

4.0 Analyses of Individual Nonattainment Area

4.5 Region 5 Nonattainment Areas

4.5.3 Michigan

Michigan Area Designations For the 24-Hour Fine Particle National Ambient Air Quality Standard

The table below identifies the counties in Michigan that EPA has designated as not attaining the 2006 24-hour fine particle (PM_{2.5}) standard.¹ A county or part thereof is designated as nonattainment if it has an air quality monitor that is violating the standard or if the county is determined to be contributing to the violation of the standard.

Area	Michigan Recommended Nonattainment Counties	EPA's Designated Nonattainment Counties
Detroit	Livingston Macomb Monroe Oakland St. Clair* Washtenaw Wayne*	Livingston Macomb Monroe Oakland St. Clair Washtenaw Wayne
Grand Rapids	Kent	Kent Ottawa

* Michigan recommended that Wayne and St. Clair Counties each be a separate area. EPA designated the seven counties as a single nonattainment area.

EPA has designated the remaining counties in the state as “attainment/unclassifiable.”

EPA Technical Analysis for Detroit-Ann Arbor-Flint, Michigan

There are monitors with data showing violations of the 2006 PM_{2.5} NAAQS in Monroe, Oakland, St. Clair, Wayne, and Washtenaw Counties. EPA previously designated these five counties, along with Livingston and Macomb Counties, as the nonattainment area for the 1997 PM_{2.5} NAAQS.

Michigan recommended that EPA designate all seven counties as nonattainment for the 2006 PM_{2.5} NAAQS. However, Michigan recommended that the nonattainment area be

¹ EPA designated nonattainment areas for the 1997 fine particle standards in 2005. In 2006, the 24-hour PM_{2.5} standard was revised from 65 micrograms per cubic meter (average of 98th percentile values for 3 consecutive years) to 35 micrograms per cubic meter; the level of the annual standard for PM_{2.5} remained unchanged at 15 micrograms per cubic meter (average of annual averages for 3 consecutive years).

subdivided into three separate areas. The first area would include only Wayne County, which Michigan characterized as distinctly industrialized. The second area would include just St. Clair County, which Michigan characterized as being especially influenced by international transport from Canada. The third area would include the remaining five counties. EPA reviewed relevant information for these seven counties and for surrounding counties, and in particular, considered Michigan's recommendation of three separate nonattainment areas for the Detroit area.

EPA agrees with the counties Michigan recommended for designation as nonattainment for the 2006 PM_{2.5} NAAQS, but disagrees with Michigan's recommendation to subdivide the nonattainment area into three separate areas. While some components of the observed concentrations vary in magnitude and significance from location to location, EPA believes that a high fraction of the overall observed PM_{2.5} concentrations at monitors throughout the Detroit area reflect common origins, including not only a common regional transported component but also a common metropolitan scale impact from sources located throughout the seven counties in the Detroit area. The level of commuting from county to county is also such that planning by necessity must address the Detroit area as a single broad area. Indeed, the existing metropolitan planning organization already addresses the seven counties of the existing 1997 PM_{2.5} NAAQS nonattainment area, and thus is already designed to conduct planning for the prospective nonattainment area as a whole. While Michigan may ultimately opt for a mix of control strategies that include controls to address emissions that have especially significant impacts in particular areas, EPA believes that the particulate matter concentrations in various parts of the area are sufficiently interrelated that it is essential that a single plan be developed for the entire Detroit area that addresses the combined effects throughout the area.

EPA reviewed the relevant information for other counties within the combined statistical area as well as counties adjacent to the combined statistical area in order to determine the appropriate nonattainment area. Genesee County, which includes Flint, has moderately low emissions, and the county has a low CES, reflecting the distance of the county from violating monitors in the Detroit area and the relative infrequency with which winds blow from Genesee County to those violating monitors on high concentration days. A further reason for excluding Genesee County is to facilitate planning by providing consistency with other designations, including the exclusion of the county from the nonattainment area defined for the 1997 PM_{2.5} NAAQS and the treatment of Flint as a separate ozone nonattainment area (now maintenance area) from the Detroit area. Lucas County, Ohio is more commonly upwind of most of the violating monitors in the Detroit area, but Lucas County is somewhat distant from the violating monitors in the Detroit area, and Lucas County (dominated by Toledo) is a separate and distinct urban area with little commuting into or other connection with the Detroit area. Other nearby counties have relatively low emissions and no other information warranted inclusion of the counties in the Detroit nonattainment area. Based upon analysis of the Detroit area considering information relevant to the factors that EPA recommended in guidance, analytical tools discussed below, and other information provided by Michigan, EPA has determined that

Michigan's recommended nonattainment counties and attainment counties were appropriate.

Figure 1 is a map of the counties in the nonattainment area and other relevant information such as the locations and design values of air quality monitors, and the metropolitan area boundary.

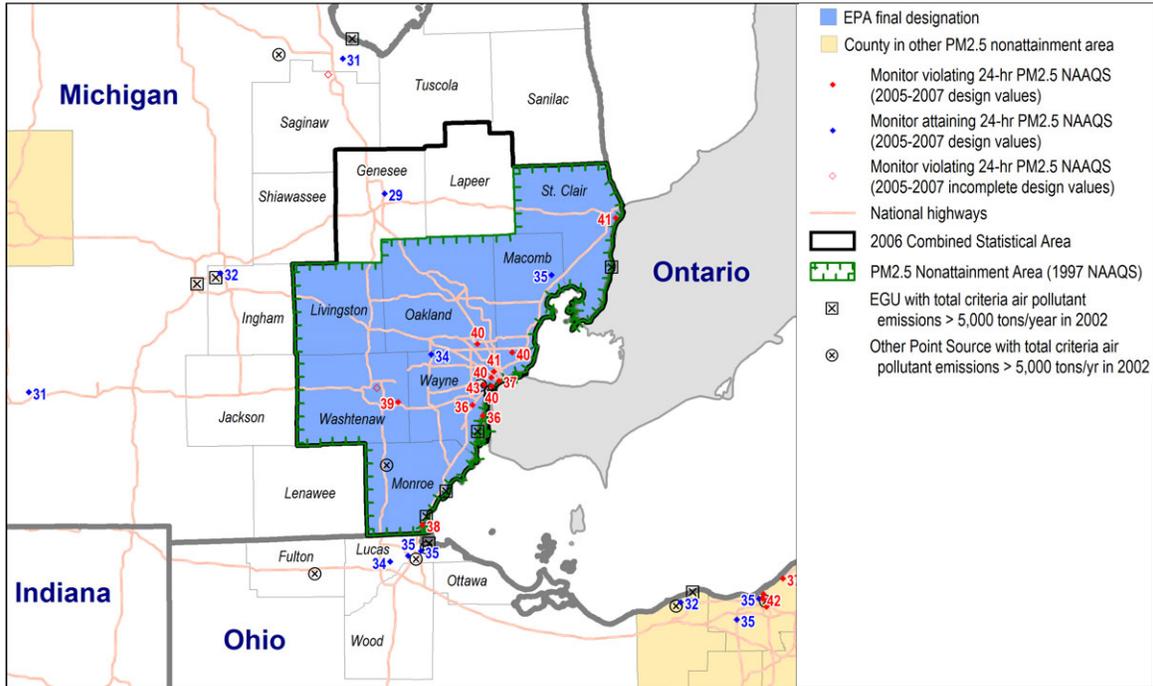


Figure 1

For this area, EPA previously established PM_{2.5} nonattainment boundaries for the 1997 PM_{2.5} NAAQS that included seven counties, with all being located in Michigan.

In its December 17, 2007 letter, Michigan recommended that the same counties be designated as “nonattainment” for the 2006 24-hour PM_{2.5} standard based on air quality data from 2004-2006. Michigan did recommend dividing the seven counties into three separate nonattainment areas. This varies from the designation of these counties as a single nonattainment area for the 1997 PM_{2.5} NAAQS.

In August 2008, EPA notified Michigan of its intended designations. In this letter, EPA also requested that if the State wished to provide comments on EPA's intended designation, it should do so by October 20, 2008. EPA stated that it would consider any additional information (e.g., on power plants or partial county areas) provided by the state in making final decisions on the designations. Michigan did not provide information on power plants in Southeast Michigan, and neither EPA nor Michigan recommended designating any partial county areas. Michigan did provide further information in support of its initial recommendations; further discussion of this information is provided in the response to comments document.

Based on EPA's technical analysis described below, EPA designated seven Michigan counties as nonattainment for the 2006 24-hour PM_{2.5} air-quality standard as a single, unified Detroit nonattainment area.

The following is a review of data for relevant factors for the Detroit, Michigan area.

Factor 1: Emissions data

For this factor, EPA evaluated county level emission data for the following PM_{2.5} components and precursor pollutants: “PM_{2.5} emissions total,” “PM_{2.5} emissions carbon,” “PM_{2.5} emissions other,” “SO₂,” “NO_x,” “VOCs,” and “NH₃.” “PM_{2.5} emissions total” represents direct emissions of PM_{2.5} and includes: “PM_{2.5} emissions carbon,” “PM_{2.5} emissions other”, primary sulfate (SO₄), and primary nitrate. (Although primary sulfate and primary nitrate, which are emitted directly from stacks rather than forming in atmospheric reactions with SO₂ and NO_x, are part of “PM_{2.5} emissions total,” they are not shown in Table 1 as separate items). “PM_{2.5} emissions carbon” represents the sum of organic carbon (OC) and elemental carbon (EC) emissions, and “PM_{2.5} emissions other” represents other inorganic particles (crustal). Emissions of SO₂ and NO_x, which are precursors of the secondary PM_{2.5} components sulfate and nitrate, are also considered. VOCs (volatile organic compounds) and NH₃ (ammonia) are also potential PM_{2.5} precursors and are included for consideration.

Emissions data were derived from the 2005 National Emissions Inventory (NEI), version 1. See http://www.epa.gov/ttn/naaqs/pm/pm25_2006_techinfo.html.

EPA also considered the Contributing Emissions Score (CES) for each county. The CES is a metric that takes into consideration emissions data, meteorological data, and air quality monitoring information to provide a relative ranking of counties in and near an area. Note that this metric is not the exclusive manner for considering data for these factors. A more detailed description can be found at http://www.epa.gov/ttn/naaqs/pm/pm25_2006_techinfo.html#C.

Table 1 shows emissions of PM_{2.5} and precursor pollutants components (given in tons per year) and the CES for violating and potentially contributing counties in the Detroit area. Counties that are part of the Detroit nonattainment area for the 1997 PM_{2.5} NAAQS are shown in boldface. Counties are listed in descending order by CES.

Table 1. PM_{2.5} 24-hour Component Emissions, and CESs

County	State Recommended Nonattainment?	CES	PM _{2.5} emissions total	PM _{2.5} emissions carbon	PM _{2.5} emissions other	SO ₂	NO _x	VOCs	NH ₃
Monroe, MI	Yes	100	6,476	752	5,723	129,523	49,678	11,507	937
St. Clair, MI	Yes	100	3,120	547	2,574	69,799	29,200	9,656	470
Wayne, MI	Yes	100	8,401	2,701	5,699	67,359	98,677	80,390	2,442
Macomb, MI	Yes	46	1,834	834	999	5,412	27,287	32,074	1,019
Oakland, MI	Yes	37	3,116	1,556	1,559	7,070	49,789	57,995	1,525
Washtenaw, MI	Yes	13	1,412	560	852	2,042	15,859	16,169	1,194
Livingston, MI	Yes	4	1,383	472	910	937	7,533	9,913	479

Lucas, OH	No	13	2,395	758	1,637	26,551	31,475	23,612	1,780
Genesee, MI	No	3	1,550	602	948	2,029	18,603	20,570	808

Oakland, Macomb, Monroe, St. Clair, and Wayne Counties all have high a CES relative to other counties in the area, and high emissions. In particular, Wayne, Monroe, St. Clair, and Oakland Counties have high amounts of direct PM_{2.5} emissions that add directly to the aggregate ambient levels of PM_{2.5} at violating monitors in Wayne County. Monroe, St. Clair, and Wayne Counties have particularly large amounts of emissions of SO₂ and NO_x that combines with other precursors in this area to make secondarily formed PM_{2.5} particles that cumulatively add to the ambient levels of PM_{2.5}, primarily from large stationary source emissions. By contrast, other counties in the area like Oakland, Macomb, and Washtenaw, have large amounts of NO_x and VOC emissions, more indicative of smaller stationary sources and mobile sources that cumulatively contribute to violations of the NAAQS in the Detroit area. EPA notes that these emissions occur in geographic areas well within the range of transport for PM_{2.5} and PM_{2.5} precursors. EPA has concluded, consistent with the recommendation of Michigan, that other counties in the area do not require inclusion within the nonattainment area, based on emissions. Lucas County, Ohio, in the Toledo area, has emissions similar to Macomb and Oakland Counties though it is further from Wayne County as the Table 2 data show. Thus based on the emissions factor, Lucas County, Ohio is a possible candidate for being designated as nonattainment. Genesee County has relatively low emissions.

Table 2 provides the data for CES weighting factors. The trajectory factors are used in CES calculations to account for seasonal meteorology. For the top 10% of days in both the cold and warm seasons, wind trajectories were run for a 48 hour period preceding the high monitor reading. The amount of time the air mass was over a county within the mixing height was calculated. The values were scaled so that the maximum value is 100. Thus, the county that is most likely to be upwind of a monitor on a high concentration day in a season is given a score of 100. The scores for the other counties will reflect the relative likelihood of being upwind. As the concentration of a pollutant will decrease as it goes further downwind, a distance weighting factor is also used in calculating the CES. The distance factor listed on Table 2 provides the distance from the center of a county to the center of the violating county. If a county is violating, the distance used is the average distance from the center to the county line.

Table 2. CES Factor Data

County	CES	Trajectory Factor- Cold	Trajectory Factor- Warm	Distance (mi)
Monroe, MI	100	91	99	25.1
St. Clair, MI	100	29	25	56.4
Wayne, MI	100	100	100	13.3
Macomb, MI	46	58	50	37
Oakland, MI	37	53	49	29.1
Washtenaw, MI	13	52	56	25.1
Livingston, MI	4	24	23	38.3
Lucas, OH	13	69	79	50.4
Genesee, MI	3	11	10	55.5

Factor 2: Air quality data

This factor considers the 24-hour PM_{2.5} design values (in µg/m³) for air quality monitors in counties in the Detroit area based on data for the 2005-2007 period. These data are from Federal Reference Method (FRM) monitors located in the state. A monitor's design value indicates whether that monitor attains a specified air quality standard. The 24-hour PM_{2.5} standards are met when the 3-year average of a monitor's 98th percentile values are 35 µg/m³ or less. A design value is only valid if minimum data completeness criteria are met.

The 24-hour PM_{2.5} design values for counties in the Detroit area are shown in Table 3.

Table 3. Air Quality Data

County	State Recommended Nonattainment?	Design Values 2004-2006	Design Values 2005-2007
Monroe, MI	Yes	39	38
St. Clair, MI	Yes	39	41
Wayne, MI	Yes	44	43
Macomb, MI	Yes	36	35
Oakland, MI	Yes	39	40
Washtenaw, MI	Yes	38	39
Livingston, MI	Yes		
Lucas, OH	No	35	35
Genesee, MI	No	30	29

Oakland, Monroe, St. Clair, Washtenaw, and Wayne all have monitors with 2005-2007 design values in excess of the 2006 24-hour PM_{2.5} standards. Macomb County has a monitor with a 2005-2007 design value that now meets the air quality standards, although its 2004-2006 design value did not meet the standards. Genesee County and Lucas County, Ohio also are meeting the standard. Livingston County does not have PM_{2.5} air quality monitoring data.

For purposes of its review, EPA used data available from the Chemical Speciation Network and the Interagency Monitoring of Protected Visual Environments (IMPROVE) network to estimate the composition of fine particle mass on days with the highest fine particle concentrations. Analysis of these data indicates that the days with the highest fine particle concentrations in the Detroit area occur about 35% in the warm season and 65% in the cool season. In the warm season, the average chemical composition of the highest days is 20% sulfate, no nitrate, 67% carbon, and 13% crustal. In the cool season, the average chemical composition of the highest days is 20% sulfate, 45% nitrate, 24% carbon, and 10% crustal. These data indicate that sources of SO₂, NO_x, and direct PM_{2.5} emissions contribute to violations in the area. Sources of these types of emissions are located throughout the seven counties that EPA has concluded should be designated nonattainment for the 2006 PM_{2.5} NAAQS.

Factor 3: Population density and degree of urbanization (including commercial development)

Table 4 shows the 2005 population for each county in the area being evaluated, as well as the population density for each county in that area. Population data gives an indication of whether it is likely that population-based emissions might contribute to violations of the 24-hour PM_{2.5} standards.

Table 4. Population

County	State Recommended Nonattainment?	2005 Population	2005 Population Density (pop/sq mi)
Wayne, MI	Yes	1,990,932	3227
Oakland, MI	Yes	1,213,669	1339
Macomb, MI	Yes	828,950	1718
Lucas, OH	No	447,410	1290
Genesee, MI	No	442,732	684
Washtenaw, MI	Yes	342,124	475
Livingston, MI	Yes	181,404	309
St. Clair, MI	Yes	171,079	232
Monroe, MI	Yes	153,772	275

Oakland and Wayne Counties both have over a million residents. Macomb County trails with a population that is still over 800,000. The population density of these three counties stands out as being well above that of the other area counties. EPA believes that the high population of these counties is reflective of emissions activities that cumulatively contribute to violations at monitors in Wayne County. Lucas County, Ohio has a population density slightly lower than Oakland County’s figure, but it is in the Toledo area which is in attainment of the 2006 PM_{2.5} standards. The populations and population densities of the other area counties are still large enough that this factor does not suggest inclusion or exclusion in the Detroit nonattainment area.

Factor 4: Traffic and commuting patterns

This factor considers the number of commuters in each county who drive to another county within the Detroit area, the percent of total commuters in each county who commute within the area, as well as the total Vehicle Miles Traveled (VMT) for each county in millions of miles (see Table 5). A county with numerous commuters is generally an integral part of an urban area and is likely contributing to fine particle concentrations in the area. A large amount of VMT is also indicative of a large amount of mobile source related PM_{2.5} precursor emissions, especially NO_x and VOC.

Table 5. Traffic and Commuting Patterns

County	State Recommended Nonattainment?	2005 VMT (10 ⁶ mi)	Number Commuting to any violating counties	Percent Commuting to any violating counties	Number Commuting within/to statistical area	Percent Commuting within/to statistical area
Wayne, MI	Yes	19,866	816,490	99	819,550	99

Macomb, MI	Yes	6,790	379,440	99	380,980	99
St. Clair, MI	Yes	1,422	74,030	97	75,260	99
Oakland, MI	Yes	13,709	585,240	97	596,830	99
Washtenaw, MI	Yes	4,105	161,830	96	164,460	97
Monroe, MI	Yes	2,058	53,620	78	53,750	78
Livingston, MI	Yes	1,925	39,760	50	76,610	96
Genesee, MI	No	5,447	26,310	14	178,980	96
Lucas, OH	No	4,418	7,740	4	7,780	4

The listing of counties on Table 5 reflects a ranking based on the number of people commuting to other counties. The counties that are in the nonattainment area for the 1997 PM_{2.5} NAAQS are shown in boldface. The commuting data implies that all the counties that are in the 1997 standards nonattainment area counties are all integrated into the Detroit area. In particular, the commuting data for Lucas County, Ohio show little connection of this county to the Detroit area with just 4% of its workers commuting to violating counties and into the Detroit area. In contrast, the seven counties in the Detroit area all have a high percentage of workers commuting to violating counties and within the Detroit area. In terms of VMT, this data reflect that Wayne, Oakland, Macomb, and Washtenaw have relatively large numbers of both drivers and miles traveled that indicate significant NOx and VOC emissions. These emissions occur within a geographic area that is well within the range for transport to the violating monitors in Wayne County, and meteorological data confirm that this transport can occur on days with high ambient PM_{2.5} levels in Wayne County. This factor suggests that Livingston, Macomb, Monroe, Oakland, St. Clair, Washtenaw, and Wayne should be included in the Detroit nonattainment area. This factor also indicates that Lucas County, Ohio is not a part of the Detroit area and thus is weak candidate for inclusion in the Detroit nonattainment area.

Note: The 2005 VMT data used for table 5 and 6 of the 9-factor analysis has been derived using methodology similar to that described in “Documentation for the final 2002 Mobile National Emissions Inventory, Version 3, September 2007, prepared for the Emission Inventory Group, U.S. EPA. This document may be found at: ftp://ftp.epa.gov/EmisInventory/2002finalnei/documentation/mobile/2002_mobile_nei_version_3_report_092807.pdf. The 2005 VMT data were taken from documentation which is still draft, but which should be released in 2008.

Factor 5: Growth rates and patterns

This factor considers population growth for 2000-2005 and growth in vehicle miles traveled for 1996-2005 for counties in Detroit area, as well as patterns of population and VMT growth. A county with rapid population or VMT growth is generally an integral part of an urban area and likely to be contributing to fine particle concentrations in the area.

Table 6 below shows population, population growth, VMT, and VMT growth for counties that are included in the Detroit area. Counties are listed in descending order based on VMT growth between 1996 and 2005.

Table 6. Population and VMT Growth and Percent Change

County	Population (2005)	Population % change (2000-05)	2005 VMT (10 ⁶ mi)	VMT % change (1996-2005)
Oakland, MI	1,213,669	1	13,709	42
Monroe, MI	153,772	5	2,058	38
Washtenaw, MI	342,124	5	4,105	37
Genesee, MI	442,732	1	5,447	23
Livingston, MI	181,404	14	1,925	18
Wayne, MI	1,990,932	-3	19,866	10
Lucas, OH	447,410	-2	4,418	8
Macomb, MI	828,950	5	6,790	8
St. Clair, MI	171,079	4	1,422	-23

Livingston County experienced population growth of 14% from 2000 to 2005. The population change was 5% or less in the other counties during the same period. Considering VMT growth, Oakland County had the greatest percent increase. Monroe and Washtenaw also had large VMT growth. The other area counties had more modest VMT growth except for St. Clair County. VMT dropped by 23% in St. Clair County.

Factor 6: Meteorology (weather/transport patterns)

For this factor, EPA considered data from National Weather Service instruments and other meteorological monitoring sites in the area. Wind direction and wind speed data for 2005-2007 were analyzed, with an emphasis on “high PM_{2.5} days” for each of two seasons, an October-April “cold” season and a May-September “warm” season. These high days are defined as days where any FRM or FEM air quality monitors had 24-hour PM_{2.5} concentrations above 95% on a frequency distribution curve of PM_{2.5} 24-hour values.

For each air quality monitoring site, EPA developed a “pollution rose” to understand the prevailing wind direction and wind speed on the days with highest fine particle concentrations. The figure identifies 24-hour PM_{2.5} values by color; days exceeding 35 µg/m³ are denoted with a red or black icon. A dot indicates the day occurred in the warm season; a triangle indicates the day occurred in the cool season. The center of the figure indicates the location of the air quality monitoring site, and the location of the icon in relation to the center indicates the direction from which the wind was blowing on that day. An icon that is close to the center indicates a low average wind speed on that day. Higher wind speeds are indicated when the icon is further away from the center.

Pollution roses for three Detroit area counties are provided as Figure 2A, 2B, and 2C. In the Wayne County figure, Figure 2A, winds on high concentration days tend to come from South to Southwest. Therefore, counties located to the south and southwest of the violating monitor in Wayne County are more likely than others to be contributing to the violation when considering meteorology alone. As Michigan recommended dividing the area into three nonattainment areas, EPA also examined pollution roses for other counties. Figure 2B is the pollution rose for St. Clair County. It shows the winds in St. Clair County tend to be from the South. St. Clair County is in the northern portion of the

Detroit area. This suggests emissions from other Detroit area counties contribute to the St. Clair County violation. Oakland County is North of Wayne County and Southwest of St. Clair County. The pollution rose for Oakland County is Figure 2C. It shows the winds come from South to Southeast most frequently, but it also comes from Northeast occasionally. Considering this factor, Wayne County emissions appear to affect the PM_{2.5} concentrations in Oakland County. Considering that the wind is occasionally from other directions, other counties in the area may also contribute to the violation in Oakland County. This factor does not indicate that Wayne County or St. Clair County should be separate nonattainment areas from the rest of the Detroit area.

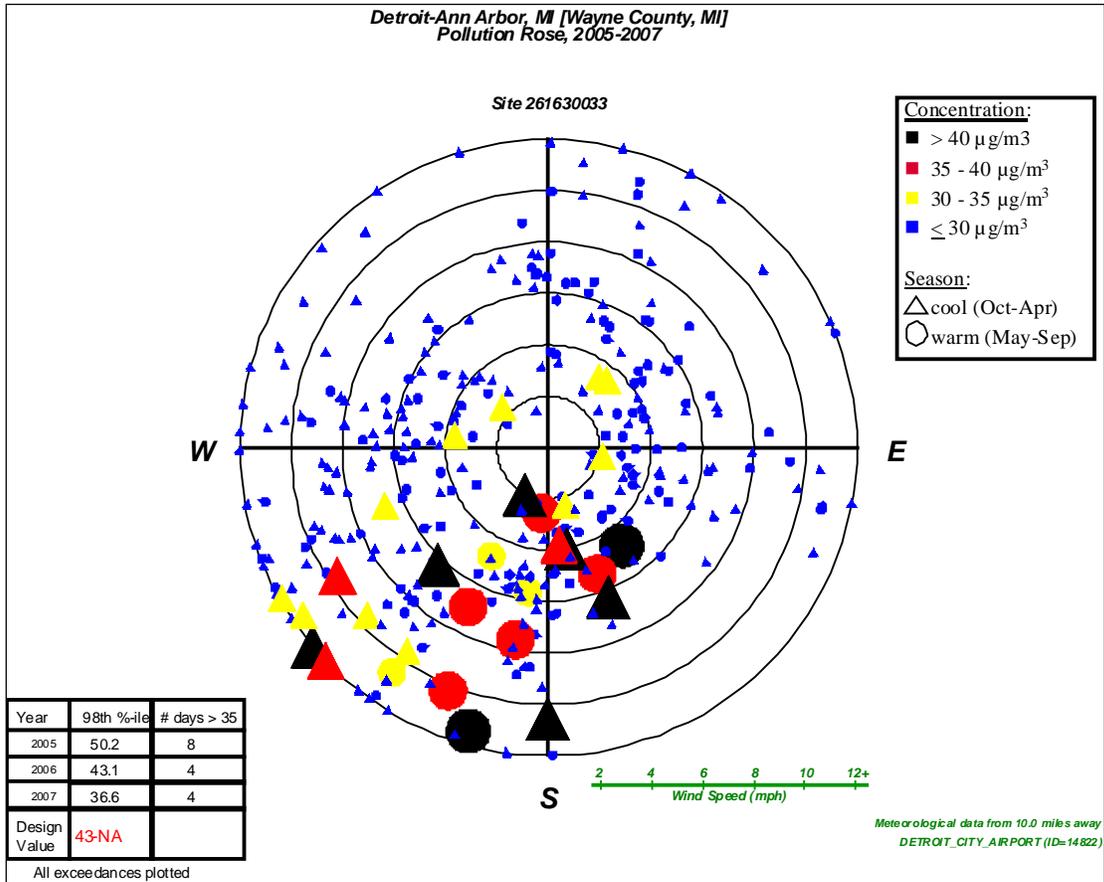


Figure 2A Wayne County

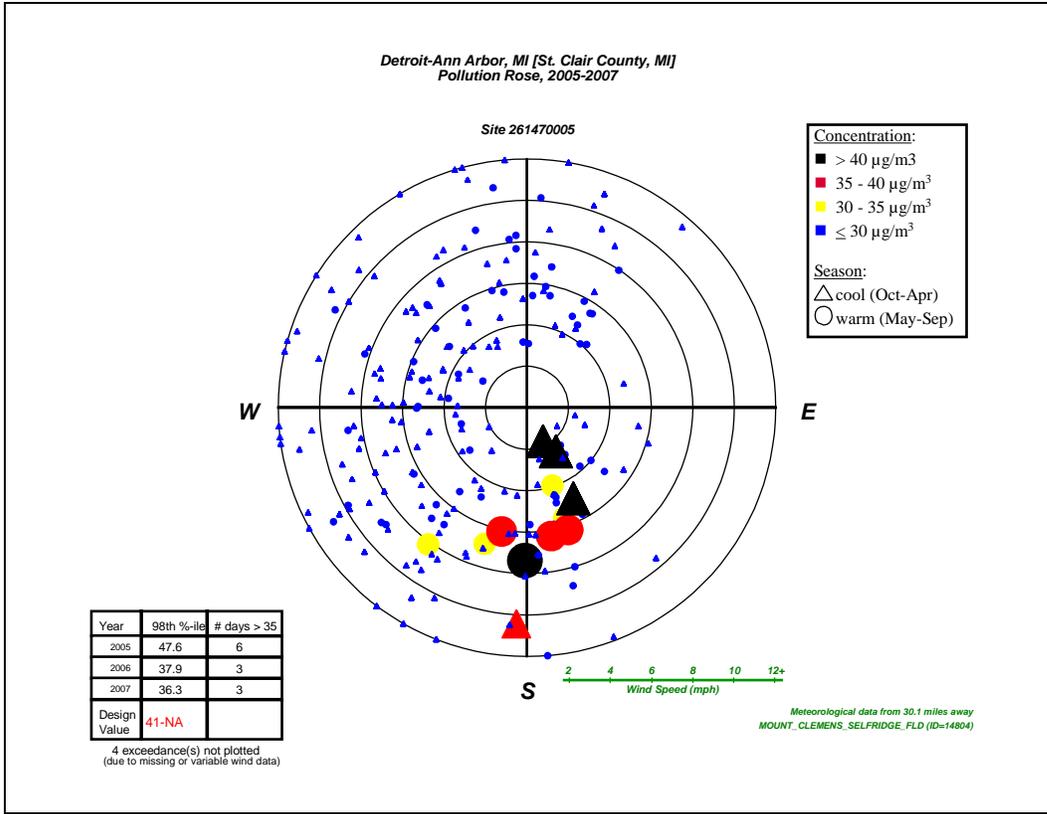


Figure 2B St. Clair County

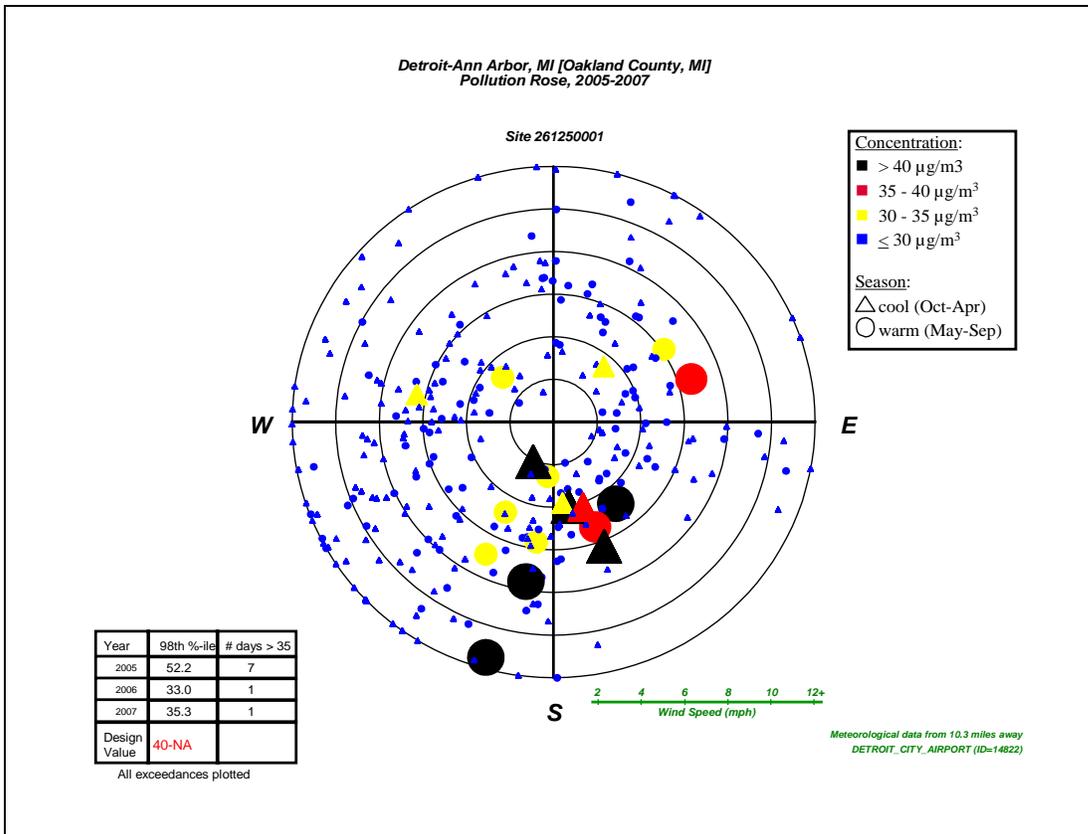


Figure 2C Oakland County

Note: the meteorology factor is also considered in each county's Contributing Emissions Score because the method for deriving this metric included an analysis of trajectories of air masses for high PM_{2.5} days.

Factor 7: Geography/topography (mountain ranges or other air basin boundaries)

The geography/topography analysis evaluates the physical features of the land that might have an effect on the air shed and, therefore, on the distribution of PM_{2.5} over the area.

The Detroit area does not have any geographical or topographical barriers significantly limiting air-pollution transport within its air shed. This supports the conclusion that emissions and emissions activities in the counties surrounding Wayne County can transport to violating monitors and add to the aggregate ambient PM_{2.5} in the area.

Factor 8: Jurisdictional boundaries

In evaluating the jurisdictional boundary factor, EPA gave special consideration to areas that were already designated nonattainment in 2005 for violating the 1997 fine particle standards. Analysis of chemical composition data in these areas indicates that the same components that make up most of the PM_{2.5} mass in the area on an annual average basis such as sulfate and direct PM_{2.5} carbon in many eastern areas also are key contributors to the PM_{2.5} mass on days exceeding the 24-hour PM_{2.5} standard. These data indicate that in

many cities, the same source categories that contribute to violations of the annual standard also contribute to exceedances of the 24-hour standard.

EPA has generally concluded that counties that were designated as having emissions sources contributing to fine particle concentrations exceeding the 1997 standards (all areas violated the annual standard, two also violated the previous 24-hour standard) also contribute to fine particle concentrations on the highest days. For this reason, EPA believes that for most existing nonattainment areas, the nonattainment area for the 2006 24-hour standard should be the same. Consideration also should be given to existing boundaries and organizations as they may facilitate air quality planning and the implementation of control measures to attain the standard. Areas already designated as nonattainment represent important boundaries for state air quality planning.

The Southeast Michigan Council of Governments (SEMCOG) is the Metropolitan Planning Organization (MPO) for Livingston, Macomb, Monroe, Oakland, St. Clair, Washtenaw, and Wayne counties. This planning organization already exists to facilitate coordinated air planning across the Detroit area, including all seven counties that EPA is designating nonattainment for the PM_{2.5} NAAQS. SEMCOG webpage: <http://www.semco.org/>

The Detroit ozone nonattainment area includes Lenawee, Livingston, Macomb, Monroe, Oakland, St Clair, Washtenaw, and Wayne Counties. The Flint ozone maintenance area includes Genesee and Lapeer Counties.

In this area, EPA's analysis has confirmed that the same boundaries are appropriate for the 1997 PM_{2.5} NAAQS and the 2006 PM_{2.5} NAAQS. In particular, EPA has concluded that the same emissions sources and activities are contributing to violations of both NAAQS, as evidenced by the emissions inventories for these counties and speciated PM_{2.5} data for this area. In addition, the geographic location of these counties adjacent to Wayne County, and the meteorological data for this area, confirms that these emissions are contributing to ambient PM_{2.5} levels at the violating monitor in Wayne County. Thus, the existence of the prior boundaries and the local planning organization covering that area, will serve to facilitate development of a more effective and coordinated nonattainment area plan that will be more likely to result in achievement of the NAAQS as expeditiously as practicable.

Since a planning body is already established to provide planning on exactly the boundaries EPA and the State have recommended, the jurisdictional boundaries factor supports establishing a seven county nonattainment area. The jurisdictional boundary factor indicates a link between the seven counties that EPA is designating nonattainment in the Detroit area. Thus, this factor gives EPA an indication that dividing the counties into separate nonattainment areas would be inappropriate.

Factor 9: Level of control of emission sources

Under this factor, the existing level of control of emission sources is taken into consideration. The emissions data used by EPA in this technical analysis and provided in Table 1 under Factor 1 represent emissions levels taking into account any control strategies implemented in the Detroit area before 2005 on stationary, mobile, and area sources. Data are presented for PM_{2.5} components that are directly emitted, carbonaceous PM_{2.5} and crustal PM_{2.5}, and for pollutants which react in the atmosphere to form fine particles such as SO₂, NO_x, VOC, and ammonia.

In considering county-level emissions, EPA used data from the 2005 National Emissions Inventory, the most updated version of the national inventory available at the beginning of the designations process in late 2007. However, EPA recognized that for certain counties, emissions may have changed since 2005. For example, certain power plants or large sources of emissions in or near this area may have installed emission controls or otherwise significantly reduced emissions since 2005. Some States provided updated information on emissions and emission controls in their comments to EPA. EPA considered such additional information in making final designation decisions.

With regard to nearby power plants, EPA considered information about whether a specific plant installed federally enforceable emission controls by December 2008 resulting in significant emissions reductions. A control requirement is considered to be federally-enforceable if it is required by a State regulation adopted in a State implementation plan, if it is included in a federally-enforceable Title V operating permit, or if it is required by a consent decree which also requires the controls to be included in a federally enforceable permit upon termination of the consent decree. In making final decisions, EPA also considered whether a facility would continue to emit pollutants which contribute to PM_{2.5} exceedances even after emission controls are operational.

Michigan did not provide other information regarding power plants or any other large sources in the Detroit area to indicate that the emissions have recently changed at these sources in any material way.

EPA Technical Analysis for Grand Rapids, Michigan

A monitor in Grand Rapids (Kent County) is showing violations of the 2006 PM_{2.5} NAAQS. Michigan recommended a nonattainment area for the 2006 PM_{2.5} standards consisting solely of Kent County. EPA reviewed relevant information for the six counties in the combined statistical area for Grand Rapids and for surrounding counties.

EPA has concluded that the appropriate nonattainment area for Grand Rapids consists of Kent and Ottawa Counties. Kent County is violating the air quality standards and contributes to those violations. Ottawa County is immediately adjacent to Kent County. Ottawa County has greater emissions of most of the relevant pollutants than Kent County, and indeed EPA's CES analysis suggests that Ottawa County contributes more to the violations in Kent County than Kent County itself. A sizable fraction of Ottawa County commuters commute into Kent County. The pollution rose for this area likewise

confirms that there are winds from the direction of Ottawa County towards Kent County on days with high ambient PM_{2.5} levels, and thus supports the conclusion that there is contribution from the direction of Ottawa County towards the violating monitor in Kent. Kent and Ottawa comprise the Grand Rapids ozone maintenance area, so a planning area that consists of these two counties will also provide for air planning consistent with historical practice.

EPA reviewed relevant information for other counties within the combined statistical area as well as for counties adjacent to the combined statistical area in order to determine the appropriate nonattainment area. Muskegon and Allegan Counties have moderate emissions, but low population, low percentage of commuters commuting into Kent County, and low probable impact on violations in Kent County. Therefore, EPA believes that the Grand Rapids PM_{2.5} nonattainment area should not include these two counties. Other Michigan counties in or near the combined statistical area have relatively low emissions, and no other relevant information warranted inclusion of these counties in the nonattainment area.

Figure 1 is a map of the counties in the nonattainment area and other relevant information such as the locations and design values of air quality monitors, and the metropolitan area boundary.

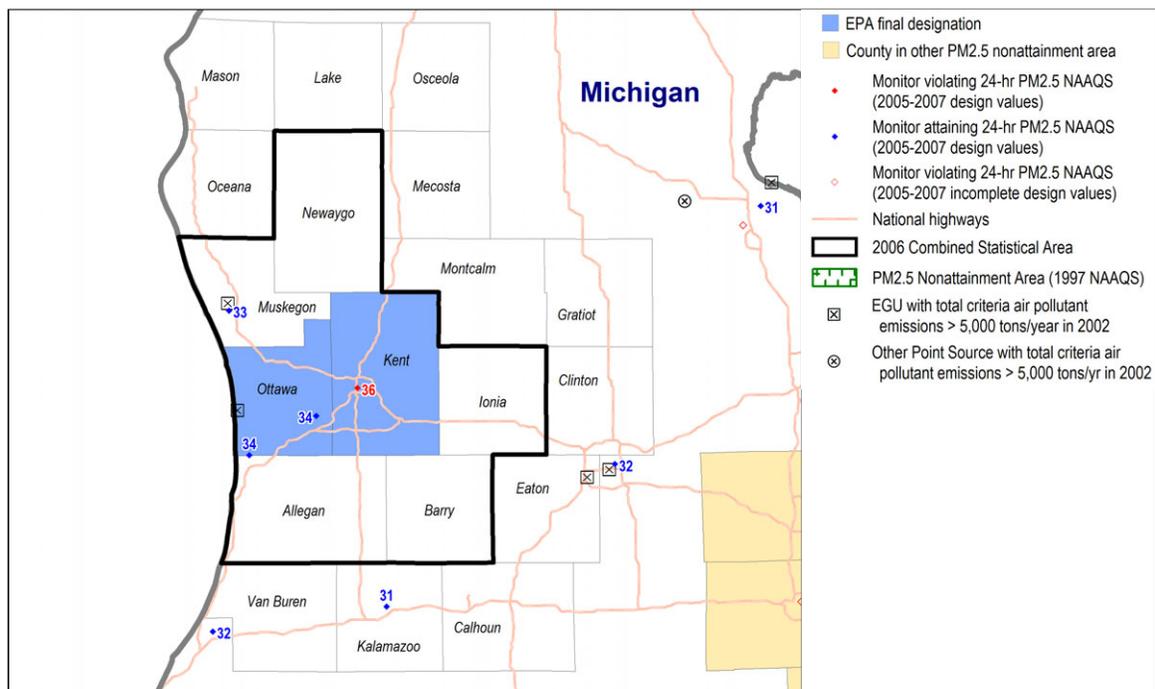


Figure 1

In its December 17, 2007 letter, Michigan recommended that only Kent County be designated as “nonattainment” for the 2006 24-hour PM_{2.5} standard based on air quality data from 2004-2006.

In August 2008, EPA notified Michigan of its intended modification of the State's recommendation to include Ottawa County. In this letter, EPA also requested that if the State wished to provide comments on EPA's intended designation, it should do so by October 20, 2008. EPA stated that it would consider any additional information (e.g., on reduced emissions from sources or appropriate partial county areas) provided by the state in making final decisions on the designations. The information that Michigan provided is discussed here and in the response to comments document.

Based on EPA's technical analysis described below, EPA is designating two Michigan counties as nonattainment for the 2006 24-hour PM_{2.5} NAAQS as the Grand Rapids nonattainment area, based upon currently available information.

The following is a review of data for relevant factors for the Grand Rapids, Michigan area.

Factor 1: Emissions data

For this factor, EPA evaluated county level emission data for the following PM_{2.5} components and precursor pollutants: "PM_{2.5} emissions total," "PM_{2.5} emissions carbon," "PM_{2.5} emissions other," "SO₂," "NO_x," "VOCs," and "NH₃." "PM_{2.5} emissions total" represents direct emissions of PM_{2.5} and includes: "PM_{2.5} emissions carbon," "PM_{2.5} emissions other", primary sulfate (SO₄), and primary nitrate. (Although primary sulfate and primary nitrate, which are emitted directly from stacks rather than forming in atmospheric reactions with SO₂ and NO_x, are part of "PM_{2.5} emissions total," they are not shown in Table 1 as separate items). "PM_{2.5} emissions carbon" represents the sum of organic carbon (OC) and elemental carbon (EC) emissions, and "PM_{2.5} emissions other" represents other inorganic particles (crustal). Emissions of SO₂ and NO_x, which are precursors of the secondary PM_{2.5} components sulfate and nitrate, are also considered. VOCs (volatile organic compounds) and NH₃ (ammonia) are also potential PM_{2.5} precursors and are included for consideration.

Emissions data were derived from the 2005 National Emissions Inventory (NEI), version 1. See http://www.epa.gov/ttn/naaqs/pm/pm25_2006_techinfo.html.

EPA also considered the Contributing Emissions Score (CES) for each county. The CES is a metric that takes into consideration emissions data, meteorological data, and air quality monitoring information to provide a relative ranking of counties in and near an area. Note that this metric is not the exclusive manner for considering data for these factors. A more detailed description can be found at http://www.epa.gov/ttn/naaqs/pm/pm25_2006_techinfo.html#C.

Table 1 shows emissions of PM_{2.5} and precursor pollutants components (given in tons per year) and the CES for violating and potentially contributing counties in the Grand Rapids area. Counties that are part of the Grand Rapids nonattainment area for the 1997 PM_{2.5} NAAQS are shown in boldface. Counties are listed in descending order by CES.

Table 1. PM_{2.5} 24-hour Component Emissions, and CESs

County	State Recommended Nonattainment?	CES	PM _{2.5} emissions total	PM _{2.5} emissions carbon	PM _{2.5} emissions other	SO ₂	NOx	VOCs	NH ₃
Ottawa, MI	No	100	3,153	667	2,485	46,545	27,918	14,897	3,837
Kent, MI	Yes	71	2,102	895	1,207	5,005	24,130	33,459	2,152
Allegan, MI	No	17	1,238	423	814	994	5,271	11,625	4,196
Muskegon, MI	No	15	1,808	490	1,317	14,804	11,273	10,400	709
Barry, MI	No	6	764	274	491	287	1,789	4,769	618
Ionia, MI	No	5	823	223	600	375	2,440	3,556	2,122

The CES and emissions of Kent and Ottawa Counties are well above all other counties in the area. Indeed, the CES for Ottawa is higher than that of Kent County. Allegan and Muskegon Counties have moderate emissions, but the relatively low CES for each suggests that these counties would have substantially less impact on Kent County than Ottawa County. Barry and Ionia Counties have even less impact, based upon their respective CES and emissions. Moreover, the emissions inventories confirm that Ottawa County has the highest amount of emissions of direct PM_{2.5}, SO₂, NOx and VOCs for this area. As noted below, these emissions occur in an area that is geographically close to, and generally upwind of, the violating monitor in Kent County. Thus the CES and emissions support inclusion of Ottawa County within the Grand Rapids area.

Table 2 provides the data for CES weighting factors. The trajectory factors are used in CES calculations to account for seasonal meteorology. For the top 10% of days in both the cold and warm seasons, wind trajectories were run for a 48 hour period preceding the high monitor reading. The amount of time the air mass was over a county within the mixing height was calculated. The values were scaled so that the maximum value is 100. Thus, the county that is most likely to be upwind of a monitor on a high concentration day in a season is given a score of 100. The scores for the other counties will reflect the relative likelihood of being upwind. As the concentration of a pollutant will decrease as it goes further downwind, a distance weighting factor is also used in calculating the CES. The distance factor listed on Table 2 provides the distance from the center of a county to the center of the violating county. If a county is violating, the distance used is the average distance from the center to the county line.

Table 2. CES Factor Data

County	CES	Trajectory Factor- Cold	Trajectory Factor- Warm	Distance (mi)
Ottawa, MI	100	99	88	23.3
Kent, MI	71	79	63	16.3
Allegan, MI	17	100	100	34.7
Muskegon, MI	15	63	41	38
Barry, MI	6	63	62	32.5
Ionia, MI	5	44	33	24.8

Factor 2: Air quality data

This factor considers the 24-hour PM_{2.5} design values (in µg/m³) for air quality monitors in counties in the Grand Rapids area based on data for the 2005-2007 period. These data

are from Federal Reference Method (FRM) monitors located in the state. A monitor's design value indicates whether that monitor attains a specified air quality standard. The 24-hour PM_{2.5} standards are met when the 3-year average of a monitor's 98th percentile values are 35 µg/m³ or less. A design value is only valid if minimum data completeness criteria are met.

The 24-hour PM_{2.5} design values for counties in the Grand Rapids area are shown in Table 3.

Table 3. Air Quality Data

County	State Recommended Nonattainment?	Design Values 2004-2006	Design Values 2005-2007
Ottawa, MI	No	34	34
Kent, MI	Yes	37	36
Allegan, MI	No	34	34
Muskegon, MI	No	35	33
Barry, MI	No		
Ionia, MI	No		

The Kent County 2005-2007 design value is above the 2006 standards. Allegan, Muskegon, and Ottawa Counties meet the 2006 standards. There is no air quality monitoring data for Barry and Ionia Counties. However, the absence of a violating monitor alone does not eliminate counties from nonattainment status. Each county has been evaluated based on the weight of evidence of the nine factors and other relevant information.

For purposes of its review, EPA used data available from the Chemical Speciation Network and the Interagency Monitoring of Protected Visual Environments (IMPROVE) network to estimate the composition of fine particle mass on days with the highest fine particle concentrations. Analysis of these data indicates that the days with the highest fine particle concentrations in the Grand Rapids area occur about 43% in the warm season and 57% in the cool season. In the warm season, the average chemical composition of the highest days is 59% sulfate, no nitrate, 37% carbon, and 4% crustal. In the cool season, the average chemical composition of the highest days is 22% sulfate, 49% nitrate, 27% carbon, and 1% crustal. These data indicate that sources of SO₂, NO_x, and direct PM_{2.5} emissions contribute to violations in the area. Ottawa and Kent County have relatively large emissions of the pollutants (or precursors thereof) that are found in significant quantities on the speciation monitor.

Factor 3: Population density and degree of urbanization (including commercial development)

Table 4 shows the 2005 population for each county in the area being evaluated, as well as the population density for each county in that area. Population data gives an indication of whether it is likely that population-based emissions might contribute to violations of the 24-hour PM_{2.5} standards. Kent County has the largest population in the area. The population exceeds 100,000 people in Ottawa, Muskegon, and Allegan Counties. Barry

and Ionia Counties have modest populations. This evidence supports designating Kent and Ottawa Counties as the nonattainment area.

Table 4. Population

County	State Recommended Nonattainment?	2005 Population	2005 Population Density (pop/sq mi)
Kent, MI	Yes	595,979	685
Ottawa, MI	No	255,187	442
Muskegon, MI	No	174,971	333
Allegan, MI	No	113,052	134
Ionia, MI	No	64,468	111
Barry, MI	No	59,817	103

Factor 4: Traffic and commuting patterns

This factor considers the number of commuters in each county who drive to another county within the Grand Rapids area, the percent of total commuters in each county who commute within the area, as well as the total Vehicle Miles Traveled (VMT) for each county in millions of miles (see Table 5). A county with numerous commuters is generally an integral part of an urban area and is likely contributing to fine particle concentrations in the area.

Table 5. Traffic and Commuting Patterns

County	State Recommended Nonattainment?	2005 VMT (10 ⁶ mi)	Number Commuting to any violating counties	Percent Commuting to any violating counties	Number Commuting within/to statistical area	Percent Commuting within/to statistical area
Ottawa, MI	No	2,024	29,960	25	119,480	99
Kent, MI	Yes	6,342	258,700	91	277,270	98
Allegan, MI	No	1,159	8,380	16	44,550	87
Muskegon, MI	No	1,699	4,510	6	74,240	99
Barry, MI	No	417	6,940	26	19,930	74
Ionia, MI	No	658	7,090	27	20,730	78

The listing of counties on Table 4 reflects a ranking based on the number of people commuting to other counties. The commuting statistics show that there is limited commuting into Kent County, the only violating county in the area. There is some commuting from Ottawa County to Kent County. There are just a few commuters into Kent County from the other area counties. Within this area, Ottawa County does have the second highest number of commuters to Kent County, and the second highest amount of VMT. Although information related to this factor is not conclusive, EPA believes that this supports inclusion of Ottawa County in the Grand Rapids area. These data also support excluding Muskegon and Allegan Counties from the nonattainment area.

Note: The 2005 VMT data used for table 5 and 6 of the 9-factor analysis has been derived using methodology similar to that described in “Documentation for the final 2002 Mobile National Emissions Inventory, Version 3, September 2007, prepared for the

Emission Inventory Group, U.S. EPA. This document may be found at: ftp://ftp.epa.gov/EmisInventory/2002finalnei/documentation/mobile/2002_mobile_nei_version_3_report_092807.pdf. The 2005 VMT data were taken from documentation which is still draft, but which should be released in 2008.

Factor 5: Growth rates and patterns

This factor considers population growth for 2000-2005 and growth in vehicle miles traveled for 1996-2005 for counties in Grand Rapids area, as well as patterns of population and VMT growth. A county with rapid population or VMT growth is generally an integral part of an urban area and likely to be contributing to fine particle concentrations in the area.

Table 6 below shows population, population growth, VMT, and VMT growth for counties that are included in the Grand Rapids area. Counties are listed in descending order based on VMT growth between 1996 and 2005.

Table 6. Population and VMT Growth and Percent Change

County	Population (2005)	Population % change (2000-2005)	2005 VMT (10 ⁶ mi)	VMT % change (1996-2005)
Kent, MI	595,979	3	6,342	31
Muskegon, MI	174,971	3	1,699	24
Barry, MI	59,817	5	417	18
Ionia, MI	64,468	5	658	4
Allegan, MI	113,052	7	1,159	-1
Ottawa, MI	255,187	7	2,024	-5

The populations in the area are all rather stable with the limited growth rates. Kent, Muskegon, and Barry Counties are experiencing strong VMT growth. VMT is declining in Ottawa County. There was little VMT change in Allegan and Ionia Counties.

Factor 6: Meteorology (weather/transport patterns)

For this factor, EPA considered data from National Weather Service instruments and other meteorological monitoring sites in the area. Wind direction and wind speed data for 2005-2007 were analyzed, with an emphasis on “high PM_{2.5} days” for each of two seasons, an October-April “cold” season and a May-September “warm” season. These high days are defined as days where any FRM or FEM air quality monitors had 24-hour PM_{2.5} concentrations above 95% on a frequency distribution curve of PM_{2.5} 24-hour values.

For each air quality monitoring site, EPA developed a “pollution rose” to understand the prevailing wind direction and wind speed on the days with highest fine particle concentrations. The figure identifies 24-hour PM_{2.5} values by color; days exceeding 35 µg/m³ are denoted with a red or black icon. A dot indicates the day occurred in the warm season; a triangle indicates the day occurred in the cool season. The center of the figure indicates the location of the air quality monitoring site, and the location of the icon in

relation to the center indicates the direction from which the wind was blowing on that day. An icon that is close to the center indicates a low average wind speed on that day. Higher wind speeds are indicated when the icon is further away from the center.

The pollution rose for the Grand Rapids area is provided as Figure 2. Winds on high concentration days tend to come from the East to Southwest. These data indicate that Ottawa County (as well as Allegan County) will commonly be upwind of Kent County on high concentration days.

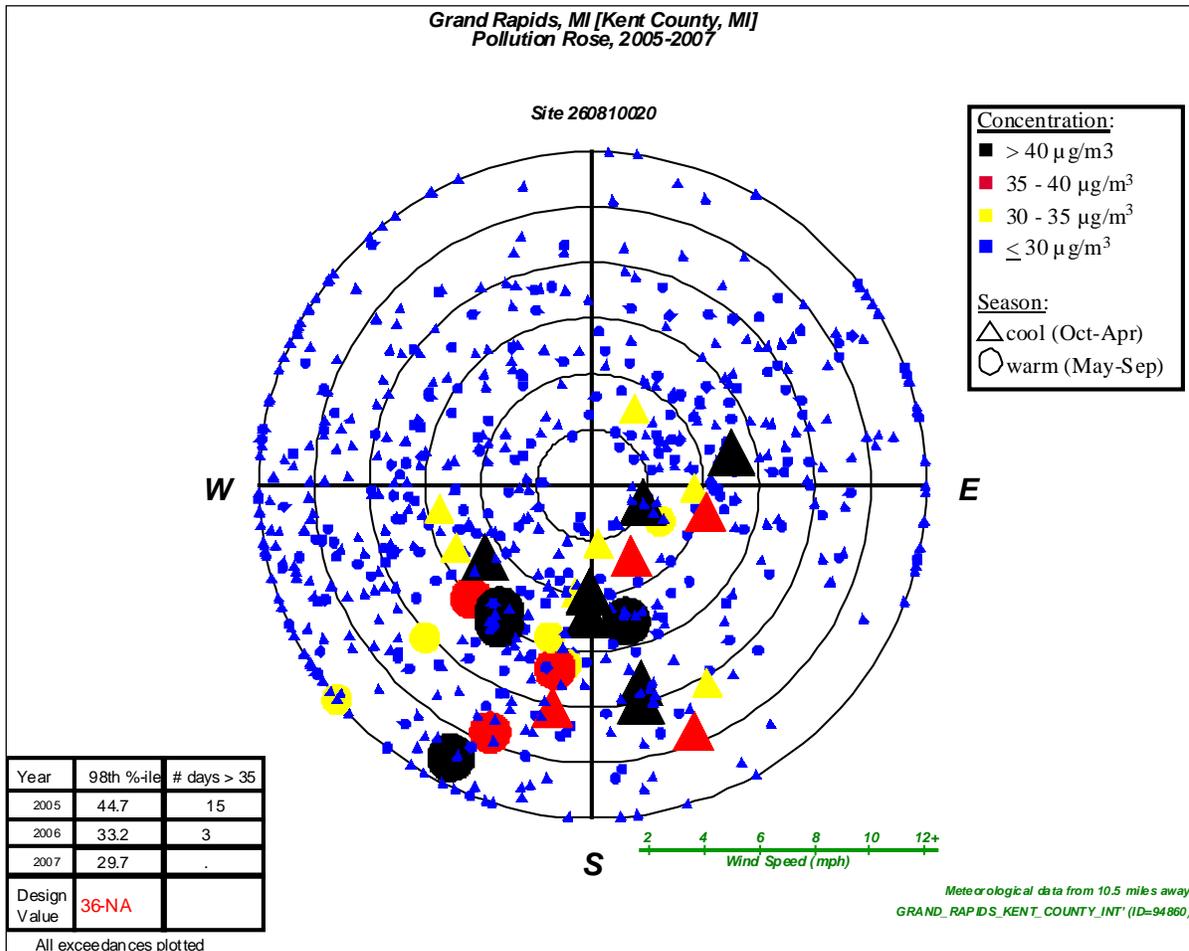


Figure 2

Note: the meteorology factor is also considered in each county's Contributing Emissions Score because the method for deriving this metric included an analysis of trajectories of air masses for high PM_{2.5} days.

Factor 7: Geography/topography (mountain ranges or other air basin boundaries)

The geography/topography analysis evaluates the physical features of the land that might have an effect on the air shed and, therefore, on the distribution of PM_{2.5} over the area.

The Grand Rapids area does not have any geographical or topographical barriers significantly limiting air-pollution transport within its air shed. Therefore, this factor did not play a significant role in the decision-making process.

Factor 8: Jurisdictional boundaries

In evaluating the jurisdictional boundary factor, EPA gave special consideration to areas that were already designated nonattainment in 2005 for violating the 1997 fine particle standards. However, the Grand Rapids area was designated attainment for the 1997 standards, so nonattainment area boundaries for the 1997 standards were not a factor in determining the Grand Rapids nonattainment area boundaries.

The Grand Valley Metropolitan Council is the metropolitan planning organization for Allegan, Barry, Ionia, Kent, Montcalm, and Ottawa Counties in Michigan. Its web site is www.gvmc.org.

The Grand Rapids, Michigan ozone maintenance area consists of Kent and Ottawa Counties. To the degree appropriate, based upon violations and contributions to violations of the ozone and PM_{2.5} NAAQS in a particular area, EPA believes it may be helpful for air planning purposes and for attainment of both NAAQS, for there to be some consistency between ozone and PM_{2.5} nonattainment area boundaries. **Furthermore,** the jurisdictional boundary factor indicates a link between Kent and Ottawa Counties. Therefore, this factor supports a nonattainment area that includes Kent and Ottawa Counties. While this factor suggests some link between Kent County and other counties in Southwest Michigan, other factors suggest less linkage.

Factor 9: Level of control of emission sources

Under this factor, the existing level of control of emission sources is taken into consideration. The emissions data used by EPA in this technical analysis and provided in Table 1 under Factor 1 represent emissions levels taking into account any control strategies implemented in the Grand Rapids area before 2005 on stationary, mobile, and area sources. Data are presented for PM_{2.5} components that are directly emitted, carbonaceous PM_{2.5} and crustal PM_{2.5}, and for pollutants which react in the atmosphere to form fine particles such as SO₂, NO_x, VOC, and ammonia.

In considering county-level emissions, EPA used data from the 2005 National Emissions Inventory, the most updated version of the national inventory available at the beginning of the designations process in late 2007. However, EPA recognized that for certain counties, emissions may have changed since 2005. For example, certain power plants or large sources of emissions in or near this area may have installed emission controls or otherwise significantly reduced emissions since 2005. Some States provided updated information on emissions and emission controls in their comments to EPA. EPA considered such additional information in making final designation decisions.

With regard to nearby power plants, EPA considered information about whether a specific plant installed federally enforceable emission controls by December 2008 resulting in significant emissions reductions. A control requirement is considered to be federally-enforceable if it is required by a State regulation adopted in a State implementation plan, if it is included in a federally-enforceable Title V operating permit, or if it is required by a consent decree which also requires the controls to be included in a federally enforceable permit upon termination of the consent decree. In making final decisions, EPA also considered whether a facility would continue to emit pollutants which contribute to PM_{2.5} exceedances even after emission controls are operational.

Michigan provided information regarding emission control devices planned in the future for a Kent County power plant. EPA considered this information in the process of the final designation. However, EPA is promulgating these designations based on current emissions and air quality, not on potential future emissions or air quality. Therefore, this information about future reductions in contribution was not relevant to this designation. EPA notes that such reductions may be appropriate for consideration in the development of the nonattainment area SIP for this area.