

4.0 Analyses of Individual Nonattainment Area

4.7 Region 7 Nonattainment Areas

4.7.2 Missouri

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

The table below identifies the counties/areas in Missouri 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	Missouri Recommended Nonattainment Counties	EPA's Designated Nonattainment Counties
St. Louis, MO-IL	None	Franklin Jefferson St. Charles St. Louis City of St. Louis ²

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

EPA Technical Analysis for St. Louis, MO

Introduction

Pursuant to section 107(d) of the Clean Air Act, EPA must designate as nonattainment those areas that violate the NAAQS and those nearby areas that contribute to violations. This technical analysis for the St. Louis area identifies the counties with monitors that violate the 24-hour $PM_{2.5}$ standard and evaluates nearby counties for contributions to fine particle concentrations in the area. EPA has evaluated these counties based on the weight of evidence of the following nine factors recommended in EPA guidance and any other relevant information:

- pollutant emissions

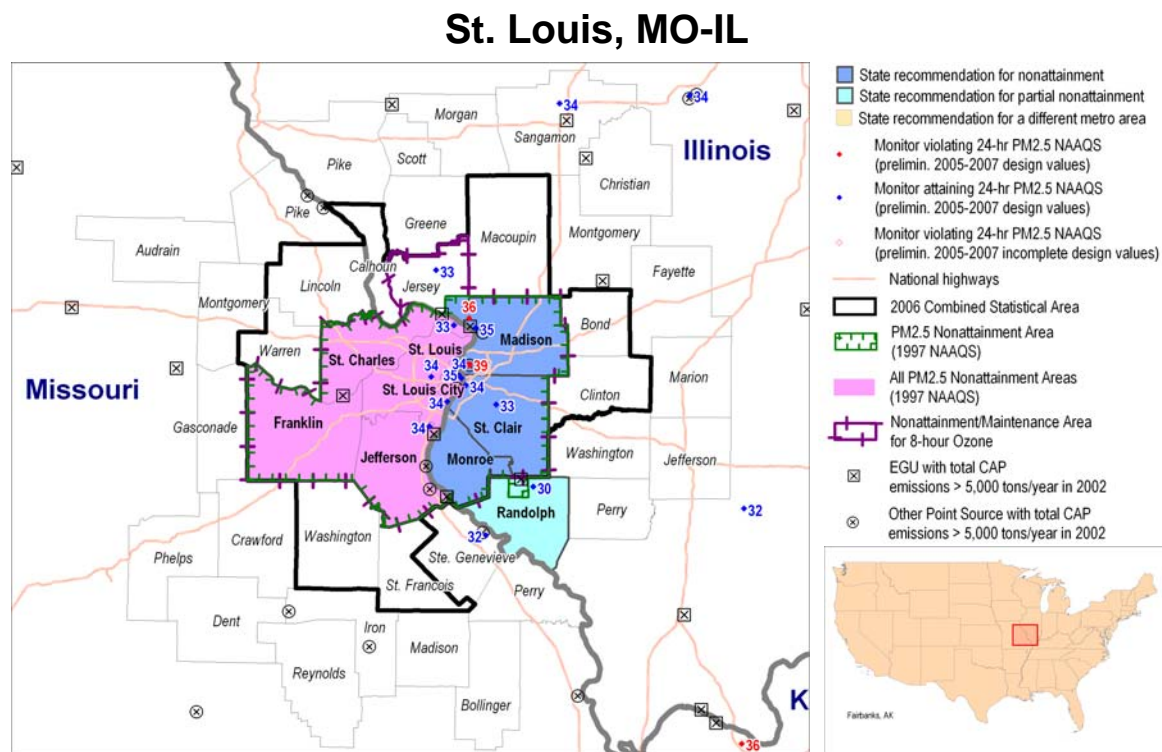
¹ EPA designated nonattainment areas for the 1997 fine particle standards in 2005. In 2006, the 24-hour $PM_{2.5}$ standard was revised from 65 micrograms per cubic meter (average of 98th percentile values for 3 consecutive years) to 35 micrograms per cubic meter; the level of the annual standard for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

² Under Missouri law, the City of St. Louis is not contained within any county and is therefore not a portion of a county.

- air quality data
- population density and degree of urbanization
- traffic and commuting patterns
- growth
- meteorology
- geography and topography
- jurisdictional boundaries
- level of control of emissions sources

EPA also used analytical tools and data such as pollution roses, fine particle composition monitoring data, back trajectory analyses, and the contributing emission score (CES) to evaluate these areas. (See additional discussion of the CES under factor 1 below.)

Figure A is a map of the counties in the area. The Figure includes other relevant information such as the locations and design values of air quality monitors, the metropolitan area boundary, and counties recommended as nonattainment by the State.



Counties labeled in bold reflect NAAAs under 1997 NAAQS

Figure A.

Background

The St. Louis metro area was previously established by EPA as a PM_{2.5} nonattainment boundary for the 1997 annual PM_{2.5} NAAQS. That boundary included a total of eight full counties and one city (City of St. Louis), with four of the counties and the city being located in Missouri. These same counties, and city, are being designated as nonattainment for the 2006 24-hour PM_{2.5} standard.

In December 2007, Missouri recommended that all areas in the state be designated as attainment for the 2006 24-hour PM_{2.5} standard based primarily on its analysis of air quality data from 2004-2006. All data submitted by Missouri related to the violations occurring in Madison County, IL during 2004-2006, at the Granite City and VFW monitoring sites are included in this rulemaking docket. These data are from Federal Reference Method (FRM) monitors. The State based its attainment recommendation on the argument that the two monitors were violating because of the contributions of direct PM_{2.5} from one local source, US Steel in Granite City, Illinois.

In August 2008, EPA notified Missouri 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. On October 16, 2008, the state of Missouri provided its response to EPA's August letter. The information contained in the letter is addressed in EPA's response to comments and in this document.

Based on EPA's technical analysis described below, EPA is designating portions of the St Louis, Missouri area (previously designated nonattainment for the 1997 annual PM_{2.5} NAAQS) as nonattainment for the 24-hour PM_{2.5} NAAQS, based upon currently available information. These areas are listed in the table below. The EPA must utilize the most recent three years of quality assured monitoring data in making these designations. In this case, the most current, quality assured monitor data is from the period 2005-2007. During the period 2005-2007, the violating monitors in the St. Louis metro area were both in Madison County, IL. These monitors are commonly referred to as the Granite City and Alton monitors. (It should be noted that Missouri's analysis in response to EPA's 120-day letter did not include consideration of violations at the Alton monitor.)

The following is a technical analysis for the EPA Region 7 (Missouri) portion of the St. Louis 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," "SO₂," "NO_x," "VOCs," and "NH₃." "PM_{2.5} emissions total" represents direct emissions of PM_{2.5} and includes: "PM_{2.5} emissions carbon," "PM_{2.5} emissions other", primary sulfate (SO₄), and primary nitrate. (Although primary sulfate and primary nitrate, which are emitted directly from stacks rather than forming in

atmospheric reactions with SO₂ and NO_x, are part of “PM_{2.5} emissions total,” they are not shown in Table 1 as separate items). “PM_{2.5} emissions carbon” represents the sum of organic carbon (OC) and elemental carbon (EC) emissions, and “PM_{2.5} emissions other” represents other inorganic particles (crustal). Emissions of SO₂ and NO_x, which are precursors of the secondary PM_{2.5} components sulfate and nitrate, are also considered. VOCs (volatile organic compounds) and NH₃ (ammonia) are also potential PM_{2.5} precursors and are included for consideration.

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 analytical tool used to consider data for these factors. A summary of the CES is included in attachment 2, and a more detailed description can be found at http://www.epa.gov/ttn/naaqs/pm/pm25_2006_techinfo.html#C. NOTE: The emissions data used to derive the CES were taken from the 2005 National Emissions Inventory (NEI), version 1. See http://www.epa.gov/ttn/naaqs/pm/pm25_2006_techinfo.html.

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 St. Louis Area. Counties that are part of the St. Louis nonattainment area for the 1997 PM_{2.5} NAAQS are shown in boldface. Counties are listed in descending order by CES.

County	State Recommended Nonattainment?	CES	PM _{2.5} emissions total (tpy)	PM _{2.5} emissions carbon (tpy)	PM _{2.5} emissions other (tpy)	SO ₂ (tpy)	NO _x (tpy)	VOCs (tpy)	NH ₃ (tpy)
Madison, IL*	Yes	100	4,945	1,148	3,796	27,320	19,373	15,676	1,393
St. Louis, MO*	No	55	4,221	1,707	2,513	29,966	55,605	54,821	2,954
St. Louis City*	No	48	1,686	625	1,060	12,171	24,702	20,647	439
St. Clair, IL*	Yes	22	1,496	487	1,009	2,142	10,233	10,869	1,281
St. Charles, MO*	No	17	3,694	619	3,075	54,561	20,773	12,419	1,182
Jefferson, MO*	No	16	2,945	824	2,121	45,574	16,722	9,273	493
Randolph, IL**	Partial	9	2,505	306	2,199	24,605	9,384	2,331	993
Franklin, MO*	No	5	2,812	621	2,190	56,767	15,595	5,748	1,818
Monroe, IL*	Yes	5	744	235	508	293	3,057	2,529	654

* Counties in bold represent those in the St. Louis nonattainment area for the 1997 PM_{2.5} NAAQS (This table does not include all counties considered in the 9 factor analysis and those counties not shown had no factors that indicated that they should be candidates for a nonattainment status.)
** Part of Randolph County, Illinois is in the 1997 PM_{2.5} NAAQS nonattainment area

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

EPA notes that Franklin County, the lowest CES ranked county in Missouri which EPA is including in the nonattainment area, has a CES score equal to the lowest scoring Illinois county (Monroe) included in the nonattainment area (by that State of Illinois and EPA Region 5) and more than ten times the total PM_{2.5} direct and precursor emissions of Monroe County.

By reviewing and comparing 2002 National Emissions Inventory data for Missouri and Illinois counties, Missouri counties' potential to contribute to the violating monitor can be evaluated relative to other emissions in the metro area. A review of this data shows that collectively the point sources in the Missouri counties under review emit 50-74% of the primary and precursor pollutants of PM 2.5. Specifically, Figure 1 and Table 1.1 demonstrate that the Missouri counties emit approximately 50% of the total tons per year (tpy) of direct PM_{2.5}, approximately 57% of the total tpy of NO_x, and approximately 74% of the total tpy of SO₂ emitted in the nonattainment area. The figure and table clearly demonstrate Missouri counties have a equal or greater PM_{2.5}, emissions and precursors when compared to the Illinois metro areas included within the nonattainment boundary and therefore, have the potential to contribute air pollution emissions to the violating monitors.

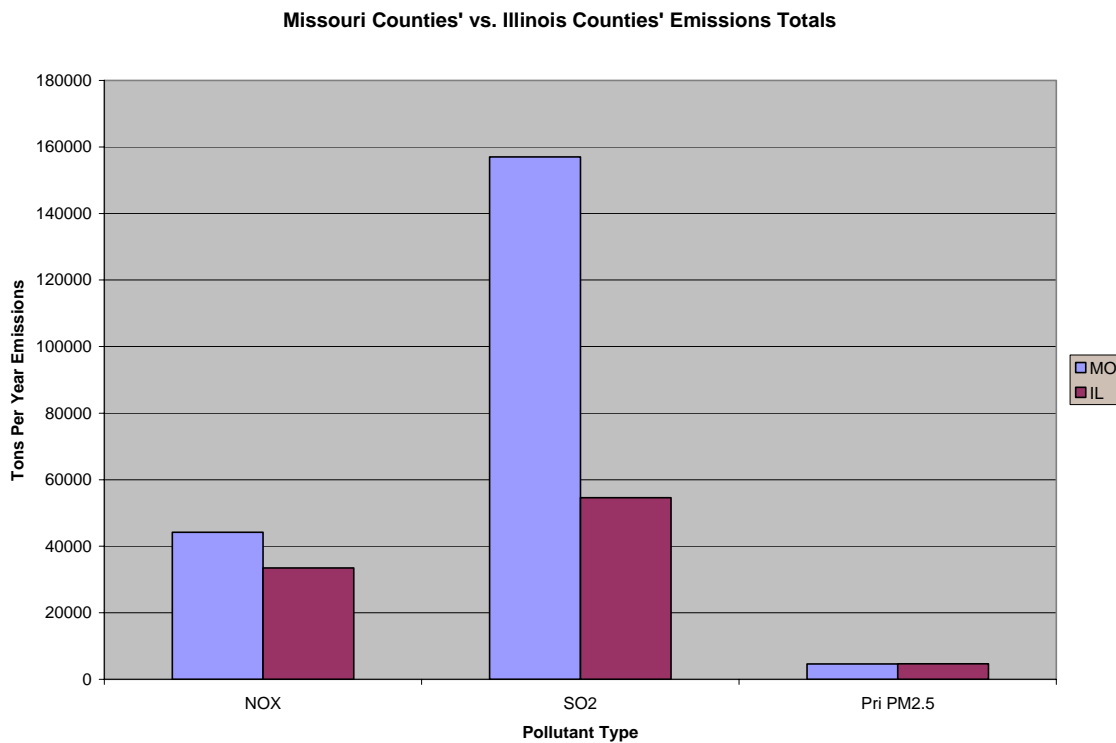


Figure 1: Missouri counties' emissions from point sources in the reviewed counties vs. Illinois counties' emissions from point source in the reviewed counties. Data from the 2002 NEI.

County	NO _x	SO ₂	PM _{2.5}
Franklin County	7851.837	47612.6224	1005.612776
Jefferson County	9202.056	39281.1982	979.12496
St. Charles County	14691.27	46644.8862	1377.532697

St. Louis city	2014.306	6771.233	610.0265779
St. Louis County	10438.98	16689.3744	634.9402981
Madison County	10608.49	26745.56085	2601.379465
Monroe County	3.49	0.08046	27.57737963
Randolph County	22467.41	26295.97834	1766.661372
St. Clair County	368.7823	1540.66522	271.647678
Total TPY	77646.61	211581.5991	9274.503203
Missouri Total	44198.44	156999.3	4607.237
MO % Contribution	57%	74%	50%

Table 1.1: 2002 NEI TPY by pollutant.

In summary, EPA's analysis of Factor 1 indicates that based on emission levels and CES values, the Missouri counties are probable contributors to the violating monitors and should remain candidates for a 24-hour PM_{2.5} nonattainment designation.

Factor 2: Air quality data

This factor considers the 24-hour PM_{2.5} design values (in µg/m³) for air quality monitors in counties in the St. Louis 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 98th percentile values are 35 µg/m³ or less. A design value is only valid if minimum data completeness criteria are met.

The 24-hour PM_{2.5} design values for counties in the St. Louis Area are shown in Table 2.

County	State Recommended Nonattainment?	Design Values 2004-06 (µg/m ³)	Design Values 2005-07 (µg/m ³)
Madison, IL*(Granite City)	Yes	39	39
Madison, IL (Alton)	Yes	34	36
St. Louis, MO*	No	32	34
St. Louis City, MO*	No	34	35
St. Clair, IL*	Yes	33	34
St. Charles, MO*	No	32	33
Jefferson, MO*	No	32	34
Randolph, IL**	Partial	27	30
Franklin, MO*	No	0***	0***
Monroe, IL*	Yes	0***	0***

* Counties in bold represent those in the St. Louis nonattainment area for the 1997 PM_{2.5} NAAQS

** Part of Randolph County, Illinois is in the 1997 PM_{2.5} NAAQS nonattainment area

*** There are no PM_{2.5} monitors in this county; therefore there are no monitoring values for this county.

Table 2. Air Quality Data

Two locations in Madison County, Illinois have recent monitored violations of the 24-hour PM_{2.5} standard as outlined in Table 2.³ Those three locations are the Alton, Granite City Steel and VFW monitors. Therefore, Madison County, Illinois is included in the St. Louis nonattainment

³ As stated previously, the VFW monitor recorded violations for 2004-2006, but not for 2005-2007.

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.

Under this factor, EPA also considered fine particle composition monitoring data. Air quality monitoring data on the composition of fine particle mass are available from the EPA Chemical Speciation Network. As shown in Table 2.1, on high concentration days during cold weather months in this area, EPA found on average a total PM_{2.5} contribution of 18.9 ug/m³, consisting 5.2 ug/m³ of sulfate, 0 ug/m³ of nitrate, 11.6 ug/m³ of carbon particulate and 2.1 ug/m³ of crustal particulate. On high concentration days during warm weather months in this area, EPA found on average a total PM_{2.5} contribution of 37.7 ug/m³, consisting of 28.4 ug/m³ of sulfate, 0 ug/m³ nitrate, 8.2 ug/m³ carbon particulate and 1 ug/m³ of crustal particulate emissions. These estimates were used also for weighting of the emissions of different pollutants in calculating the CES.

PM _{2.5} Composition Data	Sulfate (µg/m ³)	Nitrate (µg/m ³)	Carbon (µg/m ³)	Crustal (µg/m ³)	Total (µg/m ³)	Sulfate Percent	Nitrate Percent	Carbon Percent	Crustal Percent
Total Concentration (Cold)	5.2	0	11.6	2.1	18.9	28	0	61	11
Regional Concentration (Cold)	3	0	2.5	1.3	6.8	44	0	37	19
Urban Increment (Cold)	2.2	0	9.1	0.8	12.1	18	0	75	7
Total Concentration (Warm)	28.4	0	8.2	1	37.7	75	0	22	3
Regional Concentration (Warm)	25.1	0	4.4	1.2	30.7	82	0	14	4
Urban Increment (Warm)	3.3	0	3.8	0	7.1	46	0	54	0
Total Concentration (Ann Avg)	3	2.7	9.2	1.1	16	19	17	58	7
Regional Concentration (Ann Avg)	2.1	0.8	2.8	0.8	6.5	32	12	43	12
Urban Increment (Ann Avg)	0.9	1.9	6.4	0.3	9.5	9	20	67	3

Table 2.1 Speciation data from the Chemical Speciation Network and the IMPROVE monitoring network.

Analysis of data in Table 2.1 indicates that the days with the highest fine particle concentrations occur in both cool and warm seasons, and the average chemical composition of the highest days is typically characterized by high levels of carbon in the cold season, and high levels of sulfates in the warm season. Table 2.2 denotes all design values in the St. Louis area for 2005-2007. An evaluation of Table 2.2 indicates that 75% of the violations at the Alton monitor and 73% of the violations at the Granite City monitor occur during the warm season.

2nd&Mound	Margaretta	Blair	S. Broadway	Hunter	Sunset Hills	W. Alton	Arnold	Ste Genevieve	Swansea	13th&Tudor	Wood River	Alton	Granite City	VFW	Jerseyville	Houston- Bkgd	Season
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1/28/2005	19.5	18.3	20.8	18.9	20.1	18.8	19.9	17.4	15.6	17.6	17.8	15.7		19.2	35.1		13.2	Cold
1/31/2005	45	41.5	46.1	46.9	43.6	43.8	38.5	41.3	38.3	37.9		18.6		39.6				Cold
2/1/2005	40.8	37.5	43	41.6	36.8			40.5										Cold
2/2/2005	46.7	43.4	47.5	48.3	44.2			46.3								10.1		Cold
2/3/2005	44.8	38.8	41.6	38.1	43.5	37.3	31.6	33.5	26	44.7		41.7		41.8	23		29.3	Cold
2/27/2005	39.2	38.1	39.7	38.4	36.9	37	32.7	36.7	33.2	35.3	39.5		35.5	37.9	36.3	32.8	31.1	Cold
3/17/2005															37			Cold
4/4/2005		24.8		29	24.3			23.9							38.2			Cold
6/24/2005	32.4	31.8	33.7	36.9	31.7	29.3	34.2	31.8	32.1	32.4		34.7		36	41.1			Warm
6/26/2005	40.8		40.3	39.5				40.5										Warm
6/27/2005	39.4	40	38.6	38.6	38.9		41.4	39.1	32.4	37.9	39.6	44.1	45.1	44.1	46.1	43.7	32.4	Warm
6/29/2005	39		37.4	38				39.6										Warm
7/23/2005	33.4		31.5	31.4				36.6										Warm
8/1/2005	45.3		41.9	41.5				45.8										Warm
8/2/2005	37.6	40.4	39.3	37	36.9	38.3	37.9	41.6	32.5	35.9	38.6	39.2	38.3	41.2	41.2	40.9	31.3	Warm
8/8/2005	41.6	38.4	38.7	38.4	39.7	36.2	38.2	37	33.2		40.4	41.2	39.4	44.7	41	37.2	34.3	Warm
8/9/2005			36.5					39.5										Warm
9/7/2005	39.8	36.4	36.4	36.3	34.5	36.2	34	37.8	36.1	33		38.8	35.4	45.8	42.1	33.1	32.1	Warm
9/10/2005	39.4	38.4	39.7	38	38.9	37.7	41.5	39.9	37.7	37		40.8		42.7	39.1			Warm
9/11/2005	41.8		41.5	39.3				41.7										Warm
9/13/2005		23.1		21.8	22.4	20.6	24.4	22.9	26	24.9	22	27.3	28.6	30.4	36	26.4	28	Warm
2/28/2006	31.8	30.5	32.8	29.3	27.7	23.3	27.2	22.6	15.3	19	29.2	28.3	25.8	40	27	29.5	13	Cold
4/29/2006	17.6	17.7	18	17.6			19.3	26.1		18.7	18.4	17.3	20.2	36.3	28	18.6	19.3	Warm
5/8/2006	20	19.5	20	18.1	19.2	16.6	20.7	18.2	17			21.9		25.1	37.2			Warm
7/20/2006	35.8			32.5				30.7										Warm
8/12/2006	29.6	30.8	29.2	31.7	31.6		28.1	32.4	34.4	28.1		25.1		39.9	32.9			Warm
8/13/2006	34.2		34.2	35.4				39.1										Warm
2/21/2007	37.9	0	33.8	30.7	21.2		24.5	22.3		26.8								Cold
5/24/2007	32.5	32.5	32.1	31.7	28.5		32.2			33.8	34.9	34.3	35.4	38.4				Warm
6/14/2007	36.3	36.3		35.8	36.1		34.1	35.2		32.9		31						Warm
6/17/2007	34.6	34.2	34.2	34.2	32.7		35	34.9		30.8	32.7	33.8	34.7	35.3				Warm
7/4/2007	20		21.7	22.5	16.8		17.5	45.7		9.6								Warm
8/1/2007	25.8		26.3	29.2	27		25.7	30.4		22		35		24.3				Warm
8/2/2007	47.9		47.1	41.3	41.9		39.4	41.1										Warm
8/3/2007	47.9		50.4	45	45.8		49.7	42.5										Warm
8/4/2007	33.8		34.2	32.9	29.3		33.9	32.6		28.4	32.5	38.4	33.4	36				Warm
9/21/2007	32.1		33.3	33.3	31.7		30.5	30.8		29.5		34.5	35	38.4				Warm

Table 2.3. Air Quality Monitoring Data on Exceedance Days.

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 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.

In summary, EPA’s review of Factor 2 indicates that both local and regional contributions to the violating monitors are likely. Due to the spatial separation of the Granite City monitor from the Alton monitor, it is not likely that one source or a small group of localized sources is exclusively impacting both monitors. The speciation data also indicates that sulfur and organic carbon sources are likely significant contributors to the total mass on the filters. Both of these PM_{2.5} precursor emissions are emitted in substantial quantities in upwind Missouri areas. Consequently, Factor 2 supports broader non-attainment boundaries including all four of the nearby Missouri counties and St. Louis City.

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

Table 3 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.

County	State Recommended Nonattainment?	2005 Population	2005 Population Density (pop/sq mi)
Madison, IL*	Yes	263,975	357
St. Louis, MO*	No	1,002,258	1914
St. Louis City, MO*	No	352,572	5334
St. Clair, IL*	Yes	259,388	385
St. Charles, MO*	No	329,606	557
Jefferson, MO*	No	213,011	321
Randolph, IL**	Partial	33,116	55
Franklin, MO*	No	98,987	107
Monroe, IL*	Yes	31,289	79

* Counties in bold represent those in the St. Louis nonattainment area for the 1997 PM_{2.5} NAAQS
 ** Part of Randolph County, Illinois is in the 1997 PM_{2.5} NAAQS nonattainment area

Table 3. Population

A review of the population data for the bi-state metro area indicates that Missouri counties/areas were consistently in the top three rankings for both total population numbers and population density. All Missouri counties in the ranking for non-attainment consideration have populations of over 90,000 people. (Of the counties in Missouri, Franklin County is the least populated with 98,987 people). The total population for Franklin County is approximately 3 times greater than that of Monroe County, IL, which is the lowest population-ranked Illinois County that was recommended for non-attainment by both EPA and the state of Illinois.

In summary, EPA’s review of Factor 3 indicates that 78% of the total population in the bi-state area lives on the Missouri side of the St. Louis area. While, population and population density alone do not provide absolute justification for determining nonattainment boundaries, this data is indicative of population-based emissions. Since these highly populated Missouri areas are commonly upwind of the monitors on high PM_{2.5} monitored days, these Missouri counties/areas remain candidates for consideration in the nonattainment area designation.

Factor 4: Traffic and commuting patterns

This factor considers the number of commuters in each county who drive to another county within the St. Louis area the percent of total commuters in each county who commute to other counties within the area as well as the total Vehicle Miles Traveled (VMT) for each county in millions of miles (see Table 4). 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. 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.

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
St. Louis, MO*	No	14,165	3,800	1	493,070	99
St. Charles, MO*	No	3,185	740	0	147,420	99
St. Louis City*	No	3,638	1,250	1	139,280	99
Madison, IL*	Yes	2,318	75,490	62	119,590	98
St. Clair, IL*	Yes	3,019	7,040	6	110,870	98
Jefferson, MO*	No	2,241	490	1	96,860	99
Franklin, MO*	No	1,436	150	0	43,600	97
Monroe, IL*	Yes	359	420	3	13,560	95
Randolph, IL**	Partial	261	180	1	2,790	21
* Counties in bold represent those in the St. Louis nonattainment area for the 1997 PM _{2.5} NAAQS						
** Part of Randolph County, Illinois is in the 1997 PM _{2.5} NAAQS nonattainment area						

Table 4. Traffic and Commuting Patterns

Although the majority of the populous does not regularly travel directly to/from the county monitoring violations (Madison County), the population does routinely travel to/from and within the MSA as a whole. Specifically, the information in the table suggests a typical pattern of high urban core traffic with the major interstate highways such as Interstates 70, 270, 44, and 55 located in the Missouri portion of the bi-state area. The interstate highways outside the core urban area are responsible for the majority of the VMT in those particular counties.

Table 4 also reveals that Missouri counties account for 78% of the total number of commuting miles into the MSA. Of the Missouri areas: St. Louis County and City of St. Louis and St. Charles rank as the top three commuting areas in the bi-state metro area.

In summary, EPA’s review of Factor 4 indicates that all of the Missouri counties/areas rank high in terms of total VMT and are therefore logical candidates for consideration in the nonattainment area designation

Note: The 2005 VMT data used for table 4 and 5 of the 9-factor analysis have been derived using methodology such as that described in "Documentation for the 2005 Mobile National Emissions Inventory, Version 2," December 2008, prepared for the Emission Inventory Group, U.S. EPA. This document may be found at:
ftp://ftp.epa.gov/EmisInventory/2005_nei/mobile_sector/documentation/2005_mobile_nei_version_2_report.pdf

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 St. Louis 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 5 below shows population, population growth, VMT and VMT growth for counties that are included in the area. Counties are listed in descending order based on VMT growth between 1996 and 2005.

County	Population (2005)	Population % change (2000-05)	2005 VMT (10 ⁶ mi)	VMT % change (1996-2005)
Monroe, IL*	31,289	13	359	47
St. Louis, MO*	1,002,258	-1	14,165	33
St. Charles, MO*	329,606	15	3,185	28
Franklin, MO*	98,987	5	1,436	19
St. Clair, IL*	259,388	1	3,019	13
Randolph, IL**	33,116	-2	261	2
Jefferson, MO*	213,011	7	2,241	1
St. Louis City, MO*	352,572	2	3,638	-8
Madison, IL*	263,975	2	2,318	-12

* Counties in bold represent those in the St. Louis nonattainment area for the 1997 PM_{2.5} NAAQS
 ** Part of Randolph County, Illinois is in the 1997 PM_{2.5} NAAQS nonattainment area

Table 5. Population and VMT Growth and Percent Change.

Data from Table 5 indicate that Missouri counties/areas occupied 4 of the top 5 rankings in terms of total population and population growth between the years 2000-2005. In addition, Missouri counties/areas, ranked in 3 out of the top 5 rankings in terms of VMT growth.

As listed in Table 5, population growth above 5% occurred in the following counties between 2000 and 2005: St. Charles, Franklin, and Jefferson counties in Missouri and Monroe County in Illinois. Only two counties had a decline in population from 2000-2005 and those were St. Louis County, Missouri and Randolph County, Illinois. Madison County, which is the county with the violating monitors, experienced a 12% reduction in VMT between the years 2000 and 2005. Also, it is notable from Table 5 that no area had a concurrent drop in population and VMT. In other words, each area has experienced recent growth in at least one or the other indices.

In summary, EPA’s review of Factor 5 indicates that all areas in the bi-state metro area experienced growth in either population or VMT and sometimes both. All of the Missouri areas consistently rank high in terms of growth rates and growth patterns thereby supporting their candidacy for non-attainment designations.

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.

Table 6 shows the average prevailing surface wind directions for high PM_{2.5} days by quadrant for each county in the St. Louis area. These data show that 24-hour PM_{2.5} concentrations are influenced by emissions in all directions at various times, but these data also suggest that emissions southeast and southwest of the violating monitor are more likely to contribute to high PM_{2.5} concentrations than emissions from other directions.

High days	Prevailing Wind Direction (%)			
	NW	SW	SE	NE
Days when only 1 monitor in St. Louis Area violated				
2/18/04	0	76	4	4
1/28/05	0	0	96	4
9/13/05	0	59	16	4
2/28/06	0	0	13	42
4/29/06	0	0	96	0
5/8/06	0	29	44	0
8/12/06	0	0	48	28
Days when more than 1 monitor in St. Louis Area violated				
9/3/04	4	12	50	8

9/12/04	14	0	41	0
1/31/05	9	0	4	40
2/3/05	17	55	0	0
2/27/05	4	0	58	12
6/24/05	0	54	24	10
6/27/05	0	60	12	0
8/2/05	0	8	54	0
8/8/05	0	12	55	0
9/10/05	0	36	32	0
Data based on EPA Wind Roses for St. Louis International Airport All percentages approximate. Due N, S, E, and W winds not included				

Table 6. Prevailing Wind Directions for High PM_{2.5} Days

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. Figure 3 identifies 24-hour PM_{2.5} values by color; days exceeding 35 ug/m³ are denoted with a red or black icon. A dot indicates the day occurred in the warm season; a triangle indicates the day occurred during 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.

**Madison County, IL
Pollution Rose, 2004-2006**

Existing NAA: St. Louis, MO-IL
CSA: St. Louis-St. Charles-Farmington, MO-IL
CBSA: St. Louis, MO-IL

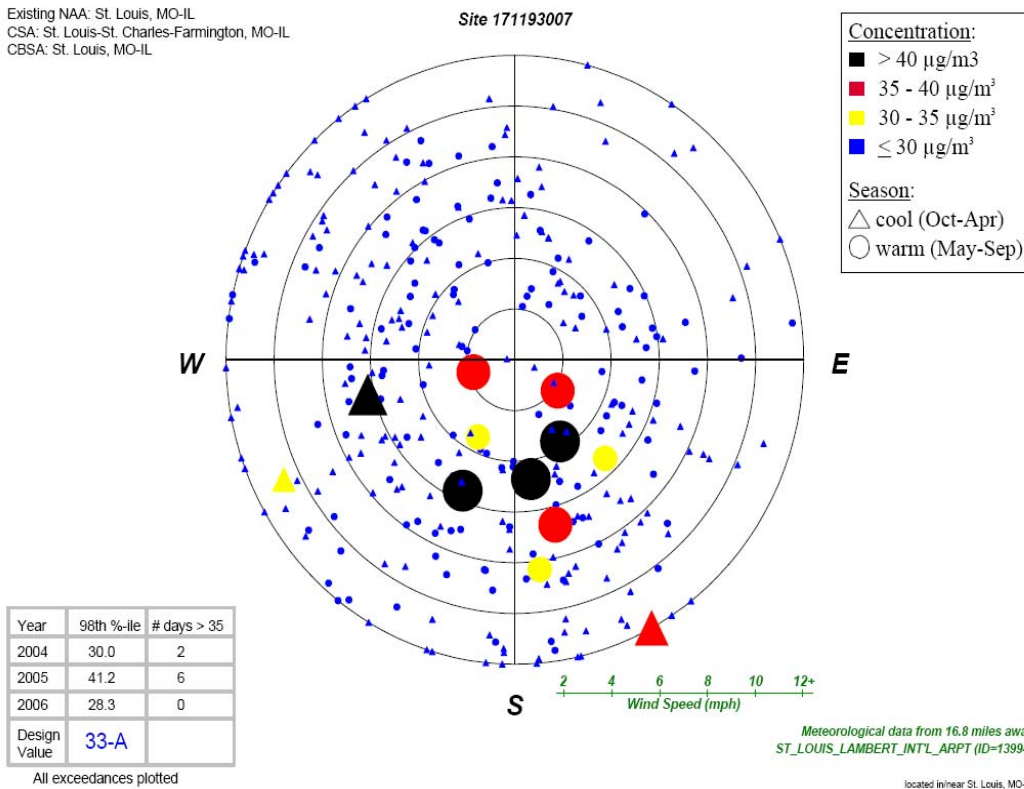


Figure 3 Pollution Rose for Madison County, Illinois (County with violating monitor in 2004-2006)

As shown in the pollution rose in Figure 3, the average prevailing surface wind direction for high PM_{2.5} days in Madison County, Illinois (which is the county with the violating monitors) are from the southeast and southwest. However, the pollution rose shows that 24-hour PM_{2.5} concentrations can be influenced by emissions from any direction at various times.

In summary, EPA notes that the bulk of the Missouri portion of the St. Louis bi-state area is located to the south-southwest of the two violating monitors. A review of the Factor 6 analysis indicates that prevailing winds during PM_{2.5} episode are commonly from the southeast and southwest. Under these conditions, the majority of the Missouri emissions for PM_{2.5} and precursors are upwind of the monitors during these times and thus likely contributors to the total mass on the filters. Consequently, Factor 6 supports the position that Missouri counties/areas are candidates for consideration in the nonattainment area designation.

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 St. Louis area does not have any geographical or topographical barriers significantly limiting air-pollution transport within its air shed.

In summary, there are no physical barriers that would prevent Missouri emissions from traveling downwind to the monitors on high PM_{2.5} episode days. Consequently, our review of Factor 7 supports the position that all of the Missouri counties/areas are candidates for consideration in the non-attainment area designation.

Factor 8: Jurisdictional boundaries (e.g., existing PM_{2.5} areas)

In evaluating the jurisdictional boundary factor, EPA gave 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) also are key contributors to the PM_{2.5} mass on many days exceeding the 24-hour PM_{2.5} standard in St. Louis. These data indicate that in metropolitan areas like St. Louis, 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 standards this is true with the St. Louis metro area, as well. 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 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 existing nonattainment area for the 1997 PM_{2.5} NAAQS is as follows:

- In Missouri- St. Charles, Franklin, Jefferson, St. Louis counties and the City of St. Louis.
- In Illinois- Madison, Monroe, St. Clair Counties and Baldwin Township, Randolph County

The existing nonattainment area for the 1997 8-hour ozone NAAQS is as follows:

- In Missouri -St. Charles, Franklin, Jefferson, St. Louis counties and the City of St. Louis.
- In Illinois - Jersey, Madison, Monroe, and St. Clair Counties

In summary, EPA's review of Factor 8 indicates that the St. Louis metro area has yet to attain the annual PM_{2.5} standard. Since, many of the same pollutants and pollutant sources could be implicated in the 24 hour violations as they were for the annual violations, Factor 8 supports including all of the Missouri counties/areas in the non-attainment designation for the 24-hour standard and including those relevant jurisdictional authorities in the development of the air quality solution.

Factor 9: Level of control of emission sources

The emission estimates on Table 1 include any control strategies implemented by the States in the St. Louis area before 2002 that may influence emissions of any component of PM_{2.5} emissions (i.e., total carbon, SO₂, NO_x, and crustal PM_{2.5}). In considering county-level emissions, EPA considered 2002 emissions data from the National Emissions Inventory.

EPA recognizes that certain power plants or large sources of emissions in this potential non-attainment area may have installed emission controls or otherwise significantly reduced emissions since 2002 and that this information may not be reflected in this analysis. However, EPA also notes that many of the controls that Missouri and Illinois will likely rely upon to bring the St. Louis metro area back into attainment with the annual PM_{2.5} standard have not yet been implemented and thus it is difficult to determine what impact those reductions will have on the monitors measuring violations of the 24 hour standard.

In summary, EPA's review of Factor 9 is inconclusive. In other words, no clear conclusions can be drawn regarding the limitation of the non-attainment boundaries for the St. Louis metro area based on these data.

Conclusion

After review of the nine factors for the four counties and the City of St. Louis (including five counties in Illinois) EPA is designating the City of St. Louis, St. Louis County, Franklin County, Jefferson County and St. Charles County in Missouri as nonattainment for the 2006 24-hour PM_{2.5} standard. Although the violating monitors are located in Madison County, Illinois, the four Missouri counties and city described above are probable contributors of PM_{2.5} to the violating monitors based on analysis of all the factors and analytic tools. Information for each of these Missouri entities is contained in the above discussion of the nine factors. Conclusions with respect to the entire area in Missouri which we are designating nonattainment are as follows:

- Surface wind direction for monitored days with high PM_{2.5} concentrations in Madison County, Illinois is from the southeast-southwest. This means that the majority of the Missouri portion of the bi-state area is located upwind of the violating monitors on a significant number of high PM_{2.5} concentration days.
- Missouri counties/areas contribute the majority of PM_{2.5} and PM_{2.5} precursor emissions to the bi-state metro area. Specifically, approximately 50% of the total tons per year (tpy) of direct PM_{2.5}, approximately 57% of the total tpy of NO_x, and approximately 74% of the total tpy of SO₂ emitted in the bi-state area.
- 70% or greater of the exceedance days occur during the warm season and are influenced by SO₂. Missouri counties account for 74% of the SO₂ emissions in the bi-state area.
- 78% of the total population and their associated emissions in the bi-state area are located on the Missouri side of the St. Louis bi-state area. While, population and

- population density alone do not provide absolute justification for determining non-attainment boundaries, this data is indicative of population-based emissions.
- Due to the spatial separation of the Granite city monitor from the Alton monitor, it is not likely that one source or a small group of localized sources is exclusively impacting both monitors. The speciation data also indicates that sulfur and organic carbon sources are likely significant contributors to the total mass on the filters. Both of these PM_{2.5} precursor emissions are emitted in substantial quantities in upwind Missouri areas.
 - All areas in the bi-state metro area experienced growth in either population or VMT and sometimes both in recent years. However, Missouri areas consistently ranked among the highest in terms of growth rates.
 - There are no physical barriers that would prevent Missouri emissions from traveling downwind to the Madison County monitors on high PM_{2.5} episode days.
 - The St. Louis metro area has yet to attain the annual PM_{2.5} standard. Speciation data and pollution rose data indicate that many of the same pollutants and pollutant sources and source regions that were implicated in the violations of the annual standard could be implicated in the 24 hour violations, as well
 - The area in Missouri which EPA is including as non-attainment is already part of a nonattainment area for existing Ozone and annual PM_{2.5} standards. Therefore, the boundary established by EPA is consistent with established jurisdictional boundaries for air quality and transportation planning for the previously mentioned ambient air quality standards.

In conclusion, the above analysis shows that Missouri counties/areas have significant PM_{2.5} and precursor emissions and substantial growth rates when compared to the rest of the metro area. Data also show that Missouri areas are commonly upwind of the violating monitors on high PM_{2.5} episode days. The air quality monitoring, including the speciation data analysis, the level of control analysis, and the geographic/topographic analysis, indicate that emissions contributions from Missouri counties/areas cannot be ruled out.

None of the analyses conducted by Missouri or EPA under the 9 Factor approach led to a conclusive determination that Missouri counties/areas were not contributing to the filter mass at any of the Monroe County, Illinois violating monitors contribute to the violating monitors.

Based on this review, EPA is designating the Missouri Counties of Franklin, Jefferson, St. Charles and St. Louis, and the City of St. Louis as non-attainment for the 24 hour PM_{2.5} standard.

Additional information regarding responses to specific State comments can be found in EPA's Response to State Comments document at <http://www.epa.gov/pmdesignations/2006standards/tech.htm>.

Description of the Contributing Emissions Score

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. Using this methodology, scores were developed for each county in and around the relevant metro area. The county with the highest contribution potential was assigned a score of 100, and other county scores were adjusted in relation to the highest county. The CES represents the relative maximum influence that emissions in that county have on a violating county. The CES, which reflects consideration of multiple factors, should be considered in evaluating the weight of evidence supporting designation decisions for each area.

The CES for each county was derived by incorporating the following significant information and variables that impact PM_{2.5} transport:

- Major PM_{2.5} components: total carbon (organic carbon (OC) and elemental carbon (EC)), SO₂, NO_x, and inorganic particles (crustal).
- PM_{2.5} emissions for the highest (generally top 5%) PM_{2.5} emission days (herein called “high days”) for each of two seasons, cold (Oct-Apr) and warm (May-Sept)
- Meteorology on high days using the NOAA HYSPLIT model for determining trajectories of air masses for specified days
- The “urban increment” of a violating monitor, which is the urban PM_{2.5} concentration that is in addition to a regional background PM_{2.5} concentration, determined for each PM_{2.5} component
- Distance from each potentially contributing county to a violating county or counties

A more detailed description of the CES can be found at http://www.epa.gov/ttn/naaqs/pm/pm25_2006_techinfo.html#C.