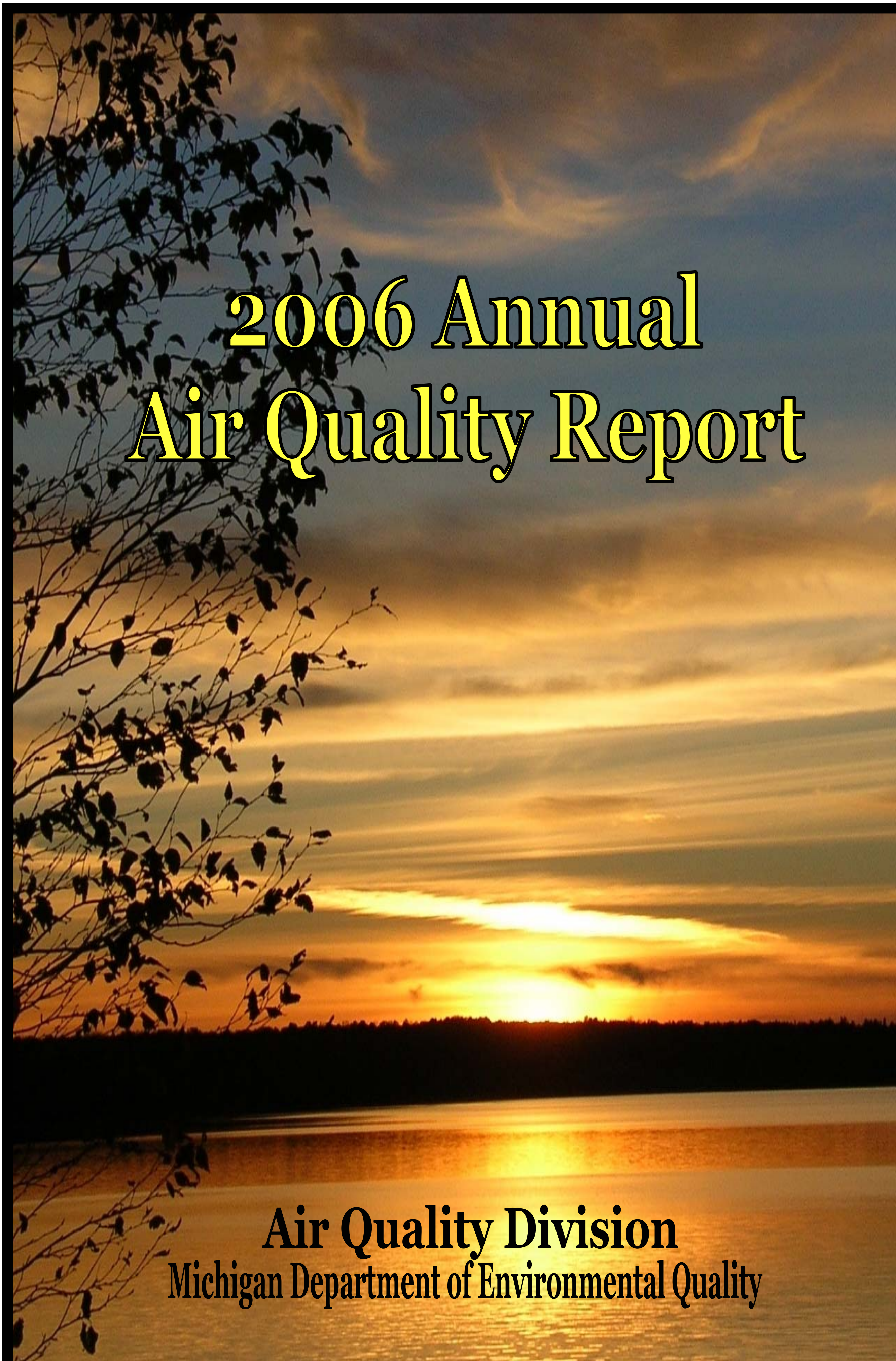
Michigan



2006 Annual Air Quality Report

Air Quality Division

Michigan Department of Environmental Quality

DEQ

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MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY

PROTECTING MICHIGAN'S ENVIRONMENT, ENSURING MICHIGAN'S FUTURE

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2006 ANNUAL AIR QUALITY REPORT

AIR QUALITY DIVISION
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Cover Photo: October 2006 sunset at Indian Lake State Park, Manistique, located in Michigan's Upper Peninsula. Photo courtesy of Sheila Blais, AQD.

TABLE OF CONTENTS

TABLE OF CONTENTS (CONTINUED)

LIST OF TABLES

LIST OF FIGURES

TABLE OF CONTENTS (CONTINUED)

LIST OF FIGURES (CONTINUED)

TABLE OF CONTENTS (CONTINUED)

LIST OF FIGURES (CONTINUED)

PAGE

LIST OF APPENDICES

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 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 (<u><</u>) 10 or 2.5 microns in diameter (PM_{10} and $PM_{2.5}$, respectively), and sulfur dioxide (SO_2). The AQD also monitors for air toxics (discussed in **Chapter 3**). The purpose of this report is to provide a summary of the 2006 air quality data, which includes air quality trends, updates on Michigan's monitoring network, the air toxics monitoring program, and other new programs that have been developed (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]

In 2006, the MDEQ provided EPA with the essential elements required to request that 16 Michigan counties be redesignated to attainment for the 8-hour O_3 NAAQS.[3] In early 2007, EPA approved the redesignation requests for the counties of Benzie, Berrien, Calhoun, Cass, Clinton, Eaton, Genesee, Huron, Ingham, Kalamazoo, Kent, Lapeer, Mason, Muskegon, Ottawa, and Van Buren. The nine remaining nonattainment counties are Allegan (located in West Michigan) and the eight Southeast Michigan counties of Lenawee, Livingston, Macomb, Monroe, Oakland, St. Clair, Washtenaw and Wayne. As is shown in **Chapter 2.4**, utilizing 2004-2006 air monitoring data, all counties in Michigan, except for Allegan County were meeting the NAAQS for 8-hour O_3.

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 $PM_{2.5}$, 2006 levels have continued to decline and air monitoring data shows that many of these areas are now meeting attainment. 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 <u>daily</u> $PM_{2.5}$ standard from 65 micrograms per cubic meter ($\mu g/m^3$) to 35 $\mu g/m^3$ and revoking the <u>annual</u> PM_{10} NAAQS. No changes were made to the <u>annual</u> $PM_{2.5}$ NAAQS and the <u>daily</u> PM_{10} NAAQS (discussed in **Chapter 2.5**). Under the newly revised 24-hour $PM_{2.5}$ NAAQS, Michigan must 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 AQD along with it partners will continue to work at meeting attainment for all of the criteria pollutants.

In addition, at the end of 2006, EPA amended the federal ambient air monitoring regulations, effective December 18, 2006, that changed the requirements of Michigan's existing monitoring network. Basically, the amended monitoring requirements increased the frequency of $PM_{2.5}$ sampling and will establish 75 National Core (NCORE) monitoring stations around the country beginning in 2011. NCORE sites will be multi-pollutant in nature and may ultimately add measurement of "inhalable coarse particles" (i.e., $PM_{10-2.5}$).

[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."
[3] Details on Michigan's air quality endeavors can be reviewed on-line from the AQD's *About the Air* newsletter, which is available from the AQD's website at http://www.michigan.gov/deqair under "Air Publications."

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. Every five years EPA is required to review the scientific information and the standards for each criteria pollutant and obtain advice from the Clean Air Scientific Advisory Committee on each review. Once a standard is set, EPA must then determine the best means of implementing that standard. On October 17, 2006, new PM NAAQS were adopted to address fine ($PM_{2.5}$) and coarse (PM_{10}) particle pollution (discussed further in **Chapter 2.5**).

Table 1-1 lists the primary and secondary NAAQS, averaging time, and concentration level for each criteria pollutant that was in effect at the end of 2006. 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). **NOTE**: Both the 1-hour O_3 and the annual PM_{10} standard have been revoked (2005 and 2006, respectively) and are not shown in **Table 1-1**. The newly revised $PM_{2.5}$ 24-hour concentration is included.

Table 1-1: Current NAAQS in Effect for the Criteria Pollutants

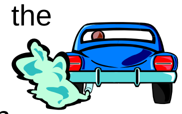
CRITERIA POLLUTANT	PRIMARY (HEALTH RELATED)		SECONDARY (WELFARE RELATED)	
	TYPE OF AVERAGE	STANDARD LEVEL CONCENTRATION	TYPE OF AVERAGE	STANDARD LEVEL CONCENTRATION
CO	8-hour	9 ppm (10 mg/m^3)	No Secondary Standard	
	1-hour	35 ppm (40 mg/m^3)		
Pb	Maximum Quarterly Average	1.5 $\mu g/m^3$	Same as Primary 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	0.085 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, EPA has defined specific criteria for each pollutant, which is summarized in **Table 1-2**.

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 0.085 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. [4]

[4] Information on the primary sources of lead exposure for most children can be found on the EPA's website at http://www.epa.gov/lead/.

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 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 new Manistee County site (added in 2006) is handled by the Little River Band of Ottawa Indians.[5] **Figure 1-1** shows the 2006 MASN monitoring sites.

FIGURE 1-1: 2006 MASN MAP

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 (that supplement the FRM monitor 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 new air quality reporting webpage MIair (discussed in **Chapter 4**). The types of monitoring conducted in 2006 and the MASN locations are shown in **Table 1-4**.

[5] In 2006, the AQD took over the operation of the Seney National Wildlife Refuge, which had previously been handled by the U.S. Fish and Wildlife Service.

Table 1-4: MASN Stations and Monitoring Conducted in 2006

AIRS ID	SITE NAME	CO	Pb	NO_2	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				√						
260330901	+Sault Ste. Marie – Easterday						√*			√	√
260330902	+Sault Ste. Marie – Marquette Ave.						√				
260330903	Bay Mills						√				
260370001	Rose Lake				√						
260430002	Channing						√				
260490021	Flint		√		√	√	√■	√			√
260492001	Otisville				√						
260630007	Harbor Beach				√						
260650012	Lansing				√		√■				
260710001	Crystal Falls						√				
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

+Managed by Inter-Tribal Council
++Managed by Grand Traverse Band of Ottawa & Chippewa Indians
+++Managed by Little River Band of Ottawa Indians

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 2006.

Table 1-5: 2006 Meteorological Data Collected at the MASN Stations

AIRS ID	SITE NAME	Wind Speed	Wind Direction	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 and is used to measure and determine what areas are meeting the NAAQS for the six criteria pollutants.[6] It is important to note that effective December 18, 2006, the EPA amended its air monitoring requirements by reshaping existing monitoring networks to ensure that monitors are concentrated in areas that are not meeting the NAAQS and allow those areas that have maintained levels well below the NAAQS to eliminate unneeded monitors (with EPA approval). In addition, the amended requirements include more co-located monitors to provide real-time air quality measurements (see **Chapter 4**).

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

The amended air monitoring requirements will also add about 75 National Core (NCORE) monitoring stations around the country beginning in 2011. NCORE sites will be multi-pollutant in nature, utilizing existing and new technologies to provide a comprehensive assessment of air quality throughout the nation and enhance the understanding of how pollution travels. While the exact locations for the NCORE monitoring stations have not yet been identified, Michigan is required to operate two or three NCORE sites. The amended requirements also contain a number of technical changes that include improvements in monitoring technologies.[7] Information on the effects of the 2006 amended monitoring requirements is discussed by criteria pollutant in **Chapter 2**.

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 will be 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).[8] 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 CSAs 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.

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

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

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 2006 measurement 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 2006, attainment/nonattainment status, monitoring site locations, and air quality trends from 1997-2006 broken down by location.[9] The criteria pollutant subsections found in **Chapter 2** include:

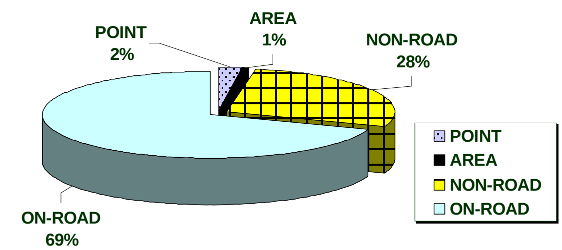
- **Chapter 2.1**: Carbon Monoxide (CO)
- **Chapter 2.2**: Lead (Pb)
- **Chapter 2.3**: Nitrogen Dioxide (NO_2)
- **Chapter 2.4**: Ozone (O_3)
- **Chapter 2.5**: Particulate Matter (PM_{10}, $PM_{2.5}$, and $PM_{2.5}$ Chemical Speciation)
- **Chapter 2.6**: Sulfur Dioxide (SO_2)

The actual 2006 data for each criteria pollutant is available in **Appendix A**.

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.

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



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.

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 (**1, 2**).

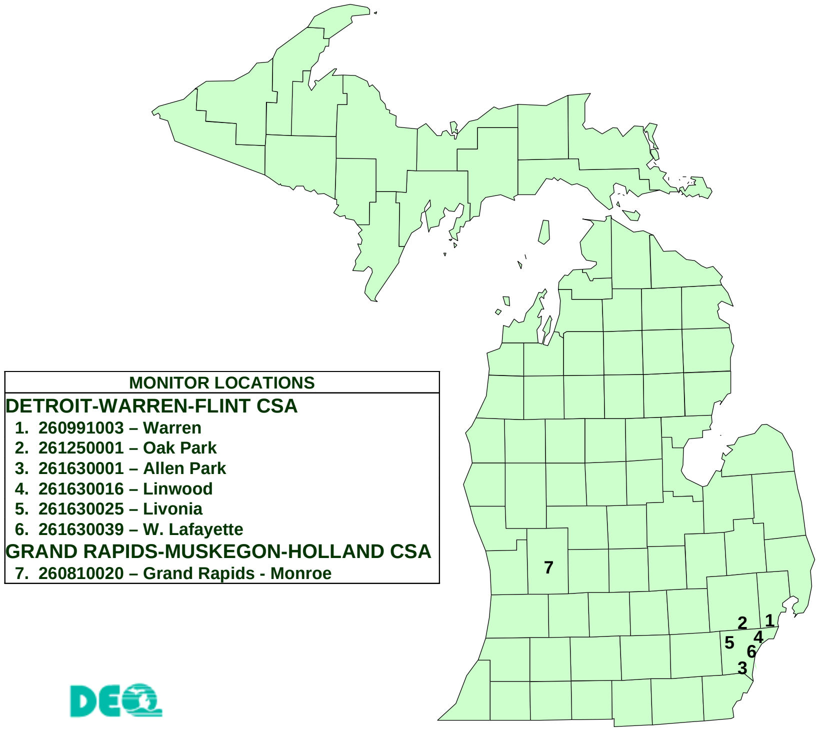
Michigan's CO emission totals are estimated to be 20% less than what the emissions were in 1990 and historically, Michigan has had better air quality when compared to nationwide trend site averages.[10] As of August 30, 1999, all areas in Michigan have been designated as attainment for CO and no monitoring 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 2006, as shown in **Figure 2.1-2**, there were a total of seven CO monitors in operation, with six located in Southeast Michigan and one in West Michigan.[11]

[9] 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.
[10] Information on Nationwide Air Quality Trends is available at: http://www.epa.gov/airtrends/carbon.html.
[11] The two previously established sites at Newberry and Seney were shut down on March 31, 2006.

FIGURE 2.1-2: CO MONITORS ACTIVE IN 2006



CO TRENDS BY LOCATION:

Figure 2.1-3 provides the maximum 2nd highest 1-hour CO level trends for Michigan from 1997-2006, which demonstrates that there have not been any exceedances of the 1-hour CO NAAQS.

Figure 2.1-3: CO Levels in MI from 1997-2006
(2nd Highest 1-Hr Maximum Values)

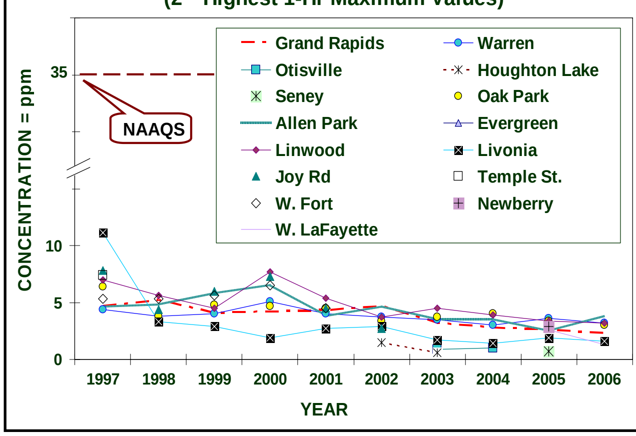


Figure 2.1-4: CO Levels in MI from 1997-2006
(2nd Highest 8-Hr Maximum Values)

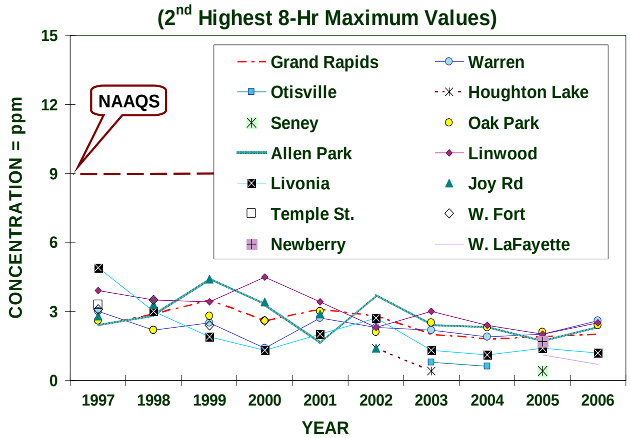
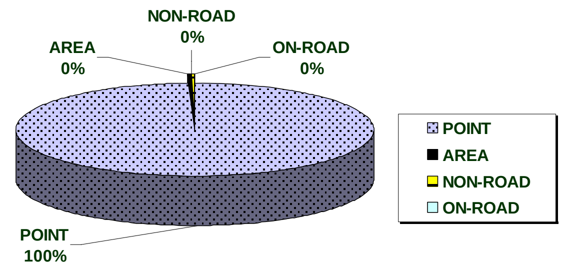


Figure 2.1-4 provides the 2nd highest 8-hour CO maximum values for Michigan's CO sites. In 2006, five of the seven CO monitoring sites (two in West Michigan and three in Southeast Michigan) had slightly elevated CO levels from the previous year. However, the values continue to remain well below the standard and Michigan has not experienced any exceedances of the 8-hour CO NAAQS.

CHAPTER 2.2: LEAD (PB)

Michigan Pb emissions have significantly decreased over the past 25 years and ambient Pb levels have been far below the Pb NAAQS. Much of this reduction can be attributed to the removal of alkylated Pb from automotive gasoline. **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, since there are no large Pb point sources in Michigan and with the state in attainment for Pb, point source monitoring is not conducted. Michigan does monitor for Pb under its toxics monitoring program.

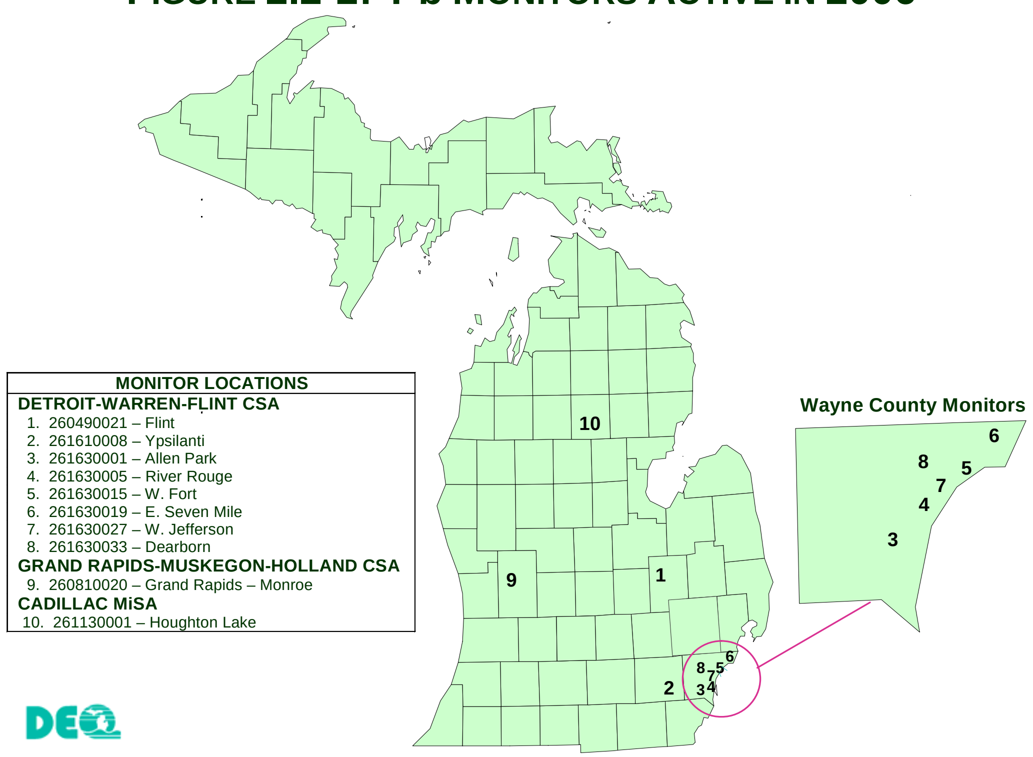
Figure 2.2-1: Percentage of Pb Emissions in Michigan By Source Type (EPA 2002 Emissions Inventory Data)



PB MONITORING IN MICHIGAN:

Although the 1999 monitoring regulations allow the discontinuance of many monitors, Michigan has continued Pb monitoring, along with other trace metals, as part of the Michigan Toxics Air Monitoring Program (MITAMP), the National Air Toxics Trend Sites (NATTS), and the Detroit Air Toxics Initiative (DATI) (discussed in **Chapter 3**). The MITAMP sites include Flint, Grand Rapids (Monroe), Ypsilanti, Allen Park, River Rouge, Detroit's W. Fort and E. Seven Mile, and Houghton Lake (a background site). As part of the NATTS program, the Dearborn site, must determine trace metal concentrations from PM_{10} filter. For the DATI program, Detroit's W. Jefferson monitoring site is being utilized for TSP, polynuclear aromatic hydrocarbons (PAHs), mercury, and toxics. The ten Michigan monitoring sites for Pb in 2006 are shown in **Figure 2.2-2**.

FIGURE 2.2-2: Pb MONITORS ACTIVE IN 2006



It is important to note that the 2006 amended monitoring requirements also de-emphasize Pb monitoring and under the NCORE network, there will only be ten sites nationally that will be required to measure Pb. However, since operation of the Dearborn NATTS site is funded through a different grant source, monitoring of Pb and other trace metals, both as 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**). If EPA adopts a more stringent form of the NAAQS 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 the years 1997-2006, **Figure 2.2-3** shows those 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 2.2-3: Pb Levels in MI's Detroit-Warren-Flint CSA from 1997-2006 (Maximum Quarterly Values)

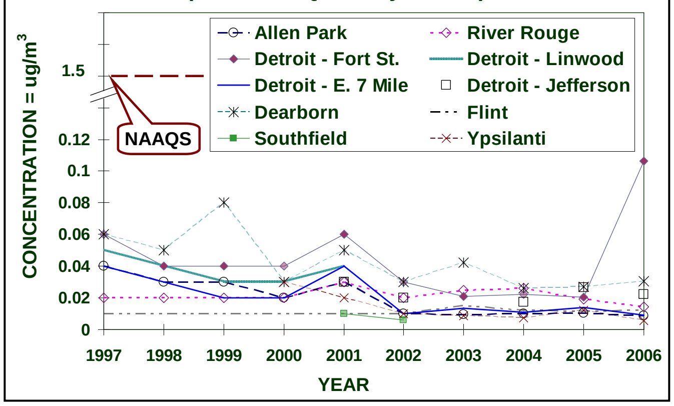


Figure 2.2-4: Pb Levels in Grand Rapids-Muskegon-Holland CSA and Northern MI from 1997-2006 (Maximum Quarterly Values)

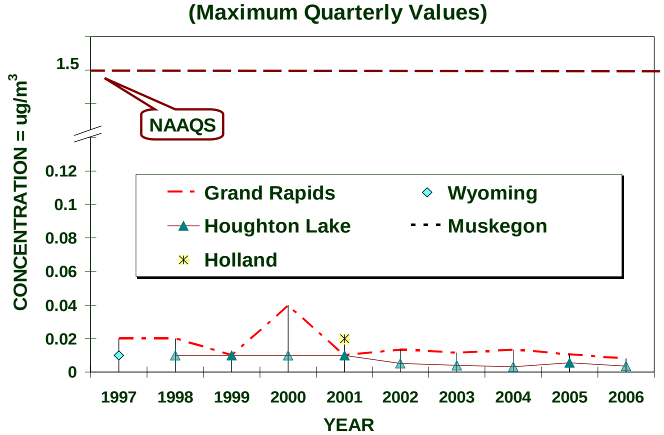
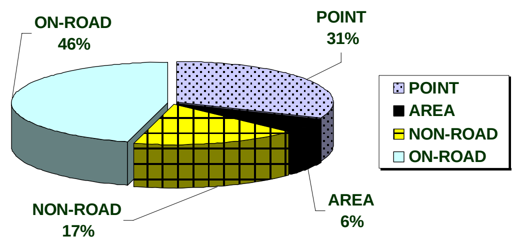


Figure 2.2-4 includes the remainder of Michigan's monitoring sites located in the Grand Rapids-Muskegon-Holland CSA and Northern Michigan for the years 1997-2006.

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.

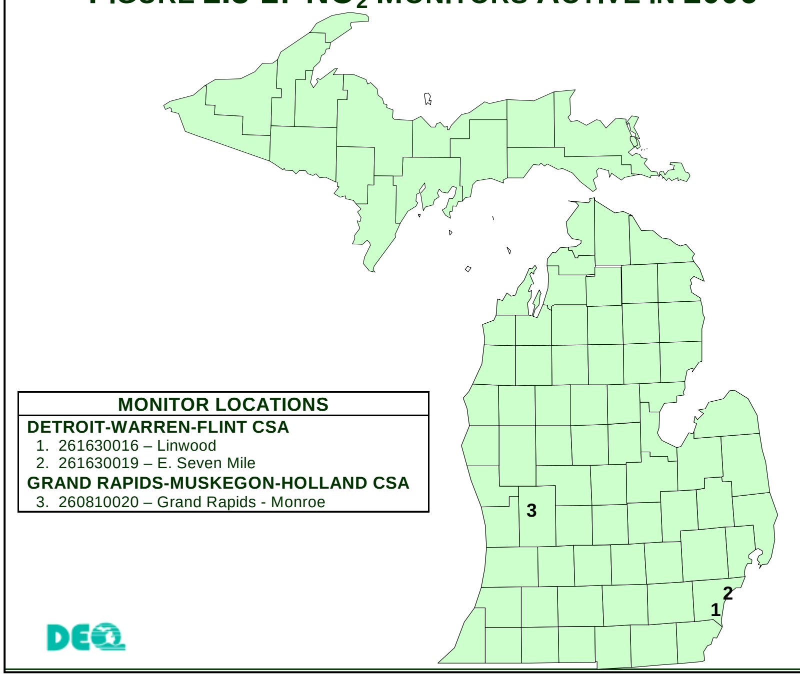
Figure 2.3-1: Percentage of NO_X Emissions in Michigan By Source Type (EPA 2002 Emissions Inventory Data)



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 2006, **Figure 2.3-2** shows that there were three NO_2 monitors in operation - two were located in the Detroit CSA and one in the Grand Rapids-Muskegon-Holland CSA (Grand Rapids-Monroe site). For the Detroit CSA, the Linwood monitor measures neighborhood scale air masses used for determining photo-chemical production of NO_2 in an area with the largest emissions of NO_X, and the E. Seven Mile monitor is a downwind urban scale site that measures NO_2 produced from the reaction of O_3 with NO_X.

FIGURE 2.3-2: NO_2 MONITORS ACTIVE IN 2006

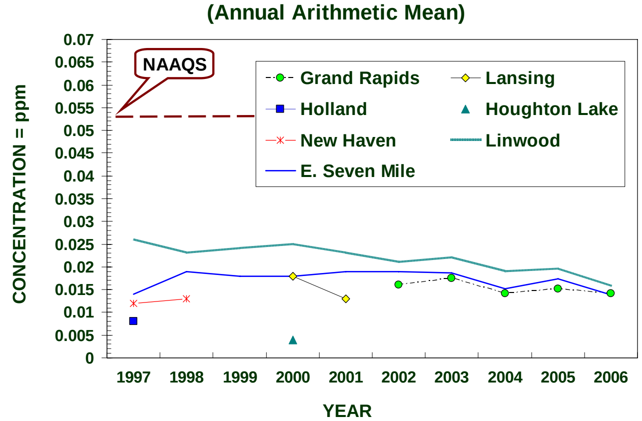


It is important to note that the revised 2006 air quality monitoring regulations no longer require NO_2 monitoring. Under the new NCORE requirements, trace monitoring will be necessary and Michigan will establish trace monitors at Grand Rapids and Allen Park before January 2008.

NO_2 TRENDS BY LOCATION:

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

Figure 2.3-3: NO_2 Levels in MI from 1997-2006 (Annual Arithmetic Mean)

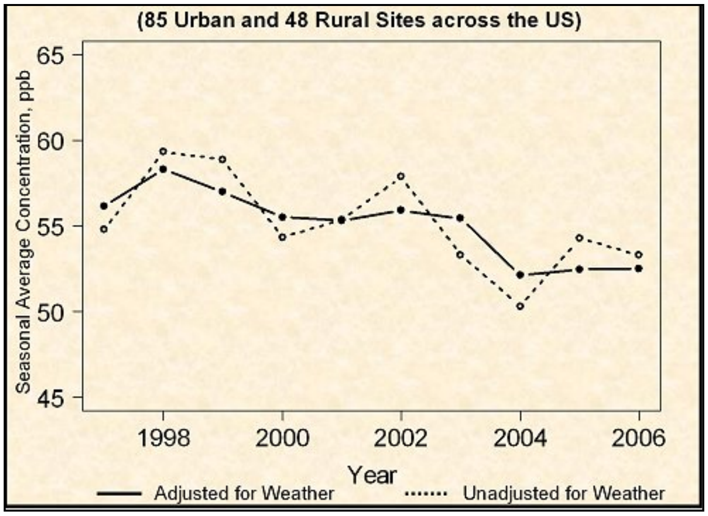


CHAPTER 2.4: OZONE (O_3)

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.[12]

In **Figure 2.4-1**, EPA used 8-hour O_3 concentrations from 85 urban and 48 rural sites across the U.S.[13] Typical weather conditions were determined by averaging conditions (e.g., temperature, humidity, etc.) for the summers (May-September) of 1997 through 2006. 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 10% between 1997 and 2006. 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 1997-2006

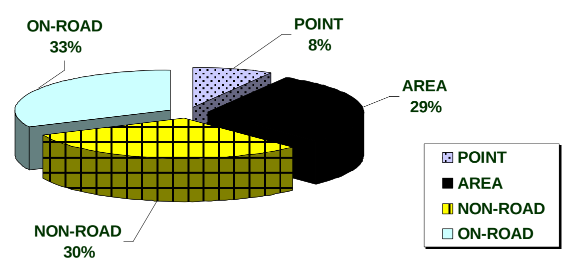


According to EPA's 2002 EI data (**Figure 2.4-2**), Michigan's on-road and non-road sources still account for a large percentage of VOC emissions. Michigan's VOC emission sources include:

- 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.

VOCs can also include the terpenes and isoprenes naturally emitted from vegetation.

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



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

[13] 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.

Under the 8-hour O_3 NAAQS, EPA designated 25 counties in Michigan as nonattainment on June 15, 2004 (**Figure 2.4-3**). Following implementation of the 8-hour O_3 standards, EPA revoked the 1-hour standard on July 15, 2005.

In 2006, the MDEQ successfully petitioned EPA to change the status for 16 of the 25 designated nonattainment counties to attainment.[14] 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.[15] **Figure 2.4-4** shows the nine counties in Michigan that remain in nonattainment.

The following **Table 2.4-1** shows the three-year averages of the 4th highest 8-hour O_3 values for all of Michigan's monitoring sites from 1997-2006. It is important to point out that the three-year averages for the 2004-2006 monitoring period show that all sites, except Holland (Allegan County), were meeting the O_3 NAAQS.

<u>NOTE</u>: In 2006, the AQD added O_3 monitors at a new site in Manistee and at Detroit's West Fort site. Because there is only one year's worth of data, only the 2006 values are noted in **Table 2.4-1** for these two sites.

Figure 2.4-3: EPA's Designated 8-hour Ozone Attainment/Nonattainment Areas for Michigan
(Utilizing 2001-2003 Monitoring Data)

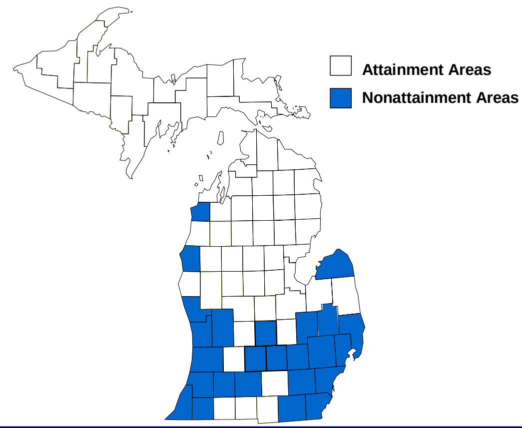
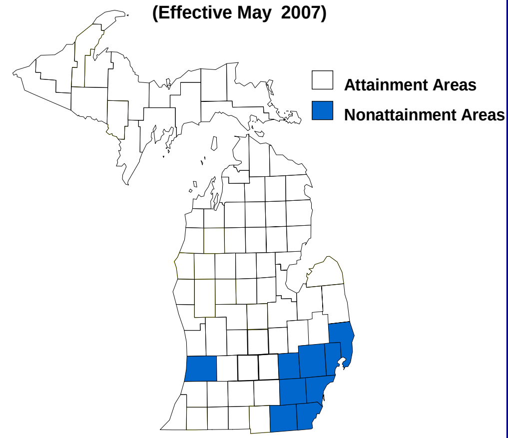


Figure 2.4-4: EPA's Designated 8-hour Ozone Attainment/Nonattainment Areas for Michigan
(Effective May 2007)



[14] 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.
[15] 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

Table 2.4-1: Three-Year Average of the 4th Highest 8-Hr O_3 Values From 1997-2006

AIRS ID	SITE NAME	VALUES	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
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
		Three-year Average ppm	0.098	0.094	0.094	0.089	0.087	0.092	0.097	0.093	0.089	0.088
		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**
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
		Three-year Average ppm	0.087	0.084	0.088	0.089	0.089	0.086	0.088	0.083	0.083	0.080
		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
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
		Three-year Average ppm	0.098	0.096	0.096	0.088	0.087	0.087	0.091	0.086	0.084	0.080
		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
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
		Three-year Average ppm	0.094	0.092	0.092	0.088	0.087	0.090	0.093	0.089	0.084	0.079
		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
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
		Three-year Average ppm	0.074	0.074	0.081	0.079	0.082	0.082	0.086	0.080	0.078	0.073
		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
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
		Three-year Average ppm	0.082	0.084	0.084	0.083	0.084	0.083	0.088	0.083	0.080	0.075
		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
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
		Three-year Average ppm	0.080	0.084	0.087	0.086	0.086	0.084	0.090	0.085	0.082	0.077
		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
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
		Three-year Average ppm	0.080	0.082	0.084	0.083	0.083	0.082	0.087	0.080	0.077	0.073
		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
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
		Three-year Average ppm	0.083	0.080	0.082	0.082	0.083	0.082	0.085	0.080	0.078	0.074
		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
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
		Three-year Average ppm	0.086	0.084	0.086	0.082	0.082	0.081	0.086	0.081	0.078	0.072
		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

TABLE 2.4-1: THREE-YEAR AVERAGE OF THE 4TH HIGHEST 8-HR O_3 VALUES FROM 1997-2006 (CONTINUED)

AIRS ID	SITE NAME	VALUES	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
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
		Three-year Average ppm	0.086	0.081	0.080	0.077	0.078	0.079	0.085	0.080	0.078	0.078
		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
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
		Three-year Average ppm	0.087	0.084	0.086	0.084	0.084	0.082	0.088	0.084	0.082	0.079
		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
260890001	Peshawbestown	4th Highest 8-hr Value ppm							0.079	0.070	0.080	0.073
		Three-year Average ppm									0.076	0.074
		Rounded to 0.01 ppm									0.08	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
		Three-year Average ppm	0.083	0.082	0.081	0.083	0.083	0.085	0.087	0.083	0.081	0.077
		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
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
		Three-year Average ppm	0.091	0.093	0.095	0.090	0.089	0.088	0.097	0.092	0.090	0.082
		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
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
		Three-year Average ppm	0.087	0.087	0.087	0.085	0.087	0.087	0.095	0.088	0.087	0.079
		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
261010922	Manistee	4th Highest 8-hr Value ppm										0.083
		Three-year Average ppm										
		Rounded to 0.01 ppm										
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
		Three-year Average ppm	0.096	0.088	0.091	0.089	0.091	0.087	0.089	0.082	0.081	0.077
		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
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
		Three-year Average ppm				0.081	0.082	0.078	0.081	0.076	0.075	0.073
		Rounded to 0.01 ppm				0.08	0.08	0.08	0.08	0.08	0.08	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
		Three-year Average ppm	0.099	0.091	0.093	0.091	0.092	0.089	0.095	0.086	0.084	0.083
		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

TABLE 2.4-1: THREE-YEAR AVERAGE OF THE 4TH HIGHEST 8-HR O_3 VALUES FROM 1997-2006 (CONTINUED)

AIRS ID	SITE NAME	VALUES	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
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
		Three-year Average ppm	0.078	0.079	0.084	0.084	0.084	0.086	0.091	0.086	0.081	0.075
		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
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
		Three-year Average ppm	0.082	0.082	0.085	0.084	0.084	0.085	0.089	0.084	0.081	0.079
		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
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
		Three-year Average ppm	0.086	0.085	0.087	0.087	0.085	0.088	0.090	0.086	0.082	0.080
		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
261530001	Seney Nat'l Wildlife Refuge	4th Highest 8-hr Value ppm						0.083	0.076	0.074	0.085	0.076
		Three-year Average ppm								0.077	0.078	0.078
		Rounded to 0.01 ppm								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
		Three-year Average ppm	0.082	0.082	0.083	0.084	0.087	0.087	0.091	0.084	0.081	0.077
		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
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
		Three-year Average ppm	0.078	0.078	0.080	0.077	0.078	0.078	0.084	0.079	0.075	0.070
		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
261630015	West Fort	4th Highest 8-hr Value ppm										0.067
		Three-year Average ppm										
		Rounded to 0.01 ppm										
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
		Three-year Average ppm	0.088	0.089	0.091	0.088	0.088	0.085	0.091	0.082	0.081	0.075
		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

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:

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

O_3 monitoring networks often extend beyond the vicinity where most precursor emissions occur 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 (**3**). 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, which have been in operation for 8 and 14 years, respectively, are useful for quantifying the effectiveness of control strategies at upwind sites. For eastern Michigan, regional 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 regional 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.

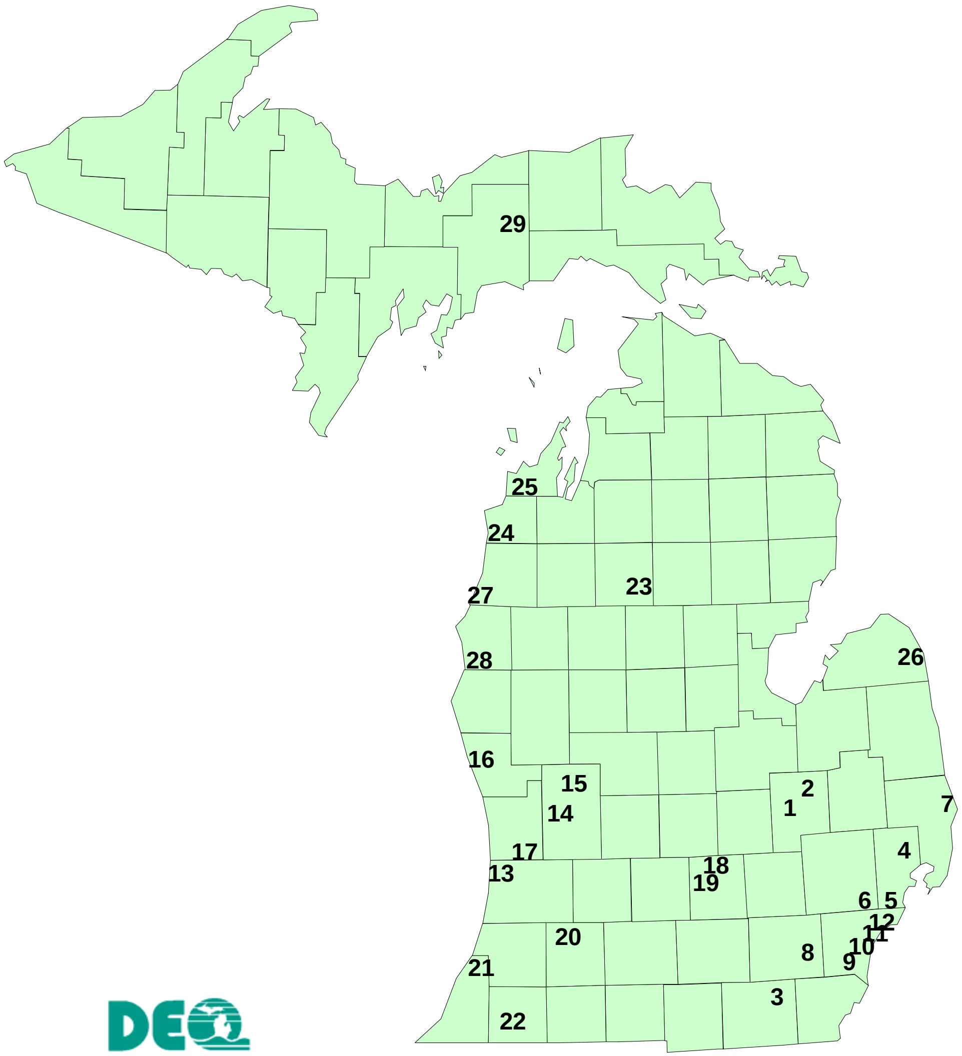
Southeast Michigan monitors are located to provide an indication of population exposure at the neighborhood scale and urban scale air masses. O_3 is also measured at a neighborhood scale in Flint, Lansing, and Grand Rapids (Monroe). For urban scale air masses, the maximum O_3 concentrations are measured 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.

In 2006, two O_3 monitors were added to the monitoring network. One is located in Manistee County and is managed by the Little River Band of Ottawa Indians. The other monitor is located in the Detroit area at the West Fort site. **Figure 2.4-5** shows the locations and types of all 29 O_3 air quality monitors active in Michigan during 2006.

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 will be required in these MSAs.[16]

[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: O_3 MONITORS ACTIVE IN 2006



MONITOR LOCATIONS

DETROIT-WARREN-FLINT CSA
1. 260490021 – FLINT
2. 260492001 - OTISVILLE
3. 260910007 - TECUMSEH
4. 260990009 - NEW HAVEN
5. 260991003 - WARREN
6. 261250001 - OAK PARK
7. 261470005 - PORT HURON
8. 261610008 - YPSILANTI
9. 261630001 - ALLEN PARK
10. 261630015 - W. FORT
11. 261630016 - LINWOOD
12. 261630019 - E. SEVEN MILE

GRAND RAPIDS-MUSKEGON-HOLLAND CSA
13. 260050003 - HOLLAND
14. 260810020 - GRAND RAPIDS
15. 260810022 - EVANS - SLAMS
16. 261210039 - MUSKEGON
17. 261390005 – JENISON

LANSING-E. LANSING-OWOSSO CSA
18. 260370001 - ROSE LAKE
19. 260650012 - LANSING

KALAMAZOO-PORTAGE MSA
20. 260770008 - KALAMAZOO

NILES-BENTON HARBOR MSA
21. 260210014 - COLOMA

SOUTH BEND-MISHAWAKA (IN-MI) MSA
22. 260270003 – CASSOPOLIS

CADILLAC MiSA
23. 261130001 - HOUGHTON LAKE

TRAVERSE CITY MiSA
24. 260190003 – FRANKFORT/BENZONIA
25. 260890001 – PESHAWBESTOWN - TRIBAL

HURON CO.
26. 260630007 - HARBOR BEACH

MANISTEE CO.
27. 261010922 – MANISTEE - TRIBAL

MASON CO.
28. 261050007 – SCOTTVILLE

SCHOOLCRAFT CO.
29. 261530001 - SENEY

8-HOUR O_3 TRENDS BY LOCATION:

Figure 2.4-6: 8-Hour O_3 Level Events Exceeding the NAAQS from 1980-2006

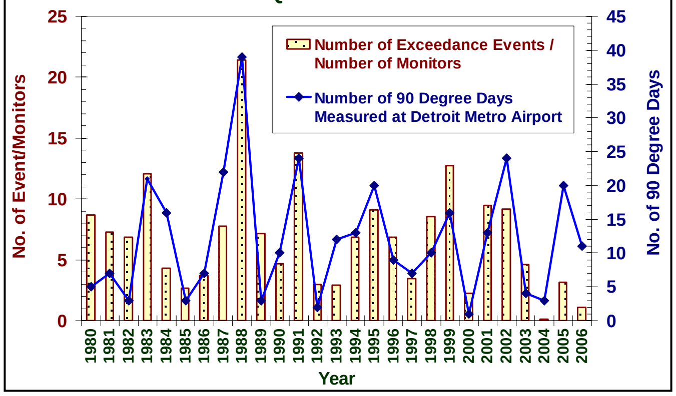


Figure 2.4-6 compares 8-hour O_3 readings ≥ 0.085 ppm with the number of 90°F days (≥ 90°F) measured at the Detroit Metropolitan Airport. The total number of statewide 8-hour readings above 0.085 ppm was divided by the number of monitors that were in operation each year to provide a relative indication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

This comparison shows the influence of temperature with respect to elevated O_3 levels. Over the past 22 years, a typical summer would have 12 1/2 days with the maximum daily temperature exceeding 90°F. Over the time period from 1980 through 2006, the highest number of 90°F days occurred in 1988 (39 days), while the lowest number occurred in 2000 (one day). For 2006, there were eleven 90°F days.

During the 2006 monitoring season, only two of the 29 O_3 monitoring sites registered readings at or above the 0.085 ppm (4th highest value). However, when all the sites had their three-year averages calculated (2004-2006), only the Holland site (at 0.09 ppm), which has the highest O_3 values throughout the state, exceeded the 8-hour O_3 NAAQS. The Holland site continues to have elevated O_3 values and 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.

Figure 2.4-7 (at right) shows that all 12 monitors located in the Detroit-Warren-Livonia CSA (East and Southeast Michigan sites) had 2006 O_3 concentration levels below the 8-hour NAAQS and when averaged, all sites were in attainment.

Figure 2.4-7: O_3 Levels in Detroit-Warren-Flint CSA from 1997-2006, (4th Highest 8-Hour O_3 Values)

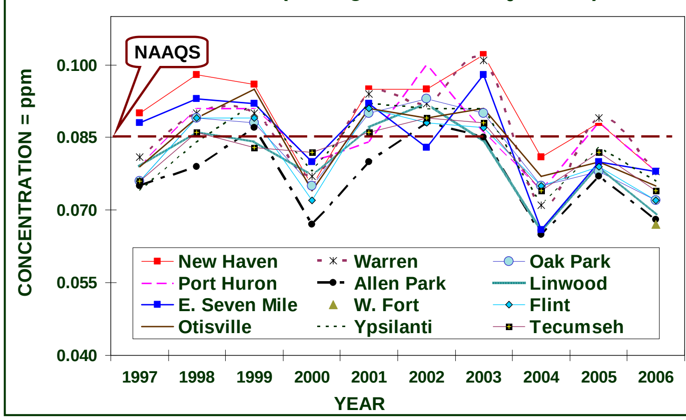
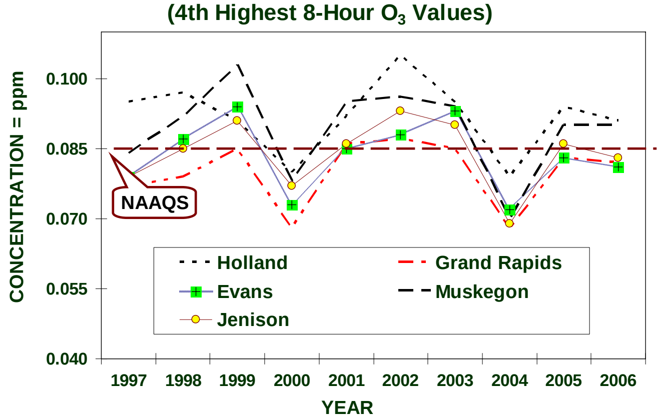


Figure 2.4-8: O_3 Levels in the Grand Rapids-Muskegon-Holland CSA from 1997-2006 (4th Highest 8-Hour O_3 Values)



For West Michigan, **Figure 2.4-8** shows that in 2006, two of the six monitors (Muskegon and Holland) in the Grand Rapids-Muskegon-Holland CSA had yearly levels above the O_3 NAAQS (0.090 and 0.091 ppm, respectively). However, as stated previously, only the Holland site, when averaged over the 2004-2006 period, was above the 8-hour O_3 NAAQS.

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 1997-2006 (4th Highest 8-Hour O$_3$ Values)

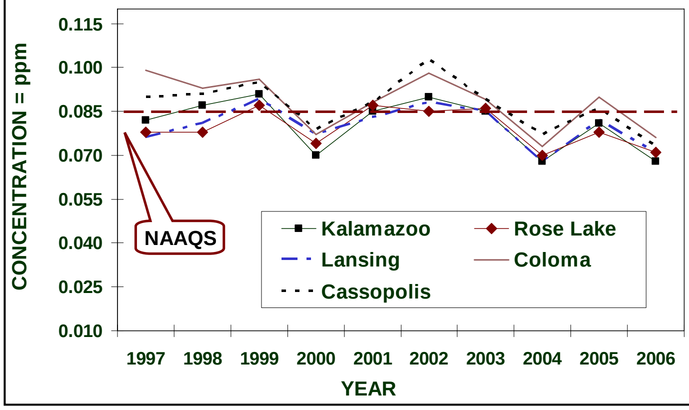
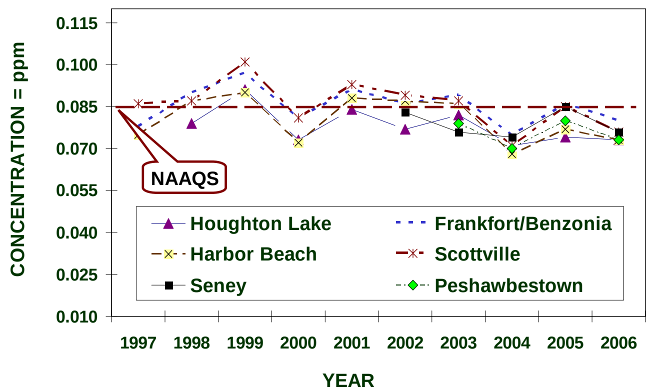


Figure 2.4-9 contains those sites located in Kalamazoo (Kalamazoo-Portage MSA), Rose Lake and Lansing (Lansing-E. Lansing-Owosso CSA), Coloma (Niles-Benton Harbor MSA) and Cassopolis (South Bend-Mishawaka [Indiana-MI] MSA).[17] As shown, all sites had 2006 levels below the 8-hour O$_3$ concentration of 0.085 ppm and their three-year averages were also below the 8-hour O$_3$ NAAQS.

Figure 2.4-10: O$_3$ Levels in MI's Northern Lower and Upper Peninsula Areas from 1997-2006 (4th Highest 8-Hour O$_3$ Values)



For the remainder of those sites located in Northern Michigan's Lower Peninsula and the Upper Peninsula, **Figure 2.4-10** shows the concentrations for the monitors at Houghton Lake (Cadillac MiSA), Benzonia and Peshawbestown (Traverse City MiSA), Harbor Beach (Huron County), Scottville (Mason County) and Seney (Schoolcraft County in the Upper Peninsula). For 2006, all monitoring sites had yearly levels below the 8-hour O$_3$ NAAQS and were in attainment.

In summary, the O$_3$ levels in Michigan have continued to decline, justifying Michigan's request for redesignating the 16 nonattainment counties to attainment. The AQD along with it partners continue to work at maintaining attainment for the 8-hour O$_3$ NAAQS.

[17] The Cassopolis monitor is a downwind site of South Bend, Indiana.

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

PM is categorized according to the size and health impact of the particles. Particle size is the major factor that determines which particles will enter the lungs and how deeply they will penetrate. $PM_{2.5}$ are much smaller "fine 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 will affect how monitoring for PM will be conducted in the future. Although the impact of these revisions will not affect the 2006 monitoring data presented in this report, it is important to discuss.

On October 17, 2006, EPA amended the ambient air monitoring requirements impacting how $PM_{2.5}$ will be measured. Under the 2006 amended regulations, the $PM_{2.5}$ monitoring network requires every-day sampling for those areas that approach the 24-hour $PM_{2.5}$ standard, while others will operate on every third or sixth day cycles.[18] As with the O_3 monitoring network, MSA boundaries have been modified and population totals tied to measurements of ambient air quality have increased. 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 those MSAs. Another important aspect of the regulations is that the proposed NCORE sites will add measurement of "inhalable coarse particles," (i.e. $PM_{10-2.5}$) with some monitors providing continuous mass concentration monitoring and others 24-hour filter-based sampling to enable development of $PM_{10-2.5}$ methods for chemical speciation.[19]

Effective December 18, 2006, 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.[20] Under the newly revised 24-hour $PM_{2.5}$ NAAQS, Michigan must 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. EPA will notify states by August 2008 on their designation determinations with 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.

It is important to note that many national programs have been put in place to reduce levels of PM. These programs control directly emitted PM and/or the emissions that contribute to PM formation, such as SO_2, NO_X, and VOCs. For example, EPA's Clean Air Interstate Rule (CAIR), finalized in 2005, focus on those states whose SO_2 and NO_X emissions significantly contribute to the $PM_{2.5}$ and O_3 pollution problems in other downwind states. The NO_X SIP Call, which began in 2004, reduces NO_X and regional transport of ground-level O_3 pollution for those states in the eastern U.S. (such as Michigan). Based on EPA's modeling of year 2015 results from the NO_X SIP call and other federally implemented programs that reduce NO_X and SO_2 (e.g., CAIR, etc.), it is expected that all Michigan counties, except for Wayne County (which is also out of compliance for the annual $PM_{2.5}$ standard), will attain compliance.[21] The following **Table 2.5-1** is from EPA's Particle Pollution Report: Current Understanding of Air Quality and Emissions through 2003 and lists the major emission control programs since 1995 that have or will reduce PM.[22]

[18] Effective January 1, 2007, the required changes have been made to Michigan's $PM_{2.5}$ monitoring network.
[19] In the original draft revision of the 1997 PM NAAQS, EPA had proposed implementing a new "inhalable coarse particle" category but decided that further research was needed. Therefore, this new method of measurement ($PM_{10-2.5}$) was established under the 2006 revised air monitoring regulations.
[20] 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.
[21] Additional information on PM is available on the AQD's website at http://www.michigan.gov/deqair under "Assessment and Planning," "Attainment/Nonattainment Information," then "Particulate Matter."
[22] The Particle Pollution Report is available at http://www.epa.gov/air/airtrends/aqtrnd04/pm.html.

Table 2.5-1: Select PM Emission Control Programs from 1995-2015

Program	Sector	Direct PM[a] Reductions	PM Precursors: SO_2 Reductions	PM Precursors: NO_x Reductions	PM Precursors: VOC Reductions	Implementation Date
Clean Air Nonroad Diesel Rule	Mobile sources	X	X	X		2004-2015
Clean Air Interstate Rule (proposed December 2003)	Electric Utilities	X	X	X		2010-2015
Acid Rain Program	Electric Utilities		X	X		1995-2010
NO_x SIP Call	Electric Utilities		X	X		2004
Regional Haze Rule/ Best Available Retrofit Technology	Electric Utilities[b]	X	X	X		2013-2015
$PM_{2.5}$ Implementation[c]	Stationary/Area/ Mobile sources	X	X	X	X	2008-2015
PM_{10} SIPs (e.g., San Joaquin Valley)	Stationary/Area/ Mobile sources	X	X	X	X	Ongoing
Maximum Achievable Control Technology (MACT) Standards[d]	Stationary/Area	X			X	1996-2003
Various Mobile Source Programs[e]		X	X	X	X	Ongoing

[a] Includes elemental and organic carbon, metals, and other direct emissions of PM.

[b] Also applies to industrial boiler and the other source categories also covered under Prevention of Significant Deterioration (PSD).

[c] Includes Reasonably Available Control Technology (RACT) and Reasonably Available Control Measures (RACM).

[d] Includes a variety of source categories such as Boilers and Process heaters, Pulp and Paper, Petroleum Refineries, various minerals and ores, and others. While these standards are for hazardous air pollutants (HAPs) such as metals, measures to reduce HAPs in many cases also reduce PM emissions.

[e] Includes such programs as onroad diesel and gasoline engines, nonroad gasoline engines, Low Sulfur Diesel and Gasoline Fuel Limits for onroad and offroad engines, Motorcycles, Land-based recreational vehicles, and Marine diesel engines.

PM_{10}:

Figure 2.5-1 shows Michigan's percentage of 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 2.5-2** 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)

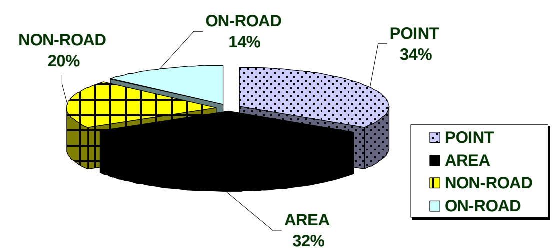
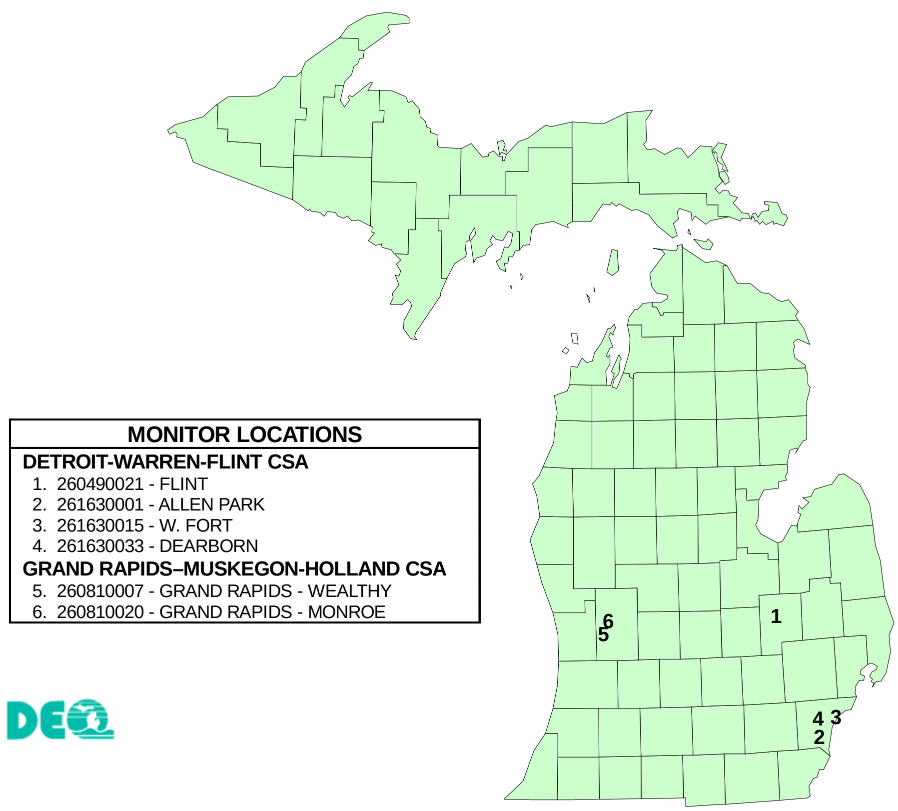


Table 2.5-2: PM_{10} Point and Area Source Types in Michigan

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 is maintained at 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 2006. These monitors are located in the state's largest populated urban areas -- three in the Detroit area, one in Flint, 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.

FIGURE 2.5-2: PM_{10} MONITORS ACTIVE IN 2006



PM_{10} TRENDS BY LOCATION:

Figure 2.5-3 shows the annual arithmetic means for the Detroit-Warren-Flint CSA from 1997-2006. For 2006, all monitoring sites in the Detroit area had readings below the PM_{10} standard with the Dearborn continuing to have the highest maximum annual mean (31.5 µg/m^3) in the state.

Figure 2.5-3: PM_{10} Levels in MI's Detroit-Warren-Flint CSA from 1997-2006 (Annual Arithmetic Means)

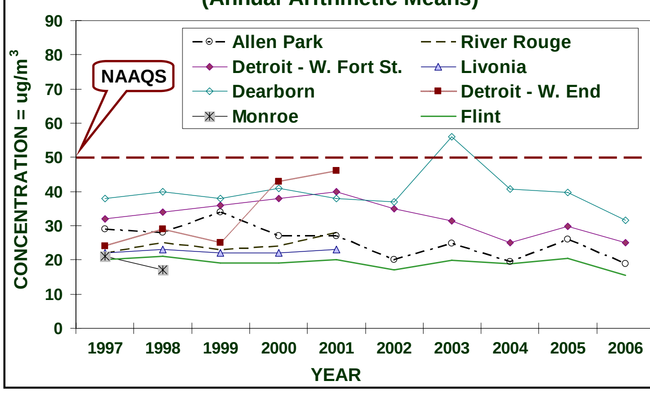


Figure 2.5-4: PM_{10} Levels in the Grand Rapids-Muskegon-Holland CSA & North MI from 1997-2006 (Annual Arithmetic Means)

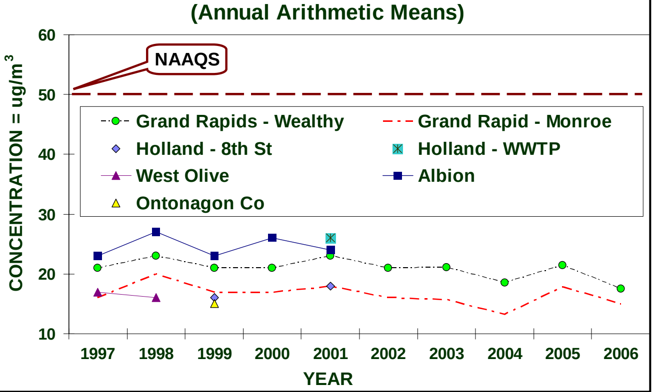
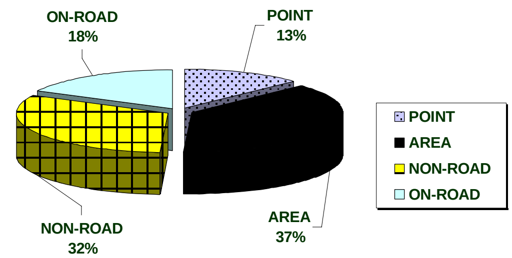


Figure 2.5-4 shows the annual arithmetic means for the Grand Rapids-Muskegon-Holland CSA and Northern Michigan from 1997-2006. In 2006, the two PM_{10} monitoring sites located in the Grand Rapids area continue to show a decline in the annual mean levels. For the decade, all the monitoring sites in western Michigan have maintained a level well below the PM_{10} NAAQS.

PM2.5:

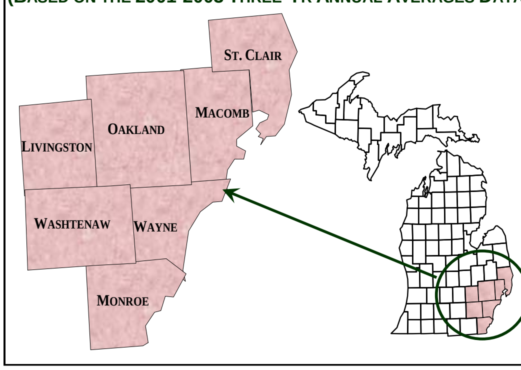
Figure 2.5-5 shows that according to EPA's 2002 EI data, Michigan area sources produce the majority of $PM_{2.5}$ emissions in the state (37%). However, when you combine non-road (32%) and on-road (18%) sources together, they produce 50% of Michigan's $PM_{2.5}$ emissions. Point sources, such as fossil 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 2005, EPA designated under the 1997 $PM_{2.5}$ NAAQS, seven Southeast Michigan counties as nonattainment (shown in **Figure 2.5-6**). By 2010, Michigan is required to develop control strategies to bring the areas into attainment. The final $PM_{2.5}$ Implementation Rule describing the requirements needed to develop these control strategies, was issued by EPA on March 29, 2007. The AQD is currently working on Michigan's SIP due to EPA by April 18, 2008 for these seven Southeast Michigan nonattainment counties. **NOTE**: The final $PM_{2.5}$ Implementation Rule addresses the 1997 PM NAAQS and is not intended, at this time, to be used for the newly revised 2006 PM NAAQS.

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



COMPREHENSIVE MONITORING FOR PM2.5 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 $PM_{2.5}$.

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 30 $PM_{2.5}$ 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. The FRM monitors at the Channing and Crystal Falls sites in Michigan's Upper Peninsula were established for a short-term study to determine the impact of outdoor wood boilers on air quality. 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 (**4, 5, 6**). Co-located PM_{10} and $PM_{2.5}$ sites include Flint, Grand Rapids (Monroe), Dearborn, and Detroit's Allen Park and W. Fort.

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 (**5**).

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 2004, 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.

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 $PM_{2.5}$ (**7**). There are nine SASS monitors operating in Michigan.

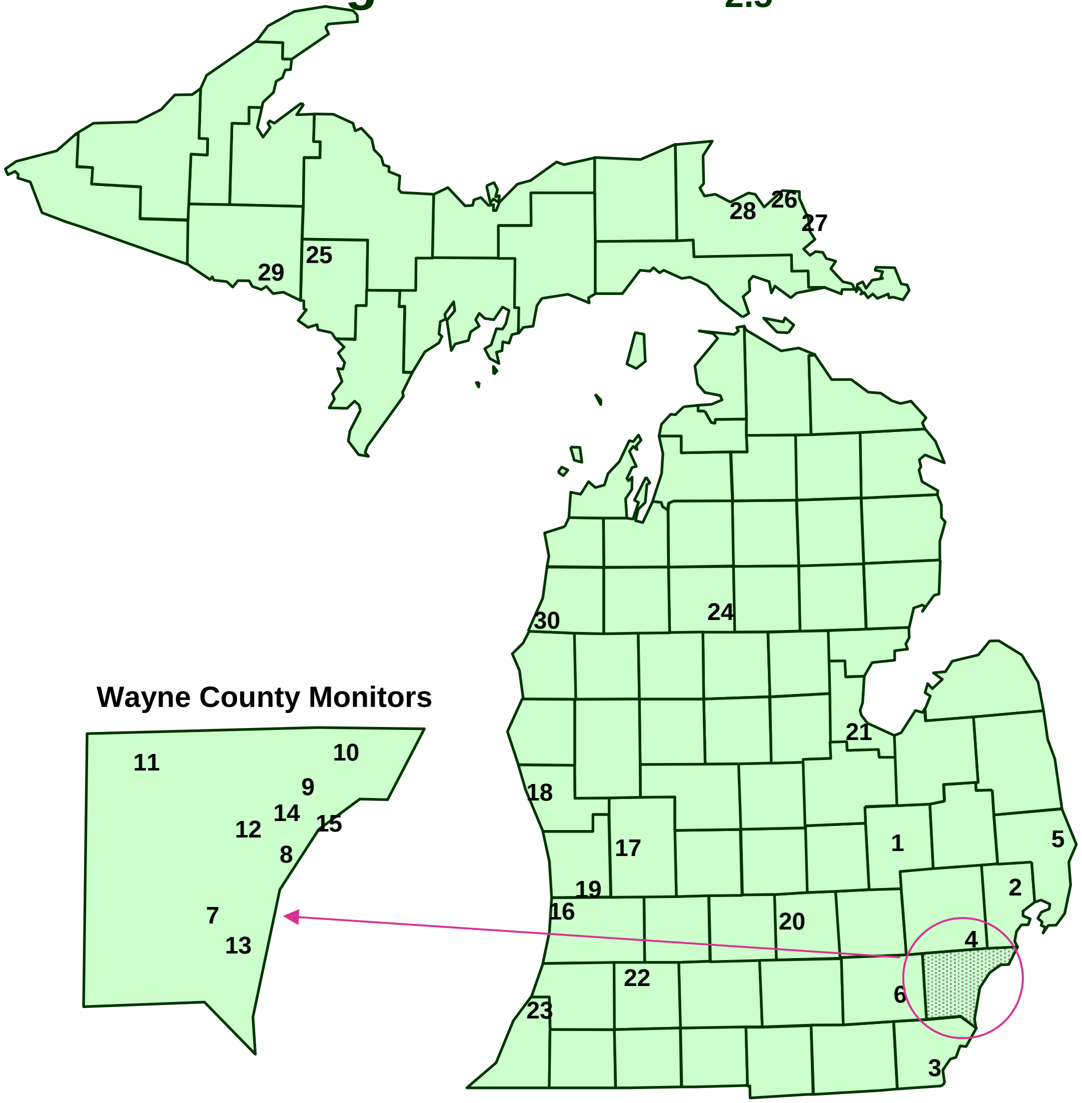
The primary objectives of the chemical speciation monitoring sites are to provide data that will be used to determine air quality and to support the development of attainment strategies. Historical speciation data for Michigan indicates that $PM_{2.5}$ is made up of 30% nitrate compounds, 30% sulfate compounds, 30% organic carbon,[23] 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.

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.[24] Continued operation of the speciation trend site in Detroit (Allen Park) is required on a national level and the sampling frequency has increased to once every three days.

In 2006, the monitors in Saginaw and Ann Arbor were shut down and a Tribal site was added in Manistee County. **Figure 2.5-7** shows all of Michigan's 30 $PM_{2.5}$ FRM monitoring stations operating in 2006 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.

[23] 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.
[24] Current information on both proposals can be found at http://www.epa.gov/air/particles/actions.html.

Figure 2.5-7: $PM_{2.5}$ FRM Monitors Active in 2006



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. 260810020 – Grand Rapids (TEOM/SASS)
18. 261210040 – Muskegon
19. 261390005 – Jenison

LANSING-E. LANSING-OWOSSO CSA
20. 260650012 – Lansing (TEOM)

SAGINAW-BAYCITY-SAGINAW TWP. NORTH CSA
21. 260170014 – Bay City (TEOM)

KALAMAZOO-PORTAGE MSA
22. 260770008 – Kalamazoo (TEOM/SASS)

NILES-BENTON HARBOR MSA
23. 260210014 – Coloma

CADILLAC MiSA
24. 261130001 – Houghton Lake (TEOM/SASS)

IRON MOUNTAIN (MI-WI) MiSA
25. 260430002 – Channing

SAULT STE. MARIE MiSA
26. 260330901 – Sault Ste Marie, Easterday – TRIBAL (SASS)
27. 260330902 – Sault Ste Marie, Marquette – TRIBAL
28. 260330903 – Bay Mills - TRIBAL

IRON COUNTY
29. 260710001 – Crystal Falls

MANISTEE COUNTY
30. 261010922 – Manistee - TRIBAL

Table 2.5-3 provides the 1999-2006 annual mean $PM_{2.5}$ concentrations by individual monitoring stations.[25] Stations labeled #2 provide a precision estimate of the overall measurement and operate on a one in six sampling schedule. All other monitors sample on a one in three day schedule except for Holland, Grand Rapids #1, Allen Park #1, and Linwood, which sample daily.

Table 2.5-3: Annual Mean $PM_{2.5}$ Concentrations By Monitoring Station from 1999-2006 (Annual Mean, Rounded)

AIRS ID – Station Name	1999	2000	2001	2002	2003	2004	2005	2006	2004-2006 Mean
260050003 - Holland	12.1	11.7	12.8	12.4	12.38	11.21	12.39	11.48	11.7
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	10.8
260210014 - Coloma	12.3	12.1	13.2	12.5	12.46	10.23	13.05	10.95	11.41
260330901 - Sault Ste. Marie #1			8.2	7.6	8.64	7.16	8.16	8.99*	8.1
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*	7.6
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	11.4
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	12.0
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*	12.6
260770008 - Kalamazoo #2	14.7	14.7	14.6	15.0	14.27*	11.09	14.64*	12.76*	12.8
260810020 - Grand Rapids #1	13.8	13.8	14.4	13.3	13.51	12.00	13.72	12.62	12.8
260810020 - Grand Rapids #2	13.9	13.8	14.2	13.2	14.00	11.26	**15.37**	13.04	13.2
260990009 - New Haven	12.7	13.4	13.6	13.4	12.8	11.96	14.37	11.28	12.5
261010922 – Manistee								9.13*	**
261130001 - Houghton Lake					7.96	7.29	9.38	7.77	8.1
261150005 - Luna Pier		**15.2**	**15.3**	**16.3**	13.73	12.98	**15.70**	12.72	13.8
261210040 - Muskegon #1	12.2	11.9	12.6	12.4	11.87	10.16	13.07	11.30	11.5
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	13.4
261250010 - Southfield			17.1	17.6					**
261390005 - Jenison	12.9	13.2	13.8	13.6	12.69	11.33	13.99	12.02	12.4
261450018 - Saginaw #1	9.8	10.5	11.5	10.8	10.62	9.51	11.72*		10.6
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	13.1
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*	13.7
261610008 - Ypsilanti #2			13.8	13.0	**15.12**	11.09	**16.70**	13.52	13.8
261630001 - Allen Park #1	**16.7**	**15.6**	**17.3**	**15.9**	**15.2**	14.24	**15.94**	13.18	14.5
261630001 - Allen Park #2	**19.6**	**16.0**	**16.2**	13.9	**17.51***	12.32	**17.66**	13.86	14.6
261630015 - Detroit - W. Fort	**17.7**	**18.1**	**18.3**	**17.4**	**16.63**	**15.39**	**17.21**	14.68	**15.8**
261630016 - Detroit - Linwood	**17.1**	**15.5**	**15.8**	**15.6**	**15.82**	13.69	**16.01**	13.04	14.2
261630019 - Detroit - E Seven Mile		14.5	14.5	**15.6**	14.63	13.23	**16.48**	12.71	14.1
261630025 - Livonia	13.1	14.6	14.6	14.4	14.14	12.57	14.94	11.80	13.1
261630033 - Dearborn	**17.0**	**20.1**	**19.6**	**19.8**	**19.11**	**16.83**	**18.55**	**16.13**	**17.2**
261630036 - Wyandotte	**16.3**	**17.6**	**18.2**	**16.3**	**16.26**	13.66	**16.41**	12.92	14.3
261630038 - Detroit - Newberry							**16.41***	12.47*	**
261630039 - Detroit - W. Lafayette							**16.22***	13.13	**

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

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

Table 2.5-4 is a detailed assessment of the 24-hour 98TH percentile $PM_{2.5}$ concentrations for 1999-2006 showing Michigan's levels are consistently below the 65 $\mu g/m^3$ standard (three-year average).[26] However under the new 24-hour $PM_{2.5}$ NAAQS of 35 $\mu g/m^3$, only 11 of the 28 sites are showing attainment.

Table 2.5-4: 24-Hour 98th Percentile $PM_{2.5}$ Concentrations by Monitoring Station from 1999-2006 (98th Percentile, Rounded)

AIRS ID – Station Name	1999	2000	2001	2002	2003	2004	2005	2006	2004-2006 Mean
260050003 - Holland	36.5	35.7	42.1	36.7	35.6	30.3	36.1	34.1	34
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	32
260210014 - Coloma	35.4	29.7	32.3	30.6	34.1	29.0	33.8	27.7	30
260330901 - Sault Ste. Marie #1			27.9	22.1	26.3	22.3	25.1	36.1	28
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	27
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	30
260550003 - Traverse City		27.2	32.7	23.3					**
260650012 - Lansing #1	34.6	37.2	37.2	32.8	29.0	29.4	38.1	28.3	32
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	30
260770008 - Kalamazoo #2	38.7	36.5	36.0	32.0	35.7	28.9	31.5	29.1	30
260810020 - Grand Rapids #1	38.8	40.5	43.5	35.1	35.0	31.8	44.7	33.2	**37**
260810020 - Grand Rapids #2	39.3	28.1	39.4	32.4	29.6	30.5	45.6	31.5	**36**
260990009 - New Haven	31.9	33.2	42.0	35.6	31.8	31.9	41.5	34.4	**36**
261130001 - Houghton Lake					23.6	21.0	30.8	21.6	25
261010922 – Manistee								25.9	**
261150005 - Luna Pier		37.2	39.2	42.7	34.7	35.0	49.3	32.6	**39**
261210040 - Muskegon #1	38.1	35.0	34.9	29.8	36.3	32.7	41.0	29.8	**35**
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	**39**
261250010 - Southfield			44.2	31.4					**
261390005 - Jenison	38.7	33.7	35.0	36.8	31.0	30.9	42.3	30.2	**35**
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	**39**
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	**38**
261610008 - Ypsilanti #2			39.0	32.6	32.5	31.2	54.6	33.0	**40**
261630001 - Allen Park #1	49.0	41.8	48.3	39.6	40.5	36.9	43.0	34.1	**38**
261630001 - Allen Park #2	44.1	34.6	40.1	30.9	39.2	33.8	58.0	34.2	**42**
261630015 - Detroit - W. Fort St.	50.2	44.5	42.9	38.2	33.6	36.0	49.7	36.2	**41**
261630016 - Detroit - Linwood	51.7	44.0	46.0	42.7	46.2	38.3	51.8	36.9	**42**
261630019 - Detroit - E Seven Mile		42.0	42.0	34.4	37.1	35.0	52.3	36.2	**41**
261630025 - Livonia	38.4	35.9	44.7	32.7	38.1	32.2	40.2	30.4	34
261630033 - Dearborn	45.1	45.1	43.2	45.7	42.8	39.4	50.2	43.1	**44**
261630036 - Wyandotte	45.0	42.7	46.6	34.1	34.8	32.3	46.7	33.2	**37**
261630038 - Detroit - Newberry							57.5	28.6	**
261630039 - Detroit - W. Lafayette							43.9	32.4	**

*The 2004-2006 mean cannot be calculated as there is not three years worth of data or monitoring ended prior to 2006.

[26] 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 annual mean $PM_{2.5}$ trend for each monitoring site in Michigan for the years monitoring was conducted. For clarity purposes, the monitoring sites within the Detroit-Warren-Flint CSA, which are currently designated as nonattainment for the $PM_{2.5}$ NAAQS, have been broken down into two graphs. **Figure 2.5-8** shows those sites in Wayne County and **Figure 2.5-9** shows the remaining counties within the CSA.

As shown in **Figure-2.5-8**, 2006 levels have decreased from 2005 for all the monitoring sites located in Wayne County with only the Dearborn site above the standard. However, after the three-year annual means are calculated, Dearborn (17.2 µg/m) and Detroit's West Fort sites (15.8 µg/m) did not meet the $PM_{2.5}$ 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 1999-2006

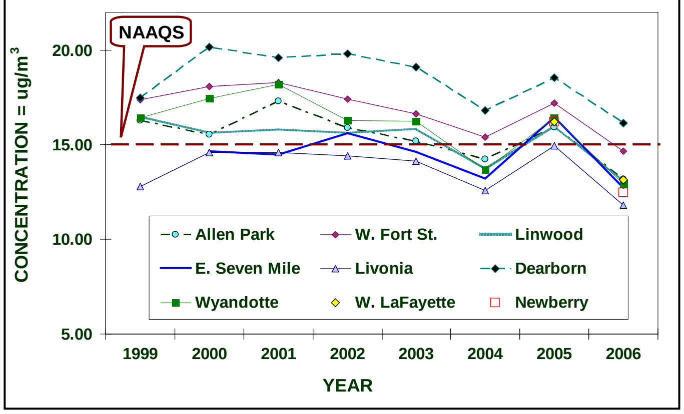


Figure 2.5-9: Detroit-Warren-Flint CSA (without Wayne County) Annual Arithmetic Means for $PM_{2.5}$ from 1999-2006

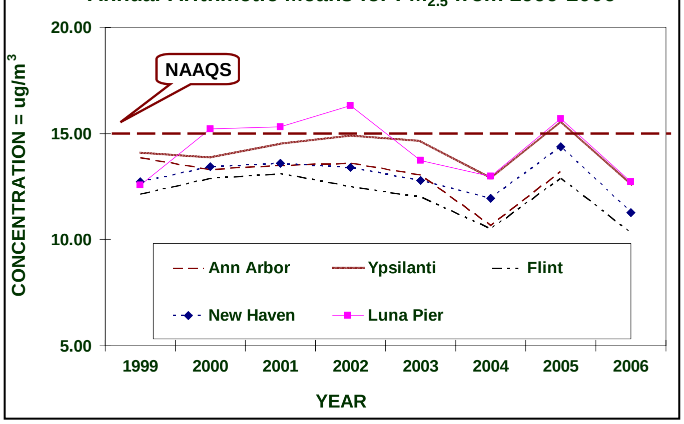


Figure 2.5-9 contains the remainder of those sites in the Detroit-Warren-Flint CSAs that are outside of Wayne County. These sites also show yearly readings in 2006 below the $PM_{2.5}$ standard and after the three-year annual mean is averaged, they remain below the $PM_{2.5}$ NAAQS. In summary, for the entire Detroit-Warren-Flint CSA, only two sites in Wayne County has three-year annual mean values above the $PM_{2.5}$ NAAQS.

Figure 2.5-10 combines the $PM_{2.5}$ monitoring sites located in West Michigan. These sites include those in the Grand Rapids-Muskegon-Holland CSA, Kalamazoo, and Coloma. As shown, all sites in West Michigan have been below the $PM_{2.5}$ NAAQS since 2002.

Figure 2.5-10: West MI - Grand Rapids-Muskegon-Holland CSA, Kalamazoo & Benton Harbor MSAs Annual Arithmetic Means for $PM_{2.5}$ from 1999-2006

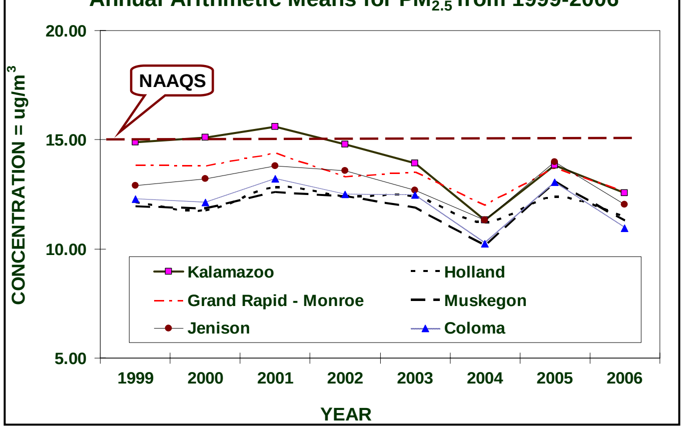


Figure 2.5-11 displays the remaining monitoring sites operational in Michigan's Lower Peninsula. These include those sites in the Lansing-E. Lansing-Owosso CSA (Lansing), Saginaw-Bay City-Saginaw Twp. North CSA (Bay City), Traverse City MiSA (Traverse City), Cadillac MiSA (Houghton Lake), Alpena MiSA (Alpena) and the new site in Manistee County. As shown, all these sites have 2006 levels below the standard and their three-year averages (except for Manistee as it has only one year's worth of monitoring data) have also remained below the $PM_{2.5}$ NAAQS.

Figure 2.5-11: Lansing-E. Lansing CSA, Saginaw-Bay City CSA, Traverse City MiSA, Alpena MiSA & Cadillac MiSA Annual Arithmetic Means for $PM_{2.5}$ from 1999-2006

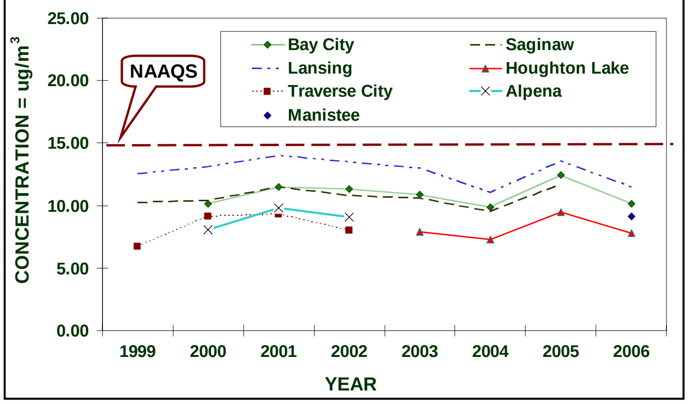


Figure 2.5-12: Sault Ste. Marie MiSA, Iron Mountain (MI-WI) MiSA, and Iron County Sites Annual Arithmetic Means for $PM_{2.5}$ from 1999-2006

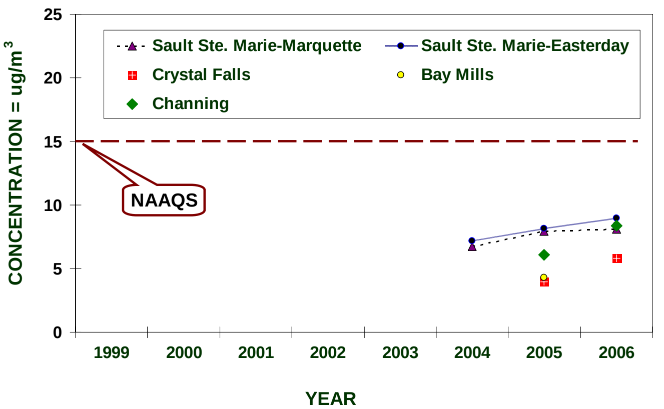


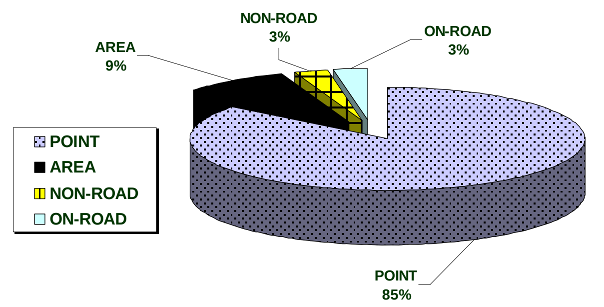
Figure 2.5-12 contains those sites located in Michigan's Upper Peninsula. All sites had 2006 levels below the $PM_{2.5}$ standard and the two Sault Ste. Marie site's three-year averages were also below the $PM_{2.5}$ NAAQS. Although, three-year annual averages are not available for Crystal Falls, Channing, and Bay Mills monitoring sites (as these site have only been in operation for two years), their annual levels are less than half of the $PM_{2.5}$ NAAQS.

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)

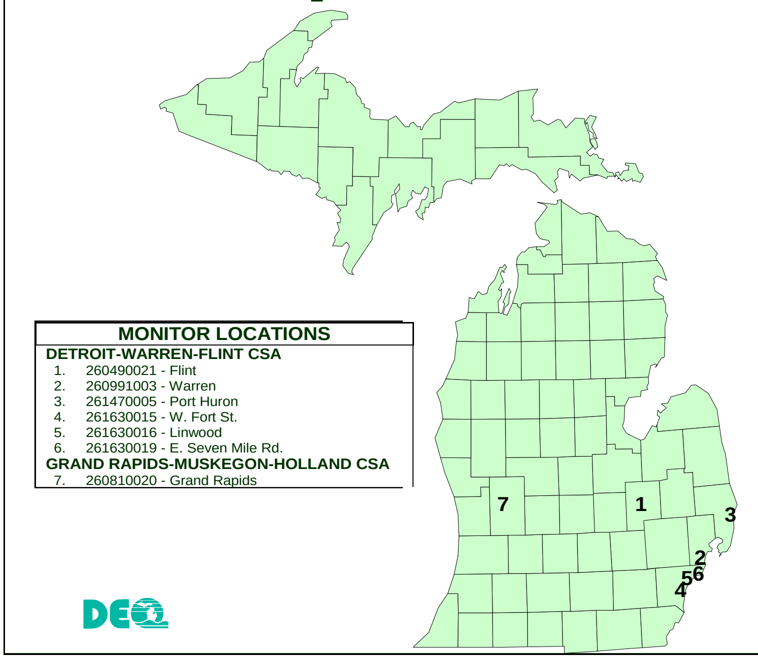


Michigan has been in attainment for SO_2 since 1982, with levels consistently well below the SO_2 NAAQS. Under the 2006 revised monitoring regulations, SO_2 monitoring is no longer required.

SO_2 MONITORING IN MICHIGAN:

For 2006, **Figure 2.6-2** shows that there were seven SO_2 monitors in operation, with the majority located in Southeast Michigan. As required under the 1997 air monitoring regulations, three monitors are located in the Detroit area measuring for neighborhood scale trends. These sites are at W. Fort (situated so that maximum SO_2 levels are being monitored), E. Seven Mile, and Warren. Additional monitors are also located at Linwood and Port Huron to measure maximum SO_2 concentrations of neighborhood or middle scale trends. The Flint monitor, though not technically located in Southeast Michigan, also measures for neighborhood scale trends. The other SO_2 site is located in Grand Rapids and it monitors neighborhood scale trends for West Michigan.

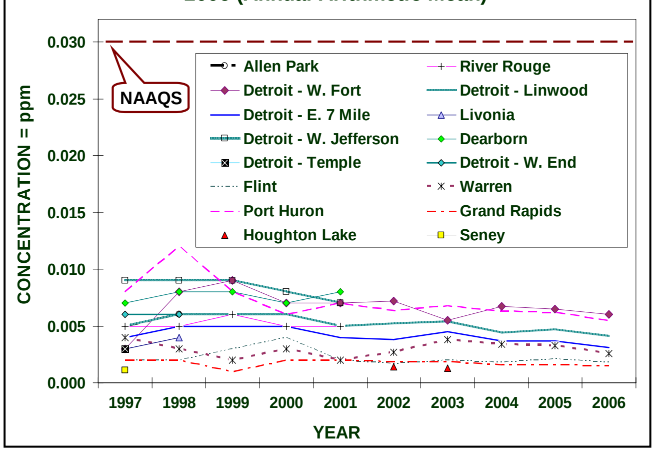
FIGURE 2.6-2: SO_2 MONITORS ACTIVE IN 2006



SO_2 TRENDS BY LOCATION:

In **Figure 2.6-3**, average SO_2 levels monitored in the state have consistently remained well below the annual 0.030 ppm NAAQS.

Figure 2.6-3: SO_2 Levels in Michigan from 1997-2006 (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.

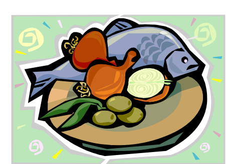
In general, air toxics can be categorized as metals, organic substances, and other substances. Examples include benzene (found in gasoline), perchlorethlyene (emitted from some dry cleaning facilities), and methylene chloride (a solvent and paint stripper used by industry). Examples of metals include 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 VOCs, carbonyl compounds (aldehydes and ketones), semi-volatile compounds (SVOCs), 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).[27] 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.



[27] 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.

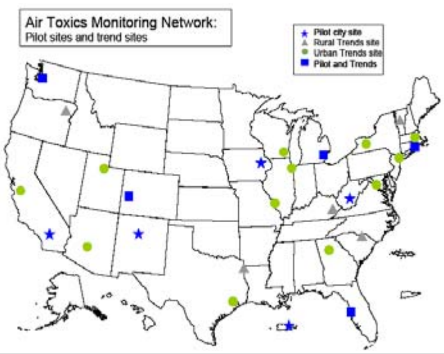
NATA: The EPA researched and authored the NATA study to identify and prioritize air toxics, emission source types and locations which are of greatest potential concern in terms of contributing to population risk. In February 2006, EPA released the results of the NATA for the 1999 air toxics emissions.[28] 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.

NATTS: The central goal of the NATTS network is to detect trends in high-risk air toxics such as benzene, formaldehyde, chromium, and 1,3-butadiene. EPA used the air toxics monitoring data generated from studies of pilot city sites to fund 13 NATTS as a preliminary step toward establishing a national air toxics monitoring network. Currently, the NATTS network contains 22 stations (**Figure 3-1**) with one located in Dearborn.

FIGURE 3-1: MAP OF 22 NATIONAL AIR TOXICS TREND STATIONS



The EPA requires that the NATTS sites measure VOCs, carbonyls, and trace metals on a once every six day sampling schedule. For Michigan, the Dearborn site in Detroit also measures trace metals as both TSP and $PM_{2.5}$ along with the required PM_{10} metals.

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

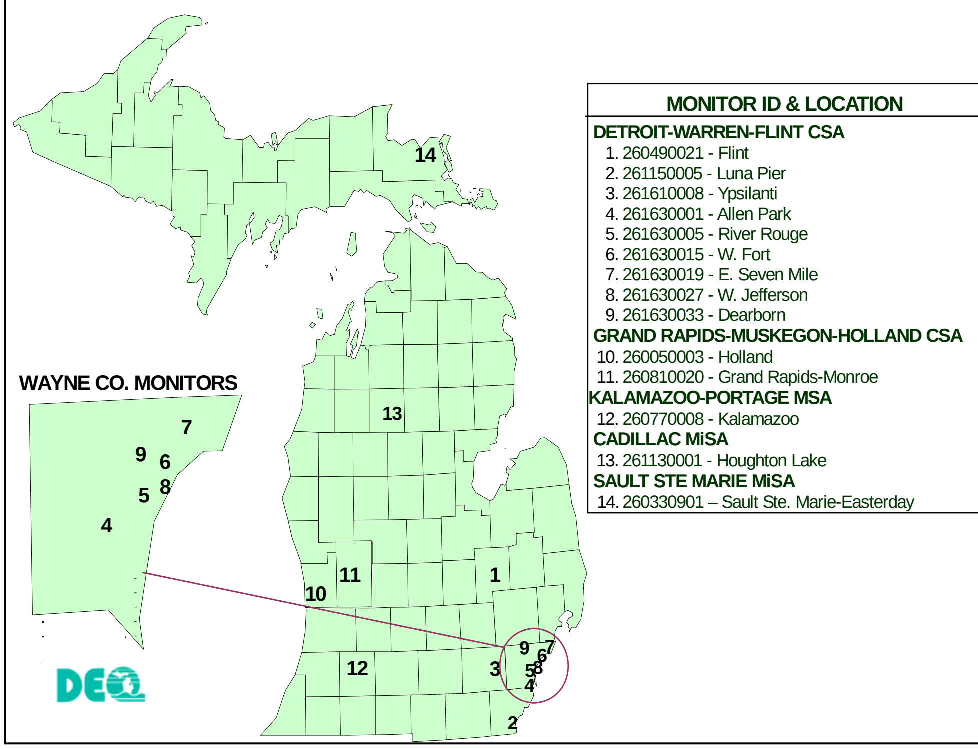
MICHIGAN TOXICS AIR MONITORING PROGRAM

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.[29]

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 the 14 MITAMP stations where air toxics were measured in 2006. Nine of the MITAMP sites are located in the Detroit-Warren-Flint CSA, with six sites operating in Wayne County.

FIGURE 3-2: MITAMP MONITORS ACTIVE IN 2006



For those sites located in Southeast Michigan, the Flint monitor collects data for toxic metals and the Luna Pier monitor has been the VOC and carbonyl trends site since 1993 and 1995, respectively. In Wayne County, the monitor at W. Fort is the MDEQ's long-term trend toxics site and the Dearborn site (a NATTS site) measures all air toxics that are monitored in the state. The monitor at River Rouge, due to historical elevated concentrations of formaldehyde, is important for the characterization of risk and for the determination of trends. For a comparison basis, the Houghton Lake background site was set up to provide data for a relatively unimpacted site (away from large urban areas or high vehicle emissions). **Table 3-1** shows the type of monitoring conducted at all the MITAMP stations.

[29] Some of the MITAMP sites only measure trace metals and some measure only carbonyls and metals.

Table 3-1: MITAMP Monitors Active in 2006 and Toxics Measured

AIRS ID – SITE NAME	VOCS	CARBONYLS	METALS TSP	METALS PM_{10}	SPECIATED $PM_{2.5}$	SVOCS
260050003 - Holland					√	
260330901 - Sault Ste. Marie-Easterday					√	√
260490021 - Flint			√			
260770008 - Kalamazoo					√	
260810020 - Grand Rapids-Monroe	√	√	√		√	
261130001 - Houghton Lake	√	√	√		√	
261150005 - Luna Pier					√	
261610008 - Ypsilanti	√	√	√		√	
261630001 - Allen Park			√		√	
261630005 - River Rouge		√	√			
261630015 - W. Fort	√	√	√			
261630019 - E. Seven Mile			√			
261630027 - W. Jefferson			√			
261630033 - Dearborn	√	√	√	√	√	

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.

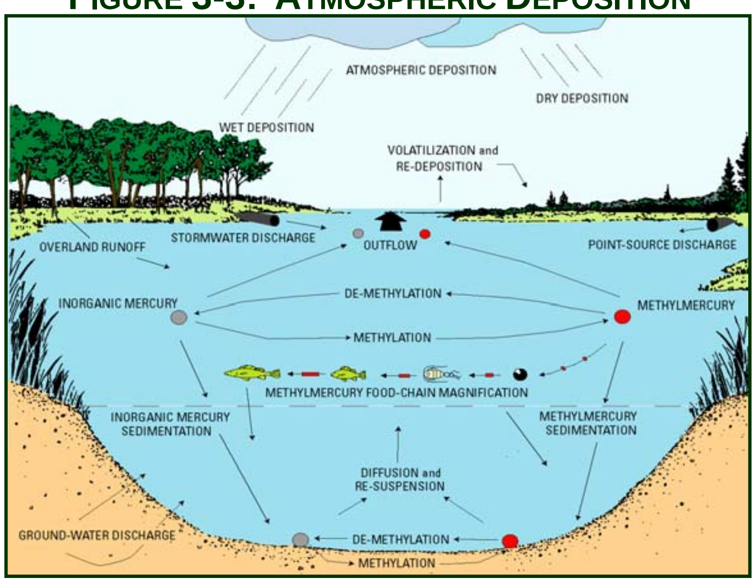
OTHER MICHIGAN AIR TOXICS DATA ANALYSIS EFFORTS

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.[30] 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.

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.

PBTs enter the environment through a variety of sources including atmospheric deposition (**Figure 3-3**). Deposition is one of the crucial elements largely

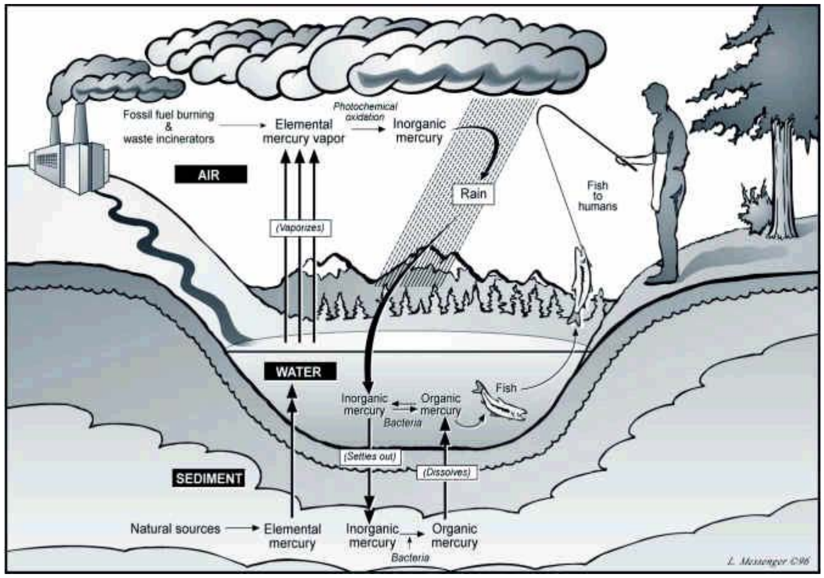
FIGURE 3-3: ATMOSPHERIC DEPOSITION



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

responsible for contamination of lakes and streams and to some of the Great Lakes by some types of pollutants, including mercury and PCBs (**8, 9, 10**). Additionally, deposition of certain pollutants like dioxin can contribute to elevated levels in soils, crops, and meat/dairy products. Although MDEQ does not have funding to support an extensive monitoring network for PBTs, a few short-term studies have been conducted specifically addressing mercury in the atmosphere and to assess loadings.

FIGURE 3-4: THE MERCURY CYCLE



MERCURY is a naturally occurring element found in air, water and soil. Mercury is also used in a wide variety of products and can be release from various sources. For Michigan, the largest industrial source of mercury air emissions is coal-fired electric generating units (EGUs). 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 (**Figure 3-4**). The general public is exposed to mercury primarily by eating certain species of fish. Consumption of fish with higher methylmercury levels can lead to elevated levels of mercury in the bloodstream of unborn babies and young children and may harm their developing nervous system. Fish and shellfish are an important part of a healthy diet. However, pregnant women, women of childbearing age, nursing mothers and young children should avoid certain types of fish that are high in mercury. All of Michigan's inland lakes are under a statewide advisory limiting the consumption of fish due to mercury contamination.

Mercury has been targeted for source identification, reduction, and elimination through various state, federal, and international efforts. The following are a few examples of studies that have been done by the AQD and its partners.

- **Michigan Mercury Electric Utility Workgroup (Mercury Utility Workgroup):** The AQD initiated the creation of this workgroup in 2003. The Mercury Utility Workgroup was charged with evaluating opportunities and developing recommendations for an emission reduction strategy for coal-fired EGUs that achieve timely and measurable reductions in mercury emissions. The 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. In order to determine the feasibility and estimated cost of reducing mercury emissions and develop reduction recommendations, a number of technical and policy issues were examined. The workgroup's report, Michigan Mercury Electric Utility Workgroup for Mercury Emissions from Coal-Fired Power Plants, along with their recommendations was finalized on June 21, 2005.[31]

[31] The Mercury Utility Workgroup report is available at http://www.deq.state.mi.us/documents/deq-aqd-air-aqe-mercury-report.pdf.

- **Michigan's Mercury Rule Workgroup:** In April 2006, the AQD developed a rules workgroup in response to the Mercury Utility Workgroup's report recommendations. The charge of the Mercury Rule Workgroup was to create a rule requiring Michigan's coal-fired EGUs to reduce their mercury emissions by 90% by 2015. Additionally, the rule should not allow trading, but it could include a utility system-wide approach as long as it would not result in "hot spot" mercury emissions that would place Michigan residents at risk. The Mercury Rule Workgroup, which included some of the representatives from the Mercury Utility Workgroup, continues to meet and anticipates a final utility mercury rule in 2008.

- **Great Lakes National Geographic Initiative:** The AQD was responsible for administering the EPA Initiative grant funds to identify and quantify sources of mercury to the atmosphere within the three Great Lakes' states (Michigan, Minnesota and Wisconsin). The AQD designed and built a mobile mercury laboratory (Tekran mercury trailer), complete with a generator, two Tekran 2537A mercury vapor analyzers, meteorological monitoring equipment, data loggers, and a computer for data compilation and analysis. The "Tekran" mercury trailer is shared on a rotation basis among the three states for quantifying mercury emissions from various sources.[32] The funding also allowed the purchase and sharing of two portable Lumex RA 915+ mercury vapor analyzers that are used to facilitate quantification of mercury concentrations in homes or businesses where mercury is spilled.

  In the summer of 2006, the AQD deployed the Tekran trailer to Grand Rapids and deployed a Tekran in Holland to obtain an upwind measurement for Grand Rapids. The monitoring trailer was then transferred to Wisconsin for monitoring activities across Lake Michigan. In August 2006, the 2005 Mercury Monitoring Activity Report was presented as a poster at the Mercury Global Conference in Madison, Wisconsin. This report assesses the fugitive elemental mercury emissions that were obtained in 2005 from several sites of concern located in Michigan's Upper Peninsula, Lansing area, and Detroit.[33]

- **Mercury Monitoring Network:** The AQD, partnering with the U of M, received grants from the Michigan Great Lakes Protection Fund and EPA's Great Lake Atmospheric Deposition program to develop a mercury monitoring network. Beginning in the fall of 2001, sites were established in three urban areas of Grand Rapids, Flint, and Detroit. In addition, the funds supported the continuation of the long-term event-based mercury deposition monitoring at the three rural sites (Dexter, Pellston, and Eagle Harbor) (**11**).[34] To allow trend analysis and to support continued speciated monitoring of deposited atmospheric mercury, additional funding was received extending this project through the spring of 2008.

[32] 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.
[33] The Mercury Monitoring Activity Report is at http://www.michigan.gov/deqair under Mercury Air Issues.
[34] Annual reports are available on the AQD's website at http://www.michigan.gov/deqair.

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

MIair, released in 2006, is the MDEQ's new air quality reporting webpage that displays air quality forecasts, the current AQI, continuous air monitor data, and animated O_3 and $PM_{2.5}$ maps as a public service. It replaces the MDEQ's Webmonmap program to provide current air quality information to the public. The following features are discussed in this chapter.

Air Quality Index | Action! Days | Air Quality Notification

Monitoring Data | Ozone Maps | $PM_{2.5}$ Maps | Links

AIR QUALITY INDEX:

Air Quality Index

The AQI is a tool that is used by the MDEQ and the EPA to report current air quality data. The real-time AQI is calculated using hourly concentrations from continuous air monitors and sorts air into one of six, color-coded categories ranging from good to hazardous air.[35] AQI values are presented in tabular form and plotted on a Michigan map with the color-coded dots. MDEQ meteorologists also provide a daily Forecast Discussion that helps keep citizens informed when air quality is poor. The AQI tool is a useful health indicator for making decisions about daily activities. Air quality forecasting is available for 75 Michigan counties.

To provide a measure of air quality, the AQI uses a relative scale of 0 to 500 (shown in **Table 4-1**).[36] The higher the AQI value, the greater the level of air pollution and potential for health concerns, in terms of acute health effects over time periods of 24 hours or less. The AQI index has limitations in that it 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.

Table 4-1: The AQI (Effective 10/4/99)

		MAXIMUM POLLUTANT CONCENTRATION PER AQI CATEGORY						
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
500		500.4	604	1.004		0.604	50	2.04
400	Hazardous (AQI > 301)	350.4	504	0.804		0.504	40	1.64
300	Very Unhealthy (AQI 201-300)	250.4	424	0.604	0.374	0.404	30	1.24
200	Unhealthy (AQI 151-200)	150.4	354	0.304	0.124	0.204	15	0.64
150	Unhealthy for sensitive groups (AQI 101-150)	65.4	254	0.224	0.104	0.164	12	
100	Moderate (AQI 51-100)	40.4	154	0.144	0.084	0.124	9	
50	Good (AQI 0-50)	15.4	54	0.034	0.064		4	
0		0	0	0	0	0	0	

[35] The AQI must not be confused with NAAQS that determine an area's compliance with provisions set forth in the federal CAA.
[36] EPA has not yet implemented new breakpoints for the AQI to address the revised $PM_{2.5}$ 24-hour standard.

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 prolonged 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. Rarely does the state record unhealthy air quality but occasionally, an area will fall into the “unhealthy for sensitive groups” range. **Appendix E** contains pie charts that were created to show the AQI values for each of Michigan’s 2006 monitoring sites and includes the total number of days measurements were taken along with the pollutant distribution of the AQI values for those measurements.

ACTION! DAYS:

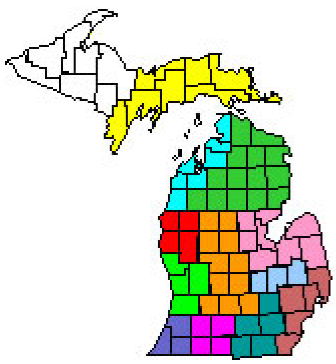
Action! Days

Voluntary "actions" save money, improve air quality and protect health by reducing exposure when air is forecast to be unhealthy. *Action!* Days are declared in Michigan when meteorological conditions are conducive for elevated ground-level O_3 to occur and when 8-hour O_3 levels are expected to exceed the AQI health indicator of 0.085 ppm. On these *Action!* Days, business, industry, government, and the public are encouraged to take voluntary action to reduce emissions that lead to the formation of O_3. Clean air choices include:

- avoiding the refueling of vehicles 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 (particularly inefficient two-stroke engines);
- reducing energy use; and
- modifying use of household solvents and cleaners.

Table 4-3 shows that during 2006, there were six *Action!* Days declared in Michigan.[37]

Table 4-3: 2006 *Action!* Day Information



Location	Year	Number	Dates
Ann Arbor	2006	2	8/1, 8/2
Benton Harbor	2006	6	6/17, 7/16, 7/17, 7/31, 8/1, 8/2
Detroit	2006	2	8/1, 8/2
Eastern U.P.	2006	0	
Flint	2006	0	
Grand Rapids	2006	6	6/17, 7/16, 7/17, 7/31, 8/1, 8/2
Houghton Lake	2006	0	
Kalamazoo	2006	5	6/17, 7/16, 7/17, 8/1, 8/2
Lansing	2006	0	
Ludington	2006	3	7/31, 8/1, 8/2
Saginaw	2006	0	
Traverse City	2006	2	7/31, 8/1

AIR QUALITY NOTIFICATION:

Air Quality Notification

Current air quality forecasts and "near" real-time AQI data are available for the public when they access the AQD website and via EPA's AIRNow (discussed at the end of this chapter). **EnviroFlash** is an additional service that sends notifications directly to subscribers via computer e-mail or mobile text messaging, on $PM_{2.5}$ and O_3 ground level pollution when the level they selected is likely to occur. In addition, **EnviroFlash** now provides UV (ultraviolet) radiation forecasts. Developed by the National Weather Service and EPA, the UV Index predicts the next day's UV radiation levels. **NOTE**: Daily O_3 depletion and seasonal weather variations cause different amounts of UV radiation to reach the Earth. Too much UV radiation can lead to skin cancer.

People with small children, family members with asthma (or other health problems), or those that will have increased respiration due to working or exercising strenuously may want to be notified when the air is predicted to be "unhealthy for sensitive groups." This "heads-up" information allows these individuals the ability to adjust their daily activities when poor air conditions are anticipated. 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.

[37] Additionally information is available at http://www.michigan.gov/deqair, under "MIair.

EnviroFlash is continually expanding and currently covers over 100 cities across the nation. The ultimate goal is to develop a nationwide notification system that provides current local environmental information. For Michigan, **EnviroFlash** has the potential to reach 98% of the state's population. As shown in **Figure 4-1**, the MDEQ provides real-time air quality forecasts and *Action*! Day notifications for those subscribers who live or work in Michigan. To sign-up for **EnviroFlash** notices and to learn more about this program, visit the AQD's website at www.michigan.gov/deqair and select **EnviroFlash** or **MIair**.

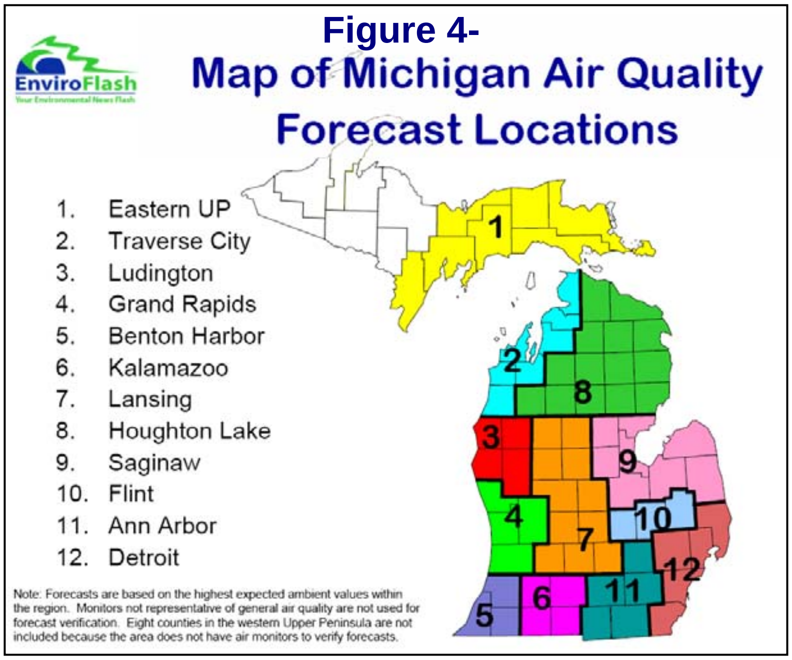


Figure 4- Map of Michigan Air Quality Forecast Locations

MONITORING DATA, MAPS AND OTHER LINKS:

Monitoring Data Hourly air quality and meteorological measurements from each of the monitoring sites in Michigan are reported in end-hour local time. Data on 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 During the O_3 season, the current day 8-hour average O_3 concentration is reported as an average of the previous eight hourly values. Current day data is reported in end-hour local time. Past day's data are reported in begin-hour standard time. The choice to animate the data is also available. During the winter season, historical data and maps can still be viewed.

$PM_{2.5}$ 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:

Michigan supplies data to EPA as part of a national effort to provide near real time information on ground level O_3 concentrations. EPA uses this O_3 data to produce maps that display O_3 concentrations covering the Midwest, New England, Mid-Atlantic, Southeastern, South Central, and Pacific Coastal regions of the country. In addition, an animation of the levels is provided of current and previous day's O_3 showing O_3 formation and transport with time. There are also web links that provide the previous and/or historical 1-hour and 8-hour peak O_3 values. The EPA AIRNow website is different from the AQD daily O_3 concentration website in that the geographical scale is much broader and data maps are generated over a less frequent time interval basis. EPA's $AIRN_{OW}$ website is available at: http://www.epa.gov/airnow/.

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 2006.

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

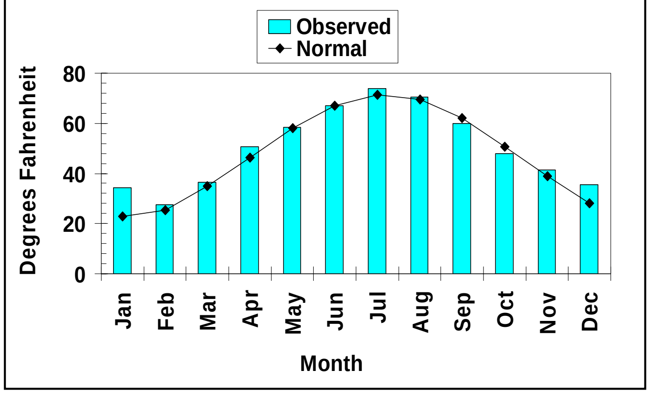


Figure 5-4: Southern Lower Peninsula
Observed Monthly Precipitation vs.
Normal Monthly Precipitation

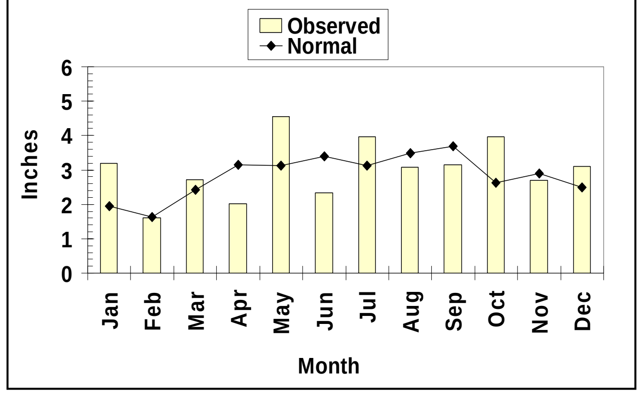


Figure 5-2: Northern Lower Peninsula
Observed Average Daily Temperatures vs.
Normal Average Daily Temperatures

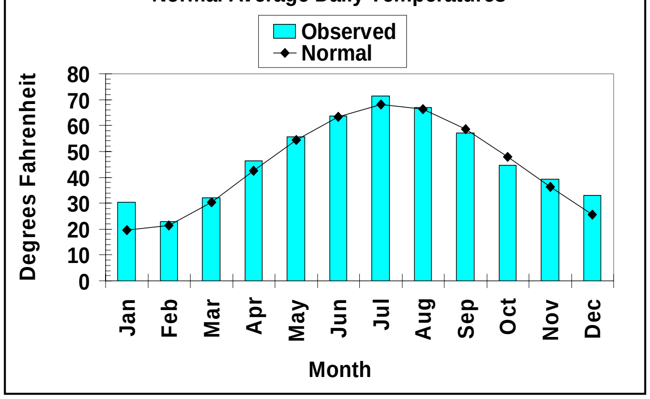


Figure 5-5: Northern Lower Peninsula
Observed Monthly Precipitation vs.
Normal Monthly Precipitation

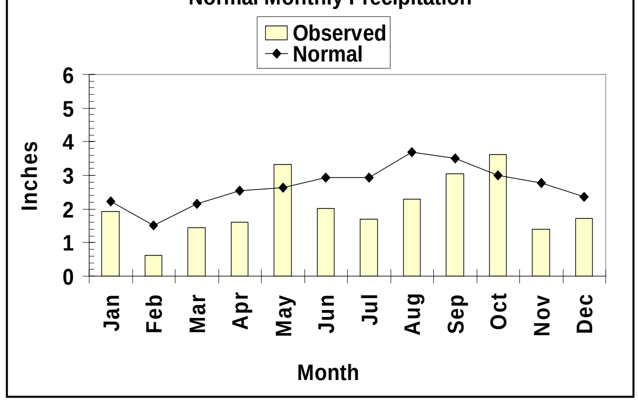


Figure 5-3: Upper Peninsula
Observed Average Daily Temperatures vs.
Normal Average Daily Temperatures

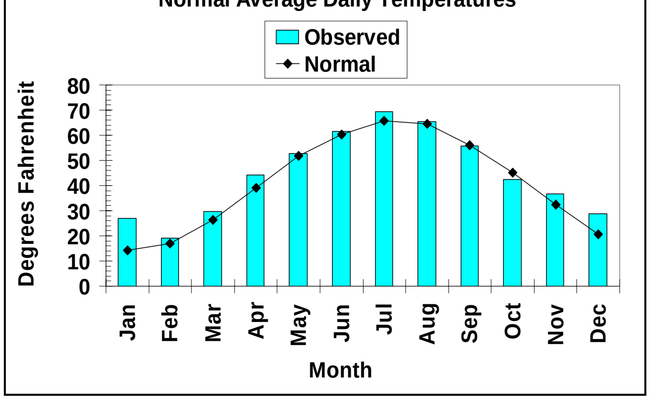
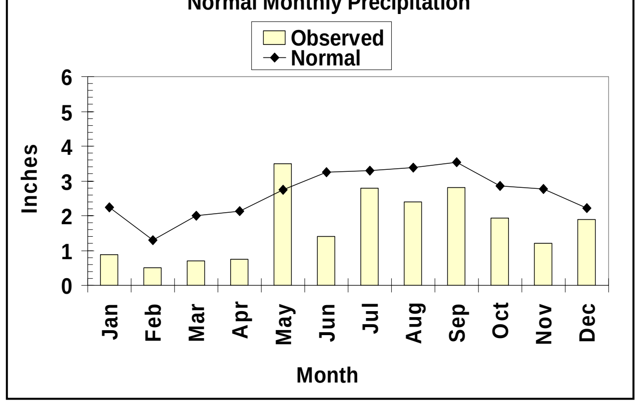


Figure 5-6: Upper Peninsula
Observed Monthly Precipitation vs.
Normal Monthly Precipitation



CHAPTER 6: REFERENCES

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LIST OF APPENDICES

APPENDIX A: CRITERIA POLLUTANT SUMMARY FOR 2006

Appendix A utilizes EPA's 2006 AQS Quick Look Report Data to present a summary of ambient air quality data collected for the criteria pollutants at monitoring locations throughout Michigan. Concentrations of non-gaseous pollutants are generally given in $\mu g/m^3$ 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 2006

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	2006	8658	2.7	2.3	0	2.0	2.0	0
260991003	1	Warren	Macomb	2006	8727	3.5	3.2	0	3.0	2.6	0
261250001	1	Oak Park	Oakland	2006	8326	3.1	3.0	0	2.6	2.4	0
261630001	1	Allen Park	Wayne	2006	8593	3.9	3.8	0	3.2	2.3	0
261630016	1	Detroit - Linwood	Wayne	2006	8124	3.7	3.2	0	2.8	2.5	0
261630025	1	Livonia	Wayne	2006	8652	2.9	1.6	0	1.3	1.2	0
261630039	1	Detroit - W. Lafayette	Wayne	2006	2088	1.5	1.3	0	1.0	0.7	0

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	2006	59	.00526	.00690	.01212	.00566	0	.06702	.02027
260810020	1	Grand Rapids	Kent	2006	30	.00519*	.00805*	.00813*	.00469*	0	.01346	.01340
261130001	1	Houghton Lake	Missaukee	2006	60	.00238	.00377	.00296	.00306	0	.02059	.01362
261610008	1	Ypsilanti	Washtenaw	2006	27	.00580*	.00449*	.00486*	.00393*	0	.00993	.00858
261630001	2	Allen Park	Wayne	2006	57	.00796	.00618	.00863	.00643	0	.02007	.01526
261630005	1	River Rouge	Wayne	2006	58	.01082	.01436	.01437	.01105	0	.03414	.02783
261630015	4	Detroit - W. Fort	Wayne	2006	60	.01568	.01502	.10616	.01621	0	1.38841	.04255
261630019	1	Detroit - E. Seven Mile	Wayne	2006	61	.00889	.00782	.00928	.00769	0	.02180	.02007
261630027	1	Detroit – W. Jefferson	Wayne	2006	57	.01494	.02179	.02240	.01611	0	.04867	.04489
261630033	2	Dearborn	Wayne	2006	59	.02082	.03048	.01974	.01710	0	.22497	.07767

*Indicates the mean does not satisfy summary criteria

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	2006	8580	.069	.061	.0142
261630016	1	Detroit - Linwood	Wayne	2006	8664	.058	.057	.0158
261630019	2	Detroit - E. Seven Mile	Wayne	2006	8609	.055	.053	.0139

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 >/= 0.085
260050003	1	Holland	Allegan	2006	100	183	.099	.091	.091	.091	4
260190003	1	Benzonia	Benzie	2006	98	179	.104	.089	.081	.080	2
260210014	1	Coloma	Berrien	2006	100	183	.086	.085	.081	.076	2
260270003	2	Cassopolis	Cass	2006	98	179	.080	.078	.076	.073	0
260370001	2	Rose Lake	Clinton	2006	99	181	.078	.076	.075	.071	0

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 >/= 0.085
260490021	1	Flint	Genesee	2006	97	177	.079	.079	.077	.072	0
260492001	1	Otisville	Genesee	2006	100	183	.083	.081	.075	.075	0
260630007	1	Harbor Beach	Huron	2006	95	174	.091	.082	.074	.073	1
260650012	2	Lansing	Ingham	2006	92	168	.074	.072	.071	.071	0
260770008	1	Kalamazoo	Kalamazoo	2006	100	183	.076	.075	.073	.068	0
260810020	1	Grand Rapids	Kent	2006	99	181	.104	.090	.083	.082	2
260810022	1	Evans	Kent	2006	96	176	.093	.089	.083	.081	2
260890001	1	Peshawbestown	Leelanau	2006	96	175	.097	.082	.077	.073	1
260910007	1	Tecumseh	Lenawee	2006	93	171	.082	.080	.079	.074	0
260990009	1	New Haven	Macomb	2006	100	183	.089	.082	.079	.078	1
260991003	1	Warren	Macomb	2006	99	181	.091	.082	.079	.078	1
261010922	1	Manistee	Manistee	2006	81	148	.105	.098	.084	.083	2
261050007	1	Scottville	Mason	2006	86	157	.104	.099	.082	.076	2
261130001	1	Houghton Lake	Missaukee	2006	95	174	.085	.084	.081	.073	1
261210039	1	Muskegon	Muskegon	2006	99	182	.102	.099	.090	.090	5
261250001	2	Oak Park	Oakland	2006	93	170	.081	.077	.072	.072	0
261390005	1	Jenison	Ottawa	2006	100	183	.105	.092	.088	.083	3
261470005	1	Port Huron	St .Clair	2006	100	183	.090	.082	.081	.078	1
261530001	1	Seney	Schoolcraft	2006	95	174	.099	.097	.081	.076	2
261610008	1	Ypsilanti	Washtenaw	2006	91	167	.078	.077	.077	.076	0
261630001	2	Allen Park	Wayne	2006	94	172	.083	.076	.069	.068	0
261630015	1	Detroit – W. Fort	Wayne	2006	100	183	.074	.072	.069	.067	0
261630016	1	Detroit – Linwood	Wayne	2006	98	180	.081	.074	.070	.069	0
261630019	2	Detroit – E. Seven Mile	Wayne	2006	95	173	.084	.083	.083	.078	0

$PM_{2.5}$ (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	2006	132	38.4	37.4	34.1	32.0	34.1	11.48
260170014	1	FRM	Bay City	Bay	2006	74	44.4	27.9	25.1	23.9	27.9	10.16
260210014	1	FRM	Coloma	Berrien	2006	75	29.2	27.7	27.5	26.2	27.7	10.95
260330901	1	FRM	Sault Ste. Marie	Chippewa	2006	28	36.1	27.8	15.8	14.6	36.1	8.99*
260330902	1	FRM	Sault Ste. Marie	Chippewa	2006	28	33.6	27.1	14.8	14.5	33.6	8.11*
260330903	1	FRM	Bay Mills	Chippewa	2006	14	33.2	14.5	12.5	11.8	33.2	8.41*
260430002	1	FRM	Channing	Dickinson	2006	67	24.7	23.6	22.2	20.5	24.7	8.36*
260490021	1	FRM	Flint	Genesee	2006	119	33.7	27.3	26.7	26.1	26.7	10.92
260650012	1	FRM	Lansing	Ingham	2006	120	43.8	29.6	28.3	27.2	28.3	11.47
260710001	1	FRM	Crystal Falls	Iron	2006	19	15.1	9.1	8.6	7.3	15.1	5.82*
260770008	1	FRM	Kalamazoo	Kalamazoo	2006	104	33.3	31.8	29.1	27.2	29.1	12.57*
260770008	2[a]	FRM	Kalamazoo	Kalamazoo	2006	53	33.1	29.1	25.9	24.9	29.1	12.76*
260810020	1	FRM	Grand Rapids	Kent	2006	175	50.4	41.1	40.1	33.2	33.2	12.62
260810020	2[a]	FRM	Grand Rapids	Kent	2006	60	42.2	31.5	30.6	30.3	31.5	13.04

$PM_{2.5}$ (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
260990009	1	FRM	New Haven	Macomb	2006	72	42.2	34.4	30.2	29.8	34.4	11.28
261010922	1	FRM	Manistee	Manistee	2006	72	33.8	25.9	23.0	22.5	25.9	9.13*
261130001	1	FRM	Houghton Lake	Missaukee	2006	114	30.5	25.0	21.6	21.0	21.6	7.77
261150005	1	FRM	Luna Pier	Monroe	2006	116	41.0	33.0	32.6	30.0	32.6	12.72
261210040	1	FRM	Muskegon	Muskegon	2006	71	42.2	29.8	29.3	27.1	29.8	11.30
261250001	1	FRM	Oak Park	Oakland	2006	72	41.7	33.0	32.8	30.0	33.0	12.11
261390005	1	FRM	Jenison	Ottawa	2006	73	31.4	30.2	30.1	28.6	30.2	12.02
261470005	1	FRM	Port Huron	St. Clair	2006	76	53.9	37.9	37.3	28.2	37.9	12.04
261610008	1	FRM	Ypsilanti	Washtenaw	2006	105	45.3	32.7	31.3	30.4	31.3	12.55*
261610008	2[a]	FRM	Ypsilanti	Washtenaw	2006	55	45.4	33.0	32.9	30.3	33.0	13.52
261630001	1	FRM	Allen Park	Wayne	2006	341	42.4	39.7	39.3	34.1	34.1	13.18
261630001	2[a]	FRM	Allen Park	Wayne	2006	54	38.7	34.2	34.0	29.3	34.2	13.86
261630015	1	FRM	Detroit - W. Fort	Wayne	2006	114	45.9	39.4	36.2	35.0	36.2	14.68
261630016	1	FRM	Detroit - Linwood	Wayne	2006	123	53.7	37.7	36.9	33.7	36.9	13.04
261630019	1	FRM	Detroit - E. Seven Mile	Wayne	2006	75	42.5	36.2	35.1	34.4	36.2	12.71
261630025	1	FRM	Livonia	Wayne	2006	73	49.0	30.4	29.5	28.7	30.4	11.80
261630033	1	FRM	Dearborn	Wayne	2006	115	43.8	43.8	43.1	40.7	43.1	16.13
261630036	1	FRM	Wyandotte	Wayne	2006	113	35.9	35.3	33.2	32.0	33.2	12.92
261630038	1	FRM	Detroit - Newberry.	Wayne	2006	84	30.7	28.6	28.4	27.5	28.6	12.47*
261630039	1	FRM	Detroit – W. Lafayette	Wayne	2006	120	34.9	34.1	32.4	32.2	32.4	13.13

*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	2006	2149	77.0	50.0	47.0	44.0	9.92
260170014	3	TEOM	Bay City	Bay	2006	3232	63.0	61.0	61.0	60.0	14.80*
260490021	3	TEOM	Flint	Genesee	2006	4025	68.0	68.0	67.0	65.0	18.65*
260650012	5	TEOM	Lansing	Ingham	2006	4248	79.0	72.0	71.0	65.0	17.45*
260770008	3	TEOM	Kalamazoo	Kalamazoo	2006	4101	162.0	102.0	101.0	97.0	14.48*
260810020	3	TEOM	Grand Rapids	Kent	2006	3576	76.0	62.0	60.0	58.0	18.30*
261130001	3	TEOM	Houghton Lake	Missaukee	2006	4144	68.0	66.0	66.0	64.0	16.04*
261470005	3	TEOM	Port Huron	St. Clair	2006	4142	101.0	98.0	88.0	70.0	21.84*
261530001	3	TEOM	Seney	Schoolcraft	2006	1676	51.0	51.0	48.0	48.0	14.04
261610008	3	TEOM	Ypsilanti	Washtenaw	2006	4054	56.0	54.0	52.0	50.0	14.44*
261630001	3	TEOM	Allen Park	Wayne	2006	3599	65.0	64.0	63.0	61.0	19.69*
261630033	3	TEOM	Dearborn	Wayne	2006	3923	117.0	110.0	101.0	98.0	27.70*
261630039	4	TEOM	Detroit – W. Lafayette	Wayne	2006	7178	83.0	79.0	74.0	63.0	11.92

*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
260170014	3	TEOM	Bay City	Bay	2006	4257	158.0	99.0	54.0	51.0	10.27*
260490021	3	TEOM	Flint	Genesee	2006	4202	111.0	100.0	95.0	76.0	11.81*
260650012	5	TEOM	Lansing	Ingham	2006	4427	57.0	49.0	49.0	46.0	11.12*
260770008	3	TEOM	Kalamazoo	Kalamazoo	2006	4563	51.0	49.0	48.0	46.0	11.46*
260810020	3	TEOM	Grand Rapids	Kent	2006	4575	56.0	52.0	50.0	49.0	11.21*
261130001	3	TEOM	Houghton Lake	Missaukee	2006	4378	39.0	36.0	36.0	36.0	8.20*
261470005	3	TEOM	Port Huron	St. Clair	2006	4500	50.0	50.0	50.0	48.0	11.40*
261530001	3	TEOM	Seney	Schoolcraft	2006	6725	49.0	39.0	39.0	37.0	6.61*
261610008	3	TEOM	Ypsilanti	Washtenaw	2006	4238	328.0	73.0	54.0	52.0	11.17*
261630001	3	TEOM	Allen Park	Wayne	2006	5068	97.0	72.0	57.0	56.0	12.60*
261630033	3	TEOM	Dearborn	Wayne	2006	4777	123.0	110.0	86.0	83.0	15.42*
261630038	3	TEOM	Detroit – Newberry	Wayne	2006	6345	50.0	48.0	48.0	48.0	10.30*
261630039	3	TEOM	Detroit – W. Lafayette	Wayne	2006	7626	179.0	149.0	135.0	101.0	18.42
261630039	4	TEOM	Detroit – W. Lafayette	Wayne	2006	1101	54.0	49.0	43.0	42.0	13.57*

*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	2006	60	61	98	38	37	33	32	15.4
260810007	1	GRAV	Grand Rapids - Wealthy	Kent	2006	59	61	97	39	33	31	30	17.5
260810020	1	GRAV	Grand Rapids - Monroe	Kent	2006	59	61	97	40	34	29	27	15.1
261630001	1	GRAV	Allen Park	Wayne	2006	59	61	97	42	38	38	36	18.8
261630015	1	GRAV	Detroit - W. Fort	Wayne	2006	59	61	97	86	60	45	45	25.0
261630033	1	GRAV	Dearborn	Wayne	2006	55	61	90	74	65	62	61	31.5

*Indicates the mean does not satisfy summary criteria

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	2006	8524	267	217	207	204	30.0

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	2006	8138	.007	.007	0	.014	.013	0	.021	.021	.0018
260810020	1	Grand Rapids	Kent	2006	7931	.007	.005	0	.014	.014	0	.020	.020	.0015
260991003	1	Warren	Macomb	2006	8670	.024	.020	0	.042	.037	0	.056	.056	.0026
261470005	1	Port Huron	St Clair	2006	8648	.045	.038	0	.111	.103	0	.182	.149	.0055
261630015	1	Detroit - W. Fort	Wayne	2006	8429	.072	.049	0	.112	.109	0	.154	.141	.0060
261630016	2	Detroit - Linwood	Wayne	2006	8722	.032	.028	0	.071	.061	0	.086	.086	.0041
261630019	1	Detroit - E. Seven Mile	Wayne	2006	8325	.016	.015	0	.033	.031	0	.055	.049	.0031

APPENDIX B: PRECISION AND ACCURACY REPORT FOR 2006

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[38].

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 and is independently audited at least once a year.

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

2006 DATA ASSESSMENT SUMMARY FOR THE FOLLOWING CRITERIA AIR POLLUTANTS

CO:

YEAR	PRECISION				ACCURACY						
Quarter	# of Analyzers	# of Checks	Probability Limits Lower	Upper	# of Audits	Level 1 Lower	Upper	Level 2 Lower	Upper	Level 3 Lower	Upper
2006	**55**	**1**	**51**	**-2**	**-2**	**1**	**14**	**-7**	**+6**	**43**	**-5**
1st	13	1	13	*	*	0	4	-8	+6	10	-2
2nd	13	1	12	-2	-2	1	3	-9	+9	12	-7
3rd	15	1	12	*	*	0	3	-5	+3	12	+1
4th	14	1	14	*	*	0	4	-7	+6	9	-7

* insufficient number of analyzers to calculate accuracy.

Pb:

YEAR	PRECISION						ACCURACY			LAB ACCURACY				
Quarter	# of Co-located Samples	# of Co-located Sites	# of Samples < Limit	Probability Limits Lower	Upper	# of Valid Co-located Data Pair	# of Audits	Level 2 Lower	Upper	# of Audits	Level 1 Lower	Upper	Level 2 Lower	Upper
2006	**55**	**1**	**51**	**-2**	**-2**	**1**	**14**	**-7**	**+6**	**43**	**-5**	**+14**	**-6**	**+17**
1st	13	1	13	*	*	0	4	-8	+6	10	-2	+9	-3	+4
2nd	13	1	12	-2	-2	1	3	-9	+9	12	-7	+21	-1	+10
3rd	15	1	12	*	*	0	3	-5	+3	12	+1	+10	-5	+21
4th	14	1	14	*	*	0	4	-7	+6	9	-7	+11	-2	+24

* measurements less than EPA's limit; cannot estimate precision

NO_2:

YEAR	PRECISION				ACCURACY						
Quarter	# of Analyzers	# of Checks	Probability Limits Lower	Upper	# of Audits	Level 1 Lower	Upper	Level 2 Lower	Upper	Level 3 Lower	Upper
2006	**3**	**79**	**-5**	**+6**	**4**	**-6**	**+4**	**-11**	**+3**	**-12**	**+4**
1st	3	21	-7	+9	1						
2nd	3	18	-3	+5	1	-5	-1	-12	+3	-13	+4
3rd	3	20	-4	+5	1						
4th	3	20	-2	+2	1	-1	+3	-12	+6	-14	+7

* insufficient number of checks to calculate accuracy.

O_3:

YEAR / Quarter	PRECISION				ACCURACY						
	# of Analyzers	# of Checks	Probability Limits Lower	Upper	# of Audits	Level 1 Lower	Upper	Level 2 Lower	Upper	Level 3 Lower	Upper
2006	**29**	**514**	**-3**	**+3**	**30**	**-5**	**+6**	**-4**	**+6**	**-4**	**+6**
1st	No data due to ozone season										
2nd	29	294	-3	+3	15	-6	+8	-6	+8	-6	+8
3rd	29	220	-2	+3	15	-4	+5	-2	+4	-2	+4
4th	No data due to ozone season										

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

PM_{10}:

YEAR / Quarter	PRECISION						ACCURACY		
	# of Co-located Samples	# of Co-located Sites	# of Samples < Limit	95% Probability Limits Lower	Upper	# of Valid Co-located Data Pairs	# of Audits	Probability Lower	Upper
2006	**112**	**2**	**57**	**-17**	**+13**	**55**	**12**	**-7**	**+8**
1st	27	2	18	-23	+25	9	3	-5	+7
2nd	26	2	14	-16	+11	12	3	-9	+10
3rd	29	2	13	-18	+6	16	3	-7	+7
4th	30	2	12	-14	+13	18	3	-9	+12

$PM_{2.5}$:

YEAR / Quarter	PRECISION						ACCURACY		
	# of Co-located Samples	# of Co-located Sites	# of Samples < Limit	95% Probability Limits Lower	Upper	# of Valid Co-located Data Pairs	# of Audits	Probability Lower	Upper
2006	**201**	**4**	**43**	**+5**	**+6**	**158**	**117**	**0**	**0**
1st	48	4	6	+3	+4	42	30	-1	0
2nd	51	4	15	+6	+9	36	30	-1	0
3rd	47	4	9	+3	+4	38	29	0	+1
4th	55	4	13	+5	+7	42	29	0	0

SO_2:

YEAR / Quarter	PRECISION				ACCURACY						
	# of Analyzers	# of Checks	Probability Limits Lower	Upper	# of Audits	Level 1 Lower	Upper	Level 2 Lower	Upper	Level 3 Lower	Upper
2006	**55**	**1**	**51**	**-2**	**-2**	**1**	**14**	**-7**	**+6**	**43**	**-5**
1st	13	1	13	*	*	0	4	-8	+6	10	-2
2nd	13	1	12	-2	-2	1	3	-9	+9	12	-7
3rd	15	1	12	*	*	0	3	-5	+3	12	+1
4th	14	1	14	*	*	0	4	-7	+6	9	-7

* insufficient number of checks to calculate accuracy.

APPENDIX C: 2006 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 2006. 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 annual averages (also called "means"), zero (0.0 $\mu g/m^3$) or the MDL, respectively, are substituted for non-detected air contaminant levels. The 2006 data in this appendix are divided into two sections:

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 2006.

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			√			√
Dearborn	261630033	√	√	√	√		√
Detroit - E. Seven Mile	261630019	√	√	√			
Detroit - W. Fort	261630015	√	√	√			
Detroit - W. Jefferson	261630027			√			
Flint	260490021			√			
Grand Rapids - Monroe	260810020	√	√	√			√
Holland	260050003						√
Houghton Lake	261130001	√	√	√			√
Kalamazoo	260770008						√
Luna Pier	261150005						√
River Rouge	261630005		√	√			
Sault Ste. Marie - Easterday	260330901					√	√
Ypsilanti	261610008	√	√	√			√

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

MDL: Analytical MDL in units of $\mu g/m^3$
 # 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 2006
Max2: second highest daily air concentration during 2006
Max3: third highest daily air concentration during 2006
Min Mean: average air concentration, assuming daily samples below MDL were equal to 0.0 $\mu g/m^3$.
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	Max1	Max2	Max3	Min Mean	Max Mean
Arsenic (TSP)	57	57	0.000145	0.00662	0.00441	0.0041	0.00146	0.00146
Barium (TSP)	57	57	0.000166	0.155	0.13	0.119	0.0492	0.0492
Beryllium (TSP)	57	55	0.000129	0.000051	0.0000453	0.0000433	0.0000206	0.0000245
Cadmium (TSP)	57	57	0.000138	0.000725	0.000664	0.000625	0.000265	0.000265
Chromium (TSP)	57	57	0.000294	0.00662	0.00624	0.0055	0.00319	0.00319
Cobalt (TSP)	57	57	0.000134	0.000681	0.000328	0.000295	0.000168	0.000168
Copper (TSP)	57	57	0.000472	0.746	0.688	0.666	0.26	0.26
Iron (TSP)	57	57	0.000199	1.42	1.08	1.01	0.565	0.565
Lead (TSP)	57	57	0.000171	0.0201	0.0153	0.0147	0.00722	0.00722
Manganese (TSP)	57	57	0.000223	0.0592	0.0498	0.0437	0.0228	0.0228
Molybdenum (TSP)	57	57	0.000171	0.0022	0.00192	0.00188	0.000881	0.000881
Nickel (TSP)	52	52	0.000199	0.00412	0.00322	0.00279	0.00163	0.00163
Vanadium (TSP)	57	57	0.000156	0.0128	0.00882	0.00881	0.0022	0.0022
Zinc (TSP)	57	57	0.00028	0.192	0.116	0.113	0.0631	0.0631

DEARBORN			AIRS ID: 261630033				Units: µg/m³	
Chemical Name	# Obs	Obs > MDL	MDL	Max1	Max2	Max3	Min Mean	Max Mean
1,1,1-Trichloroethane	86	62	0.366	0.164	0.164	0.164	0.0863	0.44
1,1,2,2-Tetrachloroethane	86	0	0.542	0	0	0	0	0.542
1,1,2-Trichloroethane	86	0	0.415	0	0	0	0	0.415
1,1-Dichloroethane	86	0	0.28	0	0	0	0	0.28
1,1-Dichloroethene	86	1	0.337	0.119	0	0	0.00138	0.337
1,2,4-Trichlorobenzene	86	3	0.602	0.0742	0.0742	0.0742	0.00259	0.601
1,2,4-Trimethylbenzene	86	73	0.344	2.3	1.9	1.77	0.555	0.729
1,2-Dibromoethane	86	0	0.606	0	0	0	0	0.606
1,2-Dichlorobenzene	86	0	0.436	0	0	0	0	0.436
1,2-Dichloroethane	86	3	0.312	3.44	0.162	0.0809	0.0428	0.353
1,2-Dichloropropane	86	0	0.419	0	0	0	0	0.419
1,3,5-Trimethylbenzene	86	63	0.343	0.77	0.66	0.541	0.149	0.445
1,3-Butadiene	86	61	0.171	0.996	0.51	0.509	0.107	0.224
1,3-Dichlorobenzene	86	0	0.424	0	0	0	0	0.424
1,4-Dichlorobenzene	86	53	0.451	0.661	0.301	0.301	0.0691	0.498
2,2,4-Trimethylpentane	23	20	1.18	1.4	1.1	0.96	0.413	0.615
2,5-dimethylbenzaldehyde	107	0	0.025	0	0	0	0	0.025
2-Chloro-1,3-Butadiene	86	1	0.332	0.109	0	0	0.00127	0.333
Acetaldehyde	107	107	0.016	5.15	4.14	3.28	1.66	1.66
Acetone	107	107	0.0365	5.44	5.25	5.18	2.47	2.47
Acetonitrile	86	77	0.494	62	50.5	42	8.09	8.15
Acetylene	63	63	0.0245	3.3	3.07	2.92	1.03	1.03
Acrylonitrile	86	2	0.344	0.434	0.195	0	0.00731	0.348
Arsenic (PM_{10})	115	115	0.000139	0.0874	0.058	0.00691	0.00319	0.00319
Arsenic (TSP)	119	118	0.000126	0.00782	0.0072	0.00653	0.00203	0.00203
Barium (PM_{10})	115	115	0.00014	0.218	0.198	0.0412	0.0218	0.0218
Barium (TSP)	119	118	0.000173	0.253	0.237	0.136	0.059	0.059
Benzaldehyde	107	62	0.014	0.365	0.36	0.273	0.0822	0.0909
Benzene	86	86	0.218	4.89	3.61	3.4	1.22	1.22
Beryllium (PM_{10})	115	113	0.000137	0.832	0.719	0.000272	0.0135	0.0135
Beryllium (TSP)	119	118	0.000136	0.000509	0.000503	0.000431	0.000131	0.000132
Bromodichloromethane	86	0	0.475	0	0	0	0	0.475
Bromoform	86	0	0.846	0	0	0	0	0.846
Bromomethane (Methyl	86	52	0.295	0.0777	0.0777	0.0777	0.028	0.299
Butyr/Isobutyraldehyde	128	128	0.00401	1.22	1.22	0.932	0.376	0.376
Cadmium (PM_{10})	115	115	0.000138	0.00413	0.00393	0.00193	0.000614	0.000614
Cadmium (TSP)	119	118	0.000152	0.00392	0.00383	0.00158	0.00059	0.000591
Carbon Disulfide	63	39	0.028	0.965	0.498	0.436	0.126	0.137
Carbon Tetrachloride	86	85	0.584	1.2	1.2	1.01	0.619	0.639
Chloroethane	86	52	0.245	0.264	0.106	0.106	0.0387	0.271
Chloroform	86	78	0.311	6.01	2.05	1.95	0.726	0.806

DEARBORN			AIRS ID: 261630033				Units: µg/m³	
Chemical Name	**# Obs**	**Obs > MDL**	**MDL**	**Max1**	**Max2**	**Max3**	**Min Mean**	**Max Mean**
Chloromethane	86	86	0.188	2.02	1.71	1.63	1.19	1.19
Chloromethyl Benzene	86	0	0.42	0	0	0	0	0.42
Chromium (PM_{10})	116	116	0.000431	0.0767	0.00894	0.00866	0.00514	0.00514
Chromium (TSP)	119	119	0.000307	0.184	0.0141	0.0136	0.00735	0.00735
Chromium VI (TSP)	79	72	0.0000148	0.000496	0.000273	0.000235	0.0000646	0.0000658
cis-1,2-Dichloroethene	86	1	0.312	0.278	0	0	0.00323	0.315
cis-1,3-Dichloropropene	86	0	0.353	0	0	0	0	0.353
Cobalt (PM_{10})	116	116	0.000133	0.0524	0.0486	0.00133	0.00117	0.00117
Cobalt (TSP)	119	119	0.000129	0.00184	0.000794	0.000771	0.000321	0.000321
Copper (PM_{10})	115	115	0.000697	0.167	0.139	0.131	0.0505	0.0505
Copper (TSP)	119	118	0.000472	1.36	0.737	0.663	0.273	0.273
Crotonaldehyde (trans)	107	59	0.0106	0.702	0.648	0.645	0.12	0.128
Dibromochloromethane	86	1	0.625	0.0852	0	0	0.000991	0.625
Dichlorodiflouromethane	86	86	0.339	4.8	4.65	4.25	2.74	2.74
Ethylbenzene	86	75	0.321	1.5	1.48	1.1	0.37	0.496
Formaldehyde	107	107	0.0127	7.42	6.1	5.78	2.76	2.76
Halocarbon 113	23	10	1.75	0.75	0.73	0.66	0.267	1.55
Halocarbon 114	86	63	0.444	0.21	0.14	0.14	0.0895	0.519
Hexachloro-1,3-Butadiene	86	5	0.805	0.533	0.32	0.213	0.0161	0.813
Hexanaldehyde	107	66	0.0208	1.81	1.62	0.782	0.137	0.152
Iron (PM_{10})	115	115	0.000199	4.36	4.12	3.19	1.07	1.07
Iron (TSP)	119	119	0.000173	8.18	6.32	5.25	2.11	2.11
Isovaleraldehyde	107	35	0.0121	0.722	0.074	0.0599	0.0191	0.0298
Lead (PM_{10})	115	115	0.000193	0.218	0.126	0.0928	0.0201	0.0201
Lead (TSP)	119	119	0.000182	0.225	0.221	0.0876	0.0228	0.0228
m,p-Tolualdehyde	43	0	0.0385	0	0	0	0	0.0385
m/p -Xylene	86	84	0.342	4.95	4.5	4.13	1.16	1.19
Manganese (PM_{10})	115	115	0.000288	0.326	0.302	0.207	0.064	0.064
Manganese (TSP)	119	119	0.000214	1.48	0.493	0.49	0.148	0.148
Methyl Ethyl Ketone	86	82	2.93	5.84	4.1	3.45	1.09	1.43
Methyl Isobutyl Ketone	86	56	0.826	1.35	0.574	0.492	0.176	0.984
Methyl Tert-Butyl Ether	86	1	0.373	0.0361	0	0	0.00042	0.373
Methylene Chloride	86	68	0.342	3.7	3.68	3.37	0.509	0.746
Molybdenum (PM_{10})	115	113	0.000182	0.00645	0.00617	0.00466	0.00128	0.00128
Molybdenum (TSP)	119	118	0.000161	0.00723	0.00638	0.00517	0.00146	0.00146
n-Butyraldehyde	43	20	0.0136	1.09	0.852	0.726	0.25	0.257
n-Hexane	23	19	2.68	4.7	4.2	3.1	1.32	1.72
Nickel (PM_{10})	116	116	0.000196	0.067	0.0121	0.00892	0.00328	0.00328
Nickel (TSP)	109	109	0.000179	0.116	0.0117	0.00871	0.00452	0.00452
n-Octane	63	53	0.028	1.17	0.748	0.514	0.174	0.178
o-Tolualdehyde	43	0	0.0393	0	0	0	0	0.0393
o-xylene	86	74	0.321	1.8	1.56	1.2	0.363	0.497
Propionaldehyde	107	92	0.0225	1.67	1.05	0.976	0.32	0.326
Propylene	63	63	0.0155	2.87	1.86	1.82	0.75	0.75
Styrene	86	51	0.334	1.62	0.383	0.298	0.0916	0.4
Tetrachloroethene	86	68	0.503	13.2	1.83	1.63	0.72	0.962
Tolualdehydes	64	62	0.0136	0.369	0.329	0.295	0.159	0.16
Toluene	86	85	0.291	10.5	9.4	7.6	2.32	2.33
trans-1,2-Dichloroethene	86	0	0.315	0	0	0	0	0.315
trans-1,3-Dichloropropene	86	0	0.342	0	0	0	0	0.342
Trichloroethene	86	24	0.399	4.08	0.322	0.215	0.0786	0.462
Trichloroflouromethane	86	85	0.368	3.1	2.98	2.81	1.51	1.51
Valeraldehyde	107	62	0.0171	0.81	0.747	0.31	0.0802	0.0951
Vanadium (PM_{10})	115	115	0.00018	0.0264	0.023	0.0127	0.00318	0.00318
Vanadium (TSP)	119	118	0.000172	0.0252	0.0213	0.0135	0.00484	0.00485
Vinyl Chloride	86	5	0.187	1.61	0.0256	0.0256	0.0199	0.206
Zinc (PM_{10})	115	115	0.000726	3.88	3.68	1.36	0.27	0.27
Zinc (TSP)	119	118	0.000191	3.78	3.21	1.9	0.325	0.325

DETROIT - E. Seven Mile		AIRS ID: 261630019				Units: µg/m³		
Chemical Name	**# Obs**	**Obs > MDL**	**MDL**	**Max1**	**Max2**	**Max3**	**Min Mean**	**Max Mean**
Arsenic (TSP)	61	61	0.000159	0.00642	0.00414	0.00318	0.00131	0.00131
Barium (TSP)	61	61	0.000195	0.212	0.12	0.12	0.0507	0.0507
Beryllium (TSP)	61	60	0.00013	0.0000944	0.0000635	0.0000613	0.0000273	0.0000291
Cadmium (TSP)	61	61	0.000131	0.00113	0.00113	0.000829	0.000283	0.000283
Chromium (TSP)	61	61	0.000301	0.00547	0.0046	0.00445	0.00288	0.00288
Cobalt (TSP)	61	61	0.000137	0.00066	0.000516	0.00041	0.000193	0.000193
Copper (TSP)	61	61	0.000473	0.351	0.307	0.305	0.155	0.155
Iron (TSP)	61	61	0.000145	1.26	1.14	1.14	0.499	0.499
Lead (TSP)	61	61	0.000159	0.0218	0.0201	0.0198	0.00841	0.00841
Manganese (TSP)	61	61	0.000212	0.0604	0.0574	0.0511	0.0225	0.0225
Molybdenum (TSP)	61	61	0.000161	0.00299	0.00205	0.00191	0.000809	0.000809
Nickel (TSP)	56	56	0.000182	0.006	0.00414	0.00361	0.00191	0.00191
Vanadium (TSP)	61	61	0.000165	0.0213	0.0111	0.0104	0.00274	0.00274
Zinc (TSP)	61	61	0.000205	1.76	0.581	0.392	0.113	0.113

DETROIT - W. Fort		AIRS ID: 261630015				Units: µg/m³		
Chemical Name	**# Obs**	**Obs > MDL**	**MDL**	**Max1**	**Max2**	**Max3**	**Min Mean**	**Max Mean**
1,1,1-Trichloroethane	23	0	1.25	0	0	0	0	1.25
1,1,2,2-Tetrachloroethane	23	0	1.71	0	0	0	0	1.71
1,1,2-Trichloroethane	23	0	1.43	0	0	0	0	1.43
1,1-Dichloroethane	23	0	0.987	0	0	0	0	0.987
1,1-Dichloroethene	23	0	0.985	0	0	0	0	0.985
1,2,4-Trichlorobenzene	23	0	2.06	0	0	0	0	2.06
1,2,4-Trimethylbenzene	23	5	1.3	1.5	1.3	1.1	0.247	1.23
1,2-Dibromoethane	23	0	1.92	0	0	0	0	1.92
1,2-Dichlorobenzene	23	0	1.65	0	0	0	0	1.65
1,2-Dichloroethane	23	2	1.03	1.3	0.34	0	0.0713	1.01
1,2-Dichloropropane	23	1	1.16	0.28	0	0	0.0122	1.12
1,3,5-Trimethylbenzene	23	0	1.26	0	0	0	0	1.26
1,3-Butadiene	23	4	0.67	0.79	0.32	0.28	0.0696	0.627
1,3-Dichlorobenzene	23	0	1.53	0	0	0	0	1.53
1,4-Dichlorobenzene	23	0	1.51	0	0	0	0	1.51
2,2,4-Trimethylpentane	23	20	1.07	0.92	0.9	0.7	0.359	0.487
2,5-dimethylbenzaldehyde	29	0	0.0544	0	0	0	0	0.0544
2-Chloro-1,3-Butadiene	23	0	0.989	0	0	0	0	0.989
Acetaldehyde	29	29	0.0279	3.46	3.26	2.5	1.71	1.71
Acetone	29	29	0.0624	5.63	5.44	3.96	2.77	2.77
Acetonitrile	23	17	1.35	6.2	4.3	4.1	1.28	1.69
Acrylonitrile	23	0	1.09	0	0	0	0	1.09
Arsenic (TSP)	60	60	0.000148	0.0071	0.00683	0.00554	0.00191	0.00191
Barium (TSP)	60	60	0.000221	0.17	0.165	0.152	0.0637	0.0637
Benzaldehyde	29	1	0.0213	0.829	0	0	0.0286	0.0492
Benzene	23	23	0.85	3.9	3.2	3.1	1.66	1.66
Beryllium (TSP)	60	60	0.000142	0.000203	0.000201	0.000178	0.0000663	0.0000663
Bromodichloromethane	23	0	1.65	0	0	0	0	1.65
Bromoform	23	0	2.46	0	0	0	0	2.46
Bromomethane (Methyl	23	0	1.02	0	0	0	0	1.02
Cadmium (TSP)	60	60	0.000132	0.00175	0.0015	0.00142	0.000591	0.000591
Carbon Tetrachloride	23	23	1.39	0.71	0.62	0.62	0.531	0.531
Chlorobenzene	23	0	1.14	0	0	0	0	1.14
Chloroethane	23	0	0.776	0	0	0	0	0.776
Chloroform	23	3	1.16	1.3	0.49	0.27	0.0896	1.11
Chloromethane	23	23	0.807	1.8	1.6	1.4	1.18	1.18
Chloromethyl Benzene	23	0	1.45	0	0	0	0	1.45
Chromium (TSP)	60	60	0.000306	0.0173	0.0135	0.00965	0.00565	0.00565
cis-1,2-Dichloroethene	23	0	1.03	0	0	0	0	1.03
cis-1,3-Dichloropropene	23	0	1.13	0	0	0	0	1.13
Cobalt (TSP)	60	60	0.000148	0.00122	0.000778	0.000764	0.000333	0.000333
Copper (TSP)	60	60	0.000454	0.568	0.534	0.482	0.224	0.224
Crotonaldehyde (trans)	29	0	0.0234	0	0	0	0	0.0234

DETROIT - W. Fort			AIRS ID: 261630015			Units: µg/m³		
Chemical Name	**# Obs**	**Obs > MDL**	**MDL**	**Max1**	**Max2**	**Max3**	**Min Mean**	**Max Mean**
Dibromochloromethane	23	0	2.06	0	0	0	0	2.06
Dichlorodiflouromethane	23	23	1.27	3.5	3.2	3	2.48	2.48
Ethylbenzene	23	14	1.15	1.5	1.1	1.1	0.475	0.848
Formaldehyde	29	29	0.0217	6.04	4.78	3.69	2.5	2.5
Halocarbon 113	23	10	1.74	0.78	0.77	0.76	0.298	1.54
Halocarbon 114	23	0	2.2	0	0	0	0	2.2
Hexachloro-1,3-Butadiene	23	0	2.44	0	0	0	0	2.44
Hexanaldehyde	29	3	0.0392	1.66	0.992	0.792	0.119	0.154
Iron (TSP)	60	60	0.000149	11.8	8.55	5.26	1.91	1.91
Isovaleraldehyde	29	0	0.0237	0	0	0	0	0.0237
Lead (TSP)	60	60	0.000178	1.39	0.0426	0.0413	0.0383	0.0383
m,p-Tolualdehyde	29	2	0.038	1.67	1.37	0	0.105	0.141
m/p -Xylene	23	21	1.35	4.6	3.9	3.5	1.72	1.9
Manganese (TSP)	60	60	0.000215	0.175	0.161	0.149	0.0674	0.0674
Methyl Ethyl Ketone	23	20	8.99	9.2	6.4	5.1	2.47	4.3
Methyl Isobutyl Ketone	23	7	2.72	6.3	3.6	3	0.918	2.84
Methyl Tert-Butyl Ether	23	0	2.47	0	0	0	0	2.47
Methylene Chloride	23	2	1.09	2.4	1.4	0	0.165	1.18
Molybdenum (TSP)	60	60	0.000149	0.00552	0.00515	0.00464	0.0016	0.0016
n-Butyraldehyde	29	11	0.0135	0.829	0.757	0.678	0.211	0.22
n-Hexane	23	18	3.13	3.8	2.5	2.5	1.11	1.47
Nickel (TSP)	55	55	0.00018	0.0171	0.0125	0.0115	0.00436	0.00436
o-Tolualdehyde	29	0	0.0405	0	0	0	0	0.0405
o-xylene	23	14	1.26	1.5	1.2	1.2	0.506	0.904
Propionaldehyde	29	16	0.0506	0.915	0.793	0.687	0.305	0.327
Styrene	23	0	1.19	0	0	0	0	1.19
Tetrachloroethene	23	3	1.6	2.5	0.75	0.53	0.164	1.51
Toluene	23	23	1.14	8.7	5.6	5	2.75	2.75
trans-1,2-Dichloroethene	23	0	1.16	0	0	0	0	1.16
trans-1,3-Dichloropropene	23	0	1.38	0	0	0	0	1.38
Trichloroethene	23	2	1.3	1.6	0.42	0	0.0878	1.25
Trichloroflouromethane	23	22	1.21	1.9	1.6	1.5	1.21	1.28
Valeraldehyde	29	1	0.0358	0.75	0	0	0.0259	0.0603
Vanadium (TSP)	60	60	0.000171	0.0229	0.0147	0.0119	0.00416	0.00416
Vinyl Chloride	23	1	0.737	0.84	0	0	0.0365	0.74
Zinc (TSP)	60	60	0.000193	0.783	0.661	0.229	0.12	0.12

DETROIT – W. Jefferson			AIRS ID: 261630027			Units: µg/m³		
Chemical Name	**# Obs**	**Obs > MDL**	**MDL**	**Max1**	**Max2**	**Max3**	**Min Mean**	**Max Mean**
Arsenic (TSP)	57	57	0.000125	0.00596	0.00491	0.00447	0.00207	0.00207
Barium (TSP)	57	57	0.000238	0.205	0.131	0.121	0.0602	0.0602
Beryllium (TSP)	57	57	0.000127	0.00141	0.000974	0.000714	0.000236	0.000236
Cadmium (TSP)	57	57	0.000123	0.00564	0.00212	0.00172	0.000767	0.000767
Chromium (TSP)	57	57	0.000304	0.0258	0.0231	0.0182	0.00839	0.00839
Cobalt (TSP)	57	57	0.000125	0.00116	0.000962	0.000931	0.000395	0.000395
Copper (TSP)	57	57	0.000467	0.383	0.334	0.325	0.172	0.172
Iron (TSP)	57	57	0.000176	10.2	5.84	5.45	2.37	2.37
Lead (TSP)	57	57	0.000158	0.0487	0.0449	0.0374	0.0187	0.0187
Manganese (TSP)	57	57	0.000219	0.805	0.605	0.503	0.166	0.166
Molybdenum (TSP)	57	57	0.000166	0.00473	0.00324	0.00313	0.0015	0.0015
Nickel (TSP)	53	53	0.000192	0.0141	0.011	0.0104	0.00442	0.00442
Vanadium (TSP)	57	57	0.000172	0.0244	0.0232	0.0186	0.00751	0.00751
Zinc (TSP)	57	57	0.000204	0.517	0.478	0.382	0.143	0.143

FLINT			AIRS ID: 260490021				Units: µg/m³	
Chemical Name	# Obs	Obs > MDL	MDL	Max1	Max2	Max3	Min Mean	Max Mean
Arsenic (TSP)	59	59	0.00013	0.00381	0.00355	0.00308	0.00129	0.00129
Barium (TSP)	59	59	0.000175	0.109	0.0959	0.0944	0.0334	0.0334
Beryllium (TSP)	59	54	0.00014	0.0000477	0.0000444	0.0000279	0.0000112	0.0000205
Cadmium (TSP)	59	59	0.000126	0.00353	0.000959	0.000559	0.000256	0.000256
Chromium (TSP)	59	59	0.000319	0.0032	0.00311	0.00293	0.00205	0.00205
Cobalt (TSP)	59	59	0.000117	0.000453	0.000411	0.00035	0.000164	0.000164
Copper (TSP)	59	59	0.00049	1.72	1.23	1.15	0.458	0.458
Iron (TSP)	59	59	0.000217	0.76	0.73	0.647	0.341	0.341
Lead (TSP)	59	59	0.000153	0.067	0.0203	0.0172	0.00752	0.00752
Manganese (TSP)	59	59	0.000205	0.0266	0.0253	0.0247	0.0103	0.0103
Molybdenum (TSP)	59	58	0.000165	0.0014	0.00116	0.00108	0.000523	0.000526
Nickel (TSP)	54	54	0.00022	0.00253	0.00198	0.00187	0.00114	0.00114
Vanadium (TSP)	59	59	0.00017	0.0046	0.00416	0.00241	0.000907	0.000907
Zinc (TSP)	59	59	0.000147	0.241	0.0835	0.0815	0.042	0.042

GRAND RAPIDS - Monroe			AIRS ID: 260810020				Units: µg/m³	
Chemical Name	# Obs	Obs > MDL	MDL	Max1	Max2	Max3	Min Mean	Max Mean
1,1,1-Trichloroethane	25	21	1.34	28	3.6	1.9	1.77	1.93
1,1,2,2-Tetrachloroethane	25	0	1.75	0	0	0	0	1.75
1,1,2-Trichloroethane	25	0	1.44	0	0	0	0	1.44
1,1-Dichloroethane	25	0	1.02	0	0	0	0	1.02
1,1-Dichloroethene	25	0	0.964	0	0	0	0	0.964
1,2,4-Trichlorobenzene	25	0	1.99	0	0	0	0	1.99
1,2,4-Trimethylbenzene	25	9	1.26	2.3	1.9	1.5	0.448	1.25
1,2-Dibromoethane	25	0	1.92	0	0	0	0	1.92
1,2-Dichlorobenzene	25	0	1.62	0	0	0	0	1.62
1,2-Dichloroethane	25	0	1.04	0	0	0	0	1.04
1,2-Dichloropropane	25	0	1.19	0	0	0	0	1.19
1,3,5-Trimethylbenzene	25	1	1.25	0.85	0	0	0.034	1.23
1,3-Butadiene	25	6	0.641	0.36	0.33	0.27	0.0644	0.512
1,3-Dichlorobenzene	25	0	1.55	0	0	0	0	1.55
1,4-Dichlorobenzene	25	1	1.55	4.5	0	0	0.18	1.66
2,2,4-Trimethylpentane	25	24	1.23	1.9	1.8	0.95	0.541	0.613
2,5-dimethylbenzaldehyde	27	0	0.0509	0	0	0	0	0.0509
2-Chloro-1,3-Butadiene	25	0	0.904	0	0	0	0	0.904
Acetaldehyde	27	27	0.0254	10.3	2.59	2.58	1.74	1.74
Acetone	27	27	0.061	18.7	11	6.69	4	4
Acetonitrile	25	17	1.39	3.3	1.7	1.5	0.825	1.36
Acrylonitrile	25	0	0.976	0	0	0	0	0.976
Arsenic (TSP)	29	29	0.000151	0.00266	0.00209	0.00189	0.001	0.001
Barium (TSP)	29	29	0.000182	0.119	0.11	0.106	0.046	0.046
Benzaldehyde	27	1	0.0201	2.86	0	0	0.106	0.125
Benzene	25	25	0.806	2	2	1.8	1.13	1.13
Beryllium (TSP)	29	28	0.000119	0.000039	0.0000287	0.0000287	0.0000137	0.0000176
Bromodichloromethane	25	0	1.64	0	0	0	0	1.64
Bromoform	25	0	2.62	0	0	0	0	2.62
Bromomethane (Methyl	25	1	1	0.81	0	0	0.0324	0.988
Cadmium (TSP)	29	29	0.000132	0.000324	0.00023	0.000221	0.000143	0.000143
Carbon Tetrachloride	25	25	1.98	0.67	0.63	0.62	0.508	0.508
Chlorobenzene	25	0	1.19	0	0	0	0	1.19
Chloroethane	25	2	0.709	0.29	0.27	0	0.0224	0.674
Chloroform	25	25	1.14	0.91	0.88	0.86	0.594	0.594
Chloromethane	25	25	0.564	1.7	1.7	1.6	1.21	1.21
Chloromethyl Benzene	25	0	1.49	0	0	0	0	1.49
Chromium (TSP)	29	29	0.000304	0.00397	0.00388	0.00378	0.00299	0.00299
cis-1,2-Dichloroethene	25	0	1.08	0	0	0	0	1.08
cis-1,3-Dichloropropene	25	0	1.24	0	0	0	0	1.24
Cobalt (TSP)	29	29	0.000135	0.000455	0.000385	0.00036	0.000175	0.000175
Copper (TSP)	29	29	0.000487	0.917	0.678	0.548	0.328	0.328

GRAND RAPIDS - Monroe			AIRS ID: 260810020				Units: µg/m³	
Chemical Name	# Obs	Obs > MDL	MDL	Max1	Max2	Max3	Min Mean	Max Mean
Crotonaldehyde (trans)	27	0	0.0202	0	0	0	0	0.0202
Dibromochloromethane	25	0	2.16	0	0	0	0	2.16
Dichlorodiflouromethane	25	25	1.4	3.8	3.5	3.4	2.62	2.62
Ethylbenzene	25	14	1.18	1.4	1.3	0.82	0.338	0.796
Formaldehyde	27	27	0.0206	29.5	4.86	4.31	3.11	3.11
Halocarbon 113	25	10	1.85	0.74	0.66	0.61	0.23	1.59
Halocarbon 114	25	0	1.61	0	0	0	0	1.61
Hexachloro-1,3-Butadiene	25	0	2.73	0	0	0	0	2.73
Hexanaldehyde	27	5	0.0373	8.39	0.791	0.774	0.416	0.447
Iron (TSP)	29	29	0.000189	1.21	0.867	0.762	0.433	0.433
Isovaleraldehyde	27	1	0.0227	1.51	0	0	0.0559	0.0781
Lead (TSP)	29	29	0.000185	0.0135	0.0134	0.0115	0.0065	0.0065
m,p-Tolualdehyde	27	0	0.0361	0	0	0	0	0.0361
m/p -Xylene	25	22	1.29	3.7	3.7	2.3	1.22	1.43
Manganese (TSP)	29	29	0.000219	0.0555	0.036	0.0296	0.0159	0.0159
Methyl Ethyl Ketone	25	23	10.3	8.7	5.3	2.6	1.86	3.02
Methyl Isobutyl Ketone	25	5	3.07	1.6	1.2	0.96	0.19	2.61
Methyl Tert-Butyl Ether	25	0	1.42	0	0	0	0	1.42
Methylene Chloride	25	8	1.47	6.8	3.3	3.1	0.794	1.98
Molybdenum (TSP)	29	29	0.000176	0.00212	0.00142	0.00138	0.000692	0.000692
n-Butyraldehyde	27	4	0.0127	2.67	0.572	0.466	0.154	0.165
n-Hexane	25	23	2.84	3.7	3.1	3.1	1.32	1.5
Nickel (TSP)	27	27	0.00021	0.00303	0.00242	0.0024	0.00133	0.00133
o-Tolualdehyde	27	0	0.0369	0	0	0	0	0.0369
o-xylene	25	17	1.16	1.3	1.3	0.94	0.402	0.715
Propionaldehyde	27	10	0.0456	2.37	0.658	0.58	0.248	0.274
Styrene	25	2	1.17	1.4	0.49	0	0.0756	1.14
Tetrachloroethene	25	1	1.69	0.47	0	0	0.0188	1.62
Toluene	25	25	1.08	22	13	7.2	4.17	4.17
trans-1,2-Dichloroethene	25	0	1.02	0	0	0	0	1.02
trans-1,3-Dichloropropene	25	0	1.13	0	0	0	0	1.13
Trichloroethene	25	4	1.3	0.88	0.82	0.73	0.122	1.22
Trichloroflouromethane	25	25	1.38	2.7	1.7	1.6	1.31	1.31
Valeraldehyde	27	1	0.0344	4.19	0	0	0.155	0.189
Vanadium (TSP)	29	29	0.000186	0.00165	0.00131	0.000907	0.000497	0.000497
Vinyl Chloride	25	0	0.672	0	0	0	0	0.672
Zinc (TSP)	30	30	0.000211	0.0936	0.0867	0.0861	0.049	0.049

HOUGHTON LAKE			AIRS ID: 261130001			Units: µg/m³		
Chemical Name	# Obs	Obs > MDL	MDL	Max1	Max2	Max3	Min Mean	Max Mean
1,1,1-Trichloroethane	46	0	1.37	0	0	0	0	1.37
1,1,2,2-Tetrachloroethane	46	0	1.77	0	0	0	0	1.77
1,1,2-Trichloroethane	46	0	1.43	0	0	0	0	1.43
1,1-Dichloroethane	46	0	1.06	0	0	0	0	1.06
1,1-Dichloroethene	46	0	1.02	0	0	0	0	1.02
1,2,4-Trichlorobenzene	46	0	2	0	0	0	0	2
1,2,4-Trimethylbenzene	46	0	1.33	0	0	0	0	1.33
1,2-Dibromoethane	46	0	1.92	0	0	0	0	1.92
1,2-Dichlorobenzene	46	0	1.55	0	0	0	0	1.55
1,2-Dichloroethane	46	0	1.12	0	0	0	0	1.12
1,2-Dichloropropane	46	0	1.2	0	0	0	0	1.2
1,3,5-Trimethylbenzene	46	0	1.33	0	0	0	0	1.33
1,3-Butadiene	46	0	0.75	0	0	0	0	0.75
1,3-Dichlorobenzene	46	0	1.61	0	0	0	0	1.61
1,4-Dichlorobenzene	46	0	1.6	0	0	0	0	1.6
2,2,4-Trimethylpentane	46	7	1.49	0.24	0.19	0.19	0.0274	1.33
2,5-dimethylbenzaldehyde	29	0	0.0522	0	0	0	0	0.0522
2-Chloro-1,3-Butadiene	46	0	0.986	0	0	0	0	0.986
Acetaldehyde	29	29	0.0268	1.88	1.83	1.54	0.813	0.813
Acetone	29	29	0.0596	4.47	3.55	3.4	1.94	1.94

HOUGHTON LAKE			AIRS ID: 261130001			Units: µg/m³		
Chemical Name	**# Obs**	**Obs > MDL**	**MDL**	**Max1**	**Max2**	**Max3**	**Min Mean**	**Max Mean**
Acetonitrile	46	31	1.5	3.1	2.5	2.4	0.663	1.14
Acrylonitrile	46	0	1.01	0	0	0	0	1.01
Arsenic (TSP)	60	60	0.000135	0.00203	0.00159	0.00153	0.000544	0.000544
Barium (TSP)	60	60	0.000195	0.102	0.0959	0.0944	0.0275	0.0275
Benzaldehyde	29	0	0.0204	0	0	0	0	0.0204
Benzene	46	45	0.927	0.89	0.84	0.81	0.392	0.412
Beryllium (TSP)	60	53	0.000139	0.0000589	0.000028	0.0000194	0.00000899	0.0000217
Bromodichloromethane	46	0	1.68	0	0	0	0	1.68
Bromoform	46	0	2.6	0	0	0	0	2.6
Bromomethane (Methyl	46	1	0.98	0.36	0	0	0.00783	0.982
Cadmium (TSP)	60	57	0.000117	0.000732	0.000698	0.000356	0.00011	0.000116
Carbon Tetrachloride	46	45	1.5	0.71	0.65	0.65	0.503	0.542
Chlorobenzene	46	0	1.25	0	0	0	0	1.25
Chloroethane	46	0	0.741	0	0	0	0	0.741
Chloroform	46	45	1.21	2.9	1.5	1.3	0.818	0.823
Chloromethane	46	46	0.631	2	1.9	1.7	1.23	1.23
Chloromethyl Benzene	46	0	1.46	0	0	0	0	1.46
Chromium (TSP)	60	60	0.000313	0.00312	0.00246	0.00242	0.00169	0.00169
cis-1,2-Dichloroethene	46	0	1.09	0	0	0	0	1.09
cis-1,3-Dichloropropene	46	0	1.21	0	0	0	0	1.21
Cobalt (TSP)	60	60	0.000146	0.000198	0.000197	0.000192	0.0000713	0.0000713
Copper (TSP)	60	60	0.000483	1.15	0.94	0.706	0.352	0.352
Crotonaldehyde (trans)	29	0	0.0227	0	0	0	0	0.0227
Dibromochloromethane	46	0	2.15	0	0	0	0	2.15
Dichlorodiflouromethane	46	45	1.35	5	4	3.9	2.53	2.57
Ethylbenzene	46	1	1.21	0.58	0	0	0.0126	1.2
Formaldehyde	29	29	0.0211	4.2	2.33	2.32	1.38	1.38
Halocarbon 113	46	17	1.85	0.89	0.82	0.79	0.25	1.68
Halocarbon 114	46	0	1.69	0	0	0	0	1.69
Hexachloro-1,3-Butadiene	46	0	2.76	0	0	0	0	2.76
Hexanaldehyde	29	0	0.0376	0	0	0	0	0.0376
Iron (TSP)	60	60	0.00021	0.377	0.336	0.315	0.108	0.108
Isovaleraldehyde	29	1	0.0227	1.51	0	0	0.0521	0.0742
Lead (TSP)	60	60	0.000149	0.0206	0.0136	0.00934	0.00304	0.00304
m,p-Tolualdehyde	29	0	0.0365	0	0	0	0	0.0365
m/p -Xylene	46	5	1.58	0.77	0.55	0.44	0.0509	1.49
Manganese (TSP)	60	60	0.000209	0.027	0.0206	0.0127	0.00529	0.00529
Methyl Ethyl Ketone	46	42	10.2	2.2	1.7	1.7	0.945	1.93
Methyl Isobutyl Ketone	46	0	3.1	0	0	0	0	3.1
Methyl Tert-Butyl Ether	46	0	1.48	0	0	0	0	1.48
Methylene Chloride	46	2	1.01	1.3	1.1	0	0.0522	1.02
Molybdenum (TSP)	60	54	0.000145	0.00082	0.00068	0.000651	0.000221	0.000235
n-Butyraldehyde	29	0	0.013	0	0	0	0	0.013
n-Hexane	46	18	3	1.8	0.92	0.82	0.19	1.9
Nickel (TSP)	55	55	0.000189	0.00177	0.00155	0.00153	0.000695	0.000695
o-Tolualdehyde	29	0	0.039	0	0	0	0	0.039
o-xylene	46	1	1.21	0.29	0	0	0.0063	1.19
Propionaldehyde	29	3	0.0488	0.406	0.377	0.373	0.0399	0.0834
Styrene	46	1	1.41	2.7	0	0	0.0587	1.44
Tetrachloroethene	46	1	1.99	0.66	0	0	0.0143	1.96
Toluene	46	29	1.07	1.2	1	0.82	0.331	0.714
trans-1,2-Dichloroethene	46	0	1.16	0	0	0	0	1.16
trans-1,3-Dichloropropene	46	0	1.2	0	0	0	0	1.2
Trichloroethene	46	0	1.61	0	0	0	0	1.61
Trichloroflouromethane	46	46	1.37	2.3	2	1.8	1.28	1.28
Valeraldehyde	29	0	0.0343	0	0	0	0	0.0343
Vanadium (TSP)	60	58	0.000186	0.00331	0.00317	0.00211	0.00044	0.000445
Vinyl Chloride	46	0	0.777	0	0	0	0	0.777
Zinc (TSP)	60	60	0.000211	0.205	0.0951	0.088	0.0298	0.0298

RIVER ROUGE		AIRS ID: 261630005				Units: µg/m³			
Chemical Name	**# Obs**	**Obs > MDL**	**MDL**	**Max1**	**Max2**	**Max3**	**Min Mean**	**Max Mean**	
Arsenic (TSP)	58	58	0.00014	0.00668	0.00644	0.00605	0.00187	0.00187	
Beryllium (TSP)	58	57	0.00013	7.85E-05	7.77E-05	7.53E-05	0.0000407	0.0000427	
Barium (TSP)	58	58	0.00024	0.237	0.142	0.102	0.0436	0.0436	
Cadmium (TSP)	58	58	0.00014	0.00484	0.00355	0.00202	0.000738	0.000738	
Chromium (TSP)	58	58	0.00029	0.0152	0.0141	0.0129	0.00547	0.00547	
Cobalt (TSP)	58	58	0.00012	0.00167	0.000882	0.000465	0.000279	0.000279	
Copper (TSP)	58	58	0.00046	1.04	0.899	0.822	0.45	0.45	
Iron (TSP)	58	58	0.00017	7.16	3.59	2.93	1.26	1.26	
Lead (TSP)	58	58	0.00017	0.0341	0.0278	0.0271	0.0126	0.0126	
Manganese (TSP)	58	58	0.00021	0.202	0.191	0.188	0.065	0.065	
Molybdenum (TSP)	58	58	0.00016	0.0032	0.00231	0.00208	0.00098	0.00098	
Nickel (TSP)	53	53	0.00019	0.0113	0.00867	0.00623	0.00285	0.00285	
Vanadium (TSP)	58	58	0.00016	0.0168	0.0141	0.0136	0.00471	0.00471	
Zinc (TSP)	58	58	0.0002	0.473	0.308	0.302	0.115	0.115	
Formaldehyde	60	60	0.02	8.34	8	8	3.58	3.58	
Acetaldehyde	60	60	0.0266	4.09	4.09	3.43	1.88	1.88	
Propionaldehyde	60	38	0.0484	1.38	0.931	0.931	0.353	0.368	
n-Butyraldehyde	60	21	0.0129	1.19	1.11	0.743	0.199	0.207	
Isovaleraldehyde	60	0	0.0226	0	0	0	0	0.0226	
Crotonaldehyde (trans)	60	0	0.0225	0	0	0	0	0.0225	
Hexanaldehyde	60	7	0.0374	1.25	1.18	0.848	0.107	0.14	
Valeraldehyde	60	2	0.0341	1.01	0.705	0	0.0286	0.0616	
Acetone	60	60	0.0593	5.1	4.91	4.52	2.28	2.28	
Benzaldehyde	60	1	0.0203	0.846	0	0	0.0141	0.0341	
2,5-dimethylbenzaldehyde	60	0	0.0518	0	0	0	0	0.0518	
o-Tolualdehyde	60	0	0.0387	0	0	0	0	0.0387	
m,p-Tolualdehyde	60	0	0.0363	0	0	0	0	0.0363	

SAULT STE. MARIE - Easterday		AIRS ID: 260330901				Units: µg/m³		
Chemical Name	**# Obs**	**Obs > MDL**	**MDL**	**Max1**	**Max2**	**Max3**	**Min Mean**	**Max Mean**
Acenaphthene	60	59	0.000000095	0.00106	0.000987	0.000929	0.000324	0.000324
Acenaphthylene	60	55	0.000000104	0.00547	0.00411	0.00389	0.000567	0.000567
Anthracene	60	56	0.000000066	0.00467	0.00451	0.00383	0.000747	0.000747
Benzo(a)anthracene	60	60	0.000000057	0.00182	0.0013	0.000769	0.000186	0.000186
Benzo(a)pyrene	60	51	0.000000079	0.00103	0.000749	0.000578	0.000132	0.000132
Benzo(b)fluoranthene	60	60	0.000000062	0.00144	0.00141	0.00105	0.000238	0.000238
Benzo(ghi)perylene	60	58	0.000000039	0.000911	0.00064	0.000578	0.000144	0.000144
Benzo(k)fluoranthene	60	60	0.000000045	0.00116	0.000932	0.000723	0.000173	0.000173
Chrysene	60	60	0.000000055	0.00237	0.00197	0.00134	0.000344	0.000344
Dibenzo(ah)anthracene	60	24	0.00000004	0.000209	0.000128	0.0000832	0.0000193	0.0000194
Fluoranthene	60	60	0.000000066	0.00715	0.00606	0.00566	0.00185	0.00185
Fluorene	60	60	0.00000016	0.00514	0.00467	0.00415	0.00117	0.00117
Indeno(123-cd)pyrene	60	56	0.000000056	0.00137	0.000786	0.000619	0.000154	0.000154
Naphthalene	60	60	0.000000343	0.0121	0.00871	0.00663	0.00145	0.00145
Phenanthrene	60	60	0.000000062	0.0137	0.0134	0.0133	0.00489	0.00489
Pyrene	60	60	0.000000079	0.00477	0.00384	0.00364	0.00108	0.00108
2,5-dimethylbenzaldehyde	60	0	0.0518	0	0	0	0	0.0518
Acetaldehyde	60	60	0.0266	4.09	4.09	3.43	1.88	1.88
Acetone	60	60	0.0593	5.1	4.91	4.52	2.28	2.28
Arsenic (TSP)	58	58	0.000142	0.00668	0.00644	0.00605	0.00187	0.00187
Barium (TSP)	58	58	0.000235	0.237	0.142	0.102	0.0436	0.0436
Benzaldehyde	60	1	0.0203	0.846	0	0	0.0141	0.0341
Beryllium (TSP)	58	57	0.000132	0.0000785	0.0000777	0.0000753	0.0000407	0.0000427
Cadmium (TSP)	58	58	0.000137	0.00484	0.00355	0.00202	0.000738	0.000738
Chromium (TSP)	58	58	0.000294	0.0152	0.0141	0.0129	0.00547	0.00547
Cobalt (TSP)	58	58	0.000123	0.00167	0.000882	0.000465	0.000279	0.000279
Copper (TSP)	58	58	0.000456	1.04	0.899	0.822	0.45	0.45
Crotonaldehyde (trans)	60	0	0.0225	0	0	0	0	0.0225
Formaldehyde	60	60	0.02	8.34	8	8	3.58	3.58

SAULT STE. MARIE - Easterday			AIRS ID: 260330901				Units: µg/m³	
Chemical Name	**# Obs**	**Obs > MDL**	**MDL**	**Max1**	**Max2**	**Max3**	**Min Mean**	**Max Mean**
Hexanaldehyde	60	7	0.0374	1.25	1.18	0.848	0.107	0.14
Iron (TSP)	58	58	0.000173	7.16	3.59	2.93	1.26	1.26
Isovaleraldehyde	60	0	0.0226	0	0	0	0	0.0226
Lead (TSP)	58	58	0.000172	0.0341	0.0278	0.0271	0.0126	0.0126
m,p-Tolualdehyde	60	0	0.0363	0	0	0	0	0.0363
Manganese (TSP)	58	58	0.000209	0.202	0.191	0.188	0.065	0.065
Molybdenum (TSP)	58	58	0.000162	0.0032	0.00231	0.00208	0.00098	0.00098
n-Butyraldehyde	60	21	0.0129	1.19	1.11	0.743	0.199	0.207
Nickel (TSP)	53	53	0.000192	0.0113	0.00867	0.00623	0.00285	0.00285
o-Tolualdehyde	60	0	0.0387	0	0	0	0	0.0387
Propionaldehyde	60	38	0.0484	1.38	0.931	0.931	0.353	0.368
Valeraldehyde	60	2	0.0341	1.01	0.705	0	0.0286	0.0616
Vanadium (TSP)	58	58	0.000158	0.0168	0.0141	0.0136	0.00471	0.00471
Zinc (TSP)	58	58	0.000204	0.473	0.308	0.302	0.115	0.115

YPSILANTI			AIRS ID: 261610008				Units: µg/m³	
Chemical Name	**# Obs**	**Obs > MDL**	**MDL**	**Max1**	**Max2**	**Max3**	**Min Mean**	**Max Mean**
1,1,1-Trichloroethane	24	0	1.3	0	0	0	0	1.3
1,1,2,2-Tetrachloroethane	24	0	1.75	0	0	0	0	1.75
1,1,2-Trichloroethane	24	0	1.45	0	0	0	0	1.45
1,1-Dichloroethane	24	0	1.01	0	0	0	0	1.01
1,1-Dichloroethene	24	0	0.986	0	0	0	0	0.986
1,2,4-Trichlorobenzene	24	0	1.93	0	0	0	0	1.93
1,2,4-Trimethylbenzene	24	4	1.21	1.7	1.5	1.2	0.229	1.22
1,2-Dibromoethane	24	0	1.9	0	0	0	0	1.9
1,2-Dichlorobenzene	24	0	1.66	0	0	0	0	1.66
1,2-Dichloroethane	24	1	1.17	1.5	0	0	0.0625	1.18
1,2-Dichloropropane	24	0	1.18	0	0	0	0	1.18
1,3,5-Trimethylbenzene	24	0	1.25	0	0	0	0	1.25
1,3-Butadiene	24	5	0.641	0.47	0.39	0.38	0.07	0.528
1,3-Dichlorobenzene	24	0	1.58	0	0	0	0	1.58
1,4-Dichlorobenzene	24	0	1.52	0	0	0	0	1.52
2,2,4-Trimethylpentane	24	23	1.14	1.5	1.2	0.92	0.424	0.499
2,5-dimethylbenzaldehyde	20	0	0.0537	0	0	0	0	0.0537
2-Chloro-1,3-Butadiene	24	0	0.935	0	0	0	0	0.935
Acetaldehyde	20	20	0.027	1.87	1.76	1.73	1.35	1.35
Acetone	20	20	0.0638	5.31	4.09	3.7	2.68	2.68
Acetonitrile	24	18	1.36	3.6	2.7	1.8	0.906	1.31
Acrylonitrile	24	1	0.983	1.9	0	0	0.0792	1.02
Arsenic (TSP)	27	27	0.000136	0.00234	0.00206	0.00184	0.00105	0.00105
Barium (TSP)	27	27	0.000207	0.104	0.0824	0.0478	0.0271	0.0271
Benzaldehyde	20	0	0.0212	0	0	0	0	0.0212
Benzene	24	24	0.79	2.6	2.6	1.8	1.12	1.12
Beryllium (TSP)	27	25	0.000136	0.0000339	0.0000326	0.0000265	0.0000133	0.0000216
Bromodichloromethane	24	0	1.64	0	0	0	0	1.64
Bromoform	24	0	2.6	0	0	0	0	2.6
Bromomethane (Methyl	24	1	0.946	0.43	0	0	0.0179	0.953
Cadmium (TSP)	27	26	0.000148	0.000264	0.000239	0.000208	0.000119	0.000124
Carbon Tetrachloride	24	24	1.46	0.89	0.68	0.62	0.531	0.531
Chlorobenzene	24	0	1.15	0	0	0	0	1.15
Chloroethane	24	2	0.794	0.57	0.26	0	0.0346	0.769
Chloroform	24	2	1.16	1.2	0.99	0	0.0913	1.14
Chloromethane	24	24	0.697	1.8	1.8	1.7	1.23	1.23
Chloromethyl Benzene	24	0	1.41	0	0	0	0	1.41
Chromium (TSP)	27	27	0.000283	0.00356	0.00321	0.00299	0.00233	0.00233
cis-1,2-Dichloroethene	24	0	1.01	0	0	0	0	1.01
cis-1,3-Dichloropropene	24	0	1.2	0	0	0	0	1.2
Cobalt (TSP)	27	27	0.00015	0.00239	0.000293	0.000262	0.000226	0.000226
Copper (TSP)	27	27	0.000416	0.613	0.603	0.567	0.328	0.328
Crotonaldehyde (trans)	20	1	0.0216	0.367	0	0	0.0184	0.0393
Dibromochloromethane	24	0	2.18	0	0	0	0	2.18

YPSILANTI			AIRS ID: 261610008				Units: µg/m³	
Chemical Name	**# Obs**	**Obs > MDL**	**MDL**	**Max1**	**Max2**	**Max3**	**Min Mean**	**Max Mean**
Dichlorodiflouromethane	24	24	1.21	5	3.6	3.4	2.64	2.64
Ethylbenzene	24	9	1.75	1.2	0.9	0.75	0.219	0.878
Formaldehyde	20	20	0.0216	3.8	3.73	3.56	2.36	2.36
Halocarbon 113	24	10	1.75	0.69	0.69	0.66	0.259	1.57
Halocarbon 114	24	0	1.65	0	0	0	0	1.65
Hexachloro-1,3-Butadiene	24	0	2.69	0	0	0	0	2.69
Hexanaldehyde	20	0	0.0392	0	0	0	0	0.0392
Iron (TSP)	27	27	0.000255	0.873	0.608	0.579	0.355	0.355
Isovaleraldehyde	20	0	0.0239	0	0	0	0	0.0239
Lead (TSP)	27	27	0.000171	0.00993	0.00858	0.00732	0.00461	0.00461
m,p-Tolualdehyde	20	0	0.0379	0	0	0	0	0.0379
m/p -Xylene	24	21	1.14	3.7	2.7	2.3	1.01	1.12
Manganese (TSP)	27	27	0.000226	0.0289	0.0258	0.0195	0.0121	0.0121
Methyl Ethyl Ketone	24	21	10.2	1.7	1.4	1.4	0.877	2.63
Methyl Isobutyl Ketone	24	0	3	0	0	0	0	3
Methyl Tert-Butyl Ether	24	1	1.47	0.15	0	0	0.00625	1.37
Methylene Chloride	24	4	1.02	5.2	4.5	2.3	0.54	1.42
Molybdenum (TSP)	27	27	0.000173	0.00156	0.00123	0.00105	0.000595	0.000595
n-Butyraldehyde	20	5	0.0134	0.442	0.437	0.422	0.1	0.111
n-Hexane	24	18	2.66	5.1	4	1.9	0.922	1.38
Nickel (TSP)	25	25	0.000184	0.00303	0.00299	0.00196	0.00126	0.00126
o-Tolualdehyde	20	0	0.0391	0	0	0	0	0.0391
o-xylene	24	10	1.17	1.4	1.1	0.87	0.265	0.864
Propionaldehyde	20	11	0.0485	0.48	0.437	0.423	0.22	0.239
Styrene	24	6	1.64	0.88	0.7	0.56	0.134	1.49
Tetrachloroethene	24	6	1.79	3.9	1.5	1.2	0.349	1.69
Toluene	24	23	1.07	9.9	6.2	5.7	2.73	2.82
trans-1,2-Dichloroethene	24	0	1.08	0	0	0	0	1.08
trans-1,3-Dichloropropene	24	0	1.17	0	0	0	0	1.17
Trichloroethene	24	2	1.33	2	0.35	0	0.0979	1.29
Trichloroflouromethane	24	24	1.3	1.8	1.7	1.7	1.26	1.26
Valeraldehyde	20	0	0.036	0	0	0	0	0.036
Vanadium (TSP)	27	27	0.000158	0.00973	0.00431	0.00409	0.00149	0.00149
Vinyl Chloride	24	1	0.666	0.29	0	0	0.0121	0.647
Zinc (TSP)	27	27	0.000208	0.0945	0.0909	0.0888	0.0437	0.0437

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

ALLEN PARK			AIRS ID: 261630001			Units: µg/m³		
Chemical Name	MDL	Obs > MDL	# Obs	Max1	Max2	Max3	Min Mean	Max Mean
Aluminum	0.0119	76	111	0.167	0.162	0.112	0.0238	0.0272
Ammonium Ion	0.114	113	113	6.95	5.13	4.8	1.6	1.6
Antimony	0.0116	28	111	0.0596	0.0373	0.028	0.00375	0.0123
Arsenic	0.000904	83	111	0.00725	0.00544	0.00536	0.00148	0.0018
Barium	0.00957	38	111	0.0958	0.0903	0.0871	0.00706	0.0112
Bromine	0.000835	98	111	0.0132	0.0118	0.0106	0.00336	0.00343
Cadmium	0.0051	31	111	0.0231	0.0143	0.0117	0.00156	0.00505
Calcium LC	0.00474	111	111	0.575	0.182	0.167	0.0561	0.0561
Cerium	0.011	21	111	0.111	0.0794	0.0668	0.00526	0.0126
Cesium	0.009	16	111	0.0529	0.0159	0.0127	0.00103	0.00737
Chlorine	0.00602	48	111	0.376	0.174	0.153	0.016	0.0198
Chromium	0.000906	74	111	0.0335	0.0217	0.0138	0.00267	0.00296
Cobalt	0.000726	31	111	0.00224	0.00176	0.00168	0.000178	0.00071
Copper	0.00098	107	111	0.0466	0.0329	0.029	0.00841	0.00844
Elemental Carbon	0.285	113	113	2.59	2.08	1.67	0.789	0.789
Europium	0.00248	14	111	0.0188	0.0146	0.0099	0.000705	0.00292
Gallium	0.00112	71	111	0.00828	0.00501	0.00479	0.000747	0.00109
Gold	0.00175	36	111	0.00397	0.00397	0.00396	0.0004	0.0016
Hafnium	0.00606	18	111	0.0118	0.00781	0.00724	0.000435	0.00548
Indium	0.00592	38	111	0.0264	0.0232	0.0167	0.00237	0.00609
Iridium	0.00204	26	111	0.00642	0.00467	0.00409	0.000494	0.00204
Iron	0.00894	111	111	0.524	0.298	0.271	0.121	0.121
Lanthanium	0.00911	16	111	0.135	0.0172	0.016	0.00224	0.00869
Magnesium	0.00735	35	111	0.0548	0.0518	0.0518	0.00754	0.0115
Manganese	0.000844	101	111	0.0177	0.0173	0.00916	0.00299	0.00308
Mercury	0.00239	38	111	0.00736	0.00712	0.00654	0.00108	0.00262
Molybdenum	0.00264	10	111	0.00816	0.00782	0.00584	0.000359	0.00262
Nickel	0.000546	93	111	0.0135	0.00785	0.00762	0.00153	0.00163
Niobium	0.00164	30	111	0.0184	0.00771	0.00513	0.000631	0.0017
Organic Carbon Peak1	0.294	113	113	2.58	2.25	2.14	0.943	0.943
Organic Carbon Peak2	0.31	113	113	3.43	2.99	2.99	1.21	1.21
Organic Carbon Peak3	0.291	113	113	2.51	2.03	1.99	0.884	0.884
Organic Carbon Peak4	0.28	112	113	1.96	1.93	1.89	0.696	0.698
Organic Carbon	0.47	113	113	10.1	8.87	8.39	3.73	3.73
Organic Carbon Pyrolytic	0.24	7	113	0.0442	0.0432	0.0314	0.00169	0.227
Phosphorus	0.00651	6	111	0.00748	0.00349	0.00163	0.000129	0.00641
Potassium Ion	0.00896	60	113	0.791	0.433	0.188	0.0528	0.0576
Potassium	0.00551	111	111	0.778	0.453	0.172	0.0655	0.0655
Rubidium	0.000814	48	111	0.00467	0.00442	0.00432	0.000479	0.00088
Samarium	0.00231	28	111	0.0103	0.00843	0.00827	0.000685	0.00247
Scandium	0.00517	9	111	0.00245	0.00198	0.00176	0.00011	0.00515
Selenium	0.000945	91	111	0.00747	0.00712	0.007	0.00182	0.002
Silicon	0.00909	109	111	0.264	0.244	0.244	0.0652	0.0653
Silver	0.00429	36	111	0.0191	0.0139	0.0107	0.00175	0.00455
Sodium Ion	0.0426	109	113	0.435	0.434	0.4	0.0852	0.0862
Sodium	0.0282	51	111	0.187	0.187	0.179	0.0235	0.0416
Strantium	0.00121	71	111	0.0149	0.0112	0.00863	0.00145	0.00185
Sulfate	0.21	113	113	15.2	12	11.7	2.95	2.95
Sulfur	0.0697	111	111	4.76	3.54	3.5	0.977	0.977
Tantalum	0.00462	22	111	0.0106	0.0104	0.00723	0.000648	0.0041
Terbium	0.00416	16	111	0.0127	0.0112	0.0107	0.000759	0.00432
Tin	0.00791	31	111	0.0507	0.0334	0.0259	0.00335	0.00878
Titatium	0.00175	61	111	0.0191	0.0168	0.0118	0.00281	0.00367
Total Nitrate	0.165	113	113	9.55	9.35	8.21	2.31	2.31
Tungsten	0.00277	30	111	0.0102	0.00688	0.00629	0.000805	0.00284
Vanadium	0.00122	84	111	0.0306	0.0127	0.0114	0.0025	0.00284
Yttrium	0.00112	52	111	0.00594	0.00326	0.00311	0.000622	0.00119
Zinc	0.00193	111	111	0.151	0.113	0.11	0.0222	0.0222
Zirconium	0.00211	36	111	0.0125	0.0099	0.00876	0.00122	0.00249

DEARBORN			AIRS ID: 261630033				Units: µg/m³	
Chemical Name	**MDL**	**Obs > MDL**	**# Obs**	**Max1**	**Max2**	**Max3**	**Min Mean**	**Max Mean**
Aluminum	0.0137	57	47	0.269	0.162	0.16	0.0403	0.0426
Ammonium Ion	0.126	58	58	6.5	5.2	5.17	1.77	1.77
Antimony	0.0113	57	10	0.0385	0.0268	0.0221	0.00227	0.0116
Arsenic	0.000959	57	43	0.0268	0.0138	0.00911	0.00251	0.0028
Barium	0.00964	57	19	0.118	0.0396	0.0239	0.0059	0.0106
Bromine	0.000824	57	51	0.022	0.0172	0.0107	0.00449	0.00453
Cadmium	0.005	57	16	0.0176	0.0148	0.0101	0.00145	0.0049
Calcium LC	0.00881	57	57	0.405	0.366	0.289	0.117	0.117
Cerium	0.00905	57	17	0.111	0.0731	0.0713	0.00724	0.0137
Cesium	0.00893	57	2	0.00548	0.00163	0	0.000125	0.00837
Chlorine	0.0102	57	33	0.617	0.589	0.404	0.0712	0.0748
Chromium	0.000941	57	27	0.0293	0.0104	0.00774	0.00209	0.00256
Cobalt	0.00121	57	8	0.00144	0.00139	0.00128	0.000124	0.00122
Copper	0.00123	57	53	0.0921	0.0382	0.0376	0.0126	0.0127
Elemental Carbon	0.289	57	56	2.01	1.93	1.89	0.842	0.846
Europium	0.00364	57	9	0.0359	0.0338	0.0325	0.00279	0.00598
Gallium	0.00102	57	22	0.00689	0.00234	0.00228	0.000442	0.00106
Gold	0.00194	57	10	0.00477	0.00432	0.00432	0.00043	0.00211
Hafnium	0.00616	57	16	0.0441	0.0301	0.0167	0.00255	0.00749
Indium	0.00585	57	18	0.0235	0.0149	0.0136	0.00282	0.00658
Iridium	0.00192	57	11	0.00455	0.00304	0.00273	0.000392	0.00196
Iron	0.0375	57	57	2.98	2.31	1.49	0.525	0.525
Lanthanium	0.00811	57	11	0.12	0.0719	0.0188	0.0046	0.00988
Magnesium	0.0086	57	30	0.368	0.321	0.173	0.0317	0.0344
Manganese	0.00207	57	55	0.211	0.0877	0.0866	0.0225	0.0225
Mercury	0.00235	57	15	0.00887	0.00874	0.00689	0.00108	0.00279
Molybdenum	0.00259	57	4	0.0117	0.00711	0.00269	0.000404	0.00271
Nickel	0.00056	57	49	0.0154	0.0117	0.00675	0.00224	0.00233
Niobium	0.0015	57	9	0.00338	0.00327	0.0021	0.000237	0.00145
Organic Carbon Peak1	0.325	57	57	3.38	3.04	2.91	1.46	1.46
Organic Carbon Peak2	0.309	57	57	2.34	1.85	1.84	1.19	1.19
Organic Carbon Peak3	0.292	57	57	2.3	1.64	1.47	0.895	0.895
Organic Carbon Peak4	0.285	57	57	2.26	2.04	1.89	0.774	0.774
Organic Carbon	0.508	57	57	10.1	8.04	6.9	4.32	4.32
Organic Carbon Pyrolytic	0.24	57	3	0.0107	0.00554	0.00047	0.000293	0.228
Phosphorus	0.00678	57	1	0.00117	0	0	0.0000205	0.00673
Potassium Ion	0.0181	58	46	3.25	1.73	0.871	0.223	0.225
Potassium	0.0164	57	57	2.92	1.7	0.918	0.221	0.221
Rubidium	0.000806	57	36	0.0131	0.00746	0.00745	0.00142	0.00167
Samarium	0.00245	57	5	0.0283	0.00443	0.00408	0.000746	0.00297
Scandium	0.00538	57	2	0.00361	0.00152	0	0.00009	0.00542
Selenium	0.000899	57	48	0.00904	0.00875	0.00875	0.00236	0.00247
Silicon	0.0125	57	56	0.481	0.341	0.319	0.114	0.114
Silver	0.00409	57	15	0.0142	0.0111	0.00734	0.00139	0.00439
Sodium Ion	0.0499	58	56	0.522	0.388	0.311	0.109	0.111
Sodium	0.0333	57	37	1.22	0.763	0.527	0.101	0.114
Strantium	0.00115	57	46	0.042	0.0114	0.00887	0.0026	0.00284
Sulfate	0.255	58	58	15.1	11.7	9.93	3.58	3.58
Sulfur	0.0779	57	57	4.7	3.71	2.96	1.09	1.09
Tantalum	0.00468	57	13	0.00862	0.00828	0.00781	0.000797	0.00441
Terbium	0.00814	57	11	0.0394	0.0377	0.0318	0.00294	0.00899
Tin	0.00797	57	17	0.0347	0.0245	0.0174	0.00281	0.00826
Titatium	0.00188	57	30	0.0343	0.0251	0.0188	0.0047	0.00567
Total Nitrate	0.181	58	58	9.43	8.11	7.77	2.53	2.53
Tungsten	0.00357	57	26	0.0564	0.0479	0.0215	0.00382	0.00562
Vanadium	0.00132	57	49	0.0209	0.0197	0.0189	0.00607	0.00627
Yttrium	0.00103	57	23	0.00287	0.00279	0.00276	0.000442	0.00103
Zinc	0.0115	57	57	2.24	0.996	0.919	0.159	0.159
Zirconium	0.00216	57	20	0.0091	0.00806	0.00769	0.00122	0.00247

GRAND RAPIDS - Monroe			AIRS ID: 260810020				Units: µg/m³	
Chemical Name	**MDL**	**Obs > MDL**	**# Obs**	**Max1**	**Max2**	**Max3**	**Min Mean**	**Max Mean**
Aluminum	0.0124	60	27	0.221	0.085	0.0712	0.0148	0.0215
Ammonium Ion	0.116	60	60	6.23	4.5	4.14	1.64	1.64
Antimony	0.0117	60	18	0.0595	0.0421	0.0397	0.00573	0.0137
Arsenic	0.0008	60	36	0.00602	0.00576	0.00498	0.00113	0.00152
Barium	0.00831	60	18	0.0388	0.0268	0.0187	0.0033	0.00717
Bromine	0.000741	60	50	0.0107	0.0106	0.00857	0.00281	0.00291
Cadmium	0.00489	60	14	0.0173	0.0163	0.0102	0.00135	0.00488
Calcium LC	0.00321	60	59	0.101	0.086	0.0809	0.0299	0.03
Cerium	0.00932	60	5	0.0197	0.00478	0.00245	0.000474	0.00754
Cesium	0.00788	60	4	0.0241	0.0222	0.0111	0.00103	0.0076
Chlorine	0.00624	60	23	0.139	0.0575	0.0511	0.00915	0.0138
Chromium	0.000929	60	41	0.0627	0.00572	0.00516	0.00258	0.00287
Cobalt	0.000664	60	17	0.00163	0.00109	0.00104	0.000134	0.00061
Copper	0.00102	60	58	0.0555	0.0215	0.0198	0.00922	0.00925
Elemental Carbon	0.275	60	60	1.75	1.17	1.07	0.61	0.61
Europium	0.00257	60	10	0.0467	0.0131	0.0124	0.00169	0.00391
Gallium	0.00102	60	39	0.00477	0.00299	0.00244	0.000648	0.00101
Gold	0.00156	60	18	0.00443	0.00365	0.00327	0.000426	0.00142
Hafnium	0.0066	60	10	0.00362	0.0021	0.00175	0.000224	0.00563
Indium	0.00569	60	18	0.0259	0.0224	0.0108	0.00232	0.0061
Iridium	0.00184	60	15	0.00513	0.00268	0.00268	0.000429	0.00179
Iron	0.00628	60	60	0.67	0.321	0.18	0.0852	0.0852
Lanthanium	0.00779	60	10	0.015	0.00897	0.00642	0.000824	0.00559
Magnesium	0.0072	60	20	0.155	0.0576	0.0509	0.0113	0.0154
Manganese	0.000933	60	54	0.028	0.0197	0.019	0.0049	0.00498
Mercury	0.00224	60	19	0.0084	0.00769	0.00677	0.00112	0.00263
Molybdenum	0.00252	60	5	0.00443	0.00163	0.00163	0.000157	0.00238
Nickel	0.000557	60	47	0.0212	0.00257	0.00237	0.000933	0.00106
Niobium	0.00145	60	7	0.0124	0.00653	0.00433	0.00053	0.00172
Organic Carbon Peak1	0.296	60	60	2.68	2.18	2.03	0.965	0.965
Organic Carbon Peak2	0.309	60	60	2.73	2.45	1.91	1.2	1.2
Organic Carbon Peak3	0.291	60	60	2.27	2.02	1.81	0.896	0.896
Organic Carbon Peak4	0.28	60	59	1.85	1.8	1.7	0.695	0.699
Organic Carbon	0.471	60	60	9.25	8.57	6.79	3.76	3.76
Organic Carbon Pyrolytic	0.24	60	3	0.019	0.0051	0.00048	0.00041	0.228
Phosphorus	0.00682	60	5	0.0222	0.0141	0.00338	0.000669	0.00718
Potassium Ion	0.0104	60	24	1.73	0.239	0.151	0.0611	0.067
Potassium	0.00702	60	60	1.68	0.241	0.155	0.0839	0.0839
Rubidium	0.000759	60	29	0.0049	0.00396	0.00362	0.00051	0.000856
Samarium	0.00236	60	5	0.0209	0.00338	0.00187	0.000465	0.00268
Scandium	0.00471	60	3	0.00163	0.00163	0.00117	0.0000738	0.00472
Selenium	0.000881	60	44	0.0049	0.00418	0.00408	0.00118	0.00141
Silicon	0.00837	60	57	0.266	0.213	0.156	0.0487	0.0492
Silver	0.00415	60	19	0.0149	0.0113	0.00748	0.00149	0.00425
Sodium Ion	0.0465	60	53	0.225	0.219	0.132	0.0473	0.0515
Sodium	0.0266	60	29	0.155	0.14	0.104	0.021	0.0361
Strantium	0.00115	60	37	0.0257	0.00795	0.00385	0.00135	0.0018
Sulfate	0.191	60	60	9.98	9.67	9.29	2.67	2.67
Sulfur	0.0659	60	60	3.25	3.23	3.16	0.925	0.925
Tantalum	0.00467	60	19	0.0106	0.00817	0.00699	0.00114	0.00403
Terbium	0.0036	60	10	0.0132	0.00921	0.00747	0.000982	0.00391
Tin	0.0075	60	12	0.0323	0.0133	0.00946	0.00158	0.00735
Titatium	0.00178	60	26	0.0154	0.0109	0.00758	0.00153	0.00262
Total Nitrate	0.177	60	60	9.66	8.79	7.85	2.47	2.47
Tungsten	0.00255	60	25	0.00745	0.00712	0.00548	0.00109	0.0025
Vanadium	0.00123	60	40	0.00454	0.0042	0.00362	0.00112	0.00159
Yttrium	0.00104	60	23	0.00287	0.00223	0.00196	0.000474	0.0011
Zinc	0.00159	60	60	0.0565	0.0456	0.0436	0.0182	0.0182
Zirconium	0.00229	60	20	0.011	0.0106	0.00933	0.00137	0.00267

HOLLAND			AIRS ID: 260050003			Units: µg/m³		
Chemical Name	MDL	Obs > MDL	# Obs	Max1	Max2	Max3	Min Mean	Max Mean
Aluminum	0.0112	15	3	0.0199	0.0117	0.0114	0.00287	0.0118
Ammonium Ion	0.159	15	15	6.2	3.62	3.53	2.24	2.24
Antimony	0.0108	15	2	0.0455	0.0107	0	0.00375	0.013
Arsenic	0.000716	15	12	0.00385	0.00267	0.00239	0.000995	0.00119
Barium	0.011	15	5	0.0163	0.0138	0.0117	0.00357	0.0106
Bromine	0.000774	15	15	0.00852	0.00654	0.00533	0.00313	0.00313
Cadmium	0.00468	15	5	0.0145	0.0142	0.00584	0.00264	0.00563
Calcium LC	0.00269	15	15	0.0439	0.0399	0.0234	0.0173	0.0173
Cerium	0.00897	15	3	0.0833	0.00222	0.0014	0.00579	0.0114
Cesium	0.00865	15	3	0.0584	0.0196	0.00373	0.00545	0.0111
Chlorine	0.00558	15	7	0.0183	0.0134	0.011	0.00491	0.00885
Chromium	0.000918	15	8	0.0105	0.0076	0.00375	0.00177	0.00221
Cobalt	0.000573	15	10	0.00148	0.00128	0.00042	0.000323	0.000523
Copper	0.000824	15	9	0.0081	0.00355	0.00319	0.00157	0.00188
Elemental Carbon	0.262	15	15	1.15	0.565	0.498	0.357	0.357
Europium	0.00209	15	4	0.00373	0.00222	0.00186	0.000567	0.00223
Gallium	0.0012	15	11	0.0042	0.00187	0.00165	0.000867	0.00111
Gold	0.00173	15	6	0.00327	0.00226	0.002	0.000673	0.0018
Hafnium	0.00857	15	7	0.00339	0.00338	0.00304	0.000857	0.0053
Indium	0.00508	15	3	0.011	0.00841	0.0007	0.00134	0.00522
Iridium	0.00193	15	3	0.00177	0.00094	0.00035	0.000204	0.00178
Iron	0.00309	15	15	0.11	0.0715	0.064	0.0405	0.0405
Lanthanium	0.00756	15	3	0.0389	0.02	0.00665	0.00437	0.007
Magnesium	0.0072	15	3	0.0121	0.0113	0.00093	0.00162	0.00642
Manganese	0.000773	15	14	0.00562	0.00538	0.00525	0.00261	0.00266
Mercury	0.00224	15	10	0.00758	0.00571	0.00526	0.00232	0.00286
Molybdenum	0.00304	15	1	0.00035	0	0	0.0000233	0.00278
Nickel	0.000577	15	8	0.00295	0.00206	0.00103	0.000586	0.00085
Niobium	0.00154	15	3	0.00572	0.00233	0.00023	0.000552	0.00163
Organic Carbon Peak1	0.271	15	15	1.08	0.903	0.844	0.541	0.541
Organic Carbon Peak2	0.288	15	15	1.87	1.28	1.1	0.843	0.843
Organic Carbon Peak3	0.273	15	15	1.3	0.801	0.705	0.553	0.553
Organic Carbon Peak4	0.269	15	15	1.39	1.13	0.75	0.509	0.509
Organic Carbon	0.385	15	15	5.63	3.93	3.39	2.45	2.45
Organic Carbon Pyrolytic	0.24	15	0	0	0	0	0	0.24
Phosphorus	0.00663	15	1	0.00024	0	0	0.000016	0.00651
Potassium Ion	0.00721	15	8	0.0878	0.077	0.0589	0.0289	0.0337
Potassium	0.0045	15	15	0.0975	0.0806	0.0639	0.0494	0.0494
Rubidium	0.000823	15	10	0.00385	0.00257	0.00117	0.000775	0.000947
Samarium	0.00211	15	3	0.00443	0.00175	0.00011	0.000419	0.0021
Scandium	0.00352	15	1	0.00058	0	0	0.0000387	0.00349
Selenium	0.00105	15	11	0.00304	0.00257	0.00229	0.00105	0.00128
Silicon	0.00611	15	15	0.0627	0.0599	0.0453	0.029	0.029
Silver	0.00432	15	7	0.0121	0.00887	0.00642	0.00295	0.00507
Sodium Ion	0.049	15	13	0.0729	0.0694	0.0453	0.0289	0.0323
Sodium	0.0363	15	3	0.049	0.049	0.00699	0.007	0.0397
Strantium	0.00104	15	13	0.00525	0.0035	0.00225	0.00151	0.00159
Sulfate	0.196	15	15	9.04	4.59	4.16	2.75	2.75
Sulfur	0.0656	15	15	3.05	1.55	1.32	0.912	0.912
Tantalum	0.00439	15	5	0.0147	0.00606	0.00128	0.00159	0.00417
Terbium	0.0027	15	6	0.00152	0.00128	0.00058	0.000287	0.00197
Tin	0.00706	15	4	0.0123	0.0116	0.00839	0.00225	0.00711
Titatium	0.00173	15	6	0.00783	0.00443	0.00175	0.000996	0.00208
Total Nitrate	0.299	15	15	9.15	7.87	7.14	4.19	4.19
Tungsten	0.00263	15	7	0.00605	0.00383	0.0028	0.00118	0.00252
Vanadium	0.00127	15	10	0.00397	0.00351	0.0021	0.00118	0.00169
Yttrium	0.00113	15	8	0.00537	0.00263	0.00245	0.00107	0.00156
Zinc	0.00108	15	14	0.0251	0.0194	0.0151	0.0104	0.0104
Zirconium	0.0014	15	5	0.00758	0.00676	0.0056	0.00167	0.00252

HOUGHTON LAKE		AIRS ID: 261130001				Units: µg/m³		
Chemical Name	**MDL**	**Obs > MDL**	**# Obs**	**Max1**	**Max2**	**Max3**	**Min Mean**	**Max Mean**
Aluminum	0.0117	53	27	0.116	0.0526	0.0525	0.0134	0.0192
Ammonium Ion	0.0592	53	53	2.82	2.81	2.75	0.84	0.84
Antimony	0.0116	53	8	0.0233	0.0152	0.0138	0.00136	0.0114
Arsenic	0.000778	53	28	0.00374	0.00303	0.00276	0.000582	0.000995
Barium	0.0084	53	15	0.0899	0.0301	0.0205	0.00402	0.00762
Bromine	0.000743	53	41	0.0144	0.00817	0.00743	0.00199	0.00211
Cadmium	0.00508	53	21	0.00793	0.00781	0.00771	0.00132	0.00423
Calcium LC	0.00252	53	43	0.0747	0.0537	0.0493	0.014	0.0143
Cerium	0.00859	53	6	0.0262	0.00629	0.00117	0.00067	0.00729
Cesium	0.00858	53	5	0.0532	0.0493	0.0244	0.00278	0.00973
Chlorine	0.00504	53	12	0.0302	0.00863	0.0084	0.00171	0.00608
Chromium	0.000842	53	36	0.00872	0.00862	0.00853	0.00154	0.00182
Cobalt	0.000545	53	21	0.00097	0.00093	0.00085	0.000144	0.000483
Copper	0.000721	53	43	0.023	0.0171	0.00713	0.00294	0.00309
Elemental Carbon	0.253	53	49	0.883	0.762	0.632	0.213	0.231
Europium	0.00209	53	7	0.00653	0.00338	0.00198	0.000275	0.00215
Gallium	0.00102	53	29	0.00513	0.00315	0.00265	0.000722	0.00112
Gold	0.00168	53	23	0.00991	0.00746	0.00373	0.000782	0.00172
Hafnium	0.0053	53	5	0.00676	0.00349	0.00117	0.000251	0.00498
Indium	0.00581	53	9	0.0231	0.0169	0.0148	0.00193	0.00664
Iridium	0.00201	53	13	0.00477	0.00361	0.0028	0.000483	0.00204
Iron	0.00199	53	48	0.079	0.0775	0.0725	0.0229	0.0229
Lanthanium	0.00725	53	4	0.0509	0.0495	0.00222	0.00196	0.00675
Magnesium	0.00665	53	15	0.0434	0.0387	0.0328	0.00472	0.00857
Manganese	0.000719	53	44	0.00311	0.00265	0.00262	0.00109	0.00123
Mercury	0.00232	53	10	0.00758	0.0049	0.00478	0.000726	0.00257
Molybdenum	0.00261	53	4	0.00617	0.00432	0.00409	0.000288	0.00258
Nickel	0.000508	53	34	0.00396	0.0034	0.00231	0.000543	0.000734
Niobium	0.00156	53	13	0.00862	0.00642	0.00595	0.000834	0.00189
Organic Carbon Peak1	0.266	53	53	1.41	1.05	0.991	0.434	0.434
Organic Carbon Peak2	0.296	53	53	3.47	1.82	1.69	0.962	0.962
Organic Carbon Peak3	0.276	53	53	1.94	1.4	1.29	0.626	0.626
Organic Carbon Peak4	0.262	53	50	1.61	1.4	1.35	0.381	0.395
Organic Carbon	0.384	53	53	7.19	5.82	4.97	2.41	2.41
Organic Carbon Pyrolytic	0.24	53	9	0.0455	0.033	0.0302	0.00322	0.202
Phosphorus	0.00583	53	2	0.0014	0.00117	0	0.0000485	0.0058
Potassium Ion	0.00865	53	17	0.206	0.116	0.11	0.0218	0.0286
Potassium	0.00381	53	52	0.208	0.105	0.105	0.0359	0.0359
Rubidium	0.000767	53	21	0.0035	0.00291	0.00245	0.000414	0.000793
Samarium	0.00214	53	11	0.00443	0.00291	0.00245	0.000378	0.00216
Scandium	0.00576	53	4	0.00198	0.00058	0.00024	0.0000574	0.00572
Selenium	0.000877	53	33	0.00945	0.00298	0.0029	0.000815	0.0011
Silicon	0.00713	53	42	0.167	0.154	0.15	0.0303	0.0314
Silver	0.0042	53	14	0.0145	0.0137	0.00793	0.00154	0.00462
Sodium Ion	0.0428	53	43	0.336	0.146	0.132	0.0446	0.0522
Sodium	0.0279	53	15	0.249	0.0958	0.0863	0.0138	0.0347
Strantium	0.00106	53	30	0.00339	0.00248	0.00239	0.000768	0.00124
Sulfate	0.132	53	53	7.78	4.76	4.32	1.83	1.83
Sulfur	0.0444	53	52	2.78	1.69	1.56	0.616	0.617
Tantalum	0.00421	53	16	0.00876	0.00771	0.00711	0.000883	0.00357
Terbium	0.00235	53	7	0.00361	0.0021	0.00199	0.00024	0.00231
Tin	0.00797	53	14	0.0212	0.0166	0.0114	0.00206	0.00763
Titatium	0.0017	53	22	0.00467	0.00466	0.0042	0.000898	0.00194
Total Nitrate	0.08	53	53	5.81	5.47	4.18	1.11	1.11
Tungsten	0.00248	53	17	0.0194	0.0139	0.00876	0.00153	0.00296
Vanadium	0.00119	53	26	0.00493	0.00348	0.00222	0.000602	0.00128
Yttrium	0.00106	53	23	0.0049	0.00443	0.00385	0.000738	0.00123
Zinc	0.000988	53	48	0.0252	0.0176	0.0154	0.00597	0.00605
Zirconium	0.00206	53	15	0.0141	0.00653	0.00455	0.000931	0.00222

KALAMAZOO			AIRS ID: 260770008				Units: µg/m³	
Chemical Name	MDL	Obs > MDL	# Obs	Max1	Max2	Max3	Min Mean	Max Mean
Aluminum	0.0113	51	31	0.0923	0.052	0.0502	0.0128	0.0169
Ammonium Ion	0.0922	51	51	3.86	3.49	3.29	1.3	1.3
Antimony	0.0121	51	10	0.0397	0.0291	0.0163	0.00238	0.0122
Arsenic	0.000806	51	37	0.00463	0.00416	0.00379	0.00142	0.00171
Barium	0.00762	51	11	0.0433	0.0188	0.0176	0.00269	0.00627
Bromine	0.000741	51	41	0.00975	0.00957	0.00885	0.00259	0.00268
Cadmium	0.00529	51	10	0.0111	0.0103	0.00781	0.000884	0.005
Calcium LC	0.00306	51	46	0.0968	0.0721	0.0677	0.0259	0.0261
Cerium	0.00827	51	7	0.0194	0.00478	0.00222	0.0006	0.00751
Cesium	0.00796	51	1	0.0317	0	0	0.000622	0.00823
Chlorine	0.00482	51	21	0.127	0.0267	0.0217	0.00624	0.00965
Chromium	0.000866	51	32	0.00853	0.00705	0.00413	0.00129	0.00162
Cobalt	0.000605	51	16	0.00152	0.00132	0.00115	0.000171	0.000594
Copper	0.000713	51	42	0.032	0.00657	0.00598	0.00272	0.00285
Elemental Carbon	0.271	51	50	1.38	1.32	1.13	0.538	0.543
Europium	0.00217	51	8	0.0127	0.00829	0.00665	0.000896	0.0028
Gallium	0.00097	51	29	0.00253	0.00238	0.00231	0.000493	0.000875
Gold	0.0016	51	19	0.00455	0.00397	0.00303	0.000485	0.00144
Hafnium	0.00508	51	9	0.00885	0.00374	0.00233	0.000418	0.00427
Indium	0.0059	51	10	0.0342	0.0258	0.0174	0.00234	0.00693
Iridium	0.00187	51	15	0.00596	0.0049	0.00314	0.000596	0.0018
Iron	0.00444	51	50	0.13	0.126	0.117	0.0579	0.0579
Lanthanium	0.00702	51	9	0.0113	0.0107	0.00524	0.000907	0.0049
Magnesium	0.00657	51	12	0.0934	0.041	0.0346	0.00591	0.0103
Manganese	0.000771	51	41	0.00528	0.00526	0.00473	0.00177	0.00194
Mercury	0.00232	51	21	0.0085	0.00513	0.00397	0.000981	0.00238
Molybdenum	0.00246	51	3	0.00851	0.00723	0.00011	0.000311	0.00254
Nickel	0.000504	51	37	0.00368	0.00259	0.00233	0.000615	0.00077
Niobium	0.00149	51	12	0.00898	0.00455	0.00443	0.000622	0.00162
Organic Carbon Peak1	0.286	51	51	2.09	1.96	1.91	0.797	0.797
Organic Carbon Peak2	0.308	51	51	2.35	2.31	2.18	1.17	1.17
Organic Carbon Peak3	0.286	51	51	1.96	1.8	1.29	0.798	0.798
Organic Carbon Peak4	0.278	51	50	2.61	1.76	1.67	0.652	0.657
Organic Carbon	0.45	51	51	8.56	6.54	5.96	3.42	3.42
Organic Carbon Pyrolytic	0.24	51	5	0.0424	0.0196	0.0194	0.002	0.218
Phosphorus	0.00696	51	4	0.0042	0.00409	0.00198	0.000222	0.00685
Potassium Ion	0.00974	51	23	1.15	0.182	0.182	0.0575	0.0629
Potassium	0.00642	51	51	1.25	0.179	0.168	0.078	0.078
Rubidium	0.000764	51	18	0.00443	0.00279	0.00168	0.000362	0.000828
Samarium	0.00224	51	15	0.00477	0.00361	0.0035	0.000558	0.00224
Scandium	0.00574	51	3	0.0007	0.00047	0.00046	0.000032	0.00569
Selenium	0.000842	51	36	0.00642	0.00571	0.00472	0.00126	0.00146
Silicon	0.00814	51	48	0.189	0.159	0.155	0.0452	0.0455
Silver	0.00453	51	19	0.0146	0.0125	0.01	0.00174	0.0046
Sodium Ion	0.0464	51	39	0.251	0.229	0.221	0.0414	0.051
Sodium	0.0239	51	20	0.0909	0.0876	0.0747	0.0144	0.0306
Strantium	0.0012	51	35	0.0174	0.0077	0.00304	0.0012	0.00165
Sulfate	0.192	51	51	9.24	8.58	7.27	2.68	2.68
Sulfur	0.0642	51	51	3.09	2.93	2.41	0.899	0.899
Tantalum	0.00359	51	15	0.0143	0.0108	0.0056	0.00111	0.00352
Terbium	0.00314	51	10	0.00513	0.00432	0.00385	0.000473	0.00294
Tin	0.00803	51	9	0.0268	0.0109	0.00853	0.00126	0.00759
Titatium	0.00178	51	20	0.0106	0.00805	0.00746	0.00153	0.00267
Total Nitrate	0.146	51	51	7.84	7.79	6.59	2.04	2.04
Tungsten	0.00239	51	12	0.00851	0.00502	0.0035	0.000679	0.00246
Vanadium	0.00123	51	33	0.00513	0.00421	0.00345	0.00105	0.00157
Yttrium	0.00101	51	17	0.00443	0.0026	0.00224	0.000421	0.00103
Zinc	0.00137	51	51	0.0598	0.0488	0.0289	0.0138	0.0138
Zirconium	0.00195	51	10	0.00572	0.00431	0.0028	0.000471	0.00188

SAULT STE. MARIE - Easterday		AIRS ID: 260330901					Units: µg/m³	
Chemical Name	**MDL**	**Obs > MDL**	**# Obs**	**Max1**	**Max2**	**Max3**	**Min Mean**	**Max Mean**
Aluminum	0.0112	15	3	0.0599	0.0228	0.00582	0.0059	0.0142
Ammonium Ion	0.087	15	15	5.07	2.56	1.68	1.22	1.22
Antimony	0.0114	15	5	0.0186	0.0151	0.00813	0.00331	0.0105
Arsenic	0.000665	15	8	0.00571	0.00246	0.00212	0.00101	0.00124
Barium	0.00917	15	4	0.0244	0.00743	0.00349	0.00246	0.00688
Bromine	0.000723	15	14	0.0119	0.00505	0.00476	0.00254	0.00256
Cadmium	0.00503	15	7	0.0207	0.0147	0.00965	0.00439	0.00662
Calcium LC	0.00375	15	15	0.105	0.1	0.091	0.0341	0.0341
Cerium	0.00869	15	2	0.00349	0.00058	0	0.000271	0.00857
Cesium	0.00764	15	1	0.00268	0	0	0.000179	0.00649
Chlorine	0.00619	15	10	0.173	0.091	0.0908	0.0286	0.031
Chromium	0.000895	15	10	0.0039	0.0028	0.00279	0.00146	0.00178
Cobalt	0.000719	15	7	0.00317	0.00095	0.00074	0.000418	0.000867
Copper	0.000829	15	12	0.00278	0.00253	0.00244	0.00118	0.00135
Elemental Carbon	0.255	15	15	0.37	0.363	0.354	0.255	0.255
Europium	0.00237	15	5	0.0224	0.0176	0.00651	0.00364	0.00535
Gallium	0.00114	15	9	0.00454	0.00192	0.00119	0.000775	0.00122
Gold	0.00168	15	8	0.00756	0.00383	0.00198	0.00121	0.00193
Hafnium	0.00887	15	7	0.0141	0.00349	0.00233	0.00167	0.00658
Indium	0.0052	15	2	0.00547	0.00535	0	0.000721	0.00504
Iridium	0.0018	15	8	0.00239	0.00232	0.00216	0.000715	0.00149
Iron	0.00834	15	15	0.477	0.46	0.257	0.112	0.112
Lanthanium	0.00731	15	2	0.00441	0.00058	0	0.000333	0.00532
Magnesium	0.00747	15	6	0.0364	0.0282	0.0186	0.00726	0.0117
Manganese	0.000883	15	13	0.0204	0.0085	0.00317	0.00316	0.00326
Mercury	0.00191	15	6	0.00571	0.0043	0.00409	0.0012	0.00227
Molybdenum	0.00297	15	1	0.00233	0	0	0.000155	0.00284
Nickel	0.000573	15	9	0.00142	0.00081	0.00075	0.000362	0.000588
Niobium	0.00145	15	2	0.00756	0.00175	0	0.000621	0.00171
Organic Carbon Peak1	0.272	15	15	1.18	1.02	0.706	0.557	0.557
Organic Carbon Peak2	0.283	15	15	1.25	1.08	0.994	0.76	0.76
Organic Carbon Peak3	0.272	15	15	0.945	0.917	0.761	0.555	0.555
Organic Carbon Peak4	0.266	15	15	1.11	0.948	0.719	0.469	0.469
Organic Carbon	0.379	15	15	4.29	3.62	3.07	2.34	2.34
Organic Carbon Pyrolytic	0.24	15	0	0	0	0	0	0.24
Phosphorus	0.00694	15	0	0	0	0	0	0.00694
Potassium Ion	0.00839	15	9	0.183	0.178	0.174	0.066	0.069
Potassium	0.00623	15	15	0.246	0.149	0.123	0.074	0.074
Rubidium	0.000822	15	10	0.00232	0.00203	0.00138	0.0006	0.000879
Samarium	0.00213	15	4	0.00511	0.00291	0.00128	0.000628	0.00229
Scandium	0.00359	15	1	0.0007	0	0	0.0000467	0.00355
Selenium	0.001	15	10	0.00349	0.00348	0.00233	0.000994	0.00128
Silicon	0.00675	15	13	0.0813	0.0674	0.0383	0.0235	0.0246
Silver	0.00445	15	6	0.0179	0.00941	0.00756	0.00353	0.00586
Sodium Ion	0.0446	15	15	0.137	0.123	0.116	0.0648	0.0648
Sodium	0.0304	15	6	0.0978	0.0922	0.0745	0.0232	0.0464
Strantium	0.000915	15	5	0.00243	0.00167	0.00117	0.000401	0.00101
Sulfate	0.174	15	15	10	3.55	3.03	2.43	2.43
Sulfur	0.0523	15	15	3.24	0.991	0.91	0.729	0.729
Tantalum	0.00415	15	7	0.0162	0.00547	0.00302	0.00192	0.00394
Terbium	0.00387	15	7	0.0223	0.0115	0.00337	0.00283	0.00487
Tin	0.00677	15	2	0.0317	0.00361	0	0.00235	0.00813
Titatium	0.00176	15	5	0.00221	0.00221	0.00128	0.000489	0.00174
Total Nitrate	0.0989	15	15	4.59	4.04	2.75	1.37	1.37
Tungsten	0.00257	15	7	0.0123	0.00523	0.00401	0.00208	0.00341
Vanadium	0.00132	15	8	0.00303	0.00267	0.00175	0.000752	0.00144
Yttrium	0.00107	15	7	0.00466	0.00112	0.00093	0.000527	0.00102
Zinc	0.00118	15	15	0.0612	0.0184	0.0116	0.0112	0.0112
Zirconium	0.00132	15	5	0.00664	0.00448	0.00213	0.0011	0.00194

LUNA PIER			AIRS ID: 261150005				Units: µg/m³	
Chemical Name	MDL	Obs > MDL	# Obs	Max1	Max2	Max3	Min Mean	Max Mean
Aluminum	0.0126	61	44	0.259	0.163	0.119	0.0295	0.0325
Ammonium Ion	0.111	61	61	6.83	5.59	3.95	1.56	1.56
Antimony	0.011	61	10	0.0433	0.0268	0.0119	0.00199	0.0113
Arsenic	0.000833	61	35	0.00714	0.00436	0.00359	0.000938	0.00135
Barium	0.00952	61	21	0.0792	0.0151	0.0128	0.00366	0.00792
Bromine	0.000803	61	49	0.0121	0.0107	0.00905	0.00287	0.00298
Cadmium	0.00497	61	18	0.0154	0.0152	0.012	0.0015	0.00481
Calcium LC	0.00619	61	59	1.88	0.16	0.142	0.0751	0.0752
Cerium	0.0102	61	7	0.182	0.0273	0.017	0.00406	0.0109
Cesium	0.00851	61	2	0.0298	0.0128	0	0.000698	0.00858
Chlorine	0.00739	61	24	1.38	0.0797	0.0348	0.028	0.0324
Chromium	0.000936	61	41	0.031	0.0236	0.0172	0.00306	0.00336
Cobalt	0.000656	61	15	0.00135	0.00128	0.00128	0.000165	0.000673
Copper	0.000727	61	51	0.00928	0.00898	0.0064	0.00218	0.00231
Elemental Carbon	0.273	61	61	1.45	1.37	1.33	0.575	0.575
Europium	0.00238	61	11	0.0106	0.0091	0.00664	0.000812	0.00284
Gallium	0.00107	61	29	0.00572	0.00571	0.00233	0.000579	0.00111
Gold	0.00168	61	20	0.0048	0.00279	0.00268	0.000479	0.00145
Hafnium	0.00618	61	14	0.0135	0.0063	0.00408	0.000828	0.00562
Indium	0.00571	61	11	0.0395	0.0128	0.0125	0.00173	0.00629
Iridium	0.00193	61	12	0.00303	0.00289	0.00246	0.000332	0.00182
Iron	0.00631	61	61	0.252	0.237	0.203	0.0803	0.0803
Lanthanium	0.00858	61	10	0.0404	0.0108	0.00957	0.00144	0.00751
Magnesium	0.00819	61	18	0.561	0.0686	0.0665	0.0157	0.02
Manganese	0.000847	61	51	0.0439	0.00873	0.00609	0.0027	0.00285
Mercury	0.00234	61	20	0.00863	0.00804	0.00734	0.00117	0.00264
Molybdenum	0.00261	61	8	0.00828	0.00654	0.00629	0.000641	0.00272
Nickel	0.000558	61	49	0.00934	0.00928	0.00894	0.00139	0.00151
Niobium	0.00154	61	13	0.00782	0.00782	0.00537	0.000681	0.00176
Organic Carbon Peak1	0.284	61	61	1.69	1.59	1.54	0.748	0.748
Organic Carbon Peak2	0.3	61	61	2.38	1.97	1.84	1.04	1.04
Organic Carbon Peak3	0.284	61	61	1.79	1.74	1.66	0.763	0.763
Organic Carbon Peak4	0.275	61	61	1.5	1.37	1.33	0.593	0.593
Organic Carbon	0.431	61	61	6.36	6.19	6.14	3.14	3.14
Organic Carbon Pyrolytic	0.24	61	7	0.0831	0.0381	0.016	0.00281	0.215
Phosphorus	0.00664	61	3	0.0172	0.00594	0.00315	0.000431	0.00681
Potassium Ion	0.00821	61	31	0.402	0.141	0.117	0.0382	0.0433
Potassium	0.00634	61	61	1.09	0.329	0.159	0.0768	0.0768
Rubidium	0.000805	61	35	0.00513	0.00361	0.00306	0.000592	0.000847
Samarium	0.00231	61	16	0.00851	0.00547	0.00478	0.00085	0.00269
Scandium	0.00491	61	6	0.00198	0.00152	0.00117	0.000103	0.00489
Selenium	0.000984	61	50	0.0246	0.0146	0.0142	0.0031	0.00327
Silicon	0.00952	61	58	0.251	0.235	0.223	0.0681	0.0684
Silver	0.00419	61	22	0.014	0.0129	0.0117	0.00234	0.00495
Sodium Ion	0.0461	61	55	0.16	0.157	0.153	0.0507	0.0545
Sodium	0.0292	61	29	0.813	0.192	0.174	0.0361	0.0553
Strantium	0.00119	61	43	0.0139	0.0118	0.00781	0.00153	0.00189
Sulfate	0.211	61	61	15.3	12.2	7.15	2.95	2.95
Sulfur	0.0708	61	61	4.98	3.74	2.66	0.992	0.992
Tantalum	0.00415	61	11	0.00862	0.00758	0.0063	0.000682	0.00398
Terbium	0.0036	61	5	0.00502	0.00501	0.0035	0.000323	0.00361
Tin	0.00768	61	17	0.0221	0.0138	0.0134	0.00166	0.00692
Titatium	0.00175	61	26	0.0394	0.00897	0.00851	0.00211	0.00318
Total Nitrate	0.15	61	61	8.82	8.28	8.22	2.1	2.1
Tungsten	0.00261	61	16	0.00887	0.00887	0.00722	0.0011	0.0029
Vanadium	0.00132	61	40	0.103	0.0101	0.00874	0.00349	0.00395
Yttrium	0.00109	61	28	0.00432	0.00396	0.00237	0.000612	0.00112
Zinc	0.00139	61	61	0.0358	0.0311	0.0297	0.0137	0.0137
Zirconium	0.00221	61	22	0.0148	0.00954	0.00891	0.00143	0.00275

YPSILANTI			AIRS ID: 261610008				Units: µg/m³	
Chemical Name	**MDL**	**Obs > MDL**	**# Obs**	**Max1**	**Max2**	**Max3**	**Min Mean**	**Max Mean**
Aluminum	0.0115	61	38	0.113	0.0723	0.0561	0.0138	0.0178
Ammonium Ion	0.102	60	60	5.91	4.22	4.04	1.43	1.43
Antimony	0.012	61	18	0.0688	0.0337	0.0315	0.0047	0.0131
Arsenic	0.000685	61	41	0.0136	0.00549	0.00431	0.00137	0.00158
Barium	0.0083	61	21	0.0547	0.021	0.018	0.00329	0.00679
Bromine	0.000685	61	51	0.00789	0.00586	0.00544	0.0022	0.00228
Cadmium	0.00514	61	17	0.0287	0.0148	0.0142	0.00198	0.00539
Calcium LC	0.00294	61	59	0.139	0.109	0.0777	0.0236	0.0236
Cerium	0.00849	61	5	0.00408	0.0035	0.00245	0.000199	0.00843
Cesium	0.00826	61	8	0.0135	0.00584	0.00583	0.000655	0.00668
Chlorine	0.00549	61	20	0.0814	0.0526	0.0475	0.0063	0.0107
Chromium	0.00086	61	37	0.00531	0.00499	0.00483	0.00136	0.00172
Cobalt	0.000589	61	20	0.00222	0.00152	0.00049	0.000133	0.000547
Copper	0.000714	61	51	0.0247	0.00686	0.00518	0.00226	0.00239
Elemental Carbon	0.264	61	59	1.09	0.973	0.832	0.422	0.43
Europium	0.00237	61	6	0.0099	0.00537	0.00174	0.000338	0.00253
Gallium	0.000944	61	33	0.00345	0.00223	0.00193	0.000467	0.000949
Gold	0.00153	61	21	0.00549	0.00384	0.00315	0.000524	0.0015
Hafnium	0.0059	61	8	0.00537	0.00315	0.00302	0.000331	0.00548
Indium	0.00591	61	19	0.0128	0.0126	0.00781	0.00147	0.0054
Iridium	0.00177	61	14	0.0071	0.00551	0.00477	0.000621	0.00195
Iron	0.00352	61	61	0.146	0.112	0.104	0.0458	0.0458
Lanthanium	0.00722	61	12	0.0159	0.0105	0.00781	0.00102	0.00475
Magnesium	0.00641	61	13	0.0611	0.0333	0.0262	0.00421	0.00878
Manganese	0.000769	61	49	0.00878	0.00574	0.00556	0.00174	0.00191
Mercury	0.0024	61	23	0.00876	0.00838	0.00733	0.00127	0.00272
Molybdenum	0.00248	61	2	0.00407	0.0007	0	0.0000782	0.00245
Nickel	0.00052	61	45	0.00562	0.00321	0.00307	0.000797	0.000943
Niobium	0.00144	61	12	0.0042	0.00328	0.0028	0.000337	0.00139
Organic Carbon Peak1	0.284	61	61	1.76	1.66	1.64	0.765	0.765
Organic Carbon Peak2	0.3	61	61	1.83	1.83	1.79	1.05	1.05
Organic Carbon Peak3	0.284	61	61	1.47	1.36	1.31	0.77	0.77
Organic Carbon Peak4	0.274	61	61	1.76	1.49	1.22	0.572	0.572
Organic Carbon	0.432	61	61	6.19	5.16	5.12	3.16	3.16
Organic Carbon Pyrolytic	0.24	61	4	0.051	0.025	0.0204	0.00188	0.226
Phosphorus	0.00648	61	1	0.00527	0	0	0.0000864	0.00647
Potassium Ion	0.00919	60	25	0.813	0.134	0.124	0.0353	0.0416
Potassium	0.00493	61	61	0.821	0.103	0.0947	0.0549	0.0549
Rubidium	0.000723	61	25	0.0019	0.00145	0.00145	0.00031	0.000741
Samarium	0.00227	61	10	0.00511	0.00395	0.00233	0.000348	0.00234
Scandium	0.00537	61	5	0.00093	0.00058	0.00035	0.0000382	0.00521
Selenium	0.000806	61	43	0.005	0.00477	0.00445	0.00108	0.00129
Silicon	0.0075	61	57	0.139	0.11	0.0995	0.0356	0.036
Silver	0.00434	61	24	0.0221	0.0128	0.01	0.00237	0.00499
Sodium Ion	0.0435	60	52	0.251	0.177	0.134	0.0517	0.0552
Sodium	0.0248	61	25	0.109	0.0906	0.0792	0.016	0.0313
Strantium	0.00114	61	40	0.0128	0.0065	0.00537	0.00118	0.00154
Sulfate	0.185	60	60	12.8	8.21	7.04	2.59	2.59
Sulfur	0.0607	61	61	3.5	3.45	2.3	0.853	0.853
Tantalum	0.00422	61	22	0.0128	0.00618	0.00615	0.00102	0.00362
Terbium	0.00298	61	7	0.0121	0.0101	0.00944	0.00075	0.00335
Tin	0.00792	61	14	0.0283	0.0239	0.0223	0.00261	0.00847
Titatium	0.00173	61	22	0.00536	0.00432	0.00374	0.000754	0.00192
Total Nitrate	0.139	59	59	9.59	8.11	7.59	1.95	1.95
Tungsten	0.00238	61	13	0.00327	0.00311	0.00291	0.000351	0.00223
Vanadium	0.0012	61	40	0.00552	0.00537	0.00502	0.000995	0.00143
Yttrium	0.00101	61	22	0.00326	0.00279	0.00188	0.000397	0.001
Zinc	0.00119	61	61	0.0293	0.0287	0.0286	0.011	0.011
Zirconium	0.002	61	20	0.00582	0.0042	0.00418	0.00069	0.00193

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
$PM_{10-2.5}$	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

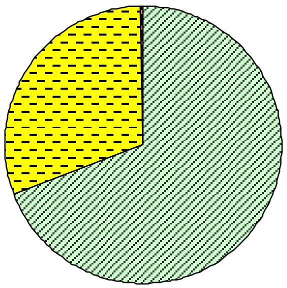
APPENDIX E: AQI PIE CHARTS

Appendix E contains pie charts that were created to show the AQI values for each of Michigan's 2006 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. The remaining sites (not part of a CSA) are divided by whether they are located in Michigan's Lower Peninsula or Upper Peninsula (**Figures 5** and **6**, respectively):

- **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-6** – Michigan's Upper Peninsula Area AQI Summaries

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

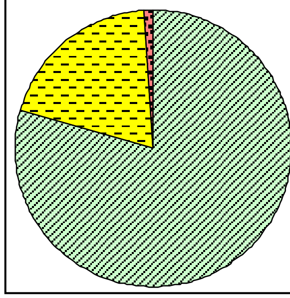
2006 AQI Summary for Allen Park
TOTAL DAYS WITH AQI VALUES = 365



- Good Days - 253
- Moderate Days - 111
- Unhealthy/Sensitives - 1
- Unhealthy Days - 0

AQI POLLUTANT SUMMARY
CO = 10 O_3 = 62 SO_2 = 0
NO_2 = 0 $PM_{2.5}$ = 291 PM_{10} = 2

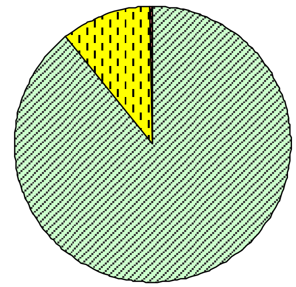
2006 AQI Summary for Dearborn
TOTAL DAYS WITH AQI VALUES = 359



- Good Days -285
- Moderate Days - 70
- Unhealthy/Sensitives - 4
- Unhealthy Days - 0

AQI POLLUTANT SUMMARY
CO = 0 O_3 = 0 SO_2 = 0
NO_2 = 0 $PM_{2.5}$ = 104 PM_{10} = 255

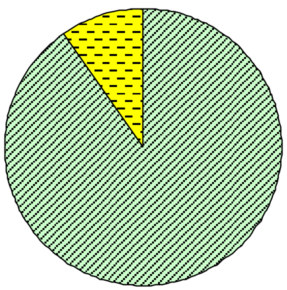
2006 AQI Summary for E. Seven Mile
TOTAL DAYS WITH AQI VALUES = 352



- Good Days - 314
- Moderate Days - 37
- Unhealthy/Sensitives - 1
- Unhealthy Days - 0

AQI POLLUTANT SUMMARY
CO = 0 O_3 = 168 SO_2 = 126
NO_2 = 0 $PM_{2.5}$ = 58 PM_{10} = 0

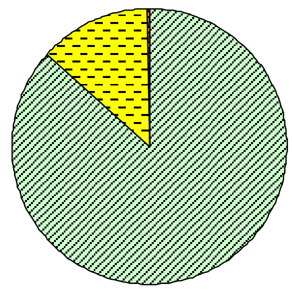
2006 AQI Summary for Flint
TOTAL DAYS WITH AQI VALUES = 358



- Good Days - 323
- Moderate Days - 35
- Unhealthy/Sensitives - 0
- Unhealthy Days - 0

AQI POLLUTANT SUMMARY
CO = 0 O_3 = 158 SO_2 = 117
NO_2 = 0 $PM_{2.5}$ = 82 PM_{10} = 1

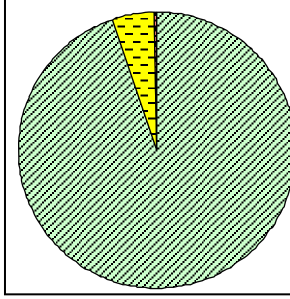
2006 AQI Summary for Linwood
TOTAL DAYS WITH AQI VALUES = 365



- Good Days - 317
- Moderate Days - 47
- Unhealthy/Sensitives - 1
- Unhealthy Days - 0

AQI POLLUTANT SUMMARY
CO = 47 O_3 = 165 SO_2 = 43
NO_2 = 0 $PM_{2.5}$ = 110 PM_{10} = 0

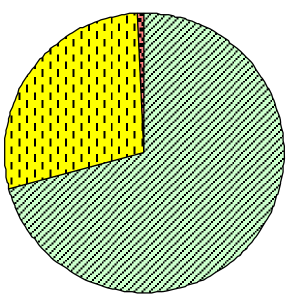
2006 AQI Summary for Livonia
TOTAL DAYS WITH AQI VALUES = 365



- Good Days - 346
- Moderate Days - 18
- Unhealthy/Sensitives - 1
- Unhealthy Days - 0

AQI POLLUTANT SUMMARY
CO = 293 O_3 = 0 SO_2 = 0
NO_2 = 0 $PM_{2.5}$ = 72 PM_{10} = 0

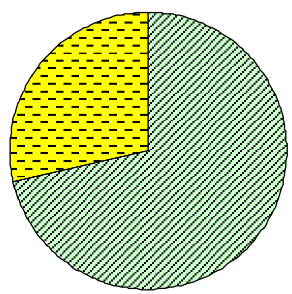
2006 AQI Summary for Luna Pier
TOTAL DAYS WITH AQI VALUES = 116



- Good Days - 82
- Moderate Days - 33
- Unhealthy/Sensitives - 1
- Unhealthy Days - 0

AQI POLLUTANT SUMMARY
CO = 0 O_3 = 0 SO_2 = 0
NO_2 = 0 $PM_{2.5}$ = 116 PM_{10} = 0

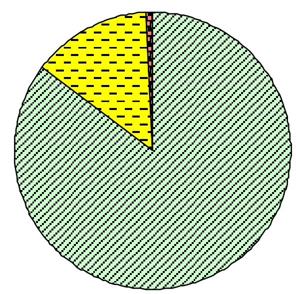
2006 AQI Summary for Newberry
TOTAL DAYS WITH AQI VALUES = 84



- Good Days - 60
- Moderate Days - 24
- Unhealthy/Sensitives - 0
- Unhealthy Days - 0

AQI POLLUTANT SUMMARY
CO = 24 O_3 = 0 SO_2 = 0
NO_2 = 0 $PM_{2.5}$ = 84 PM_{10} = 0

2006 AQI Summary for New Haven
TOTAL DAYS WITH AQI VALUES = 229

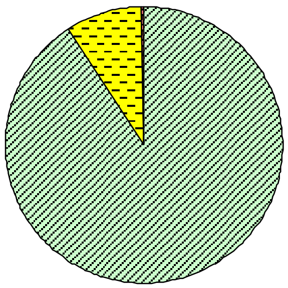


- Good Days - 195
- Moderate Days - 32
- Unhealthy/Sensitives - 2
- Unhealthy Days - 0

AQI POLLUTANT SUMMARY
CO = 0 O_3 = 177 SO_2 = 0
NO_2 = 0 $PM_{2.5}$ = 52 PM_{10} = 0

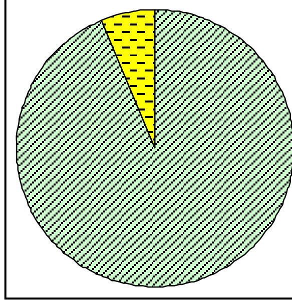
FIGURE E-1: AQI SUMMARIES FOR DETROIT-WARREN-FLINT CSA (CONTINUED)

2006 AQI Summary for Oak Park
TOTAL DAYS WITH AQI VALUES = 355



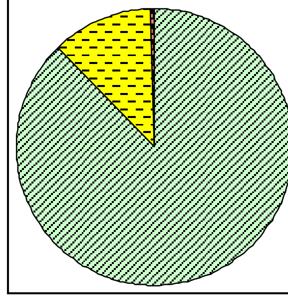
AQI POLLUTANT SUMMARY
CO = 135 O_3 = 163 SO_2 = 0
NO_2 = 0 $PM_{2.5}$ = 57 PM_{10} = 0

2006 AQI Summary for Otisville
TOTAL DAYS WITH AQI VALUES = 184



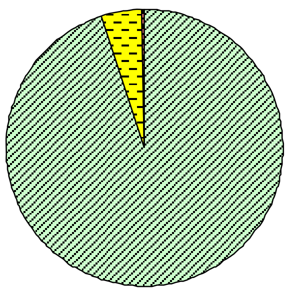
AQI POLLUTANT SUMMARY
CO = 0 O_3 = 184 SO_2 = 0
NO_2 = 0 $PM_{2.5}$ = 0 PM_{10} = 0

2006 AQI Summary for Port Huron
TOTAL DAYS WITH AQI VALUES = 365



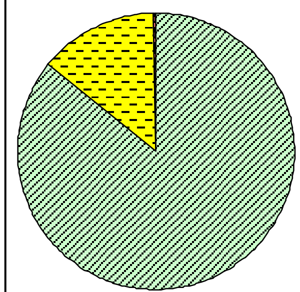
AQI POLLUTANT SUMMARY
CO = 0 O_3 = 164 SO_2 = 142
NO_2 = 0 $PM_{2.5}$ = 59 PM_{10} = 0

2006 AQI Summary for Warren
TOTAL DAYS WITH AQI VALUES = 365



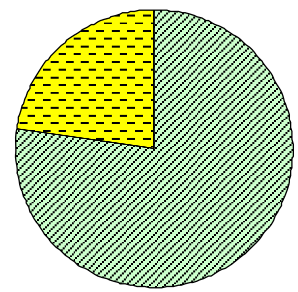
AQI POLLUTANT SUMMARY
CO = 123 O_3 = 183 SO_2 = 59
NO_2 = 0 $PM_{2.5}$ = 0 PM_{10} = 0

2006 AQI Summary for W. Fort Street
TOTAL DAYS WITH AQI VALUES = 362



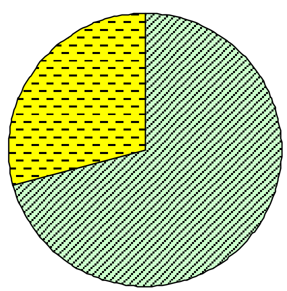
AQI POLLUTANT SUMMARY
CO = 0 O_3 = 242 SO_2 = 31
NO_2 = 0 $PM_{2.5}$ = 86 PM_{10} = 3

2006 AQI Summary for W. Lafayette
TOTAL DAYS WITH AQI VALUES = 180



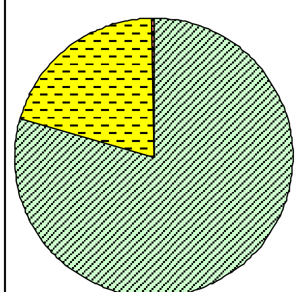
AQI POLLUTANT SUMMARY
CO = 60 O_3 = 0 SO_2 = 0
NO_2 = 0 $PM_{2.5}$ = 120 PM_{10} = 0

2006 AQI Summary for Wyandotte
TOTAL DAYS WITH AQI VALUES = 113



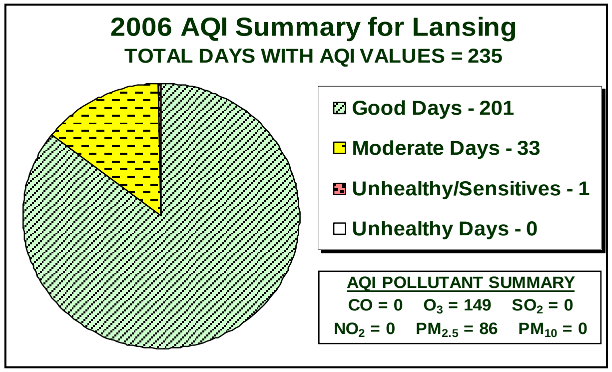
AQI POLLUTANT SUMMARY
CO = 0 O_3 = 0 SO_2 = 0
NO_2 = 0 $PM_{2.5}$ = 113 PM_{10} = 0

2006 AQI Summary for Ypsilanti
TOTAL DAYS WITH AQI VALUES = 233



AQI POLLUTANT SUMMARY
CO = 0 O_3 = 146 SO_2 = 0
NO_2 = 0 $PM_{2.5}$ = 87 PM_{10} = 0

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



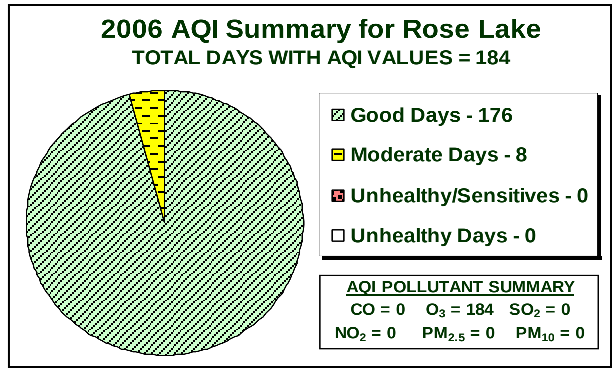
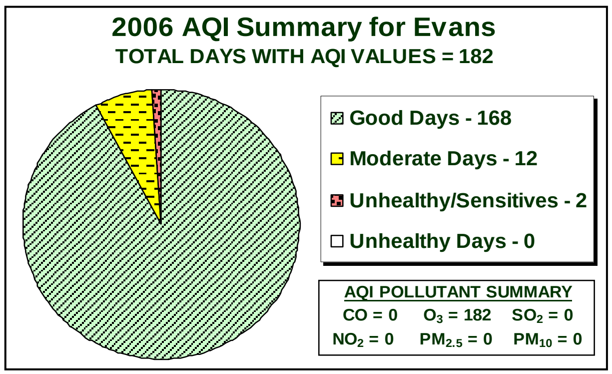
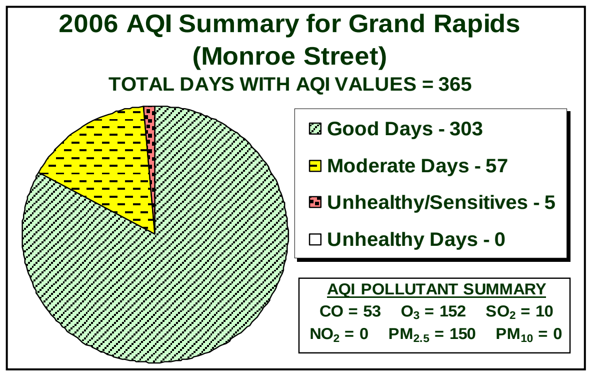
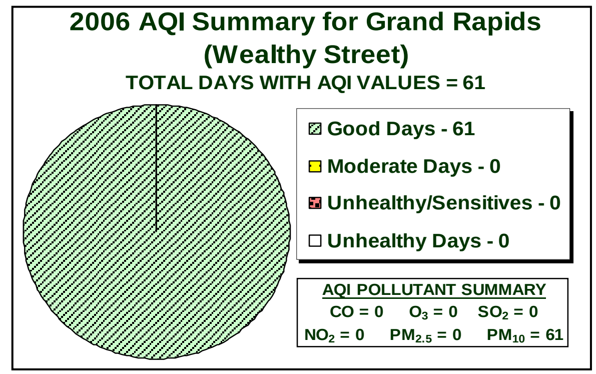
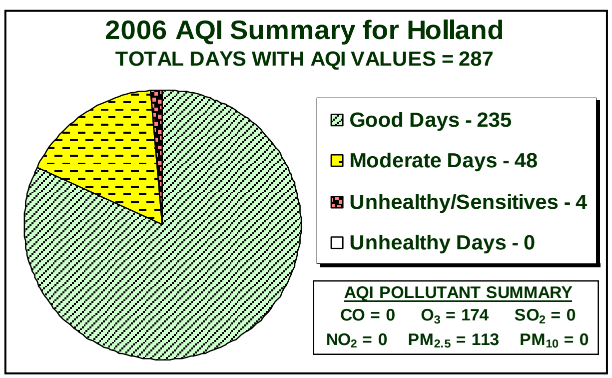


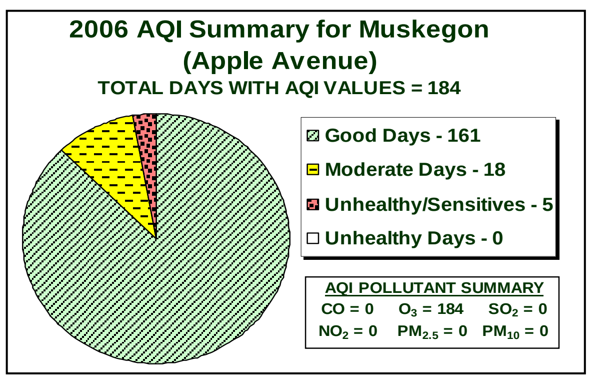
FIGURE E-3: AQI SUMMARIES FOR GRAND RAPIDS-MUSKEGON-HOLLAND CSA











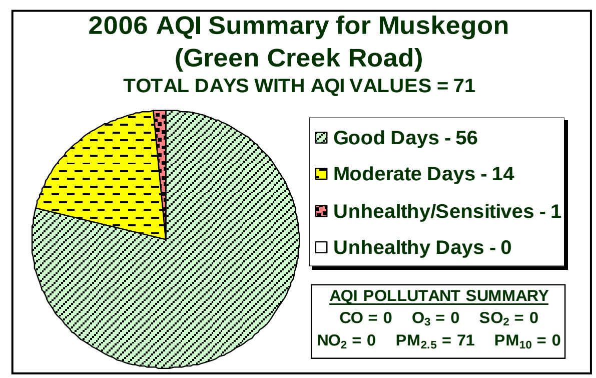


FIGURE E-4: AQI SUMMARIES FOR SAGINAW-BAY CITY-SAGINAW TWP. N. CSA

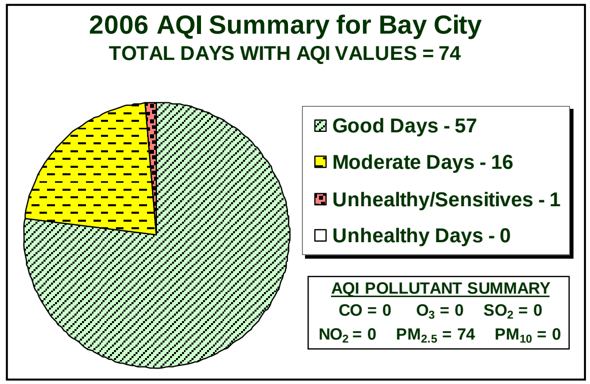
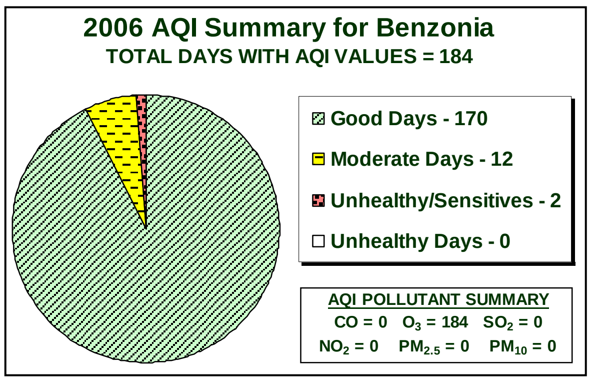
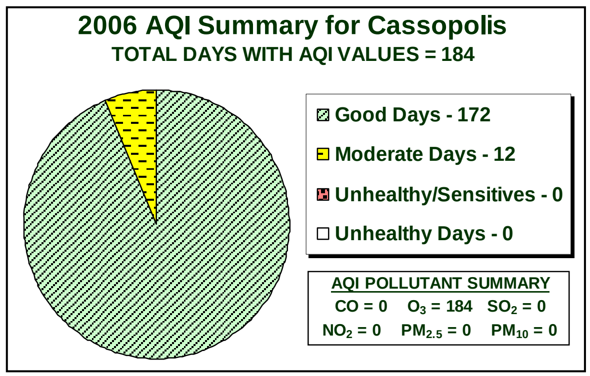
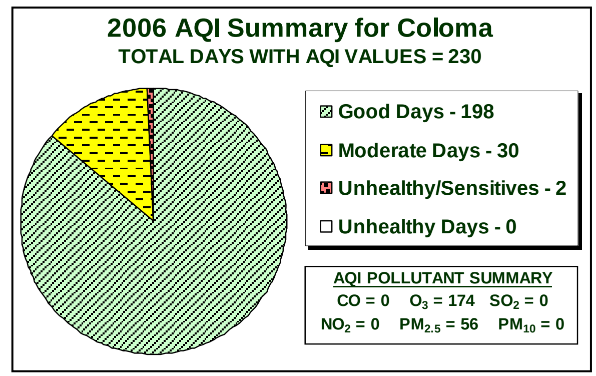
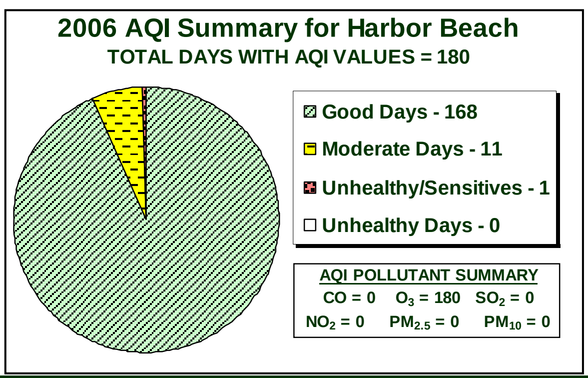


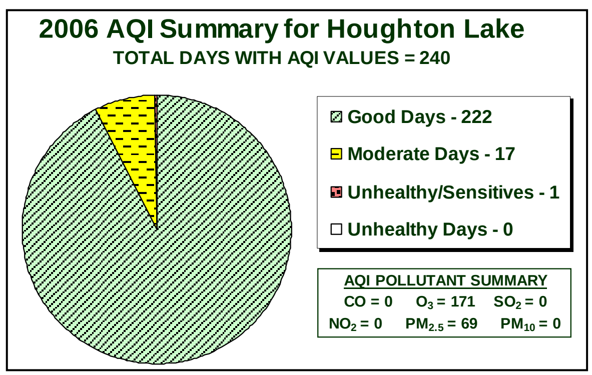
FIGURE E-5: MICHIGAN'S OTHER LOWER PENINSULA AREA AQI SUMMARIES











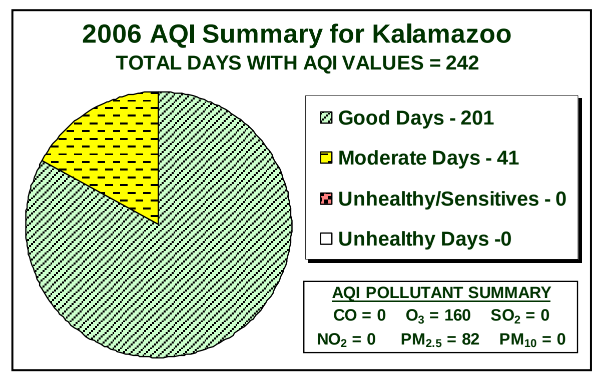
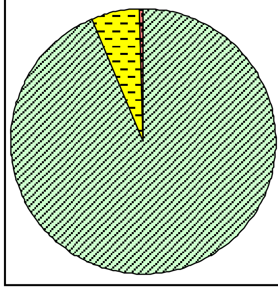
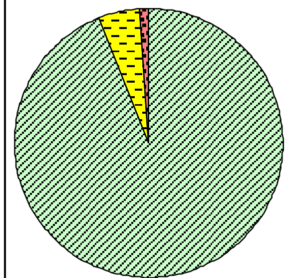


FIGURE E-5: MICHIGAN'S OTHER LOWER PENINSULA AREA AQI SUMMARIES (CONTINUED)

2006 Peshawbestown AQI Summary
TOTAL DAYS WITH AQI VALUES = 184



2006 AQI Summary for Scottville
TOTAL DAYS WITH AQI VALUES = 184



2006 AQI Summary for Tecumseh
TOTAL DAYS WITH AQI VALUES = 174

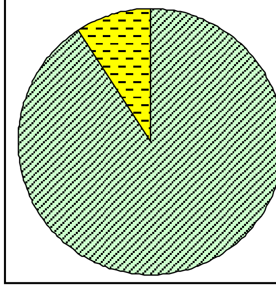
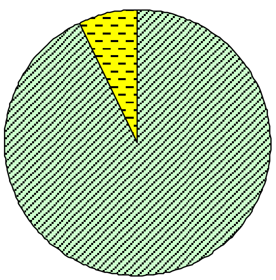
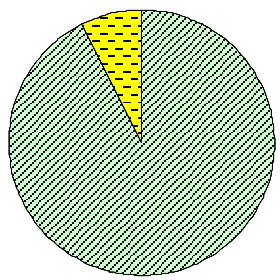


FIGURE E-6: MICHIGAN'S UPPER PENINSULA AREA AQI SUMMARIES

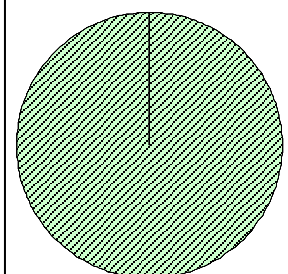
2006 AQI Summary for Bay Mills
TOTAL DAYS WITH AQI VALUES = 14



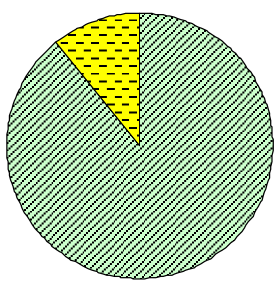
2006 AQI Summary for Channing
TOTAL DAYS WITH AQI VALUES = 67



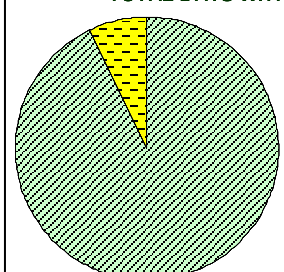
2006 AQI Summary for Crystal Falls
TOTAL DAYS WITH AQI VALUES = 19



2006 AQI Summary for Sault Ste. Marie (Easterday)
TOTAL DAYS WITH AQI VALUES = 28

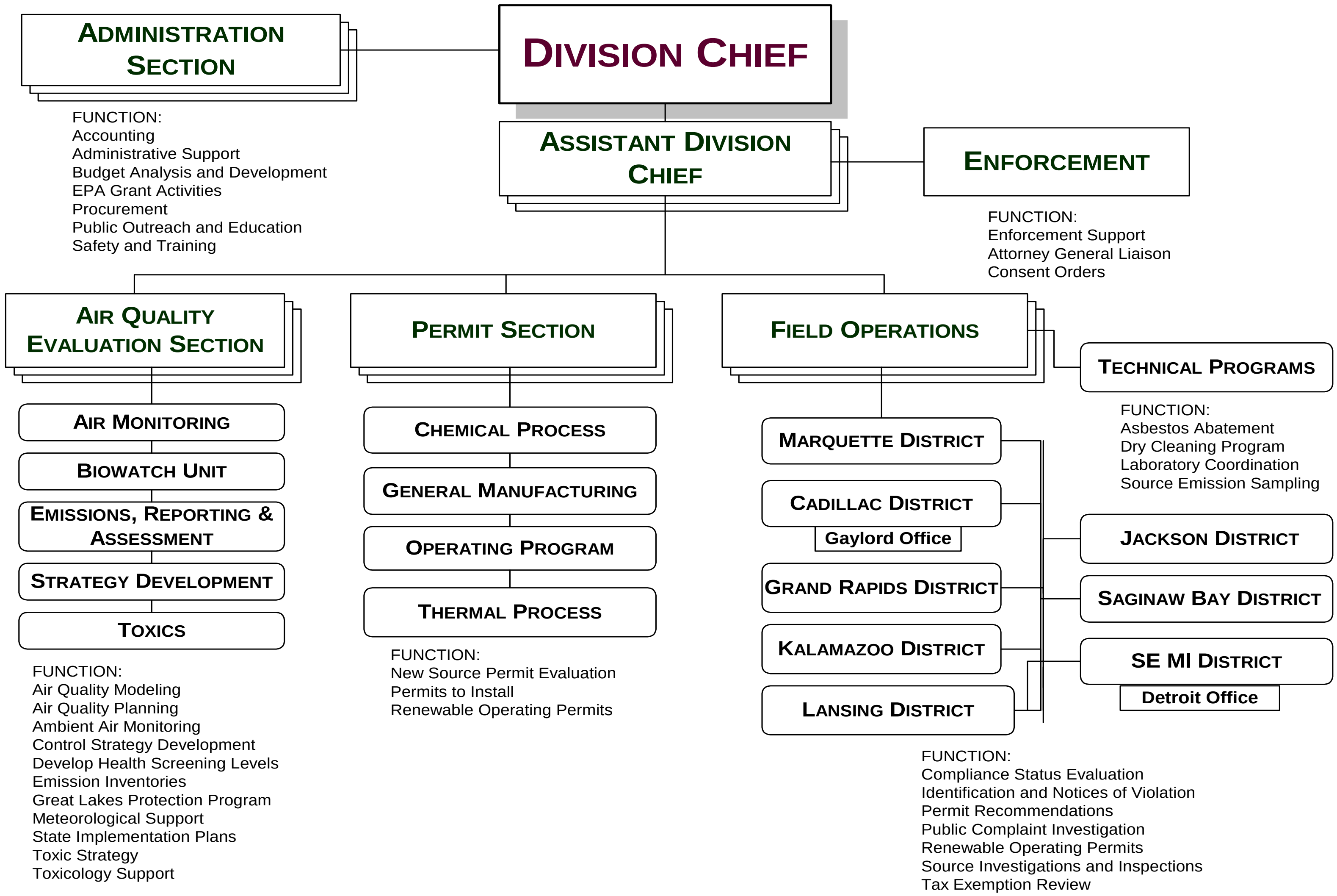


2006 AQI Summary for Sault Ste. Marie (Marquette Avenue)
TOTAL DAYS WITH AQI VALUES = 28



APPENDIX F: AQD ORGANIZATIONAL CHART

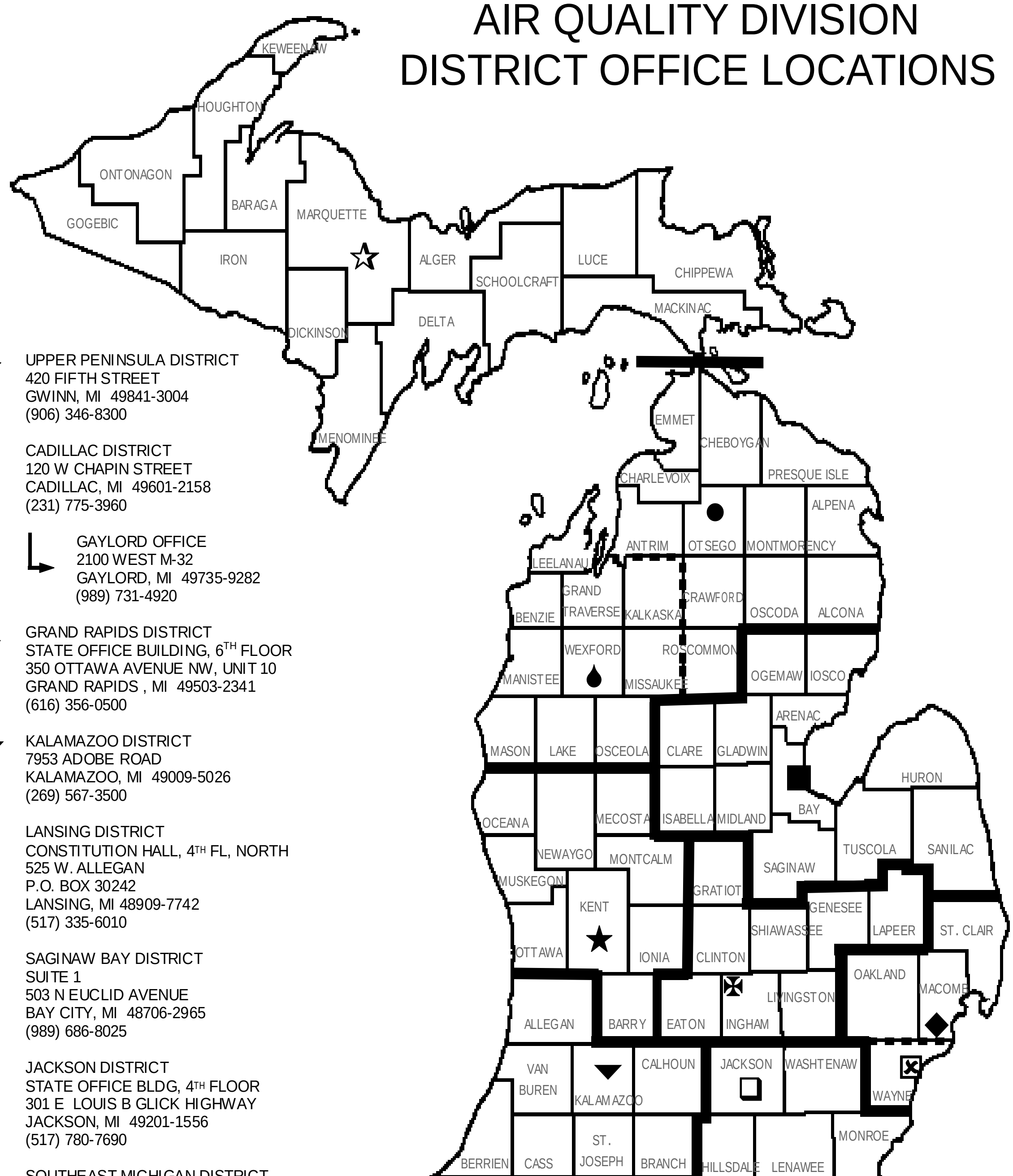
MDEQ AIR QUALITY DIVISION



APPENDIX G: AQD DISTRICT OFFICE LOCATIONS

MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY
AIR QUALITY DIVISION

AIR QUALITY DIVISION DISTRICT OFFICE LOCATIONS



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

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

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

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

▼ KALAMAZOO DISTRICT
7953 ADOBE ROAD
KALAMAZOO, MI 49009-5026
(269) 567-3500

LANSING DISTRICT
CONSTITUTION HALL, 4TH FL, NORTH
525 W. ALLEGAN
P.O. BOX 30242
LANSING, MI 48909-7742
(517) 335-6010

■ SAGINAW BAY DISTRICT
SUITE 1
503 N EUCLID AVENUE
BAY CITY, MI 48706-2965
(989) 686-8025

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

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

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

AIR QUALITY INTERNET ADDRESS:

www.michigan.gov/deqair

04-16-2007

MDEQ AIR QUALITY DIVISION
PO BOX 30260
LANSING, MI 48909