4.0 Analyses of Individual Nonattainment Area

4.5 Region 5 Nonattainment Areas

4.5.2 Indiana

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

The table below identifies the counties in Indiana 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	Indiana Recommended Nonattainment Counties	EPA's Designated Nonattainment Counties
Chicago, IL-IN	Lake	Lake Porter
Cincinnati, OH-KY-IN	None	Dearborn* (partial)
Evansville, IN-KY	Vanderburgh	Gibson* (partial) Pike* (partial) Spencer* (partial) Vanderburgh Warrick
Indianapolis, IN	Marion	Hamilton Hendricks Johnson Marion Morgan
Lafayette, IN	Tippecanoe	Tippecanoe
Louisville, KY-IN	Clark	Clark Floyd Jefferson* (partial)
Vincennes, IN	Knox	Knox

* The Indiana partial county boundaries are Dearborn- Lawrenceburg Township, Gibson- Montgomery Township, Pike- Washington Township, Spencer- Ohio Township, and Jefferson- Madison Township.

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

[1] EPA designated nonattainment areas for the 1997 fine particle standards in 2005. In 2006, the 24-hour PM2.5 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 PM2.5 remained unchanged at 15 micrograms per cubic meter (average of annual averages for 3 consecutive years).

General Comments on Size of Nonattainment Areas

Indiana recommended that each county measuring a violation be designated as a single county nonattainment area. In EPA's letter to Indiana dated August 18, 2008, EPA provided its rationale for designating multi-county nonattainment areas in many cases. Indiana provided further comments on this issue in its letter to EPA dated October 20, 2008, and EPA has provided detailed responses to these comments in its response to comments document. For the reasons EPA has given in those two documents, EPA continues to believe that many counties in Indiana that do not themselves have monitored violations must nevertheless be designated as contributing to nearby violations.

Review for Chicago-Gary-Kenosha, IL-IN-WI

EPA reviewed the relevant information for the ten counties including two counties in Indiana within the area designated nonattainment for the 1997 standards as well as for surrounding counties. There are violating monitors in Lake County, Indiana as well as in Cook and Will Counties in Illinois. Indiana recommended that Lake County be designated as a single county nonattainment area, and Indiana recommended that Porter County and other counties in and near the Chicago area be designated attainment.

EPA believes that two Indiana counties, namely Lake and Porter Counties, should be included in the Chicago nonattainment area. Lake County not only violates the standard, it also contributes to violations in Cook and Will Counties, Illinois. Porter County also has substantial emissions that contribute to violations elsewhere in the Chicago metropolitan area on a high percentage of days. Both Lake and Porter Counties have high numbers of commuters that drive into other parts of the Chicago metropolitan area. In addition, establishment of a nonattainment area for the 2006 standards that matches the existing nonattainment area boundaries set for the 1997 standards will simplify planning by assuring that the corresponding requirements for the two sets of air quality standards apply to the same 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. Jasper County has moderate emission levels, but was excluded from the nonattainment area because the other factors indicated it does not contribute to the violations in the Chicago area. Other Indiana counties in or near the combined statistical area have relatively low emissions, and no other factor warranted inclusion of the 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.

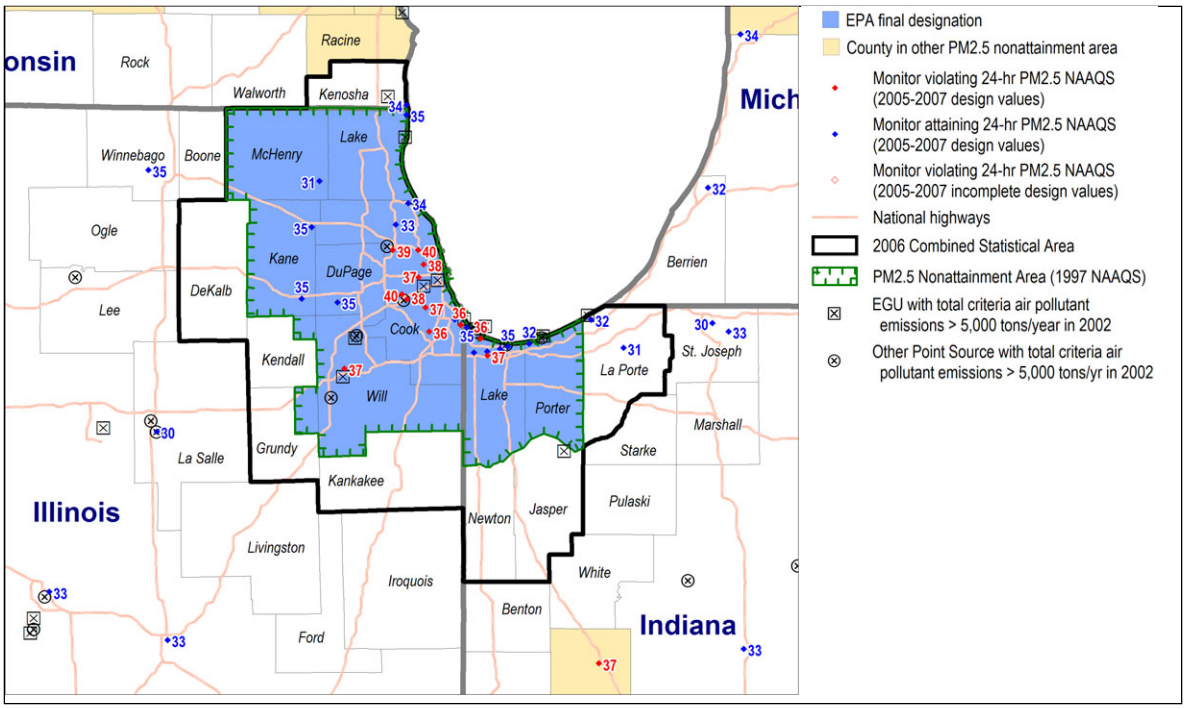


Figure 1

For this area, EPA previously established $PM_{2.5}$ nonattainment boundaries for the 1997 $PM_{2.5}$ NAAQS that included ten full and partial counties, with eight being located in Illinois and two in Indiana.

In its December 18, 2007 letter, Illinois recommended that the same full and partial counties in the Chicago area be designated as "nonattainment" for the 2006 24-hour $PM_{2.5}$ standard based on air quality data from 2004-2006. These data are from Federal Reference Method (FRM) monitors located in the state. Indiana recommended Lake County be designated as "nonattainment" for the 2006 24-hour $PM_{2.5}$ standard based on air quality data in its May 30, 2008 letter.

In August 2008, EPA notified Indiana 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. Indiana provided information on planned controls throughout the state, but this information did not indicate any significant differences between current emissions and emission estimates from the 2005 inventory for this area. Indiana also provided lengthy additional comments, including a review of information pertinent to EPA's nine factors reflecting information generally quite similar to EPA's information. EPA discusses these comments below and in the Response to Comments document.

Based on EPA's technical analysis described below, EPA has designated six full and two partial counties in Illinois and two Indiana counties as nonattainment for the 24-hour

$PM_{2.5}$ air-quality standard as the Chicago nonattainment area, based upon currently available information. These counties are listed in the table below.

The following is a review of data for relevant factors for the Chicago 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," "SO_2," "NO_x," "VOCs," and "NH_3." "$PM_{2.5}$ emissions total" represents direct emissions of $PM_{2.5}$ and includes: "$PM_{2.5}$ emissions carbon," "$PM_{2.5}$ emissions other", primary sulfate (SO_4), and primary nitrate. (Although primary sulfate and primary nitrate, which are emitted directly from stacks rather than forming in atmospheric reactions with SO_2 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 SO_2 and NO_x, which are precursors of the secondary $PM_{2.5}$ components sulfate and nitrate, are also considered. VOCs (volatile organic compounds) and NH_3 (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 Chicago area. Counties that are part of the Chicago 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
Cook, IL	**Yes**	**100**	**10,081**	**5,407**	**4,674**	**35,354**	**175,267**	**152,288**	**4,550**
Lake, IN	**No**	**100**	**7,079**	**1,219**	**5,861**	**39,500**	**54,203**	**24,679**	**3,784**
Will, IL	**Yes**	**95**	**5,432**	**1,236**	**4,195**	**78,792**	**46,028**	**19,886**	**1,407**
Porter, IN	**No**	**41**	**3,901**	**719**	**3,183**	**24,458**	**29,930**	**9,795**	**909**
DuPage, IL	**Yes**	**16**	**2,075**	**1,259**	**816**	**2,013**	**36,880**	**29,541**	**1,385**
Jasper, IN	No	14	2,641	280	2,360	40,723	20,104	3,367	2,929
Kankakee, IL	No	9	1,660	419	1,242	366	7,351	6,830	1,699
Kane, IL	**Yes**	**4**	**1,997**	**733**	**1,263**	**1,037**	**16,528**	**15,578**	**1,293**
Grundy, IL	**Partial**	**3**	**1,105**	**248**	**857**	**362**	**4,057**	**4,223**	**1,027**

Lake, IL	**Yes**	**3**	**2,657**	**1,070**	**1,587**	**14,719**	**29,478**	**32,778**	**747**
Kendall, IL	**Partial**	**2**	**811**	**230**	**581**	**351**	**3,697**	**3,693**	**753**
McHenry, IL	**Yes**	**1**	**2,102**	**634**	**1,468**	**592**	**9,493**	**10,596**	**1,224**
Kenosha, WI	No	1	1,489	460	1,030	33,988	15,967	7,857	647

In the Indiana portion of the area, emissions are highest in Lake and Porter Counties. Emissions are lower in Jasper County, but still high enough to merit consideration for nonattainment under this factor. Lake and Porter Counties are the best candidates in Indiana for a 24-hour $PM_{2.5}$ nonattainment designation.

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)
Cook, IL	100	97	72	15.8
Lake, IN	100	100	100	32.5
Will, IL	95	92	68	25.0
Porter, IN	41	84	87	42.4
DuPage, IL	16	81	50	17.5
Jasper, IN	14	58	69	64.9
Kankakee, IL	9	72	60	46.6
Kane, IL	4	42	17	36.1
Grundy, IL	3	56	28	50.1
Lake, IL	3	35	8	37.9
Kendall, IL	2	58	28	38.1
McHenry, IL	1	19	4	50.5
Kenosha, WI	1	15	1	55.4

Factor 2: Air quality data

This factor considers the 24-hour $PM_{2.5}$ design values (in $\mu g/m^3$) for air quality monitors in counties in the Chicago area based on data for the 2005-2007 period. 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 98^{th} percentile values are 35 $\mu g/m^3$ 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 Chicago area are shown in Table 3.

Table 3. Air Quality Data

County	State Recommended Nonattainment?	Design Values 2004-2006	Design Values 2005-2007
Cook, IL	Yes	42	40
Lake, IN	No	38	37
Will, IL	Yes	36	37
Porter, IN	No	31	32
DuPage, IL	Yes	33	35
Kane, IL	Yes	32	35
Grundy, IL	Partial		
Lake, IL	Yes	33	35
Kendall, IL	Partial		
McHenry, IL	Yes	31	31

Three counties, Cook and Will in Illinois and Lake in Indiana, show violations of the 24-hour $PM_{2.5}$ standard. Therefore, these counties are included in the Chicago nonattainment area. However, the absence of a violating monitor alone is not a sufficient reason to eliminate counties as candidates for 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 Chicago area occur about 47% in the warm season and 53% in the cool season. In the warm season, the average chemical composition of the highest days is 72% sulfate, no nitrate, 25% carbon, and 3% crustal. In the cool season, the average chemical composition of the highest days is 21% sulfate, 39% nitrate, 38% carbon, and 2% crustal. These data indicate that sources of SO_2, NOx, and direct $PM_{2.5}$ emissions contribute to violations in the area.

Note: Eligible monitors for providing design value data generally include State and Local Air Monitoring Stations (SLAMS) at population-oriented locations with an FRM monitor. All data from Special Purpose Monitors (SPM) using an FRM is eligible for comparison to the relevant NAAQS, subject to the requirements given in the October 17, 2006 Revision to Ambient Air Monitoring Regulations (71 FR 61236). All monitors used to provide data must meet the monitor siting and eligibility requirements given in 71 FR 61236 to 61328 in order to be acceptable for comparison to the 24-hr $PM_{2.5}$ NAAQS for designation purposes.

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/mi^2)
Cook, IL	Yes	5,303,943	5545
Lake, IN	No	491,706	980
Will, IL	Yes	642,625	758
Porter, IN	No	157,408	375
DuPage, IL	Yes	931,219	2769
Kane, IL	Yes	483,208	923
Grundy, IL	Partial	43,736	102
Lake, IL	Yes	704,086	1504
Kendall, IL	Partial	79,597	247
McHenry, IL	Yes	304,701	499
Kankakee, IL	No	107,824	158

In the Indiana portion of the Chicago area, Lake County has a sizable population and population density. Both are more moderate in Porter County, but still larger that other area counties designated as nonattainment. Jasper County has a small population of 31,761 and a low population density of 57 people per mile squared suggesting it is a mostly rural area.

Factor 4: Traffic and commuting patterns

This factor considers the number of commuters in each county who drive to another county within the Chicago 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 county	Percent Commuting to any violating county	Number Commuting within statistical area	Percent Commuting within statistical area
Cook, IL	Yes	35,294	2,113,930	89	2,352,120	99
Lake, IN	No	4,588	193,610	93	206,350	99
Will, IL	Yes	4,605	185,690	77	239,340	99
Porter, IN	No	1,677	25,470	35	70,940	98
DuPage, IL	Yes	8,802	161,940	35	464,630	99
Kane, IL	Yes	3,517	36,290	19	190,780	99
Grundy, IL	Partial	623	6,990	38	17,310	95
Lake, IL	Yes	6,016	83,930	26	313,250	99
Kendall, IL	Partial	678	4,230	15	27,860	99
McHenry, IL	Yes	2,104	31,680	24	130,520	98

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. All counties in this table are highly integrated into the Chicago area. Therefore, Lake and Porter Counties, Indiana are good candidates for the nonattainment area when considering the commuting factor. EPA also examined data for Jasper County. Its annual VMT is 757 million miles and the number of workers commuting to violating counties is 2,920. These very low commuting figures indicate that Jasper County is a poor candidate for nonattainment based on this factor.

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 Chicago 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 Chicago 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)
Kane, IL	483,208	18	3,517	364
McHenry, IL	304,701	16	2,104	196
Kendall, IL	79,597	44	678	166
Will, IL	642,625	26	4,605	135
Lake, IL	704,086	9	6,016	82
DuPage, IL	931,219	3	8,802	43
Grundy, IL	43,736	16	623	30
Porter, IN	157,408	7	1,677	10
Lake, IN	491,706	1	4,588	0
Cook, IL	5,303,943	-1	35,294	-14

Lake and Porter Counties, Indiana experienced little population and VMT growth. The growth rates are not expected to yield significant changes in the distribution of population in the area, so this factor did not significantly influence the decision-making process.

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 $\mu g/m^3$ 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 Chicago area is provided in Figure 2. Winds on high concentration days predominantly come from the southwest and southeast, thus suggesting that winds on many days would bring Lake and Porter County emissions into Illinois and, on many other days, would bring Illinois emissions into Lake and Porter Counties. Thus, this factor supports designation of a joint Illinois-Indiana nonattainment area.

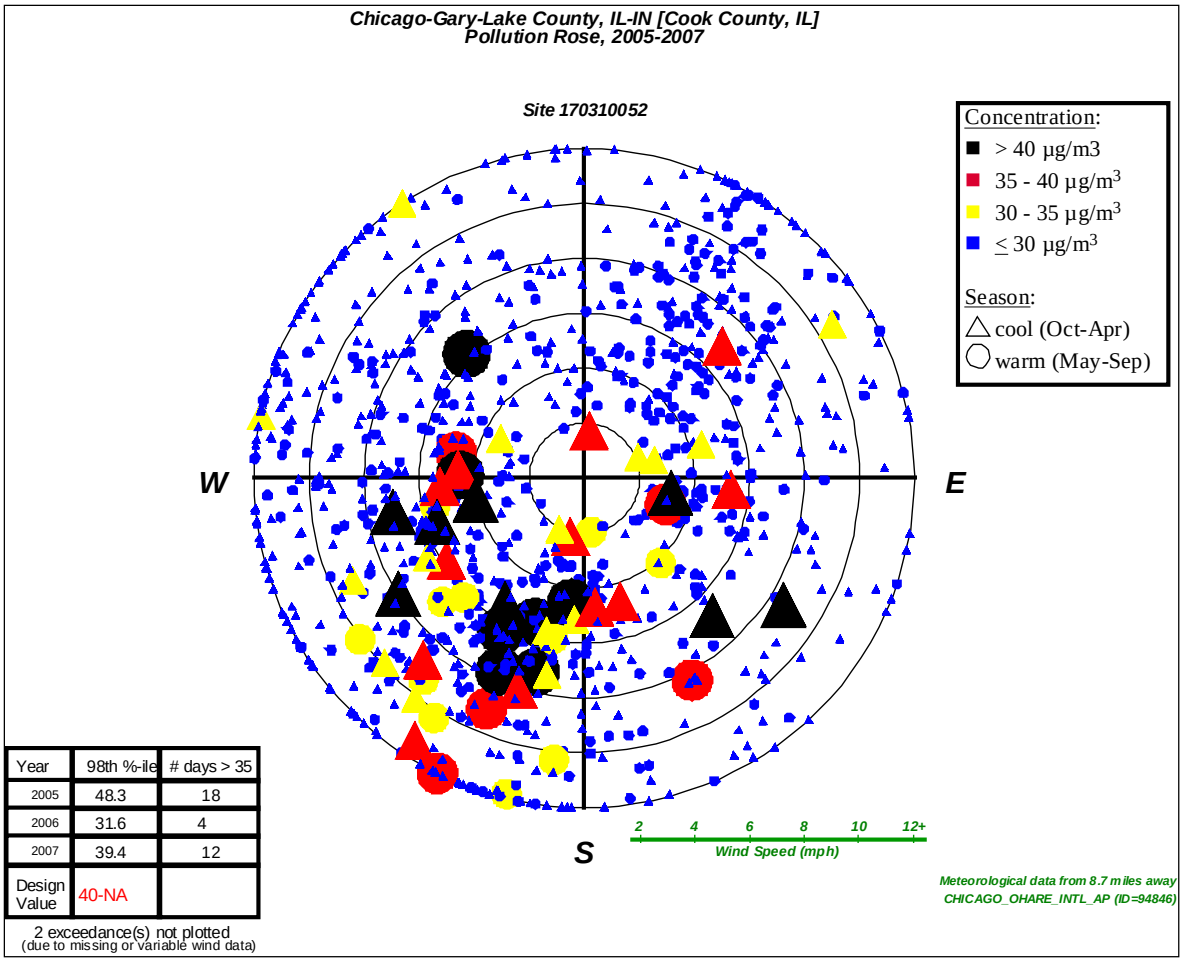


Figure 2

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 Chicago 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. 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 which exceeded 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 Chicago ozone nonattainment area consists of the following counties: Cook, Du Page, Kane, Lake, Mc Henry, Will, Aux Sable and Goose Lake Townships in Grundy County, and Oswego Township in Kendall County in Illinois and Lake and Porter Counties in Indiana. The fine particulate nonattainment area matches these boundaries, which will facilitate planning. It is also identical to the fine particulate nonattainment area designed under the 1997 standards.

The Chicago Area Transportation Study (CATS) Policy Committee is the Metropolitan Planning Organization (MPO) for the northeastern Illinois region. CATS webpage: http://www.catsmpo.com/. Northwest Indiana has a separate MPO called the Northwest Indiana Regional Planning Commission (NIRPC), serving Lake, Porter, and LaPorte Counties, with a web site at: http://www.nirpc.org/.

Jasper County was not included in any of previous nonattainment areas and not in the NIRPC. This factor suggests Lake and Porter Counties for nonattainment in the Indiana portion of the Chicago area. It also suggests against including Jasper County.

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 Chicago 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 SO_2, NOx, 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 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.

Wisconsin provided information on a power plant in Kenosha County, Wisconsin. This is immediately north of the Chicago nonattainment area. EPA determined that the Kenosha County facility is well controlled. The emission controls are federally enforceable. Kenosha County is not considered to contribute to violations in the Chicago area with the updated emissions information and the information on the other eight factors. Therefore, EPA determined that including Kenosha County in the Chicago nonattainment area is not warranted. Further information on Kenosha County emissions is provided in discussion of the Milwaukee area.

Indiana provided information on planned controls throughout the state, but this information did not indicate any significant differences between current emissions and emission estimates from the 2005 inventory for this area.

Note: EPA has provided a thorough response to each of the specific comments raised by the State in the Response to Comments document. Additional information regarding responses to specific State comments can be found in EPA's Response to Comments document at http://www.epa.gov/pmdesignations/2006standards/tech.htm.

EPA Technical Analysis for Cincinnati, OH-KY-IN

EPA reviewed the relevant information for the eight counties, including a portion of one county in Indiana, partly or fully within the area designated nonattainment for the 1997 standards as well as for surrounding counties. There are violating monitors in Hamilton and Butler Counties in Ohio and in Kenton County in Kentucky. While EPA designated Lawrenceburg Township of Dearborn County as nonattainment for the 1997 standards, Indiana recommended that this entire county be designated as attainment.

EPA believes that Lawrenceburg Township of Dearborn County contributes to violations elsewhere in the Cincinnati Combined Statistical Area. The county has high emissions relatively close to the locations of violations and is commonly upwind on days with high

concentrations. In addition, establishment of a nonattainment area for the 2006 standards that matches the existing nonattainment area boundaries set for the 1997 standards will simplify planning by assuring that the corresponding requirements for the two sets of air quality standards apply to the same area.

The information supplied by Indiana indicates that the power plant in Lawrenceburg Township is planning to install selective noncatalytic reduction control equipment to reduce NOx emissions in 2010, and no significant SO_2 emission controls are expected in the near future. EPA is promulgating designations based on current air quality and current emission levels, and EPA has concluded that the power plant in Lawrenceburg Township contributes to the violations in the Cincinnati-Middletown area. Therefore, EPA is including Lawrenceburg Township of Dearborn County in the Cincinnati-Middletown nonattainment 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. Jefferson County was not considered as a possible candidate for nonattainment in the Cincinnati area because it is considered part of the Louisville area for purposes of nonattainment designations. Other Indiana counties in or near the combined statistical area and other portions of Dearborn County have relatively low emissions, and no other factor warranted inclusion of these other areas 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.

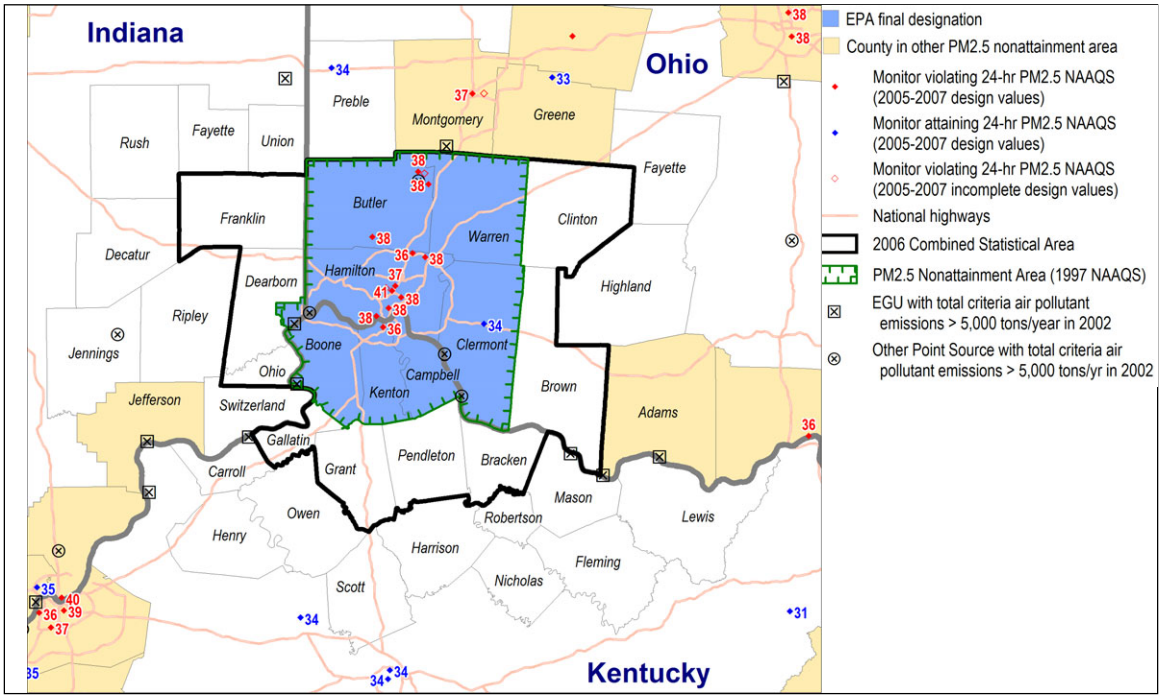


Figure 1

For this area, EPA previously established $PM_{2.5}$ nonattainment boundaries for the 1997 $PM_{2.5}$ NAAQS that included eight full and partial counties, with one being located in Indiana.

In its December 17, 2007 letter, Indiana recommended that no Indiana areas be designated as "nonattainment" for the 2006 24-hour $PM_{2.5}$ standard based on air quality data from 2004-2006. These data are from Federal Reference Method (FRM) monitors located in the state.

In August 2008, EPA notified Indiana 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.

Based on EPA's technical analysis described below, EPA has designated a partial county in Indiana as nonattainment for the 24-hour $PM_{2.5}$ air-quality standard as part of the Cincinnati nonattainment area, based upon currently available information. These counties are listed in the table below.

The following is a review of data for relevant factors for the Indiana portion of the Cincinnati, Ohio-Kentucky-Indiana 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," "SO_2," "NO_x," "VOCs," and "NH_3." "$PM_{2.5}$ emissions total" represents direct emissions of $PM_{2.5}$ and includes: "$PM_{2.5}$ emissions carbon," "$PM_{2.5}$ emissions other", primary sulfate (SO_4), and primary nitrate. (Although primary sulfate and primary nitrate, which are emitted directly from stacks rather than forming in atmospheric reactions with SO_2 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 SO_2 and NO_x, which are precursors of the secondary $PM_{2.5}$ components sulfate and nitrate, are also considered. VOCs (volatile organic compounds) and NH_3 (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 Cincinnati area. Counties that are part of the Cincinnati 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
Hamilton, OH	**Yes**	**100**	**6,489**	**1,244**	**5,245**	**88,139**	**50,060**	**38,552**	**2,359**
Clermont, OH	**Yes**	**36**	**5,399**	**733**	**4,665**	**90,341**	**35,748**	**6,982**	**407**
Butler, OH	**Yes**	**24**	**2,269**	**563**	**1,706**	**10,636**	**16,661**	**12,734**	**1,105**
Dearborn, IN	**No**	**22**	**2,780**	**288**	**2,492**	**47,908**	**12,881**	**3,268**	**229**
Jefferson, IN	No	7	1,265	168	1,097	75,319	25,214	2,272	341
Boone, KY	**No**	**6**	**1,629**	**615**	**1,014**	**5,383**	**10,852**	**5,883**	**286**
Adams, OH	No	6	5,970	494	5,476	126,316	33,822	1,918	837
Warren, OH	**Yes**	**5**	**1,304**	**535**	**768**	**568**	**7,244**	**7,278**	**792**
Kenton, KY	**No**	**3**	**537**	**269**	**268**	**1,300**	**6,316**	**5,606**	**266**
Campbell, KY	**No**	**2**	**412**	**179**	**233**	**731**	**4,231**	**2,923**	**196**

Dearborn County has similar emissions to Butler and Clermont Counties, Ohio. There is a power plant in Lawrenceburg Township which accounts for most of Dearborn County's emissions. Jefferson County, Indiana has a moderate CES in the Cincinnati area even though it has similar emissions to Dearborn County. Analysis showed that Jefferson County is more a part of the Louisville 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)
Hamilton, OH	100	100	100	10.6
Clermont, OH	36	77	71	23.2
Butler, OH	24	90	64	19
Dearborn, IN	22	73	61	21.8

Jefferson, IN	7	30	25	55.6
Boone, KY	6	77	78	16.6
Adams, OH	6	32	21	62.6
Warren, OH	5	80	57	27.4
Kenton, KY	3	79	82	15.4
Campbell, KY	2	82	84	17.4

Factor 2: Air quality data

This factor considers the 24-hour $PM_{2.5}$ design values (in $\mu g/m^3$) for air quality monitors in counties in the Cincinnati area based on data for the 2005-2007 period. 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 98^{th} percentile values are 35 $\mu g/m^3$ 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 Cincinnati area are shown in Table 3.

Table 3. Air Quality Data

County	State Recommended Nonattainment?	Design Values 2004-2006	Design Values 2005-2007
Hamilton, OH	Yes	40	41
Clermont, OH	Yes		34
Butler, OH	Yes	38	38
Dearborn, IN	No		
Boone, KY	No		
Warren, OH	Yes		
Kenton, KY	No	35	36
Campbell, KY	No		

In EPA Region 5, Hamilton and Butler Counties in Ohio show violations of the 24-hour $PM_{2.5}$ standard. There is no monitoring data for Dearborn County. 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 Cincinnati area occur about 86% in the warm season and 14% in the cool season. In the warm season, the average chemical composition of the highest days is 82% sulfate, no nitrate, 17% carbon, and 2% crustal. In the cool season, the average chemical composition of the highest days is 50% sulfate, 25% nitrate, 23% carbon, and 2% crustal. These data indicate that sources of SO_2, NOx, and direct $PM_{2.5}$ emissions contribute to violations in the area.

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/mi^2)
Hamilton, OH	Yes	828,487	2007
Clermont, OH	Yes	190,329	417
Butler, OH	Yes	349,966	745
Dearborn, IN	No	48,930	160
Boone, KY	No	106,278	414
Warren, OH	Yes	196,793	484
Kenton, KY	No	153,314	930
Campbell, KY	No	87,048	547

The population and population density of Dearborn County are both the lowest of the area counties listed on Table 4. Having a relatively low population and population density suggests that designating only a portion of Dearborn County as nonattainment may be warranted.

Factor 4: Traffic and commuting patterns

This factor considers the number of commuters in each county who drive to another county within the Cincinnati 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 statistical area	Percent Commuting within statistical area
Hamilton, OH	Yes	8,132	364,380	92	391,410	98
Butler, OH	Yes	3,059	143,800	90	153,070	96
Clermont, OH	Yes	1,799	45,070	51	86,620	98
Kenton, KY	No	1,647	51,980	68	74,830	99
Warren, OH	Yes	1,692	41,510	54	62,590	82
Boone, KY	No	1,074	17,300	39	43,420	98
Campbell, KY	No	1,000	21,460	50	42,160	99

Dearborn, IN	No	708	8,920	40	20,700	92

The listing of counties on Table 5 reflects a ranking based on the number of people commuting within the Cincinnati area. The listed counties are all in the Cincinnati nonattainment area for the 1997 $PM_{2.5}$ NAAQS.

The VMT figure for Dearborn County is much lower than the other listed counties, but 92% commuting within the statistical area suggests a tie to the Cincinnati 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 Cincinnati 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 Cincinnati 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 (1996-05)
Boone, KY	106,278	22	1,074	48
Warren, OH	196,793	22	1,692	34
Dearborn, IN	48,930	6	708	30
Butler, OH	349,966	5	3,059	28
Clermont, OH	190,329	7	1,799	16
Campbell, KY	87,048	-2	1,000	4
Hamilton, OH	828,487	-2	8,132	3
Kenton, KY	153,314	1	1,647	3

The low VMT of Dearborn County, Indiana is growing at a fair rate from 1996 to 2005. Its low population is also growing, though not nearly as fast as Boone County, Kentucky and Warren County, Ohio are growing.

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 $\mu g/m^3$ 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 Cincinnati area is provided as Figure 2. Winds on high concentration days show a preference to come from the Northeast or Southwest. Dearborn County is in the western portion of the Cincinnati area, so these data support a finding that Dearborn County contributes to violations in Hamilton and Butler Counties, Ohio.

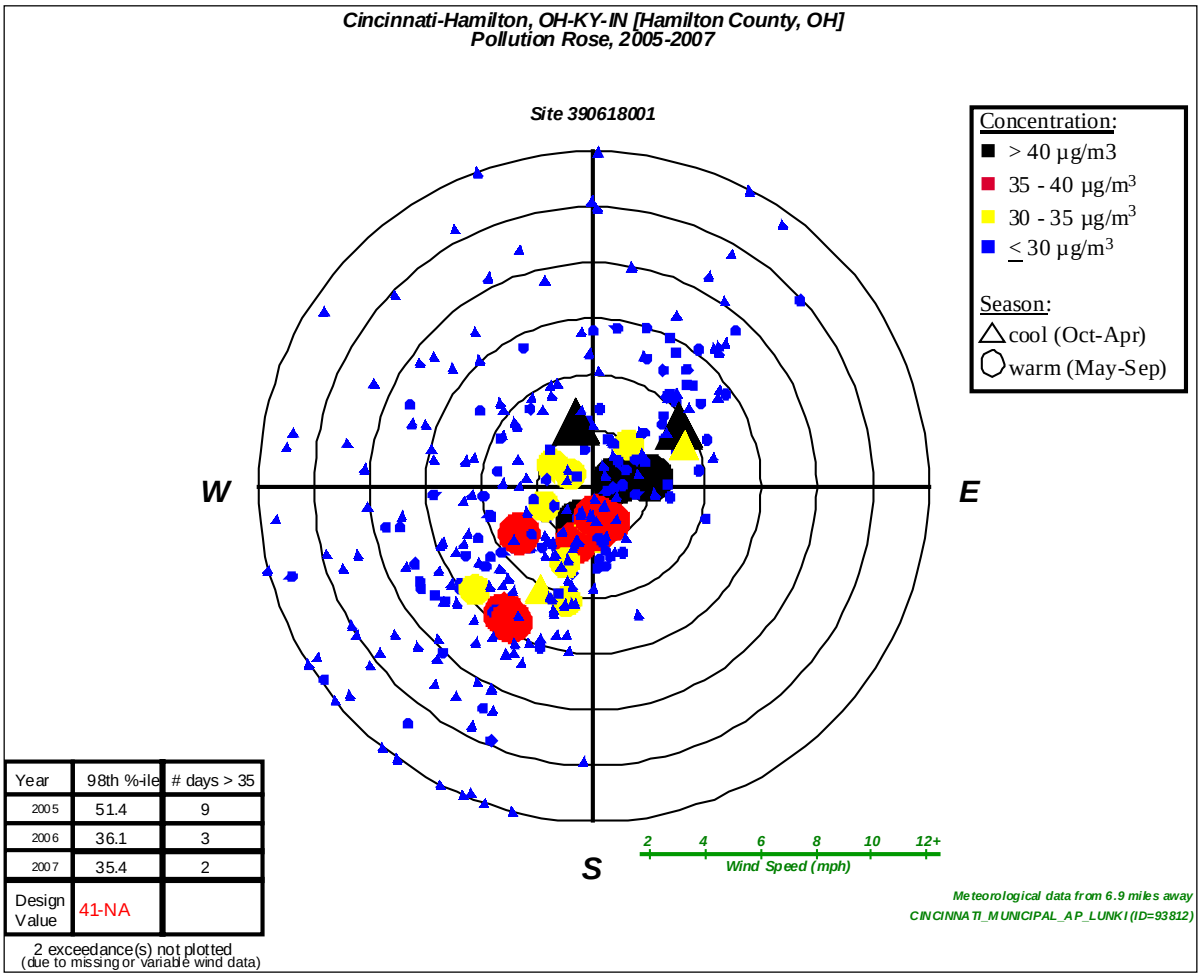


Figure 2

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 Cincinnati 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. 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.

Most areas that were originally designated nonattainment for the $PM_{2.5}$ standards still have not attained the air quality standards. Thus, EPA has generally concluded that counties that were designated as having emissions sources contributing to fine particle concentrations which continue to exceed 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 Ohio-Kentucky-Indiana Regional Council of Governments (OKI) is the Metropolitan Planning Organization (MPO) for Butler, Warren, Clermont, and Hamilton Counties in Ohio; Campbell, Kenton, and Boone Counties in Kentucky; and Dearborn County, Indiana. OKI webpage: http://www.oki.org/.

The Cincinnati ozone nonattainment area consists of the following counties: in Ohio- Butler, Clermont, Clinton, Hamilton, and Warren; in Indiana- Lawrenceburg Township in Dearborn; in Kentucky- Boone, Kenton, and Campbell.

The inclusion of Dearborn County in these particular jurisdictions is not a significant factor in EPA's decision to designate part of the county as nonattainment, but does suggest that its inclusion in the Cincinnati nonattainment area makes sense from an air quality management perspective.

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 Cincinnati 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 SO_2, NOx, 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 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.

The information supplied by Indiana indicates that the power plant in Lawrenceburg Township is planning to install selective noncatalytic reduction control equipment to reduce NOx emissions in 2010, and no significant SO_2 emission controls are expected in the near future. Thus, current emissions from this plant remain relatively high.

EPA Technical Analysis for Evansville, IN

EPA reviewed the relevant information for the six counties partly or fully within the area designated nonattainment for the 1997 $PM_{2.5}$ standards in Evansville, as well as for surrounding counties. There are monitors in Vanderburgh and Dubois Counties showing violations of the 2006 $PM_{2.5}$ standards, in particular the 24-hour standard. In 2005, EPA designated a nonattainment area for the 1997 standards that included the entirety of Dubois, Vanderburgh, and Warrick Counties and a township in each of Gibson, Pike and Spencer Counties. Indiana has requested redesignation of this area with respect to the 1997 standards. Nevertheless, EPA's designations in 2005 reflect EPA's determination at that time that those six counties contributed to the violations of the annual standard that were then being observed in Vanderburgh and Dubois Counties. EPA finds in general that violations of the 24-hour $PM_{2.5}$ standard reflect the same combination of local scale, metropolitan scale, and regional scale contributions as contribute to violations of the annual standard, and EPA believes in particular that this combination of scales of contribution are responsible for the violations of the 24-hour standard in the Evansville area.

Indiana submitted information to suggest that a number of observations of high concentrations, most notably in Dubois County, would not have been high but for exceptional events. The review of this information is provided separately. In some cases, EPA is concurring with Indiana's claim that high concentrations would not have occurred but for an exceptional event, and in other cases, EPA is not concurring with Indiana's claim. In the Evansville area, the net result of EPA's findings is a conclusion that Vanderburgh County is violating the 24-hour standard for the 2005 to 2007 period and Dubois County is attaining the standard for the same period.

EPA has concluded that the Evansville nonattainment area for the 2006 standards should include Vanderburgh County, Warrick County, Montgomery Township in Gibson County, Washington Township in Pike County, and Ohio Township in Spencer County. Vanderburgh County is recording a violation, is contributing to its violation, and was recommended as nonattainment by the State. Warrick County has relatively high emissions that are commonly upwind of the violating monitors and thus is contributing to violations in the Evansville area. Warrick County is also part of the Evansville Metropolitan Statistical Area, in part reflecting the substantial commuting between Warrick and Vanderburgh Counties.

Gibson, Pike, and Spencer Counties all have substantial emissions that are commonly upwind and contribute to the violations in Vanderburgh County. These emissions in each case predominantly arise from power plants located in the townships named above. As part of its evaluation of final designations, EPA undertook a careful review of the degree to which these power plants are controlled, the enforceability of these controls (i.e., whether EPA can be assured that the controls will remain in place), and the quantity of emissions that remain after these controls.

In Gibson County, Gibson Station has in place some longstanding SO_2 emission controls installed to address acid rain program requirements and some more recently installed SO_2 emission controls, as well as NOx emission controls installed to address the NOx budget trading program that operated during the ozone season. Nevertheless, even with these controls, emissions from this facility remain sufficiently high to be judged still to be contributing to the violations. Furthermore, given the uncertain status of the Clean Air Interstate Rule (CAIR) as a result of an adverse opinion by the D.C. Circuit Court of Appeals, the operation of the recent SO_2 controls and wintertime operation of the NOx controls is in doubt.

In Pike County, Petersburg Station has longstanding SO_2 emission controls and has installed NOx emission controls on two of the four units. In the absence of CAIR, the owner would not be required to operate the NOx emission controls in the winter. Even with these controls, emissions from this facility remain sufficiently high to be judged still to be contributing to the violations. In addition, no supplemental emission controls have been installed on Frank E. Ratts Station.

In Spencer County, Rockport Station has not installed supplemental emission controls for either SO_2 or NOx, and emissions from this facility remain sufficiently high to be judged still to be contributing to the violations.

The Evansville nonattainment area as defined for the 1997 standards included Dubois County. At the time EPA promulgated those designations, Dubois County was violating the applicable standards. Dubois County was not and is not part of the Evansville Metropolitan Statistical Area, few people commute from Dubois County into the Evansville area, and EPA did not identify Dubois County as contributing to violations in the Evansville area. Nevertheless, EPA recognized that the violations in Dubois and

Vanderburgh County had common origins, so that it was most appropriate to define a single nonattainment area creating a single planning area in which the two counties' violations that sources in the area contribute to would be addressed jointly.

However, as noted above, EPA finds that Dubois County is now attaining the standards based on 2005 to 2007 data (for planning purposes, based on exclusion of values that would have been significantly lower but for exceptional events). EPA also finds that Dubois County is not contributing to violations in Vanderburgh County. Therefore, EPA finds that consideration of relevant factors suggests a different nonattainment area for the 2006 standards than was identified for the 1997 standards, specifically that Dubois County should be excluded from the Evansville nonattainment area for the 2006 standards. EPA's rationale for concurring on the values caused by exceptional events is explained in the attachment to this TSD.

Violations are also being recorded in Knox County, which is in the Vincennes Micropolitan Statistical Area, an area that adjoins the Evansville Metropolitan Statistical Area. As is true in many areas in the Eastern United States, emissions in the Evansville area have some impact on the adjoining Vincennes area. Clean Air Act Section 107 instructs EPA to designate as nonattainment any area "that contributes to ambient air quality in a nearby area that does not meet" the standard. While the transport of fine particulate matter in the Eastern United States is such that sources even 1000 kilometers away can influence air quality, suggesting the possibility of defining a single nonattainment area including large parts of the Eastern United States, Section 107 instructs EPA to define multiple separate nonattainment areas that are limited to particular areas with violations and the nearby source areas that contribute to those violations. In implementing this provision, EPA generally defines separate metropolitan areas as separate nonattainment areas, even if as here the metropolitan areas are contiguous. That is, in judging what areas influencing air quality at a violating monitor can be considered to be "nearby," EPA commonly views separate metropolitan areas as insufficiently nearby to include in the same nonattainment area.

The Evansville area as defined for the 1997 standards reflects an exception to this general approach, with the inclusion of portions of the Jasper micropolitan statistical area (which includes Dubois and Pike Counties) along with portions of the Evansville metropolitan statistical area in a combined Evansville nonattainment area. However, in 2005, when EPA defined the Evansville nonattainment area, the Office of Management and Budget had not defined any micropolitan statistical areas, and Dubois and Pike Counties were not included in any metropolitan area and were implicitly defined as rural. Under those circumstances, EPA concluded that the violation in Dubois County, reflecting substantial contributions from various parts of the Evansville area, was best addressed jointly with the Evansville area. EPA believes that Vincennes/Knox County presents a different situation, and EPA is designating a separate Vincennes nonattainment area in light of the separate micropolitan statistical area which now exists for Vincennes.

EPA reviewed the relevant information for other counties within the Evansville metropolitan statistical area as well as other counties adjacent to the combined statistical

area in order to determine the appropriate nonattainment area boundary. Other Indiana counties in or near the combined statistical area have relatively low emissions, and no other factor warranted inclusion of any of the counties in the nonattainment area. Similarly, portions of Gibson, Pike, and Spencer Counties other than the townships identified above also have relatively low emissions and do not warrant including in the nonattainment area. Consequently, EPA is including only partial counties representing the townships that contain the large power plants.

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.

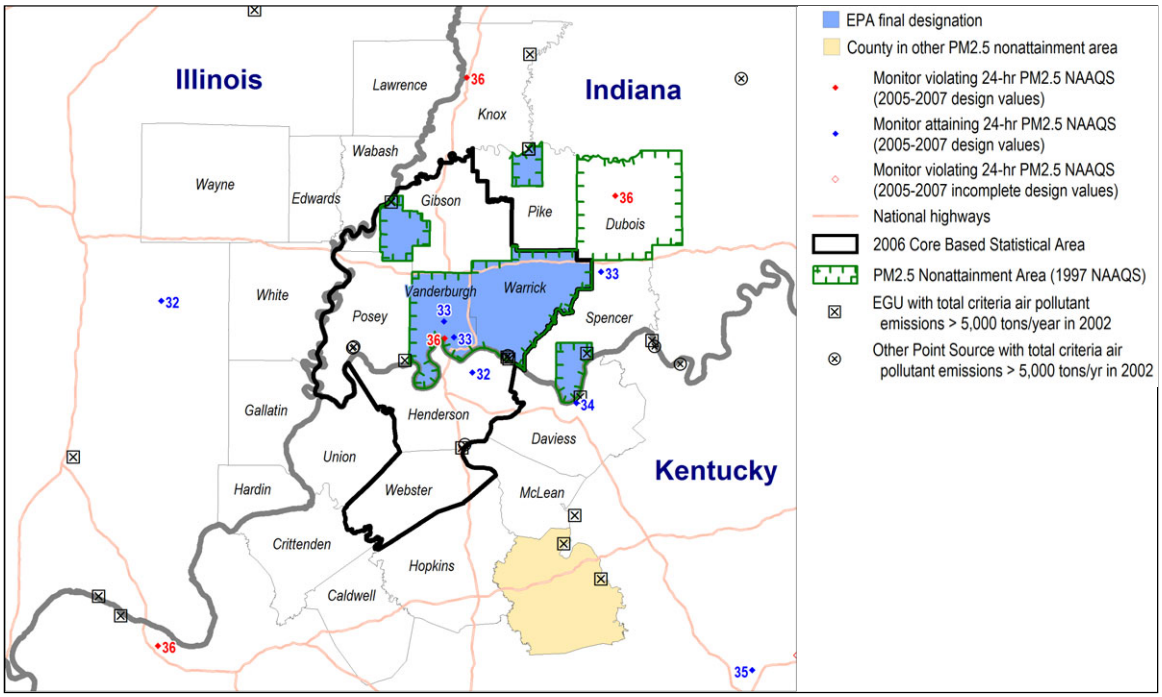


Figure 1

For this area, EPA previously established $PM_{2.5}$ nonattainment boundaries for the 1997 $PM_{2.5}$ NAAQS that included six full and partial counties, with all being located in Indiana.

In its May 30, 2008 letter, Indiana recommended that one county be designated as "nonattainment" for the 2006 24-hour $PM_{2.5}$ standard based on air quality data from 2005-2007. These data are from Federal Reference Method (FRM) monitors located in the state.

In August 2008, EPA notified Indiana 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.

Based on EPA's technical analysis described below, EPA has designated five full or partial Indiana counties as nonattainment for the 24-hour $PM_{2.5}$ air-quality standard as part of the Evansville nonattainment area, based upon currently available information. The following is a review of data for relevant factors for the Evansville, Indiana 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," "SO_2," "NO_x," "VOCs," and "NH_3." "$PM_{2.5}$ emissions total" represents direct emissions of $PM_{2.5}$ and includes: "$PM_{2.5}$ emissions carbon," "$PM_{2.5}$ emissions other", primary sulfate (SO_4), and primary nitrate. (Although primary sulfate and primary nitrate, which are emitted directly from stacks rather than forming in atmospheric reactions with SO_2 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 SO_2 and NO_x, which are precursors of the secondary $PM_{2.5}$ components sulfate and nitrate, are also considered. VOCs (volatile organic compounds) and NH_3 (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 Evansville area. Counties that are part of the Evansville nonattainment area for the 1997 $PM_{2.5}$ NAAQS are shown in boldface. Counties are listed in descending order by CES.

Table 1. $PM_{2.5}$ Related Emissions and Contributing Emissions Score

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
Warrick, IN	**No**	**100**	**8,412**	**540**	**7,872**	**92,222**	**18,291**	**3,856**	**735**
Gibson, IN	**No**	**76**	**6,642**	**420**	**6,223**	**154,782**	**32,655**	**3,679**	**1,921**
Spencer, IN	**No**	**73**	**1,568**	**201**	**1,367**	**67,705**	**24,104**	**2,223**	**1,297**
Vanderburgh, IN	**Yes**	**61**	**1,558**	**308**	**1,250**	**2,029**	**7,048**	**8,405**	**469**
Pike, IN	**No**	**53**	**2,412**	**163**	**2,249**	**52,836**	**18,990**	**1,206**	**487**
Henderson, KY	No	33	1,202	267	936	8,612	5,525	3,068	670
Posey, IN	No	19	1,602	193	1,409	14,531	12,161	3,443	1,343

Dubois, IN	**No**	**15**	**1,204**	**228**	**977**	**2,131**	**3,438**	**5,792**	**3,917**
Daviess, KY	No	15	1,413	367	1,046	7,605	11,880	6,322	1,547

The emissions from Gibson, Spencer, Pike, Vanderburgh, and Warrick Counties are all relatively high, which indicates that based on this factor these counties should be included in the nonattainment area. The emissions from Dubois and Posey Counties in Indiana and Daviess and Henderson Counties in Kentucky are modest.

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)
Warrick	100	93	100	30.5
Gibson	76	84	53	37.5
Spencer	73	81	87	26.7
Vanderburgh	61	100	96	45.7
Pike	53	72	53	19.8
Henderson	33	93	93	54.3
Posey	19	89	52	59.1
Dubois	15	61	49	11.7
Daviess	15	79	85	44.1

Factor 2: Air quality data

This factor considers the 24-hour $PM_{2.5}$ design values (in $\mu g/m^3$) for air quality monitors in counties in the Evansville area based on data for the 2005-2007 period. 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 98^{th} percentile values are 35 $\mu g/m^3$ 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 Evansville area are shown in Table 3.

Table 3. Air Quality Data

County	State Recommended Nonattainment?	Design Values 2004-2006	Design Values 2005-2007

Warrick, IN	No		
Gibson, IN	No		
Spencer, IN	No	31	33
Vanderburgh, IN	Yes	34	36
Pike, IN	No		
Dubois, IN	No	34	35
Henderson, KY	No	30	32
Posey, IN	No		
Daviess, KY	No		34

Vanderburgh Counties has a design values that exceed the air quality standards based on 2005-2007 data. Therefore, it must be designated nonattainment. Dubois County had a design value above the 2006 standards, so it was previously designated as nonattainment. The air quality in Dubois County now meets the standards (for planning purposes) after consideration of exceptional events as described in the attachment. The absence of a violating monitor alone is not sufficient reason to eliminate counties as candidates for nonattainment status. EPA must also evaluate whether Dubois County contributes to violations in Vanderburgh County.

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 Evansville area occur about 94% in the warm season and 6% in the cool season. In the warm season, the average chemical composition of the highest days is 83% sulfate, no nitrate, 16% carbon, and 1% crustal. In the cool season, the average chemical composition of the highest days is 60% sulfate, 32% nitrate, 7% carbon, and 1% crustal. These data indicate that sources of SO_2, NOx, and direct $PM_{2.5}$ emissions contribute to violations in the area.

Note: Eligible monitors for providing design value data generally include State and Local Air Monitoring Stations (SLAMS) at population-oriented locations with an FRM monitor. All data from Special Purpose Monitors (SPM) using an FRM is eligible for comparison to the relevant NAAQS, subject to the requirements given in the October 17, 2006 Revision to Ambient Air Monitoring Regulations (71 FR 61236). All monitors used to provide data must meet the monitor siting and eligibility requirements given in 71 FR 61236 to 61328 in order to be acceptable for comparison to the 24-hr $PM_{2.5}$ NAAQS for designation purposes.

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. Vanderburgh County, Indiana with the City of Evansville has the largest population in the area indicating that for this factor it should be included in the nonattainment area. The other area counties all have modest populations.

Table 4. Population

County	State Recommended Nonattainment?	2005 Population	2005 Population Density (pop/sq mi)
Warrick, IN	No	56,435	144
Gibson, IN	No	33,347	67
Spencer, IN	No	20,476	51
Vanderburgh, IN	Yes	172,774	734
Pike, IN	No	12,766	37
Dubois, IN	No	40,922	94
Henderson, KY	No	45,563	98
Posey, IN	No	26,834	64
Daviess, KY	No	92,837	195

Factor 4: Traffic and commuting patterns

This factor considers the number of commuters in each county who drive to another county within the Evansville area, the percent of total commuters in each county who commute to other counties within the statistical 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
Vanderburgh, IN	**Yes**	**1,452**	**75,290**	**90**	**81,640**	**98**
Warrick, IN	**No**	**797**	**14,890**	**56**	**24,950**	**95**
Henderson, KY	No	508	3,570	17	19,430	94
Gibson, IN	**No**	**469**	**4,330**	**28**	**13,880**	**90**
Posey, IN	No	553	5,600	44	12,520	98
Spencer, IN	**No**	**430**	**3,020**	**31**	**2,200**	**22**
Daviess, KY	No	782	660	2	1,740	4
Pike, IN	**No**	**169**	**2,310**	**41**	**920**	**16**
Dubois, IN	**No**	**539**	**19,030**	**93**	**450**	**2**

The listing of counties on Table 4 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. Vanderburgh County stands out with its VMT being well above the other area counties indicating that for this factor it should be included in the nonattainment area. Daviess County, Kentucky and Dubois County, Indiana show limited commuting into the MSA. Note that the Dubois County figures were calculated when Dubois County was considered a violating county. So, the commuting within or to violating counties figures for Dubois County are erroneously high. Indiana provided 2005 commuting data showing that 27,867 people lived and worked in Dubois County and just 198 people commuted from Dubois to Vanderburgh County. In fact, just 6.5% of Dubois County residents commute outside the county.

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: atftp://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 the Evansville 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 Evansville area. Counties are listed in descending order based on VMT growth between 1996 and 2005.

Table 6. Population and VMT Values and Percent Change.

County	Population (2005)	Population % change (2000-2005)	2005 VMT (10^6 mi)	VMT % change (1996-2005)
Posey, IN	26,834	-1	553	22
Dubois, IN	40,922	3	539	21
Spencer, IN	20,476	0	430	20
Gibson, IN	33,347	2	469	19
Warrick, IN	56,435	7	797	9
Henderson, KY	45,563	2	508	1
Pike, IN	12,766	0	169	0
Daviess, KY	92,837	1	782	0
Vanderburgh, IN	172,774	1	1,452	-7

Dubois, Gibson, Posey, and Spencer Counties all have VMT growth of around 20% though their annual VMT remains modest. The VMT growth is lower in the other counties. The population growth is limited across the area, so that this factor was not significant in determining the nonattainment area boundary.

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 $\mu g/m^3$ 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.

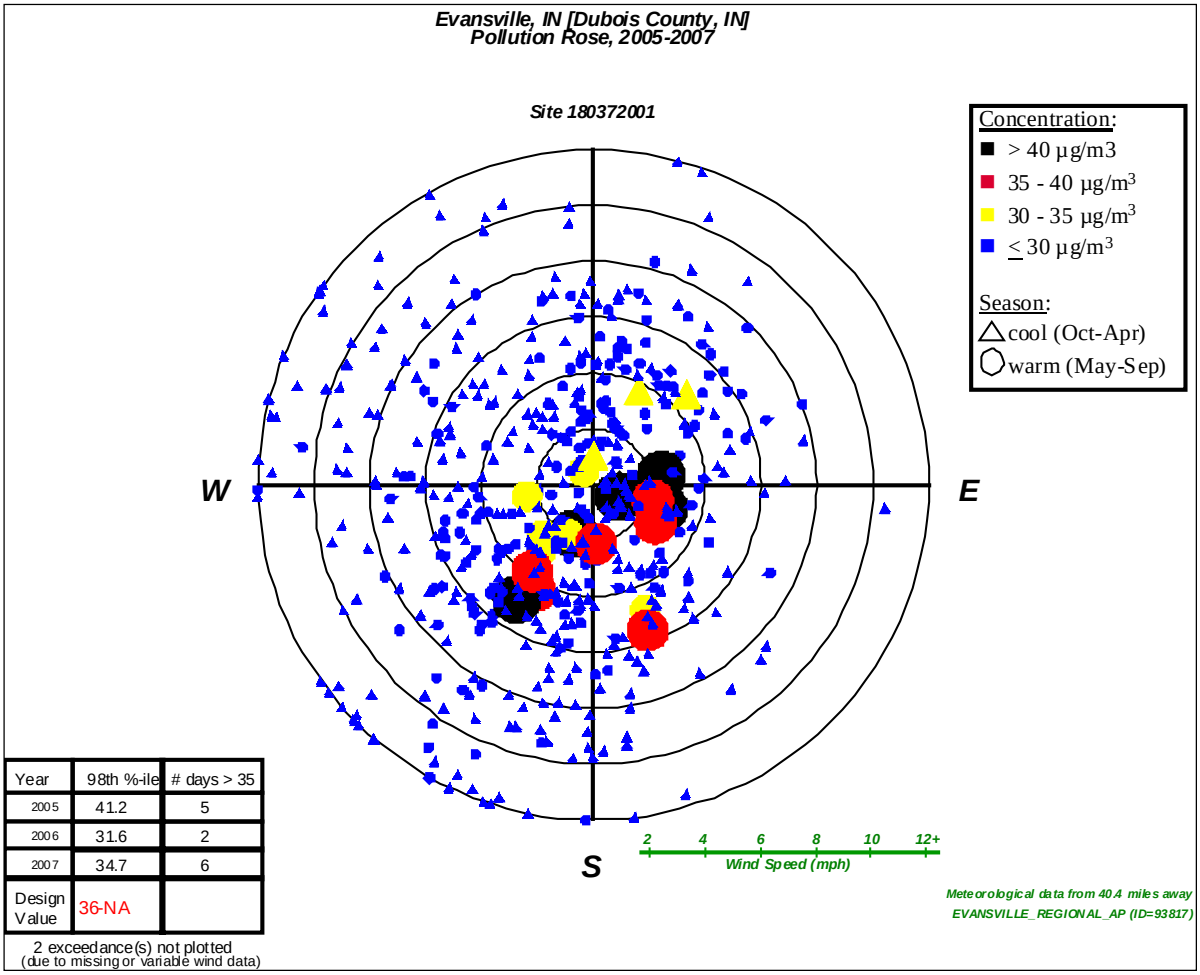


Figure 2.

As shown in the pollution rose in Figure 2, on high $PM_{2.5}$ days prevailing surface winds come from a variety of directions. So, it was appropriate to consider counties in all directions from the violation.

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 Evansville area.

The Evansville 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 (e.g., existing $PM_{2.5}$ areas)

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.

Most areas that were originally designated nonattainment for the $PM_{2.5}$ standards still have not attained the air quality standards. Thus, EPA has generally concluded that counties that were designated as having emissions sources contributing to fine particle concentrations which continue to exceed 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 MPO for Vanderburgh and Warrick Counties is the Evansville Urban Transportation Study.

Vanderburgh and Warrick Counties are in the Evansville ozone maintenance area. All other area counties were designated as attainment/unclassified for 8-hour ozone.

In addition to Vanderburgh and Warrick Counties, Dubois and Pike Counties are also included in the $PM_{2.5}$ Evansville nonattainment area designated under the 1997 standards. These counties are not in the Evansville Metropolitan Statistical Area. Dubois County

was included in the 1997 standards Evansville area because it was violating the standards, although it is currently attaining the 2006 standards excluding the influence of exceptional events. Pike County was included due to its contributing emissions. Dubois and Pike Counties are now in a separate area, the Jasper Micropolitan Area. The fact that Dubois County is in a separate area from the Evansville metropolitan area lends support to the view that Dubois County sources, especially commuting vehicles, do not contribute to violations in Vanderburgh County. Pike County was in the 1997 standards Evansville area and it is adjacent to Evansville Metropolitan Statistical Area, so it belongs with the Evansville nonattainment area.

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 Evansville 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 (e.g. SO_2, NOx, 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 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.

Indiana provided information on the controls in place at power plants in Gibson, Pike, Posey, Spencer, and Warrick Counties. No major reductions have occurred since 2005, so the emissions data used to analyze the Evansville area were appropriate. EPA concluded based on that data that the five counties or partial counties of Vanderburgh County, Warrick County, Montgomery Township in Gibson County, Washington Township in Pike County, and Ohio Township in Spencer County should be included in the Evansville 24 hour $PM_{2.5}$ nonattainment area.

EPA Technical Analysis for Indianapolis, IN

EPA reviewed the relevant information for the five counties in the area designated nonattainment for the 1997 standards as well as for surrounding counties. There are violating monitors in Marion County. While EPA designated Hamilton, Hendricks, Johnson, Marion, and Morgan Counties as nonattainment with respect to the 1997 standards, Indiana recommended that only Marion County be designated nonattainment.

EPA believes that all of the areas designated nonattainment for the 1997 standards also contribute to violations of the 2006 standards. While Marion County likely makes the greatest contribution to violations within Marion County, the other four counties designated nonattainment for the 1997 all have substantial emissions, are commonly upwind of the violating monitors on high concentration days, and are relatively nearby to the violating monitor.

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. Other Indiana counties in or near the combined statistical area have relatively low emissions, and no other factor warranted inclusion of the 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.

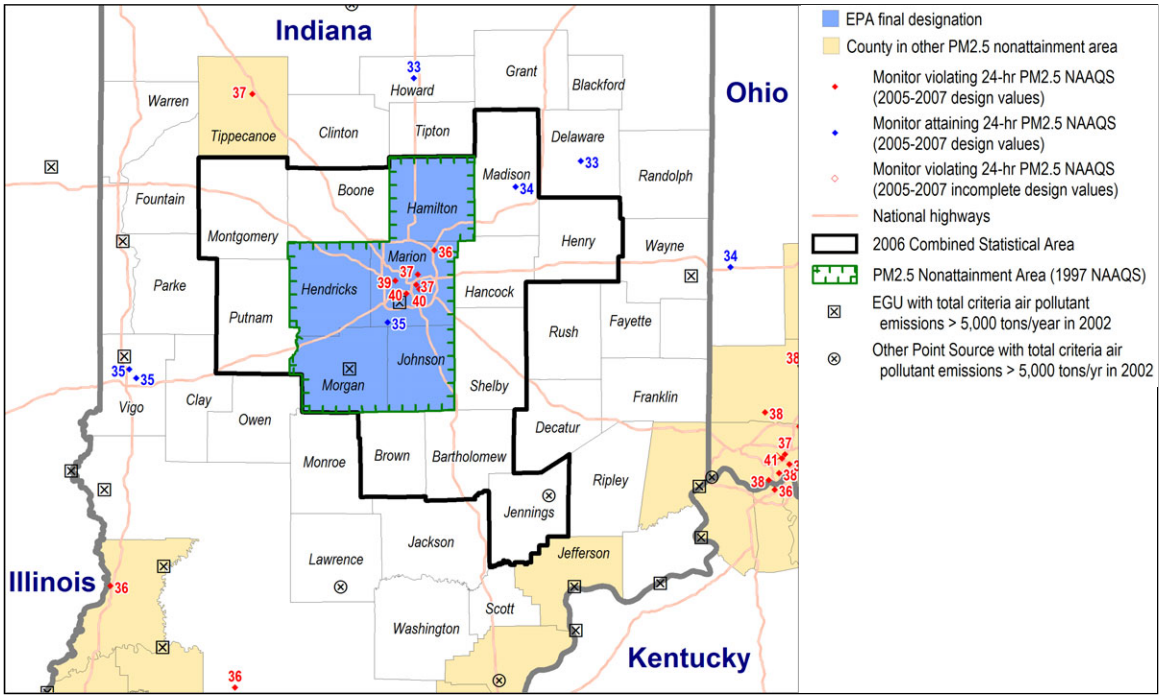


Figure 1

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

In it December 17, 2007 letter, Indiana recommended that one county be designated as "nonattainment" for the 2006 24-hour $PM_{2.5}$ standard based on air quality data from 2004-2006. These data are from Federal Reference Method (FRM) monitors located in the state.

In August 2008, EPA notified Indiana 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. Indiana provided information on pollution controls recently added to a Marion County power plant.

Based on EPA's technical analysis described below, EPA has designated the same counties as previously designated for $PM_{2.5}$ as nonattainment for the 24-hour $PM_{2.5}$ air-quality standard as part of the Indianapolis nonattainment area, based upon currently available information. These counties are listed in the table below.
The following is a review of data for relevant factors for the Indianapolis nonattainment 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," "SO_2," "NO_x," "VOCs," and "NH_3." "$PM_{2.5}$ emissions total" represents direct emissions of $PM_{2.5}$ and includes: "$PM_{2.5}$ emissions carbon," "$PM_{2.5}$ emissions other", primary sulfate (SO_4), and primary nitrate. (Although primary sulfate and primary nitrate, which are emitted directly from stacks rather than forming in atmospheric reactions with SO_2 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 SO_2 and NO_x, which are precursors of the secondary $PM_{2.5}$ components sulfate and nitrate, are also considered. VOCs (volatile organic compounds) and NH_3 (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 Indianapolis area. Counties that are part of the Indianapolis nonattainment area for the 1997 $PM_{2.5}$ NAAQS are shown in boldface. Counties are listed in descending order by CES.

Table 1. $PM_{2.5}$ Related Emissions and Contributing Emissions Score

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
Marion, IN	**Yes**	**100**	**6,606**	**1,245**	**5,361**	**60,898**	**37,673**	**37,017**	**1,876**
Morgan, IN	**No**	**10**	**1,617**	**240**	**1,376**	**19,016**	**6,643**	**3,881**	**413**
Hamilton, IN	**No**	**4**	**1,801**	**432**	**1,369**	**1,226**	**7,988**	**9,210**	**754**
Hendricks, IN	**No**	**4**	**1,342**	**319**	**1,022**	**602**	**5,799**	**4,898**	**685**
Johnson, IN	**No**	**4**	**1,108**	**221**	**887**	**944**	**4,704**	**6,593**	**1,276**
Shelby, IN	No	3	1,346	238	1,107	768	4,511	3,571	964
Hancock, IN	No	2	948	169	777	430	3,144	3,308	763
Boone, IN	No	1	1,041	189	852	401	3,507	3,378	1,353

Marion County stands out with its emission figures being well above the other area counties. The sulfur dioxide emissions in Morgan County push its CES above the remaining area counties. The other counties all have similar emissions. Marion County is a good candidate for nonattainment based on emissions data. Hamilton, Hendricks, Johnson, Morgan, and Shelby Counties are possible candidates for nonattainment. Boone and Hancock Counties have low emissions which makes the counties weak nonattainment candidates based on this factor.

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)
Marion	100	100	97	11.3
Morgan	10	83	86	26.8
Hamilton	4	70	43	20.8
Hendricks	4	80	70	19.6

Johnson	4	89	100	20.1
Shelby	3	73	87	25.7
Hancock	2	81	74	19.6
Boone	1	59	35	25.7

Factor 2: Air quality data

This factor considers the 24-hour $PM_{2.5}$ design values (in $\mu g/m^3$) for air quality monitors in counties in the Indianapolis area based on data for the 2005-2007 period. 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 98^{th} percentile values are 35 $\mu g/m^3$ 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 Indianapolis area are shown in Table 3. Marion County is the only area county with monitoring data. Marion County has a design value above the standard in both 2004-2006 and 2005-2007. However, the absence of a violating monitor alone is not a sufficient reason to eliminate counties as candidates for nonattainment status. Each county has been evaluated based on the weight of evidence of the nine factors and other relevant information.

Table 3. Air Quality Data

County	State Recommended Nonattainment?	Design Values 2004-2006	Design Values 2005-2007
Marion, IN	Yes	38	40
Morgan, IN	No		
Hamilton, IN	No		
Hendricks, IN	No		
Johnson, IN	No		
Shelby, IN	No		
Hancock, IN	No		
Boone, IN	No		

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 Indianapolis area occur about 70% in the warm season and 30% in the cool season. In the warm season, the average chemical composition of the highest days is 74% sulfate, no nitrate, 24% carbon, and 2% crustal. In the cool season, the average chemical composition of the highest days is 55% sulfate, 25% nitrate, 18% carbon, and 2% crustal. These data indicate that sources of SO_2, NOx, and direct $PM_{2.5}$ emissions contribute to violations in the area.

Note: Eligible monitors for providing design value data generally include State and Local Air Monitoring Stations (SLAMS) at population-oriented locations with an FRM monitor. All data from Special Purpose Monitors (SPM) using an FRM is eligible for comparison to the relevant NAAQS, subject to the requirements given in the October 17,

2006 Revision to Ambient Air Monitoring Regulations (71 FR 61236). All monitors used to provide data must meet the monitor siting and eligibility requirements given in 71 FR 61236 to 61328 in order to be acceptable for comparison to the 24-hr $PM_{2.5}$ NAAQS for designation purposes.

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)
Marion, IN	Yes	861,760	2140
Morgan, IN	No	69,751	171
Hamilton, IN	No	240,732	598
Hendricks, IN	No	127,261	312
Johnson, IN	No	129,823	404
Shelby, IN	No	43,775	106
Hancock, IN	No	62,972	205
Boone, IN	No	51,918	123

Marion County has the highest population in the area. Hamilton, Hendricks, and Johnson have the next largest populations. The other counties have much smaller populations.

Factor 4: Traffic and commuting patterns

This factor considers the number of commuters in each county who drive to another county within the Indianapolis 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 statistical area	Percent Commuting within statistical area
Marion, IN	**Yes**	**7,913**	**368,840**	**87**	**417,860**	**99**
Hamilton, IN	**No**	**2,035**	**43,360**	**46**	**90,100**	**96**
Johnson, IN	**No**	**1,359**	**28,610**	**49**	**57,810**	**99**
Hendricks, IN	**No**	**1,373**	**28,500**	**54**	**52,030**	**98**
Morgan, IN	**No**	**932**	**13,780**	**42**	**31,680**	**96**

Hancock, IN	No	813	14,000	50	27,440	98
Boone, IN	No	844	8,970	40	21,490	95
Shelby, IN	No	698	5,560	26	20,940	97

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. Marion County stands out again in the area. Its VMT is well higher that the other Indianapolis area counties. The commuting into the statistical area figures suggests an integration of all the counties into the Indianapolis area. About half of workers commute into the violating county, Marion, from the other area counties except for Shelby County. The commuting data for Hamilton, Hendricks, Johnson, and Morgan Counties makes them good candidates to be included with Marion County in the Indianapolis nonattainment area. The number of commuters, fewer than 10,000, from Boone and Shelby Counties makes these counties a weaker case for being considered for a nonattainment designation under this factor.

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 Indianapolis 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 Indianapolis 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)
Boone, IN	51,918	12	844	28
Hamilton, IN	240,732	30	2,035	24
Hancock, IN	62,972	13	813	23
Shelby, IN	43,775	0	698	22
Hendricks, IN	127,261	21	1,373	22
Johnson, IN	129,823	12	1,359	11
Morgan, IN	69,751	4	932	10
Marion, IN	861,760	0	7,913	-10

There is solid growth in VMT in the counties that ring the central county, Marion. Five of the counties have VMT growth that exceeds 20%. The other two counties, Johnson and Morgan, have seen VMT increase by about 10% from 1996 to 2005. Marion County has seen its VMT decrease during this period. The population growth appears sporadic with some counties experiencing no growth, while other saw moderate growth, and two counties experienced strong growth. Hamilton County grew by 30% while Hendricks County saw 21% growth. The growth in counties surrounding Marion County enhances the importance of having an Indianapolis area nonattainment plan that addresses these outer 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 $\mu g/m^3$ 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 Indianapolis area is provided in Figure 2. Winds on the highest concentration days in the warm season tend to come from the southwest to southeast. The wind was a variety of directions on the highest cool season days and on days year round with low or moderate concentrations. It is appropriate to consider counties in all directions from Marion County.

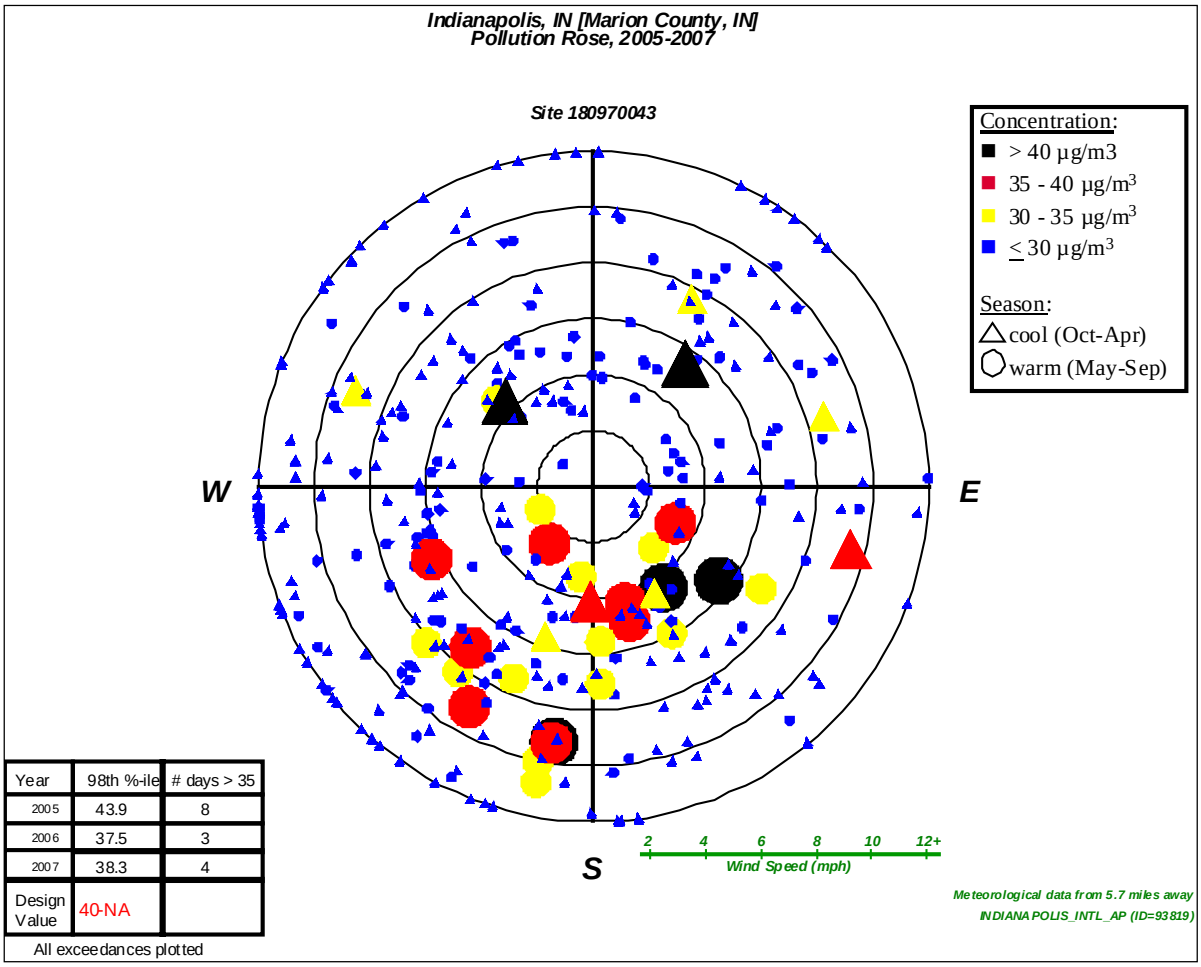


Figure 2

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 Indianapolis area.

The Indianapolis 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 (e.g., existing $PM_{2.5}$ areas)

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 which exceeded 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 Indianapolis Metropolitan Planning Organization (MPO) serves Boone, Hamilton, Hancock, Hendricks, Johnson, Marion, Morgan, and Shelby Counties.

The Indianapolis ozone maintenance area is composed of Boone, Hamilton, Hancock, Hendricks, Johnson, Madison, Marion, Morgan, and Shelby Counties in Indiana.

The Indianapolis nonattainment area is identical to the nonattainment area designated under the 1997 $PM_{2.5}$ standard. The nonattainment area consists of Hamilton, Hendricks, Johnson, Marion, and Morgan Counties.

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 Indianapolis 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 SO_2, NOx, 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 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.

Indiana informed EPA of pollution controls recently added to a Marion County power plant. Emission reductions should help Marion County air quality. Still, the design value for Marion County is above the standards. Changes in this plant's emissions, regardless of enforceability, do not alter EPA's view agreeing with the state that Marion County contributes to its own violations.

Note: EPA has provided a thorough response to each of the specific comments raised by the State in the Response to Comments document. Additional information regarding responses to specific State comments can be found in EPA's Response to Comments document at http://www.epa.gov/pmdesignations/2006standards/tech.htm.

EPA Technical Analysis for Lafayette-Frankfort, IN

The Lafayette Metropolitan Statistical Area consists of Benton, Carroll, and Tippecanoe Counties. EPA reviewed the relevant information for these counties as well as for surrounding counties. There is a violating monitor in Tippecanoe County. These counties were designated as attaining the 1997 standards. Indiana recommended that the Lafayette nonattainment area include only Tippecanoe County.

EPA agrees with Indiana's recommendation. Tippecanoe County violates the standard and contributes to its own violations. The other counties in and around the metropolitan area have relatively low emissions, and no other factor warranted inclusion of the counties in the nonattainment area. These counties are not considered to contribute to the violation in Tippecanoe County after EPA analyzed the nine factors.

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.

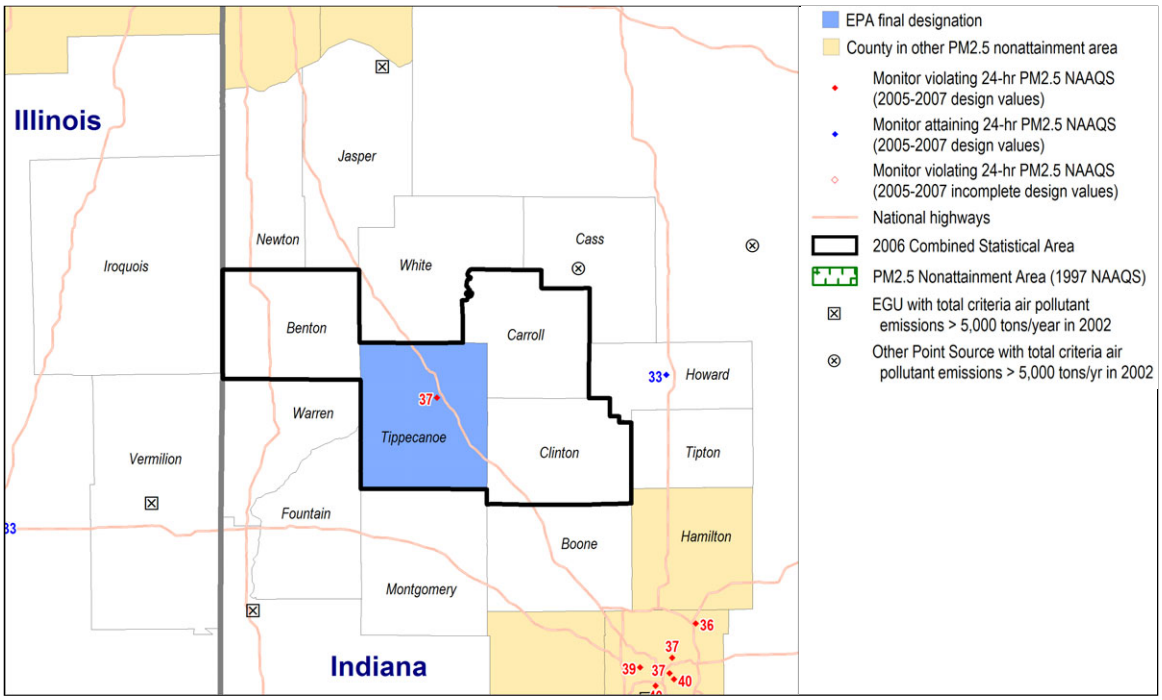


Figure 1

In April 2008, EPA also notified Indiana that a monitor in the Lafayette area was violating based on 2005-2007 data. Indiana provided EPA with a recommendation for this area in May 2008. Indiana recommended one county be designated as "nonattainment" for the 2006 24-hour $PM_{2.5}$ standard based on 2005-2007 air quality data. These data are from Federal Reference Method (FRM) monitors located in the state.

In August 2008, EPA notified Indiana 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. Indiana did not provide additional information on large sources in the Lafayette area.

Based on EPA's technical analysis described below, EPA has designated one county in Indiana as nonattainment for the 24-hour $PM_{2.5}$ air-quality standard as the Lafayette nonattainment area, based upon currently available information. The county is listed in the table below.

The following is a review of data for relevant factors for the Lafayette, Indiana 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," "SO_2," "NO_x," "VOCs," and "NH_3." "$PM_{2.5}$ emissions total"

represents direct emissions of $PM_{2.5}$ and includes: "$PM_{2.5}$ emissions carbon," "$PM_{2.5}$ emissions other", primary sulfate (SO_4), and primary nitrate. (Although primary sulfate and primary nitrate, which are emitted directly from stacks rather than forming in atmospheric reactions with SO_2 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 SO_2 and NO_x, which are precursors of the secondary $PM_{2.5}$ components sulfate and nitrate, are also considered. VOCs (volatile organic compounds) and NH_3 (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 Lafayette, Indiana area. 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
Tippecanoe, IN	Yes	100	2,341	425	1,917	8,286	8,566	9,370	1,492
Jasper, IN	No	26	2,641	280	2,360	40,723	20,104	3,367	2,929
Montgomery, IN	No	18	1,306	252	1,052	1,287	3,656	3,626	1,534
Vermilion, IL	No	15	2,278	358	1,920	12,462	6,427	7,751	1,694
Clinton, IN	No	10	1,044	130	914	743	2,334	2,776	2,162
Carroll, IN	No	6	894	112	782	293	1,391	2,016	2,654
Benton, IN	No	3	828	88	740	119	827	1,203	1,203

Tippecanoe County has the highest CES, well ahead of the other counties in the area. Jasper County has the next highest score, a moderate 26, but it is not adjacent to Tippecanoe County. Jasper County is adjacent to Lake and Porter Counties of the Chicago nonattainment area. The other counties have even lower emissions. Tippecanoe County is the only nonattainment candidate in the area from the emissions factor.

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)
Tippecanoe, IN	100	100	93	12.6
Jasper, IN	26	55	16	44.4
Montgomery, IN	18	89	100	24.1
Vermilion, IL	15	64	36	46.6
Clinton, IN	10	78	91	23.1
Carroll, IN	6	82	66	21.6
Benton, IN	3	83	48	26.6

Factor 2: Air quality data

This factor considers the 24-hour $PM_{2.5}$ design values (in $\mu g/m^3$) for air quality monitors in counties in the Lafayette area based on data for the 2005-2007 period. 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 98^{th} percentile values are 35 $\mu g/m^3$ 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 Lafayette, Indiana area are shown in Table 3.

Table 3. Air Quality Data

County	State Recommended Nonattainment?	Design Values 2004-2006	Design Values 2005-2007
Tippecanoe, IN	Yes	34	37
Clinton, IN	No		
Carroll, IN	No		
Benton, IN	No		
Jasper, IN	No		
Montgomery, IN	No		
Vermilion, IL	No		

Tippecanoe County is the only county with a violating design value. Its 2005-2007 design value exceeds the air quality standards. The surrounding counties do not have fine particulate monitoring data. However, the absence of a violating monitor alone is not a sufficient reason to eliminate counties as candidates for 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 Lafayette area occur about 75% in the warm season and 25% in the cool season. In the warm season, the average chemical composition of the highest days is 72% sulfate, no nitrate, 24% carbon, and 3% crustal. In the cool season, the average chemical composition of the highest days is 34% sulfate, 34% nitrate, 29% carbon, and 3% crustal. These data indicate that sources of SO_2, NOx, and direct $PM_{2.5}$ emissions contribute to violations in the area.

Note: Eligible monitors for providing design value data generally include State and Local Air Monitoring Stations (SLAMS) at population-oriented locations with an FRM monitor. All data from Special Purpose Monitors (SPM) using an FRM is eligible for comparison to the relevant NAAQS, subject to the requirements given in the October 17, 2006 Revision to Ambient Air Monitoring Regulations (71 FR 61236). All monitors used to provide data must meet the monitor siting and eligibility requirements given in 71 FR 61236 to 61328 in order to be acceptable for comparison to the 24-hr $PM_{2.5}$ NAAQS for designation purposes.

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. The population and population density of Tippecanoe County are much higher that any of the other counties in the area.

Table 4. Population

County	State Recommended Nonattainment?	2005 Population	2005 Population Density (pop/mi^2)
Tippecanoe, IN	Yes	154,024	307
Clinton, IN	No	34,073	84
Carroll, IN	No	20,446	55
Benton, IN	No	9,023	22
Jasper, IN	No	31,761	57
Montgomery, IN	No	38,189	76
Vermilion, IL	No	82,178	91

Factor 4: Traffic and commuting patterns

This factor considers the number of commuters in each county who drive to another county within the Lafayette 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
Tippecanoe, IN	Yes	1,332	67,730	93	69,120	95
Clinton, IN	No	526	2,750	18	12,380	83
Carroll, IN	No	272	2,500	26	7,410	76
Benton, IN	No	146	1,650	36	3,970	87
Montgomery, IN	No	751	1,250	7	1,330	7
Jasper, IN	No	757	280	2	310	2
Vermilion, IL	No	838	50	0	70	0

The listing of counties on Table 5 reflects a ranking based on the number of people commuting to other counties. Tippecanoe County has a much higher VMT that the other area counties do. The commuting into any violating county data suggests that not many people commute from Carroll and Clinton Counties into Tippecanoe County. When compared with commuting into the statistical area figures, no strong connection between these counties is suggested. Benton, Carroll, Clinton, and Tippecanoe Counties are all in the Lafayette statistical area. Tippecanoe County is the strongest candidate for nonattainment considering this factor. Benton, Carroll, and Clinton Counties are weaker nonattainment candidates.

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 Lafayette 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 Lafayette, Indiana area. Counties are listed in descending order based on VMT growth between 1996 and 2005.

Table 6. Population and VMT Growth and Percent Change.

Location	Population (2005)	Population % change (2000-	2005 VMT (10^6 mi)	VMT % change

		2005)		(1996-2005)
Montgomery, IN	38,189	2	751	25
Clinton, IN	34,073	0	526	24
Jasper, IN	31,761	5	757	20
Carroll, IN	20,446	1	272	19
Vermilion, IL	82,178	-2	838	17
Benton, IN	9,023	-4	146	15
Tippecanoe, IN	154,024	3	1,332	6

The VMT growth for Tippecanoe County is low. It is higher in other area counties, but the VMT remains well below Tippecanoe County's level. Population change is low for all area counties. The growth rates are not expected to yield significant changes in the distribution of population in the area, so this factor did not significantly influence the decision-making process.

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 $\mu g/m^3$ 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 Lafayette area is provided as Figure 2. Winds on high concentration days show a slight preference to come from the South to Southeast, but the winds come from a variety of directions. So, it is appropriate to consider counties in all directions from the violations.

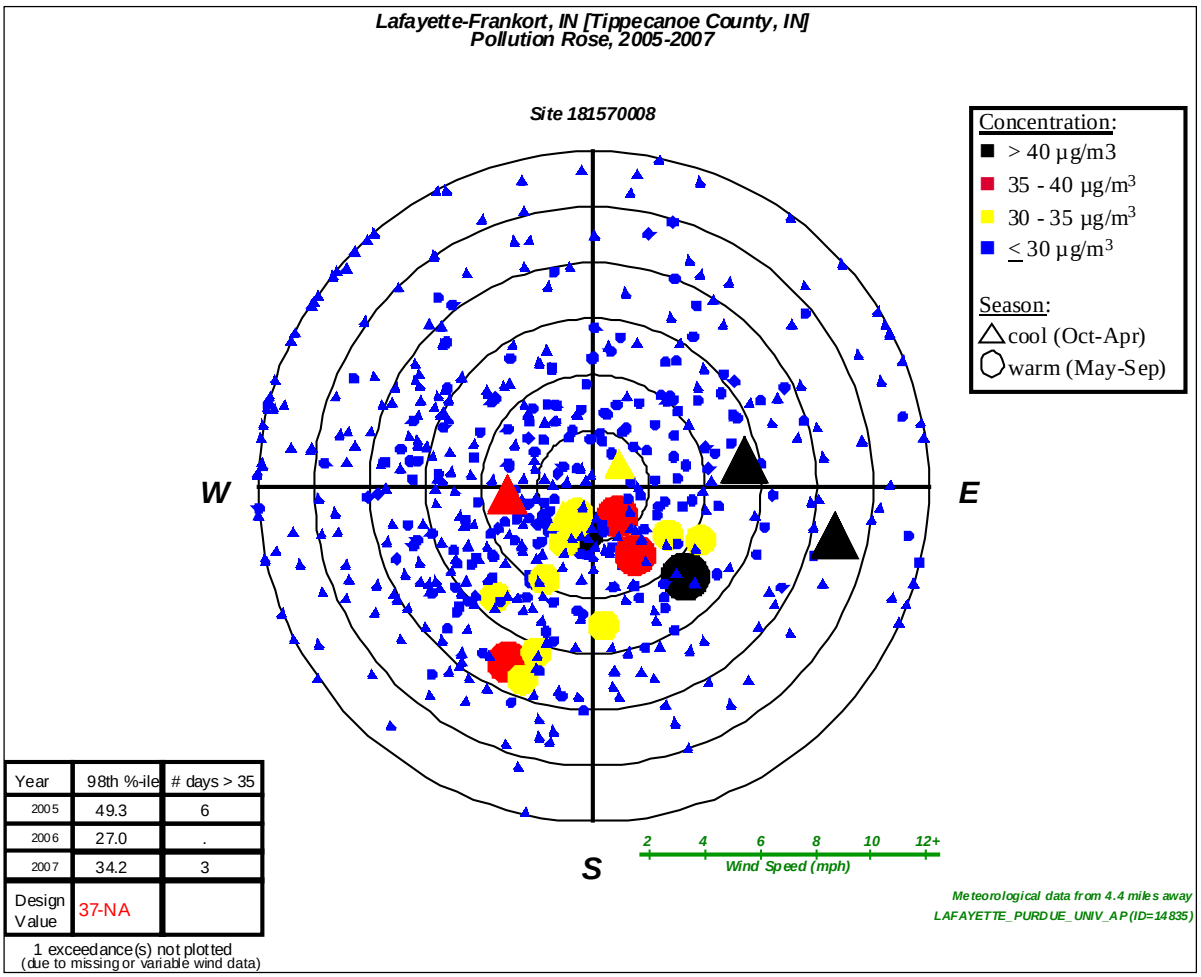


Figure 2

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 Lafayette 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, this area was designated attainment for the 1997 standards, so

nonattainment area boundaries for the 1997 standards were not a factor in determining this area's boundaries.

The metropolitan planning organization for the Lafayette area is the Tippecanoe County Area Plan Commission (TCAPC).

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 Lafayette 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 SO_2, NOx, 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 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.

Indiana did not provide any additional information on power plants or other large sources in the Lafayette area.

Note: EPA has provided a thorough response to each of the specific comments raised by the State in the Response to Comments document. Additional information regarding responses to specific State comments can be found in EPA's Response to Comments document at http://www.epa.gov/pmdesignations/2006standards/tech.htm.

EPA Technical Analysis for Louisville, KY-IN

EPA reviewed the relevant information for the five counties, including three counties in Indiana, partly or fully within the area in Louisville designated nonattainment for the 1997 PM 2.5 standards as well as for surrounding counties. There are violating monitors in Jefferson County, Kentucky, and Clark County, Indiana. While EPA designated Clark, Floyd, and Madison Township of Jefferson County as part of the Louisville nonattainment area with respect to the 1997 standards, Indiana recommended that no portion of this area be designated nonattainment for the 24 hour standard.

Indiana submitted information to indicate that some occurrences of high concentration in Clark County should be attributed to exceptional events. EPA has evaluated this information, and is providing documentation of its evaluation in a separate attachment to this TSD. While EPA concurs with some of these attributions, EPA nevertheless concludes that the area is violating the 2006 standards based on remaining exceedances.

EPA believes that all of the areas designated as nonattainment under the 1997 standards also contribute to violations of the 2006 standards, as part of a single Louisville nonattainment area. Given the range of distance scales over which $PM_{2.5}$ forms and transports, it is clear that the violations in Jefferson County, Kentucky and Clark County, Indiana are interrelated and must be addressed in a combined planning effort that fully addresses the interrelationships. Floyd County has relatively high emissions as well as substantial population, a significant fraction of which commutes into counties with violations. Emissions in Madison Township of Jefferson County, Indiana are also relatively high, and the wind blows with sufficient frequency on high concentration days from Jefferson County, Indiana toward the violating monitors for these emissions to be judged to contribute to those violations. EPA found that Jefferson County, Indiana has a modest population and it shows limited commuting to the Louisville area. The meteorological data indicates that the wind has a slight tendency to come from the Northeast, where Jefferson County, Indiana is located. Jefferson County, Indiana was designated as a partial county nonattainment area under the 1997 standards. EPA determined that the factors indicate the emissions concentrated in one township of Jefferson County, Indiana contribution to the Louisville area violations, so EPA is designating a partial county nonattainment area just as it did under the 1997 standards.

Indiana submitted information on the status of controls of Clifty Creek Station in Jefferson County, Indiana. This information indicates that flue gas desulfurization will be installed on all units at this facility in 2010, selective catalytic reduction is in place on 5 of 6 units, and this equipment will be operated on a full year basis in the future. However, this information also indicates that current emissions are relatively high. Since EPA is promulgating designations based on current air quality and current emissions contributing to existing violations as required by the Act, EPA concludes that Madison Township (including Clifty Creek Station) has relatively high emissions that contribute to violations of the air quality standard in the Louisville area and must be included in the Louisville nonattainment area notwithstanding the fact that additional controls are planned for this facility at a future date.

EPA reviewed the relevant information for other counties within the metropolitan statistical area as well as counties adjacent to the combined statistical area in order to determine the appropriate nonattainment area. Other Indiana counties in or near the combined statistical area have relatively low emissions, and no other factor warranted inclusion of the 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.

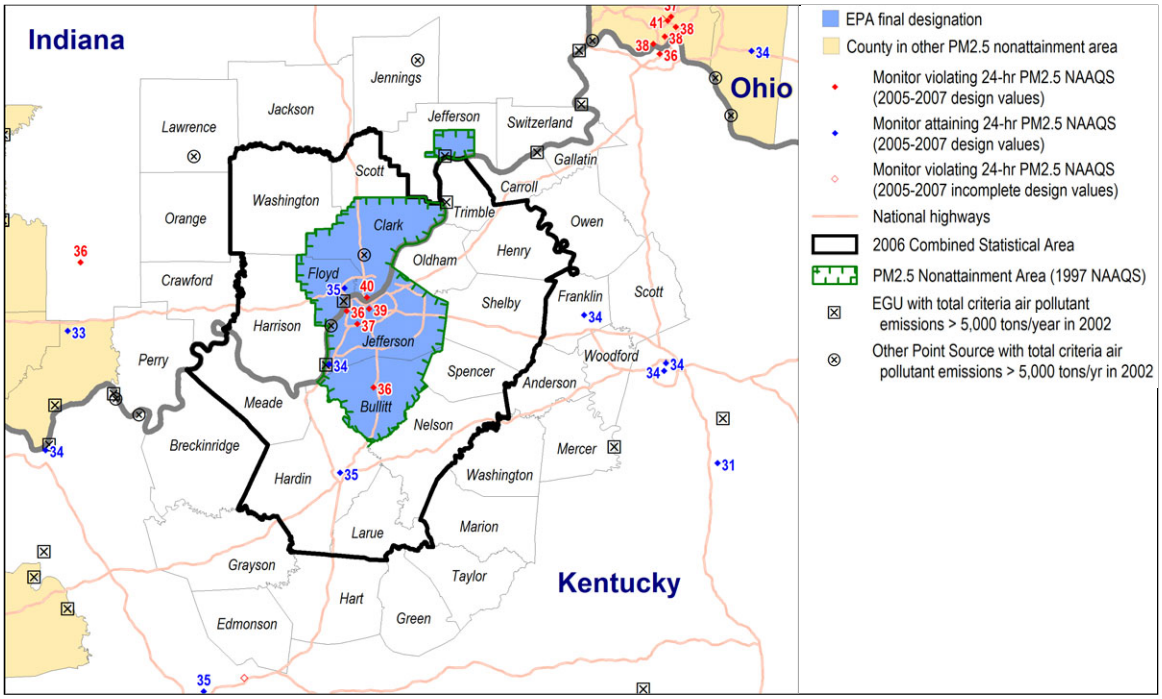


Figure 1

For this area, EPA previously established $PM_{2.5}$ nonattainment boundaries for the 1997 $PM_{2.5}$ NAAQS that included five full and partial counties, with three in Indiana and two in Kentucky.

In August 2008, EPA notified Indiana and Kentucky 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.

Based on EPA's technical analysis described below, EPA has designated three full or partial counties in Indiana and two Kentucky counties as nonattainment for the 24-hour $PM_{2.5}$ air-quality standard as the Louisville nonattainment area, based upon currently available information.

The following is a review of data for relevant factors for the Indiana portion of the Louisville 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," "SO_2," "NO_x," "VOCs," and "NH_3." "$PM_{2.5}$ emissions total" represents direct emissions of $PM_{2.5}$ and includes: "$PM_{2.5}$ emissions carbon," "$PM_{2.5}$ emissions other", primary sulfate (SO_4), and primary nitrate. (Although primary sulfate and primary nitrate, which are emitted directly from stacks rather than forming in atmospheric reactions with SO_2 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 SO_2 and NO_x, which are precursors of the secondary $PM_{2.5}$ components sulfate and nitrate, are also considered. VOCs (volatile organic compounds) and NH_3 (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 Louisville area. Counties that are part of the Louisville 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
Jefferson, KY	**No**	**100**	**5,941**	**2,726**	**3,215**	**53,066**	**58,643**	**38,095**	**1,628**
Floyd, IN	**No**	**33**	**3,206**	**285**	**2,920**	**57,498**	**8,169**	**3,462**	**258**
Clark, IN	**No**	**16**	**1,398**	**338**	**1,060**	**4,043**	**5,749**	**6,049**	**800**
Bullitt, KY	**No**	**6**	**659**	**283**	**376**	**857**	**3,140**	**5,816**	**182**
Oldham, KY	No	6	579	220	359	504	3,306	1,821	254
Harrison, IN	No	5	746	238	507	672	3,423	2,379	1,208
Jefferson, IN	**No**	**3**	**1,265**	**168**	**1,097**	**75,319**	**25,214**	**2,272**	**341**

Clark and Floyd Counties in Indiana both have sizable emissions. Their CES ranks them second and third in the area following Jefferson County, Kentucky. They rank ahead of

Bullitt County. Jefferson County, Indiana has a low CES, but it has the largest sulfur dioxide emissions and the second largest NOx emissions in the area. Harrison County has a low a CES and emissions. Considering the emissions factor, Clark, Floyd, and Jefferson Counties are good nonattainment candidates in the Indiana portion of the 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)
Jefferson, KY	100	100	100	18.9
Floyd, IN	33	98	88	10.8
Clark, IN	16	85	52	9.3
Bullitt, KY	6	89	91	33.2
Oldham, KY	6	88	63	17.7
Harrison, IN	5	85	81	24.8
Jefferson, IN	3	49	13	29.1

Factor 2: Air quality data

This factor considers the 24-hour $PM_{2.5}$ design values (in $\mu g/m^3$) for air quality monitors in counties in the Louisville area based on data for the 2005-2007 period. 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 98^{th} percentile values are 35 $\mu g/m^3$ 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 Louisville area are shown in Table 3.

Table 3. Air Quality Data

County	State Recommended Nonattainment?	Design Values 2004-2006	Design Values 2005-2007
Jefferson, KY	No	36	39
Floyd, IN	No	32	35
Clark, IN	No	37	40
Bullitt, KY	No	34	36
Jefferson, IN	No		

Oldham, KY	No		
Harrison, IN	No		

In Indiana, Clark County has a violating design value and therefore must be designated nonattainment. Floyd County monitors attainment of the 2006 $PM_{2.5}$ air quality standards. There is no monitoring data for Jefferson County, Indiana. There are also violations in the Kentucky portion of the Louisville area. However, the absence of a violating monitor alone is not a sufficient reason to eliminate counties as candidates for 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 Louisville area occur about 82% in the warm season and 18% in the cool season. In the warm season, the average chemical composition of the highest days is 67% sulfate, no nitrate, 30% carbon, and 3% crustal. In the cool season, the average chemical composition of the highest days is 50% sulfate, 23% nitrate, 25% carbon, and 2% crustal. These data indicate that sources of SO_2, NOx, and direct $PM_{2.5}$ emissions contribute to violations in the area.

Note: Eligible monitors for providing design value data generally include State and Local Air Monitoring Stations (SLAMS) at population-oriented locations with an FRM monitor. All data from Special Purpose Monitors (SPM) using an FRM is eligible for comparison to the relevant NAAQS, subject to the requirements given in the October 17, 2006 Revision to Ambient Air Monitoring Regulations (71 FR 61236). All monitors used to provide data must meet the monitor siting and eligibility requirements given in 71 FR 61236 to 61328 in order to be acceptable for comparison to the 24-hr $PM_{2.5}$ NAAQS for designation purposes.

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)
Jefferson, KY	No	699,051	1755
Floyd, IN	No	72,025	485
Clark, IN	No	101,625	270
Bullitt, KY	No	71,440	238

Jefferson, IN	No	32,379	90
Oldham, KY	No	53,459	273
Harrison, IN	No	36,729	76

Jefferson County, Kentucky stands out in the Louisville area as having a much larger population and higher population density that the other counties. Clark and Floyd Counties, Indiana and Bullitt County, Kentucky all have similarly moderate populations. Jefferson County, Indiana has a low population and population density. Factor 3 indicates that Clark and Floyd Counties are good candidates for being designated nonattainment in the Indiana portion of Louisville.

Factor 4: Traffic and commuting patterns

This factor considers the number of commuters in each county who drive to another county within the Louisville 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
Jefferson, KY	**No**	**9,030**	**312,660**	**95**	**322,950**	**98**
Clark, IN	**No**	**1,218**	**41,100**	**85**	**47,410**	**98**
Bullitt, KY	**No**	**852**	**28,570**	**94**	**30,160**	**99**
Floyd, IN	**No**	**768**	**18,380**	**52**	**34,590**	**99**
Oldham, KY	No	526	13,050	61	21,020	98
Harrison, IN	No	585	6,200	36	16,550	96
Jefferson, IN	**No**	**382**	**660**	**4**	**1,130**	**8**

The listing of counties on Table 4 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 number and percent of commuting to any violating county figures are all high for Clark County, Indiana along with Jefferson and Bullitt Counties, Kentucky. Floyd County, Indiana and Oldham County, Kentucky show more modest commuting figures. Harrison County has a modest number of commuters. The percent of commuting within the Louisville statistical area is large for the MSA counties. A small number and percent of Jefferson County, Indiana workers commute into the statistical area. The VMT and commuting into violating counties data for Jefferson County, Indiana is also low. In Indiana, Clark County is strong candidate for nonattainment and Floyd County is a potential candidate based on this factor. Harrison County is a weak candidate.

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 Louisville 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 Louisville 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)
Jefferson, IN	32,379	2	382	24
Harrison, IN	36,729	6	585	23
Oldham, KY	53,459	14	526	19
Jefferson, KY	699,051	1	9,030	18
Bullitt, KY	71,440	16	852	13
Clark, IN	101,625	5	1,218	10
Floyd, IN	72,025	2	768	3

The Indiana counties showed limited population growth. Jefferson County, Indiana has the largest VMT percent expansion. Yet, it still has the lowest VMT. Table 6 shows the VMT growth for other area counties follows closely behind Jefferson County, Indiana. The growth rates are not expected to yield significant changes in the distribution of population in the area, so this factor did not significantly influence the decision-making process.

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 $\mu g/m^3$ 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 Louisville is provided as Figure 2. The winds on high concentration days during the warm season show a slight tendency to be from the Northeast or Southwest. That is along the Ohio River. Still, the wind direction varies frequently and air quality data showed violations in several area counties. In particular, winds on occasion bring emissions from Jefferson County, Indiana, to the Louisville area, just as on various occasions winds bring emissions from Clark and Floyd Counties to the violating monitors in Clark County, Indiana, and Jefferson and Bullitt Counties, Kentucky. So, it is appropriate under this factor to include counties in all directions from Louisville.

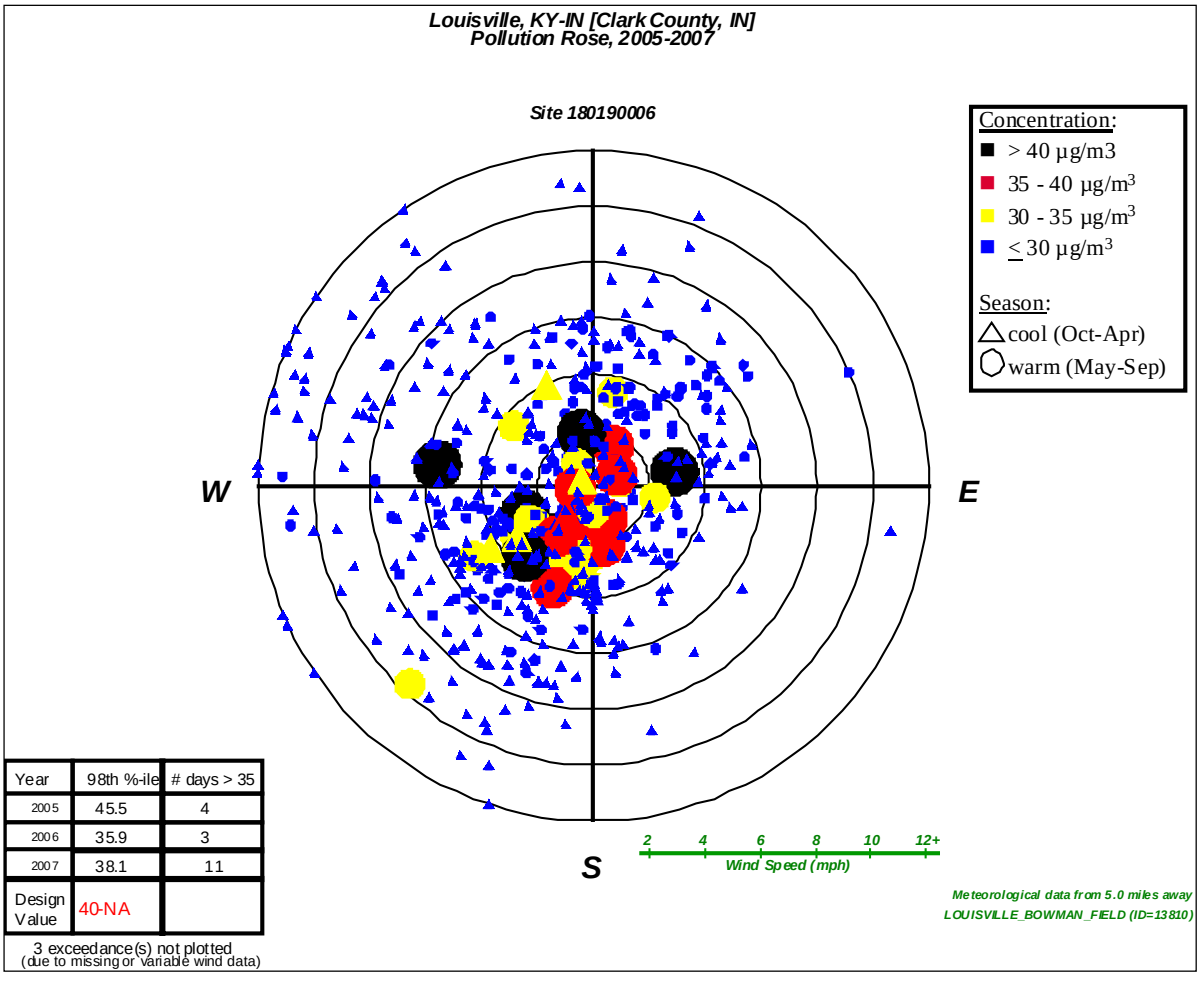


Figure 2

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 Louisville 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. 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.

Most areas that were originally designated nonattainment for the $PM_{2.5}$ standards still have not attained the air quality standards. Thus, EPA has generally concluded that counties that were designated as having emissions sources contributing to fine particle concentrations which continue to exceed 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 Kentuckiana Regional Planning and Development Agency serves as the Metropolitan Planning Organization (MPO) for Clark and Floyd Counties in Indiana.

The Louisville ozone maintenance area is made up of Clark and Floyd Counties in Indiana and Bullitt, Jefferson, and Oldham Counties in Kentucky. The fine particulate nonattainment area designed under the 1997 standards is composed of Clark, Floyd, and a portion of Jefferson County in Indiana along with Bullitt and Jefferson County, Kentucky. Thus, under this factor it would be appropriate to include Clark, Floyd, and a portion of Jefferson County (Madison Township) in Indiana in the nonattainment area.

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 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 SO_2, NOx, 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 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.

Indiana submitted information on the status of controls of Clifty Creek Station in Jefferson County, Indiana. This information indicates that flue gas desulfurization will be installed on all units at this facility in 2010, selective catalytic reduction is in place on 5 of 6 units, and this equipment will be operated on a full year basis in the future. However, this information also indicates that current emissions are relatively high. Since EPA is promulgating designations based on current air quality and current emissions contributing to existing violations as required by the Act, EPA concludes that Madison Township (including Clifty Creek Station) has relatively high emissions that contribute to violations of the air quality standard in the Louisville area and must be included in the Louisville nonattainment area notwithstanding the fact that additional controls are planned for this facility at a future date.

EPA has designated three full or partial counties in Indiana and two Kentucky counties as nonattainment for the 24-hour $PM_{2.5}$ air-quality standard as the Louisville nonattainment area based on the technical analysis. In Indiana, EPA is designating Clark and Floyd Counties and Madison Township of Jefferson County as nonattainment.

EPA Technical Analysis for Vincennes, IN

The Vincennes Micropolitan Statistical Area consists of Knox County. EPA reviewed the relevant information for this county as well as for surrounding counties. There is a violating monitor in Knox County. Knox County was designated as attaining the 1997 standards. Indiana recommended that the Vincennes nonattainment area include only Knox County.

EPA agrees with Indiana's recommendation. Knox County is adjacent to the Evansville area, an area that includes several counties with high emissions. Nevertheless, as discussed in the review of the Evansville nonattainment area, EPA believes that Vincennes warrants being designated as a separate nonattainment area from Evansville. Other Indiana counties near Knox County have relatively low emissions, and no other factor warranted inclusion of the counties in the Vincennes 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 micropolitan area boundary.

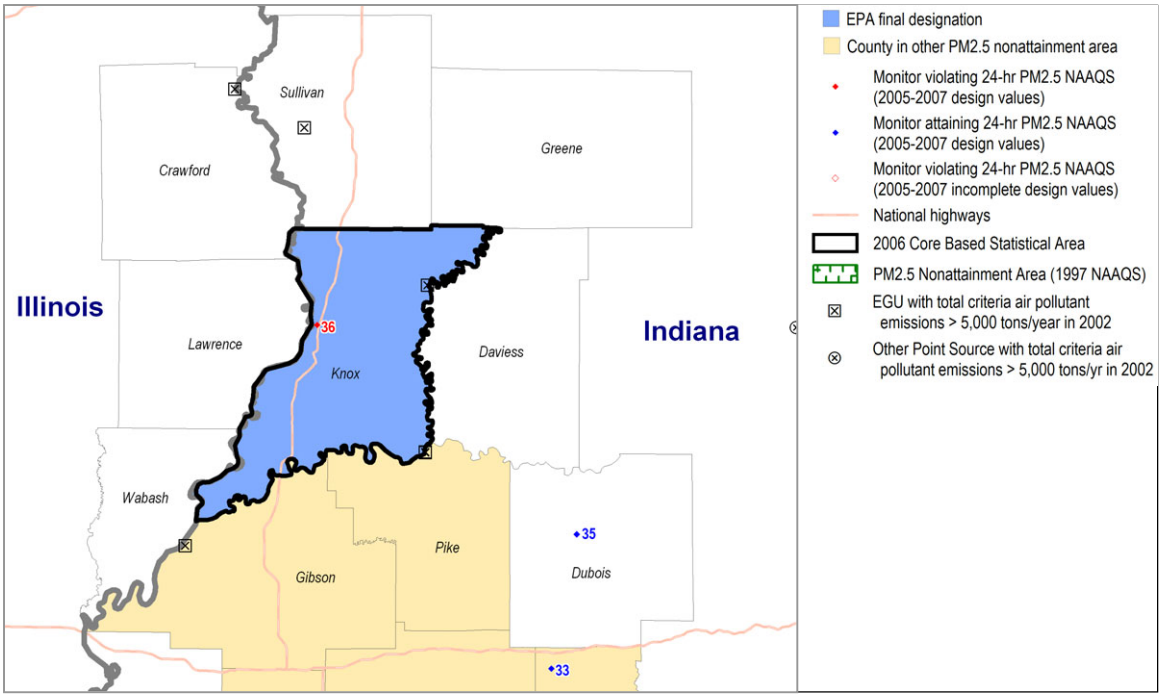


Figure 1

In April 2008, EPA also notified Indiana that a monitor in the Vincennes area was violating based on 2005-2007 data. Indiana provided EPA with a recommendation for this area in May 2008. Indiana recommended that one county be designated as "nonattainment" for the 2006 24-hour $PM_{2.5}$ standard based on air quality data from 2005-2007. These data are from Federal Reference Method (FRM) monitors located in the state.

In August 2008, EPA notified Indiana 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. Indiana provided no information on emission controls in Knox County.

Based on EPA's technical analysis described below, EPA has designated one county in the Indiana as nonattainment for the 24-hour $PM_{2.5}$ air-quality standard as part of the Vincennes nonattainment area, based upon currently available information. These counties are listed in the table below.

The following is a review of data for relevant factors for the Vincennes 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," "SO_2," "NO_x," "VOCs," and "NH_3." "$PM_{2.5}$ emissions total" represents direct emissions of $PM_{2.5}$ and includes: "$PM_{2.5}$ emissions carbon," "$PM_{2.5}$ emissions other", primary sulfate (SO_4), and primary nitrate. (Although primary sulfate and primary nitrate, which are emitted directly from stacks rather than forming in atmospheric reactions with SO_2 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 SO_2 and NO_x, which are precursors of the secondary $PM_{2.5}$ components sulfate and nitrate, are also considered. VOCs (volatile organic compounds) and NH_3 (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 Vincennes area. Counties are listed in descending order by CES.

Table 1. $PM_{2.5}$ Related Emissions and Contributing Emissions Score

County	State	CES	$PM_{2.5}$	$PM_{2.5}$	$PM_{2.5}$	SO_2	NOx	VOCs	NH_3

	Recommended Nonattainment?		emissions total	emissions carbon	emissions other				
Gibson, IN	No	100	6,642	420	6,223	154,782	32,655	3,679	1,921
Pike, IN	No	45	2,412	163	2,249	52,836	18,990	1,206	487
Knox, IN	Yes	19	1,250	178	1,073	7,422	3,793	3,270	1,429
Sullivan, IN	No	10	1,572	189	1,383	20,971	11,354	1,851	643

Gibson and Pike Counties were considered with the Evansville area. The emissions from Knox County are modest. Sullivan County has lower emissions. With Gibson and Pike Counties being in the Evansville nonattainment area, Knox County is the only nonattainment candidate in the Vincennes area from the emissions factor.

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)
Gibson	100	77	85	22.8
Pike	45	82	100	21.2
Knox	19	100	100	12.8
Sullivan	10	89	41	29

Factor 2: Air quality data

This factor considers the 24-hour $PM_{2.5}$ design values (in $\mu g/m^3$) for air quality monitors in counties in the Vincennes area based on data for the 2005-2007 period. 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 98^{th} percentile values are 35 $\mu g/m^3$ 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 Vincennes area are shown in Table 3. Knox County is the only county with air quality data. Its design value is above the air quality standards. However, the absence of a violating monitor alone is not a sufficient reason to eliminate counties as candidates for nonattainment status. Each county has been evaluated based on the weight of evidence of the nine factors and other relevant information.

Table 3. Air Quality Data

County	State Recommended Nonattainment?	Design Values 2004-2006	Design Values 2005-2007
Knox, IN	Yes	36	36
Gibson, IN	No		
Pike, IN	No		
Sullivan, IN	No		

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 Vincennes area occur about 80% in the warm season and 20% in the cool season. In the warm season, the average chemical composition of the highest days is 72% sulfate, no nitrate, 24% carbon, and 3% crustal. In the cool season, the average chemical composition of the highest days is 34% sulfate, 34% nitrate, 29% carbon, and 3% crustal. These data indicate that sources of SO_2, NOx, and direct $PM_{2.5}$ emissions contribute to violations in the area.

Note: Eligible monitors for providing design value data generally include State and Local Air Monitoring Stations (SLAMS) at population-oriented locations with an FRM monitor. All data from Special Purpose Monitors (SPM) using an FRM is eligible for comparison to the relevant NAAQS, subject to the requirements given in the October 17, 2006 Revision to Ambient Air Monitoring Regulations (71 FR 61236). All monitors used to provide data must meet the monitor siting and eligibility requirements given in 71 FR 61236 to 61328 in order to be acceptable for comparison to the 24-hr $PM_{2.5}$ NAAQS for designation purposes.

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. Knox County along with the other area counties all have low population figures. This appears to be a mostly rural county.

Table 4. Population

County	State Recommended Nonattainment?	2005 Population	2005 Population Density (pop/sq mi)
Knox, IN	Yes	38,298	73
Gibson, IN	No	33,347	67
Pike, IN	No	12,766	37
Sullivan, IN	No	21,675	48

Factor 4: Traffic and commuting patterns

This factor considers the number of commuters in each county who drive to another county within the Vincennes 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 into statistical area	Percent Commuting into statistical area
Knox, IN	Yes	448	15,020	85	14,910	84
Gibson, IN	No	469	640	4	300	2
Sullivan, IN	No	245	280	3	280	3
Pike, IN	No	169	1,920	34	130	2

The listing of counties on Table 5 reflects a ranking based on the number of people commuting to other counties. The commuting data suggests the Knox County is separate from the other counties. Indiana supplied 2005 commuting data. About 1,400 workers commute from Illinois into Knox County. Only a few hundred people commute into Knox County from each of the adjacent Indiana counties. Similarly there is modest commuting from Knox County into other counties. This factor suggests there is not a strong link between Knox County and the Evansville area counties. Thus, the commuting data suggests Knox County is separate from the Evansville 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 Vincennes 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 Vincennes 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)
Gibson, IN	33,347	2	469	19
Knox, IN	38,298	-2	448	15
Sullivan, IN	21,675	0	245	12
Pike, IN	12,766	0	169	0

Gibson, Knox, and Sullivan Counties have experienced some VMT growth. All these counties still have low VMT. The populations of all the counties kept stable.
The growth rates are not expected to yield significant changes in the distribution of population in the area, so this factor did not significantly influence the decision-making process.

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 $\mu g/m^3$ 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 Vincennes area is provided in Figure 2. Winds come from a variety of directions. So, it was appropriate to analyze counties in all directions from Knox County.

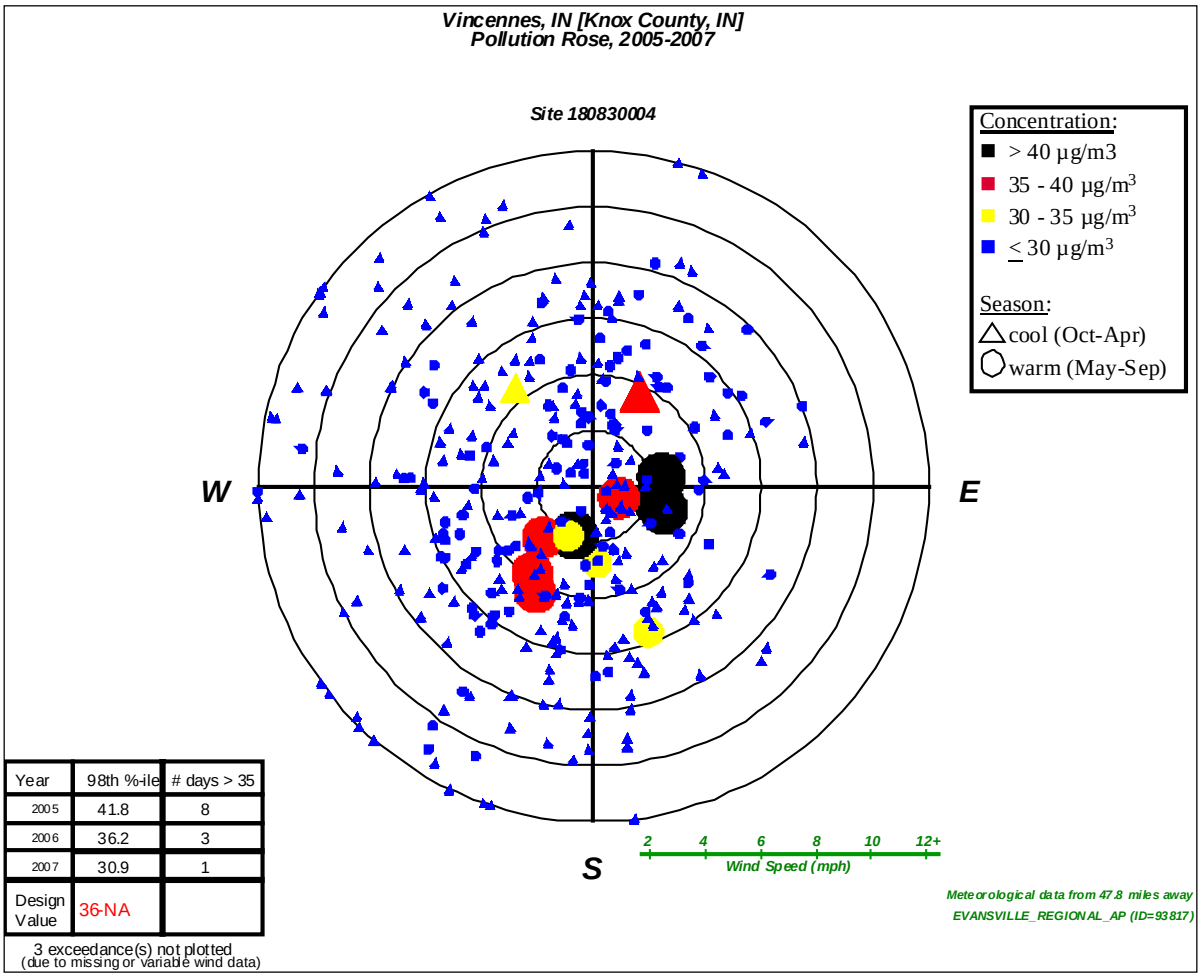


Figure 2

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 Vincennes 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, this area was designated attainment for the 1997 standards, so

nonattainment area boundaries for the 1997 standards were not a factor in determining this area's boundaries.

Knox County is not in any current or former nonattainment areas. There is not a metropolitan planning organization for Vincennes.

The Vincennes Micropolitan Statistical area, consisting of Knox County, is immediately adjacent to the Evansville Metropolitan Statistical Area. EPA commonly finds that adjoining metropolitan areas influence their neighbor's air quality. On the other hand, such influences occur across broad distances in the Eastern United States. EPA interprets the instruction in the Clean Air Act to designate areas nearby that contribute to violations as providing that EPA shall not designate a single Eastern United States nonattainment area. Instead, EPA generally designates adjoining urban areas as separate nonattainment areas.

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 Vincennes 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 SO_2, NOx, 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 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.

There are no large emission sources in Knox County. Emissions from large sources outside the Knox County may be controlled by national control programs or by local

measures. EPA has several national emission control program reducing the emissions of fine particulate precursors across the country. These programs will help lower regional background levels of fine particulate, helping nonattainment areas around the nation. Local control measures put in place to bring other Midwestern nonattainment areas meet the air quality standards will also reduce fine particulate and precursor pollution that is transported beyond the nonattainment area.

Note: EPA has provided a thorough response to each of the specific comments raised by the State in the Response to Comments document. Additional information regarding responses to specific State comments can be found in EPA's Response to Comments document at http://www.epa.gov/pmdesignations/2006standards/tech.htm.

December 10, 2008

Daniel Murray
Office of Air Quality
100 North Senate Avenue
Indianapolis, IN 46204

Re: 2007 $PM_{2.5}$ Exceptional Events

Dear Mr. Murray,

This letter is in response to Indiana Department of Environmental Quality's (IDEM) June 30, 2008 letter requesting exceptional events concurrence for 2 events which adversely affected $PM_{2.5}$ concentrations measured in Indiana. These two events were the Bugaboo Fire in Southern Georgia / Northern Florida, and 4th of July fireworks.

EPA Region 5 has reviewed IDEM's submitted demonstration package. EPA's Exceptional Events rule on flagged data allows EPA concurrence on data that exceed the standard or contribute to an exceedance of the standard if the state can demonstrate that the event caused the specific concentration at the specific monitoring location. Based on the demonstration provided by IDEM, EPA Region 5 is concurring on 19 of the 150 Bugaboo fire observations and two of the three flagged July 4 observations. We will be placing concurrence and nonconcurrence indicators in the EPA's Air Quality System (AQS) database as detailed in the documentation appended to this letter.

As always, EPA staff are available to answer questions you may have and provide help where needed. If you have any questions, please contact Michael Compher, of the Air Monitoring and Analysis Section, at (312) 886-5745.

Sincerely,

Cheryl Newton
Acting Director, Air and Radiation Division

$PM_{2.5}$ Exceptional Events Technical Support Document

U.S. Environmental Protection Agency Region 5

2007

INTRODUCTION

This document provides the EPA Region 5 rationale for concurrence or non-concurrence with exceptional event flags on the 24-hr average $PM_{2.5}$ concentration recorded during calendar year 2007 at ambient air monitoring sites operated by the Indiana Department of Environmental Management (IDEM). According to 40 CFR 50.1(j), Exceptional event means an event that affects air quality, is not reasonably controllable or preventable, is an event caused by human activity that is unlikely to recur at a particular location or a natural event, and is determined by the Administrator in accordance with 40 CFR 50.14 to be an exceptional event. It does not include stagnation of air masses or meteorological inversions, a meteorological event involving high temperatures or lack of precipitation, or air pollution relating to source noncompliance. EPA will exclude data from use in determinations of exceedances and National Ambient Air Quality Standard (NAAQS) violations where IDEM demonstrates to EPA's satisfaction that an exceptional event caused a specific air pollution concentration in excess of one or more national ambient air quality standards at a particular air quality monitoring location and otherwise satisfies the remaining requirements of the Exceptional Events Rule.

40 CFR 50.14(c)(3)(III) states that the demonstration to justify data exclusion shall provide evidence that: (A) The event satisfies the criteria set forth in 40 CFR 50.1(j); (B) There is a clear causal relationship between the measurement under consideration and the event that is claimed to have affected the air quality in the area; (C) The event is associated with a measured concentration in excess of normal historical fluctuations, including background; and (D) There would have been no exceedance or violation but for the event.

In addition to assembling and submitting the demonstration, the state must provide documentation that public comment process was followed and the state must submit the public comments it received along with its demonstration to EPA. IDEM provided Region 5 with a link to the website containing the exceptional event description, documentation, and instructions for providing comment. IDEM received no comments during the 30-day public comment period held for the 2007 $PM_{2.5}$ exceptional event flags.

EPA Region 5 has reviewed the exceptional event demonstration package submitted by IDEM on June 30th, 2008 and documented the review of each claim. The documentation follows the criteria set forth in the Exceptional Events Rule.

Northern Florida and Southern Georgia Wildfires

Indiana Department of Environmental Management (IDEM) submitted a demonstration and letter requesting concurrence to EPA Region 5 on June 30, 2008 for Exceptional Event claims due to wildfires in Northern Florida and Southern Georgia (a.k.a Bugaboo Scrub Fire). This request contained flags on 150 $PM_{2.5}$ observations which were observed throughout the state of Indiana over an eleven day period from May 23 through June 2, 2007 The following review is organized into two sections. The first section discusses the methodology used to evaluate several of the criteria set forth in the Exceptional Events Rule. Review of criteria A, B and C are addressed as a whole for the entire event in the methodology section; however, a few exceptions are specifically noted in the second section, which contains specific information addressing the review of the flagged observations for each day.

Event Description and Causal Connection Between the Event and Air Quality
IDEM's demonstration states, "During the period of May 23 – June 2, 2007, smoke from Bugaboo Scrub wildfire in northern Florida and southern Georgia impacted the State of Indiana by causing several exceedances of the 24-hour $PM_{2.5}$ NAAQS and significantly elevating $PM_{2.5}$ levels as a whole for the majority of the State." IDEM also included (Appendix 1) several maps and news articles depicting and describing the fires in Northern Florida and Southern Georgia which occurred in May and June 2007. Due to the vast acreage consumed by the wildfires, the general and widespread impacts that were observed between the location of the fires and the impacted monitoring locations in Indiana, IDEM sufficiently established a causal relationship between the measured concentrations and the Bugaboo fire during the May 23 to June 2 period.

METHODOLOGY

Assessing Whether the Flagged Observation was in Excess of the "Normal" Values Calculation
To meet the exceptional event criteria, the observation must be in excess of the normal, historical values. A useful measure of the "normal" concentration is the 84^{th} percentile (mean + 1 standard deviation) at each monitoring site. The 84^{th} percentile is considered to represent the range of normally expected high values at that site due to normal local and background sources. To account for seasonal differences in $PM_{2.5}$ concentrations, a two-month window of data in each of the preceding three calendar years was selected to determine "normal" concentrations. For the Bugaboo Scrub fire event claims, 24-hr $PM_{2.5}$ federal reference method data was selected for May and June in 2004, 2005, and 2006. An observation is considered to deviate from normal if its value is substantially higher than the upper 84^{th} percentile of the multi-year measurements for the same site in the prior three years. Comparing the site specific upper 84^{th} percentiles to the flagged observations, all of IDEM's flagged observations are in excess of the normal, historical values.

The following table provides the 84^{th} percentiles for each of IDEM's monitoring sites using the methodology described above.

Site ID	Site Name	County	84th Percentile (µg/m3)
18-089-0006	East Chicago	Lake	21.1
18-089-0022	Iitri	Lake	21.1
18-089-0026	Burr Street	Lake	24.6
18-089-0027	Griffith	Lake	20.1
18-089-0031	Madison Street	Lake	20.6 *
18-089-1003	Ivanhoe School	Lake	21.1
18-089-2004	Purdue	Lake	21.3
18-089-2010	Clark High School	Lake	21.3
18-091-0011	Marsh School	LaPorte	19.4
18-091-0012	Lake Street	LaPorte	19.2
18-127-0020	Dunes Nat'l Lakeshore	Porter	19.5
18-127-0024	Ogden Dunes	Porter	20.5
18-039-0003	Pierre Moran School	Elkhart	19.1
18-141-0014	Nuner School	St. Joseph	18.3
18-141-0015	Shields Drive	St. Joseph	20.2 *
18-141-2004	LaSalle High School	St. Joseph	18.5
18-003-0004	Beacon Street	Allen	18.5
18-003-0014	Taylor University	Allen	18.5
18-035-0006	Central High School	Delaware	19.6
18-065-0003	Mechanicsburg	Henry	19.8
18-067-0003	Kokomo	Madison	19.7
18-095-0009	West 5th Street	Madison	20.9
18-097-0042	Mann Road	Marion	20.9
18-097-0043	West Street	Marion	23.5
18-097-0066	English Avenue	Marion	24.7
18-097-0078	Washington Park	Marion	21.9
18-097-0079	East 75th Street	Marion	21.0
18-097-0081	West 18th Street	Marion	22.9
18-097-0083	East Michigan Street	Marion	21.7
18-157-0008	Greenbush Street	Tippecanoe	20.4
18-167-0018	Lafayette Avenue	Vigo	21.1
18-167-0023	Devaney School	Vigo	20.8
18-037-0004	Jasper Sport	Dubois	19.3 *
18-034-0005	Jasper Golf	Dubois	19.7 *
18-037-2001	Jasper Post Office	Dubois	24.1
18-083-0004	Southwest Ag	Knox	22.0
18-147-0009	Dale	Spencer	18.8
18-163-0006	Civic Center	Vanderburgh	22.2
18-163-0012	Mill Road	Vanderburgh	22.6
18-163-0016	Univ. of Evansville	Vanderburgh	21.8
18-019-0006	Walnut Street	Clark	24.4
18-043-1004	New Albany	Floyd	23.4

* These sites do not have a full data record from May and June 2004 to 2006

Demonstration of No Exceedance "But For" the Event

In evaluating the "but for" criteria (40 CFR 50.14(c)(3)(III))(D), there would have been no exceedance or violation but for the event), each flagged event fell into one of three categories, (A) the observation exceeded the level of the daily NAAQS (35 µg/m^3), (B) the observation did not exceed the level of the daily NAAQS but contributed to a violation of the daily NAAQS (i.e. a value at or above the annual 98th percentile for monitoring site that has a three year design value violating the daily NAAQS), or (C) the observation exceeded the level of the annual NAAQS (15 µg/m^3). In order to meet the "but for" criteria, observations needed to pass the "but for" test relative to either the specific NAAQS level that was exceeded (categories A and C), or the level at which the observation would no longer contribute to a violation of the daily NAAQS (category B).

This paragraph describes a hypothetical example of an observation in category B, described above. In 2007, a monitoring site with a three year design value (see below for annual 98th percentiles contributing to the design value) of 36 µg/m^3 observed a concentration of 34.5 µg/m^3, and this observation is appropriately flagged and documented in the EPA air quality database. Because 34.5 µg/m^3 is not a violation of the daily standard, it is not in category A described above. However, since this monitoring site violates the NAAQS with a three year design value of 36 µg/m^3, *and* the flagged 34.5 µg/m^3 observation is above the 2007 annual 98th percentile (34 µg/m^3), it contributes to the violation and thus falls into category B. The "but for" criteria for events in category B is met if the state demonstrates that there would have been no exceedance or *violation* (emphasis added) but for the event (i.e. at least below 34 µg/m^3). The "but for" criteria for events in categories A and B are met if the demonstrates that the event contributed enough mass to cause the exceedance of the respective NAAQS level.

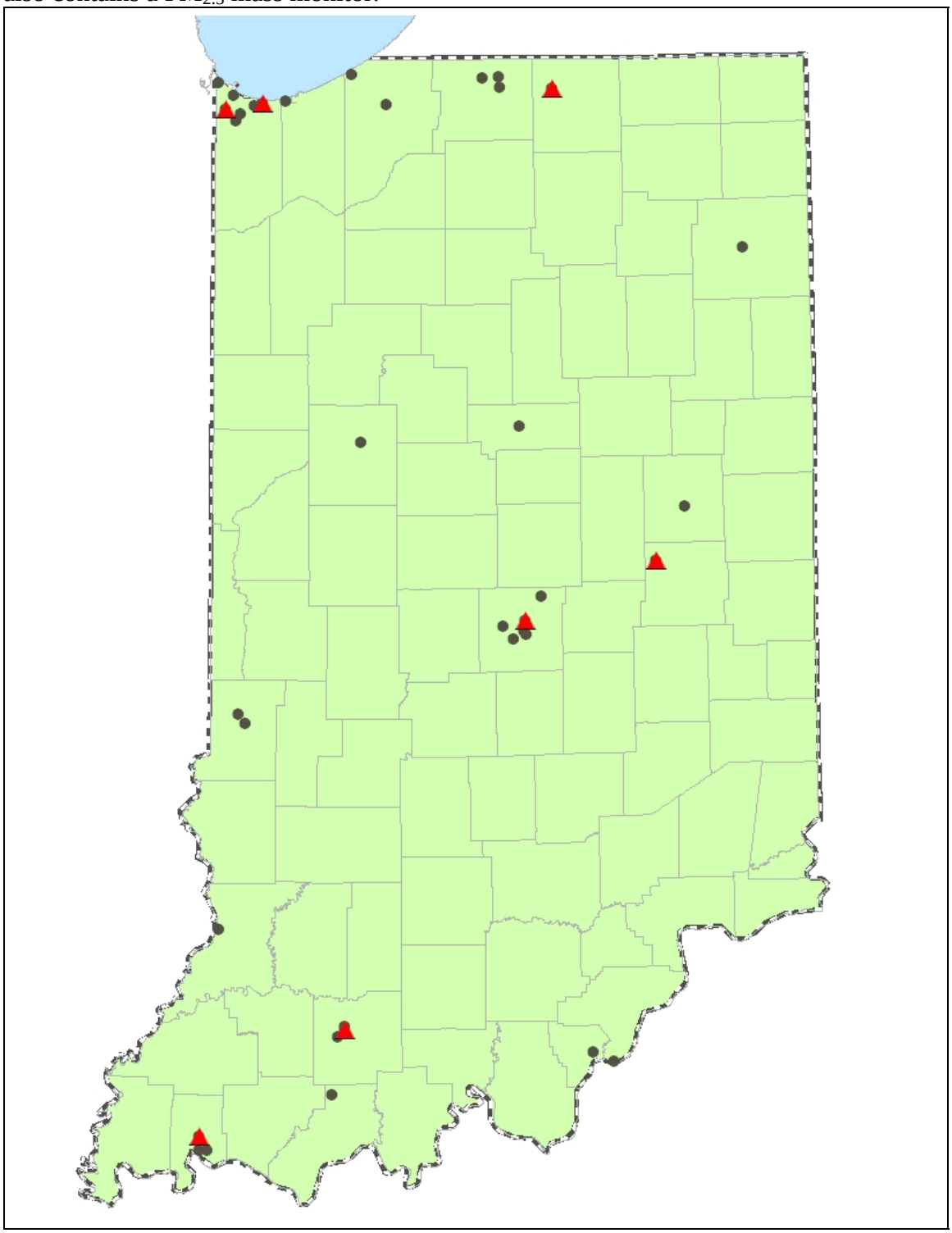
2005 98th percentile	38 µg/m^3
2006 98th percentile	36 µg/m^3
2007 98th percentile	34 µg/m^3
2005 to 2007 Design Value	36 µg/m^3

Estimating the Organic Mass Increment from $PM_{2.5}$ Speciation Data

$PM_{2.5}$ speciation data was collected on May 24 and May 30 at all of IDEM's $PM_{2.5}$ chemical speciation sites. Additional speciation data was collected at the Indianapolis Washington Park monitoring site (18-097-0078) on May 27 and June 2 because this site operates on a more frequent one in three day schedule. The table below identifies the location and operating schedule of each of IDEM's $PM_{2.5}$ chemical speciation monitors.

Site ID	Site Name	County	Operating Schedule
18-089-0022	Gary Iitri	Lake	1 in 6 days
18-089-2004	Hammond – Purdue	Lake	1 in 6 days
18-039-0003	Pierre Moran School	Elkhart	1 in 6 days
18-065-0003	Mechanicsburg	Henry	1 in 6 days
18-097-0078	Washington Park	Marion	1 in 3 days
18-037-2001	Jasper Post Office	Dubois	1 in 6 days
18-163-0006	Evansville Civic Center	Vanderburgh	1 in 6 days

The map below depicts the locations of the $PM_{2.5}$ speciation monitoring sites (red triangles) and the $PM_{2.5}$ mass monitoring sites (green circles). Each $PM_{2.5}$ speciation site also contains a $PM_{2.5}$ mass monitor.



Excess carbon is one of several indicators of contribution from biomass burning. Estimating the approximate increment above historical levels provides evidence that can be used to support the demonstration of the "but for" criteria. The following formula is used to approximate the organic mass increment.

$OM_{inc} = 2 * (OM_{obs} - OM_{hist})$, where

OM_{inc} is the approximate organic mass increment

OM_{obs} is the organic mass observed at the nearest speciation monitor

OM_{hist} is the organic mass historical average (OM_{hist}) and is derived from all site specific $PM_{2.5}$ speciation observations collected by Indiana's chemical speciation network in May and June during the previous two years.

The factor of 2 (Turpin and Lim, 2001) is an estimate of the average organic molecular weight per carbon weight for the organic aerosol.

Turpin, B.J., Lim, H.J., 2001. Species Contributions to $PM_{2.5}$ Mass Concentrations: Revisiting common Assumptions for Estimating Organic Mass; Aerosol Science and Technology. Volume 35, Pages 602-610.

In addition to approximating the organic mass increment using the historical average (OM_{hist}), 68% and 95% probabilities were calculated using the historical average ± 1 and 2 standard deviations, respectively. Calculating the probability accounts for the variability of organic mass observed at these monitoring locations over the historical period being used and thus provides additional confidence regarding the level of contribution from the event. The following table displays the site- and day-specific approximate organic mass increment, as well as estimates of the upper and lower range of 68 and 95% probabilities.

	May 24			**May 27**			**May 30**		
Site ID	**OM_{inc}**	**68%**	**95%**	**OM_{inc}**	**68%**	**95%**	**OM_{inc}**	**68%**	**95%**
18-037-2001	5.9	2.8, 9.1	-0.4, 12.2				13.5	10.3, 16.6	7.2, 19.7
18-039-0003	6.5	3.6, 9.5	0.6, 12.5				7.8	4.8, 10.8	1.9, 13.8
18-065-0003	7.4	4.6, 10.1	1.9, 12.9				7.9	5.1, 10.7	2.4, 13.4
18-089-0022	9.0	3.3, 14.6	-2.3, 20.2				6.6	1.0, 12.2	-4.6, 17.9
18-089-2004	11.3	8.0, 14.6	4.6, 18.0				7.7	4.4, 11.1	1.0, 14.4
18-097-0078	7.0	3.5, 10.5	0.0, 13.9	7.1	3.5, 10.5	0.0, 13.9	8.6	5.1, 12.1	1.6, 15.6
18-163-0012	8.1	5.4, 10.8	2.7, 13.5				6.8	4.1, 9.5	1.4, 12.2

Event Date: May 23, 2007
Pollutant: $PM_{2.5}$
Monitors and Observations Flagged:

Site ID	Site Name	County	Observed Conc. ($\mu g/m^3$)	EPA Concurrence
18-091-0011	Michigan City	LaPorte	31.7	No
18-039-0003	Pierre Moran School	Elkhart	32.8	No
18-141-0014	Nuner School	St. Joseph	33.9	No
18-003-0004	Beacon Street	Allen	43.4	No
18-035-0006	Central H.S.	Delaware	36.0	Yes
18-095-0009	West 5th Street	Madison	36.4	Yes
18-097-0066	English Avenue	Marion	37.9	Yes
18-097-0078	Washington Park	Marion	38.5	Yes
18-157-0008	Greenbush Street	Tippecanoe	34.7	Yes
18-167-0023	Devaney School	Vigo	32.6	No
18-037-2001	Jasper Post Office	Dubois	28.4	No

Causal Connection: IDEM established a causal connection between the event and air quality for all but one of the flagged observations on May 23 with the Appendix 1 accounts and maps of the Bugaboo fire in Northern Florida and Southern Georgia, forward air trajectories included in Appendix 2, back trajectories included in the area specific demonstrations, NOAA smoke maps, and wind roses. However, IDEM did not provide sufficient evidence in the demonstration to explain why the Beacon Street site (18-003-0004) in Ft. Wayne had a substantially higher concentration (approximately 5 $\mu g/m^3$) than any of the other observations collected throughout the state on May 23. Particulate matter emitted from a fire located several hundred miles away from monitoring sites relatively close to one another (as compared to the distance to the event) should have relatively uniform impact from the event, provided that there are no major differences due to meteorological factors between the monitoring sites. Therefore, Region 5 concurrence cannot be provided for the Ft. Wayne flagged observation.

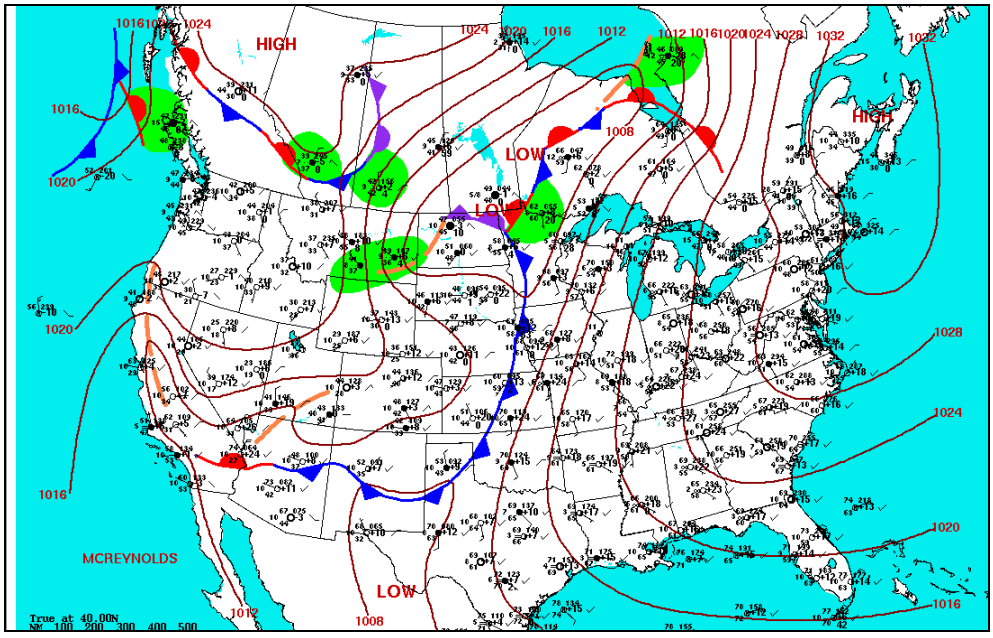


Figure 1: NOAA Daily Weather Map; May 23, 2007

Comparison to Background Levels: There are no modifications from the description contained in the Methodology Section, which concluded that all of IDEM's flagged observations related to the Bugaboo fire are in excess of the normal historical fluctuations.

Demonstration of Exceedance "But For" the Event: No chemical speciation data was collected on May 23, but Region 5 concluded that using speciation data from May 24 is acceptable based on a review finding no major changes between the meteorology on May 23 and May 24, as well as additional similarities from estimates of sulfate and smoke based on the Naval Research Laboratory NAAPS global dust model.

Using speciation data from May 24, the approximate organic carbon increment ranges from 5.9 to 11.3 $\mu g/m^3$. Given this range of approximate organic mass increments, the 4 observations which exceeded the 35 $\mu g/m^3$ NAAQS level meet the "but for" criteria; because, had there been no event, the concentrations would not have exceeded the 24-hr NAAQS. The 34.7 $\mu g/m^3$ observed at site 18-157-0008 (Greenbush Street) contributes to a violation because the 2005 to 2007 daily design value for that site is above the daily NAAQS and the 2007 annual 98^{th} percentile contributing to the violation at that site is 34.2 $\mu g/m^3$. Since the organic mass increment is estimated as several micrograms per cubic meter, then this observation also satisfies the "but for" test. Additionally, using the lower incremental estimates calculated as the historical mean plus 1 standard deviation (68% probability), the more conservative approximate increment for the nearest speciation site also satisfies the "but for" criteria.

Because the remaining 5 observations (ranging from 28.4 to 33.9 $\mu g/m^3$) do not exceed or contribute to violations of the 24-hour NAAQS, the annual NAAQS becomes relevant. Accordingly, the exceptional event has to be determined to cause exceedances or violations of that NAAQS (15 µg/m3). . None of these 5 observations meet the "but for" criteria relative to the annual NAAQS and thus Region 5 does not concur on the exceptional event flags.

Event Date: May 24, 2007
Pollutant: $PM_{2.5}$
Monitors and Observations Flagged:

Site ID	Site Name	County	Observed Conc. ($\mu g/m^3$)	EPA Concurrence
18-089-0006	East Chicago	Lake	29.5	No
18-089-0022	Iitri	Lake	28.4	No
18-089-0026	Burr Street	Lake	31.2	No
18-089-0027	Griffith	Lake	27.6	No
18-089-0031	Madison Street	Lake	27.6	No
18-089-1003	Ivanhoe School	Lake	30.4	No
18-089-2004	Purdue	Lake	30.1	No
18-089-2010	Clark High School	Lake	29.3 *	No
18-091-0011	Marsh School	LaPorte	27.9	No
18-091-0012	Lake Street	LaPorte	27.0	No
18-127-0020	Dunes Nat'l Lakeshore	Porter	25.8	No
18-127-0024	Ogden Dunes	Porter	27.9	No
18-039-0003	Pierre Moran School	Elkhart	30.9	No
18-141-0014	Nuner School	St. Joseph	31.7	No
18-141-0015	Shields Drive	St. Joseph	28.6	No
18-141-2004	LaSalle High School	St. Joseph	28.7	No
18-003-0004	Beacon Street	Allen	34.9	No
18-003-0014	Taylor University	Allen	31.0	No
18-035-0006	Central High School	Delaware	31.4	No
18-065-0003	Mechanicsburg	Henry	30.7	No
18-067-0003	Kokomo	Madison	30.6	No
18-095-0009	West 5th Street	Madison	29.4	No
18-097-0042	Mann Road	Marion	30.7	No
18-097-0043	West Street	Marion	31.6	No
18-097-0066	English Avenue	Marion	33.1	No
18-097-0078	Washington Park	Marion	31.9	No
18-097-0079	East 75th Street	Marion	30.5	No
18-097-0081	West 18th Street	Marion	IN	
18-097-0083	East Michigan Street	Marion	30.2	No
18-157-0008	Greenbush Street	Tippecanoe	27.8	No
18-167-0018	Lafayette Avenue	Vigo	28.8	No
18-167-0023	Devaney School	Vigo	27.7	No
18-037-0004	Jasper Sport	Dubois	25.7	No
18-034-0005	Jasper Golf	Dubois	26.5	No
18-037-2001	Jasper Post Office	Dubois	25.0	No
18-083-0004	Southwest Ag	Knox	28.4	No
18-147-0009	Dale	Spencer	25.5	No
18-163-0006	Civic Center	Vanderburgh	IN	
18-163-0012	Mill Rd.	Vanderburgh	23.9	No
18-163-0016	Univ. of Evansville	Vanderburgh	25.8	No
18-019-0006	Walnut Street	Clark	32.0	No
18-043-1004	New Albany	Floyd	29.7	No

* the concentration reported in the demonstration on 5/24 at the Clark High School site was 39.3 $\mu g/m^3$, however the concentration reported by IDEM in EPA's Air Quality (AQS) database is 29.3$\mu g/m^3$.

Causal Connection: IDEM established a causal connection between the event and air quality for all of the flagged observations on May 24 with the Appendix 1 accounts and

maps of the Bugaboo fire in Northern Florida and Southern Georgia, forward air trajectories included in Appendix 2, back trajectories included in the area specific demonstrations, NOAA smoke maps, and wind roses.

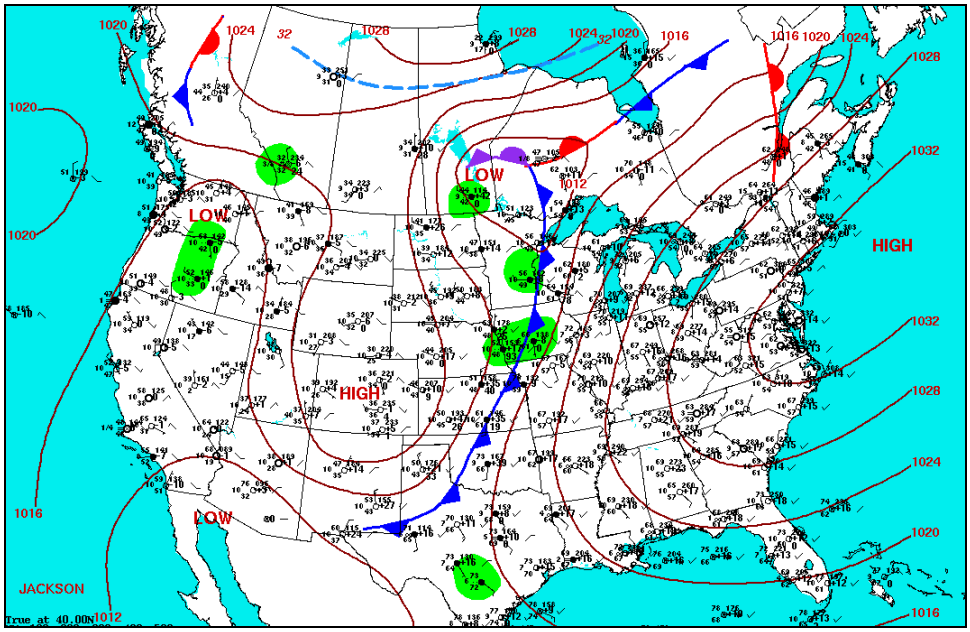


Figure 2: NOAA Daily Weather Map; May 24, 2007

Comparison to Background Levels: There are no modifications from the description contained in the Methodology Section, which concluded that all of IDEM's flagged observations related to the Bugaboo fire are in excess of the normal historical fluctuations.

Demonstration of Exceedance "But For" the Event: None of the observations on May 24 (ranging from 23.9 to 33.1 µg/m^3) exceed or contribute to violations of the 24-hour NAAQS, so the annual NAAQS becomes relevant. Accordingly, the exceptional event has to be determined to cause exceedances or violations of that NAAQS (15 µg/m3). . Chemical speciation data was collected on May 24, and the approximate organic carbon increment ranges from 5.9 to 11.3 µg/m^3. The highest (9.0 and 11.3) of these approximate organic carbon increments are from the speciation monitors located in Lake County. The $PM_{2.5}$ mass from monitors in this area, however, is more than 9 µg/m^3 above the annual NAAQS. The lowest flagged value (23.9 µg/m^3) on May 24 was in Vanderburgh County, where the approximate organic carbon increment was 8.1. Given this range of approximate organic mass increments and the spatial distribution of those estimates with respect to the flagged $PM_{2.5}$ mass observations, none of the observations meet the "but for" criteria. Without the impact from the fire, the observations would have exceeded the annual NAAQS and therefore Region 5 does not concur on any of the exceptional event flags for May 24.

Event Date: May 25, 2007
Pollutant: $PM_{2.5}$
Monitors and Observations Flagged:

Site ID	Site Name	County	Observed Conc. ($\mu g/m^3$)	EPA Concurrence
18-035-0006	Central High School	Delaware	30.7	No
18-095-0009	West 5th Street	Madison	30.2	No
18-097-0066	English Avenue	Marion	35.8	Yes
18-097-0078	Washington Park	Marion	34.9	No
18-167-0023	Devaney School	Vigo	30.4	No
18-037-2001	Jasper Post Office	Dubois	25.9	No
18-019-0006	Walnut Street	Clark	32.8	No

Causal Connection: IDEM established a causal connection between the event and air quality for all of the flagged observations on May 25 with the Appendix 1 accounts and maps of the Bugaboo fire in Northern Florida and Southern Georgia, forward air trajectories included in Appendix 2, back trajectories included in the area specific demonstrations, NOAA smoke maps, and wind roses. As seen on the surface weather map below, a front pushed through NW Indiana, keeping the area of impact limited to central and southern Indiana.

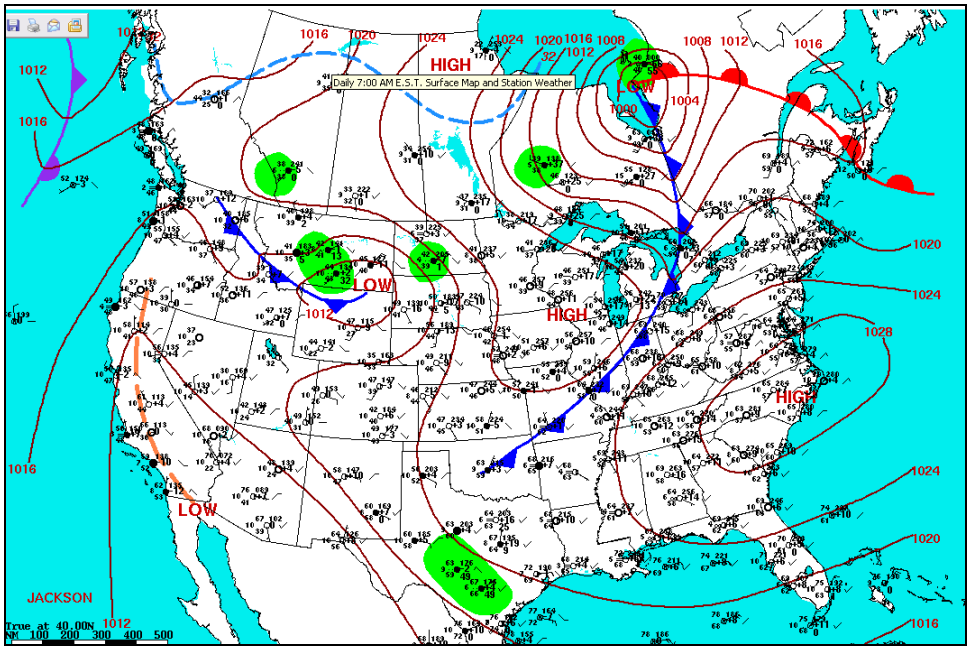


Figure 3: NOAA Daily Weather Map; May 25, 2007

Comparison to Background Levels: There are no modifications from the description contained in the Methodology Section, which concluded that all of IDEM's flagged observations related to the Bugaboo fire are in excess of the normal historical fluctuations.

Demonstration of Exceedance "But For" the Event: No chemical speciation data was collected on May 25, but EPA has determined that using speciation data from May 24 is acceptable based on a review of the finding no major changes between the meteorology

on May 24 and May 25 at the flagged monitoring locations, as well as additional similarities from estimates of sulfate and smoke based on the Naval Research Laboratory NAAPS global dust model.

Only one of the flagged observations on May 25 exceeded the 24-hr NAAQS of 35 $\mu g/m^3$. Using speciation data from May 24, the approximate organic carbon increment range from the nearest speciation monitor is 7.0 $\mu g/m^3$. Subtracting this estimate from the observed value (35.8 $\mu g/m^3$) results in an adjusted concentration below the 24-hr NAAQS. Therefore, the observation from Indianapolis' English Avenue site (18-097-0066) satisfies the "but for" criteria.

Because the remaining flagged observations (ranging from 25.9 to 34.9 $\mu g/m^3$) do not exceed or contribute to violations of the 24-hour NAAQS, the annual NAAQS becomes relevant. Accordingly, the exceptional event has to be determined to cause exceedances or violations of that NAAQS (15 µg/m3). . None of these 5 observations meet the "but for" criteria relative to the annual NAAQS and thus Region 5 does not concur on the exceptional event flags.

Event Date: May 26, 2007
Pollutant: $PM_{2.5}$
Monitors and Observations Flagged:

Site ID	Site Name	County	Observed Conc. ($\mu g/m^3$)	EPA Concurrence
18-095-0009	West 5th Street	Madison	27.8	No
18-097-0066	English Avenue	Marion	31.3	No
18-097-0078	Washington Park	Marion	29.3	No
18-037-2001	Jasper Post Office	Dubois	41.5	No
18-019-0006	Walnut Street	Clark	32.6	No

Causal Connection: IDEM established a causal connection between the event and air quality for all but one of the flagged observations on May 26th with the Appendix 1 accounts and maps of the Bugaboo fire in Northern Florida and Southern Georgia, forward air trajectories included in Appendix 2, back trajectories included in the area specific demonstrations, NOAA smoke maps, and wind roses. However, IDEM did not provide sufficient evidence in the demonstration to explain why the Jasper Post Office site (18-037-2001) in Dubois County had a substantially higher concentration (approximately 9 $\mu g/m^3$) than any of the other observations collected throughout the state on May 26. Particulate matter emitted from a fire located several hundred miles away from monitoring sites relatively close to one another (as compared to the distance to the event) should have relatively uniform impact from the event, provided that there are no major differences due to meteorological factors between the monitoring sites. Therefore, Region 5 concurrence cannot be provided for the Dubois County flagged observation.

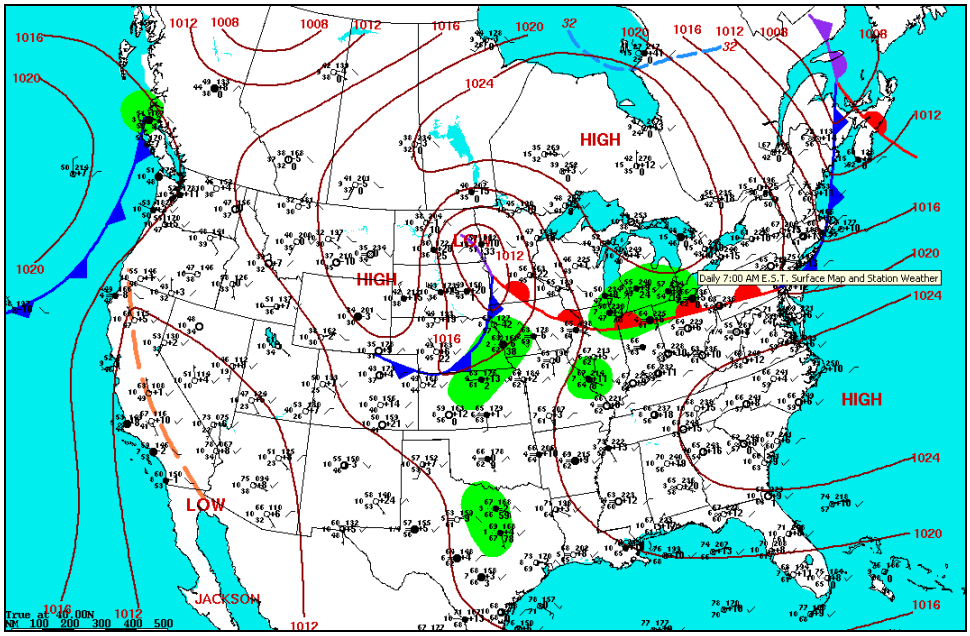


Figure 4: NOAA Daily Weather Map; May 26, 2007

Comparison to Background Levels: There are no modifications from the description contained in the Methodology Section, which concluded that all of IDEM's flagged observations related to the Bugaboo fire are in excess of the normal historical fluctuations.

Demonstration of Exceedance "But For" the Event: Aside from the Dubois County observation addressed above, none of the observations on May 26 (ranging from 27.8 to 32.6 µg/m^3) exceed or contribute to violations of the 24-hour NAAQS, so the annual NAAQS becomes relevant. Accordingly, the exceptional event has to be determined to cause exceedances or violations of that NAAQS (15 µg/m3). . Chemical speciation data was collected on May 27 at the $PM_{2.5}$ speciation trends site in Indianapolis and the approximate organic carbon increment is 7.1 µg/m^3. Given this increment, none of the observations meet the "but for" criteria. Had there been no event, the concentrations would have exceeded the annual NAAQS; therefore, Region 5 does not concur on any of the remaining exceptional event flags for May 26.

Event Date: May 27, 2007
Pollutant: $PM_{2.5}$
Monitors and Observations Flagged:

Site ID	Site Name	County	Observed Conc. ($\mu g/m^3$)	EPA Concurrence
18-095-0009	West 5th Street	Madison	24.5	No
18-097-0042	Mann Road	Marion	23.0	No
18-097-0043	West Street	Marion	25.1	No
18-097-0066	English Avenue	Marion	26.6	No
18-097-0078	Washington Park	Marion	24.5	No
18-097-0079	East 75th Street	Marion	25.2	No
18-097-0081	West 18th Street	Marion	25.4	No
18-097-0083	East Michigan Street	Marion	25.3	No
18-037-0004	Jasper Sport	Dubois	30.0	No
18-034-0005	Jasper Golf	Dubois	30.0	No
18-037-2001	Jasper Post Office	Dubois	30.5	No
18-083-0004	Southwest Ag	Knox	29.5	No
18-147-0009	Dale	Spencer	30.5	No
18-163-0006	Civic Center	Vanderburgh	IN	
18-163-0012	Mill Rd.	Vanderburgh	29.9	No
18-163-0016	Univ. of Evansville	Vanderburgh	27.7	No
18-019-0006	Walnut Street	Clark	28.9	No
18-043-1004	New Albany	Floyd	25.4	No

Causal Connection: IDEM established a causal connection between the event and air quality for all of the flagged observations on May 27 with the Appendix 1 accounts and maps of the Bugaboo fire in Northern Florida and Southern Georgia, forward air trajectories included in Appendix 2, back trajectories included in the area specific demonstrations, NOAA smoke maps, and wind roses.

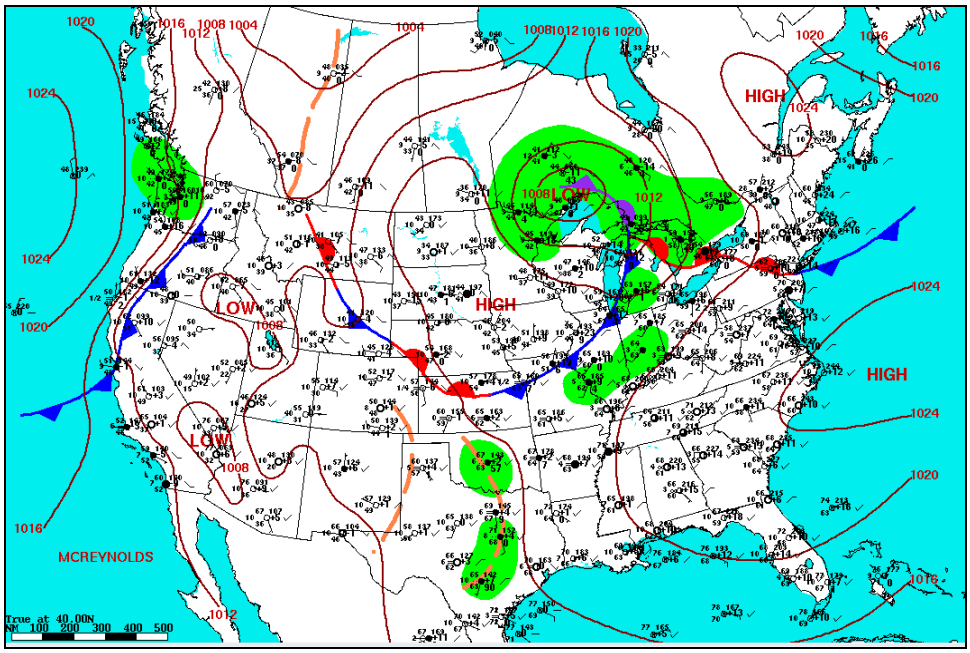


Figure 5: NOAA Daily Weather Map; May 27, 2007

Comparison to Background Levels: There are no modifications from the description contained in the Methodology Section, which concluded that all of IDEM's flagged observations related to the Bugaboo fire are in excess of the normal historical fluctuations.

Demonstration of Exceedance "But For" the Event: None of the observations on May 27 (ranging from 23.0 to 30.5 $\mu g/m^3$) exceed or contribute to violations of the 24-hour NAAQS, so the annual NAAQS becomes relevant. Accordingly, the exceptional event has to be determined to cause exceedances or violations of that NAAQS (15 $\mu g/m^3$). Chemical speciation data was collected on May 27th at the $PM_{2.5}$ speciation trends site in Indianapolis and the approximate organic carbon increment is 7.1 $\mu g/m^3$. Given this increment, none of the observations meet the "but for" criteria. Had there been no event, the concentrations would have exceeded the annual NAAQS; therefore, Region 5 does not concur on any of the exceptional event flags for May 27.

Event Date: May 28, 2007
Pollutant: $PM_{2.5}$
Monitors and Observations Flagged:

Site ID	Site Name	County	Observed Conc. ($\mu g/m^3$)	EPA Concurrence
18-095-0009	West 5th Street	Madison	22.8	No
18-097-0066	English Avenue	Marion	28.7	No
18-097-0078	Washington Park	Marion	26.3	No
18-037-2001	Jasper Post Office	Dubois	34.2	Yes
18-019-0006	Walnut Street	Clark	33.8	No

Causal Connection: IDEM established a causal connection between the event and air quality for all of the flagged observations on May 28 with the Appendix 1 accounts and maps of the Bugaboo fire in Northern Florida and Southern Georgia, forward air trajectories included in Appendix 2, back trajectories included in the area specific demonstrations, NOAA smoke maps, and wind roses. Similar to the previous several days, the northern portion of the state was not impacted due to frontal boundaries impacting and restricting transport of smoke from the Bugaboo fires.

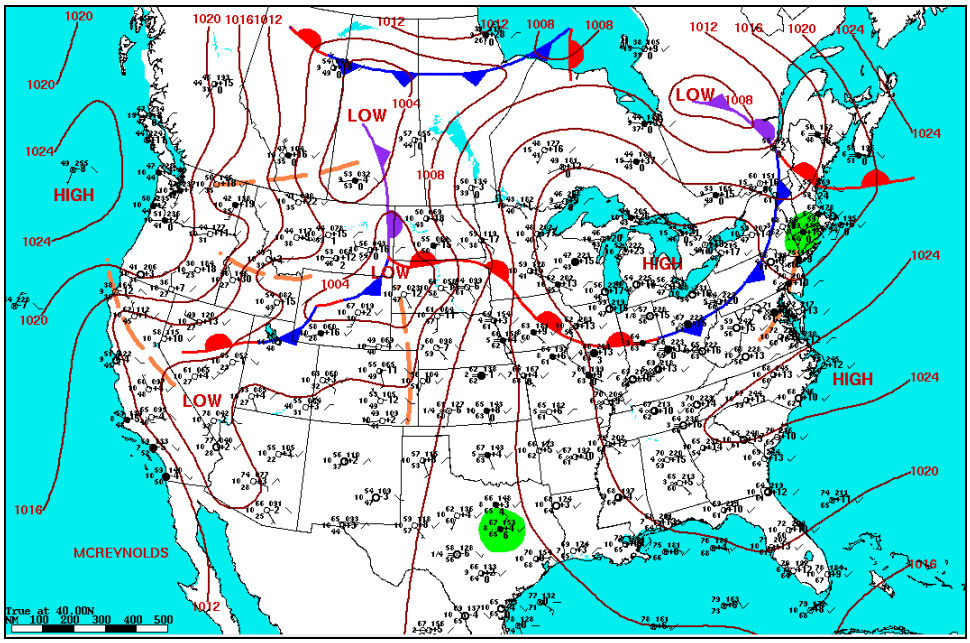


Figure 6: NOAA Daily Weather Map; May 28, 2007

Comparison to Background Levels: There are no modifications from the description contained in the Methodology Section, which concluded that all of IDEM's flagged observations related to the Bugaboo fire are in excess of the normal historical fluctuations.

Demonstration of Exceedance "But For" the Event: None of the observations on May 27 (ranging from 22.8 to 34.2 $\mu g/m^3$) exceeded the 24-hour NAAQS; however, the Jasper Post Office observation does contribute to a violation of the 24-hr NAAQS. The 34.2 µg/m3 observed at this site contributes to a violation because the 2005 to 2007 daily design value for that site is above the standard and the 2007 annual 98th percentile at that

site is 34.2 µg/m3. Since this observation is the annual 98th percentile, a contribution of 0.1 or more µg/m3 from the Bugaboo fire is evidence to satisfy the "but for" test. The causal connection was clearly established, and the highest concentrations observed throughout the period were observed on the following day. Therefore, Region 5 concurs on the exceptional event flag at this site.

For the remaining four flagged observations, the exceptional event has to be determined to cause exceedances or violations of that NAAQS (15 µg/m^3). Chemical speciation data was collected on May 27 at the $PM_{2.5}$ Speciation trends site in Indianapolis and the approximate organic carbon increment is 7.1 µg/m^3. Given this increment, none of the observations meet the "but for" criteria according to the annual NAAQS. Therefore, Region 5 does not concur on any of the remaining exceptional event flags for May 28.

Event Date: May 29, 2007
Pollutant: $PM_{2.5}$
Monitors and Observations Flagged:

Site ID	Site Name	County	Observed Conc. ($\mu g/m^3$)	EPA Concurrence
18-091-0011	Michigan City	LaPorte	36.7	Yes
18-039-0003	Pierre Moran School	Elkhart	34.7	Yes
18-141-0014	Nuner School	St. Joseph	37.1	Yes
18-003-0004	Beacon Street	Allen	33.8	No
18-035-0006	Central H.S.	Delaware	35.1	Yes
18-095-0009	West 5th Street	Madison	38.0	Yes
18-097-0066	English Avenue	Marion	37.9	Yes
18-097-0078	Washington Park	Marion	37.6	Yes
18-157-0008	Greenbush Street	Tippecanoe	36.8	Yes
18-167-0023	Devaney School	Vigo	39.6	Yes
18-037-2001	Jasper Post Office	Dubois	39.5	Yes
18-019-1004	Walnut Street	Clark	38.2	Yes

Causal Connection: IDEM established a causal connection between the event and air quality for all of the flagged observations on May 29th with the Appendix 1 accounts and maps of the Bugaboo fires in Northern Florida and Southern Georgia, forward air trajectories included in Appendix 2, back trajectories included in the area specific demonstrations, NOAA smoke maps, and wind roses.

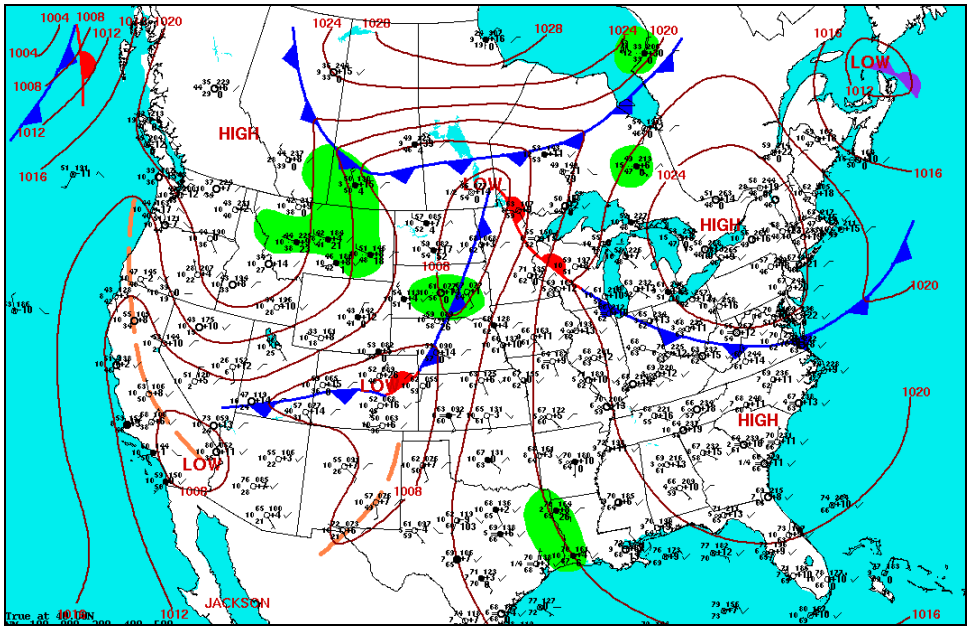


Figure 7: NOAA Daily Weather Map, May 29, 2007

Comparison to Background Levels: There are no modifications from the description contained in the Methodology Section, which concluded that all of IDEM's flagged observations related to the Bugaboo fire are in excess of the normal historical fluctuations.

Demonstration of Exceedance "But For" the Event: The highest concentrations observed during the multi-day period impacted by the Bugaboo fires were on May 29. All but two of the flagged observations exceeded the 24-hour NAAQS, the highest being 39.6 µg/m^3 observed at Devaney School (18-167-0023) in Vigo County in West Central Indiana.

Using speciation data from May 30, the day after these elevated concentrations were observed, the approximate organic carbon increment ranges from 6.6 in northern Indiana to 13.5 µg/m^3 in southern Indiana. After subtracting the approximate organic carbon increments from the nearest speciation monitor, the exceedances of the daily NAAQS would not have occurred "but for" the event. Furthermore, using the more conservative incremental estimates calculated as the historical mean plus 2 standard deviations (95% probability), the more conservative approximate increment still satisfies the "but for" criteria. Therefore, Region 5 concurs on these events.

The flagged observation (34.7) at Pierre Moran School in Ft. Wayne does not exceed the 24-hr NAAQS, but does contribute to a violation because the 2005 to 2007 daily design value for that site is above the standard and the 2007 annual 98th percentile at that site is 34.6 µg/m3. Since the organic mass increment is estimated as several micrograms per cubic meter at the nearest speciation site, then this observation also satisfies the "but for" criteria relative to the level of the 98^{th} percentile. Region 5 concurs on this flagged observation.

The remaining flagged observation (33.8 at Beacon Street) did not exceed the 24-hr NAAQS and does not contribute to a violation, so the annual NAAQS becomes relevant. Accordingly, the exceptional event has to be determined to cause exceedances or violations of that NAAQS (15 µg/m^3). The approximate organic carbon increments from the speciation network do not provide enough mass to conclude that the exceedance of the annual NAAQS would not have occurred but for the event. Therefore, Region 5 does not concur on the exceptional event flag at this site.

Event Date: May 30, 2007
Pollutant: $PM_{2.5}$
Monitors and Observations Flagged:

Site ID	Site Name	County	Observed Conc. ($\mu g/m^3$)	EPA Concurrence
18-089-0006	East Chicago	Lake	32.5	No
18-089-0022	Iitri	Lake	31.9	No
18-089-0026	Burr Street	Lake	36.8	Yes
18-089-0027	Griffith	Lake	IN	No
18-089-0031	Madison Street	Lake	IN	No
18-089-1003	Ivanhoe School	Lake	33.1	No
18-089-2004	Purdue	Lake	32.4	No
18-089-2010	Clark High School	Lake	32.2	No
18-091-0011	Marsh School	LaPorte	31.5	No
18-091-0012	Lake Street	LaPorte	31.0	No
18-127-0020	Dunes Nat'l Lakeshore	Porter	30.1	No
18-127-0024	Ogden Dunes	Porter	31.5	No
18-039-0003	Pierre Moran School	Elkhart	32.8	No
18-141-0014	Nuner School	St. Joseph	34.0	No
18-141-0015	Shields Drive	St. Joseph	30.8	No
18-141-2004	LaSalle High School	St. Joseph	31.3	No
18-003-0004	Beacon Street	Allen	33.7	No
18-003-0014	Taylor University	Allen	33.1	No
18-035-0006	Central High School	Delaware	33.4	No
18-065-0003	Mechanicsburg	Henry	32.4	No
18-067-0003	Kokomo	Madison	33.5	No
18-095-0009	West 5th Street	Madison	32.9	No
18-097-0042	Mann Road	Marion	31.0	No
18-097-0043	West Street	Marion	33.2	No
18-097-0066	English Avenue	Marion	34.1	No
18-097-0078	Washington Park	Marion	34.1	No
18-097-0079	East 75th Street	Marion	32.4	No
18-097-0081	West 18th Street	Marion	31.4	No
18-097-0083	East Michigan Street	Marion	32.9	No
18-157-0008	Greenbush Street	Tippecanoe	32.7	No
18-167-0018	Lafayette Avenue	Vigo	29.2	No
18-167-0023	Devaney School	Vigo	29.6	No
18-037-0004	Jasper Sport	Dubois	IN	No
18-034-0005	Jasper Golf	Dubois	33.1	No
18-037-2001	Jasper Post Office	Dubois	31.8	No
18-083-0004	Southwest Ag	Knox	29.1	No
18-147-0009	Dale	Spencer	31.2	No
18-163-0006	Civic Center	Vanderburgh	26.5	No
18-163-0012	Mill Rd.	Vanderburgh	28.0	No
18-163-0016	Univ. of Evansville	Vanderburgh	27.6	No
18-019-0006	Walnut Street	Clark	29.2	No
18-043-1004	New Albany	Floyd	28.4	No

Causal Connection: IDEM established a causal connection between the event and air quality for all of the flagged observations on May 31 with the Appendix 1 accounts and maps of the Bugaboo fire in Northern Florida and Southern Georgia, forward air

trajectories included in Appendix 2, back trajectories included in the area specific demonstrations, NOAA smoke maps, and wind roses.

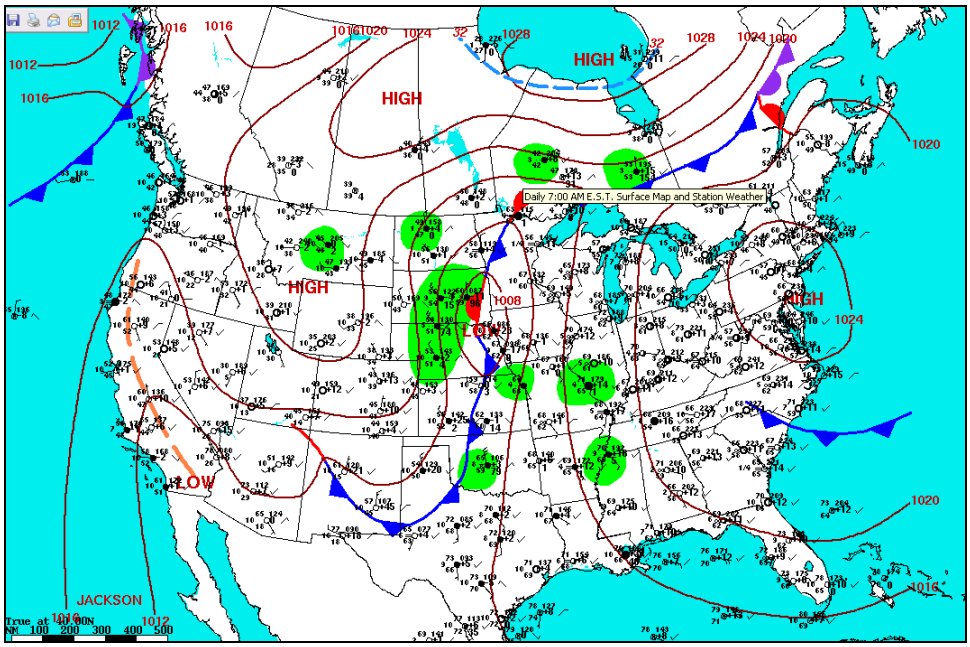


Figure 8: NOAA Daily Weather Map; May 30, 2007

Comparison to Background Levels: There are no modifications from the description contained in the Methodology Section, which concluded that all of IDEM's flagged observations related to the Bugaboo fire are in excess of the normal historical fluctuations.

Demonstration of Exceedance "But For" the Event: Only one of the observations on May 30 exceeds or contributes to a violation of the 24-hour NAAQS. The 36.8 µg/m^3 observed at the Burr Street monitor (18-089-0026) in Lake County meets the "but for" criteria based on incremental impact (6.6 µg/m^3) approximated from the nearby Gary Iitri $PM_{2.5}$ speciation data.

The remaining flagged observations (ranging from 26.5 to 34.1 µg/m^3) did not contribute to a violation of the 24-hr NAAQS and do not contribute to a violation, so the annual NAAQS becomes relevant. Accordingly, the exceptional event has to be determined to cause exceedances or violations of that NAAQS (15 µg/m^3). The approximate organic carbon increment ranges from 6.6 to 8.6 µg/m^3, except for the Dubois site, which is approximated at 13.5 µg/m^3. Taken this range of approximate organic mass increments and applied to the observed flagged concentrations, none of the remaining observations meet the "but for" criteria. For May 30, Region 5 concurs only on the 36.8 µg/m^3 observed at the Burr Street monitor (18-089-0026) in Lake County.

Event Date: May 31st, 2007
Pollutant: $PM_{2.5}$
Monitors and Observations Flagged:

Site ID	Site Name	County	Observed Conc. ($\mu g/m^3$)	EPA Concurrence
18-091-0011	Michigan City	LaPorte	30.2	No
18-039-0003	Pierre Moran School	Elkhart	31.3	No
18-141-0014	Nuner School	St. Joseph	32.0	No
18-003-0004	Beacon Street	Allen	33.0	No
18-035-0006	Central H.S.	Delaware	30.2	No
18-095-0009	West 5th Street	Madison	32.6	No
18-097-0066	English Avenue	Marion	34.6	No
18-097-0078	Washington Park	Marion	32.0	No
18-157-0008	Greenbush Street	Tippecanoe	30	No
18-167-0023	Devaney School	Vigo	30.5	No
18-037-2001	Jasper Post Office	Dubois	IN	
18-019-1004	Walnut Street	Clark	33.4	No

Causal Connection: IDEM established a causal connection between the event and air quality for all of the flagged observations on May 31st with the Appendix 1 accounts and maps of the Bugaboo fire in Northern Florida and Southern Georgia, forward air trajectories included in Appendix 2, back trajectories included in the area specific demonstrations, NOAA smoke maps, and wind roses.

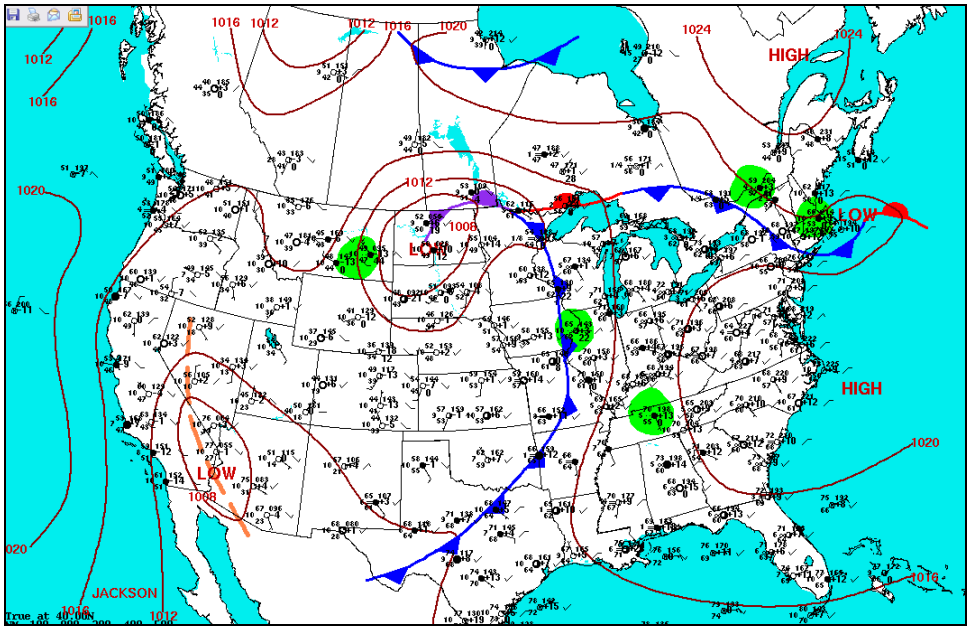


Figure 9: NOAA Daily Weather Map; May 31, 2007

Comparison to Background Levels: There are no modifications from the description contained in the Methodology Section, which concluded that all of IDEM's flagged observations related to the Bugaboo fire are in excess of the normal historical fluctuations.

Demonstration of Exceedance "But For" the Event: None of the observations on May 31 exceeded the 24-hour NAAQS, nor did any of them contribute to a violation of the 24-hr NAAQS, so the annual NAAQS becomes relevant. Accordingly, the exceptional event has to be determined to cause exceedances or violations of that NAAQS (15 $\mu g/m^3$). Chemical speciation data was collected on May 30. The approximate organic carbon increment ranges from 6.6 to 8.6 $\mu g/m^3$, except for the Dubois site, which is approximated at 13.5 $\mu g/m^3$. Given the range of the approximated increment and spatial distribution of speciation monitors, none of the flagged observations meet the "but for" criteria relative to the annual NAAQS. Therefore, Region 5 does not concur on any of the exceptional event flags for May 31st.

Event Date: June 1, 2007
Pollutant: $PM_{2.5}$
Monitors and Observations Flagged:

Site ID	Site Name	County	Observed Conc. ($\mu g/m^3$)	EPA Concurrence
18-019-1004	Walnut Street	Clark	32.3	No

Causal Connection: IDEM established a causal connection between the event and air quality for all of the flagged observations on June 1 with the Appendix 1 accounts and maps of the Bugaboo fire in Northern Florida and Southern Georgia, forward air trajectories included in Appendix 2, back trajectories included in the area specific demonstrations, NOAA smoke maps, and wind roses.

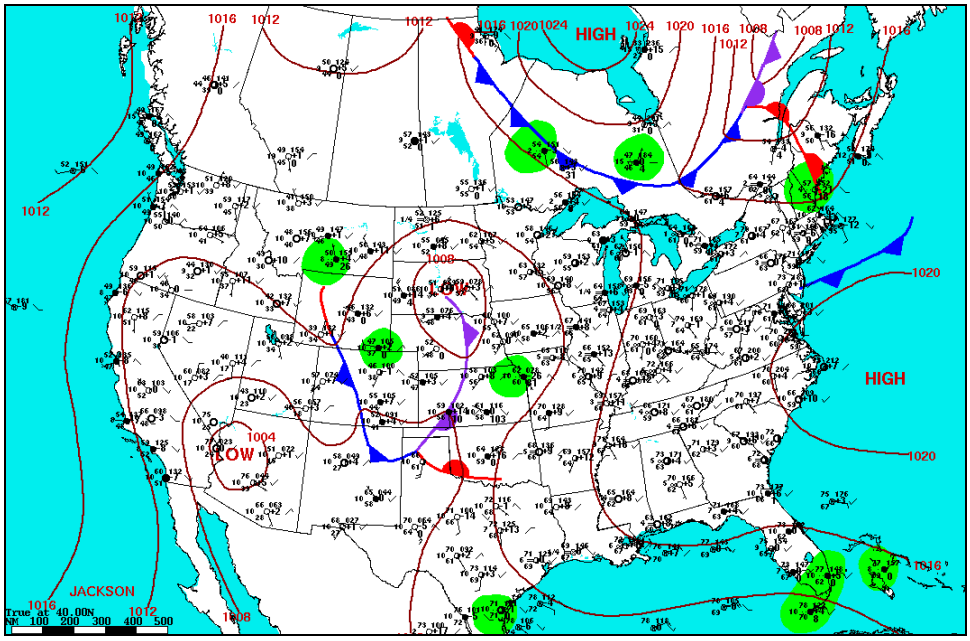


Figure 10: NOAA Daily Weather Map; June 1, 2007

Comparison to Background Levels: There are no modifications from the description contained in the Methodology Section, which concluded that all of IDEM's flagged observations related to the Bugaboo fire are in excess of the normal historical fluctuations.

Demonstration of Exceedance "But For" the Event: Concentrations significantly dropped throughout the State of Indiana on June 1, except for the Louisville area (Clark and Floyd Counties) (see Smoke Map, Figure 11). This is primarily due to changing weather patterns that pushed the smoke plume to the east. Speciation data collected at Washington Park in Indianapolis on June 2 is therefore not suitable to be used to approximate organic mass increment. Because the flagged observation on June 1 does not exceed the 24-hr NAAQS and does not contribute to a violation of the 24-hr NAAQS, the annual NAAQS becomes relevant. Accordingly, the exceptional event has to be determined to cause exceedances or violations of that NAAQS (15 $\mu g/m^3$). There is

insufficient evidence to determine that there would have been no exceedance or violation but for the event. Therefore, Region 5 does not concur on this exceptional event request.

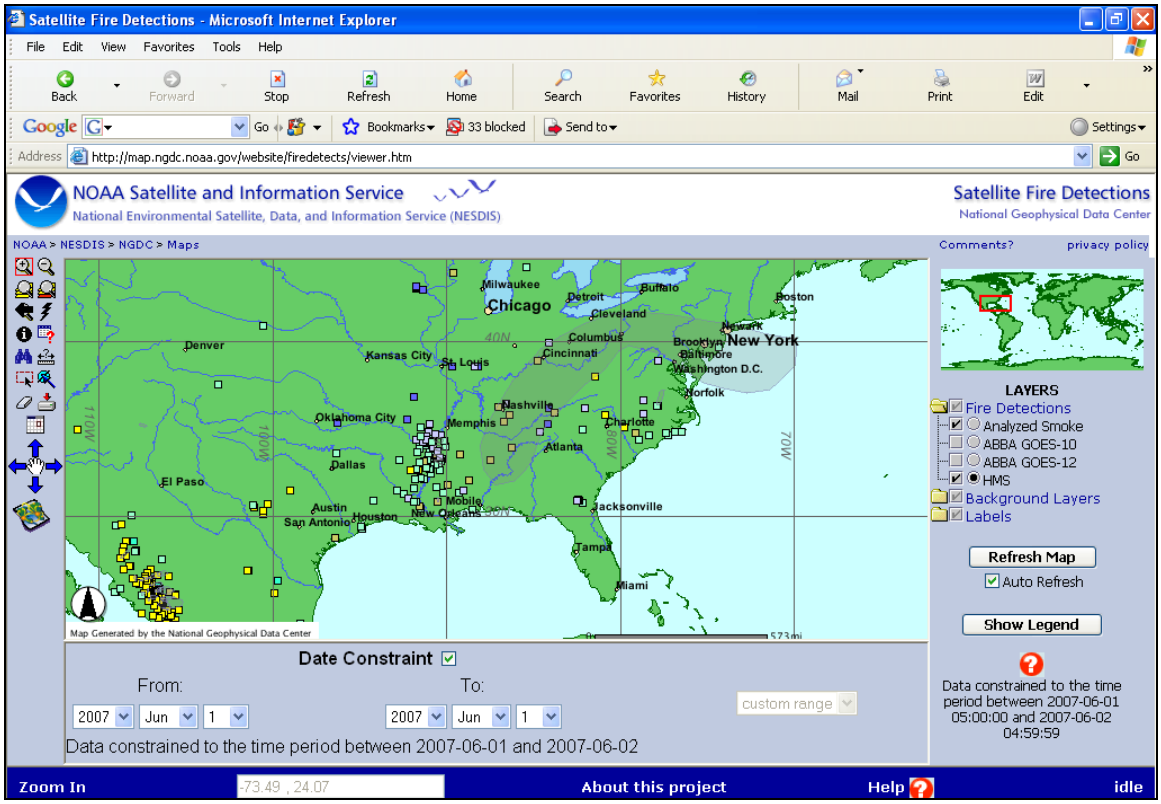


Figure 11: NOAA Satellite and Information Service's Satellite Fire Detection Map; June 1, 2007

Event Date: June 2, 2007
Pollutant: $PM_{2.5}$
Monitors and Observations Flagged:

Site ID	Site Name	County	Observed Conc. ($\mu g/m^3$)	EPA Concurrence
18-019-1004	Walnut Street	Clark	40.2	No
18-043-1004	New Albany	Floyd	35.1	No

Causal Connection: Region 5 requested additional information from IDEM regarding the June 2 event. The request for information was based on a reference to a local fire on June 2nd of the original demonstration from IDEM. IDEM responded with several HYSPLIT back trajectories to refine the direction of transport on June 2 and concluded that the high $PM_{2.5}$ values collected in Jeffersonville and New Albany on June 2 were not influenced by the fires located to the northwest of the sites. Rather, the predominant direction of transport was from the south-southwest. The fires which were referenced were small brush fires along the Muscatatuck River, approximately 35 miles to the north-northwest of New Albany.

IDEM established a causal connection between the event and air quality for all of the flagged observations on June 2 with the Appendix 1 accounts and maps of the Bugaboo fire in Northern Florida and Southern Georgia, forward air trajectories included in Appendix 2, back trajectories included in the area specific demonstrations, NOAA smoke maps, and wind roses.

Comparison to Background Levels: There are no modifications from the description contained in the Methodology Section, which concluded that all of IDEM's flagged observations related to the Bugaboo fire are in excess of the normal historical fluctuations

Demonstration of Exceedance "But For" the Event: Both of the flagged values on June 2 exceed the 24-hr NAAQS, and therefore the exceptional event has to be determined to cause exceedances or violations of that NAAQS (35 $\mu g/m^3$). The evidence to support the "but for" criteria provide mixed results, unlike the evidence had generally provided during several of the prior days in this event period. The sulfate pattern (Figure 14) mirrors the $PM_{2.5}$ concentration pattern, which indicates that the observed levels are due to anthropogenic (controllable) emissions. Due to the relatively stable surface conditions, widespread elevated $PM_{2.5}$ concentrations are observed. However, there is an isolated area of smoke in Southern Indiana indicated in the NAAPS smoke map (Figure 15). The NOAA Satellite Fire Detection Map shows that smoke is being concentrated on the Gulf Coast do weather patterns created by the approach of Hurricane Barry in Florida. Speciation data was collected in the Indianapolis, but since there is a clear demarcation between the observed concentrations in central Indiana from the two flagged observations in southeast Indiana, it is not appropriate to use Indianapolis' speciation data to calculate the approximate organic increment for these two observations collected in southeast Indiana. Due to the conflicting evidence and lack of additional data to approximate the impact of the Bugaboo fire on these sites, the requirement to establish that there would have been no exceedance or violation but for the event has not been met. Therefore, Region 5 does not concur on these two flagged events.

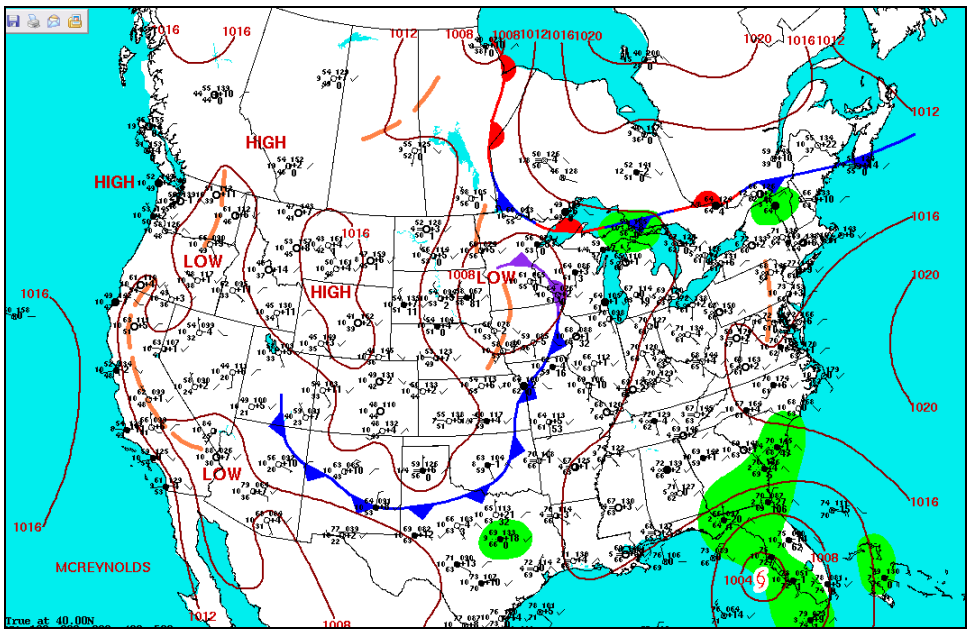


Figure 12: NOAA Daily Weather Map, June 2, 2007

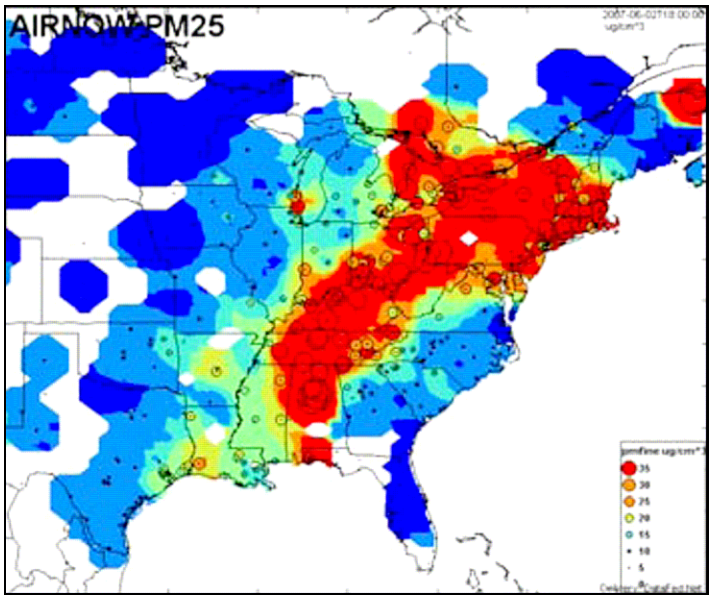


Figure 13: AIRNOW PM2.5

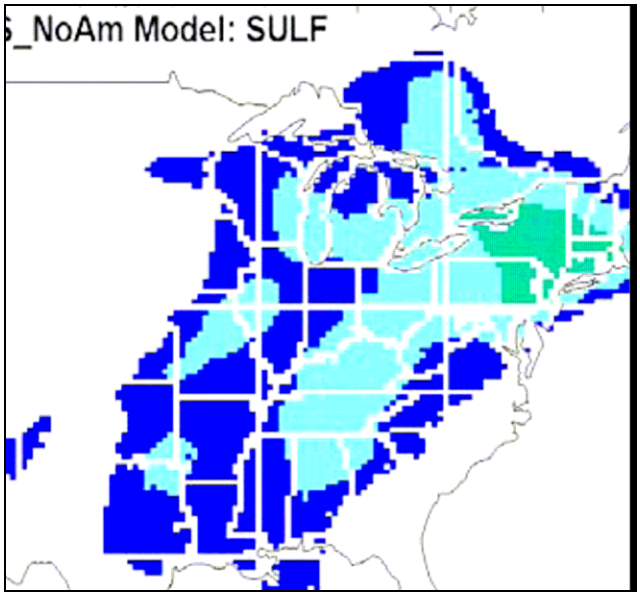


Figure 14: Modeled Sulfate, June 2, 2007; Naval Research Laboratory NAAPS global dust model

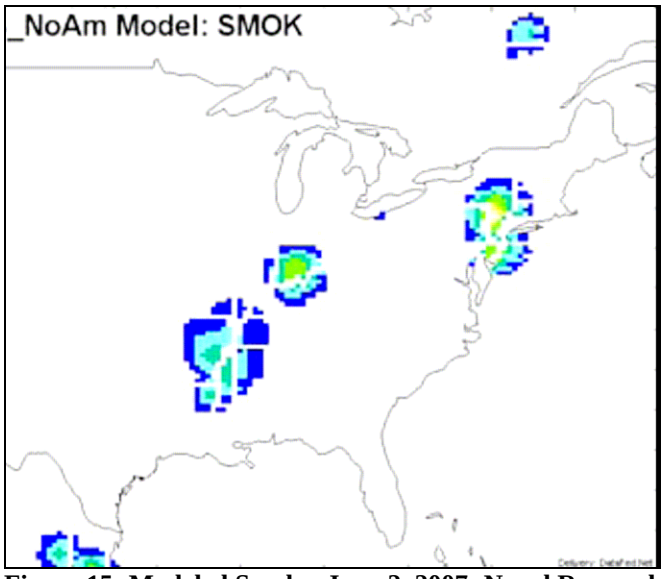


Figure 15: Modeled Smoke, June 2, 2007; Naval Research Laboratory NAAPS global dust model

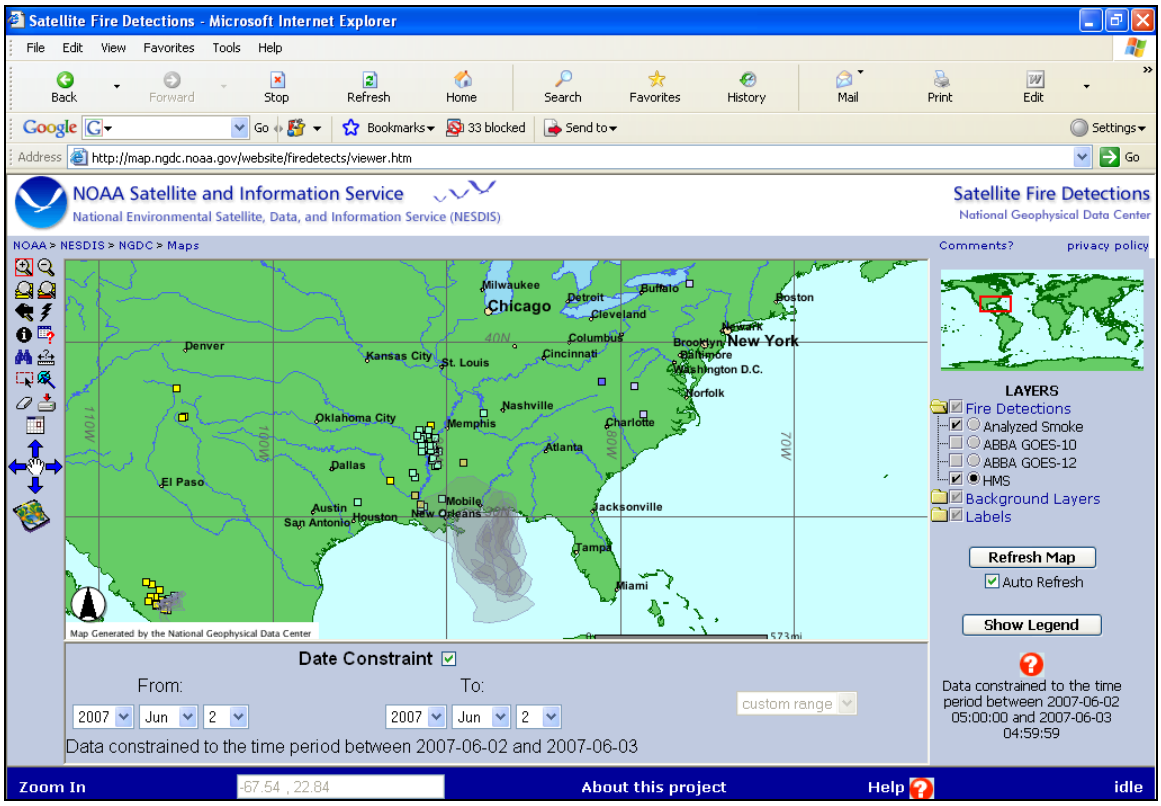


Figure 16: NOAA Satellite and Information Service's Satellite Fire Detection Map; June 2, 2007

July 4 Fireworks

40 CFR 50.14(b)(2) states that EPA shall exclude data from use in determinations of exceedances and NAAQS violations where a State demonstrates to EPA's satisfaction that emissions from fireworks displays caused a specific air pollution concentration in excess of one or more national ambient air quality standards at a particular air quality monitoring location and otherwise satisfies the requirements of this section. Such data will be treated in the same manner as exceptional events under this rule, provided a State demonstrates that such use of fireworks is significantly integral to traditional national, ethnic, or other cultural events including, but not limited to July Fourth celebrations which satisfy the requirements of this section.

Event Date: July 4, 2007
Pollutant: $PM_{2.5}$
Monitors and Observations Flagged:

Site ID	Site Name	County	Observed Conc. ($\mu g/m^3$)	EPA Concurrence
18-039-0003	Pierre Moran School	Elkhart	70.6	Yes
18-141-0014	Nuner School	St. Joseph	39.0	Yes
18-003-0004	Beacon Street	Allen	34.3	No

Event Description: IDEM's demonstration states, "Most communities have a tradition of celebrating the Fourth of July with several activities throughout the day ending with huge fireworks displays in the evening. Unfortunately, this traditional celebration may have a short term impact on air quality especially if meteorological conditions are such that dispersion of the smoke plumes from these events is hindered. The short term effects typically last 2 - 6 hours and depending on the meteorological conditions and duration, can substantially impact the particulate loading of $PM_{2.5}$ samples. In the State of Indiana, three sites in different communities experienced significantly high $PM_{2.5}$ 24-hour concentrations on this date." IDEM did not provide specific descriptions of the location or quantity of the fireworks displays for these three exceptional event claims.

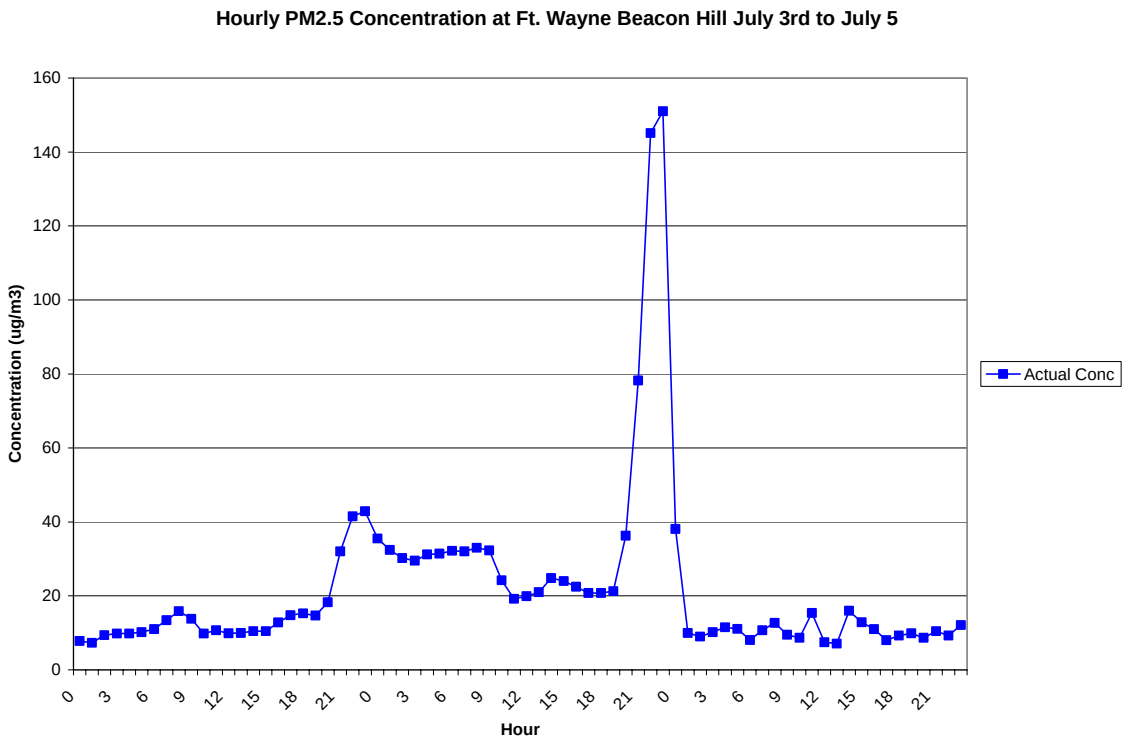
Comparison to Background Levels: Each of the observed and flagged July 4th concentrations is in excess of the upper 84th percentile of the multi-year measurements for the same site in the prior two years during the month of July. Therefore, they meet the criteria of being in excess of normal historical values.

Demonstration of Exceedance "But For" the Event: The Pierre Moran School monitoring site is approximately 2 miles southwest of Central High School, which is where Elkhart County's annual firework display occurs. IDEM's exceptional event demonstration states that the winds were relatively calm across Northern Indiana at the time of the fireworks displays. A wind rose from a monitoring site in South Bend confirms the calm conditions. Unfortunately there is not continuous $PM_{2.5}$ monitor located at this site to break down hourly components of the 24-hr average. This monitoring site does operate a $PM_{2.5}$ speciation monitor; however, it operates every 6th day and did not operate on July 4th. Because this extremely high exceedance occurred on July 4, the monitor was very close to the county's firework display, and was an isolated

high observation consistent with a local emission source, Region 5 concurs on this observation.

Fireworks displays occurred at the Indiana University-Purdue University Fort Wayne campus, which is less than two miles Northwest of the Beacon Street monitoring site. The 24-hr average flagged observation (34.3 µg/m^3) did not exceed the 24-hr NAAQS, and it does not contribute to a violation because this site has a 2005 to 2007 design value of 33 µg/m^3. Therefore, the exceptional event has to be determined to cause exceedances or violations of that NAAQS (15 µg/m^3).

The Beacon Street monitoring site in Ft. Wayne also hosts a continuous $PM_{2.5}$ monitor that provides hourly observations. The hourly $PM_{2.5}$ observations from July 3 to July 5 are plotted below. It is clear that evening hours on July 4th had much higher $PM_{2.5}$ concentrations than hours before or after the period of fireworks. Using the hourly data, a 24-hr average concentration was calculated with and without the inclusion of the impacted hours on July 4th. Including all hourly observations, the 24-hr average of the continuous data is 39.5 µg/m^3, which is a few micrograms higher than the flagged observation (34.3 µg/m^3) recorded by the federal reference $PM_{2.5}$ monitor. Excluding the 3 hours impacted by the fireworks and re-calculating the 24-hr average of remaining hourly observations (21 hours), the average is 26.9 µg/m^3. The impact of the fireworks can then be estimated from the difference of the average calculated with and without the impacted hours included. The fireworks contributed approximately 12 µg/m^3. Subtracting this estimate of impact from the flagged value suggests that but for the event, the observed concentration would have still been above the level of the annual standard. Therefore, the requirement to establish that there would have been no exceedance or violation but for the event has not been met and Region 5 does not concur on this flagged event.



On July 4th, 2007, Coveleski Stadium displayed fireworks after the baseball game. This stadium is located about 3.5 miles west of the Nuner School monitoring site. The Nuner School monitoring site does not have a continuous $PM_{2.5}$ monitor, but a continuous monitor does operate at the Shields Drive site located approximately three miles to the North. Using the same approach as explained above, the 24-hr average value calculated from the hourly concentrations was 40.5 with all hours, and 19.9 when taking the average of the 21 hours collected on July 4 before the fireworks occurred. Region 5 concurs on this event because the fireworks contributed approximately 20 µg/m^3 which provides sufficient evidence that there would have been no exceedance or violation but for the event.

AQSID	dDV_05to07	County	MSA	2005 98th %ile	2006 98th %ile	2007 98th %ile
180030004	33	Allen	Fort Wayne, IN	38.4	26.2	33.0
180030014	31	Allen	Fort Wayne, IN	34.9	26.5	32.0
180190006	40	Clark	Louisville/Jefferson County, KY	45.5	35.9	38.1
180350006	32	Delaware	Muncie, IN	37.3	27.4	31.1
180372001	35	Dubois	Jasper, IN	41.2	31.6	32.0
180370004		Dubois	Jasper, IN		33.6	35.2
180370005		Dubois	Jasper, IN		32.2	36.2
180390003	33	Elkhart	Elkhart-Goshen, IN	40.8	25.5	33.2
180431004	35	Floyd	Louisville/Jefferson County, KY	40.1	28.2	35.4
180650003	32	Henry	New Castle, IN	37.3	27.2	32.4
180670003	33	Howard	Kokomo, IN	37.6	27.6	33.6
180830004	36	Knox	Vincennes, IN	41.8	36.2	30.9
180890026	36	Lake	Chicago-Naperville-Joliet, IL-	43.7	30.4	35.0
180890006	36	Lake	Chicago-Naperville-Joliet, IL-	39.9	29.4	37.2
180890022	35	Lake	Chicago-Naperville-Joliet, IL-	40.4	28.5	35.2
180892010	35	Lake	Chicago-Naperville-Joliet, IL-	40.9	27.9	35.2
180890031	34	Lake	Chicago-Naperville-Joliet, IL-	38.7	27.1	36.2
180892004	33	Lake	Chicago-Naperville-Joliet, IL-	37.6	26.2	34.9
180891003	33	Lake	Chicago-Naperville-Joliet, IL-	39.0	25.8	33.8
180890027	32	Lake	Chicago-Naperville-Joliet, IL-	37.1	25.8	34.1
180910011	32	LaPorte	Michigan City-La Porte, IN	37.5	28.1	31.5
180910012	31	LaPorte	Michigan City-La Porte, IN	36.5	24.7	31.0
180950009	33	Madison	Anderson, IN	38.3	28.0	32.6
180970043	40	Marion	Indianapolis-Carmel, IN	43.9	37.5	38.3
180970066	39	Marion	Indianapolis-Carmel, IN	44.0	36.2	37.2
180970081	39	Marion	Indianapolis-Carmel, IN	45.7	34.8	37.1
180970083	37	Marion	Indianapolis-Carmel, IN	40.3	33.5	37.2
180970078	37	Marion	Indianapolis-Carmel, IN	42.5	31.7	35.3
180970079	36	Marion	Indianapolis-Carmel, IN	43.4	30.7	33.5
180970042	35	Marion	Indianapolis-Carmel, IN	39.4	31.0	35.6
181270024	32	Porter	Chicago-Naperville-Joliet, IL-	37.5	26.1	33.3
181270020	32	Porter	Chicago-Naperville-Joliet, IL-	37.6	26.6	30.6
181470009	33	Spencer		39.7	27.7	31.4
181410014	33	St. Joseph	South Bend-Mishawaka, IN-MI	40.2	24.9	33.3
181412004	30	St. Joseph	South Bend-Mishawaka, IN-MI	35.8	24.1	31.3
181411008		St. Joseph	South Bend-Mishawaka, IN-MI	37.3	24.7	
181410015		St. Joseph	South Bend-Mishawaka, IN-MI		24.9	30.8
181570008	36	Tippecanoe	Lafayette, IN	49.3	27.0	32.0
181630006	36	Vanderburgh	Evansville, IN-KY	42.5	30.5	33.6
181630012	33	Vanderburgh	Evansville, IN-KY	41.5	27.9	29.9
181630016	33	Vanderburgh	Evansville, IN-KY	37.0	29.5	31.5
181670018	35	Vigo	Terre Haute, IN	43.1	31.0	31.0
181670023	35	Vigo	Terre Haute, IN	42.5	29.1	32.1