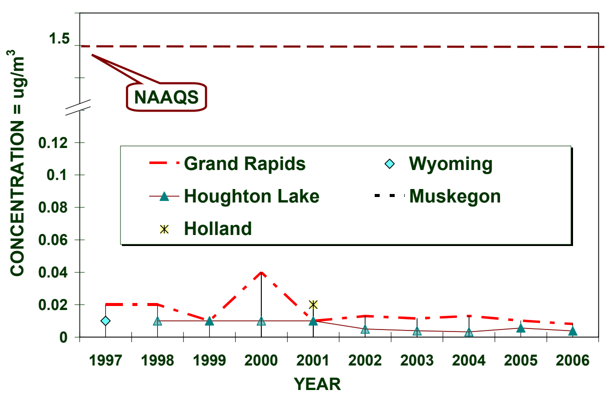


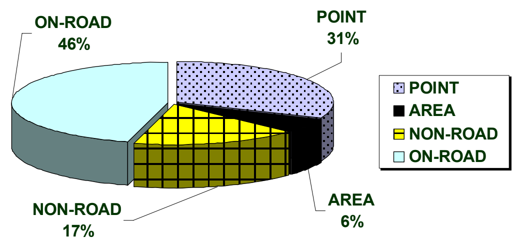
Figure 2.2-4: Pb Levels in Grand Rapids-Muskegon-Holland CSA and Northern MI from 1997-2007 (Maximum Quarterly Values)



CHAPTER 2.3: NITROGEN DIOXIDE (NO_2)

Michigan ambient NO_2 levels have always been well below the NAAQS. **Figure 2.3-1** shows that on-road (46%) and point sources (31%) make up most of Michigan's total NO_X emissions. Point sources include industrial, commercial, institutional, and residential fossil fuel combustion. Since March 3, 1978, all areas in Michigan have been in attainment for NO_2.

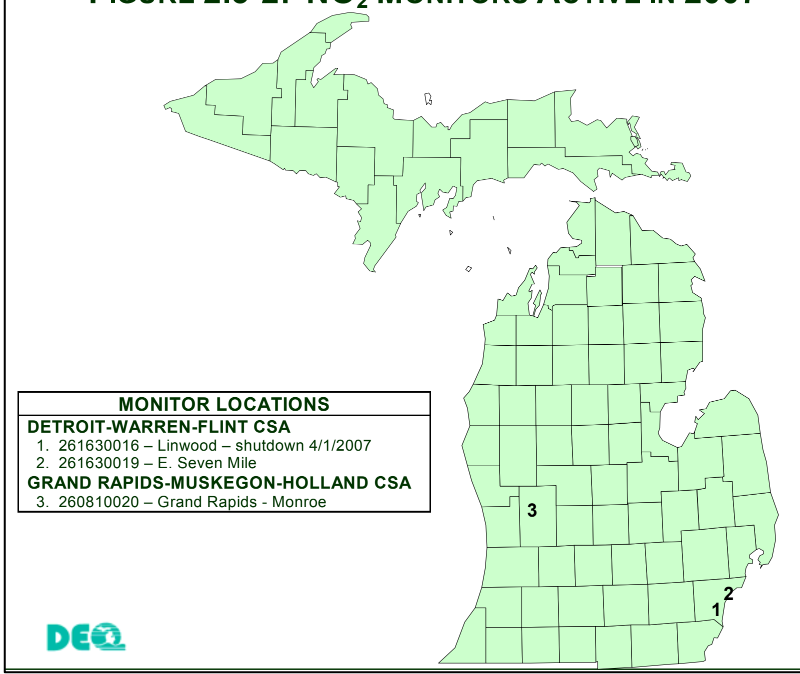
Figure 2.3-1: Percentage of NO_X Emissions in Michigan By Source Type (EPA 2002 Emissions Inventory Data)



NO_2 MONITORING IN MICHIGAN:

Even though there are no nonattainment areas for NO_2 in Michigan and monitoring for attainment purposes is not required, monitors continue to operate to support photochemical model validation work. For 2007, **Figure 2.3-2** shows that there were three NO_2 monitors in operation. However, due to budget cuts, both the Grand Rapids and Detroit's Linwood sites were shut down on April 1, 2007. The E. Seven Mile monitor in Detroit, a downwind urban scale site that measures NO_2 produced from the reaction of O_3 with NO_X, is the only monitoring site that was operational throughout 2007.

FIGURE 2.3-2: NO_2 MONITORS ACTIVE IN 2007



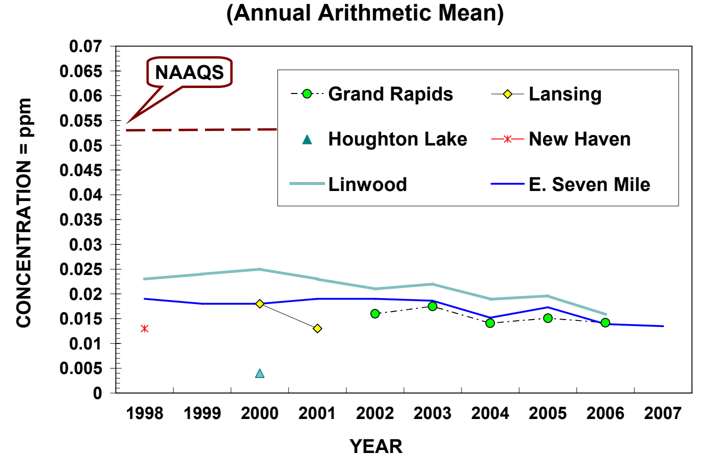
It is important to note that the revised 2006 air quality monitoring regulations no longer require NO_2 monitoring. Under the new NCORE requirements, trace monitoring will be necessary and Michigan will establish trace monitors at Grand Rapids and Allen Park beginning approximately in January 2008. (Only NO_2 monitors can be used for attainment/nonattainment purposes, however.)

NO_2 TRENDS BY LOCATION:

For trend purposes, only the E. Seven Mile monitor is shown in **Figure 2.3-3**, as it is the only site in 2007 with a full year of NO_2 data.

There has never been an exceedance of the NO_2 standard in Michigan. As shown in **Figure 2.3-3**, all monitoring sites have had an annual NO_2 concentration at less than half of the 0.053 ppm NAAQS.

Figure 2.3-3: NO_2 Levels in MI from 1998-2007 (Annual Arithmetic Mean)

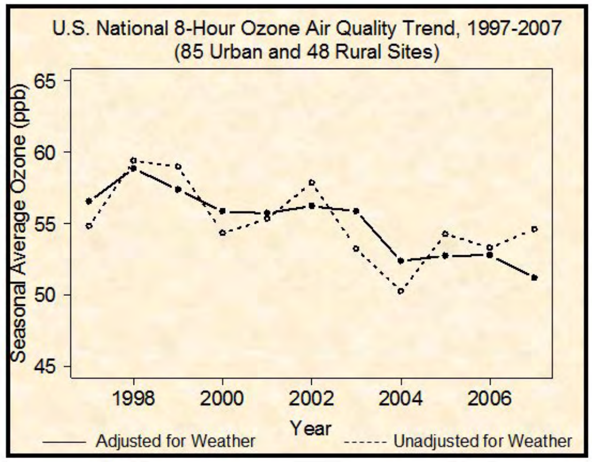


CHAPTER 2.4: OZONE (O_3)

Ground-level O_3 is not emitted directly from any source, but is created by photochemical reactions involving NO_X and VOCs (O_3 precursors) in the presence of sunlight. EPA states that nationwide, O_3 levels (1-hour and 8-hour) have improved considerably. National programs that have cut VOC and NO_X emissions from vehicles, industrial facilities, and electric utilities, along with the reformulation of fuels, and other consumer/commercial products (i.e., paints and chemical solvents that contain VOC) have helped to reduce the levels of O_3. EPA notes that variations in weather conditions also play an important role in determining O_3 levels.[9]

In **Figure 2.4-1**, EPA used 8-hour O_3 concentrations from 85 urban and 48 rural sites across the U.S.[10], including four in Michigan. Typical weather conditions were determined by averaging conditions (e.g., temperature, humidity, etc.) for the summers (May-September) of 1997 through 2007. The dotted line shows the trend in observed values at monitoring sites, while the solid line illustrates the underlying O_3 trend after removing the effects of weather. The solid line represents O_3 levels anticipated under typical weather conditions and serves as a more accurate O_3 trend for assessing changes in emissions. EPA states that for Michigan, on average, O_3 levels declined 12% between 1997 and 2007. These improvements are in response to both state and regional reductions in NO_X and VOC emissions.

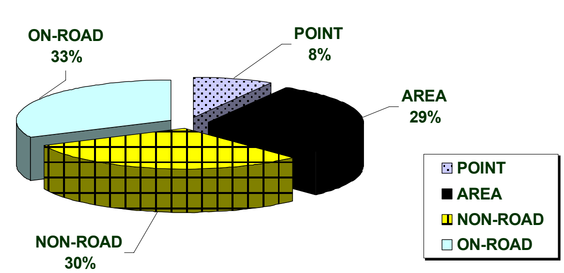
Figure 2.4-1: EPA's National 8-Hour O_3 Air Quality Trends from 1997-2007



According to EPA's 2002 EI data (**Figure 2.4-2**), Michigan's on-road and non-road sources still account for the largest percentage of anthropogenic VOC emissions. Michigan's VOC emission sources include:

- motor vehicles;
- storage, transport, processing, and marketing of petroleum products;
- combustions of fuels; and
- industrial processes such as production/use of organic chemicals, paints, polymers, resins, surface coatings, plastic product manufacturing, coke production/byproducts, and degreasing.

Figure 2.4-2: Percentage Of VOC Emissions in Michigan By Source Type (EPA 2002 Emissions Inventory Data)



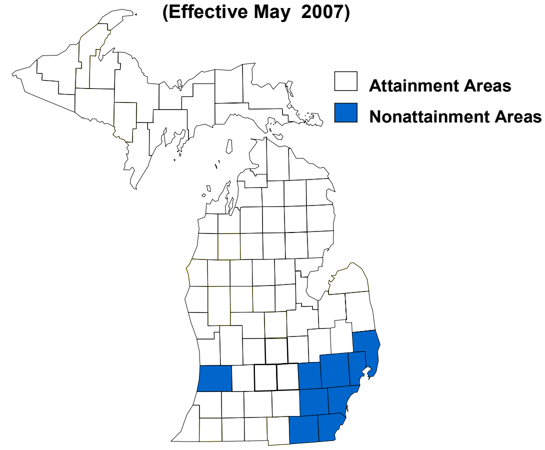
[9] Information was obtained from EPA's website, Trends in Ozone Adjusted for Weather Conditions available at http://www.epa.gov/airtrends/weather.html.

[10] EPA Reference: Cox, William M. and Shao-Hang Chu. (1996). "Assessment of Interannual Ozone Variation in Urban Areas from a Climatological Perspective." Atmospheric Environment, 30.14, 2615-2625.

In June 2004, EPA designated 25 counties in Michigan as nonattainment for the 8-hour O_3 NAAQS. On July 15, 2005, EPA revoked the 1-hour standard.

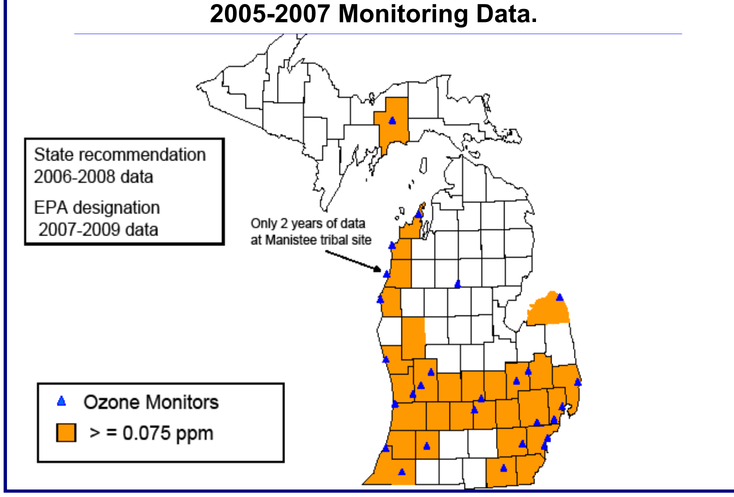
In 2006, the MDEQ successfully petitioned EPA to change the status for 16 of the 25 designated nonattainment counties to attainment.[11] EPA's final rule approving Michigan's redesignation requests for the counties of Benzie, Berrien, Calhoun, Cass, Clinton, Eaton, Genesee, Huron, Ingham, Kalamazoo, Kent, Lapeer, Mason, Muskegon, Ottawa, and Van Buren was published in the May 16, 2007 Federal Register.[12] **Figure 2.4-3** shows the nine counties in Michigan that remained in nonattainment in 2007.

Figure 2.4-3: EPA's Designated 8-hour Ozone Attainment/Nonattainment Areas for Michigan
(Effective May 2007)



It is important to note that in July 2007, the EPA announced in the Federal Register their proposal to lower the 8-hour O_3 NAAQS from 0.08 ppm to between 0.070 and 0.075 ppm.[13] On March 27, 2008, the EPA finalized the levels of the new NAAQS at 0.075 ppm.[14] As shown in **Figure 2.4-4**, utilizing 2005-2007 monitoring data, it is estimated that all areas except for Houghton Lake could be in nonattainment under the proposed lower 8-hour ozone NAAQS of 0.075 ppm.

Figure 2.4-4: Proposed Nonattainment Areas Under the Proposed Primary Ozone Standard of 0.075 ppm (using 2005-2007 Monitoring Data.



The following **Table 2.4-1** shows the 4th highest 8-hour O_3 values for all of Michigan's monitoring sites from 1997-2007. During the 2007 monitoring season, 11 of the 29 O_3 monitoring sites registered readings at or above the current 8-hour O_3 value of 0.08 ppm (4th highest value). When the the three-year averages were calculated (2005-2007), there were only five monitors which exceeded the O_3 NAAQS, three sites in West Michigan (Holland, Muskegon, and Jenison) and two sites in Southeast Michigan (New Haven and Warren). Holland (at 0.093 ppm) had the highest O_3 three-year average value in the state and is influenced by regional O_3 transport across or along Lake Michigan shoreline from other major urban areas.

[11] Michigan's redesignation request actions are located at http://www.deq.state.mi.us/documents/deq-aqd-air-aqe-ozone-11countyredesignation-march06.pdf and http://www.deq.state.mi.us/documents/deq-aqd-air-aqe-ozone-5-county-redesignation-5-30-06.pdf.

[12] The May 16, 2007 Federal Register notice is available at http://www.deq.state.mi.us/documents/deq-aqd-air-aqe-ozone-redesignations-5-07.pdf

[13] Federal Register, Vol. 72, No. 132, pp 37818-37919.

[14] Federal Register, Vol. 73, No. 60, pp 16435-16514.

Table 2.4-1: Three-Year Average of the 4th Highest 8-Hr O_3 Values From 1997-2007

AIRS ID	SITE NAME	VALUES	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
260050003	Holland	4th Highest 8-hr Value ppm	0.095	0.097	0.091	0.080	0.092	0.105	0.095	0.079	0.094	0.091	0.094
		Three-year Average ppm	0.098	0.094	0.094	0.089	0.087	0.092	0.097	0.093	0.089	0.088	0.093
		Rounded to 0.01 ppm	0.10	0.09	0.09	0.09	0.09	0.09	0.10	0.10	0.09	0.09	**0.09**
260190003	Frankfort/ Benzonia	4th Highest 8-hr Value ppm	0.078	0.090	0.097	0.081	0.091	0.086	0.089	0.075	0.086	0.080	0.082
		Three-year Average ppm	0.087	0.084	0.088	0.089	0.089	0.086	0.088	0.083	0.083	0.080	0.083
		Rounded to 0.01 ppm	0.09	0.08	0.09	0.09	0.09	0.09	0.09	0.08	0.08	0.08	0.08
260210014	Coloma	4th Highest 8-hr Value ppm	0.099	0.093	0.096	0.077	0.088	0.098	0.089	0.073	0.090	0.076	0.086
		Three-year Average ppm	0.098	0.096	0.096	0.088	0.087	0.087	0.091	0.086	0.084	0.080	0.084
		Rounded to 0.01 ppm	0.10	0.10	0.10	0.09	0.09	0.09	0.09	0.09	0.08	0.08	0.08
260270003	Cassopolis	4th Highest 8-hr Value ppm	0.090	0.091	0.095	0.079	0.088	0.103	0.089	0.077	0.086	0.073	0.083
		Three-year Average ppm	0.094	0.092	0.092	0.088	0.087	0.090	0.093	0.089	0.084	0.079	0.081
		Rounded to 0.01 ppm	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.08	0.08	0.08
260370001	Rose Lake	4th Highest 8-hr Value ppm	0.078	0.078	0.087	0.074	0.087	0.085	0.086	0.070	0.078	0.071	0.081
		Three-year Average ppm	0.074	0.074	0.081	0.079	0.082	0.082	0.086	0.080	0.078	0.073	0.077
		Rounded to 0.01 ppm	0.07	0.07	0.08	0.08	0.08	0.08	0.09	0.08	0.08	0.07	0.08
260490021	Flint	4th Highest 8-hr Value ppm	0.076	0.089	0.089	0.072	0.091	0.088	0.087	0.075	0.079	0.072	0.082
		Three-year Average ppm	0.082	0.084	0.084	0.083	0.084	0.083	0.088	0.083	0.080	0.075	0.078
		Rounded to 0.01 ppm	0.08	0.08	0.08	0.08	0.08	0.08	0.09	0.08	0.08	0.08	0.08
260492001	Otisville	4th Highest 8-hr Value ppm	0.079	0.089	0.095	0.074	0.091	0.089	0.091	0.077	0.080	0.075	0.084
		Three-year Average ppm	0.080	0.084	0.087	0.086	0.086	0.084	0.090	0.085	0.082	0.077	0.08
		Rounded to 0.01 ppm	0.08	0.08	0.09	0.09	0.09	0.08	0.09	0.09	0.08	0.08	0.08
260630007	Harbor Beach	4th Highest 8-hr Value ppm	0.075	0.087	0.090	0.072	0.088	0.087	0.086	0.068	0.077	0.073	0.084
		Three-year Average ppm	0.080	0.082	0.084	0.083	0.083	0.082	0.087	0.080	0.077	0.073	0.078
		Rounded to 0.01 ppm	0.08	0.08	0.08	0.08	0.08	0.08	0.09	0.08	0.08	0.07	0.08
260650012	Lansing	4th Highest 8-hr Value ppm	0.076	0.081	0.089	0.077	0.083	0.088	0.085	0.068	0.082	0.071	0.08
		Three-year Average ppm	0.083	0.080	0.082	0.082	0.083	0.082	0.085	0.080	0.078	0.074	0.078
		Rounded to 0.01 ppm	0.08	0.08	0.08	0.08	0.08	0.08	0.09	0.08	0.08	0.07	0.08
260770905 260770008	Kalamazoo Kalamazoo[1]	4th Highest 8-hr Value ppm	0.082	0.087	0.091	0.070	0.085	0.090	0.085	0.068	0.081	0.068	0.081
		Three-year Average ppm	0.086	0.084	0.086	0.082	0.082	0.081	0.086	0.081	0.078	0.072	0.077
		Rounded to 0.01 ppm	0.09	0.08	0.09	0.08	0.08	0.08	0.09	0.08	0.08	0.07	0.08

Table 2.4-1: Three-Year Average of the 4th Highest 8-Hr O_3 Values From 1997-2007 (Continued)

AIRS ID	SITE NAME	VALUES	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
260810020	Grand Rapids (Monroe)	4th Highest 8-hr Value ppm	0.077	0.079	0.085	0.068	0.083	0.087	0.085	0.068	0.083	0.082	0.084
		Three-year Average ppm	0.086	0.081	0.080	0.077	0.078	0.079	0.085	0.080	0.078	0.078	0.083
		Rounded to 0.01 ppm	0.09	0.08	0.08	0.08	0.08	0.08	0.09	0.08	0.08	0.08	0.08
260812001 260810022	Parnell Evans	4th Highest 8-hr Value ppm	0.079	0.087	0.094	0.073	0.085	0.088	0.093	0.072	0.083	0.081	0.085
		Three-year Average ppm	0.087	0.084	0.086	0.084	0.084	0.082	0.088	0.084	0.082	0.079	0.082
		Rounded to 0.01 ppm	0.09	0.08	0.09	0.08	0.08	0.08	0.09	0.08	0.08	0.08	0.08
260890001	Peshawbestown	4th Highest 8-hr Value ppm							0.079	0.070	0.080	0.073	0.079
		Three-year Average ppm									0.076	0.074	0.077
		Rounded to 0.01 ppm									0.08	0.07	0.07
260910007	Tecumseh	4th Highest 8-hr Value ppm	0.076	0.086	0.083	0.082	0.086	0.089	0.088	0.074	0.082	0.074	0.081
		Three-year Average ppm	0.083	0.082	0.081	0.083	0.083	0.085	0.087	0.083	0.081	0.077	0.079
		Rounded to 0.01 ppm	0.08	0.08	0.08	0.08	0.08	0.09	0.09	0.08	0.08	0.08	0.08
260990009	New Haven	4th Highest 8-hr Value ppm	0.090	0.098	0.096	0.075	0.095	0.095	0.102	0.081	0.088	0.078	0.093
		Three-year Average ppm	0.091	0.093	0.095	0.090	0.089	0.088	0.097	0.092	0.090	0.082	0.086
		Rounded to 0.01 ppm	0.09	0.09	0.09	0.09	0.09	0.09	0.10	0.09	0.09	0.08	**0.09**
260991003	Warren	4th Highest 8-hr Value ppm	0.081	0.090	0.090	0.077	0.094	0.092	0.101	0.071	0.089	0.078	0.091
		Three-year Average ppm	0.087	0.087	0.087	0.085	0.087	0.087	0.095	0.088	0.087	0.079	0.086
		Rounded to 0.01 ppm	0.09	0.09	0.09	0.09	0.09	0.09	0.10	0.09	0.09	0.08	**0.09**
261010922	Manistee	4th Highest 8-hr Value ppm										0.083	0.083
		Three-year Average ppm											0.083
		Rounded to 0.01 ppm											0.08
261050006 261050007	Ludington[2] Scottville	4th Highest 8-hr Value ppm	0.086	0.087	0.101	0.081	0.093	0.089	0.087	0.071	0.085	0.076	0.083
		Three-year Average ppm	0.096	0.088	0.091	0.089	0.091	0.087	0.089	0.082	0.081	0.077	0.081
		Rounded to 0.01 ppm	0.10	0.09	0.09	0.09	0.09	0.09	0.09	0.08	0.08	0.08	0.08
261130001	Houghton Lake	4th Highest 8-hr Value ppm		0.079	0.091	0.073	0.084	0.077	0.082	0.071	0.074	0.073	0.076
		Three-year Average ppm				0.081	0.082	0.078	0.081	0.076	0.075	0.073	0.074
		Rounded to 0.01 ppm				0.08	0.08	0.08	0.08	0.08	0.08	0.07	0.07
261210039	Muskegon	4th Highest 8-hr Value ppm	0.084	0.092	0.103	0.078	0.095	0.096	0.094	0.070	0.090	0.090	0.086
		Three-year Average ppm	0.099	0.091	0.093	0.091	0.092	0.089	0.095	0.086	0.084	0.083	0.087
		Rounded to 0.01 ppm	0.10	0.09	0.09	0.09	0.09	0.09	0.10	0.09	0.08	0.08	**0.09**

Table 2.4-1: Three-Year Average of the 4th Highest 8-Hr O_3 Values From 1997-2007 (Continued)

AIRS ID	SITE NAME	VALUES	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
261250001	Oak Park	4th Highest 8-hr Value ppm	0.076	0.089	0.088	0.075	0.090	0.093	0.090	0.075	0.078	0.072	0.086
		Three-year Average ppm	0.078	0.079	0.084	0.084	0.084	0.086	0.091	0.086	0.081	0.075	0.079
		Rounded to 0.01 ppm	0.08	0.08	0.08	0.08	0.08	0.09	0.09	0.09	0.08	0.08	0.08
261390005	Jenison	4th Highest 8-hr Value ppm	0.079	0.085	0.091	0.077	0.086	0.093	0.090	0.069	0.086	0.083	0.088
		Three-year Average ppm	0.082	0.082	0.085	0.084	0.084	0.085	0.089	0.084	0.081	0.079	0.086
		Rounded to 0.01 ppm	0.08	0.08	0.09	0.08	0.08	0.09	0.09	0.08	0.08	0.08	**0.09**
261470005	Port Huron	4th Highest 8-hr Value ppm	0.079	0.091	0.091	0.080	0.084	0.100	0.086	0.074	0.088	0.078	0.089
		Three-year Average ppm	0.086	0.085	0.087	0.087	0.085	0.088	0.090	0.086	0.082	0.080	0.085
		Rounded to 0.01 ppm	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.08	0.08	0.08
261530001	Seney Nat'l Wildlife Refuge	4th Highest 8-hr Value ppm						0.083	0.076	0.074	0.085	0.076	0.085
		Three-year Average ppm								0.077	0.078	0.078	0.082
		Rounded to 0.01 ppm								0.08	0.08	0.08	0.08
261610005 261610007 261610008	Ann Arbor Ann Arbor[3] Ypsilanti	4th Highest 8-hr Value ppm	0.074	0.084	0.092	0.078	0.092	0.091	0.091	0.071	0.083	0.076	0.077
		Three-year Average ppm	0.082	0.082	0.083	0.084	0.087	0.087	0.091	0.084	0.081	0.077	0.079
		Rounded to 0.01 ppm	0.08	0.08	0.08	0.08	0.09	0.09	0.09	0.08	0.08	0.08	0.08
261630001	Allen Park	4th Highest 8-hr Value ppm	0.075	0.079	0.087	0.067	0.080	0.088	0.085	0.065	0.077	0.068	0.079
		Three-year Average ppm	0.078	0.078	0.080	0.077	0.078	0.078	0.084	0.079	0.075	0.070	0.075
		Rounded to 0.01 ppm	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.07	0.07
261630016	Linwood	4th Highest 8-hr Value ppm	0.079	0.086	0.084	0.077	0.087	0.092	0.084	0.066	0.079	0.069	
		Three-year Average ppm	0.078	0.081	0.083	0.082	0.082	0.085	0.087	0.080	0.076	0.071	
		Rounded to 0.01 ppm	0.08	0.08	0.08	0.08	0.08	0.09	0.09	0.08	0.08	0.07	
261630019	E. Seven Mile	4th Highest 8-hr Value ppm	0.088	0.093	0.092	0.080	0.092	0.083	0.098	0.066	0.080	0.078	0.092
		Three-year Average ppm	0.088	0.089	0.091	0.088	0.088	0.085	0.091	0.082	0.081	0.075	0.083
		Rounded to 0.01 ppm	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.08	0.08	0.08	0.08

1. Kalamazoo site monitor operation responsibility was assumed by MDEQ on 10/96, and site ID number changed.
2. Ludington site monitor was closed in 10/97 due to loss of site access, and relocated to Scottville.
3. Ann Arbor site monitor was relocated elsewhere in Ann Arbor and later moved to Ypsilanti due to site access difficulty.

O_3 MONITORING IN MICHIGAN:

The O_3 monitoring season in Michigan is from April 1 through September 30. In addition to attainment designation applications, monitoring is also conducted to assess urban air quality, population exposure, and to provide current air quality information for the public via the AQD's MIair website (discussed in **Chapter 4**).

O_3 monitoring network extends beyond the vicinity of highest emissions because of the time it takes for O_3 to form from the reaction of NO_X and VOC emissions. Upwind and background sites are situated according to the predominant morning upwind direction from a metropolitan area.[15] For example, the monitors near Houghton Lake and in Seney provide background concentrations in remote rural environments for Michigan's Lower and Upper Peninsula, respectively. In West Michigan, high O_3 concentrations are attributed to regional O_3 transport across or along the Lake Michigan shoreline from other major urban areas. The monitors at Scottville and Benzonia are sited to measure transport of O_3 along Lake Michigan and are an important part of Michigan's maintenance plan. These sites are therefore useful for quantifying the effectiveness of control strategies at upwind sites. For eastern Michigan, O_3 transport is also experienced at the Port Huron monitor located downwind of the Detroit urban area. Further north and downwind of the Port Huron site is the Harbor Beach monitor which provides additional monitoring of O_3 transport into Michigan's "thumb" area. The Tecumseh monitor measures O_3 coming into Ann Arbor and into the Detroit metropolitan area and is required by Michigan's maintenance plan.

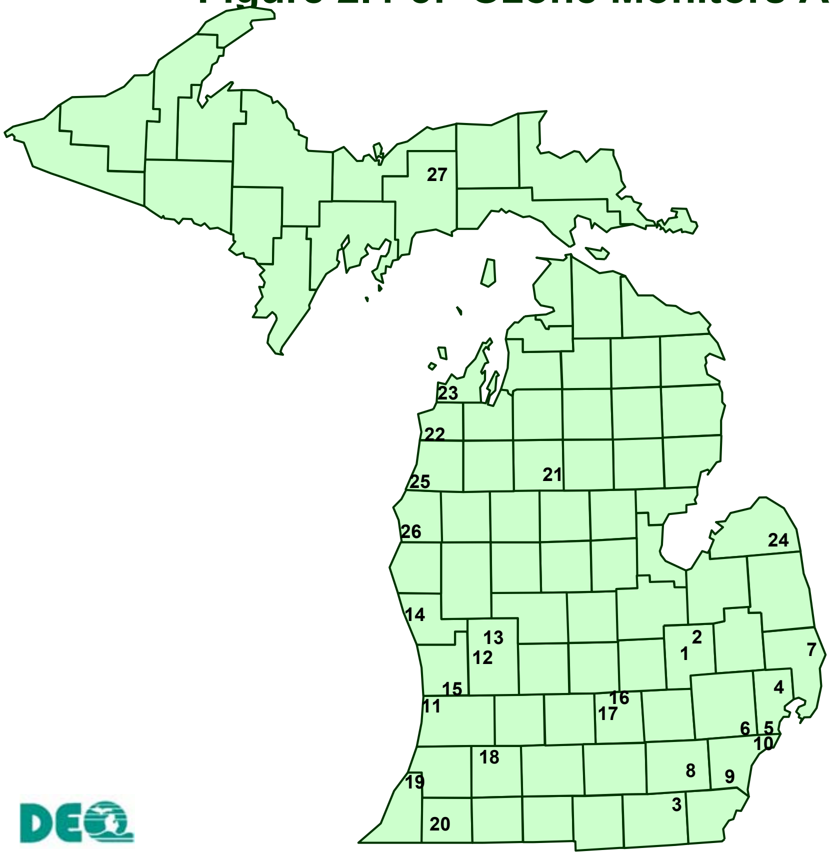
Southeast Michigan monitors are located to assess population exposure at the neighborhood and urban scale. O_3 is also measured at a neighborhood scale in Flint, Lansing, and Grand Rapids. The maximum O_3 concentrations are measured in Otisville, Rose Lake, Evans, Warren, and New Haven as they are situated downwind of urban areas (Flint, Lansing - E. Lansing, Grand Rapids, and Detroit, respectively). The Cassopolis monitor is a downwind site for the South Bend area.

On April 1, 2007, the Linwood and Detroit's W. Fort sites were shut down due to budget cuts. **Figure 2.4-5** shows the locations and types of the remaining 27 O_3 air quality monitors active in Michigan during the 2007 O_3 monitoring season.

It is important to note that under the 2006 amended air monitoring regulations, MSA boundaries have been modified and population totals tied to measurements of ambient air quality have increased. Basically, the amended regulations state that any monitors with a design value, using the most recent three years of data, that is greater than or equal to 85% of the O_3 NAAQS, have a higher probability of violating the standard. Therefore, more monitors could be required in these MSAs.[16]

[15] Utilizing the Guidance on Ozone Monitoring Site Selection. EPA-454/R-98-002. August 1998. EPA, OAQPS, RTP, NC, 27711.
[16] Additional information is available in Michigan's 2006 Ambient Air Monitoring Network Review Final Report at http://www.deq.state.mi.us/documents/deq-aqd-air-aqe-Monitoring-Network-Review-final-9-6-07.pdf.

Figure 2.4-5: Ozone Monitors Active in 2007



MONITOR LOCATIONS

DETROIT-WARREN-FLINT CSA
1. 260490021 – Flint - NAMS
2. 260492001 – Otisville – NAMS
3. 260910007 – Tecumseh - SLAMS
4. 260990009 – New Haven - SLAMS
5. 260991003 – Warren - NAMS
6. 261250001 – Oak Park – SLAMS (proposed NAMS)
7. 261470005 – Port Huron - SLAMS
8. 261610008 – Ypsilanti – SLAMS (proposed NAMS)
9. 261630001 – Allen Park - SLAMS
10. 261630019 – E. Seven Mile - SLAMS

GRAND RAPIDS-MUSKEGON-HOLLAND CSA
11. 260050003 – Holland - SLAMS
12. 260810020 – Grand Rapids – NAMS
13. 260810022 – Evans – SLAMS (proposed NAMS)
14. 261210039 – Muskegon – SLAMS
15. 261390005 – Jenison - SLAMS

LANSING-E. LANSING-OWOSSO CSA
16. 260370001 – Rose Lake - NAMS
17. 260650012 – Lansing - NAMS

KALAMAZOO-PORTAGE MSA
18. 260770008 – Kalamazoo - SLAMS

NILES-BENTON HARBOR MSA
19. 260210014 – Coloma - SLAMS

SOUTH BEND-MISHAWAKA (IN-MI) MSA
20. 260270003 – Cassopolis - SLAMS

CADILLAC MiSA
21. 261130001 – Houghton Lake – SPM

TRAVERSE CITY MiSA
22. 260190003 – Frankfort/Benzonia – SLAMS
23. 260890001 – Peshawbestown – TRIBAL

HURON COUNTY
24. 260630007 – Harbor Beach – SLAMS

MANISTEE COUNTY
25. 261010922 – Manistee – TRIBAL

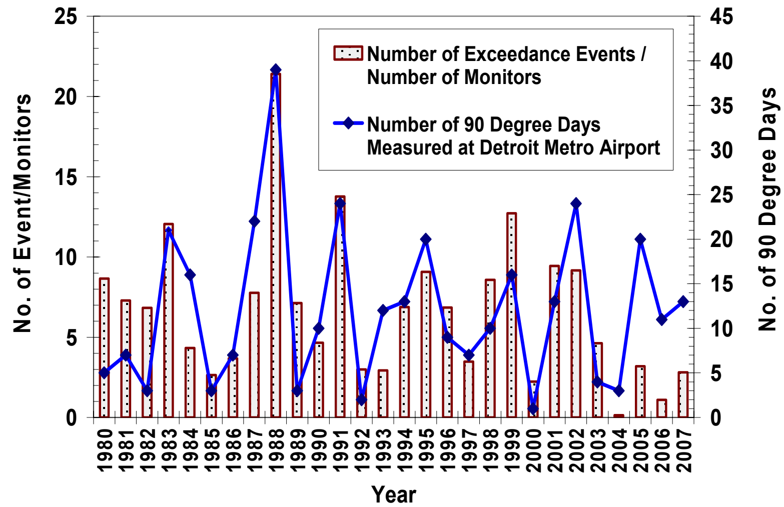
MASON COUNTY
26. 261050007 – Scottville – SLAMS

SCHOOLCRAFT COUNTY
27. 261530001 – Seney - SLAMS

8-HOUR O_3 TRENDS BY LOCATION:

Figures 2.4-6 shows 8-hour O_3 readings ≥ 0.085 ppm with the number of 90°F days (≥ 90°F) measured at the Detroit Metropolitan Airport. The total number of statewide 8-hour readings above 0.085 ppm, were divided by the number of monitors that were in operation each year to provide a relative indication of the frequency of elevated 8-hour O_3 values.

Figure 2.4-6: 8-Hour O_3 Level Events Exceeding the NAAQS from 1980-2007



This comparison shows the influence of temperature with respect to elevated O_3 levels. Over the past 23 years, a typical summer would have 12½ days with the maximum daily temperature exceeding 90°F. Over the time period from 1980 through 2007, the highest number of 90°F days occurred in 1988 (39 days), while the lowest number occurred in 2000 (one day). For 2007, there were thirteen 90°F days.

During the 2007 monitoring season, 11 of the 27 O_3 monitoring sites registered readings at or above 0.085 ppm (4th highest value), and all of the sites recorded readings above 0.075 ppm (4th highest). When all the sites had their three-year averages calculated (2005-2007), every site except for Allen Park and Houghton Lake were above the new 0.075 ppm NAAQS. Holland (at 0.093 ppm) had the highest O_3 three-year average value in the state. The Holland site is influenced by regional O_3 transport across or along Lake Michigan shoreline from other major urban areas.

The following **Figures 2.4-7** through **2.4-10**, show the 4th highest 8-hour O_3 value trends for every monitoring site in Michigan over the last ten years (see **Table 2.4-1** for reference). These figures are broken down by location to enable readers to view specific parts of Michigan to see how O_3 has affected their area of interest.

NOTE: The new 2008 O_3 standard of 0.075 ppm is also shown in **Figures 2.4-7** through **2.4-10** to show its impact.

Figure 2.4-7: O_3 Levels in Detroit-Warren-Flint CSA from 1998-2007, (4th Highest 8-Hour O_3 Values)

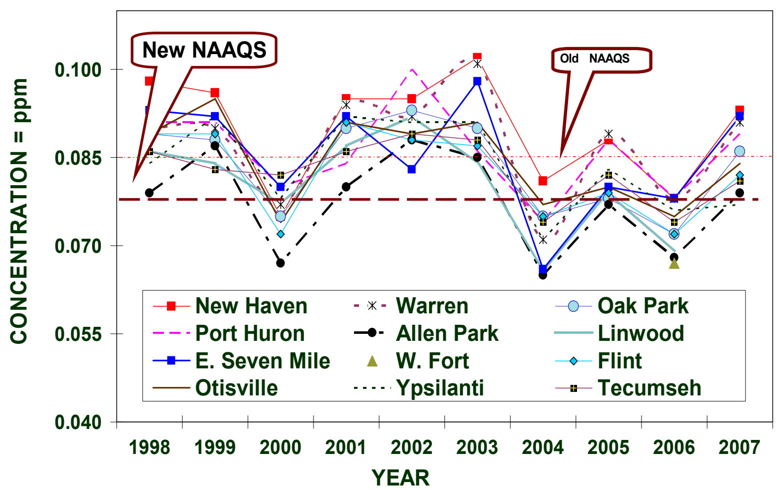


Figure 2.4-8: O_3 Levels in the Grand Rapids-Muskegon-Holland CSA from 1998-2007 (4th Highest 8-Hour O_3 Values)

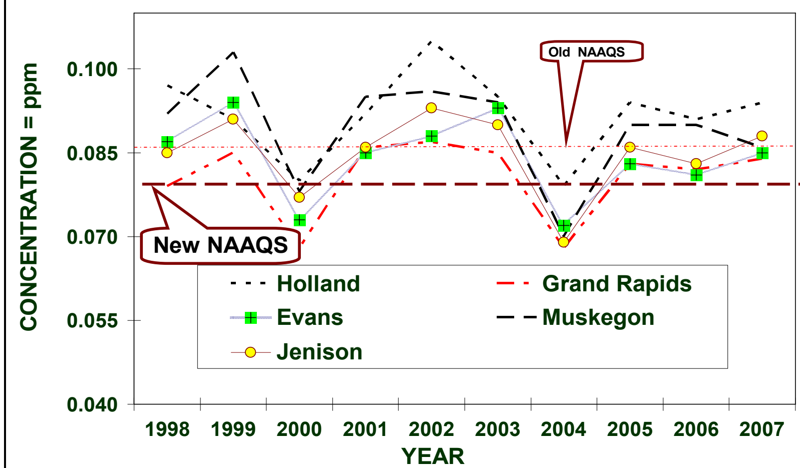


Figure 2.4-9: O_3 Levels in the Kalamazoo-Portage MSA, Lansing-E. Lansing-Owosso CSA, Niles-Benton Harbor MSA, & South Bend-Mishawaka (IN-MI) MSAs from 1998-2007 (4th Highest 8-Hour O_3 Values)

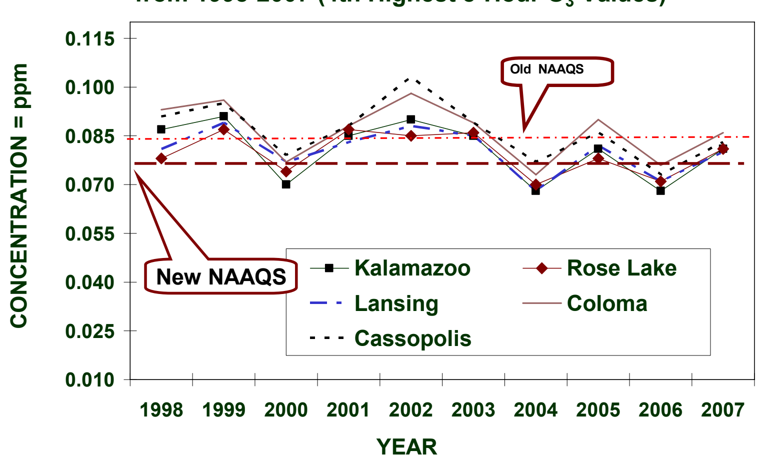
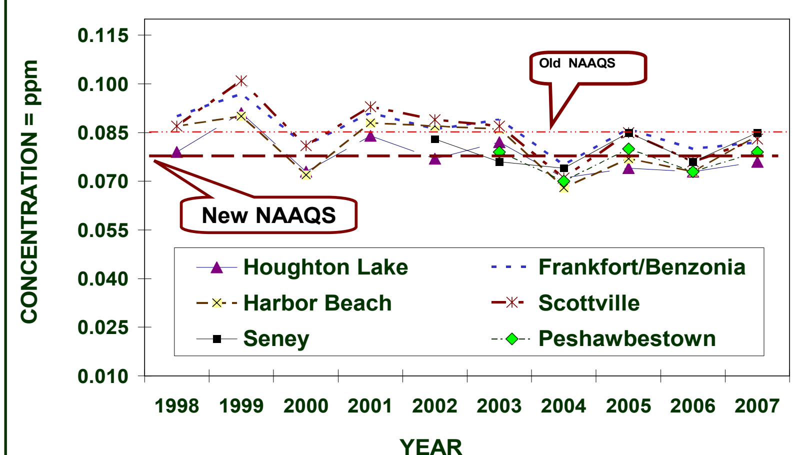


Figure 2.4-10: O_3 Levels in MI's Northern Lower and Upper Peninsula Areas from 1998-2007 (4th Highest 8-Hour O_3 Values)



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

PM is categorized according to size, as size is the major factor in determining which particles will enter the lungs and how deeply they will penetrate. $PM_{2.5}$ are particles equal to or less than 2.5 µm in diameter and cause the most serious health effects. At the end of 2006, there were two important federal regulation revisions that affected how monitoring for PM is conducted.

On October 17, 2006, EPA amended the ambient air monitoring regulations requiring every-day sampling for those areas that approach the 24-hour $PM_{2.5}$ standard.[17] Also, any monitors with a design value (using the most recent three years worth of data) which is greater than or equal to 85% of the $PM_{2.5}$ NAAQS, will require more monitors in their corresponding MSAs.

Effective December 18, 2006, the EPA also revised the 1997 PM NAAQS, which establishes a more stringent 24-hour $PM_{2.5}$ annual standard and revokes the PM_{10} annual standard.[18] Under the newly revised 24-hour $PM_{2.5}$ NAAQS, Michigan had to provide to EPA by December 18, 2007 (based on 2004-2006 monitoring data), its recommendations on which areas in the state should be designated as attainment and nonattainment. The EPA notified states on August 8, 2008, of their designation determinations witch have an effective date of December 2008. Following final designations, states with nonattainment areas are required to submit SIPs within three years (April 2011) and must show attainment by 2013.

PM_{10}:

Figure 2.5-1 shows Michigan's percentage of PM_{10} emissions by source category. Michigan's on-road and off-road PM_{10} emissions combined contribute 34%, point sources 34%, and area sources 32%. For area source contributions, Michigan had a substantial increase in percentages from the 2002 emissions inventory (32%) to the 1999 emissions inventory (12%). **Table 2.5-1** lists the different types of point and area sources that contribute PM_{10} in Michigan.

Figure 2.5-1: Percentage of PM_{10} Emissions in Michigan By Source Type (EPA 2002 Emissions Inventory Data)

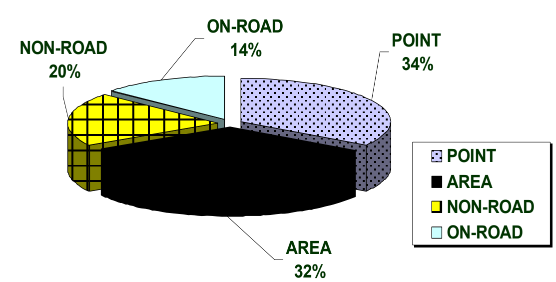


Table 2.5-1: PM_{10} Point and Area Source Types in Michigan

POINT SOURCES	AREA SOURCES
fossil fuel combustion (i.e., coal burning)	fossil fuel combustion; other combustion (i.e., residential fireplaces/wood stoves); incineration; and open burning
chemical and allied product manufacturing	oil and gas production
metals processing	agriculture, food, and mineral products
petroleum, petroleum products, and related industries	wood, pulp and paper, and publishing products; misc. industrial processes
other industrial processes	agriculture and forestry

Since October 4, 1996, all areas in Michigan have been in attainment with the PM_{10} NAAQS. Due to the recent focus upon $PM_{2.5}$ and because of the relatively low level of PM_{10} measured over recent years, Michigan's PM_{10} network has been reduced a minimum level. The map in **Figure 2.5-2** identifies the locations of the six PM_{10} monitoring stations that were operating in Michigan during 2007. These monitors are located in the state's largest populated urban areas --

[17] Effective January 1, 2007, the required changes were made to Michigan's $PM_{2.5}$ monitoring network.
[18] EPA's October 16, 2006 federal register notice for the new PM NAAQS is available at http://www.epa.gov/fedrgstr/EPA-AIR/2006/October/Day-17/a8477.pdf.

three in the Detroit area and two in Grand Rapids. To better characterize the nature of PM in Michigan, many of the existing PM_{10} monitors are co-located with $PM_{2.5}$ monitors in population-oriented areas.

PM_{10} TRENDS BY LOCATION:

Figure 2.5-3 below shows the annual arithmetic means for the Detroit-Warren-Flint CSA from 1998-2007. On April 1, 2007, the Flint monitor was shutdown because of budget issues and the partial year data is not included in **Figure 2.5-3**. For 2007, all monitoring sites in the Detroit area had readings below the old PM_{10} standard with Dearborn continuing to have the highest maximum annual mean (31.5 µg/m^3) in the state.

FIGURE 2.5-2: PM_{10} MONITORS ACTIVE IN 2007

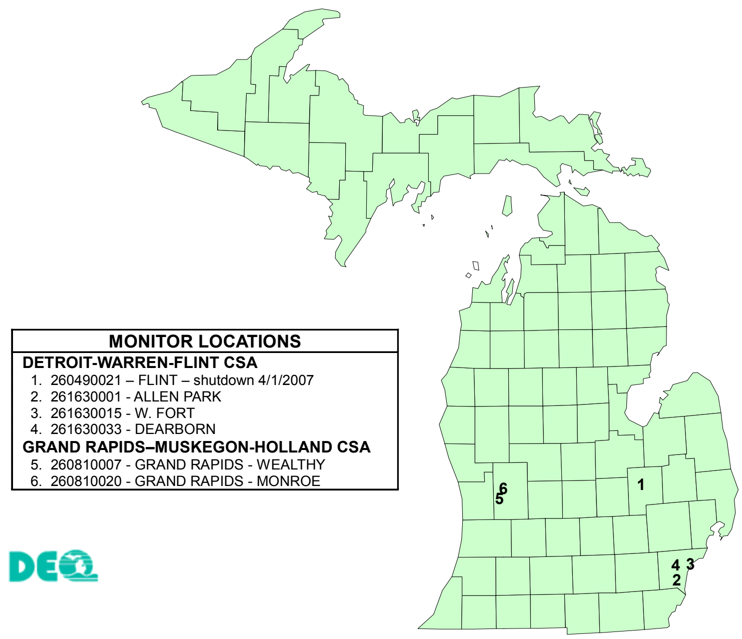


Figure 2.5-3: PM_{10} Levels in MI's Detroit-Warren-Flint CSA from 1998-2007 (Annual Arithmetic Means)

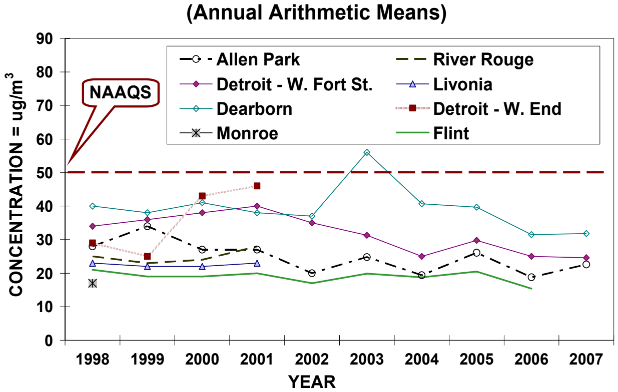
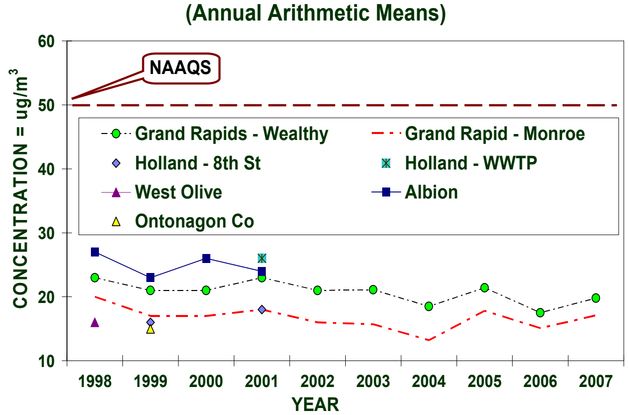


Figure 2.5-4 below shows the annual arithmetic means for the Grand Rapids-Muskegon-Holland CSA and Northern Michigan from 1998-2007. In 2007, the two PM_{10} monitoring sites located in the Grand Rapids area continue to show a decline in the annual mean levels. For the decade, all the monitoring sites in western Michigan have maintained a level well below the PM_{10} NAAQS.

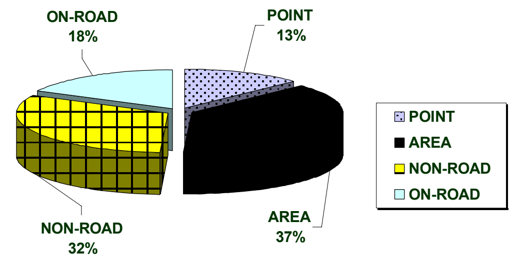
Figure 2.5-4: PM_{10} Levels in the Grand Rapids-Muskegon-Holland CSA & North MI from 1998-2007 (Annual Arithmetic Means)



$PM_{2.5}$:

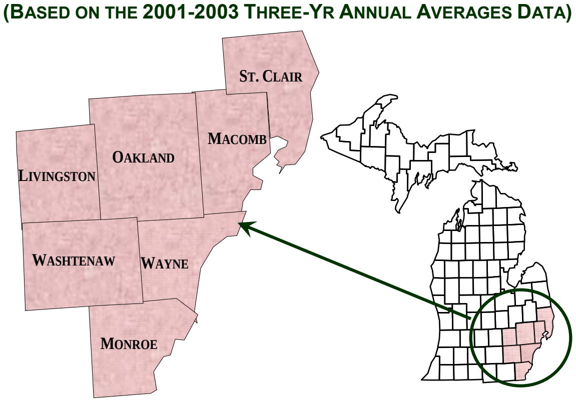
Figure 2.5-5 shows that according to EPA's 2002 emissions inventory data, Michigan area sources produce the majority of $PM_{2.5}$ emissions in the state (37%). However, when you combine non-road (32%) and on-road (18%) sources together, they produce 50% of Michigan's $PM_{2.5}$ emissions. Point sources, such as fossil fuel (coal) combustion, metal processing, incineration, etc., account for the remaining 13% of Michigan's $PM_{2.5}$ emissions.

Figure 2.5-5: Percentage Of $PM_{2.5}$ Emissions in Michigan By Source Type (EPA 2002 Emissions Inventory Data)



In December 2007, the MDEQ recommended that seven Southeast Michigan counties (shown in **Figure 2.5-6**) and one West Michigan county be designated as nonattainment. For Southeast Michigan, the MDEQ had requested that the area be broken into three different nonattainment areas: 1) Wayne County; 2) St. Clair County; and 3) Livingston, Macomb, Monroe, Oakland, and Washtenaw Counties. On August 18, 2008, the EPA proposed to modify the MDEQ's request by keeping all seven Southeast Michigan counties as one nonattainment area. In additional the EPA added Ottawa County, on the west side of the State, as a nonattainment area.

FIGURE 2.5-6: EPA'S $PM_{2.5}$ NONATTAINMENT AREA DESIGNATIONS FOR SOUTHEAST MICHIGAN (BASED ON THE 2001-2003 THREE-YR ANNUAL AVERAGES DATA)



COMPREHENSIVE MONITORING FOR $PM_{2.5}$ IN MICHIGAN:

The statewide particulate network consists of many components which together provide a picture of the nature of PM within the state. The concentrations of $PM_{2.5}$ measured over a 24-hour time period are determined using the federal reference method (FRM). Only data generated by FRM monitors are used for comparisons to the NAAQS. The Michigan monitoring sites are located in urban, commercial, and residential areas where people are exposed to $PM_{2.5}$. Under the revised 2006 air monitoring regulations, the minimum number of $PM_{2.5}$ sites using a FRM in a MSA was changed. For West Michigan, that meant that two monitors are now required in the Grand Rapids-Wyoming MSA. Monitoring is conducted at the Grand Rapids–Monroe site and in January 2007, the MDEQ added a $PM_{2.5}$ FRM monitor to the Grand Rapids-Wealthy site.

In addition to the FRM monitors, continuous and speciated monitors are also used at some locations. Continuous monitoring is beneficial as it provides real time hourly data that supplements the $PM_{2.5}$ data collected by FRM monitors. Speciated monitoring provides a better understanding of the chemical composition of $PM_{2.5}$ material and better characterizes background levels. The following are brief descriptions of the types of monitors that make up Michigan's $PM_{2.5}$ monitoring network.

$PM_{2.5}$ FRM Monitoring Network: $PM_{2.5}$ FRM monitors are deployed at all of Michigan's 26 $PM_{2.5}$ monitoring sites to characterize background or regional $PM_{2.5}$ transport collectively from upwind sources. The two monitoring sites in Detroit's W. Lafayette and Newberry investigate PM levels in an area of Detroit heavily impacted by mobile source emissions. In addition, five $PM_{2.5}$ FRM monitoring sites are co-located with PM_{10} monitors to allow for $PM_{2.5}$ and PM_{10}

comparisons.[19] Co-located PM_{10} and $PM_{2.5}$ sites include Grand Rapids (Monroe and Wealthy), Dearborn, Allen Park, and Detroit's W. Fort Street station.

Continuous $PM_{2.5}$ Monitoring: Short-term measurements of $PM_{2.5}$ or PM_{10} are updated on an hourly basis using Tapered Element Oscillating Microbalance (TEOM) instruments. At least one continuous TEOM is required at a core monitoring $PM_{2.5}$ site in a metropolitan area with a population greater than one million. Both Detroit (Allen Park) and Grand Rapids (Monroe) meet this requirement.[20] Under the revised 2006 air monitoring regulations, 50% of the FRM monitoring sites are now required to have a continuous $PM_{2.5}$ monitor. For Michigan, there are 26 FRM monitoring sites and 13 of those sites have TEOMS.

Initially, the MDEQ operated all TEOM units with an inlet temperature of 50 degrees Celsius but this high inlet temperature was volatilizing nitrate during the winter months. Between 2003 and 2005, filter dynamic measurement system (FDMS) inlets were added to all TEOMs. However, maintenance problems occurred during summer days with high humidity which also interfered with data capture. As a possible solution, in 2006 the MDEQ operated all 14 TEOMS with the FDMS inlets installed only during the winter months and removed the FDMS inlets during the summer. (both data are shown in **Appendix A**). It is important to note that performance was worse in 2006 and several discontinued parts had broken. Therefore, in February 2007, all FDMS units were removed from the TEOMS. In October 2007, the MDEQ began operating TEOMs with a 30°C inlet temperature October through March and a 50°C inlet temperature between April and September. The MDEQ is currently analyzing the data to determine the success of this latest change.

Chemical Speciation Monitoring: Single event Met-One spiral ambient speciation samplers (SASS) are used throughout Michigan's speciation network and are placed in population-oriented stations in both urban and rural locations. $PM_{2.5}$ chemical speciation samples are collected on three types of filters: teflon, nylon, and quartz over a 24-hour period. Each filter is analyzed by a different method to determine various components of $PM_{2.5}$. There are eight SASS monitors operating in Michigan.

The primary objectives of the chemical speciation monitoring sites are to provide data that will be used to determine air quality and to support the development of attainment strategies. Historical speciation data for Michigan indicates that $PM_{2.5}$ is made up of 30% nitrate compounds, 30% sulfate compounds, 30% organic carbon, [21] and 10% as unidentified or trace elements. In January 2007, EPA released its new SPECIATE 4.0 which includes a total of 4,080 PM speciation and total organic compound profiles of air pollution sources. These profiles are used to create speciated emissions inventories for regional haze, $PM_{2.5}$, and O_3 air quality modeling, and to estimate hazardous and toxic air pollutant emissions from the speciation emissions.

Continuous $PM_{2.5}$ Speciation Monitoring: To determine diurnal changes in $PM_{2.5}$ composition, in 2007 the MDEQ operated four aethalometers and two elemental carbon/organic carbon (EC/OC) monitors. Aethalometers measure carbon black, a

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

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

[21] To better understand the chemical composition of the organic carbon fraction, a number of studies have been conducted in Southeast Michigan to further investigate organic carbon. Information can be found in the Michigan 2006 Ambient Air Monitoring Network Review, available at http://www.michigan.gov/deqair.

combustion by-product typical of transportation sources, by concentrating particulate on a filter tape and measuring changes in optical transmissivity and absorption. In 2007, MDEQ's aethalometers were located at Dearborn, Allen Park and Detroit's Newberry and W. Lafayette sites.

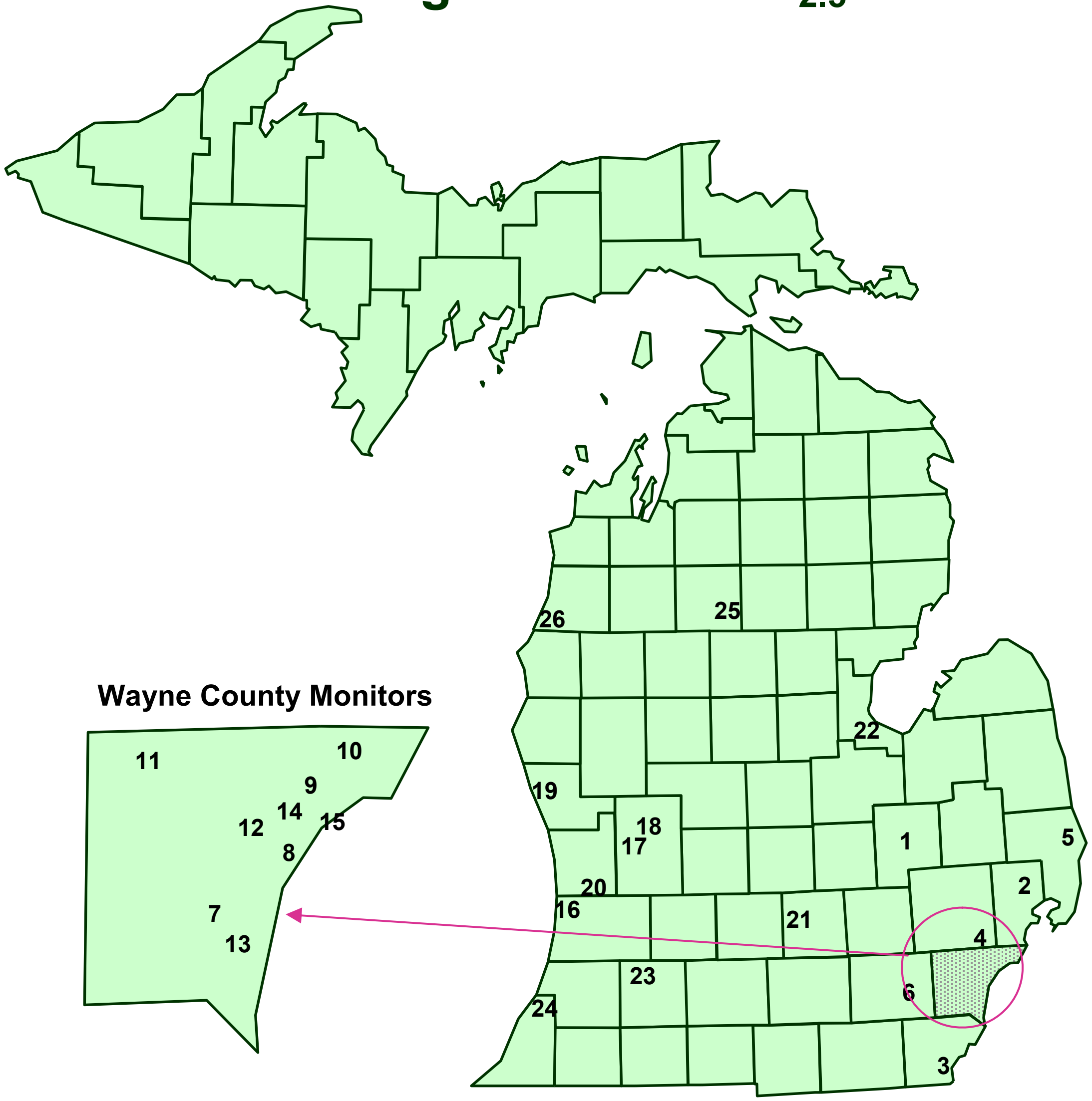
Carbon black is closely related to the elemental carbon that the EC/OC instruments measure. However, EC/OC monitors use an additional analytical technique. EC/OC monitors use proloysis coupled with a non-dispersive infrared detector to separate the elemental and organic carbon fractions. In 2005, MDEQ acquired its first EC/OC monitor as part of a EPA Community Monitoring Grant. This instrument was deployed at Detroit's Newberry and began operation in February. In 2007, MDEQ, acquired a second EC/OC monitor began operation at Dearborn in June.

It is important to note that the 2006 amended air monitoring regulations specify speciation monitoring but did not provide much detail except that measurements of $PM_{10-2.5}$ will be added to the NCORE sites.[22] The MDEQ is still awaiting a finalization of a $PM_{10-2.5}$ monitoring methodology before implementing this monitoring. Continued operation of the speciation trend site in Detroit (Allen Park) is required on a national level.

Several of the special purpose monitors located in Michigan's Upper Peninsula were shut down at the end of 2006. The remaining ones are tribal monitors which are no longer handled by the MDEQ and are not included in **Figure 2.5-7**. With the addition of the new site established in Grand Rapids (Wealthy Street), **Figure 2.5-7** shows all of Michigan's 26 $PM_{2.5}$ FRM monitoring stations operating in 2007 and denotes which sites also have TEOM and/or SASS monitors in operation. **NOTE**: A TEOM is operating at the Seney site along with an O_3 monitor, but is not included in **Figure 2.5-7** as it does not have a $PM_{2.5}$ FRM monitor.

[22] Current information on both proposals can be found at http://www.epa.gov/air/particles/actions.html.

Figure 2.5-7: $PM_{2.5}$ Monitors Active in 2007



MONITOR LOCATIONS

DETROIT-WARREN-FLINT CSA

1. 260490021 – Flint (TEOM)
2. 260990009 – New Haven
3. 261150005 – Luna Pier (SASS)
4. 261250001 – Oak Park
5. 261470005 – Port Huron (TEOM)
6. 261610008 – Ypsilanti (TEOM/SASS)
7. 261630001 – Allen Park (TEOM/SASS)
8. 261630015 – W. Fort
9. 261630016 – Linwood
10. 261630019 – E. Seven Mile
11. 261630025 – Livonia
12. 261630033 – Dearborn (TEOM/SASS)
13. 261630036 – Wyandotte
14. 261630038 – Newberry (TEOM)
15. 261630039 – W. Lafayette (TEOM)

GRAND RAPIDS-MUSKEGON-HOLLAND CSA

16. 260050003 – Holland (TEOM/SASS)
17. 260810007 – Grand Rapids - Wealthy
18. 260810020 – Grand Rapids – Monroe (TEOM/SASS)
19. 261210040 – Muskegon
20. 261390005 – Jenison

LANSING-E. LANSING-OWOSSO CSA

21. 260650012 – Lansing (TEOM)

SAGINAW-BAYCITY-SAGINAW TWP. NORTH CSA

22. 260170014 – Bay City (TEOM)

KALAMAZOO-PORTAGE MSA

23. 260770008 – Kalamazoo (TEOM/SASS)

NILES-BENTON HARBOR MSA

24. 260210014 – Coloma

CADILLAC MSA

25. 261130001 – Houghton Lake (TEOM/SASS)

MANISTEE COUNTY

26. 261010922 – Manistee - TRIBAL

Table 2.5-2 provides the 1999-2007 annual mean $PM_{2.5}$ concentrations by individual monitoring stations.[23] Stations labeled #2 provide a precision estimate of the overall measurement and operate on a one in six sampling schedule. All other monitors sampled on a one in three day schedule except for Holland, Grand Rapids #1, Allen Park #1, and Linwood, which sample daily.

Table 2.5-2: Annual Mean $PM_{2.5}$ Concentrations By Monitoring Station from 1999-2007 (Annual Mean, Rounded)

AIRS ID – Station Name	1999	2000	2001	2002	2003	2004	2005	2006	2007	2005-2007 Mean
260050003 - Holland	12.1	11.7	12.8	12.4	12.38	11.21	12.39	11.48	11.69	11.85
260070005 - Alpena		7.6	9.8	9.1						**
260170014 - Bay City		10.1	11.5	11.3	10.89	9.85	12.44	10.16	10.47	11.02
260210014 - Coloma	12.3	12.1	13.2	12.5	12.46	10.23	13.05	10.95	11.53	11.84
260330901 - Sault Ste. Marie #1			8.2	7.6	8.64	7.16	8.16	8.99*		**
260330901 - Sault Ste. Marie #2			7.9	8.2	9.45*	6.28	9.29*			**
260330902 - Sault Ste. Marie			7.9	7.8	8.09	6.74	7.94	8.11*		**
260330903 - Bay Mills							4.31*	8.41*		**
260430002 - Channing							6.11*	8.36*		**
260490021 - Flint	12.0	13.0	13.1	12.5	12.01	10.49	12.89	10.92	11.07	11.63
260550003 - Traverse City		8.6	9.3	8.0						**
260650012 - Lansing #1	12.6	13.1	14.0	13.50	13.01	11.06	13.54	11.47	11.48	12.16
260650012 - Lansing #2	12.9	13.6	13.3	12.4	14.08*	6.20*				**
260710001 - Crystal Falls							3.97*	5.82*		**
260770008 - Kalamazoo #1	14.9	**15.1**	**15.6**	14.8	13.92	11.33	13.83	12.57*	12.61	13.00
260770008 - Kalamazoo #2	14.7	14.7	14.6	15.0	14.27*	11.09	14.64*	12.76*	13.95*	13.78
260810007 - Grand Rapids									12.84	**
260810020 - Grand Rapids #1	13.8	13.8	14.4	13.3	13.51	12.00	13.72	12.62	12.25	13.06
260810020 - Grand Rapids #2	13.9	13.8	14.2	13.2	14.00	11.26	**15.37**	13.04	14.66	13.72
260990009 - New Haven	12.7	13.4	13.6	13.4	12.8	11.96	14.37	11.28	11.93	12.53
261010922 - Manistee								9.13*	8.54	**
261130001 - Houghton Lake					7.96	7.29	9.38	7.77	7.88	8.34
261150005 - Luna Pier		**15.2**	**15.3**	**16.3**	13.73	12.98	**15.70**	12.72	13.08	13.83
261210040 - Muskegon #1	12.2	11.9	12.6	12.4	11.87	10.16	13.07	11.30	10.50	11.62
261210040 - Muskegon #2	14.5	11.0								**
261250001 - Oak Park	14.2	**15.4**	14.7	15.0	14.58	12.76	**15.46**	12.11	13.33	13.63
261250010 - Southfield			17.1	17.6						**
261390005 - Jenison	12.9	13.2	13.8	13.6	12.69	11.33	13.99	12.02	11.68	12.56
261450018 - Saginaw #1	9.8	10.5	11.5	10.8	10.62	9.51	11.72*			**
261450018 - Saginaw #2	10.4	9.8	10.3							**
261470005 - Port Huron #1	13.2	14.4	14.0	13.8	14.16	12.10	**15.09**	12.04	12.44	13.19
261470005 - Port Huron #2			13.2	13.0	**15.67***					**
261530001 - Seney Nat'l Wildlife			7.5	6.0	3.73*					**
261610005 - Ann Arbor	12.8	13.2	13.5	13.6	13.06*	10.67	13.20			**
261610008 - Ypsilanti #1	14.2	14.3	14.5	14.9	14.64	12.87	**15.61**	12.55*	12.98	13.71
261610008 - Ypsilanti #2			13.8	13.0	**15.12**	11.09	**16.70**	13.52	14.30	14.84
261630001 - Allen Park #1	**16.7**	**15.6**	**17.3**	**15.9**	**15.2**	14.24	**15.94**	13.18	12.75	13.96
261630001 - Allen Park #2	**19.6**	**16.0**	**16.2**	13.9	**17.51***	12.32	**17.66**	13.86	15.65*	15.72
261630015 - Detroit - W. Fort	**17.7**	**18.1**	**18.3**	**17.4**	**16.63**	**15.39**	**17.21**	14.68	14.54	**15.48**
261630016 - Detroit - Linwood	**17.1**	**15.5**	**15.8**	**15.6**	**15.82**	13.69	**16.01**	13.04	13.86	14.30
261630019 - Detroit - E Seven Mile		14.5	14.5	**15.6**	14.63	13.23	**16.48**	12.71	13.01	14.07
261630025 - Livonia	13.1	14.6	14.6	14.4	14.14	12.57	14.94	11.80	12.75	13.16
261630033 - Dearborn	**17.0**	**20.1**	**19.6**	**19.8**	**19.11**	**16.83**	**18.55**	**16.13**	**16.89**	**17.19**
261630036 - Wyandotte	**16.3**	**17.6**	**18.2**	**16.3**	**16.26**	13.66	**16.41**	12.92	13.45	14.26
261630038 - Detroit - Newberry							**16.41***	12.47*	14.01	14.30
261630039 - Detroit - W. Lafayette							**16.22***	13.13	13.83	14.39

*The mean does not satisfy summary criteria. **There is not three years worth of data to calculate the $PM_{2.5}$ NAAQS

[23]For comparison to the standard, the average annual means is rounded to the nearest 0.1 $\mu g/m^3$.

Table 2.5-3 is a detailed assessment of the 24-hour 98TH percentile $PM_{2.5}$ concentrations for 1999-2007, showing Michigan's levels are consistently below the old 65 $\mu g/m^3$ standard (three-year average).[24] However, under the new 24-hour $PM_{2.5}$ NAAQS of 35 $\mu g/m^3$, only 11 of the 26 sites are showing attainment.

Table 2.5-3: 24-Hour 98th Percentile $PM_{2.5}$ Concentrations by Monitoring Station from 1999-2007 (98th Percentile, Rounded)

AIRS ID – Station Name	1999	2000	2001	2002	2003	2004	2005	2006	2007	2005-2007 Mean
260050003 - Holland	36.5	35.7	42.1	36.7	35.6	30.3	36.1	34.1	31.7	33.9
260070005 - Alpena		25.4	35.1	27.3						*
260170014 - Bay City		27.7	34.2	32.0	26.7	28.0	40.5	27.9	25.2	31.23
260210014 - Coloma	35.4	29.7	32.3	30.6	34.1	29.0	33.8	27.7	33	31.5
260330901 - Sault Ste. Marie #1			27.9	22.1	26.3	22.3	25.1	36.1		*
260330901 - Sault Ste. Marie #2			25.4	21.4	38.3	15.4	28.3			*
260330902 - Sault Ste. Marie			28.0	27.0	25.4	23.2	25.1	33.6		*
260330903 - Bay Mills							11.1	33.2		*
260430002 - Channing							18.4	24.7		*
260490021 - Flint	32.8	32.2	38.0	30.8	32.2	27.9	35.9	26.7	25.1	29.23
260650012 - Lansing #1	34.6	37.2	37.2	32.8	29.0	29.4	38.1	28.3	29	31.8
260650012 - Lansing #2	36.8	35.3	40.4	30.1	28.9	6.2				*
260710001 - Crystal Falls							13.9	15.1		*
260770008 - Kalamazoo #1	38.0	35.5	40.0	32.3	36.9	27.3	33.3	29.1	29.2	30.5
260770008 - Kalamazoo #2	38.7	36.5	36.0	32.0	35.7	28.9	31.5	29.1	32.5	31
260810007 - Grand Rapids									29.7	*
260810020 - Grand Rapids #1	38.8	40.5	43.5	35.1	35.0	31.8	44.7	33.2	29.7	**35.87**
260810020 - Grand Rapids #2	39.3	28.1	39.4	32.4	29.6	30.5	45.6	31.5	31.7	**36.3**
260990009 - New Haven	31.9	33.2	42.0	35.6	31.8	31.9	41.5	34.4	29	34.97
261010922 - Manistee								25.9	26.5	*
261130001 - Houghton Lake					23.6	21.0	30.8	21.6	23.2	25.2
261150005 - Luna Pier		37.2	39.2	42.7	34.7	35.0	49.3	32.6	32.2	**38.03**
261210040 - Muskegon #1	38.1	35.0	34.9	29.8	36.3	32.7	41.0	29.8	28.1	32.97
261210040 - Muskegon #2	39.1	23.5								*
261250001 - Oak Park	42.8	40.7	39.4	38.4	36.6	32.5	52.2	33.0	35.3	**40.17**
261390005 - Jenison	38.7	33.7	35.0	36.8	31.0	30.9	42.3	30.2	28.1	33.5
261450018 - Saginaw #1	31.0	27.5	34.6	26.0	26.8	27.4	37.8			*
261450018 - Saginaw #2	34.3	28.4	10.3							*
261470005 - Port Huron #1	44.5	33.1	40.5	35.3	37.2	32.2	47.6	37.9	36.3	**40.6**
261470005 - Port Huron #2			35.9	37.7	38.0					*
261530001 - Seney Nat'l Wildlife			26.0	18.0	15.8					*
261610005 - Ann Arbor	38.2	33.1	38.5	31.3	33.3	28.4	39.1			*
261610008 - Ypsilanti #1	40.6	30.3	39.7	30.9	38.8	31.5	52.1	31.3	34.5	**39.3**
261610008 - Ypsilanti #2			39.0	32.6	32.5	31.2	54.6	33.0	30.6	**39.4**
261630001 - Allen Park #1	49.0	41.8	48.3	39.6	40.5	36.9	43.0	34.1	31	**36**
261630001 - Allen Park #2	44.1	34.6	40.1	30.9	39.2	33.8	58.0	34.2	36.2	**42.8**
261630015 - Detroit - W. Fort St.	50.2	44.5	42.9	38.2	33.6	36.0	49.7	36.2	34	**39.97**
261630016 - Detroit - Linwood	51.7	44.0	46.0	42.7	46.2	38.3	51.8	36.9	34.3	**41**
261630019 - Detroit - E Seven Mile		42.0	42.0	34.4	37.1	35.0	52.3	36.2	31.9	**40.1**
261630025 - Livonia	38.4	35.9	44.7	32.7	38.1	32.2	40.2	30.4	32.8	34.47
261630033 - Dearborn	45.1	45.1	43.2	45.7	42.8	39.4	50.2	43.1	36.6	**43.3**
261630036 - Wyandotte	45.0	42.7	46.6	34.1	34.8	32.3	46.7	33.2	28.6	**36.17**
261630038 - Detroit - Newberry							57.5	28.6	33.4	**39.8**
261630039 - Detroit - W. Lafayette							43.9	32.4	34.8	**37**

*The 2005-2007 mean cannot be calculated as there is not three years worth of data or monitoring ended prior to 2007.

[24] The 98TH percentile value was obtained from the EPA AQS. For the purpose of comparing calculated values, the three-year 24-hour average is rounded to the nearest 1 $\mu g/m^3$.

The following **Figures 2.5-8** through **2.5-12** shows the current annual mean $PM_{2.5}$ trend for each monitoring site in Michigan for the years monitoring was conducted. As shown in **Figure-2.5-8**, 2007 levels in Wayne County have remained below the standard except for the Dearborn site. However, after the three-year annual means are calculated, Dearborn (17.2 µg/m) and Detroit's W. Fort sites (15.5 µg/m) did not meet the annual $PM_{2.5}$ NAAQS. Historically (since 1999), the Dearborn and W. Fort monitoring sites have continually been above the $PM_{2.5}$ NAAQS with Dearborn having the highest readings in the state.

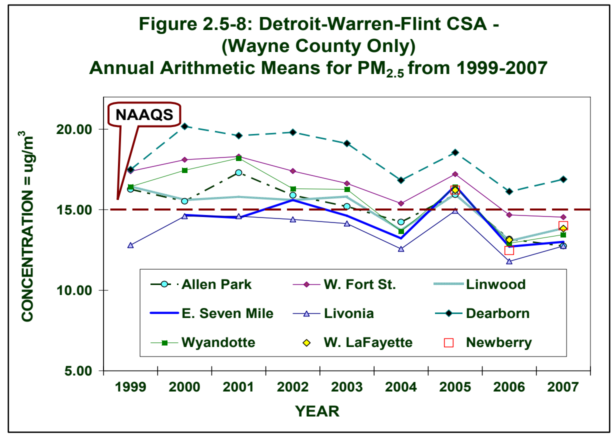


Figure 2.5-8: Detroit-Warren-Flint CSA - (Wayne County Only) Annual Arithmetic Means for $PM_{2.5}$ from 1999-2007

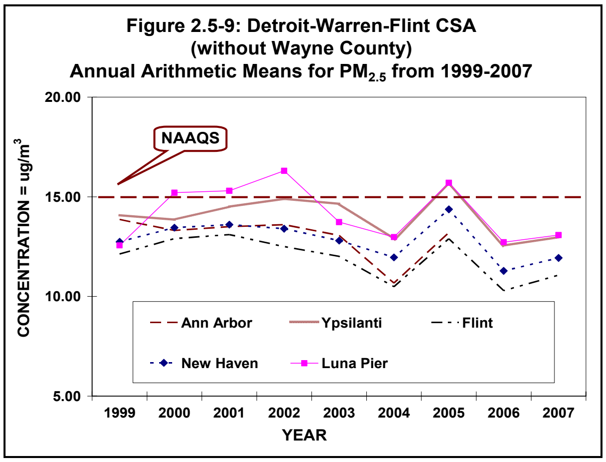


Figure 2.5-9: Detroit-Warren-Flint CSA (without Wayne County) Annual Arithmetic Means for $PM_{2.5}$ from 1999-2007

Figure 2.5-9 contains the remainder of those sites in the Detroit-Warren-Flint CSA's that are outside of Wayne County. These sites also show yearly readings in 2007 below the $PM_{2.5}$ standard and after the three year annual mean is averaged, they remain below the current $PM_{2.5}$ NAAQS.

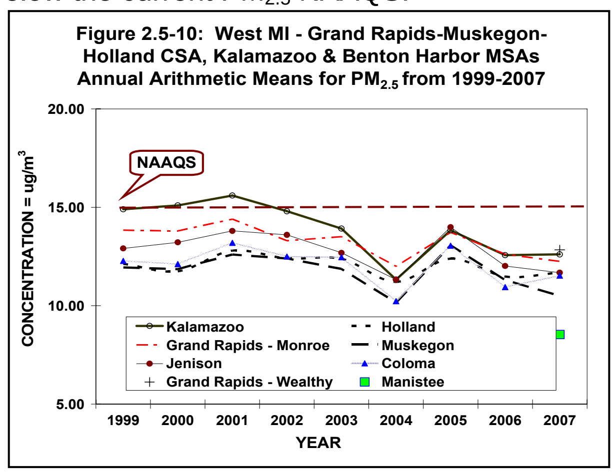


Figure 2.5-10: West MI - Grand Rapids-Muskegon-Holland CSA, Kalamazoo & Benton Harbor MSAs Annual Arithmetic Means for $PM_{2.5}$ from 1999-2007

Figure 2.5-10 combines the $PM_{2.5}$ monitoring sites located in West Michigan. As shown, all sites in West Michigan have been below the annual $PM_{2.5}$ NAAQS since 2002.

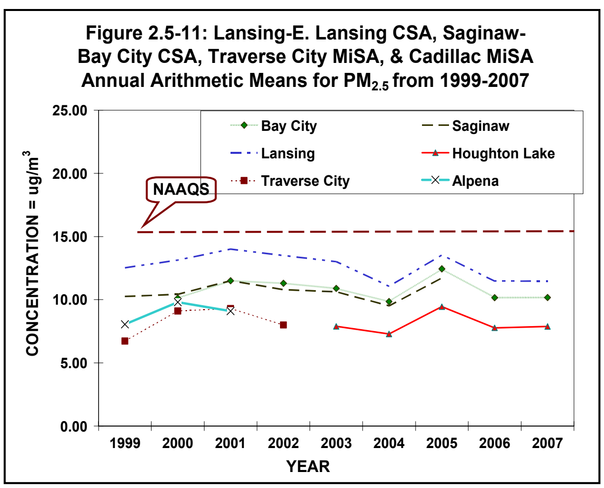


Figure 2.5-11: Lansing-E. Lansing CSA, Saginaw-Bay City CSA, Traverse City MiSA, & Cadillac MiSA Annual Arithmetic Means for $PM_{2.5}$ from 1999-2007

Figure 2.5-11 displays the remaining monitoring sites operational in Michigan's Lower Peninsula. As shown, all these sites have 2007 levels below the standard and their three-year averages (except for Manistee as it has only two years' worth of monitoring data) have also remained below the annual $PM_{2.5}$ NAAQS.

Figure 2.5-12 contains those sites that were located in Michigan's Upper Peninsula. However, no $PM_{2.5}$ monitoring by the MDEQ was conducted for 2007. As noted, all sites had levels below the $PM_{2.5}$ standard.

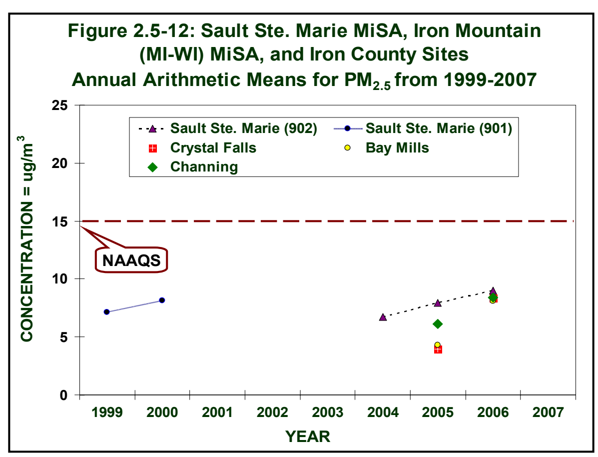


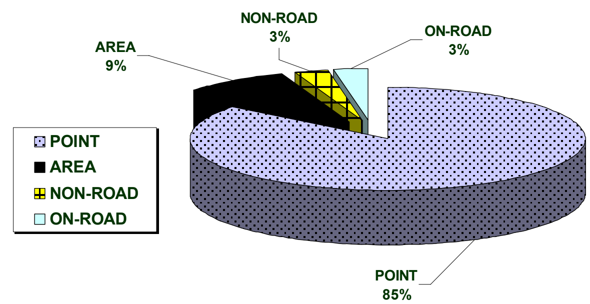
Figure 2.5-12: Sault Ste. Marie MiSA, Iron Mountain (MI-WI) MiSA, and Iron County Sites Annual Arithmetic Means for $PM_{2.5}$ from 1999-2007

CHAPTER 2.6: SULFUR DIOXIDE (SO_2)

According to EPA's 2002 EI data, **Figure 2.6-1** illustrates that point source emissions contribute 85% of the overall SO_2 emissions in Michigan. These point sources include:

- fossil fuel (coal) combustion,
- chemical and allied product manufacturing,
- metals processing,
- petroleum and related industries,
- incineration, and
- other industrial processes.

Figure 2.6-1: Percentage of SO_2 Emissions in Michigan By Source Type (EPA 2002 Emissions Inventory Data)

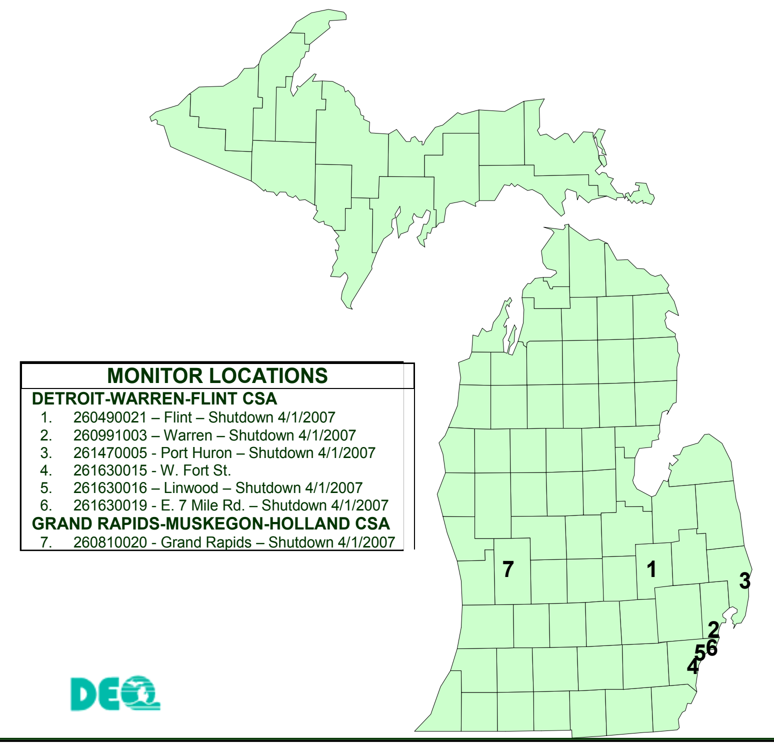


Michigan has been in attainment for SO_2 since 1982, with levels consistently well below the SO_2 NAAQS. Under the 2007 revised monitoring regulations, SO_2 monitoring is no longer required.

SO_2 MONITORING IN MICHIGAN:

For 2007, **Figure 2.6-2** shows that there were seven SO_2 monitors in operation in Michigan. However, because of EPA's 2006 monitoring requirements and MDEQ budgetary concerns, six of the SO_2 monitoring sites were deactivated on April 1, 2007. Only the W. Fort Street monitor in Detroit remained in operation for all of 2007.

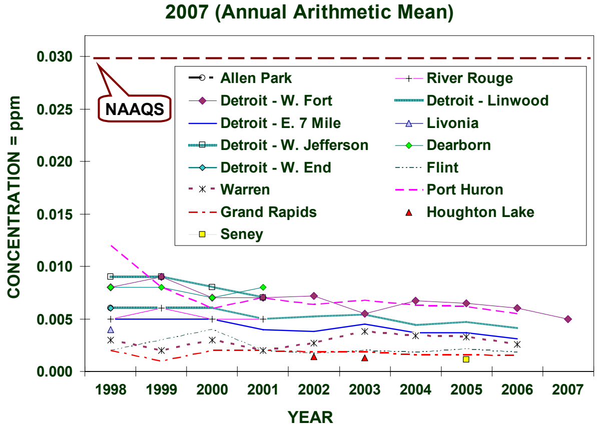
FIGURE 2.6-2: SO_2 MONITORS ACTIVE IN 2007



SO_2 TRENDS BY LOCATION:

Figure 2.6-3 only shows the W. Fort Street monitor as it is the only monitor in 2007 with one year's worth of SO_2 data. As shown, the W. Fort Street monitor has technically monitored the highest SO_2 levels in Michigan. In 2007, as in past years, recorded SO_2 levels were well below the NAAQS.

Figure 2.6-3: SO_2 Levels in Michigan from 1998-2007 (Annual Arithmetic Mean)



CHAPTER 3: TOXIC AIR POLLUTANTS

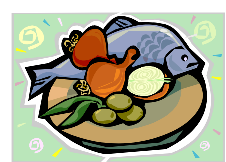
In addition to the six criteria pollutants discussed in the previous chapters, the AQD monitors a wide variety of substances classified as toxic air pollutants (air toxics), also known as hazardous air pollutants (HAPs). The exact compounds and substances included in this category are determined by the various state and federal regulations that address these materials. For example, under the CAA, the EPA specifically addresses a group of 187 HAPs. In Michigan, under the state's air regulations, toxic air contaminants (TACs) are defined as all non-criteria pollutants that may be "…harmful to public health or the environment when present in the outdoor atmosphere in sufficient quantities and duration." The definition of TACs goes on to list 41 substances which are *not* TACs, indicating that all others *are* TACs.

In general, air toxics can be categorized as metals, organic substances, and other substances. Examples include benzene (found in gasoline), perchlorethlyene (emitted from some dry cleaning facilities), and methylene chloride (a solvent and paint stripper used by industry). Examples of metals include aluminum, arsenic, beryllium, barium, cadmium, chromium, cobalt, copper, iron, mercury, manganese, molybdenum, nickel, lead, vanadium, and zinc. The organic toxics classification can be divided into sub-categories that include volatile organic compounds (VOCs), carbonyl compounds (aldehydes and ketones), semi-volatile compounds (SVOCs), polycyclic aromatic hydrocarbons (PAHs)/polynuclear aromatic hydrocarbons (PNAs), pesticides, polychlorinated biphenyls (PCBs), and polycyclic organic matter. The other substances include asbestos, dioxin, and radionuclides such as radon.

With such a large, diverse group of substances that may be considered air toxics, regulatory agencies have developed shorter lists for the purpose of addressing particular concerns. For example, some initiatives have targeted those substances that are persistent, bioaccumulative and toxic (PBT), such as mercury which accumulates in body tissues. The EPA has developed an Integrated Urban Air Toxics Strategy with a focus on 33 substances (the Urban HAPs List).[25] Air toxics also pose a challenge due to monitoring and analytical methods that are either unavailable for some compounds or cost prohibitive for others (e.g., dioxins).

The evaluation of air toxics levels is also hindered by several additional factors. Unlike the six criteria pollutants, there are no health-protective NAAQS for the air toxics. Instead, air quality assessments utilize various short-term and long-term screening levels and health benchmark levels estimated to be safe considering the critical effects of concern for specific substances. This is made more difficult by the lack of complete toxicity information for many substances. For some air toxics, the analytical detection limits are too high to consistently measure the amount present; and in some cases, the risk assessment-based "safe" levels are below the detection limits. Another problem is that there are data gaps regarding the potential for interactive toxic effects for co-exposure to multiple substances present in emissions and in ambient air. These factors make it difficult to accurately assess the potential health concerns of air toxics. Nevertheless, it is feasible and important to characterize the potential health hazards and risks associated with air toxics.

EXPOSURE AND HEALTH EFFECTS OF AIR TOXICS



Air toxics are known or suspected to cause cancer or other serious health effects (e.g., reproductive effects or birth defects). People are exposed to air toxics in many ways, such as breathing contaminated air (e.g., industrial emissions), eating contaminated food products from animals that feed on contaminated plants (fish, meat, milk, eggs, etc.), drinking from contaminated waters, or by making contact with contaminated soil, dust, or water.

[25] EPA's Air Toxics Website – Urban Strategy is located at http://www.epa.gov/ttn/atw/urban/urbanpg.html.

Once air toxics enter the body, there is a wide range of potential health effects. Examples include: the aggravation of asthma; irritation to the eyes, nose, and throat; carcinogenicity; developmental toxicity; nervous system effects; and various other effects on internal organs. Some substances have one "critical" effect, while others may have several. Some effects appear with a short period of exposure, while others may appear after long-term exposure or after a long period of time has passed since the exposure ended; and, most toxic effects are not unique to one substance. Also, some effects may be of concern only after the substance has deposited to the ground or to a water body (e.g., mercury, dioxin) followed by exposure through an oral pathway such as the eating of fish or produce, further complicating the assessment of air toxics concerns due to the broad range of susceptibility that various people may have.

NATIONAL MONITORING EFFORTS AND DATA ANALYSIS

The EPA administers national programs that identify air toxics levels, detect trends, and prioritize air toxics research. The MDEQ participates in these programs through the submission of air emission data. This emission data, submitted to the national EI database, forms the bulk of raw data that is used in EPA's National-Scale Air Toxics Assessment (NATA). In addition, the AQD operates a site in Dearborn that is part of EPA's National Air Toxics Trend Stations (NATTS). These programs are described below.

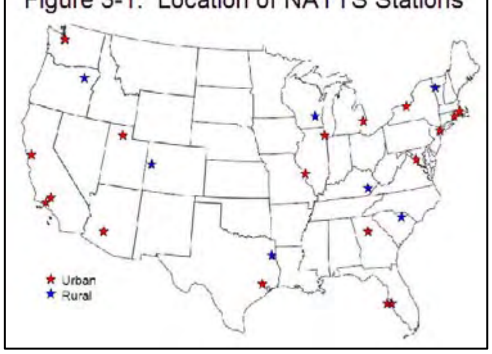
NATA: The EPA researched and authored the NATA study to identify and prioritize air toxics, emission source types and locations which are of greatest potential concern in terms of contributing to population risk. In 2006, EPA released the results of the NATA for the 1999 air toxics emissions.[26] The NATA 1999 study includes 177 air toxics plus diesel PM. The assessment follows four steps:

1. Compiling a national emissions inventory of air toxics emissions from outdoor sources including large sources such as waste incinerators and factories, and smaller sources such as dry cleaners, small manufacturers, and wildfires. Also included are emissions from highway and non-road mobile sources, such as cars, trucks and boats.
2. Estimating ambient concentrations of air toxics across the U.S.
3. Estimating population exposures across the contiguous U.S.
4. Characterizing potential public health risk due to inhalation of air toxics including both cancer and non-cancer effects.

The NATA is intended to provide state, local, tribal and other agencies with a better understanding of the risks from inhalation exposure to toxic air pollutants from outdoor sources. EPA intends to continue updating the NATA study every three years. At the time of this writing, EPA was still in the process of drafting the next version of NATA, using the 2002 emissions data. As of September 2008, EPA expected the NATA 2002 version to become available in the summer of 2009.

NATTS: The purpose of the NATTS network is to detect trends in high-risk air toxics such as benzene, formaldehyde, chromium, and 1,3-butadiene and to measure the progress of air toxics regulatory programs at the national level. Currently, the NATTS network contains 25 stations (18 urban, 7 rural) with one located in Dearborn (see **Figure 3-1**). The EPA requires that the NATTS sites measure VOCs, carbonyls, and trace metals on a once every six day sampling schedule. The Dearborn site also measures trace metals as both TSP and $PM_{2.5}$ along with the required PM_{10} metals. In 2007, EPA decided to measure PAHs, at NATTS sites, which should start sometime in 2008.

Figure 3-1: Location of NATTS Stations



[26] The 1999 study is available at http://www.epa.gov/ttn/atw/nata1999/.

MICHIGAN TOXICS AIR MONITORING PROGRAM

Data on the ambient levels of air toxics are needed to assess potential exposure levels. In 1990, the Michigan Toxics Air Monitoring Program (MITAMP) was established with the purpose of determining the ambient air levels and long-term trends of air toxics in urban areas. MITAMP also includes a background site near Houghton Lake for comparison purposes. Since the MITAMP's inception, more than 50 toxic organic compounds and up to 15 trace metals have been routinely monitored at various urban locations throughout the state.[27]

To collect MITAMP data, the AQD operates monitors using sampling techniques specifically designed for pollutants of interest. High-volume sampler filters are used to collect metals, evacuated steel canisters are used to sample for VOCs, and carbonyl cartridges are used for aldehydes and ketones. On a non-routine basis, samplers using polyurethane foam and other sorbents are used to collect SVOCs, PCBs, etc.

Figure 3-2 shows there were 13 MITAMP stations where air toxics were measured in 2007.[28] The Dearborn site (a NATTS site) measures all air toxics that are monitored in the state, including all 14 trace metals. The W. Fort monitor is MDEQ's long-term toxics trend site for VOC and carbonyl sampling. On April 1, 2007, due to budget cuts, the trace metal monitoring network was reduced. In the case of the Flint site, only manganese is being monitored. For the Allen Park, River Rouge, W. Fort, and W. Jefferson sites, trace metal monitoring was reduced from 14 to 4 (manganese, arsenic, cadmium, and nickel). Carbonyl sampling is still being performed at River Rouge and VOC and carbonyl sampling continues at W. Fort Street. Sites that were completely shut down for VOCs, carbonyls, and trace metals included Houghton Lake (background site), Grand Rapids, Ypsilanti, and E. Seven Mile.

FIGURE 3-2: MITAMP MONITORS ACTIVE IN 2007

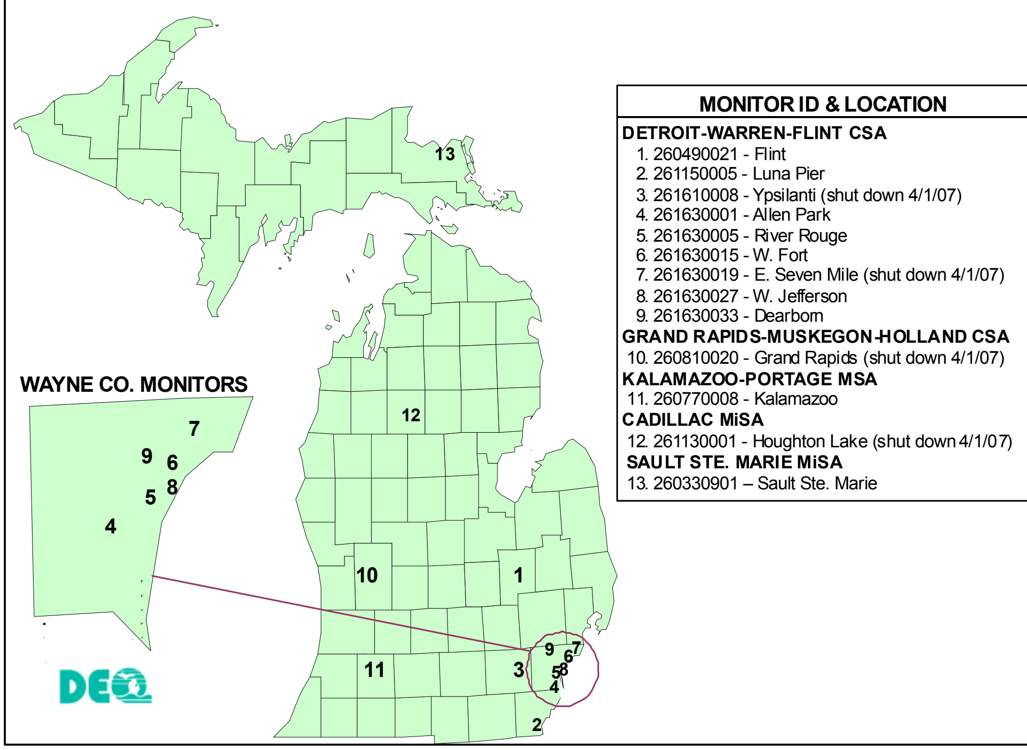


Table 3-1 shows the type of monitoring conducted at all the MITAMP stations.

[27] Some of the MITAMP sites only measure trace metals and some measure only carbonyls and metals.
[28] The Sault Ste. Marie site is a tribal site and is not managed by the AQD.

Table 3-1: Air Toxics Measured in 2007 with Last Month Sampled

AIRS ID – SITE NAME	VOCS	CARBONYLS	METALS TSP*	METALS PM_{10}	SPECIATED $PM_{2.5}$	SVOCS
260330901 - Sault Ste. Marie						Dec
260490021 - Flint			March			
260770008 – Kalamazoo					Dec	
260810020 - Grand Rapids - Monroe	March	March	March		Dec	
261130001 - Houghton Lake	March	March	March		Dec	
261150005 - Luna Pier					Dec	
261610008 - Ypsilanti	March	March	March		Dec	
261630001 - Allen Park			March/Dec		Dec	
261630005 - River Rouge		Dec	March/Dec			
261630015 - Detroit - Fort Street	Dec	Dec	March/Dec			
261630019 - Detroit – E. Seven Mile			March			
261630027 – Detroit – W. Jefferson			March/Dec			
261630033 - Dearborn	Dec	Dec	Dec	Dec	Dec	

* Metals-TSP: Arsenic, Cadmium, Manganese and Nickel were monitored for a full year. The other metals were only monitored through March.

The summarized analytical results for trace metals, VOCS, SVOCs, and carbonyl compounds for the MITAMP stations listed above are provided in **Appendix C1**. **Appendix C2** has the summaries of speciated $PM_{2.5}$ analytical results. **NOTE**: A decrease in state and federal monies available for air monitoring necessitated decreases in the number of air samples collected during 2007.

OTHER MICHIGAN AIR TOXICS DATA ANALYSIS EFFORTS

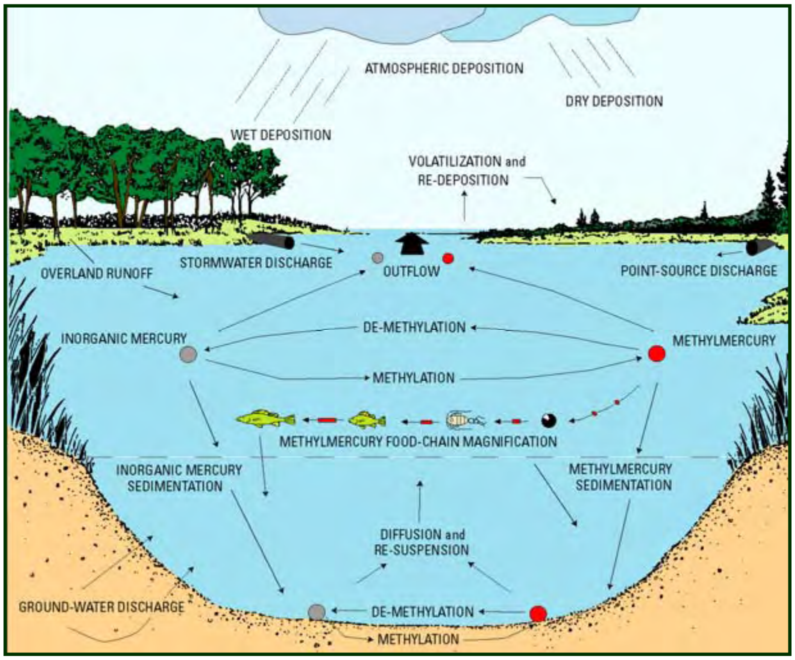
Detroit Air Toxics Initiative (DATI): Air toxics monitoring in Michigan has shown that air toxics levels are generally higher in large urban areas, such as Detroit, than in small cities or rural areas. The DATI, funded by an EPA 2003 Community Assistance and Risk Reduction Initiative grant, was a risk assessment and risk reduction project based on the Detroit pilot project's 2001-2002 air toxics monitoring data. The AQD finalized the DATI Risk Assessment Report, along with a Technical Summary and Public Summary of that report in 2005.[29] The AQD continues to monitor air toxics in the Detroit area in response to the DATI findings. This monitoring will determine whether the levels of air toxics have changed since the 2001-2002 data, or if some substances remain at levels of concern. The AQD is in the process of performing an abbreviated update of the risk assessment portion of DATI for the 12-month period of March 2006 through March 2007.

PERSISTENT, BIOACCUMULATIVE TOXICS (PBTS):

Many toxic air pollutants are of concern because they may pose health risks to people breathing air contaminated with these pollutants. A subset of these pollutants, known as PBTs, may not occur at levels high enough in the ambient air to cause concern from direct inhalation, but may pose a health risk through indirect exposure to persistent air pollutants that have been deposited. Such indirect exposures can occur from various routes, such as ingesting contaminated water, soil, meat, dairy products, or fish. Examples of effects that can result from sufficiently high levels or duration of exposure to PBTs include cancer, developmental and reproductive toxicity, and other effects in humans and wildlife.

[29] The DATI reports are available on the MDEQ AQD's website at http://www.michigan.gov/deqair.

FIGURE 3-3: ATMOSPHERIC DEPOSITION

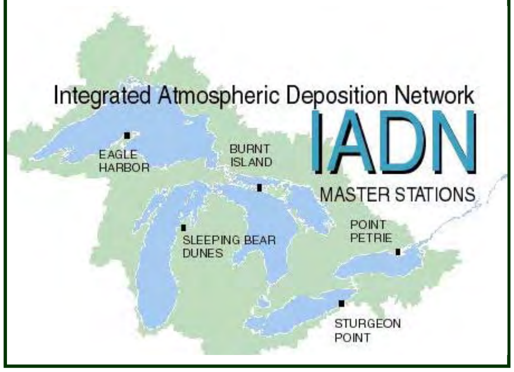


PBTs enter the environment through a variety of sources including atmospheric deposition (**Figure 3-3**). Atmospheric deposition has been shown to be the most significant source of PBTs to remote inland lakes and to some of the Great Lakes.[29] Typically, atmospheric deposition of PBTs to the environment occurs via three processes, including:

- *Wet Deposition* refers to gases and particles carried in precipitation (rain, snow, fog, and sleet) that are deposited on land and water surfaces.
- *Dry Deposition* refers to pollutants bound to PM that are deposited on water and land surfaces in the absence of precipitation.
- *Gas Absorption or Exchange* refers to pollutants in a gaseous state that cross the air-water interface, and are absorbed in the water column by gas transfer.

Deposition is one of the crucial elements largely responsible for contamination of lakes and streams by some types of pollutants, including mercury and PCBs. Additionally, deposition of certain pollutants like dioxin can contribute to elevated levels in soils, crops, and meat/dairy products. The following discusses EPA's Integrated Atmospheric Deposition Network (IADN) within the Great Lakes Basin.

FIGURE 3-4: IADN



IADN: The EPA and Canada have established a limited monitoring network within the Great Lakes Basin in response to the 1990 CAA and the 1987 amended Great Lakes Water Quality Agreement - Annex 15. The IADN (**Figure 3-4**) was mandated to assess the extent of atmospheric deposition of HAPs to the Great Lakes. Two sites were established in Michigan as part of this network with one located in Sleeping Bear Dunes on the Lake Michigan shoreline and the other is at Eagle Harbor on the Lake Superior shoreline in the Keweenaw Peninsula.

At the IADN sites, precipitation and air samples are collected and analyzed for trace metals including Pb, arsenic and cadmium, as well as PCBs, PAHs, and pesticides including lindane, dieldrin, dichlorodiphenyltrichloroethane (DDT), and endosulfan. This data has been summarized in several published articles.[30]

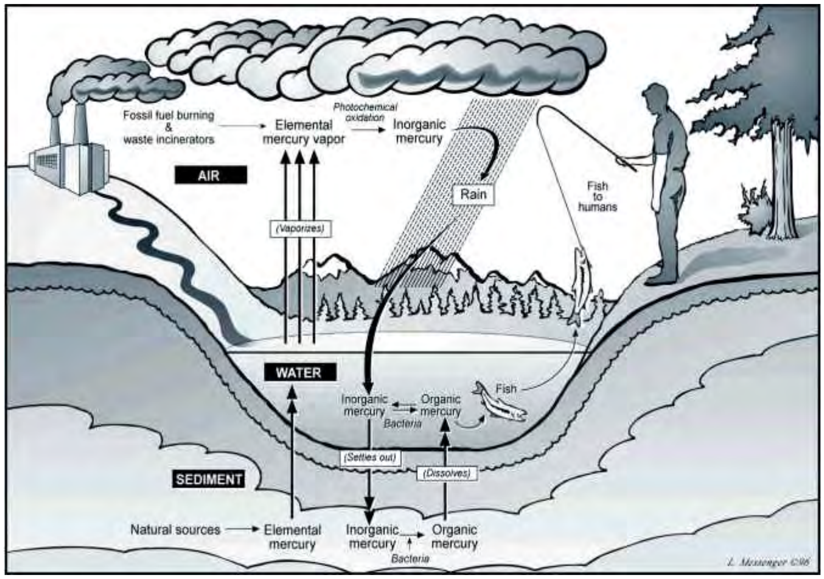
[29] Reference documents: (1) Deposition of Air of Pollutants to the Great Waters. First Report to Congress [GEPA-453/R-93-055, May 1994]; (2) Monitoring the Great Lakes - Metal Concentrations in Sediments. [EPA-R995233, January 1996]; and (3) Atmospheric Cycling and Air-Water Exchange of Mercury over Mid-Continental Lacustrine Regions. 1991. [Water, Air, and Soil Pollution 56:745].

[30] Reference documents: (1) Atmospheric Deposition of Toxic Pollutants to the Great Lakes As Measured by the Integrated Atmospheric Deposition Network, 1998 [Environmental Science & Technology 32 (10) 2216] and (2) Atmospheric Monitoring of Toxic Pollutants in the Great Lakes. EPA 1998. Available at http://www.epa.gov/glnpo/monitoring/air/iadn/atmospheric_monitoring_old.htm

The IADN serves as an important tool in establishing background concentrations of PBTs and in assessing atmospheric deposition temporal trends for the PBTs listed above. Due to resource constraints, sampling and analysis for mercury and dioxins/furans have not been conducted routinely at the IADN sites.

Mercury: A naturally occurring element found in air, water and soil, mercury is also used in a wide variety of products and can be released from various sources. For Michigan, the largest industrial source of mercury air emissions is coal-fired power plants. When certain forms of mercury emissions settle in aquatic systems, mercury can then be converted into methylmercury that can eventually build up in fish tissue. The primary route of exposure for the general public is through the consumption of certain fish that contain methylmercury in the fish tissue (**Figure 3-5**).[31]

FIGURE 3-5: THE MERCURY CYCLE



Mercury has been targeted for source identification, reduction, and elimination through various state, federal, and internation efforts. The MDEQ was directed by Governor Granholm to pursue the reduction and phase-out of mercury emissions from coal-fired power plants, along with reductions of NO_X (a precursor to both $PM_{2.5}$ and O_3), SO_2 (a precursor to the formation of $PM_{2.5}$ and NO_X), and carbon dioxide (CO_2).

The AQD initiated the creation of the Michigan Mercury Electric Utility Workgroup for Mercury Emissions from Coal-Fired Power Plants in 2003. This workgroup consisted of MDEQ and Michigan Public Service Commission staff; representative from utilities potentially impacted by the workgroup recommendations; and representatives from environmental, scientific, and public policy groups. The workgroup's report along with their recommendations was finalized on June 21, 2005.[32] This report also includes detailed information on:

- background, sources, and uses of mercury;
- its impacts to health, environment, and recreation;
- Michigan's monitoring efforts and regulatory programs;
- mercury emissions, deposition and modeling, including a mercury emissions inventory;
- federal and other states/regional regulations;[33]
- energy choices and policy development;

[31] The Michigan Department of Community Health's 2007 Michigan Family Fish Consumption Guide, available at http://www..michigan.gov/documents/FishAdvisory03_67354_7.pdf and provides consumption advice by waterbody, fish species, and fish length.
[32] The Michigan's Mercury Electric Utility Workgroup Final Report on Mercury Emissions from Coal-Fired Power Plants is available at http://www.deq.state.mi.us/documents/deq-aqd-air-aqe-mercury-report.pdf.
[33] In 2005, EPA addressed mercury emissions with the Clean Air Mercury Rule (CAMR), which established an emissions cap and a schedule to reduce mercury emissions from coal-fired power plants (now vacated).

- along with controls, costs, methodologies and other issues associated with mercury reduction programs from coal-fired utilities.

In January 2005, the MDEQ convened the Mercury Strategy Workgroup consisting of a team of MDEQ staff representing multi-media mercury programs, following a directive from MDEQ Director Chester to develop "consistent priorities and goals related to mercury policies, regulations, legislation, monitoring, sources, and outreach efforts." The MDEQ Mercury Strategy Staff Report along with its Appendices contains 67 action steps to reduce anthropogenic mercury use and releases in Michigan, with implementation of the strategy to begin utilizing the top ten recommendations listed.[34]

On April 17, 2006, Governor Granholm announced that the MDEQ will develop a regulation that requires Michigan's coal-fired electric utilities to reduce their mercury emissions by 90% by 2015. The governor asked that the rule take into account both technological and cost-based considerations. The recommendation for development of a rule to reduce mercury emissions from coal-fired electric utilities is encompassed in the MDEQ Mercury Strategy Staff Report. A Mercury Rules Workgroup was created and a proposed rule was drafted. The MDEQ is currently reviewing comments received during the public hearing and public comment period.[35]

THE GREAT LAKES REGIONAL COLLABORATION

In May 2004, President Bush issued an Executive Order creating the federal Great Lakes Interagency Task Force to promote a regional collaboration of national significance for the Great Lakes. Members of the federal Great Lakes Interagency Task Force, the Council of Great Lakes Governors, the Great Lakes and St. Lawrence Cities Initiative, Great Lakes tribes (represented by the Great Lakes Indian Fish and Wildlife Commission) and the Great Lakes Congressional Task Force convened a group known as the Great Lakes Regional Collaboration (GLRC). President Bush initiated the GLRC to improve federal coordination of Great Lakes programs and for the EPA to convene a "regional collaboration of national significance; to create a national agenda for the Great Lakes." The GLRC is furthering efforts to identify and eliminate or reduce PBTs in the Great Lakes Basin. A key recommendation (that addresses PBTs) crafted by the strategy teams for the GLRC that developed a GLRC Strategy includes a recommendation to:

> Reduce and virtually eliminate the discharge of mercury and other toxic substances to the Great Lakes; institute a comprehensive research, surveillance and forecasting capability; create consistent, accessible basin-wide messages on fish consumption and toxic reduction methods and choices; and support efforts to reduce continental and global sources of toxics to the Great Lakes (see Toxic Pollutants Initiative).

The strategy teams developed the recommendations that form the basis of the report titled, "Great Lakes Regional Collaboration Strategy to Restore and Protect the Great Lakes," released on December 12, 2005, which calls for the continued reduction and virtual elimination of persistent toxic substances such as mercury in the basin. MDEQ is currently developing a framework for Michigan's Great Lakes Restoration and Protection that will include recommendations to address PBTs.

Although MDEQ does not have funding to support an extensive monitoring network for PBTs, a few short-term studies have been conducted to better understand the levels of PBTs, specifically addressing mercury in the atmosphere and to assess loadings. The following is a brief summary of these on-going studies:

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[34] The Strategy Report is available at http://www.michigan.gov/deq by clicking on the mercury icon on the left side of the webpage.
[35] Additional information can be found on the AQD's website at http://www.michigan.gov/deqair.

- In 2000, the MDEQ, the Minnesota Pollution Control Agency, and the Wisconsin Department of Natural Resources applied for and received a grant from EPA's Great Lakes National Geographic Initiative to identify and quantify sources of mercury to the atmosphere within the three Great Lakes' states. MDEQ's AQD was responsible for administering the funds which included the design and building of a mobile mercury laboratory, housed in a climate-controlled trailer, complete with a generator, two Tekran 2537A mercury vapor analyzers, meteorological monitoring equipment, data loggers, and a computer for data compilation and analysis.[36] This "Tekran" mercury trailer was then shared and continues to be shared on a rotation basis among the three states for quantifying mercury emissions from:

TEKRAN MERCURY TRAILER

  - manufacturing facilities (thermometers, chlor-alkali),
  - scrap metal yards and shredders,
  - mercury recyclers (fluorescent bulbs, smelters, and other materials),
  - solid waste processing facilities,
  - medical waste autoclaves,
  - land-applied wastes (sewage sludge, wood ash, coal ash),
  - taconite tailings basins,
  - control soils, and
  - parking lots.

  In addition, the funding also allowed the purchase and sharing of two portable Lumex RA 915+ mercury vapor analyzers. The three states assist local health departments in providing use of the Lumex to facilitate quantification of mercury concentrations in homes or businesses where mercury was spilled. The final grant report titled, Identification of Atmospheric Mercury Sources in the Great Lakes States Through an Ambient Monitoring Program was finalized in November 2003.[37]

  The mercury monitoring equipment continues to be used in Michigan. In 2005, the monitoring equipment was used to assess the fugitive elemental mercury emissions from steel mills, an aluminum smelter, a dental amalgam manufacturer, a fluorescent bulb crusher, and a metal shredder. A final report documenting this work has been drafted and is available on AQD's website. Several applications of the trailer have continued in 2007 in all three states.

- The AQD, partnering with the University of Michigan (U of M), were awarded grants from the Michigan Great Lakes Protection Fund and the EPA's Great Lake Atmospheric Deposition (GLAD) program administered by the Great Lakes Commission to develop a mercury monitoring network. The project began in the fall of 2001. Because Michigan lacks long-term mercury data from urban areas, sites were established in three urban areas of Grand Rapids, Flint, and Detroit. In addition, the recording of long-term event-based mercury deposition continued at three rural sites in Michigan (Dexter, Pellston, and Eagle Harbor).[38]

  Preliminary data demonstrated the influence of local sources emitting mercury and the importance of speciated mercury monitoring to assess man-made source contributions to wet (e.g., rain) deposition of mercury. To allow trend analysis, the AQD and U of M received additional funding to extend this project through fall 2005.

[36] Reference: Identification of Atmospheric Mercury Sources in the Great Lakes' States through an Ambient Monitoring Program. 1999. MDEQ AQD; Minnesota Pollution Control Agency, Environmental Outcomes Division; and Wisconsin DNR, Bureau of Air Management.
[37] The final grant report is available on the AQD's website at http://www.deq.state.mi.us/documents/deq-aqd-toxics-Hgfinalreport.pdf.
[38] Reference: Taylor Morgan, J. and G. Keeler. 2000. Monitoring Atmospheric Mercury Species in Michigan. Michigan Great Lakes Protection Fund Proposal.

Recently, the U of M principle investigator received additional funding from the EPA's GLAD program to continue the project through the fall of 2007. This funding will support continued speciated monitoring of deposited atmospheric mercury using hybrid receptor modeling and compare the results with those of the models used by EPA. The sites coordinated by the U of M that continue to operate in Michigan are located at Grand Rapids, Pellston and Dexter.

While PBT air monitoring and atmospheric deposition studies have been conducted in the past several years, they were for a limited time frame and for a limited set of pollutants. These somewhat fragmented studies demonstrate the need for implementation of a comprehensive, continuous atmospheric deposition network within the state and region.

CHAPTER 4: MIAIR – AQD'S AIR QUALITY INFORMATION SERVICE

MIair is MDEQ's on-line air monitoring webpage that provides current air quality information as a public service. The webpage opens to the current AQI map and information plus air quality forecasts. **MIair** also hosts the automated EnviroFlash air quality notification system information and enrollment page; provides raw data from continuous air monitors in real-time; and shows static and animated O_3 and $PM_{2.5}$ maps. Webpage features are discussed in this chapter.

AIR QUALITY INDEX:

The AQI is a tool used by the MDEQ and the EPA to report current air quality data. The AQI is calculated using hourly data from continuous air monitors. The program sorts air concentrations into one of six, color-coded categories ranging from good to hazardous.[39] AQI values are presented in a table and by color-coded dots plotted on a Michigan map. MDEQ meteorologists provide a daily Forecast Discussion that helps keep citizens informed about upcoming air quality conditions. The AQI is a useful air health indicator, a tool for making decisions about daily activities.

The AQI uses a relative scale of 0 to 500 (shown in **Table 4-1**) to communicate pollutant levels. The higher the AQI value, the greater the pollution level and potential for health concerns, in terms of acute health effects over time periods of 24 hours or less. The AQI index does not provide an indication of chronic air pollution exposure over months or years, nor does it reflect additive, synergistic, or antagonistic health effects that may result from exposure from two or more air pollutants. Note that during 2008, the AQI values for $PM_{2.5}$ and O_3 concentrations were adjusted to align better with national ambient air quality standard changes.

Table 4-1: The AQI

		MAXIMUM POLLUTANT CONCENTRATION PER AQI CATEGORY DURING 2007						
AQI VALUE	**AQI DESCRIPTOR**	**$PM_{2.5}$ (24 hr) µg/m³**	**PM_{10} (24 hr) µg/m³**	**SO_2 (24 hr) ppm**	**O_3 (8 hr) ppm**	**O_3 (1 hr) ppm**	**CO (8 hr) ppm**	**NO_2 (1 hr) ppm**
401-500	Hazardous	500.4	604	1.004	→	0.604	50	2.04
301-400		350.4	504	0.804	→	0.504	40	1.64
201-300	Very Unhealthy	250.4	424	0.604	0.374	0.404	30	1.24
151-200	Unhealthy	150.4	354	0.304	0.124	0.204	15	0.64
101-150	Unhealthy for Sensitive Groups	65.4	254	0.224	0.104	0.164	12	-
51-100	Moderate	40.4	154	0.144	0.084	0.124	9	-
0-50	Good	15.4	54	0.034	0.064	-	4	-

[39] The AQI must not be confused with NAAQS that determine an area's compliance with provisions set forth in the federal CAA.

Table 4-2 identifies the AQI colors and the associated health statements by individual air pollutant.

Table 4-2: The AQI Colors and Health Statements

AQI COLOR, CATEGORY & VALUE	PARTICULATE MATTER ($\mu g/m^3$) 24-Hour	OZONE (ppm) 8-Hour / 1-Hour	CARBON MONOXIDE (ppm) 8-hour	SULFUR DIOXIDE (ppm) 24-hour	NITROGEN DIOXIDE (ppm) 1-hour
GREEN: Good 1-50	**None**	**None**	**None**	**None**	**None**
YELLOW: Moderate 51-100	Unusually sensitive people should consider reducing prolonged or heavy exertion	Unusually sensitive people should consider reducing prolonged or heavy exertion	**None**	**None**	**None**
ORANGE: Unhealthy for Sensitive Groups 101-150	People with heart or lung disease, older adults, and children should reduce prolonged or heavy exertion.	Active children and adults, and people with lung disease such as asthma, should reduce prolonged or heavy outdoor exertion.	People with cardiovascular disease, such as angina, should limit heavy exertion and avoid sources of CO, such as heavy traffic.	People with asthma should consider limiting outdoor exertion.	**None**
RED: Unhealthy 151-200	People with heart or lung disease, older adults, and children should avoid prolonged or heavy exertion. Everyone else should limit prolonged exertion.	Active children and adults, and people with lung disease such as asthma, should avoid pro-longed or heavy exertion. Everyone else, especially children, should reduce prolonged outdoor exertion.	People with cardiovascular disease, such as angina, should limit moderate exertion and avoid sources of CO, such as heavy traffic.	Children, asthmatics, and people with heart or lung disease should limit outdoor exertion.	**None**
PURPLE: Very Unhealthy 201-300	People with heart or lung disease, older adults, and children should avoid all physical activity outdoors. Everyone else should avoid prolonged or heavy exertion.	Active children and adults, and people with respiratory disease such as asthma, should avoid all outdoor exertion. Everyone else, especially children should limit outdoor exertion.	People with cardiovascular disease, such as angina, should avoid exertion and sources of CO, such as heavy traffic.	Children, asthmatics, and people with heart or lung disease should avoid outdoor exertion. Everyone else should limit outdoor exertion.	Children and people with respiratory disease, such as asthma, should limit heavy outdoor exertion.
MAROON: Hazardous 301-500	Everyone should avoid any outdoor exertion; people with heart or lung disease, older adults, and children should remain indoors.	Everyone should avoid all outdoor exertion.	People with cardiovascular disease, such as angina, should avoid exertion and sources of CO, such as heavy traffic. Everyone else should limit heavy exertion.	Children, asthmatics, and people with heart or lung disease should remain indoors. Everyone else should avoid outdoor exertion.	Children and people with respiratory disease, such as asthma, should limit moderate or heavy outdoor exertion.

Air quality in Michigan generally falls in the good or moderate range. An area will occasionally fall into the “unhealthy for sensitive groups” range, but rarely reaches unhealthy levels.

Appendix E contains pie charts created to show the AQI values for each of Michigan’s 2007 monitoring sites.

ACTION! DAYS:

Voluntary "actions" save money, improve air quality and protect health by reducing exposure when poor air quality is forecast. *Action!* Days are declared in Michigan when meteorological conditions are conducive for elevated ground-level O_3 – specifically, when 8-hour O_3 levels are expected to exceed the AQI health indicator. On *Action!* Days, business, industry, government, and the public are all encouraged to take voluntary action to reduce emissions that lead to the formation of O_3. Clean air choices include:

- avoiding vehicle refueling or choosing to refuel during the evening hours;
- omitting unnecessary travel;
- selecting alternative transportation options such as carpools, taking the bus, walking or biking; deferring the use of gasoline-powered lawn and recreation equipment;
- reducing energy use; and
- reducing the use of household solvents and cleaners.

Table 4-3 shows that during the summer of 2007, a total of six ACTION! DAYS were declared in Michigan.[40]

Table 4-3: 2007 *Action!* Day Information

Location	Year	Number	Dates
Ann Arbor	2007	2	6/18, 8/2
Benton Harbor	2007	5	6/16, 6/18, 8/1, 8/2, 8/28
Detroit	2007	3	6/18, 8/1, 8/2
Eastern U.P.	2007	0	
Flint	2007	2	6/18, 8/2
Grand Rapids	2007	6	6/16, 6/18, 8/1, 8/2, 8/28, 9/5
Houghton Lake	2007	0	
Kalamazoo	2007	3	6/16, 6/18, 8/2
Lansing	2007	2	6/18, 8/2
Ludington	2007	4	6/18, 8/2, 8/28, 9/5
Saginaw	2007	1	6/18
Traverse City	2007	1	6/18

AIR QUALITY NOTIFICATION:

Air quality forecasts and near real-time AQI data are available for the public when they access the **MIair** or EPA's AIRNow webpage (discussed at the end of this chapter). EnviroFlash is a free service that sends automated notifications directly to subscribers via computer e-mail or mobile text messaging. This is available for $PM_{2.5}$ and ground level ozone. Users select the health level at which they want to be notified. Parents with small children, family members with asthma (or other health problems), and people who experience increased respiration due to strenuous outdoor work or exercise usually select notification at the "unhealthy for sensitive groups" level. This provides the ability to adjust daily activities when poor air conditions are expected. People enrolled in EnviroFlash get only the information they choose to receive sent directly to their computer e-mail or mobile phone with text messaging.

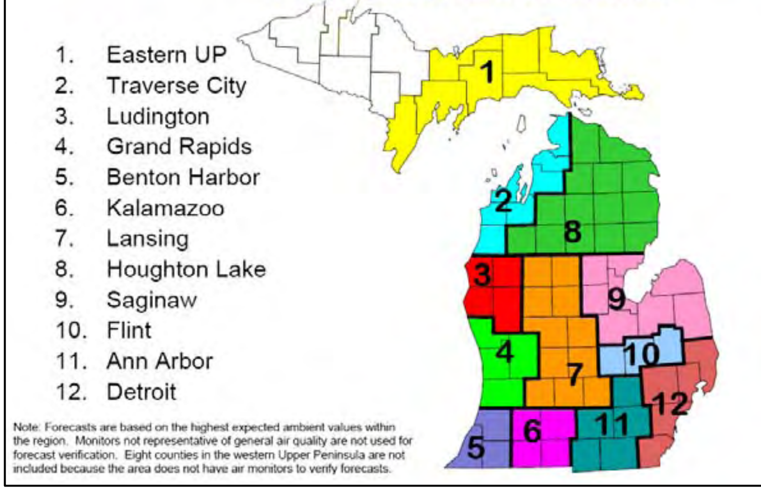
[40] More information is available under the Action Day tab in **MIair** at http://www.deqmiair.org/.

EnviroFlash is available in many areas across the nation. The Michigan network has the potential to reach 98% of the state's population as shown in **Figure 4-1**.

EnviroFlash also offers UV (ultraviolet) radiation forecast notifications provided by the National Weather Service and EPA. Note: Stratospheric ozone depletion and seasonal weather variation cause varying amounts of UV radiation to reach the Earth. Exposure to UV radiation can lead to skin cancer.

To sign-up for EnviroFlash notices and to learn more about this program, go to www.michigan.gov/deqair and select EnviroFlash or **MIair**.

Figure 4-1: Map of Michigan Air Quality Forecast Locations



MONITORING DATA, MAPS AND OTHER LINKS:

Monitoring Data Hourly raw air quality and meteorological measurements from monitoring sites across Michigan are reported in end-hour local time. Continuous monitor data for O_3 (collected from April through September), $PM_{2.5}$, CO, SO_2, NO_2 temperature, wind direction, and wind speed are graphed and can be viewed in near real-time. Past air data is also available.

Ozone Maps The O_3 season runs from April through September. Current day 8-hour average O_3 concentrations are reported as an average of the previous eight hourly values. Current data is reported in end-hour local time. Past data are reported in beginning-hour standard time. The choice to animate the data map is available. After the ozone season has ended, past data and maps can still be viewed using the calendar feature (remember to mouse click on "go" after selecting the date).

$PM_{2.5}$ Maps The current 24-hour average $PM_{2.5}$ concentrations are reported as an average of the previous 24 hourly values. Current data are reported in end-hour local time. Past data are midnight-to-midnight averages to align with the NAAQS reporting methodologies.

Links The links page includes information about the **MIair** Website, MDEQ, Local Clean Air Coalition Partners, Great Lakes Region, EPA (such as AIRNow) and Tools (which provides websites to other national programs).

AIRNOW:

The EPA AIRNow website illustrates a national view of air quality. Michigan supplies raw air monitoring data to EPA as a partner in their effort to provide this broad picture of real time information. AIRNow uses state and local air agency O_3 and $PM_{2.5}$ data to produce AQI maps for the Midwest, New England, Mid-Atlantic, Southeastern, South Central, and Pacific Coastal regions as well as the entire nation. Animations show pollutant transport across regions over time. There are also links that provide forecasts, previous AQI data, health information, and more.[41]

[41] Addition information is available at http://www.epa.gov/airnow/. Note that AIRNow forecast information and data maps are generated over less frequent time intervals than **MIair**.

CHAPTER 5: METEOROLOGICAL INFORMATION

The following **Figures 5-1** through **5-3** (average daily temperatures) and **Figures 5-4** through **5-6** (total monthly precipitation amounts) show total amounts as compared to their climatic norms for sites in the Upper Peninsula, and the northern and southern Lower Peninsula. These figures were constructed by averaging data from several National Weather Service stations and therefore are not meant to be representative of any one single location in Michigan. Instead, they are intended to depict the regional trends that occurred during the year 2007.

Figure 5-1: Southern Lower Peninsula Observed Average Daily Temperatures vs. Normal Average Daily Temperatures

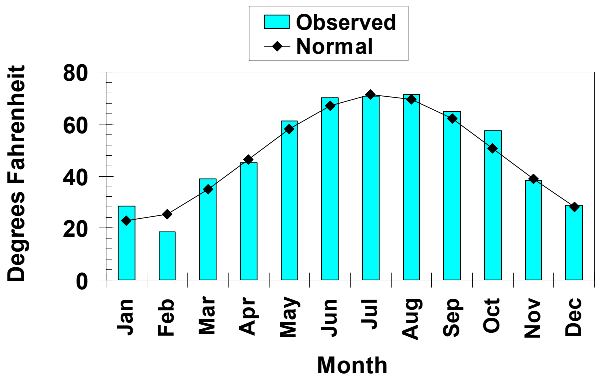


Figure 5-4: Southern Lower Peninsula Observed Monthly Precipitation vs. Normal Monthly Precipitation

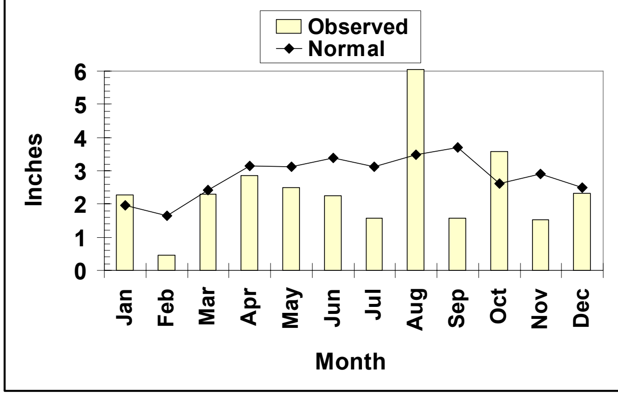


Figure 5-2: Northern Lower Peninsula Observed Average Daily Temperatures vs. Normal Average Daily Temperatures

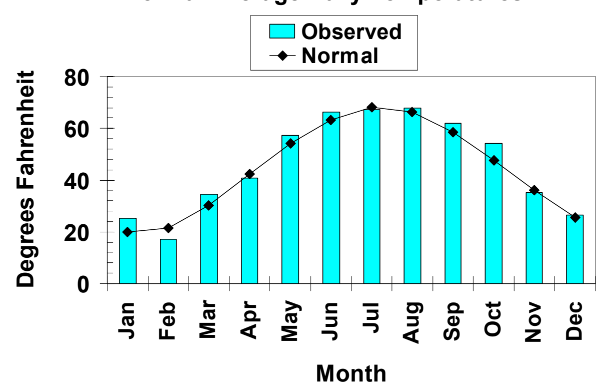


Figure 5-5: Northern Lower Peninsula Observed Monthly Precipitation vs. Normal Monthly Precipitation

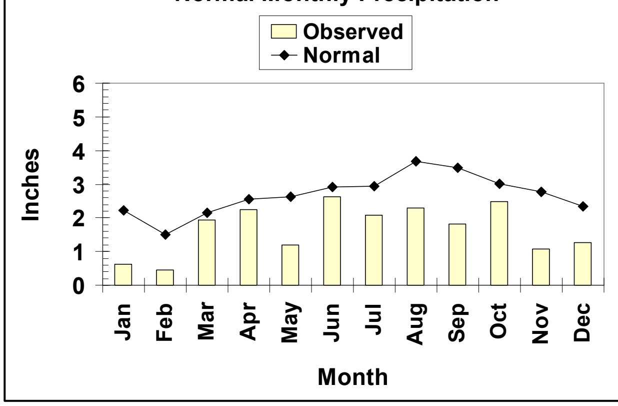


Figure 5-3: Upper Peninsula Observed Average Daily Temperatures vs. Normal Average Daily Temperatures

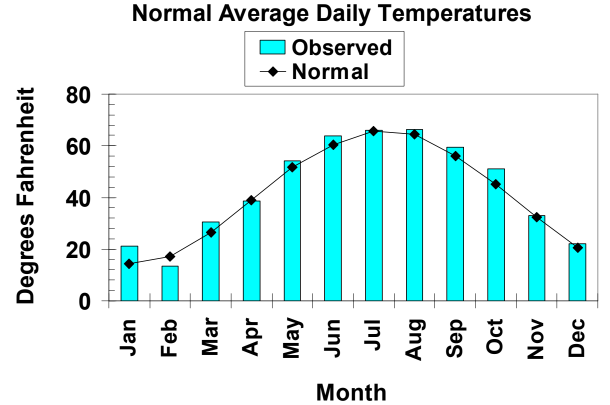
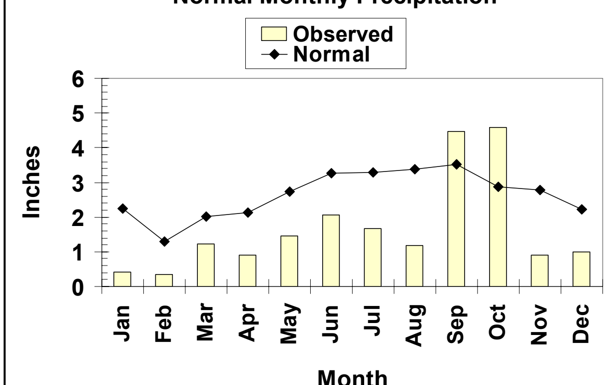


Figure 5-6: Upper Peninsula Observed Monthly Precipitation vs. Normal Monthly Precipitation



LIST OF APPENDICES

APPENDIX A: CRITERIA POLLUTANT SUMMARY FOR 2007

Appendix A utilizes EPA's 2007 AQS Quick Look Report Data to present a summary of ambient air quality data collected for the criteria pollutants at monitoring locations throughout Michigan. As discussed previously, some monitors were shut down at some locations on April 1, 2007 due to budget cuts. Data collected for those monitors is still being provided and is noted that the information may not be representative for that particular area.

Concentrations of non-gaseous pollutants are generally given in $\mu g/m^3$ and in ppm for gaseous pollutants. The following define some of the terms listed in the **Appendix A** reports.

Site I.D.: The AQS site ID is the EPA's code number for these sites and has replaced the MASN number. Prior to 1989, each site was labeled with a five-digit MASN code number.

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

- 1 - federal reference method (FRM);
- 2 - co-located FRM;
- 3 - TEOM hourly PM_{10} and $PM_{2.5}$ measurements; and
- 5 - $PM_{2.5}$ speciation monitors

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

For continuous monitors (CO, NO_2, O_3, $PM_{2.5}$ TEOM, and SO_2,), # OBS refers to the total valid hourly averages obtained from the analyzer.

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

>: The "greater than" symbol (>) heads the column reporting values or observations above the corresponding primary or secondary standards.

CRITERIA POLLUTANT SUMMARY FOR 2007

CO Measured in ppm

Site ID	POC	City	County	Year	# OBS	1-hr Highest Value	1-hr 2nd Highest Value	# > 35	8-hr Highest Value	8-hr 2nd Highest Value	# > 9
260810020	1	Grand Rapids	Kent	2007	6493	1.8	1.7	0	1.3	1.1	0
260991003	1	Warren #	Macomb	2007	2124	2.6	2.0	0	1.6	1.3	0
261250001	1	Oak Park #	Oakland	2007	1683	2.4	1.7	0	1.3	1.1	0
261630001	1	Allen Park	Wayne	2007	5261	2.3	1.9	0	1.4	1.4	0
261630016	1	Detroit – Linwood #	Wayne	2007	1901	2.0	1.9	0	1.2	1.1	0
261630025	1	Livonia #	Wayne	2007	1666	1.2	1.1	0	1.0	0.7	0

Data may not be representative for all of 2007 as it was only collected through March 2007.

Pb (24-Hour) Measured in $\mu g/m^3$

Site ID	POC	City	County	Year	# OBS	Qtr 1 Arith Mean	Qtr 2 Arith Mean	Qtr 3 Arith Mean	Qtr 4 Arith Mean	# Means > 1.5	Highest Value	2nd Highest Value
260490021	4	Flint #	Genesee	2007	15	.00				0	.01	.01
260810020	1	Grand Rapids #	Kent	2007	8	.00*				0	.01	.01
261130001	1	Houghton Lake #	Missaukee	2007	14	.00				0	.00	.00
261610008	1	Ypsilanti #	Washtenaw	2007	8	.00*				0	.01	.01
261630001	2	Allen Park #	Wayne	2007	14	.01				0	.01	.01
261630005	1	River Rouge #	Wayne	2007	15	.01				0	.02	.01
261630015	4	Detroit - W. Fort #	Wayne	2007	13	.01				0	.02	.01
261630019	1	Detroit - E. Seven Mile #	Wayne	2007	15	.01				0	.01	.01
261630027	1	Detroit – W. Jefferson #	Wayne	2007	15	.01				0	.03	.02
261630033	1	Dearborn	Wayne	2007	71	.02	.02	.02	.02	0	.12	0.6

*Indicates the mean does not satisfy summary criteria
Data may not be representative for all of 2007 as it was only collected through March 2007.

NO_2 Measured in ppm

Site ID	POC	City	County	Year	# OBS	1-Hr Highest Value	1-Hr 2nd Highest Value	Annual Arith Mean
260810020	1	Grand Rapids #	Kent	2007	1950	0.059	0.054	0.0170
261630016	1	Detroit – Linwood #	Wayne	2007	1822	0.045	0.044	0.0167
261630019	2	Detroit - E. Seven Mile	Wayne	2007	8464	0.053	0.053	0.0135

Data may not be representative for all of 2007 as it was only collected through March 2007.

O_3 (8-Hour) Measured in ppm

Site ID	POC	City	County	Year	% OBS	Valid Days Measured	Highest Value	2nd Highest Value	3rd Highest Value	4th Highest Value	Day Max > 0.075
260050003	1	Holland	Allegan	2007	100	183	.109	.108	.098	.094	21
260190003	1	Benzonia	Benzie	2007	100	183	.088	.084	.082	.082	10
260210014	1	Coloma	Berrien	2007	98	180	.106	.091	.091	.086	13
260270003	2	Cassopolis	Cass	2007	100	183	.086	.086	.086	.083	8
260370001	2	Rose Lake	Clinton	2007	98	180	.085	.083	.082	.081	4

O_3 (8-Hour) Measured in ppm (continued)

Site ID	POC	City	County	Year	% OBS	Valid Days Measured	Highest Value	2nd Highest Value	3rd Highest Value	4th Highest Value	Day Max > 0.075
260490021	1	Flint	Genesee	2007	97	178	.088	.086	.083	.082	7
260492001	1	Otisville	Genesee	2007	96	175	.090	.090	.085	.084	9
260630007	1	Harbor Beach	Huron	2007	99	182	.096	.089	.088	.084	14
260650012	2	Lansing	Ingham	2007	96	175	.084	.082	.081	.08	5
260770008	1	Kalamazoo	Kalamazoo	2007	97	178	.084	.082	.081	.081	6
260810020	1	Grand Rapids	Kent	2007	100	183	.087	.086	.086	.084	8
260810022	1	Evans	Kent	2007	97	178	.091	.09	.09	.085	12
260890001	1	Peshawbestown	Leelanau	2007	98	180	.082	.081	.079	.079	5
260910007	1	Tecumseh	Lenawee	2007	97	177	.089	.088	.081	.081	5
260990009	1	New Haven	Macomb	2007	100	183	.100	.099	.093	.093	18
260991003	1	Warren	Macomb	2007	95	174	.100	.095	.095	.091	15
261010922	1	Manistee	Manistee	2007	100	183	.09	.089	.084	.083	13
261050007	1	Scottville	Mason	2007	100	183	.096	.089	.085	.083	13
261130001	1	Houghton Lake	Missaukee	2007	98	179	.083	.081	.08	.076	4
261210039	1	Muskegon	Muskegon	2007	97	177	.093	.09	.089	.086	15
261250001	2	Oak Park	Oakland	2007	97	178	.089	.088	.087	.086	13
261390005	1	Jenison	Ottawa	2007	97	177	.093	.091	.089	.088	10
261470005	1	Port Huron	St .Clair	2007	100	183	.096	.093	.092	.089	13
261530001	1	Seney	Schoolcraft	2007	96	176	.092	.086	.085	.085	14
261610008	1	Ypsilanti	Washtenaw	2007	96	175	.088	.079	.078	.077	4
261630001	2	Allen Park	Wayne	2007	96	176	.082	.082	.082	.079	7
261630019	2	Detroit – E. Seven Mile	Wayne	2007	100	183	.097	.095	.094	.092	16

$PM_{2.5}$ (24-Hour) Measured in $\mu g/m^3$ at Local Conditions

Site ID	POC	Monitor	City	County	Year	# OBS	Highest Value	2nd Highest Value	3rd Highest Value	4th Highest Value	98%	Wtd. Arith. Mean
260050003	1	FRM	Holland	Allegan	2007	111	32.9	32.2	31.7	30.3	31.7	11.69
260170014	1	FRM	Bay City	Bay	2007	112	30.2	25.2	25.2	24.5	25.2	10.47
260210014	1	FRM	Coloma	Berrien	2007	117	35.9	34.2	33	32.4	33	11.53
260490021	1	FRM	Flint	Genesee	2007	118	32.8	27.4	25.1	24.6	25.1	11.07
260650012	1	FRM	Lansing	Ingham	2007	117	33.5	32.2	29	26.9	29	11.48
260770008	1	FRM	Kalamazoo	Kalamazoo	2007	118	42.5	34.1	29.2	28.5	29.2	12.61
260770008	2[a]	FRM	Kalamazoo	Kalamazoo	2007	24	32.5	29.7	28.8	25.6	32.5	13.95*
260810007	1	FRM	Grand Rapids	Kent	2007	112	43.4	30	29.7	29.5	29.7	12.84
260810020	1	FRM	Grand Rapids	Kent	2007	116	30.9	30	29.7	28.4	29.7	12.25
260810020	2[a]	FRM	Grand Rapids	Kent	2007	29	31.7	31.4	30.2	29.4	31.7	14.66
260990009	1	FRM	New Haven	Macomb	2007	114	34.5	32.2	29	27.9	29	11.93
261010922	1	FRM	Manistee	Manistee	2007	100	31.3	28.1	26.5	25.7	26.5	8.54
261130001	1	FRM	Houghton Lake	Missaukee	2007	110	24.9	23.3	23.2	21.6	23.2	7.88
261150005	1	FRM	Luna Pier	Monroe	2007	114	39.8	33	32.2	29	32.2	13.08
261210040	1	FRM	Muskegon	Muskegon	2007	348	35	30.7	30.1	28.9	28.1	10.50

$PM_{2.5}$ (24-Hour) Measured in $\mu g/m^3$ at Local Conditions (continued)

Site ID	POC	Monitor	City	County	Year	# OBS	Highest Value	2nd Highest Value	3rd Highest Value	4th Highest Value	98%	Wtd. Arith. Mean
261250001	1	FRM	Oak Park	Oakland	2007	118	41.9	35.3	35.3	34.6	35.3	13.33
261390005	1	FRM	Jenison	Ottawa	2007	360	33.2	32.7	31.2	29.5	28.1	11.68
261470005	1	FRM	Port Huron	St. Clair	2007	116	36.9	36.3	36	33.2	36.3	12.44
261610008	1	FRM	Ypsilanti	Washtenaw	2007	114	35.8	35.7	34.5	31.3	34.5	12.98
261610008	2[a]	FRM	Ypsilanti	Washtenaw	2007	25	30.6	29.4	29.3	24.3	30.6	14.3
261630001	1	FRM	Allen Park	Wayne	2007	352	37.6	35.9	35.5	35.3	31	12.75
261630001	2[a]	FRM	Allen Park	Wayne	2007	23	36.2	27.5	27	24	36.2	15.65*
261630015	1	FRM	Detroit - W. Fort	Wayne	2007	114	42.5	37.3	34	29.1	34	14.54
261630016	1	FRM	Detroit - Linwood	Wayne	2007	111	39.2	34.8	34.3	31.4	34.3	13.86
261630019	1	FRM	Detroit - E. Seven Mile	Wayne	2007	116	33.3	33	31.9	29.2	31.9	13.01
261630025	1	FRM	Livonia	Wayne	2007	114	35.8	32.8	32.8	31.6	32.8	12.75
261630033	1	FRM	Dearborn	Wayne	2007	114	38.4	36.9	36.6	36.6	36.6	16.89
261630036	1	FRM	Wyandotte	Wayne	2007	116	36.9	29.1	28.6	28.2	28.6	13.45
261630038	1	FRM	Detroit - Newberry.	Wayne	2007	112	38.2	34.6	33.4	33.3	33.4	14.01
261630039	1	FRM	Detroit – W. Lafayette	Wayne	2007	117	36.6	35.6	34.8	32.2	34.8	13.83

*Indicates the mean does not satisfy summary criteria   [a] POC 2 FRM: used primarily for precision purposes.

$PM_{2.5}$ TEOM (1-Hour) Measured in $\mu g/m^3$ During the Winter with FDMS (filter dynamic measurement system)

Site ID	POC	Monitor (with FDMS)	City	County	Year	# OBS	Highest Value	2nd Highest Value	3rd Highest Value	4th Highest Value	Wtd. Arith. Mean
260050003	3	TEOM	Holland	Allegan	2007						
260170014	3	TEOM	Bay City	Bay	2007	56	23	22	22	21	11.46
260490021	3	TEOM	Flint	Genesse	2007	1397	72	71	69	63	19.06
260650012	5	TEOM	Lansing	Ingham	2007	2143	59	58	57	57	15.20
260770008	3	TEOM	Kalamazoo	Kalamazoo	2007	1087	43	40	39	36	12.05
260810020	3	TEOM	Grand Rapids	Kent	2007	1265	52	52	44	44	11.47
261130001	3	TEOM	Houghton Lake	Missaukee	2007	1397	45	44	40	40	11.16
261470005	3	TEOM	Port Huron	St. Clair	2007	2146	118	106	101	96	16.59
261530001	3	TEOM	Seney	Schoolcraft	2007	2064	52	51	51	51	12.70
261610008	3	TEOM	Ypsilanti	Washtenaw	2007	1407	50	50	49	45	12.90
261630001	3	TEOM	Allen Park	Wayne	2007	1403	56	55	53	52	15.49
261630033	3	TEOM	Dearborn	Wayne	2007	593	131	69	69	68	26.46
261630039	4	TEOM	Detroit – W. Lafayette	Wayne	2007	4236	296	232	163	141	21.72
260170014	3	TEOM	Bay City	Bay	2007	7212	49	49	47	47	9.94
260490021	3	TEOM	Flint	Genesee	2007	6960	80	69	60	56	10.65
260650012	5	TEOM	Lansing	Ingham	2007	6280	371	368	80	51	11.32
260770008	3	TEOM	Kalamazoo	Kalamazoo	2007	6417	147	141	125	100	11.81
260810020	3	TEOM	Grand Rapids	Kent	2007	7277	109	78	77	72	11.55
261130001	3	TEOM	Houghton Lake	Missaukee	2007	7294	50	48	47	47	8.17
261470005	3	TEOM	Port Huron	St. Clair	2007	6574	121	115	84	70	12.14
261530001	3	TEOM	Seney	Schoolcraft	2007	6550	102	92	79	68	7.45

*Indicates the mean does not satisfy the criteria

$PM_{2.5}$ TEOM (1-Hour) Measured in $\mu g/m^3$ During the Summer without FDMS

Site ID	POC	Monitor (w/o FDMS)	City	County	Year	# OBS	Highest Value	2nd Highest Value	3rd Highest Value	4th Highest Value	Wtd. Arith. Mean
261610008	3	TEOM	Ypsilanti	Washtenaw	2007	7133	121	115	80	58	11.74
261630001	3	TEOM	Allen Park	Wayne	2007	7089	209	103	85	80	13.21
261630033	3	TEOM	Dearborn	Wayne	2007	7130	291	193	159	145	15.51
261630038	3	TEOM	Detroit – Newberry	Wayne	2007	8080	389	295	235	176	11.28
261630039	3	TEOM	Detroit – W. Lafayette	Wayne	2007	8317	136	109	69	65	12.33
261630039	4	TEOM	Detroit – W. Lafayette	Wayne	2007	3661	103	103	101	85	15.07

*Indicates the mean does not satisfy the criteria

PM_{10} (24-Hour) Measured in $\mu g/m^3$

Site ID	POC	Monitor	City	County	Year	# OBS	# Req.	% OBS	Highest Value	2nd Highest Value	3rd Highest Value	4th Highest Value	Wtd Arith Mean
260490021	1	GRAV	Flint #	Genesee	2007	15	15	100	19	19	19	17	13.7*
260810007	1	GRAV	Grand Rapids - Wealthy	Kent	2007	42	45	93	59	45	43	36	19.8*
260810020	1	GRAV	Grand Rapids - Monroe	Kent	2007	55	60	92	60	42	35	34	17.1
261630001	1	GRAV	Allen Park	Wayne	2007	56	60	93	60	49	48	34	22.6
261630015	1	GRAV	Detroit - W. Fort	Wayne	2007	58	60	97	74	57	42	39	24.6
261630033	1	GRAV	Dearborn	Wayne	2007	55	60	92	75	72	69	67	31.8

*Indicates the mean does not satisfy summary criteria
Data may not be representative for all of 2007 as it was only collected through March 2007.

PM_{10} TEOM (1-Hour) Measured in $\mu g/m^3$

Site ID	POC	Monitor	City	County	Year	# OBS	Highest Value	2nd Highest Value	3rd Highest Value	4th Highest Value	Wtd. Arith. Mean
261630033	3	TEOM	Dearborn	Wayne	2007	8562	182	117	81	80	31.1

SO_2 Measured in ppm

Site ID	POC	City	County	Year	# OBS	24-hr Highest Value	24-hr 2nd Highest Value	OBS > 0.14	3-hr Highest Value	3-hr 2nd Highest Value	OBS > 0.5	1-hr Highest Value	1-hr 2nd Highest Value	Arith Mean
260490021	1	Flint #	Genesee	2007	1952	.007	.005	0	.026	.019	0	.028	.027	.0023
260810020	1	Grand Rapids #	Kent	2007	1957	.006	.004	0	.012	.012	0	.015	.014	.0015
260991003	1	Warren #	Macomb	2007	2124	.016	.013	0	.029	.028	0	.036	.035	.0025
261470005	1	Port Huron #	St Clair	2007	2153	.061	.031	0	.089	.082	0	.110	.106	.0055
261630015	1	Detroit - W. Fort	Wayne	2007	7802	.046	.029	0	.088	.088	0	.127	.120	.0050
261630016	2	Detroit – Linwood #	Wayne	2007	2150	.022	.013	0	.039	.039	0	.050	.048	.0032
261630019	1	Detroit - E. Seven Mile #	Wayne	2007	2032	.017	.016	0	.046	.036	0	.060	.045	.0035

Data may not be representative for all of 2007 as it was only collected through March 2007.

APPENDIX B: PRECISION AND ACCURACY REPORT FOR 2007

Appendix B provides the quality assurance assessment summary for precision and accuracy of the AQD's Air Monitoring Unit (AMU) network monitors for the criteria air pollutants. The AMU follows a quality system where quality assurance project plans are developed and implemented as well as standard operating procedures to ensure that the monitoring data that is collected and reported is accurate and defendable. Precision (repeatability of a measurement) and accuracy (closeness of the measurement to a true value) are the two primary components of the quality system[42].

The AMU adheres to the quality assurance requirements of the EPA for gaseous and particulate air pollutant monitors as specified in Title 40 of the Code of Federal Regulation (CFR), Part 58. Gaseous monitors are used for O_3, CO, SO_2, and NO_2; particulate monitors are used for PM (TSP, PM_{10}, $PM_{2.5}$); and Pb is collected using a High Volume sampler (Hi-Vol).

PRECISION MEASUREMENTS

GASEOUS MONITORS: Title 40 CFR 58 specifies the concentration levels of calibration gas to be used for gaseous monitor precision and span checks. These precision and span checks are conducted on the criteria pollutant monitors by the site operators every two weeks. The precision checks are performed by challenging the monitor with a level of gas that is closest to the expected ambient level. The span check is conducted by challenging the monitor with a higher level of gas that is at the upper end of the monitor's calibration range.

PARTICULATE MONITORS: The particulate monitors also have precision criteria in Title 40 CFR 58, but the evaluation of precision is achieved through co-located sampling. Co-located sampling is conducted by placing two monitors in the same location, sampling for the same duration, and on the same day. The closeness of the measurements to each other is how precision is evaluated.

ACCURACY MEASUREMENTS

GASEOUS MONITORS: Accuracy is evaluated for gaseous monitors by the site operator conducting the two week calibration checks and the quarterly multi-point calibration gas checks. Accuracy for gaseous monitors is also evaluated by a yearly independent audit where three levels of audit gas are used to challenge the gaseous monitors. Quality Assurance Team Members conduct audits using dedicated audit equipment and gases. The assessment summary in this appendix reports the results of the accuracy calculations for Level 1, 2, and 3 of the calibration gas.

PARTICULATE MONITORS: The site operator evaluates the accuracy on the particulate monitors by conducting quarterly flow checks on the PM_{10} and High Vol samplers, four-week checks on the $PM_{2.5}$ (FRM), and two-week checks on the continuous $PM_{2.5}$ TEOMs. The accuracy of the flow rates on the $PM_{2.5}$, PM_{10}, Hi-Vol, and TEOMs are audited at least once every six months. Quality Assurance Team members conduct these independent flow audits using dedicated audit equipment.

To ensure the accuracy of AMU's monitoring equipment, all flow measurement devises, flow orifices, thermometers, and met equipment (measuring wind speed and wind direction at the sites) are recertified once a year using a certified standard. In addition, once a year the EPA laboratory certifies two of AMU's O_3 generators which are then used as Reference Method instruments for AMU staff to certify the remaining O_3 generators and monitors. Each O_3 generator is recertified every 180 days.

[42] Audits for the Sault Ste. Marie tribal sites and Seney federal site are not included in this report.

CO:

YEAR QUARTER	PRECISION				ACCURACY										
	#ANALYZER	# CHECKS	PROBABILITY LIMITS		PROBABILITY LIMITS										
					# AUDITS	LEVEL 1		LEVEL 2		LEVEL 3		LEVEL 4		LEVEL 5	
			LOWER	UPPER		LOWER	UPPER	LOWER	UPPER	LOWER	UPPER	LOWER	UPPER	LOWER	UPPER
2007	**5**	**57**	**-7.76**	**+5.39**	**3**	*****	*****	*****	*****	**-2.74**	**-2.07**	**+.74**	**+2.59**	**-.99**	**+8.38**
1st	5	41	-4.23	+3.82	2	*	*	*	*	-2.50	-2.50	+.74	+2.59	-.99	+8.38
2nd	1	4	-7.94	-1.56	0	*	*	*	*	*	*	*	*	*	*
3rd	2	12	-13.71	+6.99	1	*	*	*	*	*	*	*	*	*	*
4th	0	0	*	*	0	*	*	*	*	*	*	*	*	*	*

Note: * Measurements less than amount needed to calculate probability limits.

Pb:

YEAR QUARTER	PRECISION						ACCURACY			LAB ACCURACY	
	# CO-LOCATED SAMPLES	# CO-LOCATED SITES	# SAMPLES < LIMIT	PROBABILITY LIMITS		# VALID CO-LOCATED DATA PAIR	# FLOW AUDITS	# SITES	FIELD & LAB RESULTS SIGNED BIAS	# AUDITS	
				LOWER	UPPER					LEVEL 1	LEVEL 2
2007	**47**	**1**	**47**	*****	*****	**0**	**8**	**7**	**+/- 10.29 %**	**15**	**12**
1st	18	1	18	*	*	0	6	7		6	3
2nd	15	1	15	*	*	0	1	1		3	3
3rd	3	1	3	*	*	0	0	1		3	3
4th	11	1	11	*	*	0	1	1		3	3

Note * Measurements less than EPA's limit; cannot estimate precision.

NO_2 :

YEAR QUARTER	PRECISION				ACCURACY						
	#ANALYZER	# CHECKS	PROBABILITY LIMITS		# AUDITS	LEVEL 3		LEVEL 4		LEVEL 5	
			LOWER	UPPER		LOWER	UPPER	LOWER	UPPER	LOWER	UPPER
2007	**3**	**39**	**-2.57**	**+5.30**	**2**	**-14.29**	**+11.1**	**-11.03**	**-2.85**	**-8.88**	**-7.02**
1st	3	19	-3.68	+4.52	1	*	*	*	*	*	*
2nd	1	7	-1.73	+4.07	1	*	*	*	*	*	*
3rd	1	7	+.48	+4.66	0	*	*	*	*	*	*
4th	1	6	+.74	+5.61	0	*	*	*	*	*	*

Note: * Measurements less than amount needed to calculate probability limits.

O_3:

YEAR QUARTER	PRECISION				ACCURACY								
	#ANALYZER	# CHECKS	PROBABILITY LIMITS		# AUDITS	LEVEL 1		LEVEL 2		LEVEL 3		LEVEL 4	
			LOWER	UPPER		LOWER	UPPER	LOWER	UPPER	LOWER	UPPER	LOWER	UPPER
2007	**27**	**439**	**-3.63**	**+3.01**	**27**	**-2.53**	**+4.42**	**-2.05**	**+3.11**	**-2.55**	**+3.17**	**-2.65**	**+3.17**
1st	No data due to ozone season												
2nd	27	237	-3.95	+2.57	15	-3.09	+3.65	-2.46	+3.14	-3.18	+3.25	-3.26	+3.12
3rd	27	202	-3.05	+3.32	12	-1.20	+4.76	-1.55	+3.08	-1.66	+2.94	-1.72	+3.08
4th	No data due to ozone season												

Note: Michigan's ozone season runs from April thru September.

PM_{10}:

YEAR QUARTER	PRECISION					ACCURACY			
	# CO-LOCATED SAMPLES	# CO-LOCATED SITES	# SAMPLES < LIMIT	% CV	# VALID CO-LOCATED DATA PAIRS	# SITES	# FLOW AUDITS	PROBABILITY	
								LOWER	UPPER
2007	**40**	**1**	**4**	**11.06**	**36**	**6**	**11**	**-7.74**	**+9.37**
1st	11	1	1	15.06	10	6	3	-9.28	+14.20
2nd	11	1	2	14.11	9	5	3	-8.00	+6.79
3rd	8	1	1	6.71	7	5	2	+.63	+9.50
4th	10	1	0	12.90	9	5	3	-5.90	+1.42

$PM_{2.5}$:

YEAR QUARTER	PRECISION					ACCURACY		
	# CO-LOCATED SAMPLES	# CO-LOCATED SITES	# SAMPLES < LIMIT	% CV	# VALID CO-LOCATED DATA PAIRS	# AUDITS	95% PROBABILITY	
							LOWER	UPPER
2007	**95**	**4**	**8**	**16.48**	**87**	**52**	**-2.71**	**+1.57**
1st	23	4	0	6.09	23	10	-2.13	+1.92
2nd	22	4	8	14.45	14	16	-2.59	+2.02
3rd	25	4	0	13.61	25	7	-1.64	+.86
4th	25	4	0	4.63	25	19	-3.11	+.87

SO_2:

YEAR QUARTER	PRECISION				ACCURACY						
	#ANALYZER	# CHECKS	PROBABILITY LIMITS		# AUDITS	LEVEL 3		LEVEL 4		LEVEL 5	
			LOWER	UPPER		LOWER	UPPER	LOWER	UPPER	LOWER	UPPER
2007	**7**	**67**	**-6.99**	**+6.38**	**3**	**-14.3**	**+18.4**	**-9.65**	**+19.65**	**-8.09**	**+19.97**
1st	7	46	-6.61	+5.17	2	-9.43	+4.43	-4.53	+6.19	-2.75	+6.60
2nd	1	7	-3.58	+3.98	0	*	*	*	*	*	*
3rd	1	7	-10.00	+15.39	1	*	*	*	*	*	*
4th	1	7	-3.63	+1.40	0	*	*	*	*	*	*

Note: * Measurements less than amount needed to calculate probability limits.

APPENDIX C: 2007 AIR TOXICS MONITORING SUMMARY FOR METALS, VOCS, CARBONYL COMPOUNDS, & SPECIATED $PM_{2.5}$

Appendix C provides summary statistics of ambient air concentrations of various substances monitored in Michigan during 2007. At each monitoring site, air samples were taken over a 24-hour period (midnight to midnight); a calendar day. These air samples are called "observations" and represent the average air concentration during that 24-hour period. The frequency of observation varies by site and chemical substance, but was typically done once every 6 or 12 days. For some substances the sampled air concentration was lower than the laboratory's analytical method detection level (MDL). Air concentrations that are lower than the MDL are given the value of "non-detect." Each substance analyzed has its own MDL, which varies from laboratory to laboratory and from year to year. The cited MDLs represent the detection limits that are routinely attained. In the calculation of the minimum and maximum averages (also called "means"), zero (0.0 μg/m³) or the MDL, respectively, are substituted for non-detected air contaminant levels. The 2007 data in this appendix are divided into two sections: For compounds that were monitored for a full year, the means represent "annual average," however, many compounds were monitored only for the first quarter of the calendar year (i.e., through the end of March), thus they represent quarterly averages.

Appendix C-1 summarizes the air concentrations of various metals (TSP), VOCs, and carbonyls; and **Appendix C-2** summarizes the air concentrations of various metals found in speciated $PM_{2.5}$.

Table C-1 shows the monitoring stations and what was monitored at each station in 2007.

Table C-1: Monitoring Station and Type of Monitoring Conducted

SITE NAME	AIRS ID	APPENDIX C-1					APPENDIX C-2
		VOC	Carbonyl	Metals TSP	Metals PM_{10}	SVOCs	Speciated $PM_{2.5}$
Allen Park	261630001			March/Dec			Dec
Dearborn	261630033	Dec	Dec	Dec	Dec		Dec
Detroit – E. Seven Mile	261630019			March			
Detroit – W. Fort	261630015	Dec	Dec	March/Dec			
Detroit – W. Jefferson	261630027			March/Dec			
Flint	260490021			March			
Grand Rapids - Monroe	260810020	March	March	March			Dec
Houghton Lake	261130001	March	March	March			Dec
Kalamazoo	260770008						Dec
Luna Pier	261150005						Dec
River Rouge	261630005			March/Dec			
Sault Ste. Marie - Easterday	260330901					Dec	Dec
Ypsilanti	261610008	March	March	March			Dec

Note: Metals-TSP: Arsenic, Cadmium, Manganese and Nickel were monitored for a full year. The other metals were monitored only through March.

The following terms and acronyms are used in the **Appendix C** data tables:

MDL: Analytical MDL in units of μg/m³
 # Obs: Number of Observations (number of daily air samples taken during the year)
Num > MDL: Number of daily samples above the MDL
Max1: highest daily air concentration during 2007
Max2: second highest daily air concentration during 2007
Max3: third highest daily air concentration during 2007
Min Mean: average air concentration, assuming daily samples below MDL were equal to 0.0 μg/m³.
Max Mean: average air concentration, assuming daily samples below MDL were equal to MDL.
AIRS ID: Aerometric Information Retrieval System identification number used by EPA and MDEQ to identify each monitoring site.

APPENDIX C1: AIR TOXICS SUMMARY FOR METALS, VOCS, & CARBONYL COMPOUNDS

ALLEN PARK			AIRS ID: 261630001				Units: µg/m³	
Chemical Name	**# Obs**	**Obs > MDL**	**MDL**	**Max 1**	**Max 2**	**Max 3**	**Min Mean**	**Max Mean**
Arsenic (TSP)	59	59	0.000111	0.00185	0.00185	0.00981	0.00604	0.00495
Barium (TSP)	14	14		0.0277	0.0277	0.0425	0.0357	0.0357
Beryllium (TSP)	14	14	0.000104	0.000019	0.000019	3.86E-05	2.83E-05	2.77E-05
Cadmium (TSP)	59	59	0.000109	0.000369	0.000369	0.00116	0.000744	0.000711
Chromium (TSP)	14	14	0.00033	0.00316	0.00316	0.00527	0.00421	0.00372
Cobalt (TSP)	14	14	0.00010	0.000115	0.000115	0.000271	0.00016	0.000153
Copper (TSP)	14	14	0.000535	0.788	0.788	1.64	1.03	0.999
Iron (TSP)	14	14		0.507	0.507	0.892	0.623	0.614
Lead (TSP)	14	14	0.000147	0.0068	0.0068	0.0133	0.013	0.0112
Manganese (TSP)	59	59	0.000227	0.0276	0.0276	0.244	0.0653	0.0456
Molybdenum (TSP)	14	14	0.000139	0.000758	0.000758	0.00145	0.000986	0.0009
Nickel (TSP)	59	59	0.000156	0.00158	0.00158	0.00461	0.00358	0.00327
Vanadium (TSP)	14	14	0.000137	0.00166	0.00166	0.00483	0.00445	0.00403
Zinc (TSP)	14	14		0.0583	0.0583	0.0953	0.0759	0.071

DEARBORN			AIRS ID: 261630033				Units: µg/m³	
Chemical Name	**# Obs**	**Obs > MDL**	**MDL**	**Max 1**	**Max 2**	**Max 3**	**Min Mean**	**Max Mean**
2,5-dimethylbenzaldehyde	15	0	0.0139	0	0.0139	0	0	0
Acetaldehyde	15	15	0.00872	1.63	1.63	2.49	2.4	2.16
Acetone	15	15	0.0227	2.82	2.82	4.18	3.42	3.37
Benzaldehyde	15	13	0.00654	0.109	0.111	0.265	0.165	0.161
Crotonaldehyde (trans)	2	0	0.0125	0	0.0125	0	0	
Formaldehyde	16	16	0.0118	2.79	2.79	5.07	4.61	3.99
Hexanaldehyde	15	15	0.00926	0.419	0.419	1.61	1.06	0.803
Isovaleraldehyde	15	5	0.00648	0.0662	0.07	0.698	0.144	0.081
m,p-Tolualdehyde	2	0	0.0391	0	0.0391	0	0	
n-Butyraldehyde	2	2	0.0133	0.616	0.616	0.723	0.51	
o-Tolualdehyde	2	0	0.0329	0	0.0329	0	0	
Propionaldehyde	15	15	0.0092	0.304	0.304	0.527	0.397	0.397
Valeraldehyde	15	14	0.0111	0.198	0.201	0.846	0.345	0.338
Carbon Disulfide	64	54	0.0661	0.611	0.621	27.4	2.61	1.06
1,1,1-Trichloroethane	65	64	0.0917	0.0991	0.103	0.246	0.224	0.175
1,1,2,2-Tetrachloroethane	65	0	0.126	0	0.126	0	0	0
1,1,2-Trichloroethane	65	1	0.105	0.000504	0.104	0.0327	0	0
1,1-Dichloroethane	65	1	0.0695	0.000872	0.0694	0.0567	0	0
1,1-Dichloroethene	65	0	0.0897	0	0.0897	0	0	0
1,2,4-Trichlorobenzene	65	2	0.331	0.0024	0.324	0.134	0.0223	0
1,2,4-Trimethylbenzene	65	64	0.0634	0.436	0.445	2.35	1.28	1.24
1,2-Dibromoethane	65	0	0.12	0	0.12	0	0	0
1,2-Dichlorobenzene	65	1	0.112	0.00139	0.112	0.0902	0	0
1,2-Dichloroethane	65	0	0.0916	0	0.0916	0	0	0
1,2-Dichloropropane	65	0	0.0956	0	0.0956	0	0	0
1,3,5-Trimethylbenzene	65	64	0.0637	0.144	0.152	0.723	0.487	0.403
1,3-Butadiene	65	62	0.046	0.0955	0.1	0.509	0.332	0.279
1,3-Dichlorobenzene	65	0	0.105	0	0.105	0	0	0
1,4-Dichlorobenzene	65	60	0.107	0.116	0.135	0.866	0.673	0.619
2,2,4-Trimethylpentane	1	1	0.14	0.31	0.31	0.31		
2-Chloro-1,3-Butadiene	65	3	0.0548	0.0044	0.057	0.13	0.0833	0.0724
Acetonitrile	65	63	0.0607	0.906	0.907	13.2	7.39	4.45
Acrylonitrile	65	3	0.0622	0.00294	0.0627	0.158	0.0195	0.013
Benzene	65	65	0.0802	1.03	1.03	5.05	2.16	2.04
Bromodichloromethane	65	0	0.132	0	0.132	0	0	0
Bromoform	65	0	0.175	0	0.175	0	0	0
Bromomethane	65	61	0.0999	0.0431	0.0516	0.28	0.0583	0.0583
Carbon Tetrachloride	65	65	0.0982	0.629	0.629	0.83	0.818	0.793
Chlorobenzene	65	62	0.0709	0.24	0.252	0.529	0.414	0.382
Chloroethane	65	61	0.0539	0.0557	0.0617	0.095	0.0924	0.0924
Chloroform	65	64	0.0878	0.878	0.882	2.31	2.18	2.11
Chloromethane	65	65	0.0572	1.21	1.21	1.78	1.7	1.63

DEARBORN			AIRS ID: 261630033				Units: µg/m³	
Chemical Name	**# Obs**	**Obs > MDL**	**MDL**	**Max 1**	**Max 2**	**Max 3**	**Min Mean**	**Max Mean**
Chloromethyl Benzene	65	4	0.0837	0.00143	0.0816	0.0311	0.0259	0.0207
cis-1,2-Dichloroethene	65	1	0.0694	0.0083	0.0767	0.539	0	0
cis-1,3-Dichloropropene	65	0	0.0814	0	0.0814	0	0	0
Dibromochloromethane	65	3	0.144	0.00157	0.14	0.0511	0.0426	0.00852
Dichlorodiflouromethane	65	65	0.0936	2.66	2.66	4.03	3.85	3.59
Ethyl Tert-Butyl Ether	64	0	0.0377	0	0.0377	0	0	0
Ethylbenzene	65	65	0.0644	0.326	0.326	1.72	0.842	0.734
Halocarbon 113	1	1	0.26	0.65	0.65	0.65		
Halocarbon 114	65	64	0.146	0.109	0.111	0.154	0.147	0.147
Hexachloro-1,3-Butadiene	65	0	0.412	0	0.412	0	0	0
m/p -Xylene	65	65	0.11	0.905	0.905	5.73	2.43	2.25
Methyl Ethyl Ketone	65	64	0.13	0.924	0.926	5.37	3.48	3.1
Methyl Isobutyl Ketone	65	62	0.0768	0.21	0.219	1.14	0.504	0.475
Methyl Tert-Butyl Ether	65	0	0.0385	0	0.0385	0	0	0
Methylene Chloride	65	65	0.0629	0.358	0.358	1.1	1.02	0.924
n-Hexane	1	1	0.82	2.5	2.5	2.5		
o-xylene	65	64	0.066	0.318	0.326	2.03	0.929	0.708
Styrene	65	55	0.065	0.0689	0.0848	0.626	0.332	0.136
Tert-Amyl Methyl Ether	64	1	0.0496	0.000131	0.049	0.00836	0	0
Tetrachloroethene	65	62	0.0861	0.286	0.298	1.8	0.949	0.705
Toluene	65	65	0.0784	2	2	15.1	6.26	5.95
trans-1,2-Dichloroethene	65	1	0.069	0.000488	0.0686	0.0317	0	0
trans-1,3-Dichloropropene	65	0	0.0814	0	0.0814	0	0	0
Trichloroethene	65	17	0.104	0.0212	0.0991	0.161	0.14	0.102
Trichloroflouromethane	65	65	0.123	1.55	1.55	2.67	2.39	2.12
Vinyl Chloride	65	7	0.064	0.00208	0.0594	0.0435	0.023	0.0204
Arsenic (PM-10)	105	105	0.000139	0.00186	0.00186	0.00702	0.0061	0.00417
Arsenic (TSP)	112	112	0.000113	0.00209	0.00209	0.00656	0.00635	0.00448
Barium (PM-10)	105	105		0.0192	0.0192	0.194	0.0611	0.0558
Barium (TSP)	112	112		0.0342	0.0342	0.183	0.0969	0.0889
Beryllium (PM-10)	105	105	0.000137	0.0000586	0.0000586	0.00028	0.000238	0.000236
Beryllium (TSP)	112	112	0.000112	0.000149	0.000149	0.000805	0.000768	0.000482
Cadmium (PM-10)	105	105	0.000137	0.000532	0.000532	0.00246	0.00238	0.0019
Cadmium (TSP)	112	112	0.000112	0.000603	0.000603	0.00224	0.00224	0.0017
Chromium (PM-10)	105	105	0.000434	0.00465	0.00465	0.00845	0.00765	0.00765
Chromium (TSP)	112	112	0.000355	0.00609	0.00609	0.0132	0.0132	0.0125
Chromium VI (TSP)	68	67	8.48E-06	0.00004	0.0000401	0.000208	0.00019	0.000133
Cobalt (PM-10)	105	104	0.00013	0.000272	0.000273	0.000749	0.00074	0.000697
Cobalt (TSP)	112	112	0.000106	0.000354	0.000354	0.00143	0.000901	0.000899
Copper (PM-10)	105	105	0.000704	0.0743	0.0743	0.258	0.257	0.249
Copper (TSP)	112	112	0.000575	0.255	0.255	1.4	0.774	0.663
Iron (PM-10)	105	105		1.01	1.01	4.62	4.39	4.3
Iron (TSP)	112	112		2.15	2.15	7.7	7.67	7.44
Lead (PM-10)	105	105	0.000193	0.0167	0.0167	0.134	0.134	0.0675
Lead (TSP)	112	112	0.000158	0.0196	0.0196	0.126	0.116	0.075
Manganese (PM-10)	105	105	0.000284	0.0578	0.0578	0.454	0.274	0.249
Manganese (TSP)	112	112	0.000232	0.138	0.138	0.507	0.468	0.417
Molybdenum (PM-10)	105	105	0.000183	0.00131	0.00131	0.00663	0.00647	0.00613
Molybdenum (TSP)	112	112	0.000149	0.00158	0.00158	0.00726	0.00683	0.00635
Nickel (PM-10)	105	105	0.000197	0.00232	0.00232	0.0104	0.01	0.00999
Nickel (TSP)	112	112	0.000161	0.00335	0.00335	0.018	0.0115	0.0103
Vanadium (PM-10)	105	105	0.00018	0.00286	0.00286	0.0147	0.0145	0.00977
Vanadium (TSP)	112	112	0.000147	0.0046	0.0046	0.0153	0.0148	0.0106
Zinc (PM-10)	105	105		0.201	0.201	2.32	1.89	1.47
Zinc (TSP)	112	112		0.291	0.291	2.34	2.28	2.2

DETROIT - E. Seven Mile			AIRS ID: 261630019				Units: µg/m³	
Chemical Name	**# Obs**	**Obs > MDL**	**MDL**	**Max 1**	**Max 2**	**Max 3**	**Min Mean**	**Max Mean**
Arsenic (TSP)	15	15	0.000107	0.000947	0.000947	0.00168	0.00168	0.00145
Barium (TSP)	15	15		0.0215	0.0215	0.0356	0.0349	0.028
Beryllium (TSP)	15	15	0.000105	0.0000211	0.0000211	5.16E-05	4.94E-05	3.35E-05
Cadmium (TSP)	15	15	0.000105	0.000293	0.000293	0.000597	0.000528	0.000463

DETROIT - E. Seven Mile			AIRS ID: 261630019				Units: µg/m³	
Chemical Name	# Obs	Obs > MDL	MDL	Max 1	Max 2	Max 3	Min Mean	Max Mean
Chromium (TSP)	15	15	0.000334	0.00243	0.00243	0.00407	0.00393	0.00293
Cobalt (TSP)	15	15	0.0001	0.000128	0.000128	0.000521	0.000196	0.000158
Copper (TSP)	15	15	0.000542	0.087	0.087	0.14	0.135	0.12
Iron (TSP)	15	15		0.473	0.473	1.29	1.11	0.682
Lead (TSP)	15	15	0.000149	0.00653	0.00653	0.0149	0.0112	0.011
Manganese (TSP)	15	15	0.000219	0.0179	0.0179	0.0519	0.0381	0.0246
Molybdenum (TSP)	15	15	0.00014	0.000697	0.000697	0.00155	0.00103	0.000923
Nickel (TSP)	15	15	0.000151	0.00109	0.00109	0.00181	0.00166	0.00147
Vanadium (TSP)	15	15	0.000139	0.00129	0.00129	0.00269	0.00266	0.00254
Zinc (TSP)	15	15		0.313	0.313	3.05	0.563	0.174

DETROIT - W. Fort Street			AIRS ID: 261630015				Units: µg/m³	
Chemical Name	# Obs	Obs > MDL	MDL	Max 1	Max 2	Max 3	Min Mean	Max Mean
2,5-dimethylbenzaldehyde	28	0	0.0535	0	0.0535	0	0	0
Acetaldehyde	28	28	0.0236	1.89	1.89	5.06	3.92	2.64
Acetone	28	28	0.0764	3.34	3.34	7.1	7.04	6.35
Benzaldehyde	28	1	0.0219	0.0423	0.0635	1.19	0	0
Crotonaldehyde (trans)	28	1	0.0127	0.014	0.0263	0.393	0	0
Formaldehyde	28	28	0.0255	2.27	2.27	5.38	4.45	3.77
Hexanaldehyde	28	6	0.0419	0.293	0.326	2.49	1.5	1.16
Isovaleraldehyde	28	3	0.0264	0.0734	0.0969	0.814	0.627	0.613
m,p-Tolualdehyde	28	5	0.04	0.348	0.381	4.24	1.79	1.56
n-Butyraldehyde	28	12	0.0137	0.269	0.277	1.25	1.04	0.844
o-Tolualdehyde	28	0	0.0337	0	0.0337	0	0	0
Propionaldehyde	28	21	0.0391	0.398	0.408	1.01	0.862	0.703
Valeraldehyde	28	6	0.04	0.222	0.254	1.62	1.34	1.13
1,1,1-Trichloroethane	30	1	0.236	0.0163	0.244	0.49	0	0
1,1,2,2-Tetrachloroethane	30	0	0.983	0	0.983	0	0	0
1,1,2-Trichloroethane	30	0	0.689	0	0.689	0	0	0
1,1-Dichloroethane	30	0	0.186	0	0.186	0	0	0
1,1-Dichloroethene	30	0	0.128	0	0.128	0	0	0
1,2,4-Trichlorobenzene	30	0	1.36	0	1.36	0	0	0
1,2,4-Trimethylbenzene	30	7	0.562	0.245	0.674	2	1.4	1.3
1,2-Dibromoethane	30	0	1.01	0	1.01	0	0	0
1,2-Dichlorobenzene	30	0	0.771	0	0.771	0	0	0
1,2-Dichloroethane	30	1	0.261	0.137	0.389	4.1	0	0
1,2-Dichloropropane	30	0	0.309	0	0.309	0	0	0
1,3,5-Trimethylbenzene	30	1	0.54	0.0193	0.541	0.58	0	0
1,3-Butadiene	30	6	0.223	0.139	0.316	2.9	0.28	0.27
1,3-Dichlorobenzene	30	0	0.706	0	0.706	0	0	0
1,4-Dichlorobenzene	30	0	0.774	0	0.774	0	0	0
2,2,4-Trimethylpentane	30	28	0.138	0.324	0.333	1.1	0.53	0.5
2-Chloro-1,3-Butadiene	30	0	0.148	0	0.148	0	0	0
Acetonitrile	30	24	0.363	2.79	2.86	39	8.3	7.2
Acrylonitrile	30	1	0.354	0.0833	0.425	2.5	0	0
Benzene	30	30	0.128	1.28	1.28	3.9	3.3	2.2
Bromodichloromethane	30	0	0.61	0	0.61	0	0	0
Bromoform	30	0	1.67	0	1.67	0	0	0
Bromomethane	30	0	0.257	0	0.257	0	0	0
Carbon Tetrachloride	30	30	0.267	0.521	0.521	0.63	0.61	0.6
Chlorobenzene	30	0	0.622	0	0.622	0	0	0
Chloroethane	30	0	0.23	0	0.23	0	0	0
Chloroform	30	19	0.247	2.07	2.16	6.7	4.7	4.7
Chloromethane	30	30	0.128	1.29	1.29	2.4	1.7	1.6
Chloromethyl Benzene	30	0	1.17	0	1.17	0	0	0
cis-1,2-Dichloroethene	30	0	0.193	0	0.193	0	0	0
cis-1,3-Dichloropropene	30	0	0.47	0	0.47	0	0	0
Dibromochloromethane	30	0	1.3	0	1.3	0	0	0
Dichlorodiflouromethane	30	30	0.399	2.74	2.74	4.5	3.1	3.1
Ethylbenzene	30	10	0.535	0.319	0.674	2.1	1.3	1.1
Halocarbon 113	29	29	0.248	0.679	0.679	0.92	0.85	0.83
Halocarbon 114	30	0	0.158	0	0.158	0	0	0

DETROIT - W. Fort Street			AIRS ID: 261630015			Units: µg/m³		
Chemical Name	**# Obs**	**Obs > MDL**	**MDL**	**Max 1**	**Max 2**	**Max 3**	**Min Mean**	**Max Mean**
Hexachloro-1,3-Butadiene	30	0	1.57	0	1.57	0	0	0
m/p -Xylene	30	22	0.621	1.59	1.74	8.7	4.6	3.4
Methyl Ethyl Ketone	30	30	0.228	3.45	3.45	15	12	7.9
Methyl Isobutyl Ketone	30	19	0.403	1.67	1.81	15	7.3	5
Methyl Tert-Butyl Ether	30	0	0.118	0	0.118	0	0	0
Methylene Chloride	30	14	0.686	1.01	1.37	7.9	4.4	3.5
n-Hexane	30	20	0.801	1.62	1.87	9.4	4.4	4.1
o-xylene	30	10	0.528	0.385	0.735	2.9	1.3	1.2
Styrene	30	0	0.555	0	0.555	0	0	0
Tetrachloroethene	30	1	0.637	0.243	0.859	7.3	0	0
Toluene	30	29	0.692	2.18	2.2	6.6	5.1	4.5
trans-1,2-Dichloroethene	30	0	0.225	0	0.225	0	0	0
trans-1,3-Dichloropropene	30	0	0.472	0	0.472	0	0	0
Trichloroethene	30	1	0.338	0.2	0.527	6	0	0
Trichloroflouromethane	30	30	0.118	1.51	1.51	6.3	2.4	2.1
Vinyl Chloride	30	1	0.0823	0.107	0.186	3.2	0	0
Arsenic (TSP)	58	58	0.000111	0.00195	0.00195	0.00479	0.00459	0.0037
Barium (TSP)	13	13		0.0281	0.0281	0.0487	0.0352	0.035
Beryllium (TSP)	13	13	0.000104	0.0000532	0.0000532	0.00013	0.000121	6.52E-05
Cadmium (TSP)	58	58	0.000109	0.000631	0.000631	0.00229	0.00216	0.00181
Chromium (TSP)	13	13	0.000332	0.00543	0.00543	0.0132	0.00941	0.00768
Cobalt (TSP)	13	12	9.93E-05	0.000243	0.00025	0.000807	0.000539	0.000324
Copper (TSP)	13	13	0.000538	0.116	0.116	0.179	0.178	0.171
Iron (TSP)	13	13		2.15	2.15	12.6	3.59	2.37
Lead (TSP)	13	13	0.000148	0.0102	0.0102	0.0231	0.0128	0.0118
Manganese (TSP)	61	61	0.000228	0.0715	0.0715	0.198	0.196	0.145
Molybdenum (TSP)	13	13	0.000139	0.00145	0.00145	0.00287	0.00218	0.00207
Nickel (TSP)	58	57	0.000158	0.00397	0.00397	0.0164	0.00954	0.009
Vanadium (TSP)	13	13	0.000138	0.0027	0.0027	0.00767	0.00503	0.00426
Zinc (TSP)	13	13		0.0998	0.0998	0.165	0.15	0.14

DETROIT – W. Jefferson			AIRS ID: 261630027				Units: µg/m³	
Chemical Name	**# Obs**	**Obs > MDL**	**MDL**	**Max 1**	**Max 2**	**Max 3**	**Min Mean**	**Max Mean**
Arsenic (TSP)	62	62	0.000114	0.00209	0.00209	0.00681	0.00575	0.00526
Barium (TSP)	15	15		0.0282	0.0282	0.0396	0.0391	0.038
Beryllium (TSP)	15	15	0.000109	0.000057	0.000057	0.000102	0.000102	0.000079
Cadmium (TSP)	62	62	0.000112	0.000734	0.000734	0.00245	0.00223	0.00202
Chromium (TSP)	15	15	0.000346	0.00482	0.00482	0.00917	0.00688	0.00607
Cobalt (TSP)	15	15	0.000104	0.000206	0.000206	0.000421	0.000315	0.000297
Copper (TSP)	15	15	0.000562	0.329	0.329	0.601	0.599	0.576
Iron (TSP)	15	15		1.24	1.24	2.23	1.9	1.86
Lead (TSP)	15	15	0.000154	0.00958	0.00958	0.0263	0.015	0.0108
Manganese (TSP)	62	62	0.000234	0.205	0.205	1.95	1.83	1.8
Molybdenum (TSP)	15	15	0.000146	0.000983	0.000983	0.00149	0.00132	0.00121
Nickel (TSP)	62	62	0.00016	0.00397	0.00397	0.0199	0.017	0.0112
Vanadium (TSP)	15	15	0.000144	0.00313	0.00313	0.0077	0.00558	0.00494
Zinc (TSP)	15	15		0.122	0.122	0.397	0.333	0.183

FLINT			AIRS ID: 260490021				Units: µg/m³	
Chemical Name	**# Obs**	**Obs > MDL**	**MDL**	**Max 1**	**Max 2**	**Max 3**	**Min Mean**	**Max Mean**
Arsenic (TSP)	15	15	0.000106	0.000757	0.000757	0.00175	0.00141	0.00101
Barium (TSP)	15	15		0.0148	0.0148	0.0191	0.0189	0.0187
Beryllium (TSP)	15	15	0.000105	6.61E-06	6.61E-06	1.19E-05	1.14E-05	1.05E-05
Cadmium (TSP)	15	15	0.000105	0.000157	0.000157	0.000243	0.000235	0.000217
Chromium (TSP)	15	15	0.000332	0.00172	0.00172	0.00208	0.00198	0.00194
Cobalt (TSP)	15	15	9.96E-05	0.0000992	0.0000992	0.000182	0.000145	0.000125
Copper (TSP)	15	15	0.000539	0.396	0.396	0.857	0.766	0.592
Iron (TSP)	15	15		0.239	0.239	0.415	0.413	0.312
Lead (TSP)	15	15	0.000148	0.0048	0.0048	0.0133	0.00694	0.00686
Manganese (TSP)	60	60	0.000224	0.0101	0.0101	0.0251	0.0246	0.0239

FLINT			AIRS ID: 260490021				Units: µg/m³	
Chemical Name	# Obs	Obs > MDL	MDL	Max 1	Max 2	Max 3	Min Mean	Max Mean
Molybdenum (TSP)	15	15	0.00014	0.000611	0.000611	0.00108	0.000822	0.000792
Nickel (TSP)	15	15	0.000151	0.0011	0.0011	0.0036	0.00256	0.00129
Vanadium (TSP)	15	15	0.000138	0.00134	0.00134	0.00898	0.00333	0.0024
Zinc (TSP)	15	15		0.0482	0.0482	0.187	0.0956	0.0841

GRAND RAPIDS - Monroe			AIRS ID: 260810020				Units: µg/m³	
Chemical Name	# Obs	Obs > MDL	MDL	Max 1	Max 2	Max 3	Min Mean	Max Mean
2,5-dimethylbenzaldehyde	8	0	0.0466	0	0.0466	0	0	0
Acetaldehyde	8	8	0.0206	1.13	1.13	1.31	1.3	1.17
Acetone	8	8	0.0664	2.83	2.83	4.14	3.93	3.35
Benzaldehyde	8	0	0.019	0	0.019	0	0	0
Crotonaldehyde (trans)	8	0	0.0111	0	0.0111	0	0	0
Formaldehyde	8	8	0.0221	1.58	1.58	2.1	1.96	1.79
Hexanaldehyde	8	0	0.0364	0	0.0364	0	0	0
Isovaleraldehyde	8	0	0.0229	0	0.0229	0	0	0
m,p-Tolualdehyde	8	0	0.0348	0	0.0348	0	0	0
n-Butyraldehyde	8	0	0.0119	0	0.0119	0	0	0
o-Tolualdehyde	8	0	0.0292	0	0.0292	0	0	0
Propionaldehyde	8	0	0.034	0	0.034	0	0	0
Valeraldehyde	8	0	0.0348	0	0.0348	0	0	0
1,1,1-Trichloroethane	7	3	0.24	0.13	0.267	0.34	0.29	0.28
1,1,2,2-Tetrachloroethane	7	0	1	0	1	0	0	0
1,1,2-Trichloroethane	7	0	0.703	0	0.703	0	0	0
1,1-Dichloroethane	7	0	0.19	0	0.19	0	0	0
1,1-Dichloroethene	7	0	0.13	0	0.13	0	0	0
1,2,4-Trichlorobenzene	7	0	1.4	0	1.4	0	0	0
1,2,4-Trimethylbenzene	7	1	0.573	0.101	0.593	0.71	0	0
1,2-Dibromoethane	7	0	1.03	0	1.03	0	0	0
1,2-Dichlorobenzene	7	0	0.783	0	0.783	0	0	0
1,2-Dichloroethane	7	0	0.267	0	0.267	0	0	0
1,2-Dichloropropane	7	0	0.313	0	0.313	0	0	0
1,3,5-Trimethylbenzene	7	0	0.55	0	0.55	0	0	0
1,3-Butadiene	7	1	0.229	0.0343	0.23	0.24	0	0
1,3-Dichlorobenzene	7	0	0.72	0	0.72	0	0	0
1,4-Dichlorobenzene	7	0	0.79	0	0.79	0	0	0
2,2,4-Trimethylpentane	7	7	0.14	0.311	0.311	0.65	0.37	0.35
2-Chloro-1,3-Butadiene	7	0	0.15	0	0.15	0	0	0
Acetonitrile	7	4	0.37	0.299	0.457	0.64	0.6	0.46
Acrylonitrile	7	0	0.36	0	0.36	0	0	0
Benzene	7	7	0.13	1.09	1.09	1.9	1.2	1.1
Bromodichloromethane	7	0	0.621	0	0.621	0	0	0
Bromoform	7	0	1.7	0	1.7	0	0	0
Bromomethane	7	0	0.26	0	0.26	0	0	0
Carbon Tetrachloride	7	6	0.273	0.45	0.489	0.62	0.6	0.55
Chlorobenzene	7	0	0.633	0	0.633	0	0	0
Chloroethane	7	0	0.233	0	0.233	0	0	0
Chloroform	7	6	0.25	0.329	0.364	0.75	0.36	0.34
Chloromethane	7	7	0.13	1.17	1.17	1.3	1.2	1.2
Chloromethyl Benzene	7	0	1.2	0	1.2	0	0	0
cis-1,2-Dichloroethene	7	0	0.199	0	0.199	0	0	0
cis-1,3-Dichloropropene	7	0	0.479	0	0.479	0	0	0
Dibromochloromethane	7	0	1.33	0	1.33	0	0	0
Dichlorodiflouromethane	7	7	0.407	2.64	2.64	3.1	2.9	2.7
Ethylbenzene	7	0	0.543	0	0.543	0	0	0
Halocarbon 113	7	7	0.253	0.597	0.597	0.71	0.64	0.63
Halocarbon 114	7	0	0.16	0	0.16	0	0	0
Hexachloro-1,3-Butadiene	7	0	1.6	0	1.6	0	0	0
m/p -Xylene	7	3	0.633	0.444	0.807	1.5	0.84	0.77
Methyl Ethyl Ketone	7	7	0.233	0.844	0.844	1.3	0.93	0.89
Methyl Isobutyl Ketone	7	0	0.41	0	0.41	0	0	0

GRAND RAPIDS - Monroe			AIRS ID: 260810020				Units: µg/m³	
Chemical Name	**# Obs**	**Obs > MDL**	**MDL**	**Max 1**	**Max 2**	**Max 3**	**Min Mean**	**Max Mean**
Methyl Tert-Butyl Ether	7	0	0.12	0	0.12	0	0	0
Methylene Chloride	7	2	0.699	0.277	0.776	1.2	0.74	0
n-Hexane	7	2	0.816	0.614	1.2	3.1	1.2	0
o-xylene	7	1	0.539	0.08	0.541	0.56	0	0
Styrene	7	0	0.563	0	0.563	0	0	0
Tetrachloroethene	7	0	0.649	0	0.649	0	0	0
Toluene	7	7	0.703	2.02	2.02	4.3	2.7	2
trans-1,2-Dichloroethene	7	0	0.23	0	0.23	0	0	0
trans-1,3-Dichloropropene	7	0	0.48	0	0.48	0	0	0
Trichloroethene	7	1	0.343	0.0943	0.389	0.66	0	0
Trichloroflouromethane	7	7	0.12	1.28	1.28	2.5	1.5	1.2
Vinyl Chloride	7	0	0.0829	0	0.0829	0	0	0
Arsenic (TSP)	8	8	0.000117	0.000998	0.000998	0.00278	0.0013	0.00102
Barium (TSP)	8	8		0.0194	0.0194	0.0304	0.0219	0.0199
Beryllium (TSP)	8	8	0.000115	8.56E-06	8.56E-06	1.25E-05	1.09E-05	1.08E-05
Cadmium (TSP)	8	8	0.000115	0.000149	0.000149	0.000181	0.000176	0.000175
Chromium (TSP)	8	8	0.000366	0.00267	0.00267	0.00481	0.00279	0.00271
Cobalt (TSP)	8	8	0.00011	0.000101	0.000101	0.00017	0.000128	0.000119
Copper (TSP)	8	8	0.000593	0.228	0.228	0.341	0.328	0.316
Iron (TSP)	8	8		0.284	0.284	0.454	0.448	0.3
Lead (TSP)	8	8	0.000163	0.00413	0.00413	0.00555	0.005	0.00493
Manganese (TSP)	8	8	0.00024	0.00996	0.00996	0.0202	0.0147	0.00963
Molybdenum (TSP)	8	8	0.000154	0.000734	0.000734	0.00107	0.000997	0.000928
Nickel (TSP)	8	8	0.000166	0.00098	0.00098	0.00208	0.00136	0.00114
Vanadium (TSP)	8	8	0.000152	0.000422	0.000422	0.000978	0.000601	0.000416
Zinc (TSP)	8	8		0.044	0.044	0.0748	0.0507	0.0446

HOUGHTON LAKE			AIRS ID: 261130001			Units: µg/m³		
Chemical Name	**# Obs**	**Obs > MDL**	**MDL**	**Max 1**	**Max 2**	**Max 3**	**Min Mean**	**Max Mean**
2,5-dimethylbenzaldehyde	7	0	0.051	0	0.051	0	0	0
Acetaldehyde	7	7	0.0226	0.764	0.764	1.27	0.842	0.809
Acetone	7	7	0.0728	2.34	2.34	4.84	2.9	2.02
Benzaldehyde	7	0	0.0209	0	0.0209	0	0	0
Crotonaldehyde (trans)	7	0	0.0121	0	0.0121	0	0	0
Formaldehyde	7	7	0.0243	1.05	1.05	2.11	1.12	1.11
Hexanaldehyde	7	0	0.04	0	0.04	0	0	0
Isovaleraldehyde	7	0	0.0251	0	0.0251	0	0	0
m,p-Tolualdehyde	7	0	0.0382	0	0.0382	0	0	0
n-Butyraldehyde	7	0	0.0131	0	0.0131	0	0	0
o-Tolualdehyde	7	0	0.0321	0	0.0321	0	0	0
Propionaldehyde	7	0	0.0373	0	0.0373	0	0	0
Valeraldehyde	7	0	0.0382	0	0.0382	0	0	0
1,1,1-Trichloroethane	12	0	0.24	0	0.24	0	0	0
1,1,2,2-Tetrachloroethane	12	0	1	0	1	0	0	0
1,1,2-Trichloroethane	12	0	0.702	0	0.702	0	0	0
1,1-Dichloroethane	12	0	0.19	0	0.19	0	0	0
1,1-Dichloroethene	12	0	0.13	0	0.13	0	0	0
1,2,4-Trichlorobenzene	13	0	1.4	0	1.4	0	0	0
1,2,4-Trimethylbenzene	12	0	0.572	0	0.572	0	0	0
1,2-Dibromoethane	12	0	1.03	0	1.03	0	0	0
1,2-Dichlorobenzene	12	0	0.782	0	0.782	0	0	0
1,2-Dichloroethane	12	0	0.268	0	0.268	0	0	0
1,2-Dichloropropane	12	0	0.313	0	0.313	0	0	0
1,3,5-Trimethylbenzene	12	0	0.55	0	0.55	0	0	0
1,3-Butadiene	12	0	0.229	0	0.229	0	0	0
1,3-Dichlorobenzene	12	0	0.72	0	0.72	0	0	0
1,4-Dichlorobenzene	12	0	0.79	0	0.79	0	0	0
2,2,4-Trimethylpentane	12	0	0.14	0	0.14	0	0	0
2-Chloro-1,3-Butadiene	12	0	0.15	0	0.15	0	0	0
Acetonitrile	12	9	0.37	0.772	0.864	1.3	1.3	1.2
Acrylonitrile	12	0	0.36	0	0.36	0	0	0

HOUGHTON LAKE			AIRS ID: 261130001			Units: µg/m³		
Chemical Name	**# Obs**	**Obs > MDL**	**MDL**	**Max 1**	**Max 2**	**Max 3**	**Min Mean**	**Max Mean**
Benzene	12	12	0.13	0.527	0.527	0.76	0.7	0.63
Bromodichloromethane	12	0	0.621	0	0.621	0	0	0
Bromoform	12	0	1.7	0	1.7	0	0	0
Bromomethane	12	0	0.26	0	0.26	0	0	0
Carbon Tetrachloride	12	12	0.273	0.533	0.533	0.6	0.59	0.58
Chlorobenzene	12	0	0.632	0	0.632	0	0	0
Chloroethane	12	0	0.233	0	0.233	0	0	0
Chloroform	12	12	0.25	0.444	0.444	0.95	0.63	0.56
Chloromethane	12	12	0.13	1.28	1.28	1.5	1.4	1.4
Chloromethyl Benzene	12	0	1.2	0	1.2	0	0	0
cis-1,2-Dichloroethene	12	0	0.199	0	0.199	0	0	0
cis-1,3-Dichloropropene	12	0	0.479	0	0.479	0	0	0
Dibromochloromethane	12	0	1.32	0	1.32	0	0	0
Dichlorodiflouromethane	12	12	0.408	2.78	2.78	3.1	3	3
Ethylbenzene	12	0	0.543	0	0.543	0	0	0
Halocarbon 113	12	12	0.252	0.783	0.783	0.89	0.86	0.82
Halocarbon 114	12	0	0.16	0	0.16	0	0	0
Hexachloro-1,3-Butadiene	12	0	1.6	0	1.6	0	0	0
m/p -Xylene	12	0	0.632	0	0.632	0	0	0
Methyl Ethyl Ketone	12	12	0.233	0.729	0.729	1.4	1.2	0.85
Methyl Isobutyl Ketone	12	0	0.41	0	0.41	0	0	0
Methyl Tert-Butyl Ether	12	0	0.12	0	0.12	0	0	0
Methylene Chloride	12	3	0.699	0.292	0.817	1.8	0.97	0.74
n-Hexane	12	3	0.816	0.308	0.92	1.9	0.94	0.86
o-xylene	12	0	0.539	0	0.539	0	0	0
Styrene	12	0	0.563	0	0.563	0	0	0
Tetrachloroethene	12	0	0.649	0	0.649	0	0	0
Toluene	12	1	0.702	0.0733	0.717	0.88	0	0
trans-1,2-Dichloroethene	12	0	0.23	0	0.23	0	0	0
trans-1,3-Dichloropropene	12	0	0.48	0	0.48	0	0	0
Trichloroethene	12	0	0.343	0	0.343	0	0	0
Trichloroflouromethane	12	12	0.12	1.21	1.21	2.7	1.4	1.4
Vinyl Chloride	12	0	0.0825	0	0.0825	0	0	0
Arsenic (TSP)	14	14	0.00011	0.000345	0.000345	0.00114	0.000489	0.000468
Barium (TSP)	14	14		0.0117	0.0117	0.0192	0.0159	0.0147
Beryllium (TSP)	14	13	0.000108	4.48E-06	0.0000119	9.7E-06	9.2E-06	8.7E-06
Cadmium (TSP)	14	14	0.000108	0.0000797	0.0000797	0.000142	0.000129	0.000118
Chromium (TSP)	14	14	0.000345	0.00132	0.00132	0.00146	0.00144	0.00141
Cobalt (TSP)	14	11	0.000103	0.0000247	0.0000465	6.45E-05	6.34E-05	5.29E-05
Copper (TSP)	14	14	0.000559	0.977	0.977	1.69	1.54	1.48
Iron (TSP)	14	14		0.0632	0.0632	0.102	0.0971	0.0828
Lead (TSP)	14	14	0.000153	0.00162	0.00162	0.00361	0.00254	0.00243
Manganese (TSP)	14	14	0.000226	0.0029	0.0029	0.00453	0.00448	0.00361
Molybdenum (TSP)	14	14	0.000145	0.00016	0.00016	0.000388	0.000351	0.000219
Nickel (TSP)	14	12	0.000156	0.000308	0.00033	0.000801	0.000798	0.000501
Vanadium (TSP)	14	14	0.000143	0.00036	0.00036	0.00178	0.00152	0.00023
Zinc (TSP)	14	14		0.0235	0.0235	0.0753	0.0443	0.0306

RIVER ROUGE			AIRS ID: 261630005			Units: µg/m³		
Chemical Name	**# Obs**	**Obs > MDL**	**MDL**	**Max 1**	**Max 2**	**Max 3**	**Min Mean**	**Max Mean**
2,5-dimethylbenzaldehyde	42	0	0.0516	0	0.0516	0	0	0
Acetaldehyde	42	42	0.0227	1.86	1.86	3.53	3.13	2.99
Acetone	42	42	0.0735	2.43	2.43	4.88	4.86	4.23
Benzaldehyde	42	0	0.021	0	0.021	0	0	0
Crotonaldehyde (trans)	42	0	0.0122	0	0.0122	0	0	0
Formaldehyde	42	42	0.0245	3.28	3.28	5.77	5.38	5.32
Hexanaldehyde	42	1	0.0403	0.0152	0.0546	0.639	0	0
Isovaleraldehyde	42	0	0.0254	0	0.0254	0	0	0
m,p-Tolualdehyde	42	0	0.0385	0	0.0385	0	0	0
n-Butyraldehyde	42	14	0.0131	0.181	0.189	0.832	0.749	0.726
o-Tolualdehyde	42	0	0.0324	0	0.0324	0	0	0
Propionaldehyde	42	28	0.0377	0.408	0.42	1.64	1.07	0.9

RIVER ROUGE			AIRS ID: 261630005				Units: µg/m³	
Chemical Name	**# Obs**	**Obs > MDL**	**MDL**	**Max 1**	**Max 2**	**Max 3**	**Min Mean**	**Max Mean**
Valeraldehyde	42	0	0.0385	0	0.0385	0	0	0
Arsenic (TSP)	60	60	0.000111	0.00183	0.00183	0.00644	0.00589	0.00499
Barium (TSP)	15	15		0.0213	0.0213	0.0282	0.0281	0.0267
Beryllium (TSP)	15	15	0.000105	0.000027	0.000027	7.23E-05	4.76E-05	3.51E-05
Cadmium (TSP)	60	60	0.000109	0.000833	0.000833	0.00333	0.00333	0.00276
Chromium (TSP)	15	15	0.000335	0.00361	0.00361	0.00595	0.00507	0.00448
Cobalt (TSP)	15	15	0.0001	0.000172	0.000172	0.000448	0.000379	0.00026
Copper (TSP)	15	15	0.000544	0.485	0.485	0.901	0.825	0.668
Iron (TSP)	15	15		0.697	0.697	1.34	1.17	1.13
Lead (TSP)	15	15	0.000149	0.00752	0.00752	0.0153	0.0137	0.00852
Manganese (TSP)	60	60	0.000228	0.0652	0.0652	0.223	0.18	0.173
Molybdenum (TSP)	15	15	0.000141	0.000776	0.000776	0.00132	0.00115	0.00104
Nickel (TSP)	60	60	0.000156	0.00245	0.00245	0.00643	0.00571	0.00568
Vanadium (TSP)	15	15	0.000139	0.00244	0.00244	0.00617	0.00557	0.00395
Zinc (TSP)	15	15		0.0679	0.0679	0.253	0.121	0.0928

SAULT STE. MARIE - Easterday			AIRS ID: 260330901				Units: µg/m³	
Chemical Name	**# Obs**	**Obs > MDL**	**MDL**	**Max 1**	**Max 2**	**Max 3**	**Min Mean**	**Max Mean**
Naphthalene	55	55	1.10E-07	0.0296	0.0296	0.124	0.119	0.1

YPSILANTI			AIRS ID: 261610008				Units: µg/m³	
Chemical Name	**# Obs**	**Obs > MDL**	**MDL**	**Max 1**	**Max 2**	**Max 3**	**Min Mean**	**Max Mean**
2,5-dimethylbenzaldehyde	10	0	0.0531	0	0.0531	0	0	0
Acetaldehyde	10	10	0.0234	1.15	1.15	1.56	1.5	1.45
Acetone	10	10	0.0756	2.44	2.44	3.49	2.97	2.92
Benzaldehyde	10	0	0.0216	0	0.0216	0	0	0
Crotonaldehyde (trans)	10	0	0.0126	0	0.0126	0	0	0
Formaldehyde	10	10	0.0252	1.82	1.82	2.88	2.52	1.93
Hexanaldehyde	10	0	0.0414	0	0.0414	0	0	0
Isovaleraldehyde	10	0	0.0261	0	0.0261	0	0	0
m,p-Tolualdehyde	10	0	0.0397	0	0.0397	0	0	0
n-Butyraldehyde	10	0	0.0135	0	0.0135	0	0	0
o-Tolualdehyde	10	0	0.0333	0	0.0333	0	0	0
Propionaldehyde	10	0	0.0388	0	0.0388	0	0	0
Valeraldehyde	10	0	0.0396	0	0.0396	0	0	0
1,1,1-Trichloroethane	8	0	0.24	0	0.24	0	0	0
1,1,2,2-Tetrachloroethane	8	0	1	0	1	0	0	0
1,1,2-Trichloroethane	8	0	0.702	0	0.702	0	0	0
1,1-Dichloroethane	8	0	0.19	0	0.19	0	0	0
1,1-Dichloroethene	8	0	0.13	0	0.13	0	0	0
1,2,4-Trichlorobenzene	8	0	1.4	0	1.4	0	0	0
1,2,4-Trimethylbenzene	8	0	0.572	0	0.572	0	0	0
1,2-Dibromoethane	8	0	1.03	0	1.03	0	0	0
1,2-Dichlorobenzene	8	0	0.782	0	0.782	0	0	0
1,2-Dichloroethane	8	0	0.266	0	0.266	0	0	0
1,2-Dichloropropane	8	0	0.313	0	0.313	0	0	0
1,3,5-Trimethylbenzene	8	0	0.55	0	0.55	0	0	0
1,3-Butadiene	8	0	0.229	0	0.229	0	0	0
1,3-Dichlorobenzene	8	0	0.72	0	0.72	0	0	0
1,4-Dichlorobenzene	8	0	0.79	0	0.79	0	0	0
2,2,4-Trimethylpentane	8	7	0.14	0.245	0.263	0.49	0.34	0.32
2-Chloro-1,3-Butadiene	8	0	0.15	0	0.15	0	0	0
Acetonitrile	8	8	0.37	1.21	1.21	3.1	1.4	1.2
Acrylonitrile	8	0	0.36	0	0.36	0	0	0
Benzene	8	8	0.13	0.93	0.93	1.2	1.2	1
Bromodichloromethane	8	0	0.621	0	0.621	0	0	0
Bromoform	8	0	1.7	0	1.7	0	0	0
Bromomethane	8	0	0.26	0	0.26	0	0	0
Carbon Tetrachloride	8	8	0.273	0.515	0.515	0.61	0.57	0.56
Chlorobenzene	8	0	0.632	0	0.632	0	0	0
Chloroethane	8	0	0.233	0	0.233	0	0	0

YPSILANTI			AIRS ID: 261610008			Units: µg/m³		
Chemical Name	# Obs	Obs > MDL	MDL	Max 1	Max 2	Max 3	Min Mean	Max Mean
Chloroform	8	5	0.25	0.606	0.7	1.8	1.6	0.72
Chloromethane	8	8	0.13	1.66	1.66	2.2	2.2	2.1
Chloromethyl Benzene	8	0	1.2	0	1.2	0	0	0
cis-1,2-Dichloroethene	8	0	0.199	0	0.199	0	0	0
cis-1,3-Dichloropropene	8	0	0.479	0	0.479	0	0	0
Dibromochloromethane	8	0	1.32	0	1.32	0	0	0
Dichlorodiflouromethane	8	8	0.407	2.79	2.79	3.3	3.2	3.2
Ethylbenzene	8	0	0.543	0	0.543	0	0	0
Halocarbon 113	8	8	0.252	0.666	0.666	0.72	0.72	0.69
Halocarbon 114	8	0	0.16	0	0.16	0	0	0
Hexachloro-1,3-Butadiene	8	0	1.6	0	1.6	0	0	0
m/p -Xylene	8	3	0.632	0.27	0.666	0.77	0.73	0.66
Methyl Ethyl Ketone	8	8	0.233	0.871	0.871	2	0.86	0.8
Methyl Isobutyl Ketone	8	0	0.41	0	0.41	0	0	0
Methyl Tert-Butyl Ether	8	0	0.12	0	0.12	0	0	0
Methylene Chloride	8	4	0.699	1.17	1.52	5.4	2.4	0.79
n-Hexane	8	3	0.815	1.69	2.2	7.5	4.6	1.4
o-xylene	8	0	0.539	0	0.539	0	0	0
Styrene	8	0	0.563	0	0.563	0	0	0
Tetrachloroethene	8	0	0.649	0	0.649	0	0	0
Toluene	8	7	0.702	1.35	1.44	2.3	1.8	1.8
trans-1,2-Dichloroethene	8	0	0.23	0	0.23	0	0	0
trans-1,3-Dichloropropene	8	0	0.48	0	0.48	0	0	0
Trichloroethene	8	0	0.343	0	0.343	0	0	0
Trichloroflouromethane	7	7	0.12	2.88	2.88	13	1.7	1.5
Vinyl Chloride	8	0	0.0825	0	0.0825	0	0	0
Arsenic (TSP)	8	8	0.000103	0.000837	0.000837	0.00218	0.00113	0.000719
Barium (TSP)	8	8		0.0173	0.0173	0.0216	0.0214	0.0191
Beryllium (TSP)	8	8	0.000101	0.0000112	0.0000112	2.32E-05	1.37E-05	1.24E-05
Cadmium (TSP)	8	8	0.000101	0.000164	0.000164	0.00033	0.000184	0.000168
Chromium (TSP)	8	8	0.000323	0.00191	0.00191	0.00228	0.00219	0.00197
Cobalt (TSP)	8	8	9.66E-05	0.0000811	0.0000811	0.000132	0.000123	0.000107
Copper (TSP)	8	8	0.000523	0.227	0.227	0.321	0.268	0.255
Iron (TSP)	8	8		0.26	0.26	0.414	0.342	0.291
Lead (TSP)	8	8	0.000144	0.00446	0.00446	0.0081	0.00539	0.00508
Manganese (TSP)	8	8	0.000211	0.00901	0.00901	0.0153	0.00957	0.00913
Molybdenum (TSP)	8	8	0.000136	0.000623	0.000623	0.000854	0.000744	0.000691
Nickel (TSP)	8	8	0.000146	0.000792	0.000792	0.00175	0.00113	0.000769
Vanadium (TSP)	8	8	0.000134	0.000903	0.000903	0.00301	0.00185	0.000487
Zinc (TSP)	8	8		0.0416	0.0416	0.0653	0.0644	0.0556

APPENDIX C2: AIR TOXICS SUMMARY FOR SPECIATED $PM_{2.5}$

ALLEN PARK			AIRS ID: 261630001			Units: µg/m³		
Chemical Name	**# Obs**	**Obs >MDL**	**MDL**	**Min Mean**	**Max Mean**	**Max 1**	**Max 2**	**Max 3**
Aluminum	120	91	0.0142	0.0332	0.0367	0.233	0.199	0.186
Ammonium Ion	120	120	0.0167	2.04	2.04	7.19	5.89	5.76
Antimony	120	23	0.0355	0.00128	0.03	0.0187	0.0163	0.0152
Arsenic	120	75	0.00152	0.00151	0.00207	0.0332	0.00939	0.00537
Barium	120	19	0.0173	0.00244	0.017	0.16	0.021	0.0186
Bromine	120	109	0.00158	0.00274	0.00288	0.00793	0.00668	0.0065
Cadmium	120	17	0.016	0.000639	0.0144	0.0152	0.0106	0.0084
Calcium	120	120	0.00615	0.0638	0.0638	0.492	0.298	0.218
Cerium	120	2	0.0195	0.0000389	0.0192	0.00432	0.00035	0
Cesium	120	17	0.0234	0.00139	0.0215	0.0571	0.0397	0.0396
Chlorine	120	100	0.00739	0.0488	0.05	0.825	0.448	0.371
Chromium	120	70	0.00229	0.00299	0.00395	0.0707	0.0527	0.0344
Cobalt	120	40	0.00134	0.000203	0.0011	0.00251	0.00154	0.00139
Copper	120	119	0.00169	0.00863	0.00865	0.0326	0.032	0.0292
Elemental Carbon	120	120	0.24	0.774	0.774	2.81	2.2	1.71
Europium	120	11	0.00553	0.000215	0.00523	0.00899	0.00373	0.0035
Gallium	120	27	0.00227	0.000146	0.00191	0.00269	0.00187	0.00147
Gold	120	15	0.00418	0.000196	0.00385	0.00361	0.00315	0.00222
Hafnium	120	10	0.00877	0.000146	0.00818	0.00374	0.00303	0.00292
Indium	120	14	0.0174	0.00063	0.016	0.0338	0.007	0.00689
Iridium	120	14	0.00498	0.000286	0.00468	0.00572	0.00385	0.00362
Iron	120	120	0.00188	0.117	0.117	0.405	0.358	0.352
Lanthanium	120	6	0.017	0.000546	0.0167	0.0315	0.0292	0.00233
Magnesium	120	37	0.0138	0.0057	0.0152	0.0653	0.0532	0.0414
Manganese	120	106	0.00196	0.00217	0.0024	0.00944	0.00781	0.0073
Mercury	120	23	0.00597	0.000635	0.00546	0.00932	0.00898	0.00863
Molybdenum	120	5	0.00628	0.0000865	0.00611	0.00385	0.00338	0.00222
Nickel	120	102	0.00134	0.0017	0.0019	0.0201	0.0142	0.0115
Niobium	120	18	0.00392	0.000355	0.00368	0.00466	0.00466	0.00385
Organic Carbon Peak1	120	120	0.24	0.929	0.929	2.48	2.41	2.35
Organic Carbon Peak2	120	120	0.24	1.42	1.42	11.2	3.57	3.39
Organic Carbon Peak3	120	120	0.24	0.894	0.894	4.41	2.5	1.95
Organic Carbon Peak4	120	119	0.24	0.781	0.783	3.83	3.39	3.1
Organic Carbon	120	120	0.24	4.03	4.03	18.7	9.46	9.25
Organic Carbon Pyrolytic	120	19	0.24	0.0123	0.214	0.516	0.22	0.169
Phosphorus	120	2	0.0118	0.0000156	0.0116	0.00117	0.0007	0
Potassium Ion	120	78	0.0142	0.0585	0.0635	0.483	0.198	0.197
Potassium	120	120	0.00626	0.0629	0.0629	0.55	0.234	0.224
Rubidium	120	48	0.00193	0.000342	0.0015	0.00275	0.00217	0.00217
Samarium	120	16	0.00543	0.000302	0.00501	0.00419	0.00397	0.00397
Scandium	120	3	0.0192	0.0000253	0.0188	0.00163	0.00082	0.00058
Selenium	120	73	0.0019	0.0012	0.00195	0.0152	0.00933	0.00527
Silicon	120	119	0.0112	0.0792	0.0793	0.489	0.387	0.379
Silver	120	23	0.0129	0.00069	0.0112	0.011	0.0106	0.00782
Sodium Ion	120	118	0.0295	0.104	0.105	1.05	0.52	0.511
Sodium	120	78	0.0401	0.0408	0.0548	0.572	0.335	0.212
Strantium	120	41	0.00234	0.000853	0.00239	0.0118	0.00769	0.00747
Sulfate	120	120	0.00871	3.66	3.66	14.1	13.4	12.1
Sulfur	120	120	0.00801	1.18	1.18	4.23	4.12	3.93
Tantalum	120	9	0.00706	0.000196	0.00673	0.0064	0.00572	0.00456
Terbium	120	7	0.0049	0.000146	0.00476	0.00806	0.00246	0.00233
Tin	120	18	0.0234	0.00154	0.0214	0.0303	0.0292	0.0163
Titatium	120	86	0.0047	0.00395	0.00528	0.0259	0.0224	0.0217
Total Nitrate	120	120	0.00697	2.58	2.58	14.6	10.5	8.99
Tungsten	120	18	0.00542	0.000288	0.0049	0.00943	0.00549	0.00537
Vanadium	120	87	0.00318	0.00229	0.00316	0.0166	0.0142	0.0139
Yttrium	120	15	0.00261	0.0000832	0.00237	0.00187	0.00148	0.00117
Zinc	120	118	0.00251	0.0171	0.0171	0.0993	0.096	0.0592
Zirconium	120	20	0.00381	0.000489	0.00367	0.00934	0.00815	0.00654

DEARBORN			AIRS ID: 261630033			Units: µg/m³		
Chemical Name	# Obs	Obs > MDL	MDL	Min Mean	Max Mean	Max 1	Max 2	Max 3
Aluminum	59	48	0.0146	0.0533	0.056	0.323	0.171	0.166
Ammonium Ion	59	58	0.0171	2.39	2.39	9.16	6.79	6.61
Antimony	59	10	0.0349	0.00093	0.0299	0.0151	0.00828	0.00746
Arsenic	59	43	0.0015	0.00158	0.00198	0.00863	0.00769	0.00653
Barium	59	11	0.017	0.00359	0.0174	0.0722	0.0525	0.0334
Bromine	59	55	0.00154	0.00578	0.00588	0.0318	0.0282	0.0281
Cadmium	59	7	0.0156	0.0003	0.0141	0.0077	0.00349	0.00245
Calcium	59	59	0.00627	0.141	0.141	0.504	0.46	0.442
Cerium	59	2	0.019	0.000436	0.0188	0.0148	0.0109	0
Cesium	59	12	0.0222	0.00305	0.0207	0.119	0.0257	0.0106
Chlorine	59	56	0.00747	0.145	0.146	1.08	0.734	0.658
Chromium	59	33	0.00228	0.00337	0.00438	0.115	0.0214	0.00729
Cobalt	59	19	0.00136	0.000319	0.00124	0.00373	0.0019	0.00175
Copper	59	58	0.00175	0.014	0.014	0.0895	0.0305	0.0296
Elemental Carbon	31	31	0.24	0.8	0.8	1.44	1.36	1.3
Europium	59	1	0.00547	0.00000593	0.00538	0.00035	0	0
Gallium	59	15	0.00227	0.000271	0.00196	0.00462	0.00248	0.00196
Gold	59	5	0.00408	0.0000792	0.00382	0.00198	0.00163	0.00047
Hafnium	59	14	0.0099	0.00241	0.00996	0.0738	0.0188	0.0077
Indium	59	8	0.0171	0.000884	0.0156	0.0252	0.00584	0.00467
Iridium	59	2	0.00482	0.0000258	0.00468	0.00117	0.00035	0
Iron	59	59	0.00191	0.48	0.48	2.14	2	1.92
Lanthanium	59	12	0.0166	0.00335	0.0166	0.0678	0.0299	0.0268
Magnesium	59	31	0.0137	0.035	0.0415	0.312	0.219	0.214
Manganese	59	55	0.00195	0.0184	0.0186	0.116	0.1	0.0964
Mercury	59	9	0.00569	0.000463	0.00529	0.0103	0.00512	0.00338
Molybdenum	59	3	0.00628	0.000105	0.00606	0.00268	0.00221	0.00128
Nickel	59	54	0.00137	0.00234	0.00245	0.0389	0.0121	0.00833
Niobium	59	5	0.00384	0.000134	0.00365	0.00326	0.00186	0.00152
Organic Carbon Peak1	31	31	0.24	1.47	1.47	3.73	3.06	2.79
Organic Carbon Peak2	31	31	0.24	1.14	1.14	2.15	2.04	2.01
Organic Carbon Peak3	31	31	0.24	0.728	0.728	1.6	1.58	1.51
Organic Carbon Peak4	31	31	0.24	1.01	1.01	3.69	2.51	2.07
Organic Carbon	31	31	0.24	4.39	4.39	10.4	8.07	7.17
Organic Carbon Pyrolytic	31	10	0.24	0.0421	0.205	0.626	0.393	0.183
Phosphorus	59	1	0.0118	0.0000297	0.0116	0.00175	0	0
Potassium Ion	59	49	0.0142	0.263	0.265	3.01	1.87	0.976
Potassium	59	59	0.0066	0.248	0.248	3	1.86	0.884
Rubidium	59	32	0.0019	0.00155	0.00242	0.0139	0.00764	0.00726
Samarium	59	6	0.00541	0.000381	0.00524	0.00676	0.00548	0.00315
Scandium	59	2	0.0182	0.0000307	0.0176	0.00163	0.00018	0
Selenium	59	43	0.00193	0.00229	0.00281	0.0115	0.0105	0.00775
Silicon	59	59	0.0115	0.131	0.131	0.515	0.375	0.356
Silver	59	7	0.0126	0.000617	0.0118	0.0103	0.00933	0.00817
Sodium Ion	59	58	0.0297	0.133	0.133	0.456	0.456	0.415
Sodium	59	40	0.0394	0.0985	0.111	0.966	0.686	0.644
Strantium	59	27	0.0023	0.00185	0.0031	0.0359	0.0197	0.00768
Sulfate	59	58	0.00892	4.41	4.41	23.9	16.1	15.4
Sulfur	59	59	0.00808	1.31	1.31	4.89	4.19	4.08
Tantalum	59	5	0.00688	0.000216	0.00651	0.00513	0.00362	0.00192
Terbium	59	9	0.00493	0.000995	0.00517	0.0184	0.012	0.01
Tin	59	11	0.0229	0.00223	0.0209	0.0494	0.0286	0.0136
Titatium	59	40	0.00475	0.00447	0.006	0.0263	0.0219	0.0208
Total Nitrate	59	58	0.00699	3.17	3.17	10.9	10.7	10.6
Tungsten	59	5	0.00533	0.000388	0.00527	0.00957	0.00712	0.00291
Vanadium	59	47	0.00319	0.00466	0.00531	0.029	0.0269	0.025
Yttrium	59	6	0.00258	0.000107	0.00242	0.00213	0.00187	0.00147
Zinc	59	59	0.00248	0.136	0.136	1.51	0.948	0.777
Zirconium	59	10	0.00372	0.000389	0.00348	0.0063	0.00291	0.00268

GRAND RAPIDS - Monroe			AIRS ID: 260810020				Units: µg/m³	
Chemical Name	# Obs	Obs > MDL	MDL	Min Mean	Max Mean	Max 1	Max 2	Max 3
Aluminum	56	36	0.0148	0.0193	0.0246	0.196	0.0886	0.0653
Ammonium Ion	55	55	0.0167	1.92	1.92	6.06	5.95	5.41
Antimony	56	8	0.036	0.0023	0.0332	0.0432	0.0303	0.0152
Arsenic	56	37	0.00139	0.000944	0.00142	0.00458	0.0042	0.00398
Barium	56	5	0.0148	0.000904	0.0144	0.0164	0.0125	0.0105
Bromine	56	50	0.00149	0.00253	0.00269	0.01	0.00895	0.00867
Cadmium	56	12	0.0159	0.00112	0.0136	0.01	0.00874	0.00863
Calcium	56	55	0.00649	0.0382	0.0383	0.171	0.151	0.0929
Cerium	56	2	0.0158	0.000114	0.0153	0.00594	0.00047	0
Cesium	56	6	0.02	0.000477	0.0184	0.012	0.00491	0.0035
Chlorine	56	48	0.00746	0.0363	0.0374	0.624	0.183	0.127
Chromium	56	24	0.00234	0.00145	0.00279	0.0201	0.0115	0.0101
Cobalt	56	19	0.00132	0.000242	0.00111	0.0014	0.00133	0.00128
Copper	56	56	0.00171	0.0107	0.0107	0.0733	0.0409	0.0328
Elemental Carbon	54	54	0.24	0.667	0.667	1.41	1.11	1.09
Europium	56	3	0.00515	0.0000479	0.00492	0.00163	0.0007	0.00035
Gallium	56	14	0.00203	0.000259	0.00178	0.00372	0.00292	0.00134
Gold	56	10	0.00365	0.000423	0.00342	0.00665	0.0042	0.00397
Hafnium	56	1	0.0094	0.0000771	0.00931	0.00432	0	0
Indium	56	9	0.017	0.000847	0.0151	0.0163	0.00816	0.00689
Iridium	56	4	0.00444	0.0000789	0.0042	0.00128	0.00128	0.00093
Iron	56	56	0.00182	0.0759	0.0759	0.225	0.212	0.192
Lanthanium	56	1	0.0138	0.0000271	0.0136	0.00152	0	0
Magnesium	56	20	0.0142	0.00706	0.0162	0.077	0.0541	0.0513
Manganese	56	48	0.0019	0.00438	0.00465	0.0289	0.0229	0.0182
Mercury	56	10	0.00535	0.000658	0.00506	0.0098	0.00759	0.00736
Molybdenum	56	3	0.00585	0.000171	0.00571	0.00503	0.00327	0.00128
Nickel	56	47	0.00132	0.0011	0.00131	0.00719	0.00526	0.00441
Niobium	56	7	0.00367	0.000306	0.00351	0.00899	0.00257	0.00233
Organic Carbon Peak1	54	54	0.24	1.05	1.05	2.98	2.39	2.05
Organic Carbon Peak2	54	54	0.24	1.37	1.37	3.2	2.61	2.32
Organic Carbon Peak3	54	54	0.24	0.915	0.915	3.61	2.29	1.83
Organic Carbon Peak4	54	54	0.24	0.856	0.856	4.29	2.67	2.37
Organic Carbon	54	54	0.24	4.19	4.19	12.2	8.17	7.77
Organic Carbon Pyrolytic	54	8	0.24	0.00663	0.211	0.128	0.0444	0.0389
Phosphorus	56		0.0126	0	0.0126	0	0	0
Potassium Ion	55	30	0.0142	0.0605	0.0669	1.02	0.144	0.12
Potassium	56	56	0.00677	0.0707	0.0707	0.932	0.146	0.134
Rubidium	56	23	0.00189	0.000297	0.00141	0.00213	0.00201	0.00168
Samarium	56	3	0.00515	0.000127	0.005	0.0035	0.0021	0.00152
Scandium	56	3	0.0181	0.000215	0.0173	0.00922	0.00141	0.0014
Selenium	56	29	0.00183	0.000615	0.00149	0.00397	0.00352	0.0032
Silicon	56	52	0.0114	0.056	0.0568	0.367	0.302	0.123
Silver	56	10	0.0126	0.00128	0.0117	0.0129	0.0105	0.0105
Sodium Ion	55	51	0.0297	0.0576	0.0597	0.29	0.184	0.182
Sodium	56	28	0.0415	0.0198	0.0406	0.182	0.175	0.154
Strantium	56	14	0.00229	0.000466	0.00218	0.00559	0.00455	0.00316
Sulfate	55	55	0.00868	2.99	2.99	12.4	10.5	9.49
Sulfur	56	56	0.00849	1.02	1.02	4.2	3.53	3.43
Tantalum	56	2	0.00664	0.000179	0.00658	0.00548	0.00455	0
Terbium	56	5	0.00463	0.000196	0.00441	0.00362	0.00361	0.00198
Tin	56	12	0.0228	0.00232	0.0202	0.0278	0.0163	0.0163
Titatium	56	33	0.00483	0.00277	0.00475	0.0196	0.0138	0.0123
Total Nitrate	55	55	0.00697	2.81	2.81	11.7	10.8	9.24
Tungsten	56	7	0.00495	0.000496	0.00483	0.012	0.00655	0.00455
Vanadium	56	28	0.00332	0.000902	0.00256	0.00677	0.00409	0.00397
Yttrium	56	3	0.00249	0.0000218	0.00238	0.00064	0.00035	0.00023
Zinc	56	56	0.00241	0.0154	0.0154	0.0462	0.0339	0.0275
Zirconium	56	4	0.00365	0.000306	0.00369	0.00827	0.00432	0.00373

HOUGHTON LAKE			AIRS ID: 261130001			Units: µg/m³		
Parameter Name	# Obs	Obs > MDL	MDL	Min Mean	Max Mean	Max 1	Max 2	Max 3
Aluminum	54	25	0.0145	0.0128	0.0206	0.135	0.0934	0.0863
Ammonium Ion	54	54	0.0168	0.932	0.932	4.11	3.69	3.26
Antimony	54	5	0.0342	0.000883	0.0319	0.0237	0.0129	0.00584
Arsenic	54	23	0.00154	0.000347	0.00123	0.00187	0.00176	0.0014
Barium	54	9	0.0185	0.000842	0.0163	0.00957	0.00816	0.00723
Bromine	54	39	0.00156	0.00149	0.00193	0.00548	0.00484	0.00426
Cadmium	54	9	0.0154	0.000741	0.0136	0.00931	0.00794	0.00594
Calcium	54	48	0.00628	0.0158	0.0165	0.128	0.078	0.0506
Cerium	54		0.0214	0	0.0214	0	0	0
Cesium	54	13	0.0226	0.00116	0.0183	0.0233	0.0137	0.00513
Chlorine	54	29	0.00766	0.00719	0.0107	0.0788	0.0695	0.0443
Chromium	54	18	0.00227	0.00129	0.00281	0.0407	0.00764	0.00744
Cobalt	54	21	0.00139	0.000221	0.00107	0.00126	0.00118	0.00114
Copper	54	45	0.00177	0.0018	0.00209	0.0102	0.0097	0.00705
Elemental Carbon	54	52	0.24	0.277	0.286	2.55	0.539	0.514
Europium	54	5	0.00568	0.000114	0.00527	0.00222	0.00187	0.00105
Gallium	54	12	0.00234	0.000162	0.00198	0.00147	0.0014	0.00131
Gold	54	6	0.00417	0.000106	0.00381	0.00128	0.00128	0.00117
Hafnium	54	4	0.0101	0.0000413	0.00939	0.0014	0.00035	0.00024
Indium	54	10	0.0168	0.000957	0.0147	0.0222	0.0128	0.00502
Iridium	54	6	0.00485	0.000179	0.00449	0.00467	0.00233	0.00105
Iron	54	54	0.00197	0.0223	0.0223	0.194	0.0983	0.087
Lanthanium	54	7	0.0186	0.000237	0.0164	0.00361	0.00268	0.0021
Magnesium	54	11	0.014	0.00283	0.014	0.0577	0.0441	0.014
Manganese	54	19	0.00198	0.000281	0.00156	0.00224	0.00198	0.0016
Mercury	54	8	0.00565	0.000356	0.00517	0.00478	0.00362	0.00222
Molybdenum	54	2	0.00622	0.0000496	0.00604	0.00245	0.00023	0
Nickel	54	36	0.00139	0.000797	0.00126	0.0141	0.0033	0.00244
Niobium	54	9	0.00388	0.000191	0.00343	0.00374	0.00292	0.00117
Organic Carbon Peak1	54	54	0.24	0.514	0.514	2.24	1.84	1.09
Organic Carbon Peak2	54	54	0.24	1	1	2.6	2.32	1.93
Organic Carbon Peak3	54	54	0.24	0.655	0.655	2.06	1.36	1.3
Organic Carbon Peak4	54	52	0.24	0.491	0.5	4.4	2.62	1.35
Organic Carbon	54	54	0.24	2.66	2.66	11.3	7.75	4.82
Organic Carbon Pyrolytic	54	11	0.24	0.00284	0.194	0.0437	0.0377	0.0125
Phosphorus	54	1	0.0117	0.0000217	0.0115	0.00117	0	0
Potassium Ion	54	19	0.0142	0.0215	0.0307	0.108	0.106	0.0942
Potassium	54	53	0.00661	0.0306	0.0308	0.119	0.091	0.072
Rubidium	54	31	0.00193	0.000454	0.00127	0.00195	0.00169	0.00145
Samarium	54	12	0.00558	0.000346	0.00469	0.00444	0.0033	0.00279
Scandium	54	3	0.0172	0.0000907	0.0163	0.00222	0.00222	0.00046
Selenium	54	16	0.00195	0.000304	0.00167	0.00195	0.00183	0.00167
Silicon	54	49	0.0115	0.033	0.034	0.318	0.144	0.131
Silver	54	12	0.0126	0.00137	0.0112	0.0168	0.0167	0.0124
Sodium Ion	54	49	0.0296	0.0621	0.0649	0.317	0.265	0.247
Sodium	54	14	0.0394	0.0116	0.0407	0.102	0.0873	0.0844
Strantium	54	5	0.00233	0.0000783	0.00219	0.00209	0.00082	0.0007
Sulfate	54	54	0.00888	2.27	2.27	10.8	10	9.33
Sulfur	54	54	0.00797	0.747	0.747	3.53	3.34	3.3
Tantalum	54	6	0.00684	0.000318	0.0064	0.0105	0.00198	0.00175
Terbium	54	5	0.00513	0.000097	0.00475	0.00233	0.00152	0.00093
Tin	54	9	0.0225	0.00141	0.0201	0.0233	0.0124	0.0105
Titatium	54	21	0.00473	0.00112	0.00401	0.012	0.00876	0.00735
Total Nitrate	54	54	0.00701	0.98	0.98	5.14	4.76	4.2
Tungsten	54	16	0.00537	0.000702	0.00448	0.00957	0.00549	0.00501
Vanadium	54	26	0.00316	0.000506	0.00214	0.00269	0.00257	0.00222
Yttrium	54	9	0.00261	0.000113	0.00229	0.00187	0.00117	0.00105
Zinc	54	45	0.00244	0.00331	0.00371	0.0106	0.00853	0.00833
Zirconium	54	9	0.00373	0.000434	0.00354	0.007	0.00572	0.00315

KALAMAZOO		AIRS ID: 260770008				Units: µg/m³		
Chemical Name	# Obs	Obs > MDL	MDL	Min Mean	Max Mean	Max 1	Max 2	Max 3
Aluminum	60	36	0.0144	0.026	0.0317	0.365	0.145	0.0825
Ammonium Ion	60	60	0.0169	1.6	1.6	5.95	4.77	3.79
Antimony	60	7	0.0348	0.00175	0.0325	0.0385	0.0303	0.0303
Arsenic	60	35	0.0015	0.00104	0.00166	0.0041	0.00377	0.00363
Barium	60	7	0.0178	0.00119	0.0169	0.035	0.00875	0.00874
Bromine	60	57	0.00155	0.00287	0.00294	0.0123	0.00731	0.0071
Cadmium	60	8	0.0157	0.000421	0.014	0.011	0.00466	0.00338
Calcium	60	59	0.00629	0.0523	0.0524	0.341	0.299	0.268
Cerium	60	1	0.0202	0.00203	0.0218	0.122	0	0
Cesium	60	9	0.0222	0.000391	0.0193	0.00548	0.00326	0.00314
Chlorine	60	45	0.00758	0.0331	0.035	0.711	0.191	0.135
Chromium	60	30	0.00229	0.000966	0.00211	0.0126	0.0116	0.00436
Cobalt	60	19	0.00137	0.000153	0.00109	0.001	0.00099	0.00093
Copper	60	56	0.00175	0.00568	0.0058	0.173	0.0129	0.011
Elemental Carbon	60	60	0.24	0.643	0.643	2.41	2.02	1.32
Europium	60	5	0.00558	0.000236	0.00535	0.0108	0.00105	0.00105
Gallium	60	14	0.00225	0.000226	0.00195	0.0026	0.00233	0.00233
Gold	60	14	0.00405	0.000258	0.00336	0.00292	0.00209	0.00186
Hafnium	60	4	0.00961	0.0000758	0.00904	0.00233	0.00186	0.00024
Indium	60	8	0.0169	0.00114	0.0158	0.0269	0.01	0.00793
Iridium	60	5	0.00476	0.000179	0.00454	0.00711	0.0021	0.0007
Iron	60	60	0.00193	0.0731	0.0731	0.231	0.2	0.164
Lanthanium	60	2	0.0175	0.000062	0.017	0.00244	0.00128	0
Magnesium	60	14	0.0137	0.011	0.0215	0.55	0.0169	0.0146
Manganese	60	47	0.00197	0.00208	0.0025	0.0173	0.00807	0.00758
Mercury	60	10	0.00563	0.00048	0.00517	0.00653	0.00514	0.00349
Molybdenum	60	2	0.00609	0.0000118	0.0059	0.00047	0.00024	0
Nickel	60	47	0.00137	0.000734	0.00103	0.00408	0.00244	0.0024
Niobium	60	9	0.00382	0.000208	0.00346	0.0035	0.00326	0.00268
Organic Carbon Peak1	60	60	0.24	0.915	0.915	3.85	2.05	1.65
Organic Carbon Peak2	60	60	0.24	1.44	1.44	11.9	3.12	3
Organic Carbon Peak3	60	60	0.24	0.929	0.929	6.61	2.94	2.46
Organic Carbon Peak4	60	60	0.24	0.888	0.888	9.67	3.62	2.3
Organic Carbon	60	60	0.24	4.21	4.21	33.4	10.8	9.23
Organic Carbon Pyrolytic	60	13	0.24	0.0346	0.223	1.35	0.444	0.106
Phosphorus	60	2	0.0119	0.000111	0.0116	0.0057	0.00093	0
Potassium Ion	60	37	0.0142	0.166	0.172	6.84	0.254	0.189
Potassium	60	60	0.00655	0.172	0.172	6.49	0.255	0.183
Rubidium	60	22	0.00193	0.000352	0.00157	0.00216	0.00182	0.00181
Samarium	60	7	0.0055	0.000229	0.00509	0.00349	0.00291	0.00221
Scandium	60	5	0.0175	0.000118	0.0162	0.00195	0.00175	0.00152
Selenium	60	32	0.00191	0.000855	0.00174	0.00407	0.0038	0.00296
Silicon	60	59	0.0113	0.0794	0.0795	0.498	0.452	0.356
Silver	60	7	0.0127	0.000781	0.012	0.0152	0.0144	0.00606
Sodium Ion	60	59	0.0297	0.118	0.118	3.26	0.187	0.187
Sodium	60	32	0.0388	0.0245	0.0427	0.198	0.167	0.129
Strantium	60	15	0.00232	0.00163	0.00337	0.0759	0.00723	0.00338
Sulfate	60	60	0.00906	3.27	3.27	12.7	11	10.5
Sulfur	60	60	0.00806	1.11	1.11	4.42	3.59	3.51
Tantalum	60	4	0.00673	0.000148	0.00643	0.00617	0.00175	0.0007
Terbium	60	4	0.00503	0.0000893	0.00478	0.0021	0.00163	0.00093
Tin	60	15	0.0226	0.00346	0.0204	0.0373	0.0291	0.0248
Titatium	60	35	0.00475	0.00398	0.00596	0.115	0.0186	0.0102
Total Nitrate	60	60	0.00701	2.52	2.52	11.2	10.2	7.14
Tungsten	60	11	0.00523	0.000358	0.00463	0.0077	0.00291	0.00257
Vanadium	60	31	0.00319	0.00104	0.00259	0.00712	0.00548	0.00515
Yttrium	60	5	0.00259	0.0000737	0.00244	0.00221	0.00086	0.00083
Zinc	60	58	0.00243	0.0154	0.0155	0.0835	0.0833	0.056
Zirconium	60	11	0.00372	0.00046	0.0035	0.00827	0.00699	0.00338

LUNA PIER			AIRS ID: 261150005			Units: µg/m³		
Chemical Name	**# Obs**	**Obs > MDL**	**MDL**	**Min Mean**	**Max Mean**	**Max 1**	**Max 2**	**Max 3**
Aluminum	60	45	0.0145	0.0256	0.0293	0.19	0.102	0.0939
Ammonium Ion	60	60	0.0172	1.97	1.97	7.19	5.08	4.54
Antimony	60	9	0.0343	0.0019	0.031	0.0745	0.014	0.00991
Arsenic	60	38	0.00162	0.000856	0.00145	0.00455	0.00397	0.00331
Barium	60	9	0.0192	0.000569	0.0169	0.00898	0.00512	0.00397
Bromine	60	52	0.00162	0.00248	0.0027	0.0106	0.00669	0.00614
Cadmium	60	9	0.0156	0.000706	0.014	0.0116	0.00908	0.00536
Calcium	60	60	0.00597	0.0384	0.0384	0.185	0.123	0.121
Cerium	60	2	0.0227	0.0000913	0.022	0.00292	0.00256	0
Cesium	60	10	0.0252	0.000466	0.0215	0.00536	0.00432	0.00408
Chlorine	60	46	0.00751	0.0214	0.0232	0.361	0.0955	0.0925
Chromium	60	33	0.00225	0.00275	0.00376	0.0342	0.0271	0.0267
Cobalt	60	20	0.00137	0.000139	0.00105	0.00094	0.00093	0.00083
Copper	60	55	0.00173	0.00312	0.00326	0.0242	0.0124	0.00957
Elemental Carbon	60	59	0.24	0.615	0.619	1.9	1.83	1.66
Europium	60	5	0.00568	0.00036	0.00557	0.00864	0.00501	0.00326
Gallium	60	17	0.00252	0.000234	0.00204	0.00303	0.00222	0.00201
Gold	60	14	0.00456	0.000311	0.00381	0.00338	0.00233	0.0021
Hafnium	60	1	0.00953	0.0000193	0.00939	0.00116	0	0
Indium	60	10	0.0173	0.00127	0.0157	0.0192	0.0191	0.0124
Iridium	60	7	0.00533	0.000338	0.00505	0.00513	0.00432	0.00385
Iron	60	60	0.00195	0.0719	0.0719	0.269	0.207	0.204
Lanthanium	60	6	0.0196	0.000167	0.0178	0.00442	0.0014	0.00128
Magnesium	60	16	0.0146	0.00225	0.013	0.0269	0.0205	0.0146
Manganese	60	43	0.00198	0.00116	0.00172	0.00612	0.00497	0.00476
Mercury	60	12	0.0062	0.000465	0.00542	0.00572	0.0049	0.0035
Molybdenum	60	4	0.00672	0.000161	0.00643	0.00582	0.0014	0.0014
Nickel	60	47	0.00138	0.00146	0.00176	0.0117	0.00777	0.00688
Niobium	60	10	0.00408	0.000292	0.00369	0.00326	0.00304	0.0028
Organic Carbon Peak1	60	60	0.24	0.769	0.769	2.24	1.85	1.49
Organic Carbon Peak2	60	60	0.24	1.11	1.11	2.48	2.44	2.13
Organic Carbon Peak3	60	60	0.24	0.766	0.766	2.06	2.04	1.87
Organic Carbon Peak4	60	60	0.24	0.731	0.731	2.99	2.12	1.73
Organic Carbon	60	60	0.24	3.38	3.38	9.33	6.9	6.28
Organic Carbon Pyrolytic	60	12	0.24	0.00687	0.199	0.127	0.11	0.0589
Phosphorus	60		0.0111	0	0.0111	0	0	0
Potassium Ion	60	38	0.0145	0.0944	0.0997	2.13	0.483	0.247
Potassium	60	60	0.00622	0.0726	0.0726	1.29	0.133	0.119
Rubidium	60	29	0.00192	0.000386	0.00138	0.00219	0.00218	0.00207
Samarium	60	8	0.00558	0.000497	0.00533	0.00747	0.00745	0.0057
Scandium	60	4	0.0193	0.000111	0.0181	0.00222	0.00221	0.00163
Selenium	60	40	0.002	0.00293	0.0036	0.021	0.0203	0.0196
Silicon	60	59	0.0115	0.0575	0.0576	0.336	0.246	0.209
Silver	60	6	0.0128	0.000367	0.0119	0.00629	0.00583	0.0035
Sodium Ion	60	60	0.0291	0.119	0.119	0.729	0.556	0.555
Sodium	60	30	0.0429	0.034	0.0555	0.215	0.186	0.179
Strantium	60	22	0.00234	0.00102	0.0025	0.0155	0.0132	0.01
Sulfate	60	60	0.00893	3.63	3.63	12.6	11.3	10.6
Sulfur	60	60	0.00772	1.2	1.2	4.53	3.98	3.97
Tantalum	60	9	0.00756	0.000402	0.00683	0.00583	0.00513	0.00466
Terbium	60	6	0.00509	0.000305	0.00489	0.00746	0.00711	0.0014
Tin	60	14	0.0234	0.00289	0.0208	0.0607	0.0323	0.0165
Titatium	60	37	0.00461	0.00243	0.0042	0.019	0.0168	0.0119
Total Nitrate	60	60	0.00702	2.55	2.55	12.4	8.47	8.07
Tungsten	60	9	0.0059	0.000301	0.00531	0.00677	0.00303	0.00257
Vanadium	60	44	0.00307	0.00177	0.00259	0.0101	0.00703	0.00594
Yttrium	60	10	0.00268	0.000116	0.00235	0.00242	0.00141	0.00124
Zinc	60	58	0.00257	0.0116	0.0116	0.0344	0.0303	0.0268
Zirconium	60	10	0.00386	0.000391	0.00361	0.00944	0.00701	0.00222

YPSILANTI			AIRS ID: 261610008			Units: µg/m³		
Chemical Name	# Obs	Obs > MDL	MDL	Min Mean	Max Mean	Max 1	Max 2	Max 3
Aluminum	60	32	0.0148	0.0138	0.0208	0.101	0.0984	0.0466
Ammonium Ion	60	58	0.0173	1.92	1.92	5.87	5.75	5.66
Antimony	60	6	0.0364	0.00169	0.0345	0.0361	0.0245	0.0174
Arsenic	60	33	0.00142	0.00101	0.00165	0.00747	0.00356	0.0035
Barium	60	5	0.0137	0.000342	0.0129	0.00699	0.00618	0.0049
Bromine	60	49	0.00149	0.00267	0.00295	0.015	0.0077	0.00666
Cadmium	60	6	0.016	0.000404	0.0148	0.00932	0.00603	0.00467
Calcium	60	58	0.00632	0.0402	0.0404	0.216	0.14	0.138
Cerium	60	1	0.0135	0.00000783	0.0133	0.00047	0	0
Cesium	60	4	0.0212	0.00135	0.0211	0.0687	0.00618	0.00351
Chlorine	60	48	0.00706	0.0207	0.0221	0.323	0.106	0.102
Chromium	60	31	0.0023	0.000879	0.00199	0.00746	0.00498	0.00481
Cobalt	60	25	0.0013	0.000235	0.000992	0.00167	0.00153	0.00118
Copper	60	53	0.0017	0.00257	0.00277	0.0263	0.00538	0.0049
Elemental Carbon	30	30	0.24	0.425	0.425	1.11	0.79	0.656
Europium	60	4	0.00504	0.000154	0.00486	0.0035	0.00234	0.00221
Gallium	60	12	0.00209	0.000279	0.00195	0.0039	0.00206	0.002
Gold	60	9	0.00387	0.000155	0.00344	0.00395	0.00175	0.00152
Hafnium	60	2	0.00953	0.0000428	0.00926	0.00152	0.00105	0
Indium	60	6	0.0176	0.000776	0.0166	0.0231	0.00594	0.00561
Iridium	60	6	0.00474	0.000142	0.00441	0.00279	0.00245	0.00152
Iron	60	58	0.00178	0.0546	0.0546	0.169	0.153	0.105
Lanthanium	60	4	0.0124	0.000385	0.0119	0.014	0.00593	0.0028
Magnesium	60	12	0.0132	0.00315	0.0137	0.0629	0.0315	0.028
Manganese	60	40	0.00186	0.00132	0.00194	0.0105	0.00845	0.00595
Mercury	60	9	0.00579	0.000446	0.00537	0.00654	0.00432	0.00363
Molybdenum	60	4	0.00638	0.000146	0.0061	0.00442	0.00199	0.00163
Nickel	60	48	0.00131	0.000673	0.000935	0.00296	0.00208	0.00208
Niobium	60	10	0.00378	0.000319	0.00347	0.00502	0.00408	0.00315
Organic Carbon Peak1	30	30	0.24	0.897	0.897	2.35	2.32	1.97
Organic Carbon Peak2	30	30	0.24	1.07	1.07	2.24	2.09	2.04
Organic Carbon Peak3	30	30	0.24	0.64	0.64	1.49	1.33	1.14
Organic Carbon Peak4	30	30	0.24	0.801	0.801	2.67	2.58	1.7
Organic Carbon	30	30	0.24	3.43	3.43	8.66	8.08	6.85
Organic Carbon Pyrolytic	30	11	0.24	0.0155	0.167	0.195	0.105	0.0628
Phosphorus	60		0.0121	0	0.0121	0	0	0
Potassium Ion	60	37	0.0145	0.0646	0.0702	1.18	0.146	0.118
Potassium	60	58	0.0066	0.0644	0.0646	0.925	0.158	0.0991
Rubidium	60	24	0.00184	0.000308	0.00141	0.00163	0.00152	0.00136
Samarium	60	5	0.00506	0.000107	0.00474	0.00327	0.00163	0.0007
Scandium	60	2	0.0204	0.000033	0.0197	0.00152	0.00046	0
Selenium	60	37	0.00188	0.000731	0.00145	0.00581	0.00286	0.00263
Silicon	60	54	0.0117	0.0525	0.0537	0.228	0.184	0.174
Silver	60	7	0.0128	0.000615	0.0119	0.0102	0.00666	0.00535
Sodium Ion	60	56	0.0291	0.0614	0.0634	0.335	0.213	0.165
Sodium	60	29	0.0393	0.0145	0.0347	0.137	0.0942	0.0604
Strantium	60	17	0.00225	0.00104	0.00265	0.0284	0.00946	0.005
Sulfate	60	58	0.00901	3.27	3.27	14.2	12.4	11.4
Sulfur	60	58	0.00833	1.02	1.02	4.45	3.44	3.28
Tantalum	60	2	0.00693	0.000041	0.00674	0.00164	0.00082	0
Terbium	60	5	0.00449	0.000103	0.00422	0.00199	0.00175	0.00139
Tin	60	11	0.0239	0.00256	0.0221	0.0355	0.0279	0.0187
Titatium	60	33	0.00478	0.0022	0.00435	0.0135	0.0121	0.00934
Total Nitrate	60	58	0.00727	2.54	2.54	9.9	9.9	7.62
Tungsten	60	8	0.00523	0.000253	0.00479	0.00442	0.00327	0.0028
Vanadium	60	33	0.00327	0.00107	0.00254	0.00552	0.00477	0.00433
Yttrium	60	7	0.00252	0.000128	0.00235	0.00241	0.0016	0.00146
Zinc	60	57	0.00257	0.0129	0.013	0.0641	0.0404	0.0282
Zirconium	60	6	0.00371	0.000431	0.00377	0.01	0.00744	0.00617

APPENDIX D: AQD ACRONYMS AND DEFINITIONS

AQD ACRONYM	DEFINITION
>	greater than
≥	greater than or equal to
<	less than
≤	less than or equal to
%	percent
AIRS ID	Aerometric Information Retrieval System identification number
AMU	Air Monitoring Unit (AQD)
AQD	Air Quality Division
AQES	Air Quality Evaluation Section
AQI	Air Quality Index
AQS	Air Quality Subsystem
CAA	Clean Air Act
CAIR	Clean Air Interstate Rule (EPA regulation)
CFR	Code of Federal Regulations
CO	carbon monoxide
CSA	Combined Statistical Area
DATI	Detroit Air Toxics Initiative
EGU	electric generating unit (coal-fired power plants)
EI	emissions inventory (EPA)
EPA	United States Environmental Protection Agency
FDMS	filter dynamic measurement system
FR	Federal Register
FRM	Federal Reference Method
HAP	Hazardous Air Pollutant
hr	hour
IN	Indiana
MASN	Michigan Air Sampling Network
MDEQ	Michigan Department of Environmental Quality
MDL	method detection limit
mg/m^3	milligrams per cubic meter
MI	Michigan
MiSA	Micropolitan Statistical Area
MITAMP	Michigan Toxics Air Monitoring Program
MSA	Metropolitan Statistical Area
NAAQS	National Ambient Air Quality Standards
NATA	National Air Toxics Assessment
NATTS	National Air Toxics Trend Site
NCORE	National Core (monitoring site)
NO	nitric oxide
NO_2	nitrogen dioxide
NO_X	oxides of nitrogen
O_3	ozone
OAQPS	Office of Air Quality Planning and Standards (EPA)
OBS	Observations

AQD ACRONYM	DEFINITION
PAHs	polycyclic aromatic hydrocarbons
Pb	lead
PBT	Persistent, Bioaccumulative Toxics
PCB	polychlorinated biphenyls
PM	Particulate Matter
$PM_{2.5}$	PM with an aerodynamic diameter $\geq$ 2.5 microns in diameter
PM_{10}	PM with an aerodynamic diameter $\geq$ 10 microns in diameter
$PM_{10\text{-}2.5}$	inhalable course particles
PNAs	polynuclear aromatic hydrocarbons
ppm	parts per million
RTP	Research Triangle Park
SASS	Spiral aerosol speciation sampler
SIP	State Implementation Plan
SO_2	sulfur dioxide
SVOC	Semi-volatile compounds
TACs	Toxic Air Contaminants
TEOM	Tapered Element Oscillating Microbalance
TSP	Total Suspended Particulates
U of M	University of Michigan
$\mu g/m^3$	micrograms per cubic meter
μm	micrometers
U.S.	United States
VOC	Volatile Organic Compounds
WEBMONMAP	Web Monitoring and Mapping
WI	Wisconsin

APPENDIX E: 2007 AQI PIE CHARTS

Appendix E contains pie charts that were created to show the AQI values for each of Michigan's 2007 monitoring sites and includes the total number of days measurements were taken along with the pollutant distribution of the AQI values for those measurements. It is important to note that not all pollutants are measured at each site. In fact, some sites only obtain AQI measurements for that portion of the year corresponding to the O_3 season, therefore, the number of days for each site may not be equivalent to 365 days per year. The following **Figures 1** through **4** are grouped by CSA. **Figure 5** shows the remaining sites (not part of a CSA) located in Michigan's Lower Peninsula:

- **Figure E-1** – AQI Summaries for Detroit-Warren-Flint CSA
- **Figure E-2** – AQI Summaries for Lansing-East Lansing-Owosso CSA
- **Figure E-3** – AQI Summaries for Grand Rapids-Muskegon-Holland CSA
- **Figure E-4** – AQI Summaries for Saginaw-Bay City-Saginaw Twp. North CSA
- **Figure E-5** – Michigan's Other Lower Peninsula Area AQI Summaries (not in a CSA)

FIGURE E-1: AQI SUMMARIES FOR DETROIT-WARREN-FLINT CSA

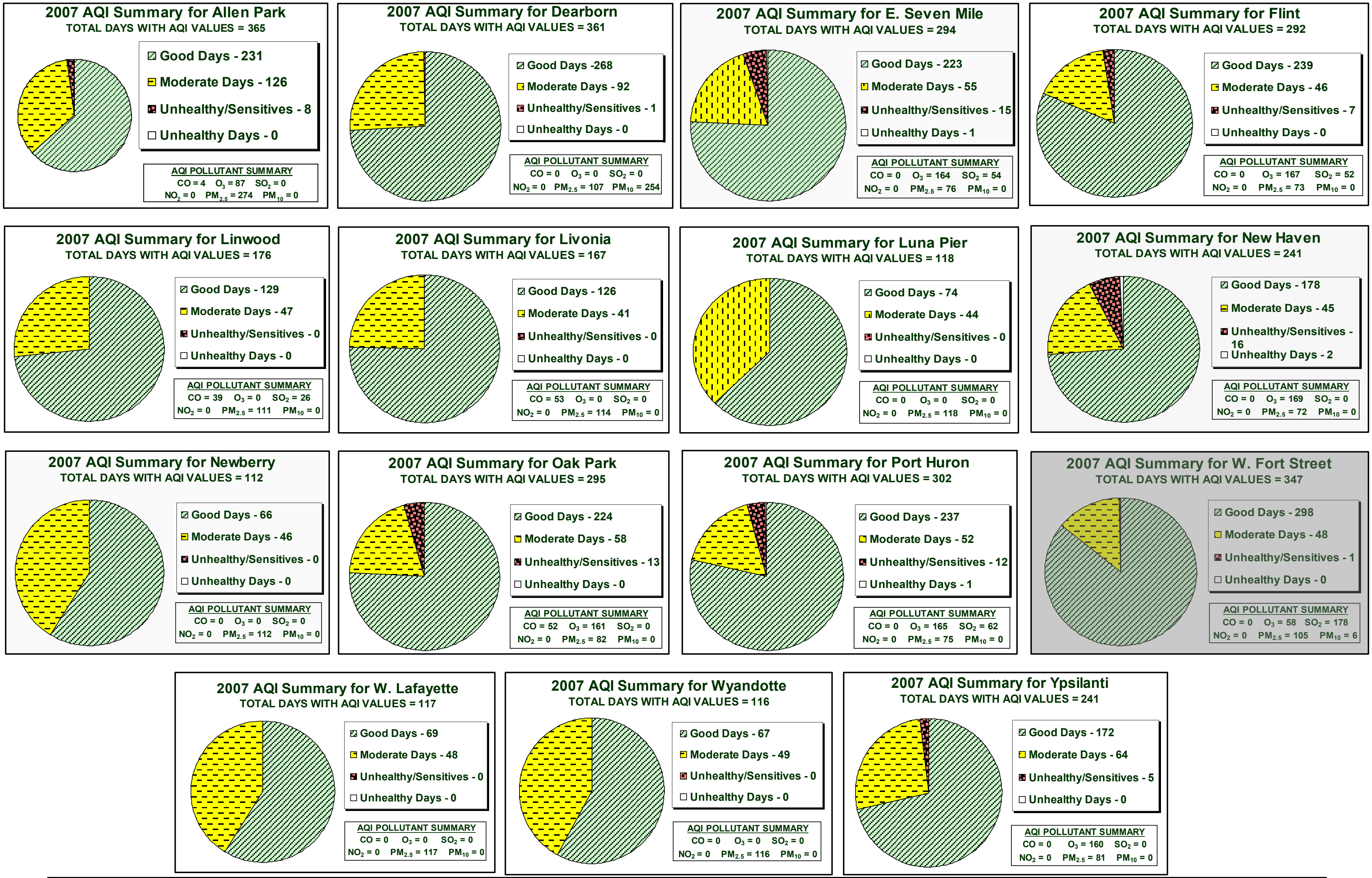


FIGURE E-2: AQI SUMMARIES FOR LANSING-E. LANSING-OWOSSO CSA

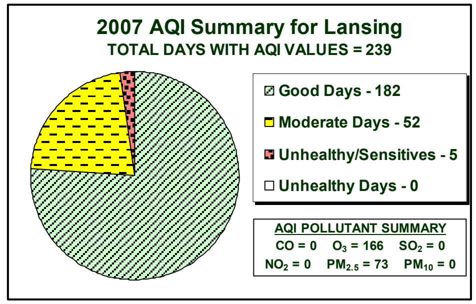
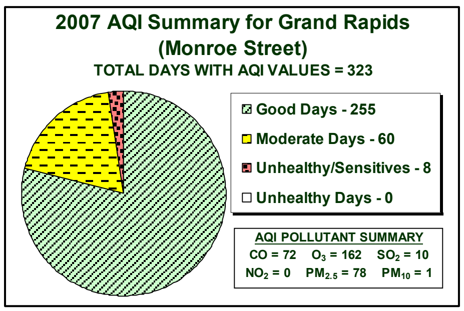
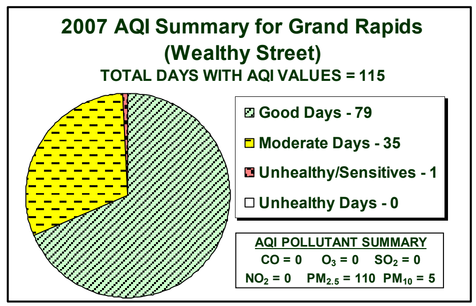
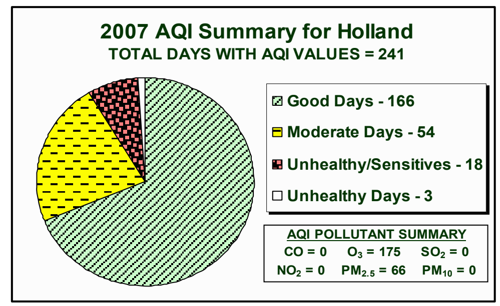
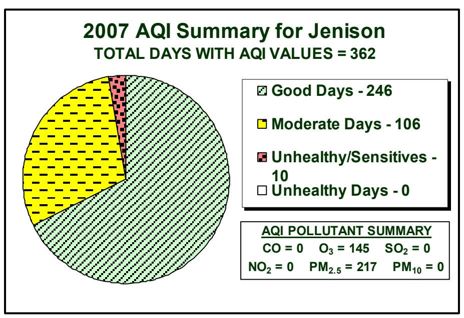


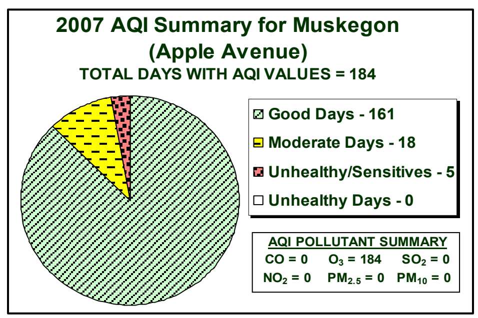
FIGURE E-3: AQI SUMMARIES FOR GRAND RAPIDS-MUSKEGON-HOLLAND CSA











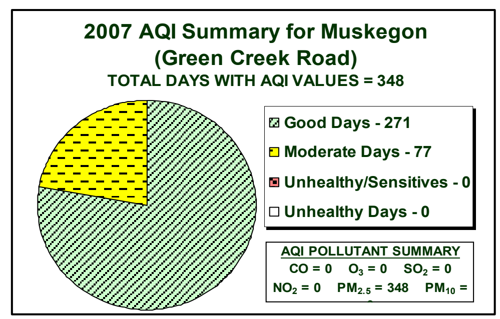


FIGURE E-4: AQI SUMMARIES FOR SAGINAW-BAY CITY-SAGINAW TWP. N. CSA

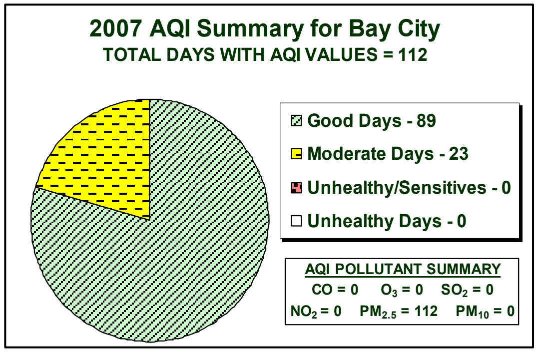
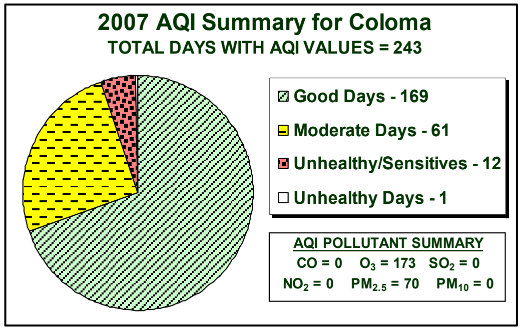
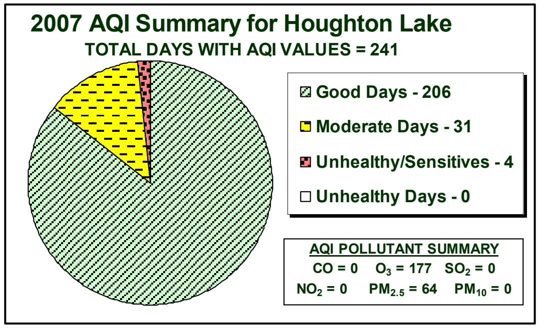
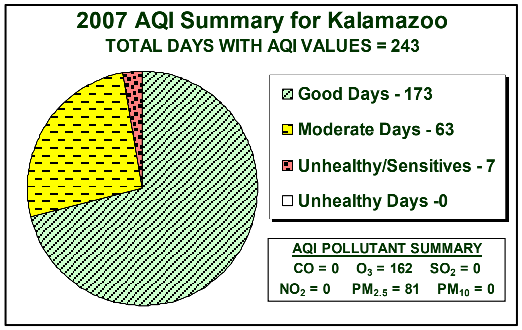


FIGURE E-5: MICHIGAN'S OTHER LOWER PENINSULA AREA AQI SUMMARIES

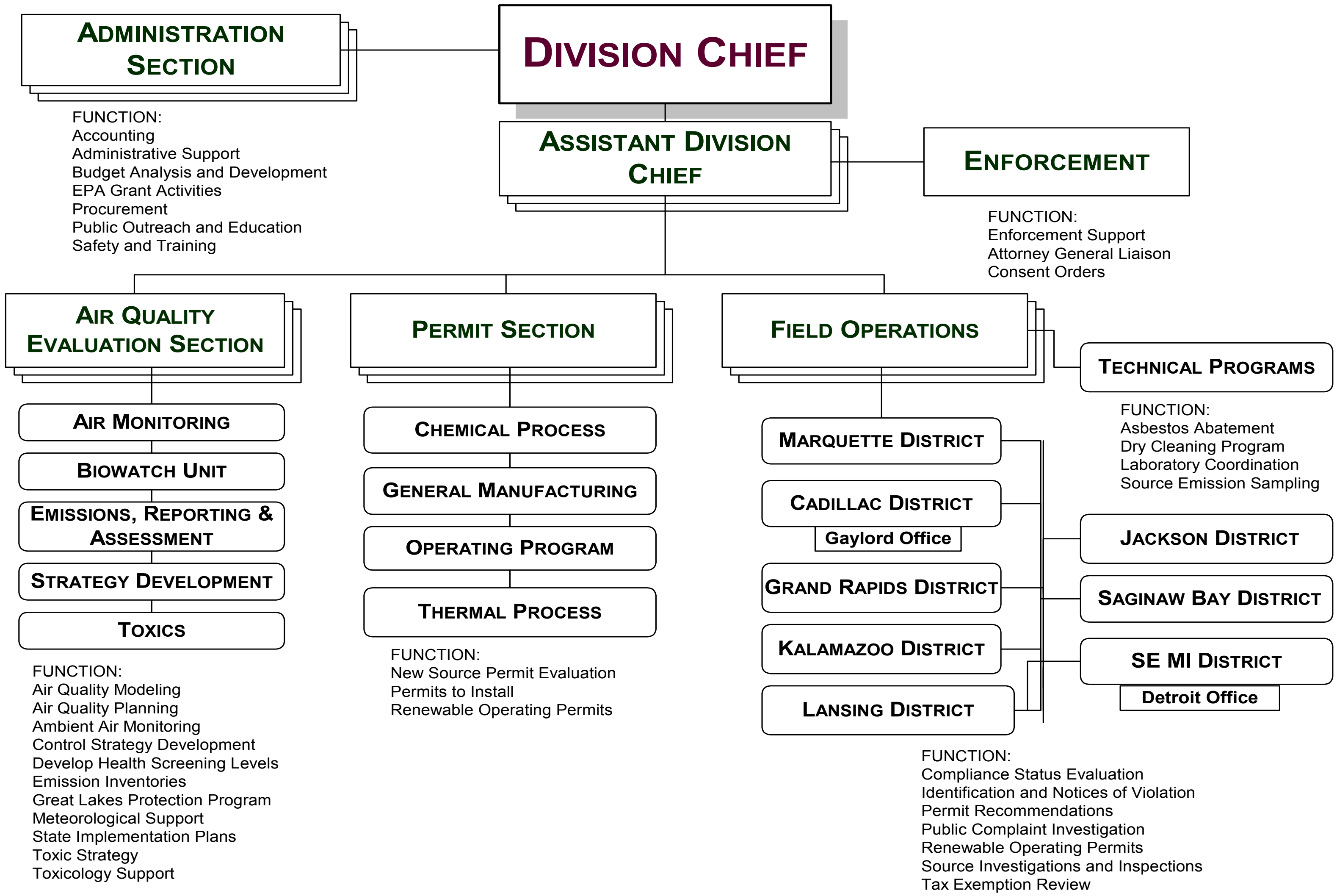






APPENDIX F: AQD ORGANIZATIONAL CHART

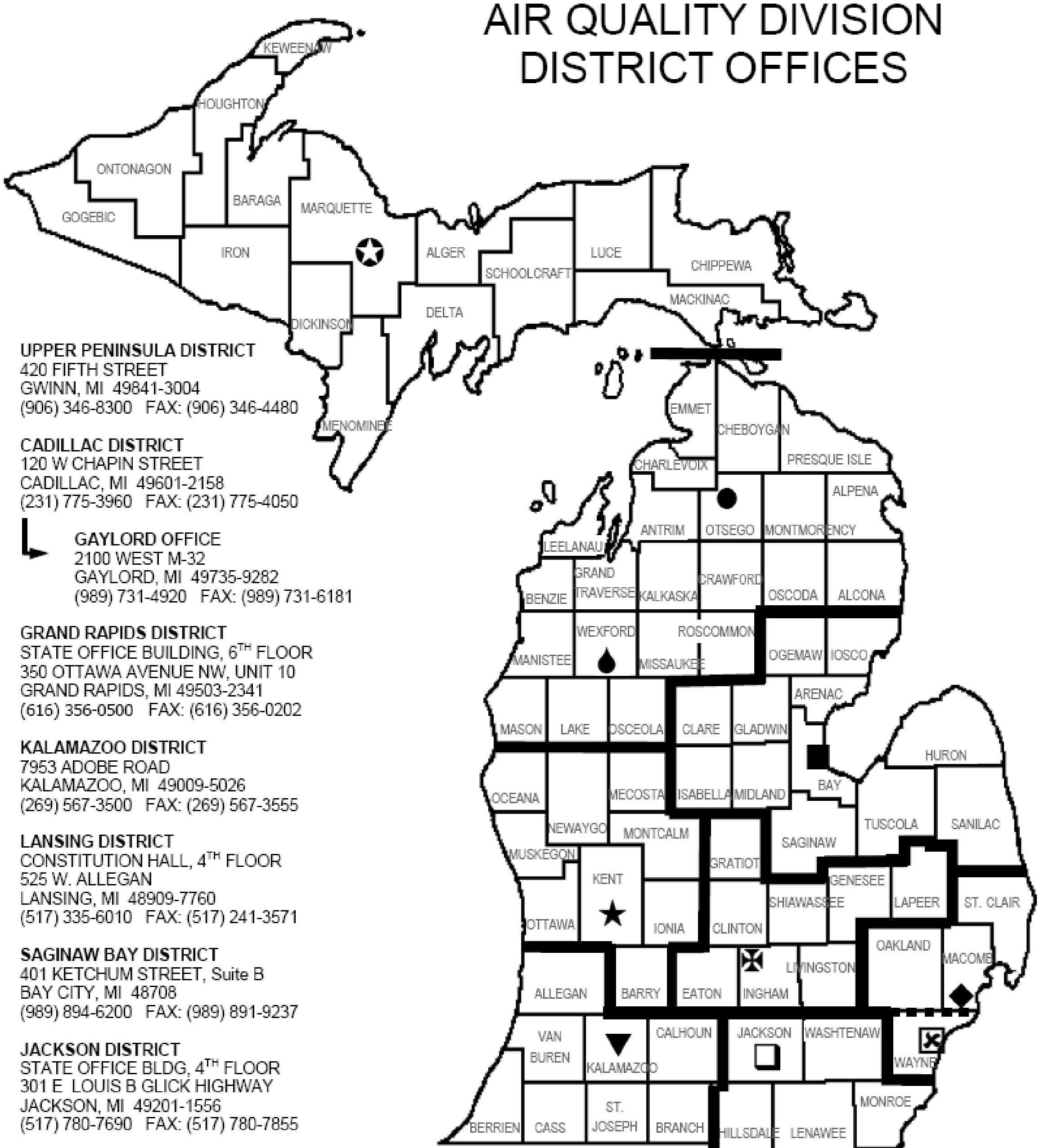
MDEQ AIR QUALITY DIVISION



APPENDIX G: AQD DISTRICT OFFICE LOCATIONS

MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY
AIR QUALITY DIVISION

AIR QUALITY DIVISION DISTRICT OFFICES



UPPER PENINSULA DISTRICT
420 FIFTH STREET
GWINN, MI 49841-3004
(906) 346-8300 FAX: (906) 346-4480

CADILLAC DISTRICT
120 W CHAPIN STREET
CADILLAC, MI 49601-2158
(231) 775-3960 FAX: (231) 775-4050

GAYLORD OFFICE
2100 WEST M-32
GAYLORD, MI 49735-9282
(989) 731-4920 FAX: (989) 731-6181

GRAND RAPIDS DISTRICT
STATE OFFICE BUILDING, 6TH FLOOR
350 OTTAWA AVENUE NW, UNIT 10
GRAND RAPIDS, MI 49503-2341
(616) 356-0500 FAX: (616) 356-0202

KALAMAZOO DISTRICT
7953 ADOBE ROAD
KALAMAZOO, MI 49009-5026
(269) 567-3500 FAX: (269) 567-3555

LANSING DISTRICT
CONSTITUTION HALL, 4TH FLOOR
525 W. ALLEGAN
LANSING, MI 48909-7760
(517) 335-6010 FAX: (517) 241-3571

SAGINAW BAY DISTRICT
401 KETCHUM STREET, Suite B
BAY CITY, MI 48708
(989) 894-6200 FAX: (989) 891-9237

JACKSON DISTRICT
STATE OFFICE BLDG, 4TH FLOOR
301 E LOUIS B GLICK HIGHWAY
JACKSON, MI 49201-1556
(517) 780-7690 FAX: (517) 780-7855

SOUTHEAST MICHIGAN DISTRICT
27700 DONALD COURT
WARREN, MI 48092-2793
(586) 753-3700 FAX: (586) 753-3731

DETROIT OFFICE
CADILLAC PLACE, SUITE 2-300
3058 WEST GRAND BLVD
DETROIT, MI 48202-6058
(313) 456-4700 FAX: (313) 456-4692
[Wayne County sources]

AIR QUALITY INTERNET ADDRESS:
www.michigan.gov/deqair

2/2009

MDEQ AIR QUALITY DIVISION
PO BOX 30260
LANSING, MI 48909