

## MEMORANDUM

**TO:** Docket No. EPA-HQ-OAR-2012-0918  
Air Quality Designations for the 2012 Fine Particulate (PM<sub>2.5</sub>) Standard

**FROM:** Beth W. Palma  
Air Quality Policy Division, OAQPS

**SUBJECT:** Tennessee Deferred Area Air Quality Designations for the 2012 PM<sub>2.5</sub> National Ambient Air Quality Standard (SAN 5706)

This memorandum provides the rationale for the U.S. Environmental Protection Agency's decision to use the additional time available to it under section 107(d)(1)(B) of the Clean Air Act (CAA) to obtain additional information and further evaluate air quality monitoring data before promulgating initial area designations for the 2012 primary annual fine particle National Ambient Air Quality Standard (2012 annual PM<sub>2.5</sub> NAAQS)<sup>1</sup> in certain areas in Tennessee.

Upon promulgation of a NAAQS, section 107(d) of the CAA requires the EPA to subsequently promulgate area designations based on that NAAQS. Specifically, EPA must designate as "nonattainment" those areas that are violating a NAAQS, or that are contributing to a violation of the NAAQS in a nearby area. By contrast, the EPA designates as "unclassifiable/attainment" those areas where air quality monitoring data indicate attainment of the NAAQS, and for areas that do not have monitors but which the EPA has reason to believe are likely to be in attainment and are not contributing to nearby violations. Finally, the EPA reserves the category of "unclassifiable" for areas where the EPA cannot determine based on available information whether an area is meeting the NAAQS or contributing to a nearby violation.

As described in more detail in the memorandum titled "Initial Area Designations for the 2012 Revised Primary Annual Final Particle National Ambient Air Quality Standard: Tennessee Data Issues," Tennessee's monitoring program has experienced data completeness issues for several areas across the state.<sup>2</sup> Given these data completeness issues, for several counties the EPA cannot calculate a valid design value for the 2011-2013 time period (the data that the EPA is using to determine areas that violate the 2012 annual PM<sub>2.5</sub> NAAQS). Without a valid design value, the EPA has insufficient information to determine whether these areas are meeting or are not meeting the NAAQS. However, the EPA believes that forthcoming monitoring data will likely result in the three years of complete and valid data needed to assess compliance with the standard and promulgate designations for the areas identified below. Accordingly, the EPA is deferring designations for these areas, and using the additional time available under section

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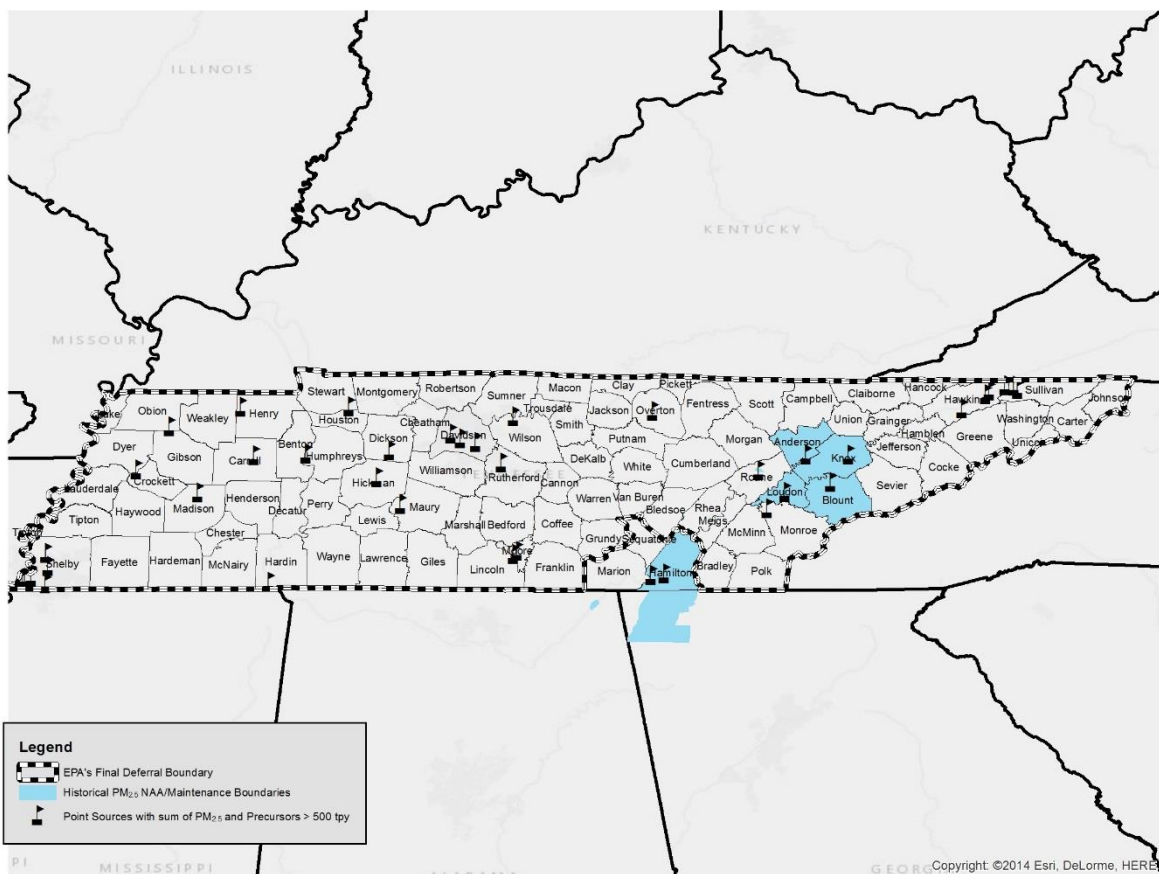
<sup>1</sup> On December 14, 2012, the EPA promulgated a revised primary annual PM<sub>2.5</sub> NAAQS (78 FR 3086, January 15, 2013). In that action, the EPA revised the primary annual PM<sub>2.5</sub> standard, strengthening it from 15.0 micrograms per cubic meter (µg/m<sup>3</sup>) to 12.0 µg/m<sup>3</sup>.

<sup>2</sup> Memorandum from Liz Naess, Group Leader, Air Quality Analysis Group, US EPA Office of Air Quality Planning and Standards, to EPA Docket EPA-HQ-OAR-2012-0918, Air Quality Designations for the 2012 PM<sub>2.5</sub> Standards, titled, "Initial Area Designations for the 2012 Revised Primary Annual Final Particle National Ambient Air Quality Standard: Tennessee Data Issues."

107(d)(1)(B) of the CAA to assess that forthcoming data, and to promulgate initial area designations for the identified areas.

The EPA is deferring designations for all counties in the state of Tennessee with the exception of Hamilton, Marion and Sequatchie counties in the Chattanooga area. Figure 1 displays a map of the areas. These areas include the listed counties in Tennessee with incomplete monitoring data that are within these areas, and counties nearby to these Tennessee counties that the EPA believes should be evaluated for potential contribution to the counties with affected data. The EPA is deferring the designations for all counties in the state of Tennessee with the exception of Hamilton, Marion and Sequatchie Counties in the Chattanooga area for the 2012 annual PM<sub>2.5</sub> NAAQS to allow the EPA to collect and assess additional information, including air quality monitoring data, before providing the EPA's intended initial area designations for these areas. There is already sufficient data in the Chattanooga area. The EPA is designating Hamilton, Marion and Sequatchie counties in the Chattanooga area as unclassifiable/attainment.

**Figure 1. Map of Tennessee Counties that the EPA is Deferring**



The EPA will work with Tennessee to finalize the designations for these counties as soon as complete certified PM<sub>2.5</sub> monitoring data are available, which the EPA anticipates will allow for

prompt promulgation of these designations. When complete air quality monitoring data are available and have been certified, the EPA invites the affected states to submit revised designation and boundary recommendations, as appropriate. If at that time the EPA believes that it is necessary to modify a state's recommendation and to promulgate a designation different from the state's recommendation, then the EPA will notify the state at least 120 days prior to promulgating the final designation and the EPA will provide the state an opportunity to comment on the potential modification. Each state will then have an opportunity to respond to the EPA's proposed designations and boundaries. Pursuant to section 107(d), the EPA cannot promulgate the designation for these areas less than 120 days from the date of the EPA's announced intention to modify the recommendation. The EPA will promulgate the designations for these deferred areas at a later date, in a separate final rule.

## **Approach**

In determining the appropriate set of neighboring counties to include with the set of monitored counties for which the EPA is deferring designations, the EPA conducted a hypothetical analysis assuming that the monitors with the incomplete data were violating the 2012 standard of 12.0  $\mu\text{g}/\text{m}^3$ . The EPA is proceeding under this assumption under the precautionary principle that because it is unclear whether there is a violation in this area due to data incompleteness, then for purposes of conducting the contribution analysis the EPA will presume that there may be such a violation. The EPA's contribution analysis for these hypothetical violations focused on counties within the same CBSA as the affected monitor because these counties would be most likely to contain nearby sources that contribute to any violations. Specifically, the EPA evaluated all counties in the same CBSA as the county with the monitors in question, in order to determine whether these presumptively "nearby" counties (beyond the county with the incomplete monitoring data) contain emissions sources that would be relatively likely to contribute to any hypothetical violation of the standard in the area with those monitors. Using information similar to the information used for determining nonattainment area boundaries,<sup>3</sup> the EPA evaluated the information available for these CBSAs, including Air Quality Data; Emissions and Emissions-related Data; Meteorology; and Geography/Topography.<sup>4</sup> One of the EPA's primary boundary considerations for determining whether to defer a final designation decision for these counties is whether the agency believes the emissions in those nearby counties are highly likely to contribute to the potential violations, and whether the meteorological data support a case that those emissions could significantly impact the affected monitor. Where available evidence indicates that emissions in adjacent counties could likely have the potential to contribute to monitors with data incompleteness, the EPA is deferring the designation for those counties as well as for the county with the affected monitor.

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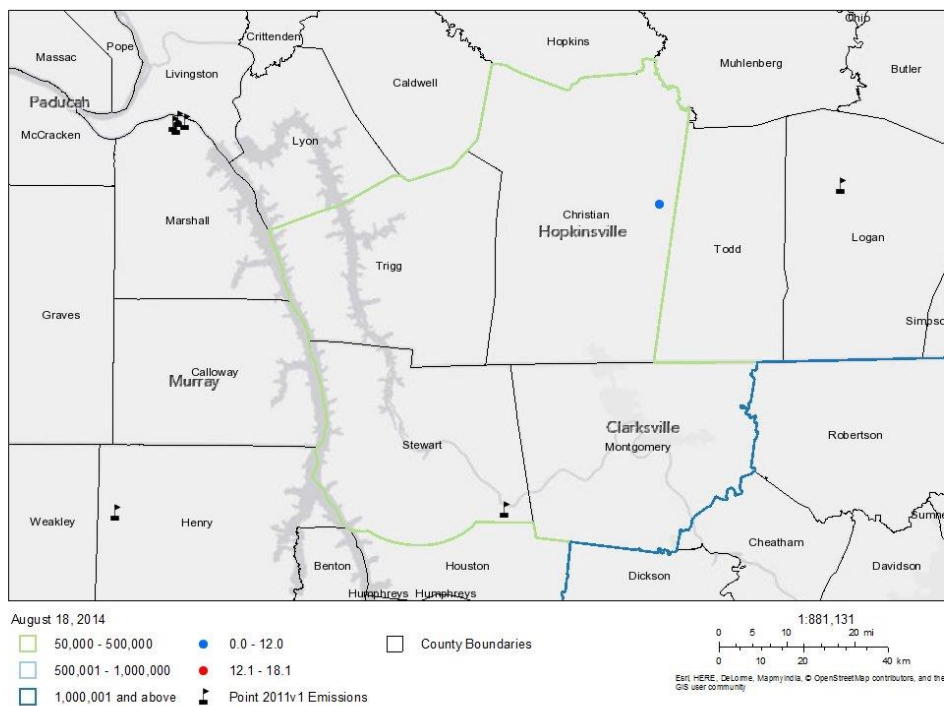
<sup>3</sup> Memorandum dated April 16, 2013, from Gina McCarthy, Assistant Administrator, to Regional Administrators, Regions 1-10, titled "Initial Area Designations for the 2012 Revised Primary Annual Fine Particle National Ambient Air Quality Standard."

<sup>4</sup> The EPA did not consider jurisdictional boundaries for purposes of deferred designations because jurisdictional boundaries are most helpful for nonattainment planning purposes, and this analysis concerns the preliminary dividing line between deferred and unclassifiable/attainment counties. No counties in Tennessee are being designated nonattainment pursuant to this analysis, although that could change in the future if forthcoming data reveal a NAAQS violation.

## Clarksville TN-KY Area

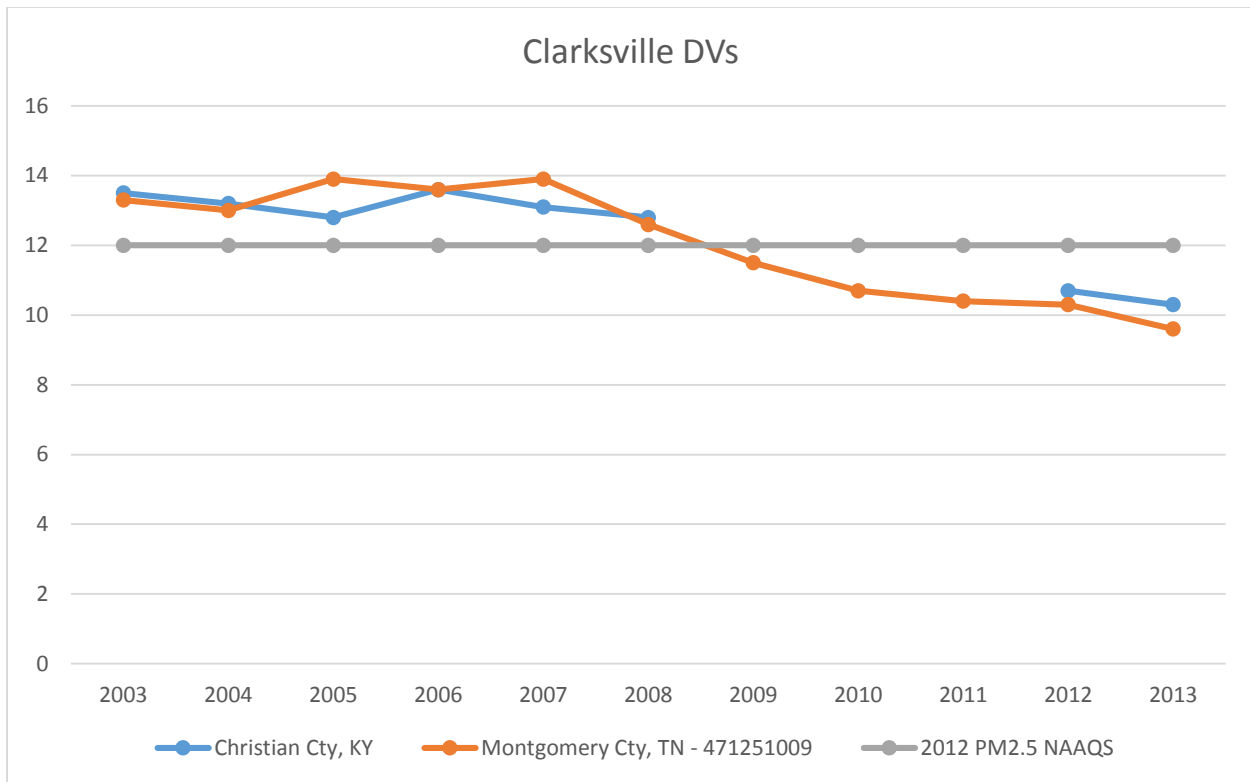
Clarksville is located in a bi-state CBSA that includes four counties: two counties in Tennessee and two counties in Kentucky. Most of the urbanized portion of Clarksville is contained within Montgomery County, Tennessee. None of the counties in the CBSA have ever been designated nonattainment for the 1997 or the 2006 PM<sub>2.5</sub> NAAQS. The Clarksville CBSA and surrounding counties are shown in Figure 2, along with the location of point sources and air quality monitors.

**Figure 2. Clarksville CBSA with Point Sources and Air Quality Monitor Locations**



There is an attaining monitor in Christian County, Kentucky with a valid design value of 10.3  $\mu\text{g}/\text{m}^3$  for the 2011-2013 timeframe. Also, the PM<sub>2.5</sub> air quality in the area has been steadily improving since the early 2000's as evidenced by the downward trend of PM<sub>2.5</sub> values measured at the monitors in the Clarksville area. This downward trend is shown in Figure 3. The Montgomery County, Tennessee monitor has an incomplete design value of 9.6  $\mu\text{g}/\text{m}^3$  for the 2011-2013 timeframe.

**Figure 3. Clarksville Area Air Monitor Design Value (DV) Trends**



The EPA evaluated PM<sub>2.5</sub> and PM<sub>2.5</sub>-precursor emissions<sup>5</sup> and related data from the counties in the Clarksville area. Table 1 provides a summary of this data. Montgomery and Stewart Counties have the majority of PM<sub>2.5</sub> and precursor emissions, population and VMT. Montgomery County has a monitor with invalid data and an urbanized core around the City of Clarksville. Stewart County has a large point source (TVA Cumberland Fossil Plant) with over 2,500 tons per year (tpy) of PM<sub>2.5</sub> emissions and over 7,600 tpy of sulfur dioxide (SO<sub>2</sub>) emissions in the upwind direction of the Montgomery County monitor.

In Kentucky, Christian County and Trigg County are outlying areas that are located primarily downwind from the Montgomery County PM<sub>2.5</sub> monitoring site. Christian County has an attaining PM<sub>2.5</sub> monitor, and while the county population is nearly half that of Montgomery County, current growth is only about 3 percent. Trigg County has very low emissions of all pollutants (e.g., 28 tpy of SO<sub>2</sub> and 389 tpy of PM<sub>2.5</sub>), and the County's population is relatively small at about 5 percent for the area.

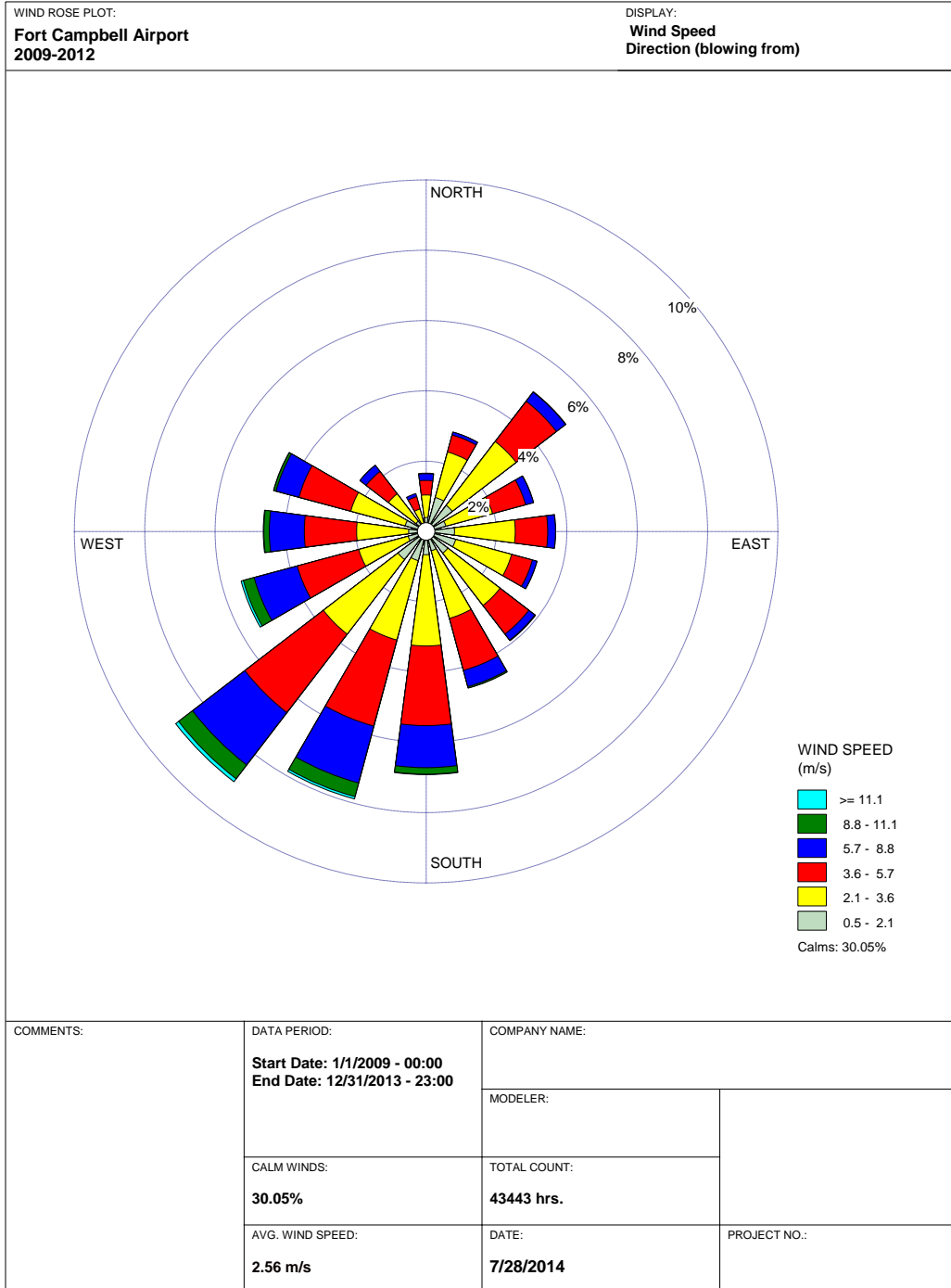
**Table 1. Summary Statistics for the Clarksville, TN-KY CBSA**

<sup>5</sup> County-level nitrogen oxide, volatile organic compound and ammonia emissions are not shown in the tables with in this memorandum because ambient PM<sub>2.5</sub> concentrations in the southeastern U.S. tend to be impacted most significantly by emissions of direct PM<sub>2.5</sub> emissions and SO<sub>2</sub> emissions.

	Montgomery	Stewart	Christian	Trigg
<b>State</b>	Tennessee	Tennessee	Kentucky	Kentucky
<b>Core urbanized county or outlying?</b>	Core	Outlying	Outlying	Outlying
<b>SO2 Emissions (tpy)</b>	1,529	7,740	77	28
<b>PM<sub>2.5</sub> emissions (tpy)</b>	1,018	2,452	947	389
<b>Population</b>	173,375	13,340	74,138	14,355
<b>Population (% of CBSA)</b>	63%	5%	27%	5%
<b>VMT (Millions)</b>	1,467	166	912	218
<b>VMT (% of CBSA)</b>	53%	6%	33%	8%

The EPA also evaluated the meteorology in the area by evaluating wind data collected at the Fort Campbell Airport. Figure 4 provides a wind rose created with five years of data from 2009-2013. The predominant winds blow from the southwest and south directions. Additionally, there is a low frequency of winds blowing from the northerly directions which limits the potential for transport of emissions from the Kentucky counties into Tennessee. These wind patterns do not support contribution of emissions from the Kentucky counties to the PM<sub>2.5</sub> air quality in the Tennessee areas. Emissions from Montgomery and Stewart counties in Tennessee are most likely to impact the monitor in Montgomery County.

**Figure 4. Wind Rose Data for the Clarksville TN-KY Area**



WRPLOT View - Lakes Environmental Software

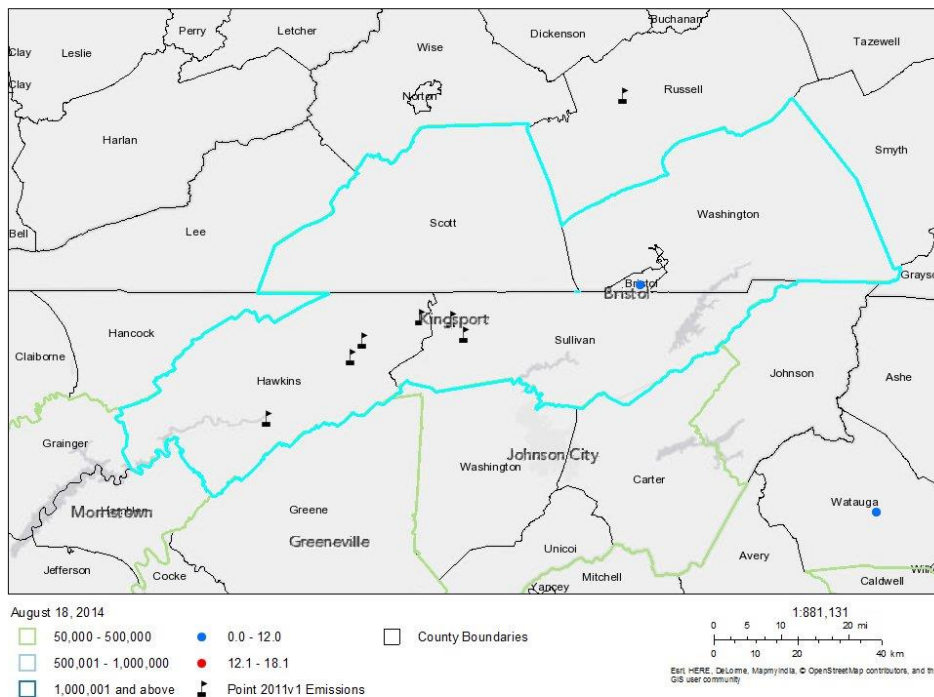
## Clarksville Area Conclusion:

As a result of our technical analysis of the Clarksville CBSA, the EPA is deferring the designations for the Tennessee counties of Montgomery and Stewart along with most of the state of Tennessee due to the ambient monitoring data quality issues, including an invalid 2013 design value at the Montgomery County monitor. The EPA agrees with the recommendation from Kentucky for Christian and Trigg Counties in the Clarksville Area and is designating these counties as unclassifiable/attainment.

## Kingsport-Bristol, TN-VA Area

Kingsport-Bristol is located in a bi-state CBSA that includes four counties and a city: two counties in Tennessee and two counties in Virginia, along with Bristol City which straddles the Tennessee and Virginia state line. Most of the urbanized portion of Kingsport-Bristol is contained within Sullivan and Hawkins Counties in Tennessee. None of the counties in the CBSA have ever been designated nonattainment for the 1997 or the 2006 PM<sub>2.5</sub> NAAQS. The Kingsport-Bristol CBSA and surrounding counties are shown in Figure 5, along with the location of point sources and air quality monitors.

*Figure 5. Kingsport-Bristol CBSA with Point Sources and Air Quality Monitor Locations*

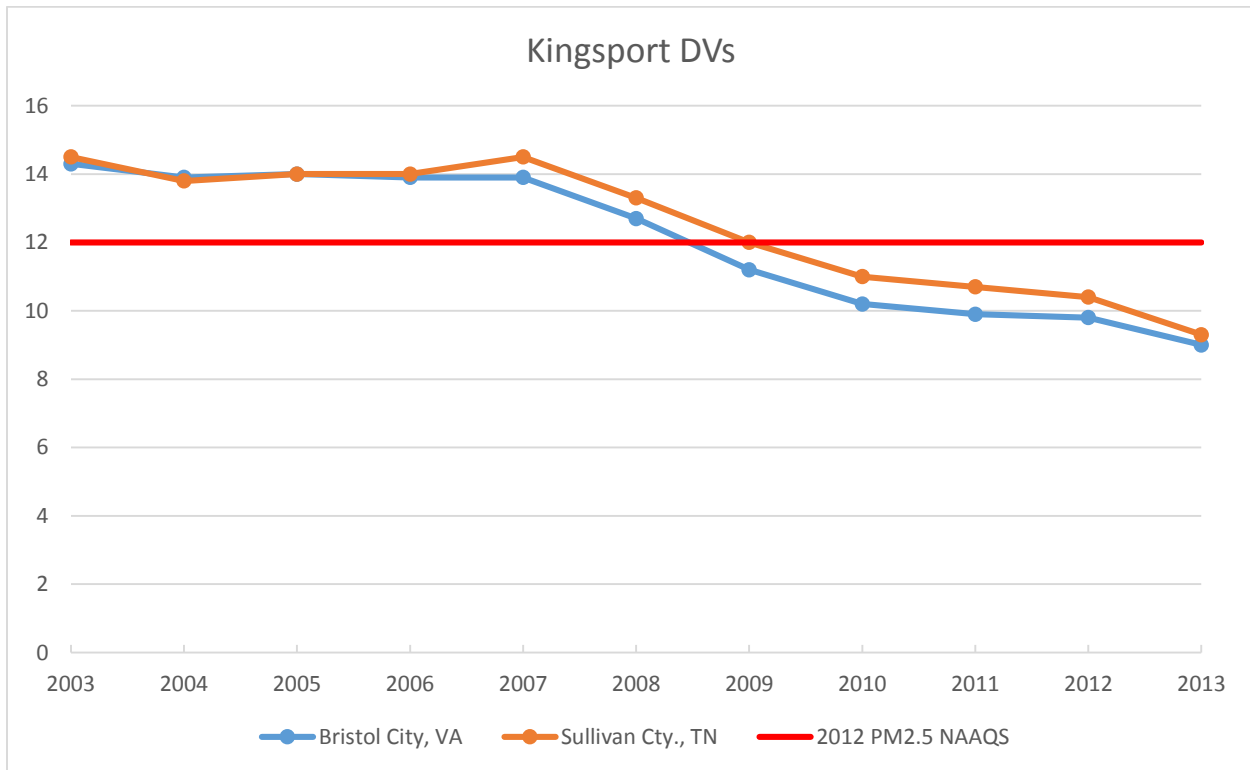


There is an attaining monitor in Bristol City on the Virginia side of the state line with a valid design value of 9.0  $\mu\text{g}/\text{m}^3$  for the 2011-2013 timeframe. Also, the PM<sub>2.5</sub> air quality in the area



has been steadily improving since the early 2000's as evidenced by the downward trend of PM<sub>2.5</sub> values measured at the monitors in the Kingsport-Bristol area. This downward trend is shown in Figure 6. The Sullivan County, Tennessee monitor has an incomplete design value of 9.3 ug/m<sup>3</sup> for the 2011-2013 timeframe.

**Figure 6. Kingsport-Bristol Area Air Monitor DV Trends**



The EPA evaluated PM<sub>2.5</sub> and PM<sub>2.5</sub>-precursor emissions and related data from the counties in the Kingsport-Bristol area. Table 2 provides a summary of this data. Sullivan and Hawkins Counties have the majority of PM<sub>2.5</sub> and precursor emissions, population and VMT. Hawkins County also has four large point sources in the upwind direction of the Sullivan County monitor, two of which, TVA John Sevier Fossil Plant and Holston Army Ammunition Plant, have significant SO<sub>2</sub> emissions of over 15,000 tpy and over 1,500 tpy, respectively.

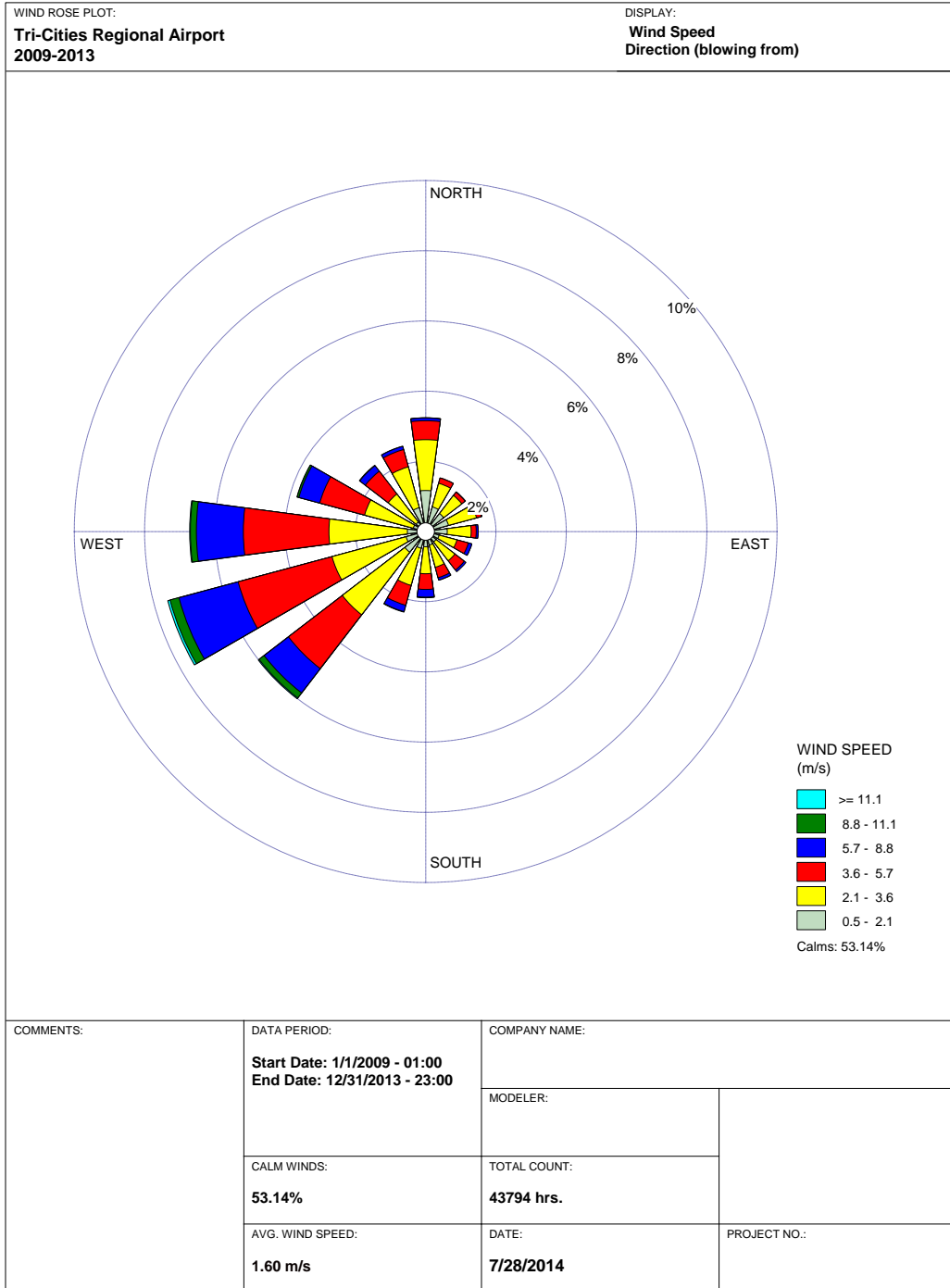
In Virginia, Scott and Washington Counties and Bristol City have low emissions, population and VMT relative to Sullivan and Hawkins Counties. These are outlying areas that are located in the primarily downwind direction from the Sullivan County PM<sub>2.5</sub> monitoring site. Bristol City has an attaining PM<sub>2.5</sub> monitor and low population and population growth of about 3 percent. Scott County has very low SO<sub>2</sub> emissions of about 40 tpy and relatively low PM<sub>2.5</sub> emissions of 306 tpy. Although Scott County has 18 percent of the area's population, the recent growth trend is negative. Washington County has very low emissions of all pollutants (e.g., 88 tpy of SO<sub>2</sub> and 104 tpy of PM<sub>2.5</sub>), and the County's population is relatively small at about 6 percent for the area.

**Table 2. Summary Statistics for the Kingsport-Bristol, TN-VA CBSA**

	<b>Hawkins</b>	<b>Sullivan</b>	<b>Bristol City</b>	<b>Scott</b>	<b>Washington</b>
<b>State</b>	Tennessee	Tennessee	Virginia	Virginia	Virginia
<b>Core urbanized county or outlying?</b>	Outlying	Core	Outlying	Outlying	Outlying
<b>SO2 Emissions (tpy)</b>	17,819	24,937	26	40	88
<b>PM2.5 emissions (tpy)</b>	892	3,036	946	306	104
<b>Population</b>	56,842	156,866	17,849	23,111	54,879
<b>Population (% of CBSA)</b>	18%	51%	6%	18%	6%
<b>VMT (Millions)</b>	537	1,748	225	275	741
<b>VMT (% of CBSA)</b>	15%	50%	6%	21%	8%

The EPA also evaluated the meteorology in the area by evaluating wind data collected at the Tri-Cities Regional Airport. Figure 7 is a wind rose created from five years of data from 2009-2013. The predominant winds blow from the west and southwest directions. Additionally, there is a low frequency of winds blowing from the northerly directions which limits the potential for transport of emissions from the Virginia counties into Tennessee. These wind patterns do not support contribution of emissions from the Virginia areas to the PM<sub>2.5</sub> air quality in the Tennessee areas. Emissions from Sullivan and Hawkins counties in Tennessee are most likely to impact the monitor in Sullivan County.

**Figure 7. Wind Rose Data for the Kingsport-Bristol TN-VA Area**



WRPLOT View - Lakes Environmental Software

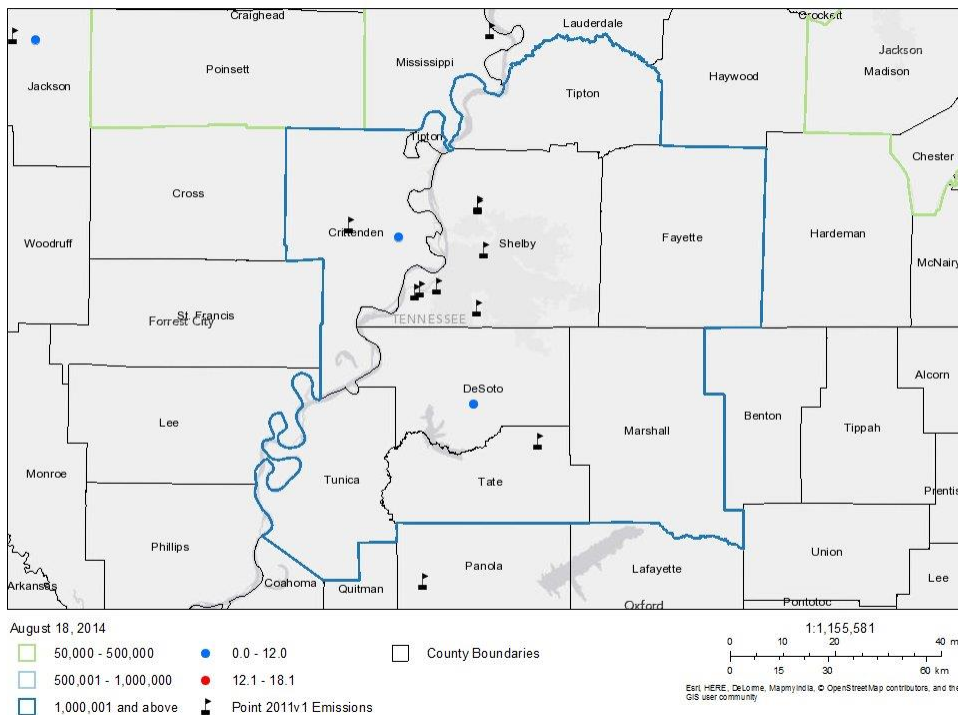
## Kingsport-Bristol Area Conclusion:

As a result of our technical analysis of the Kingsport-Bristol CBSA, the EPA is deferring the designations for the Tennessee counties of Sullivan and Hawkins along with most of the State of Tennessee due to the ambient monitoring data quality issues, including an invalid 2013 design value at the Sullivan County monitor. The EPA agrees with the recommendation from Virginia for Scott and Washington Counties and Bristol City in Virginia, and is designating these areas as attainment/unclassifiable. As discussed above, any potential violation at the Sullivan County monitor would be strongly influenced by the point sources in Sullivan and Hawkins County, Tennessee.

## Memphis TN-MS-AR Area

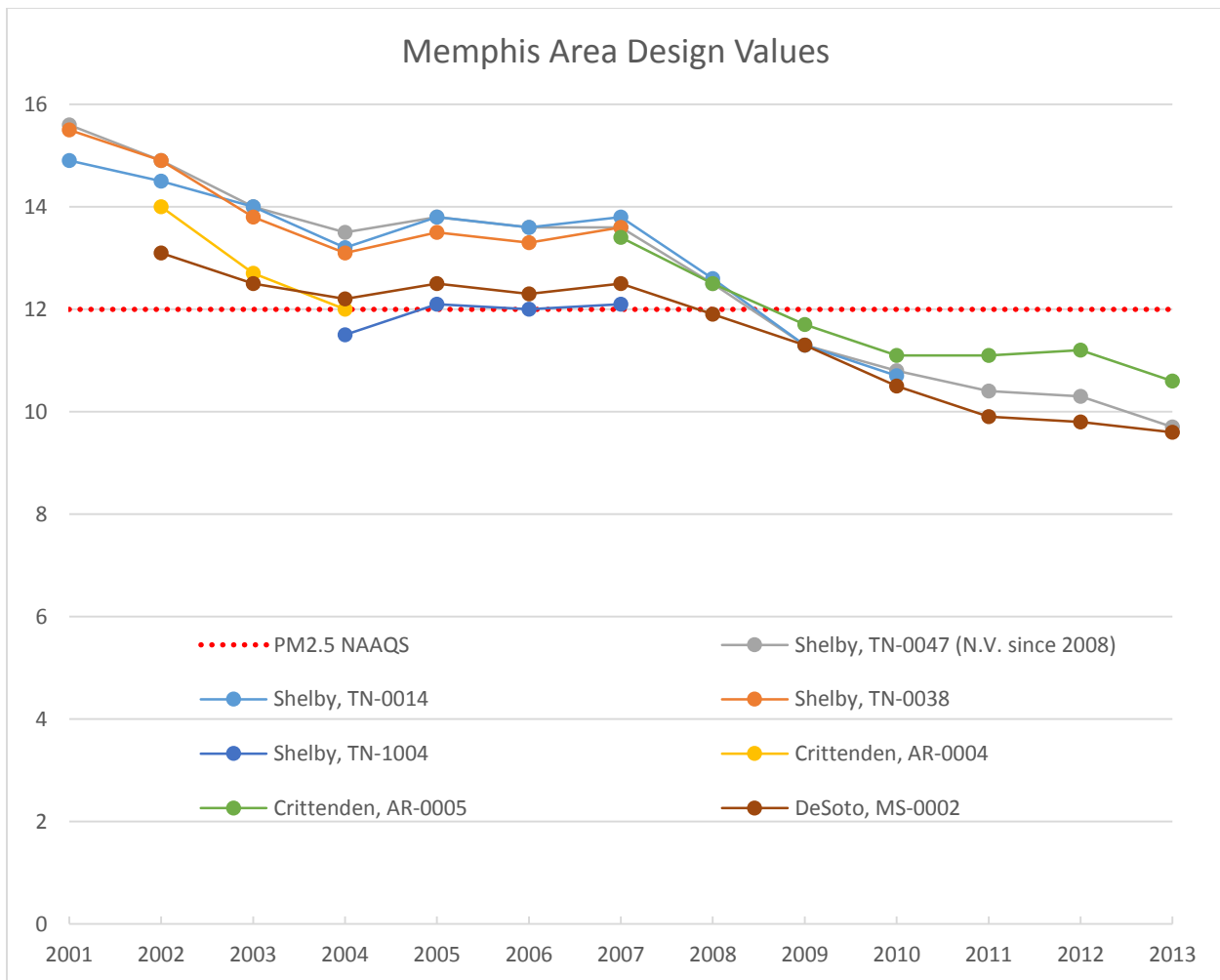
Memphis is located in a tri-state CBSA that includes nine counties: three counties in Tennessee, five counties in Mississippi, and one county in Arkansas. Most of the urbanized portion of Memphis is contained within Shelby County, Tennessee, although there are pockets of urbanization that stretch into DeSoto County, Mississippi, and Crittenden County, Arkansas. None of the counties in the CBSA have ever been designated nonattainment for either the 1997 or the 2006 PM<sub>2.5</sub> NAAQS. The Memphis CBSA and surrounding counties are shown in Figure 8, along with the location of point sources and air quality monitors.

**Figure 8. Memphis TN-MS-AR CBSA with Point Sources and Air Quality Monitor Locations**



There are attaining monitors in both DeSoto County and Crittenden County with valid design values for the 2011-2013 timeframe of 9.6  $\mu\text{g}/\text{m}^3$  and 10.6  $\mu\text{g}/\text{m}^3$ , respectively. Also, the  $\text{PM}_{2.5}$  air quality in the area has been steadily improving since the early 2000's as evidenced by the downward trend of  $\text{PM}_{2.5}$  values measured at all of the monitors in the Memphis area, including the monitors in Shelby County prior to the time when data quality issues caused that data to be unreliable for final regulatory determinations (approximately 2008). This downward trend is shown in Figure 9. The Shelby County, Tennessee monitor has an incomplete design value of 9.7  $\mu\text{g}/\text{m}^3$  for the 2011-2013 timeframe.

**Figure 9. Memphis Area Air Monitor DV Trends**



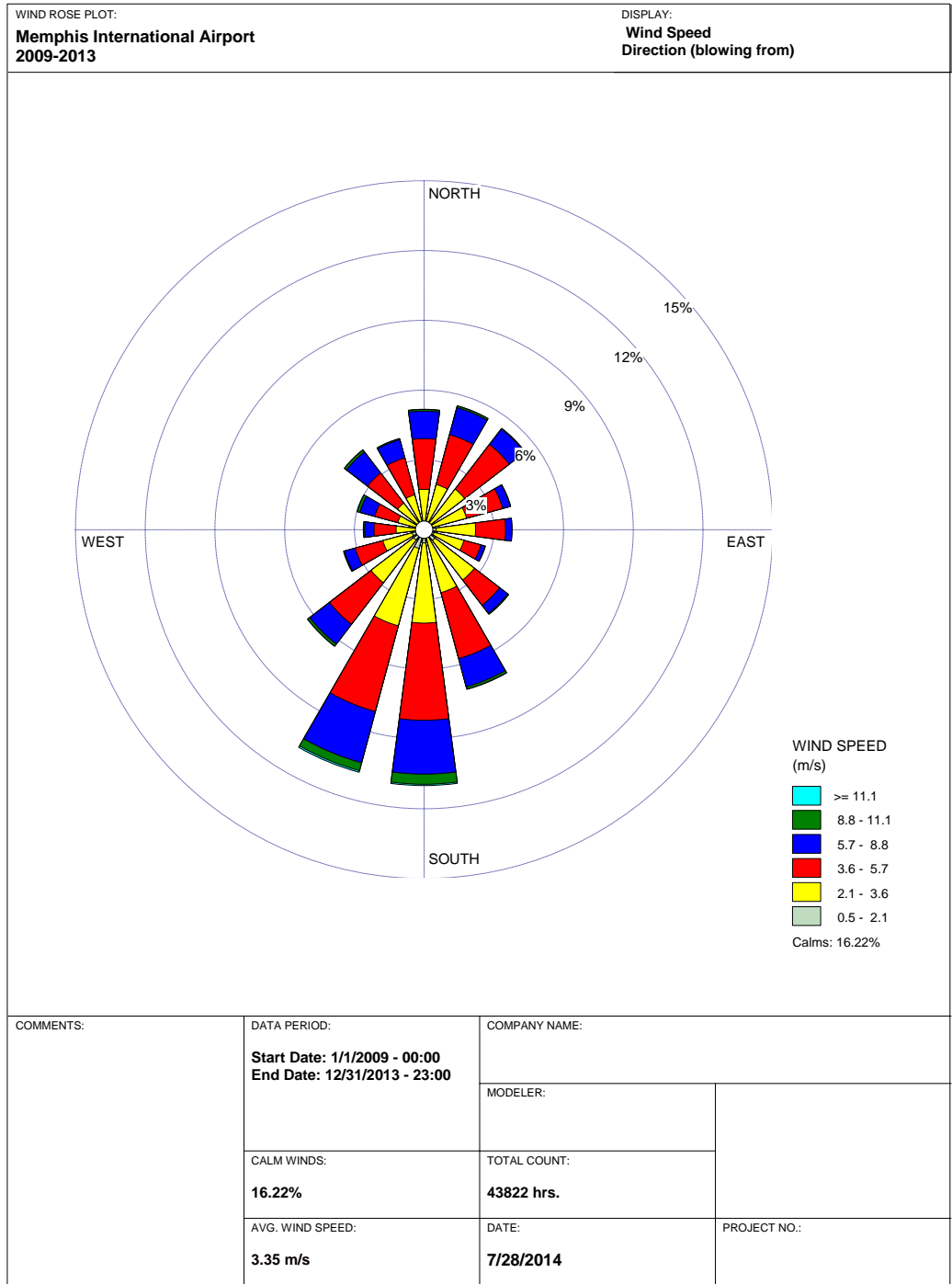
The EPA evaluated  $\text{PM}_{2.5}$  and  $\text{PM}_{2.5}$ -precursor emissions and related data from the counties in the Memphis area. Table 3 provides a summary of this data. Shelby County has the majority of  $\text{PM}_{2.5}$  and precursor emissions, population and VMT. Shelby County also has four large sources just 8-12 miles upwind of the Shelby County monitor, including Cargill Corn Milling (330 tpy  $\text{PM}_{2.5}$  and 3,000 tpy  $\text{SO}_2$ ) and Allen Fossil Plant (415 tpy  $\text{PM}_{2.5}$  and 11,000 tpy  $\text{SO}_2$ ) as can be seen in the map of the Memphis area provided in Figure 8.

**Table 3. Summary Statistics for the Memphis, TN-MS-AR CBSA**

	<b>Fayette</b>	<b>Shelby</b>	<b>Tipton</b>	<b>Benton</b>	<b>Desoto</b>	<b>Marshall</b>	<b>Tate</b>	<b>Tunica</b>	<b>Crittenden</b>
<b>State</b>	TN	TN	TN	MS	MS	MS	MS	MS	AR
<b>Core urbanized county or outlying?</b>	Outlying	Core	Outlying	Outlying	Core	Outlying	Outlying	Outlying	Core
<b>SO2 Emissions (tpy)</b>	429	20,010	308	36	52	63	58	107	125
<b>Primary Sulfate Emissions (tpy)</b>	10	140	8	10	29	6	6	8	11
<b>PM<sub>2.5</sub> emissions (tpy)</b>	790	4,042	874	475	1,419	1,064	651	1,471	1,854
<b>Population</b>	38,413	928,792	61,160	8,712	161,732	37,098	28,970	10,741	50,952
<b>Population (% of CBSA)</b>	3%	70%	5%	1%	12%	3%	2%	1%	4%
<b>Population growth (2000 – 2010)</b>	33%	4%	19%	9%	51%	6%	14%	16%	0.2%
<b>VMT (Millions)</b>	540	8,562	417	190	1,798	683	365	237	866
<b>VMT (% of CBSA)</b>	4%	63%	3%	1%	13%	5%	3%	2%	6%

The EPA also evaluated the meteorology in the area by evaluating wind data collected at the Memphis International Airport. Figure 10 is a wind rose created from five years of data from 2009-2013. The predominant winds blow from the south and southwesterly directions, with a smaller component of winds blowing from the north to the south. These wind patterns suggest the Shelby County monitor would be impacted by emissions from these large point sources in Shelby County.

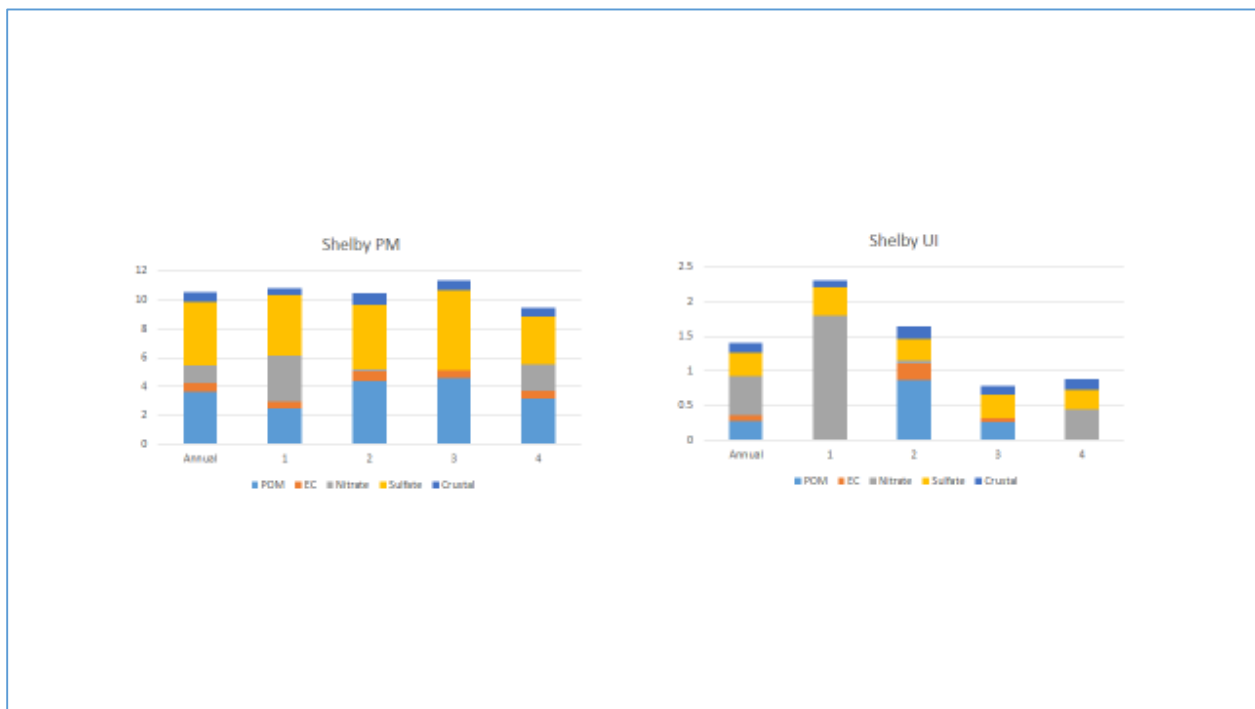
**Figure 10. Wind Rose Data for the Memphis TN-MS-AR Area**



WRPLOT View - Lakes Environmental Software

In addition, the EPA evaluated speciated PM<sub>2.5</sub> information collected at the Chemical Speciation Network monitor in the area (Figure 11). The PM<sub>2.5</sub> speciation data and the derived urban-increment analysis indicate the dominance of different contributing species in each quarter. The peak PM<sub>2.5</sub> concentrations occur during the 3<sup>rd</sup> quarter of the calendar year (July-September) when sulfate and primary organic matter are the major urban increment components of the PM<sub>2.5</sub> mass. Largely responsible for these peak concentrations are the emissions from Shelby County, which include 20,010 tpy of SO<sub>2</sub> and 140 tpy direct sulfate. By comparison, the Mississippi and Arkansas counties of the CBSA have low overall emissions, and in particular they have emissions of SO<sub>2</sub> and direct sulfate in the range of just 36 to 125 tpy and 6 to 29 tpy, respectively.

**Figure 11. Quarterly Speciated Monitoring and Urban Increment Data for the Memphis Area**



**Memphis Area Conclusion:**

As a result of our technical analysis of the Memphis CBSA, the EPA is deferring designations for the Tennessee counties of Shelby, Fayette and Tipton along with most of the State of Tennessee due to the ambient monitoring data quality issues, including an invalid 2013 design value at the Shelby County monitor. The EPA is designating Crittenden County, Arkansas, and Benton, DeSoto, Marshall, Tate and Tunica Counties in Mississippi as unclassifiable/attainment, which agrees with the recommendations from Mississippi and represents a slight modification<sup>6</sup> to the recommendation from Arkansas of attainment for Crittenden County. As discussed above,

<sup>6</sup> In its recommendation letter, Arkansas recommended Crittenden County be designated “attainment.” The EPA is designating Crittenden County “unclassifiable/attainment.”



any potential violation at the Shelby County monitor would be influenced by the point sources within Shelby County, Tennessee, particularly the much higher level of SO<sub>2</sub> and direct sulfate emissions relative to the rest of the CBSA.