State of North Carolina's

Recommendation on Boundaries

of $PM_{2.5}$ Nonattainment Areas

February 26, 2004
Governor Michael F. Easley

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Introduction

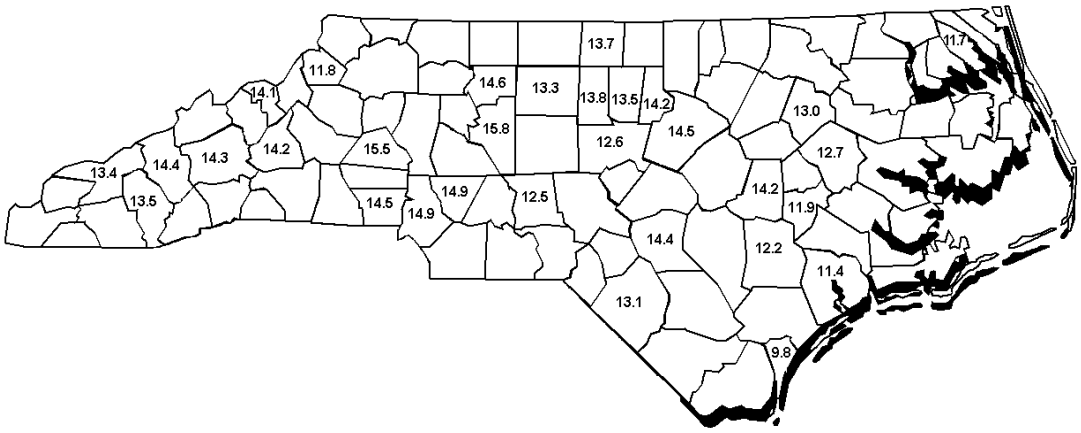
The United States Environmental Protection Agency (EPA) established a new standard for fine particulate matter ($PM_{2.5}$) in July 1997. The new standard was tied up in litigation, but recently cleared all legal hurdles. EPA has instructed the States to submit their recommendations for nonattainment boundaries for any monitors violating the $PM_{2.5}$ standard by February 15, 2004. EPA will then provide comments back to the States by July 2004. These written comments from EPA begin a 120-day period during which the States and EPA can work out any issues on the nonattainment boundaries. EPA will make the final decision on boundaries by December 15, 2004. This decision on $PM_{2.5}$ nonattainment areas will subsequently be published in the Federal Register and codified in 40 CFR 81.

Background

The Clean Air Act (CAA) requires EPA to designate areas as attainment or nonattainment following the promulgation of a new national ambient air quality standard (NAAQS). The nonattainment boundaries are to be based on the data collected at the ambient air monitoring stations. The State and local air programs operate the monitoring sites. The data is quality assured, and then submitted to EPA where it becomes part of a national database. The CAA requires that the monitoring data be evaluated to determine which monitors meet the standard and which monitors violate the standard.

For the $PM_{2.5}$ annual standard, three years worth of data for each monitor is evaluated and the 3-year average of the annual arithmetic mean is determined. The resulting average is then compared to the standard. The three-year average is referred to as the design value (DV). EPA set the $PM_{2.5}$ annual standard at 15μg/m^3. North Carolina has evaluated the monitoring data for the State for the most recent three-year period of 2001-2003, and has determined that only 2 monitors currently violate the $PM_{2.5}$ standard. Figure 1 shows the statewide 2001-2003 design values for the North Carolina $PM_{2.5}$ monitoring network. All monitoring data is from October 2000 through September 2003 except for Catawba, Davidson, Forsyth, McDowell, and Mecklenburg Counties - these data are for January 2001 through December 2003.

Figure 1. Statewide 2001-2003 $PM_{2.5}$ Design Values



Summary of Recommendation

North Carolina is firm in its belief that the entire Metropolitan Statistical Area (MSA) is not an appropriate boundary for the $PM_{2.5}$ nonattainment boundaries. As mentioned in Secretary Ross's letter of February 17, 2004, the Office of Management and Budget cautions against the use of the MSA boundary for nonstatistical purposes. North Carolina continues to believe that MSA boundaries are not appropriate for the nonattainment areas in North Carolina. Table 1 is North Carolina's recommendation of areas classified as either nonattainment or attainment under the $PM_{2.5}$ standard.

Based on the most recent data available, there are only two monitors in North Carolina that are in violation of the $PM_{2.5}$ standard. The State of North Carolina's recommendation for the nonattainment designation for the $PM_{2.5}$ standard is shown in Figure 2. A full county designation is recommended for Davidson County and a partial county designation is recommended for Catawba County. The partial county designation in Catawba County represents the Catawba County portion of the Unifour metropolitan planning organization (MPO) boundary. Due to Federal and State controls there have been significant downward trend of NOx and SO_2 emissions from utilities around the region as shown in Figure 3. North Carolina has observed a downward trend in $PM_{2.5}$ levels over the same time period. North Carolina believes that the federal and state rules already in place, and the proposed IAQR will result in attainment of the $PM_{2.5}$ standard at these two sites.

North Carolina held three public involvement meetings in Hickory, Winston-Salem, and Charlotte to gather the input of local officials and citizens in the areas affected. A public comment period was available until December 31, 2003; the comments received are included in the document as Appendix A.

Table 1. North Carolina's Recommendations on Boundaries for $PM_{2.5}$ Nonattainment Areas

Designated Area	Designation Type
Greensboro-Winston-Salem-High Point Area:	
Alamance County	Attainment
Davidson County	*Nonattainment*
Forsyth County	Attainment
Guilford County	Attainment
Caswell County	Attainment
Davie County	Attainment
Randolph County	Attainment
Rockingham County	Attainment
Hickory-Newton-Conover Area:	
Alexander County	Attainment
Burke County	Attainment
Caldwell County	Attainment
Catawba County	*Nonattainment*
Unifour MPO Boundary	
Rest of State	Attainment

Figure 2. North Carolina's Recommended $PM_{2.5}$ Nonattainment Boundaries.

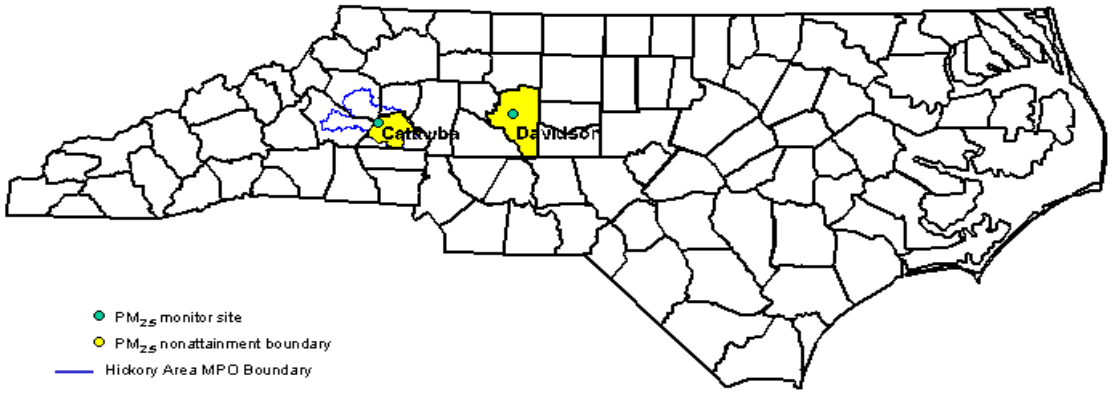
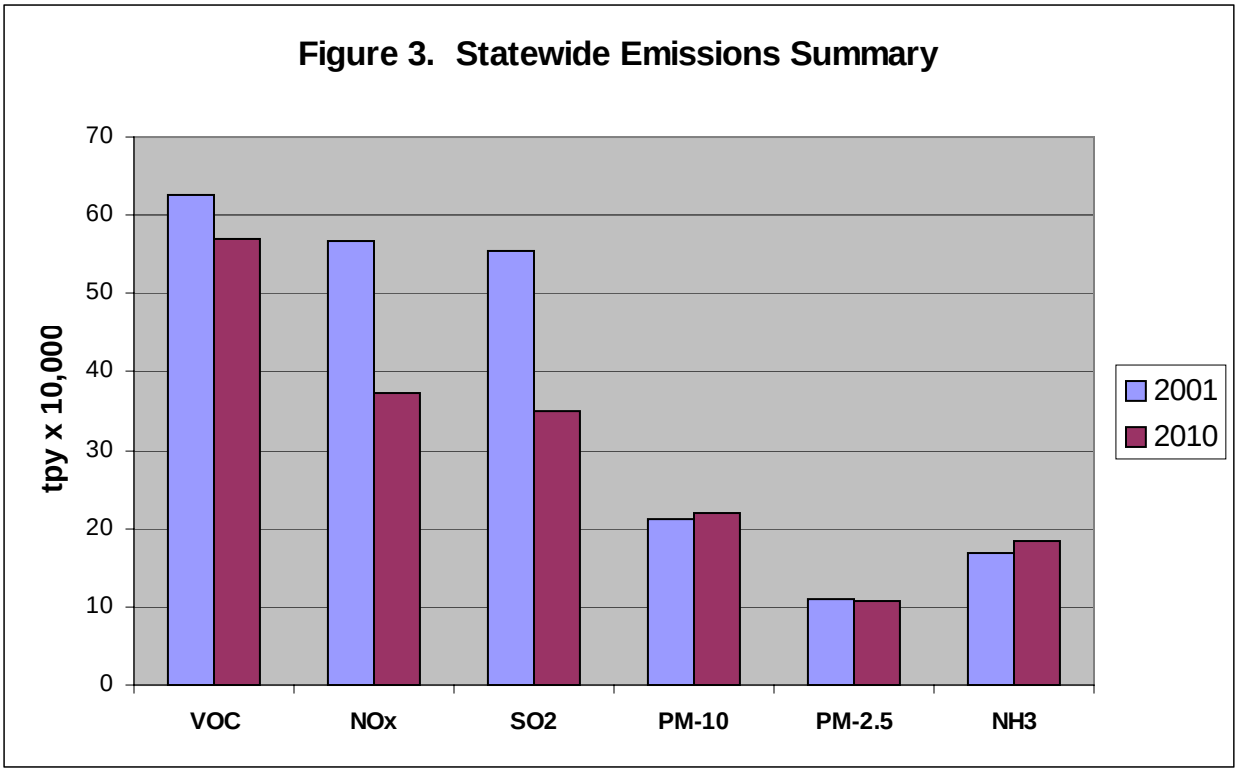


Figure 3. Statewide Emissions Summary



Criteria Used to Formulate Recommendation

In the April 1, 2003 memorandum entitled, "Designations for the Fine Particle National Ambient Air Quality Standards", EPA established criteria for States that chose to propose smaller nonattainment boundaries, including partial counties, than those matching the C/MSA. Tables 2 and 4 address these criteria for the two counties with violating monitors within North Carolina for which the recommendation is less than the MSA or county boundary.

Criterion 1: Emissions in areas potentially included versus excluded from the nonattainment area – North Carolina used the percent of NOx and SO_2 emissions that the county contributes to the area's total NOx and SO_2 emissions in 2002 for this criterion. Maps showing the location of the Title V NOx, Title V VOC, and Title V SO_2 sources in the State compared to the recommendation $PM_{2.5}$ non-attainment areas are provided as Figures 5 and 7. More detailed emissions from the VISTAS 2002 base case data for each area is included as Appendix B.

Criterion 2: Air quality in potentially included versus excluded areas monitoring data represents the three year average of averaged annual mean concentrations. The $PM_{2.5}$ design values for areas being recommended as nonattainment are from the 2001-2003 data.

Criterion 3: Population density and degree of urbanization including commercial development in included versus excluded areas – North Carolina used the 2000 population density by county and for the areas proposed to be excluded from the non-attainment boundary. The 2000 Population and land area data are from the 2000 Census and future year projections are from the NC Office of State Budgets and Management, State Demographics Unit.

Criterion 4: Traffic and commuting patterns – North Carolina evaluated VMT and commuting patterns. The percent of workers commuting from the partial or recommended attainment county into the core-urbanized counties in each area is presented.

Criterion 5: Expected growth (including extent, pattern and rate of growth) – North Carolina evaluated the 2007 population density and this information is presented in the table for the county and the portion recommended as attainment. Future year population projections are from the NC Office of State Budget and Management, State Demographics Unit.

Criterion 6: Meteorology (weather/transport patterns) – North Carolina addressed the typical source region that impacts the downwind monitors where the State is recommending a partial county for nonattainment. The back trajectory analysis for Catawba and Davidson counties is included in Appendix C and should be referenced for further information.

Criterion 7: Geography/Topography (mountain ranges or other air basin boundaries) – The only area where this criterion is important is in the Hickory-Morganton area where it abuts the mountains.

Criterion 8: Jurisdictional boundaries (e.g., counties, air districts, reservations, etc.) – North Carolina considered the MPO boundaries in Catawba County and the county boundary for Davidson County. The MPO boundary was logical due to the area being in the process of completing a regional model and plan and reflects North Carolina's recommendation for the 8-hour ozone nonattainment boundary in Catawba County.

Criterion 9: Level of control of emission sources – North Carolina believes this criterion is important to understanding the impact of certain counties and their sources on future non-attainment. Most of the sources within our State are in the process of being controlled, so evaluating the expected NOx and SO_2 reductions, 34% and 37% respectively, between 2001 and 2010 is important to capture the downward trend in emissions. This information is captured in Figure 3. The data for Figure 3 was extracted from the 2001 and 2010 emissions summaries made available in EPA's technical support document for the proposed Interstate Air Quality Rule.

Additional considerations: Regional emission reductions (e.g., NOx SIP call or other enforceable regional strategies) – North Carolina considered the impact of the NOx SIP call and the Clean Smokestacks legislation when determining the boundary recommendations. A full description of the Federal, State, and Local controls is provided in Appendix D.

Greensboro/Winston-Salem/High Point Area

As displayed in Figure 4, there is only one monitor in the Greensboro/Winston-Salem/High Point area that is in violation of the $PM_{2.5}$ annual standard located in Davidson County. The surrounding counties that have monitors are all attaining the standard. In the most recent OMB area definitions Davidson County, is the sole county in the Lexington-Thomasville, NC Micropolitan Statistical Area. The monitor is in close proximity to Interstate 85 and Highway 52 and could be influenced by heavy-duty diesel vehicles (HDDV) that use these corridors. The federal HDDV regulation in combination with the low sulfur diesel will help reduce this source category's emissions.

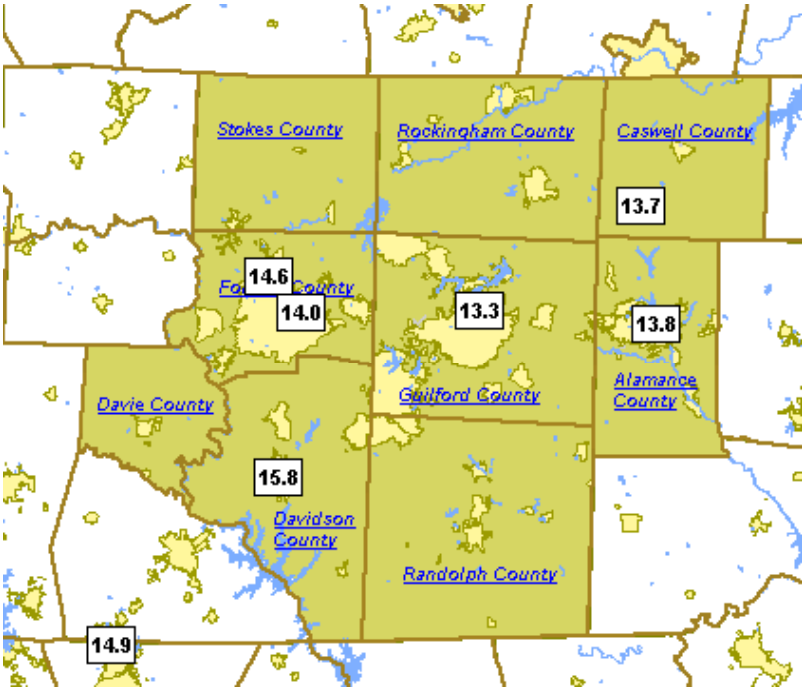


Figure 4. $PM_{2.5}$ monitors in the Triad area and their 3 year design values in µg/m^3.

Figure 5. Title V Sources in Davidson County Within the $PM_{2.5}$ Nonattainment Boundary

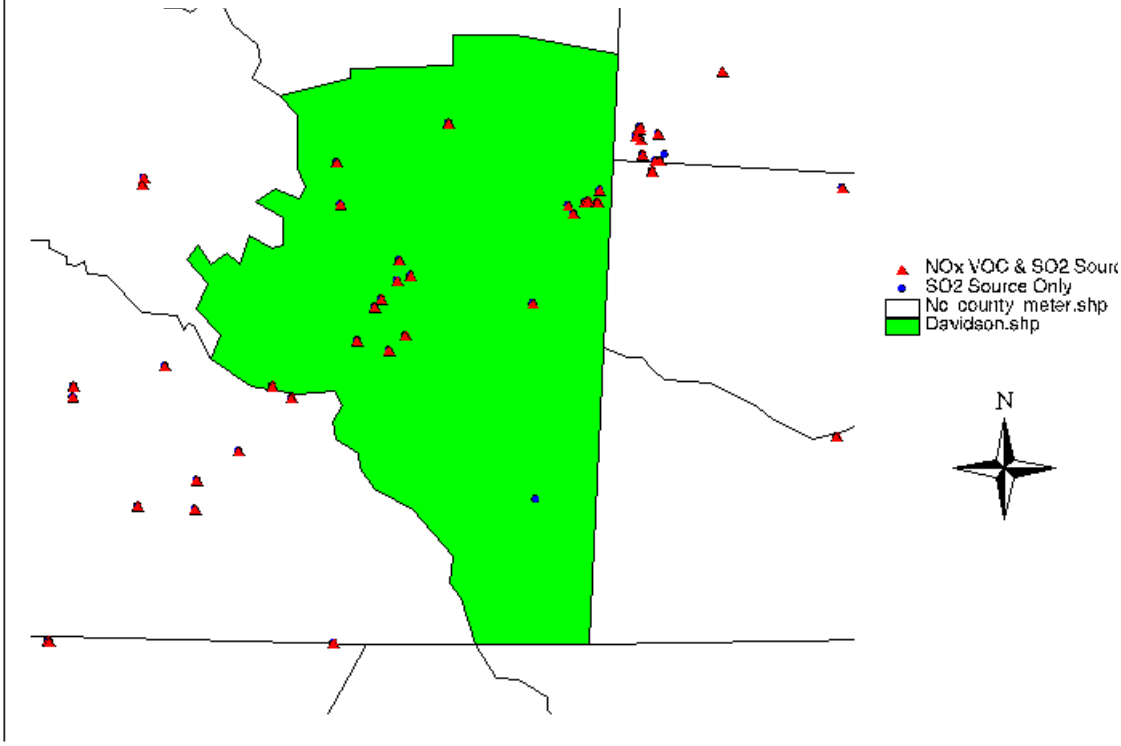


Table 2. Greensboro/Winston-Salem/High Point Area Recommendation Criteria Used for Nonattainment Designation.

Criteria:	1		2	3	5		4	6	8	
	Emissions (% of MSA)		2001-2003	Population Density (persons/sq.mile)		Location of Emissions Sources	Commuting patterns (%)[1]	Meteorology	Jurisdictional boundaries	Regional emissions reductions
County	NOx	SO_2	$PM_{2.5}$ DV ($\mu g/m^3$)	2000	2007					
Davidson	12%	2%	15.8	**267**	**292**	All Title V sources are within the recommended boundary.	5.5% to Guilford 6.5% to Forsyth	**Summertime:** Southwesterly winds and recirculation patterns dominate. Main urban areas of influence include Charlotte, the Triad, and Hickory. **Wintertime:** More northerly and stronger northwesterly winds observed than during the summer. High PM2.5 is generally observed prior to frontal passages when high pressure is in control or during strong nocturnal low-level temperature inversions. **Year-round:** Trajectories indicate influence from nearby states.	Full County Boundary	NOx SIP Call and CSA
Alamance	8%	1%	13.8	*304*	*345*	All Title V sources are outside the boundary.	2.4% to Guilford 0.2% to Forsyth	**Summertime:** Westerly and southwesterly winds and recirculation patterns dominate. Main urban areas of influence include the Triad and possibly the Triangle. **Wintertime:** More northerly winds observed than during the summer. High PM2.5 is generally observed prior to frontal passages when high pressure is in control or during strong nocturnal low-level temperature inversions.	Attainment	NOx SIP Call and CSA
Davie	6%	0%	N/A	*131*	*151*	All Title V sources are outside the boundary.	3.1% to Forsyth 0.2% to Guilford	**Summertime:** Southwesterly winds and recirculation patterns dominate. Main urban areas of influence include Charlotte, the Triad and Hickory. **Wintertime:** More northerly and stronger northwesterly winds observed than during the summer. High PM2.5 is generally observed prior to frontal passages when high pressure is in control or during strong nocturnal low-level temperature inversions.	Attainment	NOx SIP Call and CSA
Forsyth	20%	7%	14.6	*747*	*819*	All Title V sources are outside the boundary.	6.1% to Guilford 70.1% to Forsyth	**Summertime:** Southwesterly winds and recirculation patterns dominate. Main urban areas of influence include the Triad (recirculation) and Charlotte (southwest). High PM2.5 generally observed during prolonged stagnation under high pressure. **Wintertime:** More northerly and stronger northwesterly winds observed than during the summer. High PM2.5 is generally observed prior to frontal passages when high pressure is in control or during strong nocturnal low-level temperature inversions.	Attainment	NOx SIP Call and CSA

[1] The percentage of residents commuting from the respective county to the two core Triad counties, Guilford and Forsyth.

Table 2. Greensboro/Winston-Salem/High Point Area Recommendation Criteria Used for Nonattainment Designation.

Criteria:	1		2	3	5		4	6	8	
County	Emissions (% of MSA) NOx	Emissions (% of MSA) SO_2	2001-2003 $PM_{2.5}$ DV ($\mu g/m^3$)	Population Density (persons/sq.mile) 2000	Population Density (persons/sq.mile) 2007	Location of Emissions Sources	Commuting patterns (%)[1]	Meteorology	Jurisdictional boundaries	Regional emissions reductions
Guilford	26%	5%	13.3	*648*	*730*	All Title V sources are outside the boundary.	69.6% to Guilford 4.5% to Forsyth	**Summertime:** Southwesterly winds and recirculation patterns dominate. The main urban area of influence is the Triad (recirculation). **Wintertime:** More northerly and stronger northwesterly winds observed than during the summer. High PM2.5 is generally observed prior to frontal passages when high pressure is in control or during strong nocturnal low-level temperature inversions.	Attainment	NOx SIP Call and CSA
Randolph	9%	1%	N/A	*166*	*188*	All Title V sources are outside the boundary.	0.4% to Forsyth 7.5% to Guilford	**Summertime:** Southwesterly winds and recirculation patterns dominate. The main urban area of influence is the Triad (recirculation). **Wintertime:** More northerly and stronger northwesterly winds observed than during the summer. High PM2.5 is generally observed prior to frontal passages when high pressure is in control or during strong nocturnal low-level temperature inversions.	Attainment	NOx SIP Call and CSA
Stokes	16%	83%	N/A	*99*	*110*	All Title V sources are outside the boundary.	6.0% to Forsyth 0.6% to Guilford	**Summertime:** Southwesterly winds and recirculation patterns dominate. The main urban area of influence is the Triad (recirculation). **Wintertime:** More northerly and stronger northwesterly winds observed than during the summer. High PM2.5 is generally observed prior to frontal passages when high pressure is in control or during strong nocturnal low-level temperature inversions.	Attainment	NOx SIP Call and CSA
Yadkin	3%	1%	N/A	*108*	*121*	All Title V sources are outside the boundary.	3.2% to Forsyth 0.1% to Guilford	**Summertime:** Southwesterly winds and recirculation patterns dominate. The main urban area of influence is the Triad (recirculation). **Wintertime:** More northerly and stronger northwesterly winds observed than during the summer. High PM2.5 is generally observed prior to frontal passages when high pressure is in control or during strong nocturnal low-level temperature inversions.	Attainment	NOx SIP Call and CSA

Hickory/Morganton MSA

As displayed in Figure 7, there is only one monitor in the Hickory/Morganton area that is in violation of the $PM_{2.5}$ annual standard located in Catawba County. The shaded area shows the fine particulate forecast area for Hickory. The surrounding counties that have monitors are all attaining. The monitor is in close proximity to Highway 321, a major thoroughfare for the mountain region, and could be influenced by heavy-duty diesel vehicles (HDDV) that use these corridors. The federal HDDV regulation in combination with the low sulfur diesel will help reduce this source category's emissions. Rail traffic could also be an influence on this monitor as it is located between the Norfolk-Southern Railroad mainline and the Caldwell County Railroad shortline.

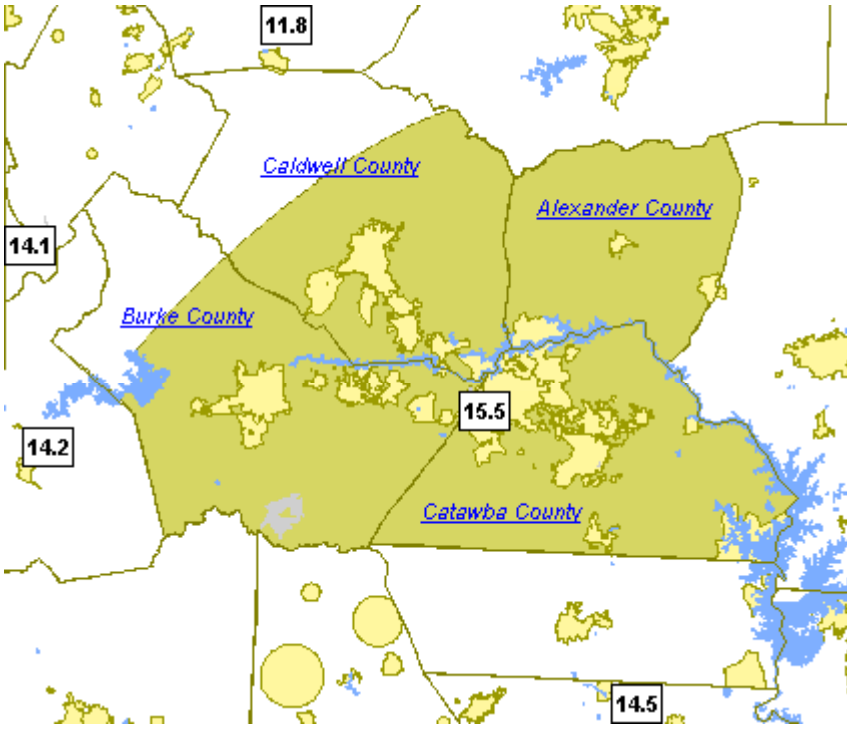


Figure 6. $PM_{2.5}$ monitors in the Hickory area and their 3 year design values in µg/m^3.

For seven quarters the DAQ operated a second monitor (Hickory 051) in the Hickory area approximately 10 miles southwest of the current Hickory PM 2.5 site (Hickory 041). This monitor, Hickory 051, was further removed from a major highway than Hickory 041. The numbers shown in Table 3 display a strong correlation between the two monitors with the one further back from the roads having consistently lower concentrations. The exception would be the first quarter of operation that could have resulted from startup issues at this site. This location was at a rescue squad and DAQ was not able to continue to use the location.

The average difference between the monitors is 1.89 µg/m3, with Hickory 051 being 1.89 µg/m3 lower than Hickory 041 over these seven quarters. If NCDAQ had been able to monitor at this location for three years, it is believed that this monitor would be showing attainment of the standard. North Carolina believes that these data show a strong regional component to the $PM_{2.5}$ values, but also a strong local component as well for the Hickory site. The data also argues for a partial county designation for Catawba County and to leave the other MSA counties out of the $PM_{2.5}$ nonattainment boundary.

Table 3. Comparison of $PM_{2.5}$ Monitor Data in Hickory

Site	AIRS ID	1Q.2000	2Q.2000	3Q.2000	4Q.2000	1Q.2001	2Q.2001	3Q.2001	4Q.2001	1Q.2002
Hickory	3703500041	16.14	16.58	18.9	20.09	15.3	16.61	18.83	13.16	13.25
Hickory	3403500051	N/A	17.97	17.94	17.02	10.23	15.3	17.9	9.88	N/A
	Difference		-1.39	0.96	3.07	5.07	1.31	0.93	3.28	

Figure 7. Title V Sources in Catawba County Within the $PM_{2.5}$ Nonattainment Boundary

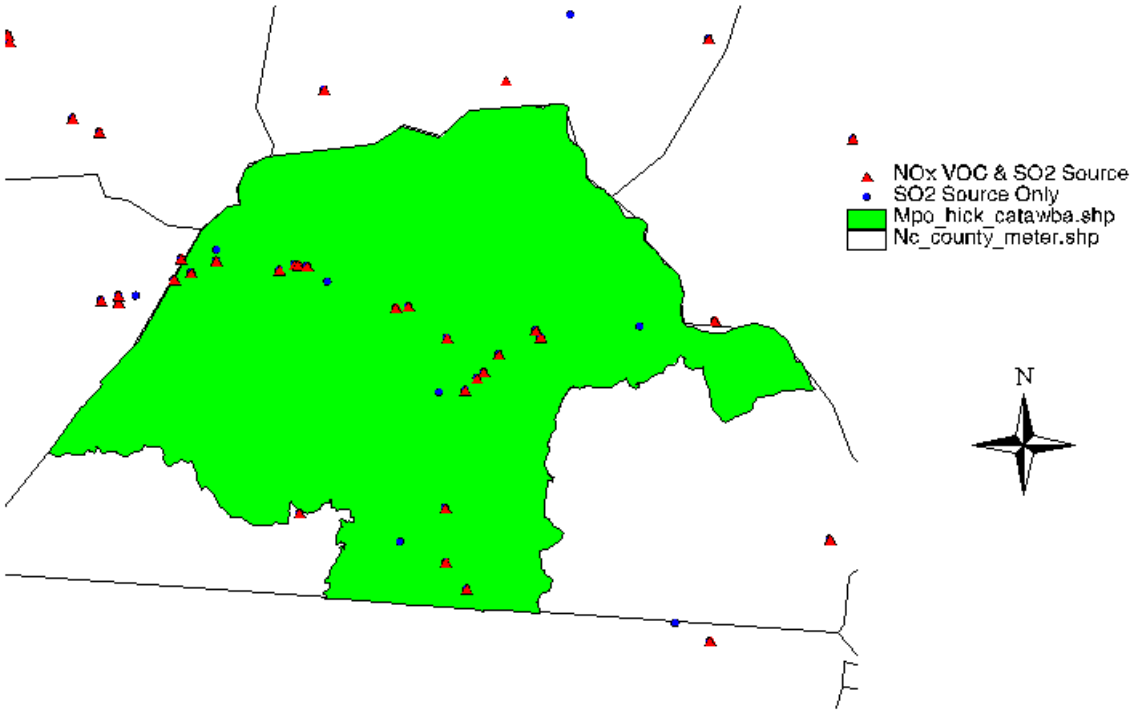


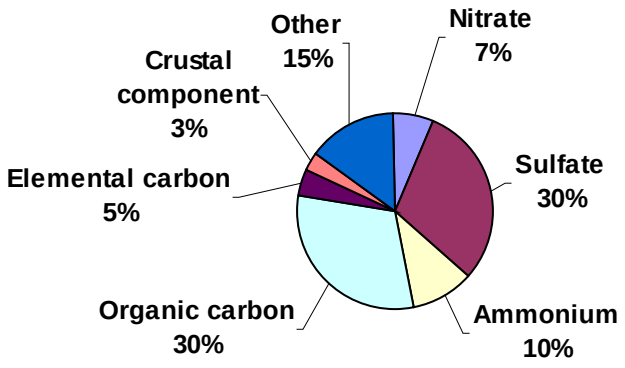
Table 4. Hickory Area Recommendation Criteria used for Nonattainment Designation.

Criteria:	1		2	3	5		4	6	7	8	
County	NOx Emissions (% of MSA) NOx	SO_2	2001-2003 $PM_{2.5}$ DV ($\mu g/m^3$)	Population Density (persons/sq.mile)[1] 2000	2007	Location of Emissions Sources	Commuting patterns (%)[2]	Meteorology	Geography/ topography issues	Jurisdictional boundaries	Regional emissions reductions
Catawba[3]	57%	96%	15.5	**354** *139*	**398** *156*	All Title V sources except Marshall Steam Station are within boundary.	N/A	**Summertime:** Southwesterly winds and recirculation patterns dominate. Main urban areas of influence include Hickory and the Triad (recirculation) and Charlotte (southwest). High PM2.5 generally observed during prolonged stagnation under high pressure. **Wintertime:** More northerly and stronger northwesterly winds observed than during the summer. High PM2.5 is generally observed prior to frontal passages when high pressure is in control or during strong nocturnal low-level temperature inversions. **Year-round:** Trajectories indicate influence from nearby states.	None	Recommended boundary follows MPO boundary.	NOx SIP Call and CSA
Alexander	5%	1%	N/A	*129*	*146*	All Title V sources are outside the recommended boundary	6.0% to Catawba (Lowest VMT in MSA)	**Summertime:** Westerly and southwesterly winds and recirculation patterns dominate. Main urban areas of influence include Hickry, the Triad and Charlotte. **Wintertime:** More northerly and stronger northwesterly winds observed than during the summer. High PM2.5 is generally observed prior to frontal passages when high pressure is in control or during strong nocturnal low-level temperature inversions.	None	Attainment	NOx SIP Call and CSA
Burke	23%	2%	N/A	*176*	*193*	All Title V sources are outside the recommended boundary	8.8% to Catawba	**Summertime:** Same as Alexander **Wintertime:** Same as Alexander	Mountain range along western part of county.	Attainment	NOx SIP Call and CSA
Caldwell	15%	1%	N/A	*164*	*172*	All Title V sources are outside the recommended boundary	8.5% to Catawba	**Summertime:** Same as Alexander **Wintertime:** Same as Alexander	Mountain range along western part of county.	Attainment	NOx SIP Call and CSA

[1] Entire county density is in bold and the recommended attainment portion density is in italics.
[2] The percentage of residents commuting from the respective county to Catawba County.
[3] Only nonattainment area designation.

In addition to operating the FRM (federal reference method) monitors, North Carolina also operates several speciated trends monitors. This speciated data provides information on the emissions sources that may need to be controlled in order for all monitors to attain the standard. For example, sulfate and organic carbon are particularly important components, as the two comprise the majority of contribution to overall $PM_{2.5}$ mass. The Hickory speciation data is presented below in Figure 8. The speciated monitor, recently placed at the Lexington monitor location in Davidson County, does not have enough data to present.

Figure 8. Hickory Area Speciation Data
Date(s): 1/3/2003 - 12/11/2003
Average Concentration (µg/m³)



Appendix A
Public Comments Received

Subject: Public Comments
Date: Mon, 5 Jan 2004 09:42:16 -0500
From: "Scott Jackson" <scottjackson5@hotmail.com>
To: <sheila.holman@ncmail.net>

Sheila,

NCmail is not working well this morning so I decided to use my personal email account. Below is the email message we talked about from what looks to be a private citizen. The only other comment in that Inbox was from Hoy Bohanan which I believe you have already seen.

In all, it looks like we have comments from three people pertaining to the Triad's attainment...LC Coonse (private citizen), Hoy Bohanan, and James McCoy. McCoy and Bohanan's comments appear to be the same thing so we really only have two individual opinions.

Don't hesitate to call if you need anything else.
Scott

I do not believe that the area designations for 2.5 um particles would be justified based on the small number of sample locations. The Hickory sample was 16.2, but a monitoring station less than two miles away from previous years which was below the 15 value was ignored I question the statistical significance of this method when considering area designations. I do believe that there is a significant health risk from the existing particulate exposure in the Hickory and NC area in general. I just believe that non-attainment status designation without enough data to determine the sources of this problem can serve no usefull purpose. It is the stick without knowing where the carrot is.

LC Coonse
71 Pinewood Rd
Granite Falls, NC 28630
828-396-3288
coonselc@msn.com

RECEIVED
DEC 31 2003
AIR QUALITY PLANNING

Keith - FYI
Alex Sheila

RECEIVED
DEC 29 2003
AIR QUALITY DIVISION
DIRECTORS OFFICE

MECKLENBURG COUNTY
Land Use and Environmental Services Agency
- AIR QUALITY -

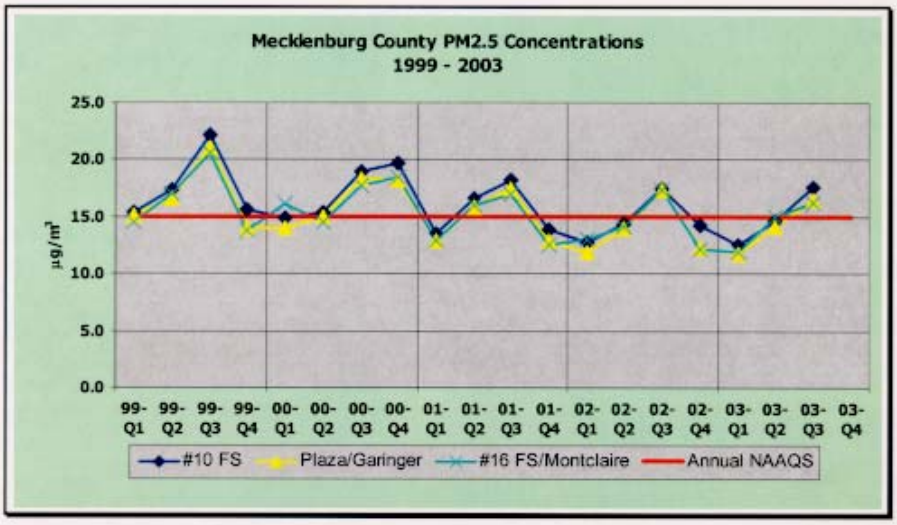
December 22, 2003

B. Keith Overcash, Director
N.C. Division of Air Quality
1641 Mail Service Center
Raleigh, NC 27699-1641

Re: NCDAQ's Proposed PM 2.5 Non-Attainment Boundary Alternatives
Comments from Mecklenburg County Air Quality

Dear Mr. Overcash:

From calendar years 1999 to 2003 the annual trend for ambient fine particulate matter (PM 2.5) concentrations in Mecklenburg County has been steadily downward. Projections indicate that this trend will continue. For the reasons presented below, *Mecklenburg County Air Quality asserts that Charlotte/Mecklenburg should not be recommended for PM 2.5 non-attainment designation.*



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These comments and recommendations are from the Air Quality program of the Mecklenburg County Land Use and Environmental Services Agency regarding North Carolina Division of Air Quality's (NCDAQ) proposed particulate matter 2.5 non-attainment boundary alternatives. These remarks represent the opinion of Mecklenburg County's technical air quality staff and not the position of the Mecklenburg County Air Quality Commission or Board of Commissioners. Mecklenburg County has operated a state "certified" local air pollution control program since 1973. Our comments are the judgment of expert staff knowledgeable about air quality, non-attainment, the local environment and what is necessary in this county and region spanning both Carolinas to achieve compliance with national ambient air quality standards.

Assumed Goal: To establish geographic boundaries of sufficient area for implemented control strategies to achieve clean healthy air for the people of the Charlotte/Mecklenburg (NAAQS attainment). The principles and recommendations below do not consider factors ancillary to the clean air goal such as balancing economic interests, convenience to state and local government planners and road builders, or cooperation among all political entities.

NCDAQ PM 2.5 Alternatives

At its public meeting in Charlotte on December 2, 2003, NCDAQ presented several designation alternatives:

- Option A – MSA Boundaries for Charlotte, Triad, Unifour
- Option B: PM 2.5 Non-Attainment Areas Based on 8-Hour Ozone Boundary
- Option C: Whole Counties With Violating Monitors
- Option D: PM 2.5 Boundary equals 8-hour ozone boundary in counties with a violating monitor
- Option E: Consideration of Spatial Averaging
  1. EPA allows establishment of Community Monitoring Zones (CMZ's)
  2. NC has three CMZ's – Buncombe County, Forsyth County, Mecklenburg County
  3. NC can use a spatial averaging technique in these CMZ's
  4. If spatial averaging is used, then the monitors in Forsyth and Mecklenburg attain the PM 2.5 annual NAAQS

PM 2.5 Facts for Charlotte/Mecklenburg

- The annual PM 2.5 National Ambient Air Quality Standard (NAAQS) is whenever the three year average of the averaged annual mean concentration is less than or equal to 15.0 $\mu g/m^3$.
- Mecklenburg County's annual PM 2.5 NAAQS compliance value from #10 Fire Station for 2003 is projected* to be 15.1 $\mu g/m^3$.
- Mecklenburg County's projected* spatial average value for 2003 (14.6 $\mu g/m^3$) using all three sites demonstrates compliance with the annual PM 2.5 NAAQS.
- Mecklenburg County's projected* spatial average value for 2003 (14.7 $\mu g/m^3$) using the two "everyday core" sites demonstrates compliance with the annual PM 2.5 NAAQS.
- Mecklenburg meets the federally established requirements and recommendations for using spatial averaging. (See attachment for detailed explanation of statements below)
  1. Mecklenburg County is designated as a Community Monitoring Zone (CMZ)

2. Requirement: The annual average concentrations at every site in the CMZ are greater than 80% (12.0 $\mu g/m^3$) and not more than 120% (18.0 $\mu g/m^3$) of the annual spatial average (Range for 2001 - 2003: 13.9 – 15.5$\mu g/m^3$)
3. Recommended: The 24-hour average concentrations have a correlation coefficient of 0.60 or greater. (Actual site correlations for 2001 - 2003 – 0.97 or higher)
4. Recommended: Emissions from the same source or types of sources of PM 2.5 do affect the entire CMZ
   a. The three monitoring sites operating in the Mecklenburg County CMZ are neighborhood scale.
   b. The sites' annual averages are within ± 20% of the CMZ-wide average on an annual basis, are influenced by similar sources and are reasonably correlated on a daily basis ($r > 0.97$).
   c. From 2001 –2003, the individual site annual average differed from the annual spatial mean within the recommended range of ±10-15%. (Actual range of -2.8% to 3.5%)
   d. The placement of monitors in densely populated urban/suburban settings measure conservative PM values (i.e. no data are being collected from the outer less densely populated areas of the county)
   e. Chemical composition of data from the Garinger site is comparable to similar sites in N.C.
5. CFR requirement for public hearing – A public meeting was held in Charlotte, N.C. on December 2, 2003 at which NCDAQ presented current data, described the health issues, presented designation alternatives, including spatial averaging and asked for public comment, meeting the intent for the required public hearing.

- Sophisticated computer modeling performed by the North Carolina Division of Air Quality (NCDAQ) using 1997 emissions inventory data currently projects that federal and state pollution control measures in place or planned will reduce ozone levels. Emissions categories and types for PM 2.5 are similar or the same as those for ozone. It is expected that as ozone levels drop, PM 2.5 levels will drop as well.

*Projection period: 10/01/00 to 9/30/03

MCAQ PM 2.5 Recommendations

- NCDAQ should not make recommendations to the secretary/governor and USEPA until all quality assured/quality controlled data are available for calendar year 2003.
- Mecklenburg County should not be included with other violating or MSA counties.
- Spatial averaging should be used in Mecklenburg County to designate attainment status.
- Mecklenburg County should not be recommended for designation as a PM 2.5 non-attainment area.

MCAQ believes that the three monitoring sites combined provide a most conservative (placement) and representative estimate of public exposures to PM 2.5 throughout Mecklenburg County. At this time, evidence shows that the people of Charlotte/Mecklenburg are not exposed to PM 2.5 values above the NAAQS and does not meet the requirements for non-attainment designation.

Please contact Joan Liu, Jeff Francis of my staff or me, if you have any questions regarding these comments. Thank you.

Sincerely,

Don R. Willard
Director

Attachment: "Mecklenburg County Community Monitoring Zone Spatial Averaging Analysis," December 18, 2003

Cc Cary Saul, Director, LUESA
Joan Liu, MCAQ
Jeff Francis, MCAQ
Bobbie Shields, General Manager, Mecklenburg County
MCAQ Staff
Mecklenburg County Air Quality Commission
Julie Burch, Asst. City Manager, Charlotte
Jim Humphrey, Director, Charlotte Dept. of Transportation

Mecklenburg County Community Monitoring Zone
Spatial Averaging Analysis
December 18, 2003

Mecklenburg County is designated as a community monitoring zone (CMZ) per the North Carolina Particulate Matter Monitoring Network Description (June 29, 1998). According to 40 CFR 58, Appendix D, §2.8.1.6.1: "The CMZs describe areas within which two or more core monitors may be averaged for comparison with the annual $PM_{2.5}$ NAAQS." The following analysis evaluates data collected in the Mecklenburg County CMZ with the conditions specified in 40 CFR 58, Appendix D, §2.8.1.6.1 relating to the use of spatial averaging.

The "Guideline on Data Handling Conventions for the PM NAAQS" (EPA-454/R-99-009, Page 38) states: "CMZs are defined to meet the following three conditions, only the first of which is required (see 40 CFR 58, Appendix D, §2.8.1.6.1)." :

- The annual average concentrations at every site in the CMZ must be no less than 80% or more than 120% of the annual spatial average [Required]
- The 24-hour average concentrations should have strong correlations (a correlation coefficient of 0.6 or greater) [Recommended]
- Emissions from the same source or types of sources of $PM_{2.5}$ affect the entire CMZ [Recommended]

The text that follows evaluates the Mecklenburg County CMZ data with regard to these conditions.

At this date (December 17, 2003) Mecklenburg County has not collected a complete data set for 2003. Since designation will be base on the three-year average 2001 – 2003, data from the last 31 days of 2000 will be used to complete the final year of the annual averages in this analysis. As soon as data is available for the final month of 2003 the analysis will be updated. The analysis is primarily for the purpose of demonstrating that CMZ spatial averaging conditions are met. Thus, using a small portion of 2000 data to complete 2003 should not create results that differ significantly from the results that will be determined once the 2003 data set is complete.

Condition 1 (Required): The annual average concentrations at every site in the CMZ must be no less than 80% or more than 120% of the annual spatial average. Table 1 lists the annual averages for each site as well as the spatial averages and the 80% and 120% limits:

Mean $PM_{2.5}$ Concentrations ($\mu g/m^3$)				
Site	2001	2002	2003	3 Year Mean
#10 Fire Station 37-119-0010	15.5	14.7	14.9	15.0
Garinger 37-119-0041	14.8	13.9	14.1	14.3
Montclaire 37-119-0042	14.6	14.1	14.4	14.4
Spatial Mean	15.0	14.2	14.6	14.6
Spatial Mean X 80%	12.0	11.4	11.7	11.7
Spatial Mean X 120%	18.0	17.0	17.5	17.5

Table 1.

For each year the $PM_{2.5}$ concentration at each individual site within the CMZ must fall between 80% and 120% of the spatial mean.

In 2001 each sites' annual mean must be $\geq 12.0\ \mu g/m^3$ and $\leq 18.0\ \mu g/m^3$. The minimum annual mean in 2001 is 14.6 and the maximum annual mean is 15.5. All sites meet the requirements of this condition in 2001.

In 2002 each sites' annual mean must be $\geq 11.4\ \mu g/m^3$ and $\leq 17.0\ \mu g/m^3$. The minimum annual mean in 2002 is 13.9 and the maximum annual mean is 14.7. All sites meet the requirements of this condition in 2002.

In 2003 each sites' annual mean must be $\geq 11.7\ \mu g/m^3$ and $\leq 17.5\ \mu g/m^3$. The minimum annual mean in 2003 is 14.1 and the maximum annual mean is 14.9. All sites meet the requirements of this condition in 2003. All sites meet the requirements for the condition during this period.

Additionally, this requirement was tested on a data set that included the two every day sampling FRMs. Both sites met the requirements of this condition in this comparison. The results are listed in Table 2.

Mean $PM_{2.5}$ Concentrations ($\mu g/m^3$)				
Site	2001	2002	2003	3 Year Mean
#10 Fire Station 37-119-0010	15.5	14.7	14.9	15.0
Garinger 37-119-0041	14.8	13.9	14.1	14.3
Spatial Mean	15.2	14.3	14.5	14.7
Spatial Mean X 80%	12.2	11.4	11.7	11.8
Spatial Mean X 120%	18.2	17.2	17.5	17.6

Table 2.

Condition 2 (Recommended): The 24-hour average concentrations should have strong correlations (a correlation coefficient of 0.6 or greater). Tables 3 through 5 list the Pearson correlation coefficients between the 24-hour average concentrations at each pair of sites for each year.

2001 Pearson Correlation	#10 FS	Garinger	Montclaire
#10 FS	X	0.98	0.98
Garinger		X	0.99
Montclaire			X

Table 3.

2002 Pearson Correlation	#10 FS	Garinger	Montclaire
#10 FS	X	0.98	0.97
Garinger		X	0.99
Montclaire			X

Table 4.

2003 Pearson Correlation	#10 FS	Garinger	Montclaire
#10 FS	X	0.99	0.99
Garinger		X	0.99
Montclaire			X

Table 5.

The minimum Pearson correlation coefficient for the three-year period is 0.97. The recommended level of the Pearson correlation coefficient is > 0.6. The 24-hour average concentrations at each site meet this condition. Since the values for the period November 16, 2003 through December 31, 2003 were not available at the time of this analysis they were not included in the Pearson correlation coefficient analysis for 2003. As soon as these values are available an updated analysis will be performed.

Condition 3 (Recommended): Emissions from the same source or types of sources of $PM_{2.5}$ affect the entire CMZ. The criteria for satisfying this condition are outlined in "Guidance for Network Design and Optimum Site Exposure for $PM_{2.5}$ and PM_{10}", December 15, 1997, Section 5.5. Several factors must be considered.

- **Spatial Measurement Scale:** Each monitoring site must represent a neighborhood or larger spatial measurement scale. The three monitoring sites operating in the Mecklenburg County CMZ are neighborhood scale.

- **Temporal Behavior:** The CMZ represents homogeneous air quality. The reference sites the analyses performed earlier in this text. The sites' annual averages must be within ± 20% of the CMZ-wide average on an annual basis and be influenced by similar sources and be reasonably correlated on a daily basis (r>0.6). The monitoring sites in the Mecklenburg County CMZ meet these requirements.

- **Consistent Trends:** The variation among the eligible core monitors should be stable over time. The initial set of annual means should be well within the ±20% (e.g. 10-15%) to allow for potential changes over time.

  During the three years of this analysis the individual site annual average differed from the annual spatial mean in the range of –2.8 % to 3.5 %, well within the recommended range of ±10-15 %.

- **Spatial Placement of Monitors:** The tools used to evaluate this condition are modeling and spatial interpolation. These analyses have not been performed at this time. The strong correlation among monitoring sites (>0.97) and the placement of the monitoring sites relative to the central business district suggests that the individual site averages may be typical of the area-wide average.

- **Chemical Composition of $PM_{2.5}$:** Chemical speciation has been performed at the Garinger site. Figure 1 gives a graphical representation of the major constituents of $PM_{2.5}$ at the Mecklenburg County Garinger High School site.

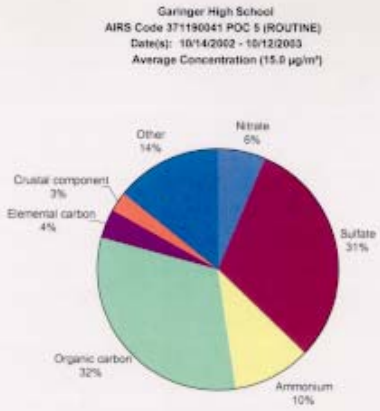


Figure 1.

Speciation analyses (October 2002 to October 2003) indicate that the major constituents of $PM_{2.5}$ collected at the Garinger site are sulfate (31%) and organic carbon (32%). These results are consistent with results collected elsewhere in North Carolina (See Attachment 1). Speciation sampling has been conducted only at the Garinger site in Mecklenburg County. There are no other speciation sites in Mecklenburg County with which to perform a comparison. However, the statewide consistency suggests some degree of homogeneity of the air mass. The speciation results indicate the sites may be influenced by similar sources.

- **Population Density and Air Quality Patterns:** The three Mecklenburg County $PM_{2.5}$ sites are located in areas of relatively high population density.

2000 Population Density within 4 km radius of each monitoring site	Average Population per Sq. Mi.
#10 FS	2259
Garinger	3644
Montclaire	2852
Mecklenburg County	1300

Table 6.

The scale of representativeness of each site is neighborhood. "Measurements in this category represent conditions throughout some reasonably homogeneous urban subregion with dimensions of a few kilometers…"[1] (0.5 km to 4 km). The population within the neighborhood scale of representativeness (4 km radius) in which the three $PM_{2.5}$ monitoring sites are located contains approximately 25% of the total county population of 695,454 (2000). The monitoring sites are population oriented. See Figure 2.

[1] – 40 CFR 58 Appendix D, § 2.8.0.5.

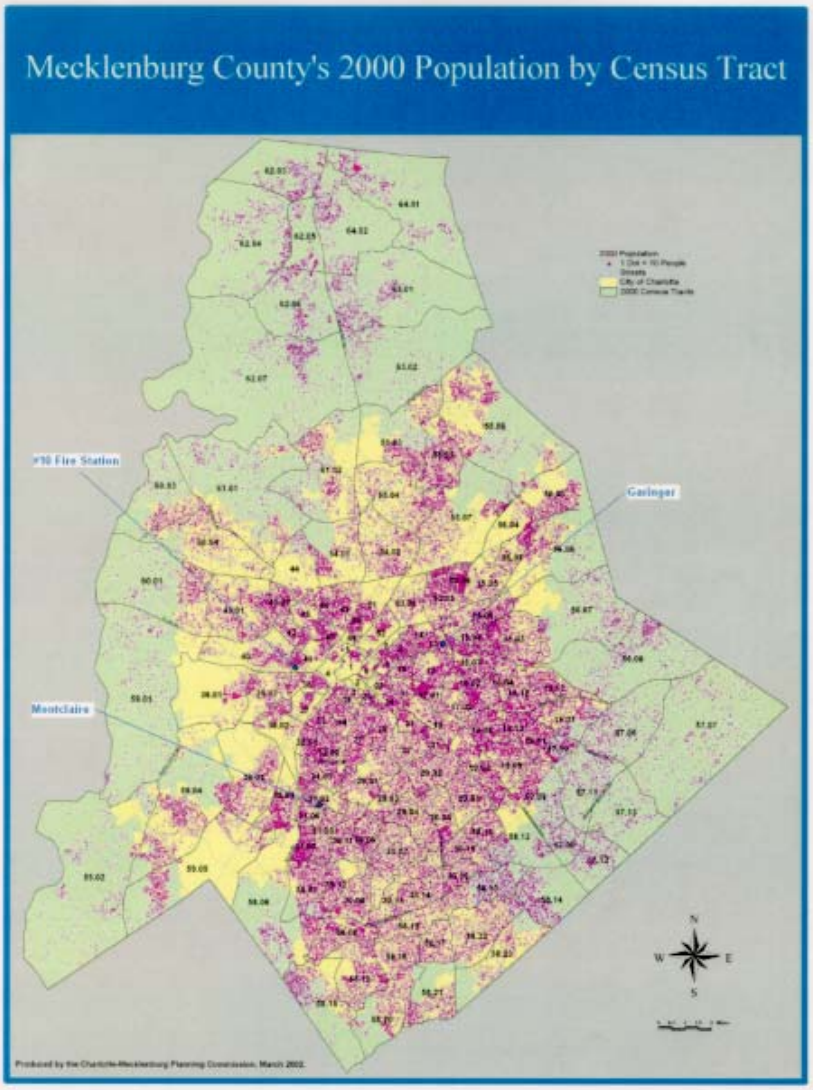
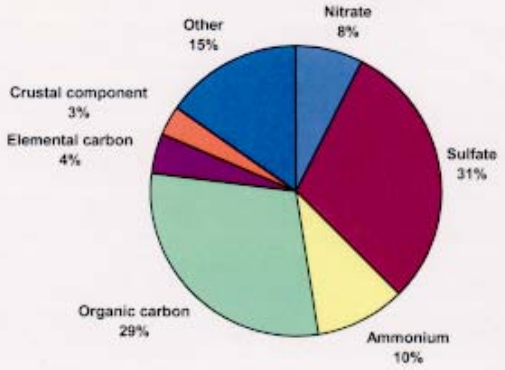

Mecklenburg County's 2000 Population by Census Tract
#30 Fire Station
Gastonia
Montclaire
N
W
E
S

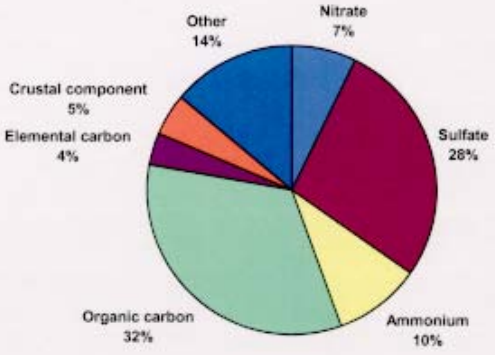
Figure 2.

Attachment 1 - Speciation Data at Other Monitoring Sites in North Carolina (Page 1 of 2)

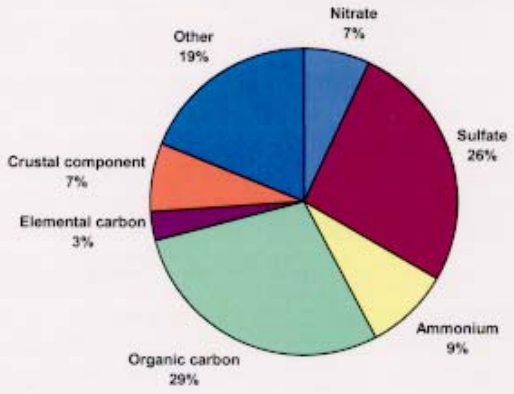
Hickory
AIRS Code 370350004 POC 5 (ROUTINE)
Date(s): 1/3/2003 - 8/13/2003
Average Concentration (16.3µg/m³)



Millbrook (Raleigh)
AIRS Code 371830014 POC 5 (ROUTINE)
Date(s): 1/3/2003 - 8/13/2003
Average Concentration (15.1µg/m³)



NORTH CAROLINA PM 2.5 SPECIATION
Statewide Avg. Concentration 17.3 ug/m3 (224 samples)
1/3/2003 - 8/13/2003



Mecklenburg County LUESA – AQ

Air Quality Monitoring Section

Attachment 2 – Selected Data Quality Summary Statistics for Mecklenburg County Air Quality $PM_{2.5}$ Monitoring Sites

Data Completeness Analysis: Quarterly data completeness should exceed 75% data capture.

Data Completeness						
Site	Year	Quarterly Data Capture (%)				Annual Percent Data Capture
		Q1	Q2	Q3	Q4	
# 10 Fire Station	2001	98	100	99	98	99%
Garinger	2001	84	76	91	99	88%
Montclaire	2001	96	93	97	93	95%
# 10 Fire Station	2002	89	100	94	90	93%
Garinger	2002	92	99	98	91	95%
Montclaire	2002	100	100	100	97	99%
# 10 Fire Station	2003*	98	98	98	99	98%
Garinger	2003*	95	98	98	92	96%
Montclaire	2003*	97	100	100	95	98%

* - 2003 Percent Data Capture through 11/30/03.

Data Precision of Collocated Samples: Collocated sampling is conducted at the Montclaire monitoring site. A collocated sample is collected every 6th day. The collocacted sample concentration is compared to the official sample concentration. Coefficient of variation between the sample concentrations should be less than 10%.

Year	Coefficient of Variation	Lower 90% Probability Limit	Upper 90% Probability Limit
2001	2.0 %	1.7 %	2.4 %
2002	2.3 %	2.0 %	2.7 %
2003*	4.0 %	3.4 %	5.0 %

* - 2003 Coefficient of Variation through 9/30/03.

Bias Assessment: The USEPA audits all samplers operated by a reporting organization each 4 years. Results should be within ± 10 %. The results for the samplers operating in Mecklenburg County are listed below:

Reporting Organization (0669) Mean Bias 1999	
Number of Comparisons =	9
Annual Average Percent Difference =	-1.9 %
Upper 95 % Confidence Limit =	1.2 %
Lower 95 % Confidence Limit =	-5.0 %

Reporting Organization (0669) Mean Bias 2003	
Number of Comparisons =	12
Annual Average Percent Difference =	-0.6 %
Upper 95 % Confidence Limit =	3.8 %
Lower 95 % Confidence Limit =	-2.6 %

References

1. Code of Federal Regulations, Title 40 Part 58, Ambient Air Quality Surveillance, Appendix A - Quality Assurance Requirements for State and Local Air Monitoring Stations, Appendix D - Network Design for State and Local Air Monitoring Stations, National Air Monitoring Stations, and Photochemical Assessment Monitoring Stations. July 2001.

2. Code of Federal Regulations, Title 40 Part 50, Appendix N. Interpretation of the National Ambient Air Quality Standards for Particulate Matter. July 1997.

3. Cohen, Jonathan, Terence Fitz-Simons, and Miki Wayland. *Guideline on Data Handling Conventions for the PM NAAQS*. Air Quality Trends and Analysis Group, Research Triangle Park, NC. EPA Report No. EPA-454/R-99-009. April 1999.

4. Charlotte-Mecklenburg Planning Commission. *Mecklenburg County's 2000 Population by Census Tract*. Charlotte, NC. March 2002.

5. Holman, Sheila. Designations for PM2.5 in North Carolina, Public Meeting to Receive Comments on NC's Potential Recommendation. (PowerPoint Presentation - PM2.5_Public_Meetings-120203.ppt), Charlotte, NC. December 2, 2003.

6. Eberly, Shelly. Re: Fwd: Re: 40 CFR 58 Appendix A Statistics - Calculations for Summary Statistics. Eberly.Shelly@epamail.epa.gov (Electronic Mail Correspondence). USEPA, Research Triangle Park, NC. December 19, 2003.

7. Papp, Michael. Re: Fwd: Re: 40 CFR 58 Appendix A Statistics - Calculations for Summary Statistics. Papp.Michael@epamail.epa.gov (Electronic Mail Correspondence). USEPA, Research Triangle Park, NC. December 18, 2003.

8. Watson, John G., Judith C. Chow, David DuBois, Mark Green, Neil Frank, and Marc Pitchford. *Guidance for Network Design and Optimum Site Exposure for $PM_{2.5}$ and PM_{10}*. Office of Air Quality Planning and Standards, U.S. Environmental Protection Agency, Research Triangle Park, NC 27711. December 15, 1997.

December 30, 2003

To: Sheila Holman
NCDAQ
Via e-mail
sheila.holman@ncmail.net

$PM_{2.5}$ Fine Particle Standard
Potential nonattainment designation for the Triad

Thank you for the opportunity to comment on the proposed fine particle attainment designation for the Triad.

Background

Based on information presented in the public meeting earlier this month, it is my understanding that using the latest 2001-3 data, all of the Triad monitors for fine particles will comply except for the one in Lexington, Davidson County. The overall trend in fine particle concentration in North Carolina is down for each year. The EPA policy for designation for the fine particle standard is set forth in a memorandum from Jeffery R. Holmstead, date-stamped April 1, 2003.[1] In response to the request for comment from the NCDENR Division of Air Quality, the following comments are submitted.

1. The Triad is in attainment because the Lexington, Davidson County monitor is a hot-spot site.

The first step in determining a violation to the standard is to identify monitoring sites that do not appear to meet the annual standard. If the site is a hot-spot site,[2] then the 24-hour standard should be applied. The Lexington, Davidson county monitor does not match any of the others in the Triad and therefore is a hot-spot site. The following graph[3] illustrates this point.

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[1] http://www.epa.gov/ttn/naaqs/pm/pm25_guide.html National Air Quality Standards for Fine Particles: Guidance for Designating Areas, accessed 12/30/03

[2] "The air quality standards for $PM_{2.5}$ specify two exceptional circumstances in which concentrations above the level of the standard are not to be interpreted as violating the standard. The first exception is that sites that monitor source-oriented hot spots in some cases should be assessed only with respect to the 24-hour standard, not the annual average standard. In 40 CFR Part 58 (Appendix D, section 2.8.1.2.3), EPA states that monitoring sites representing unique localized conditions not found elsewhere in the area should not be compared with the annual average standard. For sites that States or Tribes have designated as hot-spot sites, EPA must review whether available evidence confirms that the annual average concentrations at the site are in fact unrepresentative of conditions elsewhere in the region. If so, data from the site will not be compared against the annual average standard, but will be compared against the 24-hour standard." memorandum from Jeffery R. Holmstead, date-stamped April 1, 2003.

[3] Data obtained from George Bridgers, NCDAQ via e-mail on 12/12/03

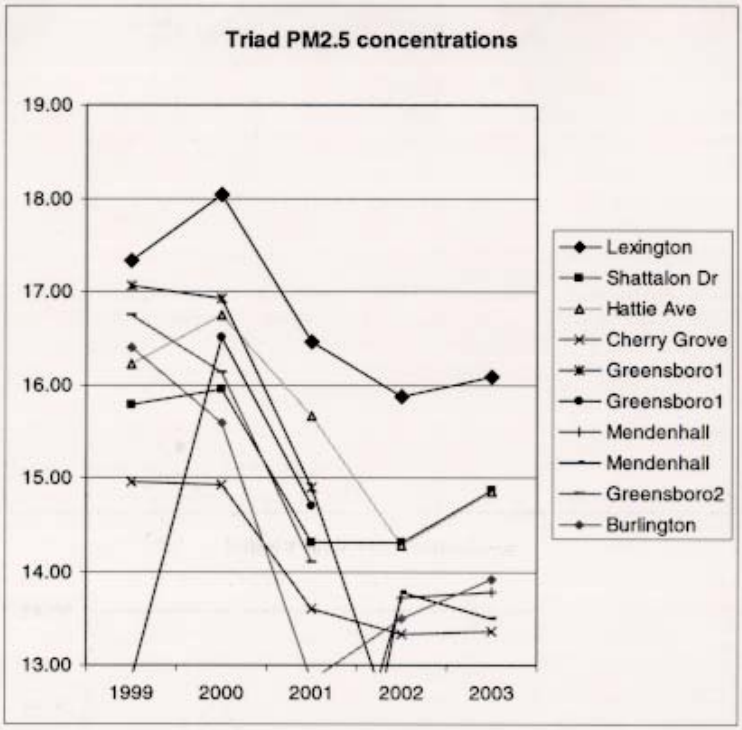

Figure 1 - Annual average $PM_{2.5}$ concentrations in the Triad. 2003 data is first three quarters. Note that the Lexington monitor exceeds the values of the other nine monitors in every year.

I believe that I was told that the Lexington monitor does comply with the 24-hour standard. If that is the case then the Triad is in compliance with the $PM_{2.5}$ standard. DAQ is encouraged to continue its plans for further investigation in order to determine if the causes of the higher readings in Lexington can be identified.

2. If an area is designated, it should not follow EPA's presumptive designation of the full CMSA.

The Triad should not be designated nonattainment because of the local hot-spot monitor. However, if EPA believes that the data from Lexington are not different from the rest of the Triad, EPA should not designate the full CMSA. EPA guidance describes the rationale for designating full CMSA areas. It is based on the presumption that the

pollution sources are centered in urban areas.[4] The discussion centers on when and why the surrounding rural areas should be included in the nonattainment area.[5] Since the Triad urban areas currently attain and the higher readings are found in the more rural county, the Triad data do not fit the EPA's rationale for its presumptive designation. Therefore, the presumptive designation guidance should not be followed in the Triad. The first option should be non-designation for Davidson County only since it appears that the county may soon attain the standard. All other Triad counties should be designated attainment. If any area must be designated nonattainment, it should only be the local hot-spot area, Davidson County. However, since it is a hot-spot, no Triad area should be designated nonattainment.

3. EPA should allow averaging for Forsyth County.

DAQ requested comment on spatial averaging. Spatial averaging has been allowed when there are multiple monitors within a county or city. This is the case in Forsyth County, therefore, it should be allowed.

Sincerely,

Hoy Bohanon
RJRTC
bohanoh@rjrt.com

[4] "EPA has examined various evidence addressing the typical geographic scale of source areas that contribute to violations of the $PM_{2.5}$ standard. This evidence indicates substantial contributions to violations of the $PM_{2.5}$ standard both from long-range transport and from thee collection of urban sources dispersed within metropolitan areas." memorandum from Jeffery R. Holmstead, date-stamped April 1, 2003.

[5] EPA found an association of higher $PM_{2.5}$ concentrations with greater levels of urban activity. Comparisons of rural versus urban concentrations of the components of $PM_{2.5}$ indicate that certain components (such as carbonaceous particles and nitrates) resulting in part from urban emissions are found in significantly higher concentrations in urban areas. These "urban emissions" arise from human activities, such as motor vehicle use and home heating as well as industrial activities, that occur with greater density in more populated areas. The metropolitan area, as delineated by the Office of Management and Budget (OMB), provides a presumptive definition of the populated area associated with a core urban area." memorandum from Jeffery R. Holmstead, date-stamped April 1, 2003.

SOUTHERN ENVIRONMENTAL LAW CENTER

200 WEST FRANKLIN STREET, SUITE 330
CHAPEL HILL, NC 27516-2520

Telephone 919-967-1450
Facsimile 919-929-9421
selcnc@selcnc.org

Charlottesville, VA
Chapel Hill, NC
Atlanta, GA

January 5, 2004

Sheila Holman
North Carolina Division of Air Quality
1641 Mail Service Center
Raleigh, NC 27699-1641

VIA EMAIL AND U.S. MAIL

Re: Designations for $PM_{2.5}$ in North Carolina

Dear Ms. Holman,

The Southern Environmental Law Center submits these comments on North Carolina's proposed designation of $PM_{2.5}$ nonattainment areas, which will be submitted to EPA by February 15, 2004. $PM_{2.5}$ is an especially lethal air pollutant, responsible for thousands of premature deaths each year from heart and lung disease. Due to the pervasive nature of $PM_{2.5}$ pollution, the diversity of sources contributing to the problem and its severe public health impacts, North Carolina should propose expansive designations to maximize its ability to address this issue.

As discussed below, we urge North Carolina to adhere to EPA's guidance in recommending $PM_{2.5}$ nonattainment areas. Pursuant to this guidance, the following factors should govern North Carolina's proposed designation:

1. Any county with a violating $PM_{2.5}$ monitor and all nearby contributing areas should be included;

2. Full Metropolitan Statistical Areas (MSAs) or CMSAs should serve as the presumptive boundaries;

3. Whole counties, rather than partial counties, should be designated; and

4. Designations should match the 8-hour ozone boundaries.

Based on EPA's guidance, we recommend that North Carolina submit to EPA a modified version of Option A presented at the December 2003 public hearings, which includes 19 counties in the 3 MSAs of Charlotte, Hickory, and Greensboro/Winston-Salem. While Option A comes

closer to implementing EPA's presumptive guidance and is more protective of public health than alternative Options B-D, it falls short of including all appropriate counties. In the Charlotte area, Iredell County and York County, South Carolina should be added for several reasons. First, both are included within the 8-hour ozone nonattainment boundary indicated by EPA in its response letter to North Carolina on December 3, 2003. Second, transportation and stationary source emissions in both counties contribute to the PM problem in the core MSA counties. Third, as to Iredell County, it makes no sense to leave out a single county as an island surrounded by several nonattaining counties for purposes of administering a comprehensive program to abate ozone pollution in piedmont North Carolina. In the Greensboro/Winston-Salem area, Rockingham and Caswell Counties should be included because they are part of the proposed ozone nonattainment area and the greater metro area which contribute to nonattainment in the area. In addition, the exclusion of any of these four counties would be counter to EPA guidance given the level of projected growth in the areas, the relatively high readings of nearby monitors and the traffic and commuting patterns in these areas.

We oppose the use of spatial averaging to eliminate from the designation the Charlotte or Greensboro/ Winston-Salem $PM_{2.5}$ nonattainment areas. Given the magnitude of this public health problem, it makes sense to designate expansively rather than restrictively to maximize the protection of public health. Indeed, given the current understanding of the threat posed by $PM_{2.5}$, areas should be designated nonattainment for $PM_{2.5}$ at least as broadly as EPA has concluded to be necessary for ozone pollution. In addition, North Carolina lacks sufficient monitoring data to be able to conclude with any level of certainty that public health will be adequately protected with a spatial averaging approach. To the extent monitoring data exists, it suggests that the standard is exceeded or almost exceeded over large areas spanning several counties, rather than one "fluke" high reading. Further, elimination of these two major metro areas, resulting in the failure to promptly implement control strategies, would be shortsighted given that EPA will likely implement stricter $PM_{2.5}$ standards.

For the foregoing reasons, we recommend that North Carolina propose designation to EPA of the 23 counties indicated above to protect the public health of the several million citizens residing in these areas.

Very truly yours,

J. David Farren

CC: Governor Mike Easley
Jimmy Palmer, EPA Region 4
Stan Meiburg, EPA Region 4
Kay Prince, EPA Region 4
Michael Shore, Environmental Defense
Molly Diggins, Sierra Club
Ulla Britt-Reeves, Southern Alliance for Clean Energy

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An Equal Opportunity Affirmative Action Employer

December 23, 2003

Ms. Sheila Holman
NC Division of Air Quality
1641 Mail Service Center
Raleigh, NC 27699-1641

Dear Ms. Holman:

As Chair of the Unifour Air Quality Committee (UAQC), I am responding to North Carolina's potential recommendation for Particulate Matter (PM) 2.5 non-attainment boundaries as it relates to our area. The Unifour Area consists of Alexander, Burke, Caldwell and Catawba Counties. North Carolina currently operates and maintains one monitor that measures particulate matter in the Unifour. The monitor is located in the City of Hickory in Catawba County.

The NC Division of Air Quality (DAQ) held a public meeting in Hickory on December 3, 2003 to receive public comments on North Carolina's potential recommendation. We learned that Catawba County's monitor violates the new federal EPA Fine Particle PM 2.5 standard and that our area may be one of two areas in North Carolina that would be designated as non-attainment for PM 2.5. Several members of the UAQC were in attendance at the public meeting and appreciated the opportunity to learn more about the PM issue.

The UAQC met on December 9, 2003 and discussed the information that was presented at the public meeting. The primary concern expressed at the UAQC meeting focused on the location of the PM monitor. We accept that high concentrations of PM can be a health issue. We question whether the location of the monitor accurately reflects the true levels of particulate matter in the Unifour. Based upon our understanding of the PM speciation in our area, it appears that the monitor is located in an area that would result in a higher PM value than would be true for the Unifour overall.

Vehicle emission pollutants are a key component of PM. The monitor is located very near US Highway 321. This portion of US 321 has the highest annual average daily traffic (ADT) in the Unifour with the exception of Interstate 40. The ADT of 40,000 per day (NCDOT 1992 figures) is located in a congested area with numerous signal lights which results in many stop and start movements with the resulting high emissions. A high percentage of diesel truck traffic is included in the 40,000 ADT. Merchants Distributors Inc. is located just north of the monitor and virtually all trucks and traffic from Caldwell County flow past the monitor on US 321. Due to the

Catawba River, Caldwell County has only one access point into Catawba County and this is at the US 321 bridge near the monitor.

The monitor location is also located between the Norfolk-Southern Railroad mainline and the Caldwell County Railroad shortline. We feel that rail traffic also contributes to the high values. In addition, the monitor is located in one of the most dense industrial manufacturing centers in the area. Immediately adjacent to the monitor is a Duke Power substation, a chemical manufacturing company and several automobile and motorcycle repair facilities. We feel that all of these transportation facilities and land uses contribute to higher PM values in that specific area and does not accurately depict the true levels of PM in the overall Unifour area.

The UAQC also requests that other PM monitors be located in each of the other three counties in the Unifour. This would enable the DAQ and the UAQC to evaluate PM levels on a regional basis rather than having one location be the sole source determiner.

In conclusion, the PM non-attainment designation will arbitrarily punish a region that has recently experienced severe economic hardships. This is especially unfair when the rationale is based upon one monitor and the PM speciation is vague. However, since the EPA requires that a designation be made, we respectfully request that the smallest geographic non-attainment designation be made. As you know, our area has been a leader in air quality planning, especially with the formation of the Early Action Compact (EAC) for ozone. We look forward to working with the DAQ and EPA in developing solutions to help improve our air quality. We pledge to continue our proactive approach to both ozone and PM planning.

If I can be of further assistance please contact me.

Sincerely,

John Tippett

John Tippett, Chair
Unifour Air Quality Committee

cc: Unifour Air Quality Committee

Subject: PM2.5 Fine Particle Standard
Date: Tue, 23 Dec 2003 10:50:44 -0500
From: James McCoy <jmccoy@winstonsalem.com>
To: "'sheila.holman@ncmail.net'" <sheila.holman@ncmail.net>

December 23, 2003

To Sheila Holman
Via e-mail
sheila.holman@ncmail.net

PM2.5 Fine Particle Standard
Potential nonattainment designation for the Triad

Thank you for the opportunity to comment on the proposed fine particle attainment designation for the Triad area.

Background
It is our understanding that using the latest 2001-3 data, all of the Triad monitors for fine particles will comply except for the one in Lexington, Davidson County. We also understand that the overall trend in North Carolina is down for each year. The EPA policy for designation for the fine particle standard is set forth in a memorandum from Jeffery R. Holmstead, date-stamped April 1, 2003. Based upon that policy and the request for comment from the NCDENR Division of Air Quality we submit the following comments.

1. The Triad is in attainment because the Davidson County Monitor is a hot spot
The first step in determining a violation to the standard is to identify monitoring sites that do not meet the annual standard. If the site is a hot-spot site, then the 24-hour standard should be applied. Davidson county monitor does not match any of the others in the Triad and therefore is a hot-spot site. The monitor does comply with the 24-hour standard; therefore, the Triad is in compliance.

We understand that DAQ plans to investigate in order to determine the causes of the higher readings.

2. If an area is designated it should not follow EPA's presumptive designation of CMSA.
EPA guidance describes the rationale for designating areas based on the presumption that the pollution sources are centered in urban areas. The discussion centers on when and why the surrounding rural areas should be included in the nonattainment area. Since the Triad urban areas currently attain and the higher readings are found in the more rural county the Triad data does not fit the EPA's rationale for its presumptive designation. Therefore the presumptive designation guidance should not be followed in the Triad. The first option should be non-designation for Davidson County only since it appears that the county may attain in 2004. If any area should be designated nonattainment it should only be the local hot spot area, Davidson County. Since it is a hot-spot, no Triad area should be designated.

3. EPA should allow averaging for Forsyth County.
Spatial averaging has been allowed when there are multiple monitors within a county or city. This is the case in Forsyth County.

Sincerely,

James McCoy
Vice President of Public Policy and Communications
Winston-Salem Chamber of Commerce
P.O. Box 1408
Winston-Salem, NC 27102
(o) 336-728-9208
(m) 336-287-7828
(f) 336-721-2209

Subject: pm 2.5
Date: Wed, 31 Dec 2003 18:35:36 EST
From: Heelsrnum1@aol.com
To: daqpubliccomments@ncmail.net
CC: sheila.holman@ncmail.net

BLUE RIDGE ENVIRONMENTAL DEFENSE LEAGUE
332 Shady Grove Church Road Winston-Salem, NC 27107
Tel (336)769-0955 - Fax (336)769-9198 - E-mail: Heelsrnum1@aol.com
www.bredl.org

December 31, 2003

Mr. Keith Overcash, Director
NC Division of Air Quality
1641 Mail Service Center
Raleigh, NC 27699-1641

Re: Non-attainment Area Boundaries for PM 2.5

Dear Mr. Overcash:

On behalf of Blue Ridge Environmental Defense League members in the Triad, I urge the Division to recommend adoption by EPA of PM 2.5 boundaries that conform to the boundaries for the 8-hour ozone standard. PM 2.5, like ozone, is a regional problem and will require regional remedies.

Local Triad governments have already joined together in an Early Action Compact to reduce ozone. As strategies to reduce ozone are implemented, there will be opportunities to reduce particulate matter as well. Those counties, other than Davidson (where I live) which has a monitor in violation, undoubtedly contribute to PM 2.5 pollution. It is essential that they be included in the steps necessary to achieve compliance.

Thank you for the opportunity to comment.

Sincerely,

David Mickey
Blue Ridge Environmental Defense League
332 Shady grove Church Road
Winston-Salem, NC 27107

Appendix B

2002 Base case Emissions

Appendix B Table 1. VISTAS 2002 Base Case Emissions for the Unifour Area

UNIFOUR

SO2	Point	Area	Nonroad	Mobile	Total	
Alexander	40	252	9	186.6	488.0	1%
Burke	381	336	40	855.2	1613.0	2%
Caldwell	29	432	54	560.4	1075.4	1%
Catawba	82337	899	105	1409.3	84750.3	96%
					87926.8	

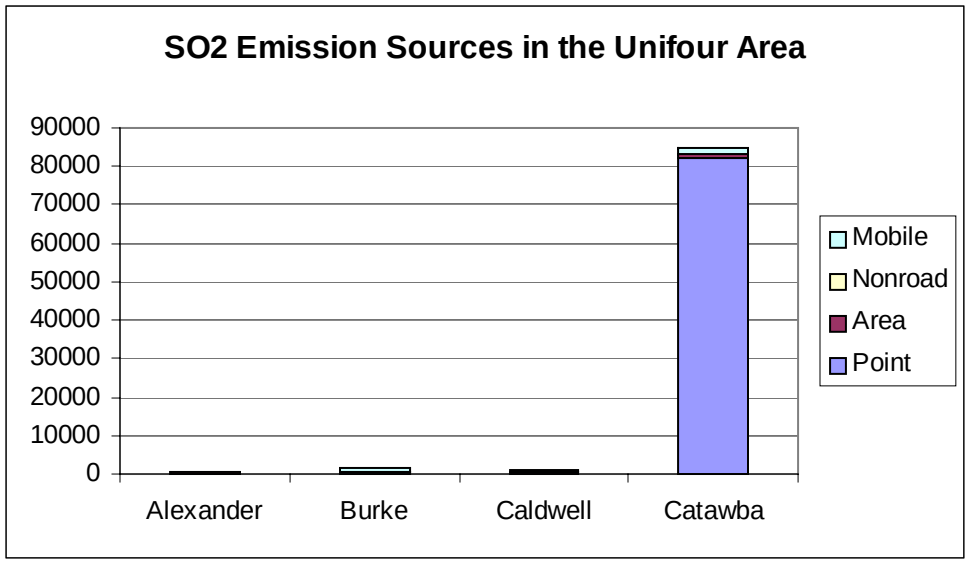
NOx	Point	Area	Nonroad	Mobile	Total	
Alexander	16	30	155	4610.9	4811.9	5%
Burke	287	165	665	21738.1	22855.0	23%
Caldwell	427	172	670	13863.9	15132.8	15%
Catawba	19692	388	1637	34927.3	56643.6	57%
					99443.3	

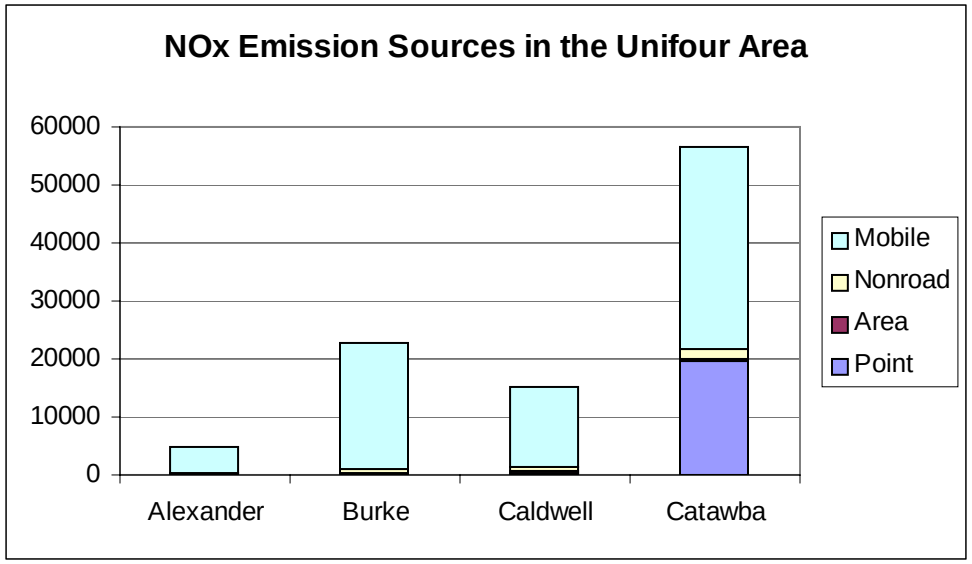
CO	Point	Area	Nonroad	Mobile	Total	
Alexander	11	1225	1292	29214.6	31742.8	5%
Burke	904	2953	4744	150355.1	158956.1	27%
Caldwell	489	3220	5134	95438.2	104281.2	18%
Catawba	1815	6051	14067	267536.5	289469.7	50%
					584449.9	

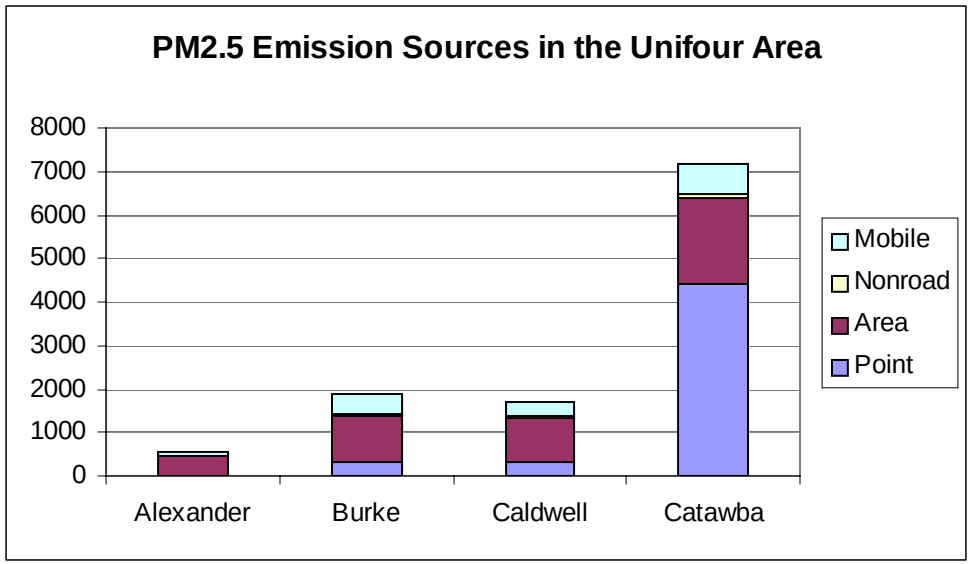
NH3	Point	Area	Nonroad	Mobile	Total	
Alexander	0	1262	0	162.9	1424.8	24%
Burke	4	450	1	788.4	1243.0	21%
Caldwell	0	458	1	522.8	981.7	17%
Catawba	15	811	1	1440.4	2267.5	38%
					5917.0	

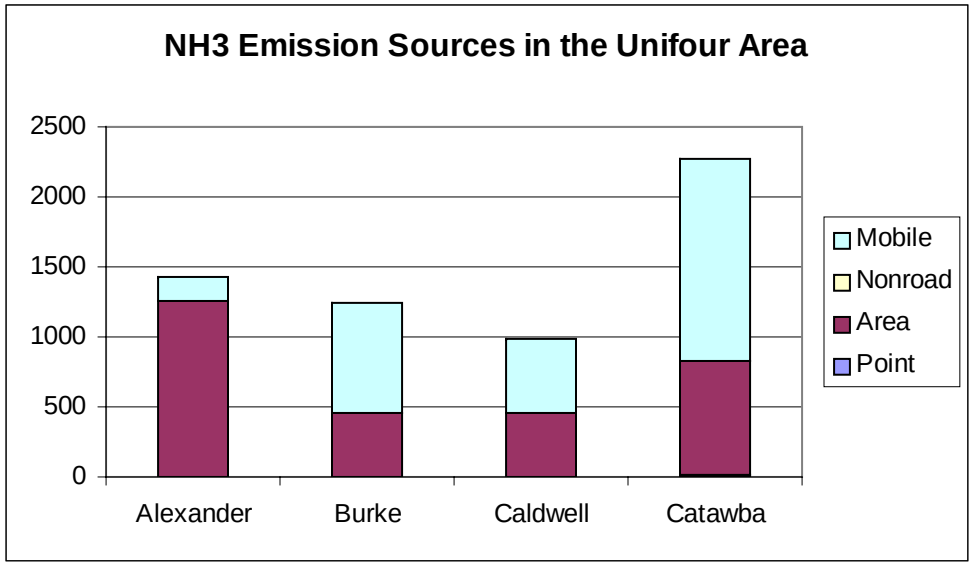
PM2.5	Point	Area	Nonroad	Mobile	Total	
Alexander	8	435	8	103.8	555.1	5%
Burke	332	1049	30	458.3	1870.1	17%
Caldwell	326	1021	41	298.7	1686.3	15%
Catawba	4436	1945	83	698.1	7162.2	64%
					11273.7	

VOC	Point	Area	Nonroad	Mobile	Total	
Alexander	414	2290	88	2504.2	5296.0	7%
Burke	1195	3900	396	3993.1	9484.6	13%
Caldwell	5937	4307	478	8452.3	19174.0	25%
Catawba	5796	10159	1033	24287.8	41275.8	55%
					75230.5	


SO2 Emission Sources in the Unifour Area
90000
80000
70000
60000
50000
40000
30000
20000
10000
0
Alexander
Burke
Caldwell
Catawba
Mobile
Nonroad
Area
Point


NOx Emission Sources in the Unifour Area
60000
50000
40000
30000
20000
10000
0
Alexander
Burke
Caldwell
Catawba
Mobile
Nonroad
Area
Point


PM2.5 Emission Sources in the Unifour Area
8000
7000
6000
5000
4000
3000
2000
1000
0
Alexander
Burke
Caldwell
Catawba
Mobile
Nonroad
Area
Point


NH3 Emission Sources in the Unifour Area
2500
2000
1500
1000
500
0
Alexander
Burke
Caldwell
Catawba
Mobile
Nonroad
Area
Point

Appendix B Table 2. VISTAS 2002 Base Case Emissions for the Triad Area

TRIAD

SO2	Point	Area	Nonroad	Mobile	Total	
Alamance	157	483	67	1045	1752.2	1%
Davidson	647	428	109	1343	2527.0	2%
Davie	16	90	15	395	516.2	0%
Forsyth	4344	1317	168	2563	8392.5	7%
Guilford	495	1519	385	3381	5780.3	5%
Randolph	136	476	66	1132	1810.6	1%
Stokes	103200	204	21	344	103768.5	83%
Yadkin	9	204	18	432	663.9	1%
					125211.2	

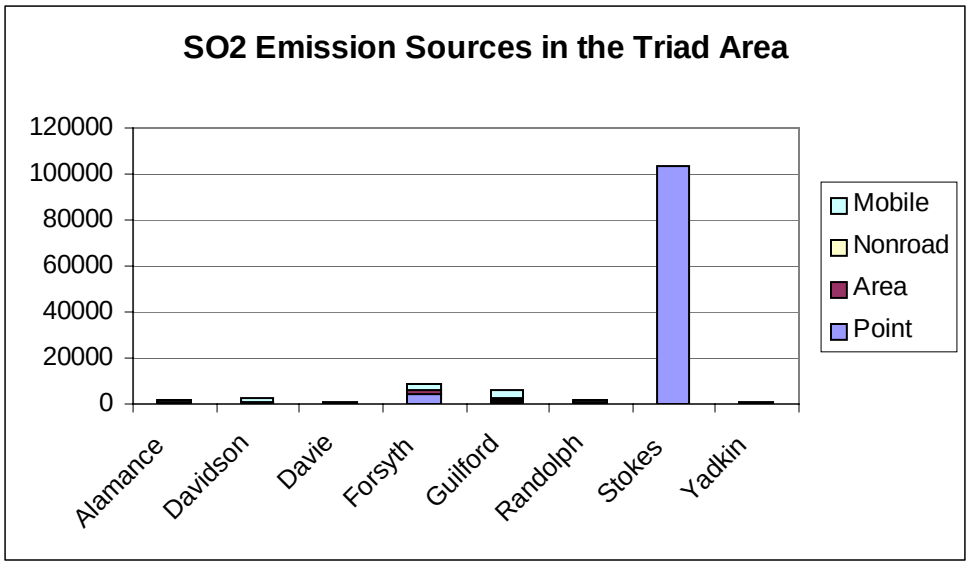
NOx	Point	Area	Nonroad	Mobile	Total	
Alamance	235	576	981	25712	27504.0	8%
Davidson	4510	323	1586	33642	40061.4	12%
Davie	66	40	196	19527	19829.3	6%
Forsyth	2313	978	2090	62133	67514.4	20%
Guilford	591	2120	4462	82064	89237.0	26%
Randolph	136	297	963	28283	29678.4	9%
Stokes	44927	47	267	8462	53702.6	16%
Yadkin	10	33	205	11251	11498.7	3%
					339025.8	

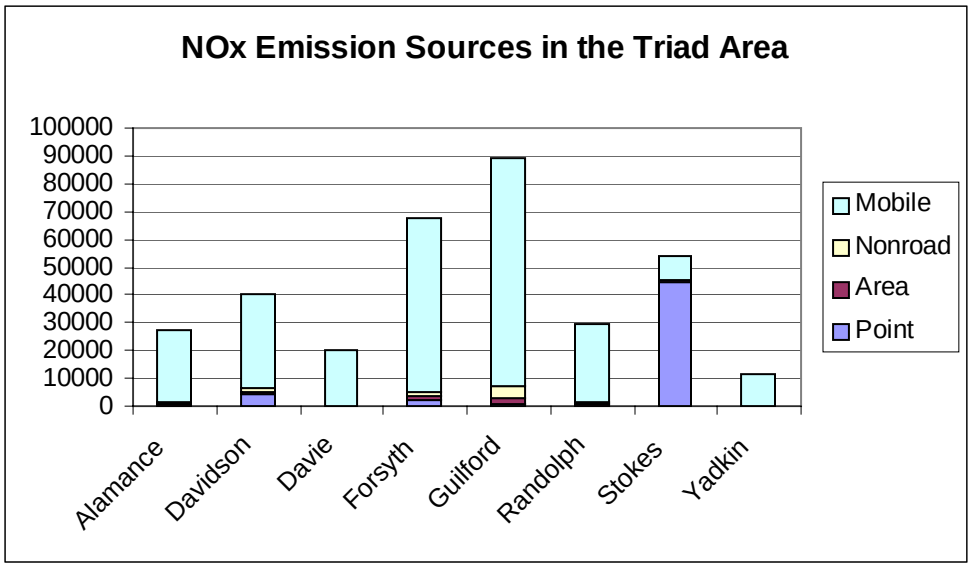
CO	Point	Area	Nonroad	Mobile	Total	
Alamance	232	4343	8817	205536	218928.4	11%
Davidson	1203	5661	9360	234573	250796.3	13%
Davie	61	1968	2153	68882	73063.0	4%
Forsyth	792	7725	26546	430015	465077.5	23%
Guilford	500	11255	55140	570662	637556.7	32%
Randolph	161	6073	8171	196909	211314.3	11%
Stokes	1359	1778	2420	54003	59560.5	3%
Yadkin	5	2485	1977	73084	77550.7	4%
					1993847.3	

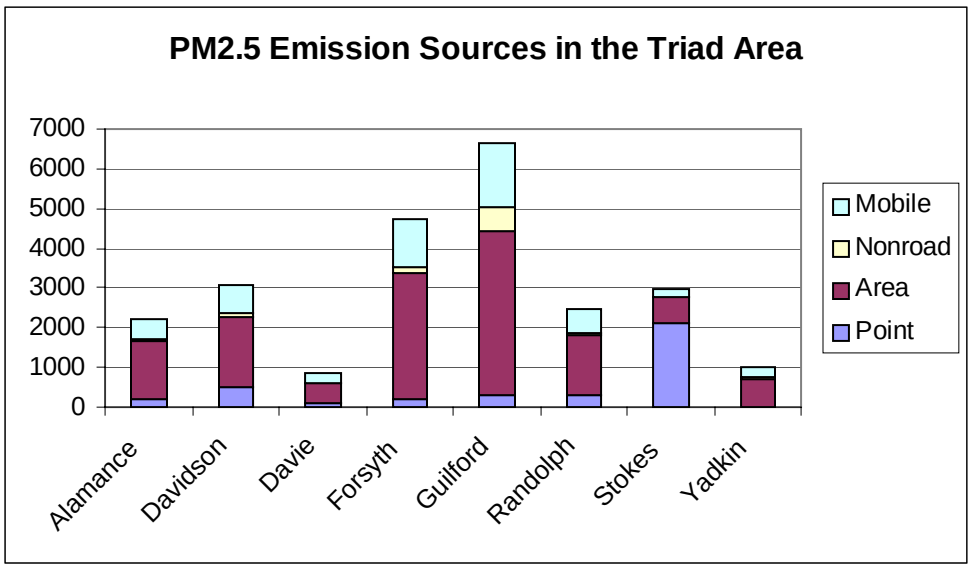
NH3	Point	Area	Nonroad	Mobile	Total	
Alamance	33	866	1	1105	2004.7	10%
Davidson	8	648	1	1251	1907.4	10%
Davie	2	396	0	340	737.8	4%
Forsyth	17	581	2	2690	3290.0	17%
Guilford	15	1064	4	3576	4658.0	24%
Randolph	0	4133	1	1053	5186.6	26%
Stokes	8	343	0	296	647.0	3%
Yadkin	0	972	0	371	1343.8	7%
					19775.2	

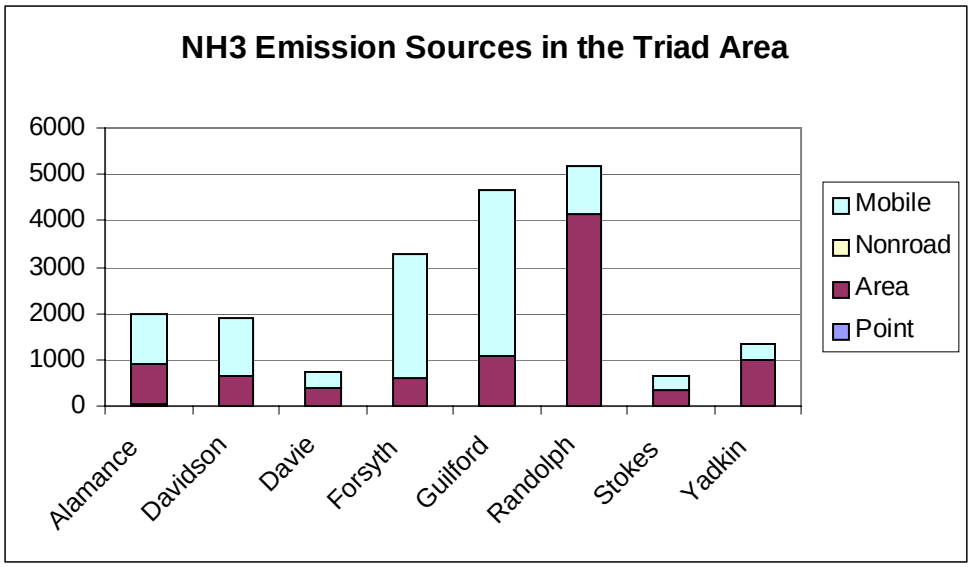
PM2.5	Point	Area	Nonroad	Mobile	Total	
Alamance	192	1459	53	501	2204.1	9%
Davidson	516	1765	74	715	3070.1	13%
Davie	81	518	13	221	833.2	3%
Forsyth	198	3168	144	1236	4746.2	20%
Guilford	295	4129	599	1621	6643.5	28%
Randolph	287	1532	52	603	2473.5	10%
Stokes	2126	625	17	192	2960.3	12%
Yadkin	9	714	17	243	983.1	4%
					23913.9	

VOC	Point	Area	Nonroad	Mobile	Total	
Alamance	477	4823	572	18431	24301.9	10%
Davidson	4657	7758	684	19416	32514.7	14%
Davie	485	1944	285	4808	7521.3	3%
Forsyth	3496	10175	1632	39993	55295.8	23%
Guilford	5396	18091	3470	53667	80624.0	34%
Randolph	1335	6061	524	16347	24267.4	10%
Stokes	198	1161	204	4395	5957.9	3%
Yadkin	82	1232	123	5284	6721.3	3%
					237204.3	


SO2 Emission Sources in the Triad Area
120000
100000
80000
60000
40000
20000
0
Alamance
Davidson
Davie
Forsyth
Guilford
Randolph
Stokes
Yadkin
Mobile
Nonroad
Area
Point


NOx Emission Sources in the Triad Area
100000
90000
80000
70000
60000
50000
40000
30000
20000
10000
0
Alamance
Davidson
Davie
Forsyth
Guilford
Randolph
Stokes
Yadkin
Mobile
Nonroad
Area
Point


PM2.5 Emission Sources in the Triad Area
7000
6000
5000
4000
3000
2000
1000
0
Alamance
Davidson
Davie
Forsyth
Guilford
Randolph
Stokes
Yadkin
Mobile
Nonroad
Area
Point


NH3 Emission Sources in the Triad Area
6000
5000
4000
3000
2000
1000
0
Alamance
Davidson
Davie
Forsyth
Guilford
Randolph
Stokes
Yadkin
Mobile
Nonroad
Area
Point

Appendix C

Wind Trajectory Analysis for Hickory and Lexington Monitors

Catawba and Davidson Counties HYSPLIT Back-Trajectory Analysis to Determine $PM_{2.5}$ Source Regions

Michael A. Abraczinskas, K. Wyat Appel, George M. Bridgers, Scott A. Jackson
North Carolina Division of Air Quality
Raleigh, NC

March 8, 2004

1. Introduction

The purpose of this analysis is to access the source regions, in particular according to state boundaries, which contribute significantly to elevated daily Fine Particulate Matter ($PM_{2.5}$) levels in North Carolina. The North Carolina Division of Air Quality (NC DAQ) has identified a specific need to know the regions, specifically according to state boundaries, which contribute significantly to primary and secondary $PM_{2.5}$ in North Carolina. The Environmental Protection Agency (EPA) has established standards for $PM_{2.5}$ at 15 $\mu g/m^3$ for the annual standard and 65 $\mu g/m^3$ for the 24-hour standard.

2. Methodology

An analysis of the National Oceanic and Atmospheric Administration Air Resource Laboratory (NOAA ARL) HYbrid Single-Particle Lagrangian Integrated Trajectory (HYSPLIT; Draxler and Rolph, 2003) model back trajectories was performed in order to access the sources that contribute to elevated $PM_{2.5}$ levels in North Carolina. An analysis of observed 24-hour average $PM_{2.5}$ values throughout from North Carolina's $PM_{2.5}$ monitor network determined that the two monitors with the highest annual $PM_{2.5}$ values in North Carolina are located in Catawba and Davidson Counties. The monitors located in these counties are Federal Reference Method (FRM) monitors and sample $PM_{2.5}$ every three days. Because these monitors had the two highest annual-average $PM_{2.5}$ values, the monitors located in these two counties were chosen as the endpoints for the HYSPLIT back trajectories. The specific location of Catawba County monitor is 35.73°N, 81.36°W, while the Davidson County monitor is located at 35.81°N, 80.26°W.

$PM_{2.5}$ data from January 1, 1999 through June 30, 2002 was analyzed to identify days when the 24-hour average $PM_{2.5}$ value was greater than or equal to 27.9 $\mu g/m^3$. This concentration was chosen since it represents the midpoint of the yellow AQI range (15.5$\mu g/m^3$ – 40.4$\mu g/m^3$) for $PM_{2.5}$, and conversations with EPA representatives have indicated that values above this point could pose a significant health risk. From the three and half years of available $PM_{2.5}$ data from those two monitors, there were a total of 41 days from the Catawba County monitor and 32 days from the Davidson County monitor where the 24-hour average $PM_{2.5}$ value was greater than or equal to 27.9 $\mu g/m^3$. The dates and observed 24-hour average $PM_{2.5}$ of these days are shown in Table 1.

For the days indicated above, HYSPLIT back trajectories were run. Thirty-six hour back trajectories ending at 17UTC, noon Eastern Daylight Time, were run separately for each monitor using the model vertical velocity option. The trajectories were run at three separate heights, specifically 10, 300 and 1000 meters above ground level (AGL). The 10 and 300-meter trajectory levels are heights of lower level circulations, while the 1000-meter trajectory level represents the top of the mixed layer and is generally a transport level. The choice of these levels is based on the experience of NC DAQ meteorologists, who use the HYSPLIT model trajectories as a routine part of their ozone and $PM_{2.5}$ forecast process. 17UTC (Noon EDT) was chosen as the ending time of the trajectories because it represents a time when significant mixing of the boundary and residual layers has occurred, but significant contributions from local-secondary production has not occurred.

3. Results

Table 1 shows the results of the analysis of the back trajectories. Columns 4 and 5 in Table 1 identify the primary and secondary source regions. The primary source region identifies the most significant region(s) contributing to the $PM_{2.5}$ in that county on that day, as determined by the meteorologists. The secondary source region identifies a region(s) that, while is not a primary contributor, does appear to contribute to a significant portion of the $PM_{2.5}$ on

that day. Note that while there is always a primary source identified for a given day, there may not be secondary source identified.

Figures 1-4 show composites of the back trajectories originating from the Catawba County site at 10, 300, and 1000 meters AGL for those days when $PM_{2.5}$ concentrations were high. Note that the trajectories are relatively short, indicating regional stagnation and recirculation. Figures 5-8 show similar composites for the Davidson County site.

Analysis of the HYSPLIT back trajectories showed that on the majority of the days the primary source region of the back trajectory was North Carolina. Table 2 shows the distribution of both primary and secondary source regions for the trajectories for both Catawba and Davidson counties. Of the 41 days for which back trajectories were run for the Catawba County monitor, 31 (76%) of them were considered to have North Carolina as the primary source region (Figure 9). Tennessee and Virginia were considered to be primary sources on 9 (22%) and 6 (15%) days, respectively. Significant secondary sources were South Carolina, Tennessee, and Georgia, which contributed on 9 (22%), 8 (20%), and 7 (17%) days respectively (Figure 10). Figure 11 shows the percent of the days in which each region was identified as either a primary or secondary source, or both.

There were 27 (66%) days when North Carolina was identified to be the only primary source region, while there were 4 (10 %) days when North Carolina and another state(s) was identified to be the source region, and 10 (24%) days when North Carolina was not identified as part of the source region. This result is significant, since it indicates that nearly 35 percent of the days when $PM_{2.5}$ was greater than or equal to 27.9 $\mu g/m^3$, back-trajectory analysis indicates transport from neighboring states, in particular Tennessee, Virginia, Georgia and South Carolina.

For the Davidson county monitor, 26 (81%) of the 31 days for which the trajectories were run indicated North Carolina as the primary source (Table 2, Figure 12). Note that there was one day for which a trajectory could not be run due to missing data. Other significant primary sources were Virginia, with 7 (23%) days, and South Carolina and Tennessee, each with 4 (13%) days. Significant secondary sources were South Carolina, Tennessee, and Virginia, each with 5 (16%) days, and Ohio with 4 (13%) days (Figure 13). Of the 31 days for which the back trajectories were run, 17 (55%) of them indicated North Carolina as the only primary source region, while on 14 (45%) days trajectories indicated another state as the primary source region. As with the Catawba County analysis, there were a significant percentage of days when trajectory analysis indicates transport from neighboring states on days when $PM_{2.5}$ was greater than or equal to 27.9 $\mu g/m^3$. The percent of days in which each region contributed as a primary or secondary source (or both), is shown in Figure 14.

Another interesting analysis is examining the 24-hour average $PM_{2.5}$ value and the associated primary source region. The trajectories run for each monitor were divided into an upper third, a middle third, and a lower third based on the observed $PM_{2.5}$ concentration. For the Catawba County monitor the upper third consists of a $PM_{2.5}$ range between 32.8 and 54.7 $\mu g/m^3$, the middle third from 30.0 and 32.7 $\mu g/m^3$, and the lower third from 28.1 to 29.6 $\mu g/m^3$. Note that there are 14 days included in the upper and middle thirds, and only 13 days included in the bottom third (Tables 3-5).

For the upper third of the days for the Catawba County monitor site, North Carolina was the primary source on 10 days, followed by Tennessee and Virginia with 2 days each. South Carolina, Tennessee, Virginia and Georgia are common secondary source regions. For total days (primary and secondary combined), North Carolina was identified on 10 days, followed by Tennessee on 5 days and South Carolina, Virginia, and Georgia each on 3 days. The results for the middle and lower third of the days are similar to those for the upper third. The same analysis for the Davidson County monitor site yields similar results. Note also that 11 days are included in the upper and middle thirds, while only 10 days are included in the bottom third.

Another analysis that was performed using the back trajectories was to quantify the residence time that the trajectories spent in each state, other than North Carolina. This was accomplished by analyzing each trajectory individually and recording the amount of time the trajectory spent in each individual state. Since trajectories were run at multiple heights, to avoid double counting, only the maximum time that all trajectory heights spent in any one state are reported. Obviously, since the end points of the trajectories are within North Carolina, some time for each trajectory must be spent in North Carolina. The results of the analysis for Davidson and Catawba counties are

shown in Tables 6 and 7 respectively. Note that this analysis contains seven events in 2002 for Catawba County and four events in 2002 for Davidson County that are not included in the previous analysis of the trajectories.

For Catawba County, the maximum number of hours the trajectories spent in another state for all events was 258 in Tennessee (recall that an event is a day where the PM2.5 concentration exceeded 27.9 $\mu g/m^3$ at the monitor in that county). This represents 15.6 percent of the total trajectory time (36 hours/event * 46 events = 1656), with an average of 18.4 hours per event. The average represents the average hours the trajectory spent in each state for only those events where the trajectory spent at least some amount of time in the state (zero hour events are not included in the average). Other results include 207 hours (12.5% of total) for South Carolina, with an average of 18.8 hours per event, and 201 hours (12.1% of total) for Kentucky, with an average of 14.4 hours per event.

For Davidson County, the maximum number of hours the trajectories spent in another state for all events was 278 in South Carolina. This was 22.7 percent of the total trajectory time (36 hours/event * 34 days), with an average of 19.9 hours spent in South Carolina for each event. Virginia had a total of 275 hours (22.5% of total) with an average of 14.5 hours per event. Tennessee had a total of 166 hours (13.6 % of total) with an average of 15.1 hours per event.

4. Discussion

Analysis of HYSPLIT back trajectories from two $PM_{2.5}$ monitor locations in North Carolina on days when 24-hour average $PM_{2.5}$ levels were 27.9 $\mu g/m^3$ or greater indicates that while North Carolina is the primary source region for the majority of those days, states neighboring and near North Carolina (including Kentucky, West Virginia, and Ohio) were shown through the trajectory analysis to be potential sources of transported pollution. Back trajectories run from points in Catawba and Davidson Counties in North Carolina show a significant percentage of days for which neighboring states could be considered primary sources for transported pollution. Significant secondary states include South Carolina, Tennessee, and Virginia. Other states with slightly fewer days when back trajectories indicated potential transport include Georgia, Kentucky, and the Ohio Valley.

REFERENCES

Draxler, R.R. and Rolph, G.D., 2003. HYSPLIT (HYbrid Single-Particle Lagrangian Integrated Trajectory) Model access via NOAA ARL READY Website (http://www.arl.noaa.gov/ready/hysplit4.html). NOAA Air Resources Laboratory, Silver Spring, MD.

County	Date	PM 2.5	Primary	Secondary	Notes
Davidson	1/1/2000	46.8	NC (Millenium Celebration)		**Low**: NC (calm conditions) and CLT; **Mid and Upper**: Upstate SC and GA
Davidson	8/13/1999	44.8	NC / SC		**Low**: NC and Eastern SC; **Mid:** SC and NC; **Upper**: NC and Upstate SC
Davidson	6/21/2001	41.6	NC	Central SC	**Low and Mid**: NC and Central SC; **Upper:** NC, Northeast TN and SW Virginia (minor)
Davidson	7/23/1999	40.5	E. KY, SW. VA	Ohio Valley	**Low and Mid:** SW Virginia and E. KY; **Upper:** long transport from Ohio Valley
Davidson	1/5/2002	39.2	NC / TN		**Low**: NC and NE TN; **Mid**: NC and Eastern TN; **Upper:** TN
Davidson	7/17/1999	38.9	NC	Central SC	**Low**: NC (CLT); **Mid**: NC and SC; **Upper**: NC and SW Virginia
Davidson	12/11/2000	38.7			Missing Data
Davidson	10/21/2000	37.7	SW. VA / E. TN	NC	**Low**: NC and Upstate SC; **Mid**: Eastern TN: **Upper**: SW VA and Eastern TN
Davidson	7/18/2001	37.7	NC / SC	SE. TN / N. GA	**Low**: SC and some NC; **Mid**: NC and Northern GA; **Upper**: NC, Eastern TN, N. GA
Davidson	7/5/1999	36.6	NC	Eastern TN (significant)	**Low**: All in NC; **Mid**: Origin in NE TN; **Upper**: Crosses KY, WV, VA
Davidson	6/2/2000	34.9	NC	Eastern TN	Missing Data
Davidson	6/29/2000	34.1	NC / N. GA / N. SC	Aloft from Ohio Valley	**Low**: NC, SC, and GA; **Mid**: NC and GA (ATL); **Upper**: Ohio Valley
Davidson	8/7/1999	33.8	NC	SW. VA	**Low**: NC; **Mid**: NC and SW VA; **Upper**: NC (CLT)
Davidson	7/2/2000	32.7	NC (CLT)	North Central SC	**Low**: Completely in NC; **Mid**: NC and Upstate SC; **Upper**: NC and Upstate SC
Davidson	8/28/1999	32.1	NC	SW. VA (less sig)	**Low**: NC; **Mid**: NC and SW VA; **Upper** NC and SW VA
Davidson	11/11/1999	31.8	TN		**Low, Mid, and Upper**: Long transport from Tennessee
Davidson	8/16/2000	31.2	NC / VA	Ohio Valley	Missing Data
Davidson	8/19/1999	31.1	NC / VA	Ohio Valley	**Low**: NC, VA, and WV; **Mid**: Eastern VA; **Upper**: NC, SW VA, and Ohio Valley
Davidson	10/27/2000	31.1	VA		**Low, Mid, and Upper**: Virginia
Davidson	1/21/1999	31.0	NC (CLT, I-85)	Upstate SC	**Low**: All in NC; **Mid and Upper**: long transport from the west
Davidson	11/8/2000	30.7	NC		**Low:** Short over NC; **Mid and Upper**: Long transport from the south (SC, GA, FL)
Davidson	7/20/1999	30.6	NE. TN, SW. VA, NC		**Low**: NC and Upstate SC; **Mid**: E. TN and NC **Upper**: VA, KY, and TN
Davidson	8/16/1999	30.1	NC		**Low, Mid, and Upper**: All completely in NC (short trajectories)
Davidson	6/11/1999	29.8	NC (PP, I-40)	Tidewater of VA (minimal)	**Low, Mid, and Upper** all over NC and originate in the Atlantic
Davidson	2/9/2000	29.4	NC	I-95 Virginia	**Low**: NC and VA; **Mid**: NC and VA; **Upper**: NC (over the mountains)
Davidson	5/30/1999	29.1	NC (CLT)	NC	**Low, Mid, and Upper** all in NC and very northern SC
Davidson	8/8/2001	29.0	Ohio Valley	WV / VA / NC	**Low**: NC and SW VA; **Mid**: VA and WV; **Upper:** VA, WV and Ohio Valley
Davidson	10/30/1999	28.5	NC		Missing Data
Davidson	8/17/2001	28.5	NC / SC	GA (ATL)	**Low**: NC (CLT) and SC; **Mid**: Mostly SC, some NC; **Upper**: NC and GA (ATL)
Davidson	7/8/1999	28.4	NC	Upstate SC, Eastern TN (3rd)	**Low**: NC; **Mid**: Upstate SC; **Upper**: NE Tennessee
Davidson	10/18/2000	28.0	NC	Eastern TN	**Low**: Completely in NC; **Mid**: Completely in NC; **Upper**: long transport from TN
Davidson	8/14/2001	27.9	NC / VA	WV	**Low**: NC and SW VA; **Mid**: NC, Central VA, and WV; **Upper**: VA, WV, and Ohio Valley

Table 1. Days when observed $PM_{2.5}$ values in Catawba and Davidson Counties was above 27.8 ug/m^3. Indicated in the table is the county, date, $PM_{2.5}$ observed value, the primary and secondary sources as determined by the NC DAQ meteorologists, and any notes made by the meteorologists concerning that days trajectories. Purple shading indicates observed values greater than 39.9 ug/m^3, red shading between 35.0 ug/m^3 and 39.9 ug/m^3, orange shading between 30.0 ug/m^3 to 34.9 ug/m^3, yellow shading between 27.9 ug/m^3 and 29.9 ug/m^3. Blue shading indicates known fire events in North Carolina. On days with missing EDAS data, surface maps were used to determine the source region(s).

County	Date	PM 2.5	Primary	Secondary	Notes
Catawba	11/2/2000	54.7	NC (Fire Event)	Ohio Valley	**Low and Mid**: Completely in NC; **Upper**: Long transport from the Ohio Valley
Catawba	11/8/2000	50.1	NC (Fire Event)	SC / E. GA / FL (minor)	**Low, Mid, and Upper**: Short trajectories in NC, then long transport from the south
Catawba	1/21/1999	41.0	NC	Upstate, North Central GA	**Low**: all in NC; **Mid**: NC, Upstate SC, and N. GA; **Upper**: long transport from the southwest
Catawba	6/21/2001	40.0	NC	SC (minor)	**Low**: NC and Upstate SC; **Mid**: Completely NC; **Upper**: All NC except for couple hours in TN
Catawba	10/21/2000	38.0	NC	N. SC and E. TN	**Low**: NC and Upstate SC; **Mid**: Eastern TN and N. GA; **Upper**: Central TN and Northern MS
Catawba	10/27/2000	36.7	SW. VA / WV	Southern Ohio Valley	**Low**: SW VA and Eastern KY; **Mid and Upper**: SW VA, Western WV, Southern Ohio Valley
Catawba	7/23/1999	36.1	NE. TN / OV / SW. VA		**Low and Mid**: Northern TN; **Upper**: long transport from the northwest
Catawba	8/7/2000	34.2	NC	Eastern TN, GA (ATL)	**Low and Mid**: NC and Northern GA; **Upper**: Eastern TN and Northern GA
Catawba	3/31/1999	30.0	NC	Northern SC	**Low**: NC; **Mid**: NC, minor SC and VA; **Upper**; Upstate SC
Catawba	2/9/2000	33.5	NC	Eastern TN, Northern GA	**Low**: NC and very minor VA; **Mid**: NC and very minor SC; **Upper**: NC, E. TN, and N. GA
Catawba	6/5/1999	33.2	NC		**Low, Mid, and Upper**: NC (CLT and Triad)
Catawba	8/7/1999	33.1	NC	SW. VA	**Low and Mid**: Mostly NC, few hours in SW VA; **Upper**: Mostly in NC, few hours in NE TN
Catawba	1/1/2000	33.0	Millenium		**Low, Mid, and Upper**: NC and transport from the west
Catawba	2/21/2001	32.8	Eastern TN	Northern GA	**Low**: Eastern TN and Northern GA; **Mid**: NE TN, SW VA (minor), and TN; **Upper**: TN and KY
Catawba	7/8/2000	32.7	NC		**Low and Mid**: Completely in NC; **Upper**: NC and Upstate SC (minor, mostly NC)
Catawba	7/17/1999	32.3	NC	Upstate SC	**Low and Mid**: NC and Upstate SC; **Upper**: All in NC
Catawba	8/2/2001	32.0	NC		**Low, Mid, and Upper**: Trajectories completely in NC
Catawba	6/8/1999	31.7	NE. TN / SW. VA / KY		**Low**: NE TN and SW VA; **Mid and Upper**: NE TN, SW VA, KY;
Catawba	8/16/1999	31.1	NC		**Low and Mid**: Completely in NC; **Upper**: NC and Upstate SC (CLT area)
Catawba	8/13/1999	31.0	NC	SC	**Low**: Completely in NC; **Mid**: NC and Upstate SC (CLT); **Upper**: NC
Catawba	6/2/2000	31.0	Eastern TN	N. GA and NC	missing data
Catawba	7/20/1999	30.9	NC / E. TN		**Low**: Completely in NC; **Mid and Upper**: Eastern TN
Catawba	5/3/2000	30.8	NC	VA and SC	**Low**: majority NC and VA; **Mid**: NC (half), VA (half); **Upper**: mostly NC, minor SC
Catawba	7/23/2000	30.6	NC		**Low, Mid, and Upper**: Completely in NC
Catawba	9/7/2001	30.4	NC	NE. TN	**Low and Mid**: Completely in NC; **Upper**: NC and NE Tennessee
Catawba	8/26/2001	30.2	NC	Eastern TN and SC (minor)	**Low**: Completely in NC; **Mid**: Mostly in NC, few hours in Upstate SC; **Upper**: Eastern TN
Catawba	1/30/1999	30.0	NC		**Low, Mid, and Upper**: NC and VA (few hours);
Catawba	2/17/1999	30.0	NC / N. GA / Upstate SC		missing data
Catawba	8/19/1999	29.6	Ohio Valley / SW. VA		**Low**: NC, SW VA, and WV; **Mid**: NC, VA, and WV; **Upper**: NC, NE TN, SW VA, and E. KY
Catawba	7/2/2000	29.4	NC	SC	**Low**: NC (CLT); **Mid**: NC and Upstate SC; **Upper**: NC and Central SC
Catawba	7/18/2001	29.3	NC	SE. TN and N. GA	**Low**: NC and Northern GA; **Mid and Upper**: Southeast TN and Northest MS
Catawba	7/5/2000	29.1	Eastern and Central TN		**Low, Mid, and Upper**: Transport from Central and Eastern Tennessee
Catawba	11/18/2001	29.0	NC	VA / Ohio Valley (upper)	**Low and Mid**: NC and VA; **Upper**: SW VA, KY, and Southern Ohio Valley
Catawba	8/10/1999	28.4	NC	E. TN	**Low and Mid**: All in NC; **Upper**: transport from KY and TN
Catawba	6/4/2002	28.4	SC	NC	**Low**: Upstate SC and NC; **Mid**: SC and NC; **Upper**: SC and NC
Catawba	7/5/1999	28.2	NE. TN	SW. VA / KY	**Low**: NE TN; **Mid**: NE TN and SW VA; **Upper**: SW VA and KY
Catawba	6/11/2000	28.2	NC / NE. TN / SC		**Low and Mid**: Majority Upstate SC, some NC; **Upper**: NC and some NE TN and Upstate SC
Catawba	8/16/2000	28.2	NE. TN / SW. VA	KY	missing data
Catawba	10/18/2000	28.2	NC	NE and Central TN	**Low**: Completely in NC; **Mid and Upper**: Eastern and Central TN
Catawba	8/4/1999	28.1	NC / VA		**Low, Mid, and Upper**: NC and SW VA
Catawba	9/31/01	28.1	NC	SW. VA and E. KY	**Low and Mid**: Completely in NC; **Upper**: SW VA and SE KY

Table 1 Continued

Table 2. Number of days that the HYSPLIT back trajectories indicated a region as a primary or secondary source for locations in Catawba and Davidson Counties in North Carolina.

Catawba County					***Davidson County***			
State/Area	**Primary (days)**	**Secondary (days)**	**Total (days)**		**State/Area**	**Primary (days)**	**Secondary (days)**	**Total (days)**
North Carolina	31	2	33		North Carolina	26	2	28
South Carolina	3	9	12		South Carolina	4	5	9
Tennessee	9	8	17		Tennessee	4	5	9
Virginia	6	5	11		Virginia	7	5	12
Georgia	1	7	8		Georgia	1	2	3
Kentucky	1	3	4		Kentucky	1	0	1
Ohio Valley	2	3	5		Ohio Valley	1	4	5
NC Only	27				NC Only	17		
NC + Other	4				NC + Other	9		
No NC	10				No NC	5		

Table 3. Number of days in the highest one-third of 24-hour average $PM_{2.5}$ values for all days for which HYSPLIT trajectories were run. Specific $PM_{2.5}$ values were 32.8 – 54.7 $\mu g/m^3$ for Catawba County and 34.9 – 46.8 $\mu g/m^3$ for Davidson County.

Catawba County – Upper Third					***Davidson County – Upper Third***			
State/Area	**Primary (days)**	**Secondary (days)**	**Total (days)**		**State/Area**	**Primary (days)**	**Secondary (days)**	**Total (days)**
North Carolina	10	0	10		North Carolina	8	1	9
South Carolina	0	3	3		South Carolina	2	2	4
Tennessee	2	3	5		Tennessee	2	3	5
Virginia	2	1	3		Virginia	2	0	2
Georgia	0	3	3		Georgia	0	1	1
Kentucky	0	0	0		Kentucky	1	0	1
Ohio Valley	1	1	2		Ohio Valley	0	1	1

Table 4. Number of days in the middle one-third of 24-hour average $PM_{2.5}$ values for all days for which HYSPLIT trajectories were run. Specific $PM_{2.5}$ values were 30.0 – 32.8 μg/m^3 for Catawba County and 30.6 – 34.1 μg/m^3 for Davidson County.

Catawba County – Middle Third					***Davidson County – Middle Third***			
State/Area	**Primary (days)**	**Secondary (days)**	**Total (days)**		**State/Area**	**Primary (days)**	**Secondary (days)**	**Total (days)**
North Carolina	10	0	10		North Carolina	9	0	9
South Carolina	1	4	5		South Carolina	1	2	3
Tennessee	3	2	5		Tennessee	2	0	2
Virginia	2	1	3		Virginia	4	2	6
Georgia	1	0	1		Georgia	1	0	1
Kentucky	1	0	1		Kentucky	0	0	0
Ohio Valley	1	0	1		Ohio Valley	0	3	3

Table 5. Number of days in the lowest one-third of 24-hour average $PM_{2.5}$ values for all days for which HYSPLIT trajectories were run. Specific $PM_{2.5}$ values were 28.1 – 29.6 μg/m^3 for Catawba County and 27.9 – 30.1 μg/m^3 for Davidson County.

Catawba County – Lower Third					***Davidson County – Lower Third***			
State/Area	**Primary (days)**	**Secondary (days)**	**Total (days)**		**State/Area**	**Primary (days)**	**Secondary (days)**	**Total (days)**
North Carolina	8	1	9		North Carolina	9	2	11
South Carolina	2	1	3		South Carolina	1	1	2
Tennessee	4	3	7		Tennessee	0	1	1
Virginia	3	3	6		Virginia	1	3	4
Georgia	0	1	1		Georgia	0	1	1
Kentucky	0	2	2		Kentucky	0	0	0
Ohio Valley	1	1	2		Ohio Valley	1	0	1

Table 6. Total number of hours back trajectories spent in states other than North Carolina for all events for the Davidson County $PM_{2.5}$ monitor. Hours are based on the maximum of all trajectory heights, and therefore do not double count. Percent of total hours based on maximum hours of all events (1224 hours). Average hours based on average of each event, excluding zero hour events.

Davidson County									
Date	***PM2.5***	***SC (hrs)***	***GA (hrs)***	***TN (hrs)***	***VA (hrs)***	***KT (hrs)***	***WV (hrs)***	***OH (hrs)***	***MAX***
1/21/1999	31.0	12	8						36
5/30/1999	29.1	20							36
6/11/1999	29.8								36
7/5/1999	36.6				6	16	12		36
7/8/1999	28.4	23	10	20					36
7/17/1999	38.9	22			22				36
7/20/1999	30.6			22	12	11			36
7/23/1999	40.5			18	13		7	4	36
8/7/1999	33.8				7				36
8/13/1999	44.8	23							36
8/16/1999	30.1								36
8/19/1999	31.1				28		13	8	36
8/28/1999	32.1				25				36
11/11/1999	31.8		15	9					36
1/17/2000	N/A								36
2/9/2000	29.4				13				36
6/2/2000	34.9								36
6/29/2000	34.1	10	16		6	18		6	36
7/2/2000	32.7	21							36
10/18/2000	28.0			25					36
10/21/2000	37.7	16	9	10	6	6			36
10/27/2000	31.1				34				36
11/8/2000	30.7	14	9						36
12/11/2000	38.7				12				36
6/21/2001	41.6	28		10	3	3			36
7/18/2001	37.7	29	11	14					36
8/8/2001	29.0				20	14	18		36
8/14/2001	27.9				20		11		36
8/17/2001	28.5	17	16						36
1/5/2002	39.2			20		4			36
7/1/2002	31.1	23			18				36
7/16/2002	33.1				6		12	12	36
8/12/2002	36.9	20		12	19				36
12/7/2002	43.7			6	5	9			36

Total Hours	**278**	**94**	**166**	**275**	**81**	**73**	**30**	**1224**
% of Total	**22.7**	**7.7**	**13.6**	**22.5**	**6.6**	**6.0**	**2.5**	
Avg. Hours	**19.9**	**11.8**	**15.1**	**14.5**	**10.1**	**12.2**	**7.5**	

Table 7. As in Table 6, except for Catawba County.

Catawba County									
Date	***PM2.5***	***SC (hrs)***	***GA (hrs)***	***TN (hrs)***	***VA (hrs)***	***KT (hrs)***	***WV (hrs)***	***OH (hrs)***	***MAX***
1/21/1999	31.0	12	10						36
1/30/1999	30.0				10		3		36
3/31/1999	30.0	9			6				36
5/30/1999	29.1								36
6/8/1999	31.7				7	25			36
7/5/1999	28.2			25	15	21			36
7/17/1999	32.3	20							36
7/20/1999	30.9			28					36
7/23/1999	36.1			30		12			36
8/4/1999	28.1				17		2		36
8/7/1999	33.1								36
8/10/1999	28.4			10		26			36
8/13/1999	31.0	31							36
8/16/1999	31.1								36
8/19/1999	29.0				6	12	16		36
1/1/2000	33.0								36
2/9/2000	33.5	6	15	12	4				36
5/3/2000	30.8	4			21	7			36
6/2/2000	31.0								36
6/11/2000	28.2	25							36
7/2/2000	29.4	24							36
7/5/2000	29.1			34					36
7/8/2000	32.7								36
7/23/2000	30.6								36
8/7/2000	34.2		26	6					36
8/16/2000	28.2								36
10/18/2000	28.2			31		6			36
10/21/2000	38.0		19	13	3	6			36
10/27/2000	36.7				13	13	10	12	36
11/2/2000	54.7								36
11/8/2000	50.1								36
2/21/2001	32.8		6	9		13			36
6/21/2001	40.0	20							36
7/18/2001	29.3		16	10					36
8/2/2001	32.0								36
8/26/2001	30.2			34					36
9/7/2001	30.4			10					36
9/13/2001	28.1				6	26			36
11/18/2001	29.0				12		15	5	36
6/4/2002	28.4	31							36
7/1/2002	33.5	25			9	16			36
7/7/2002	28.3				8				36
7/16/2002	33.5				11		15	15	36
8/3/2002	30.0								36
8/12/2002	40.7				20	8			36
12/7/2002	29.2			6		10			36
12/31/2002	28.9	12	19						36
Total Hours		**207**	**92**	**258**	**168**	**201**	**61**	**32**	**1656**
% of Total		**12.5**	**5.6**	**15.6**	**10.1**	**12.1**	**3.7**	**1.9**	
Avg. Hours		**18.8**	**15.3**	**18.4**	**10.5**	**14.4**	**10.2**	**10.7**	

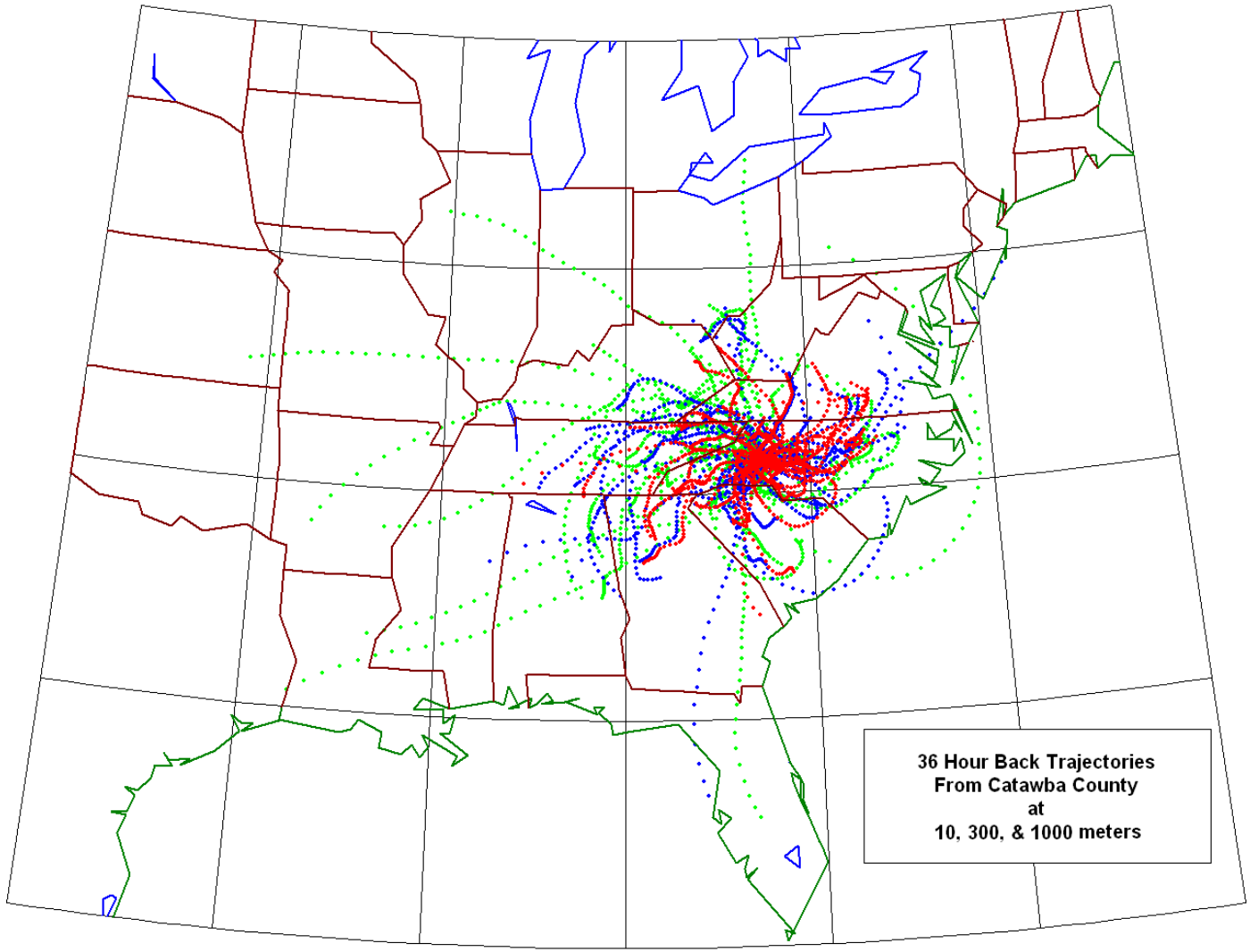


FIG 1. 36-hour back trajectories at 10 meters (red), 300 meters (blue) and 1000 meters (green) from the Catawba County site for days when the $PM_{2.5}$ concentration was high.

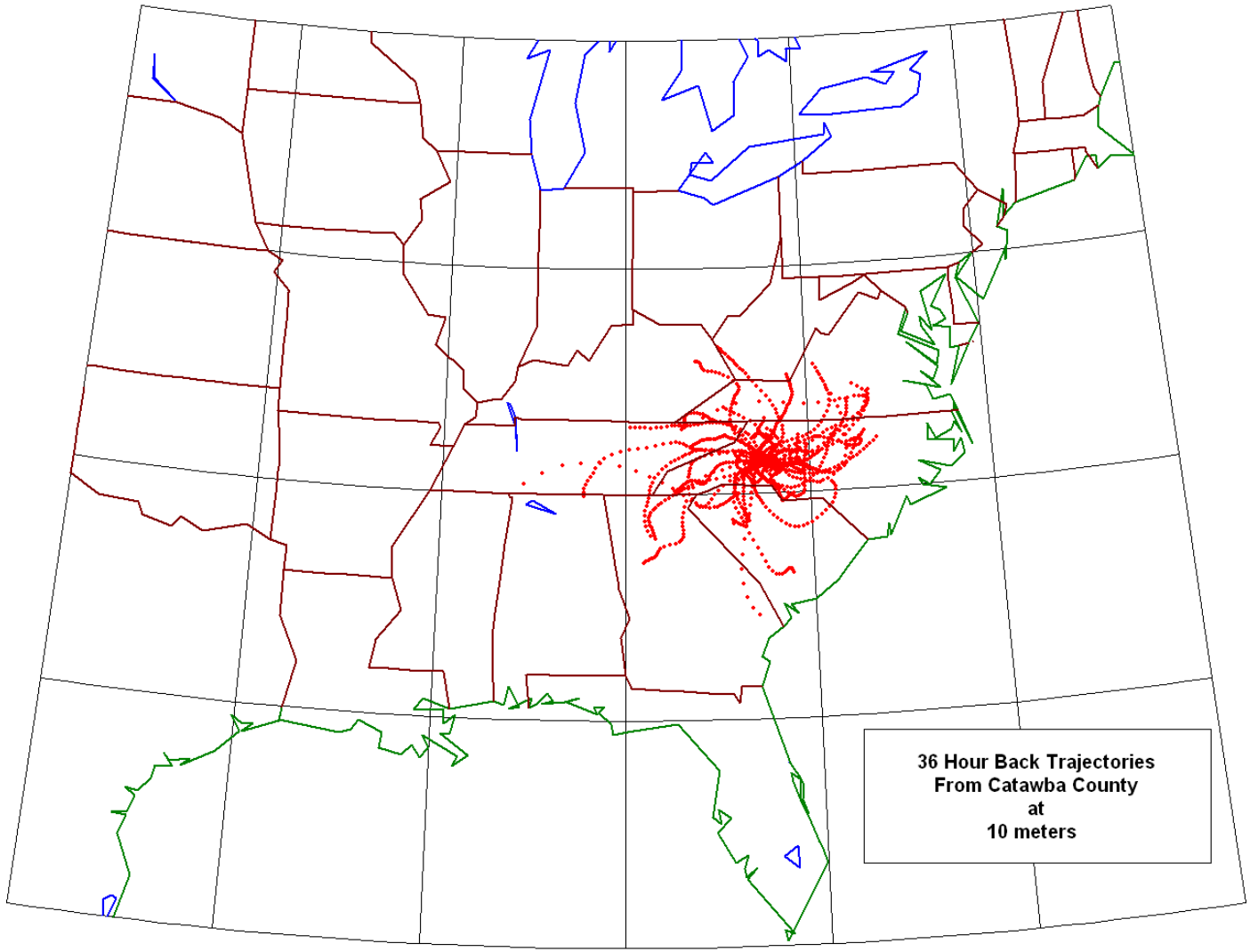


FIG 2. 36-hour back trajectories at 10 meters from the Catawba County site for days when the $PM_{2.5}$ concentration was high.

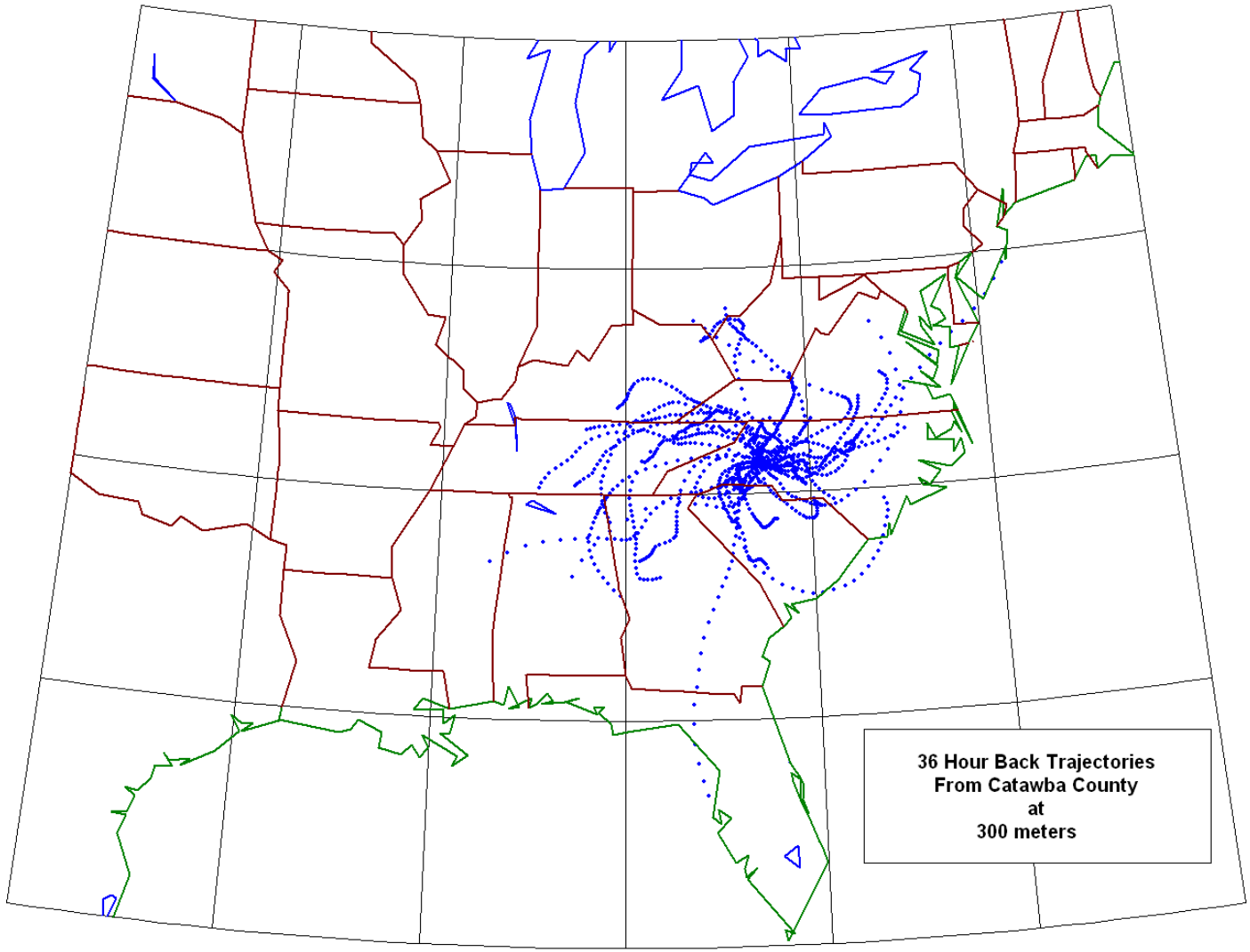


FIG 3. 36-hour back trajectories at 300 meters from the Catawba County site for days when the $PM_{2.5}$ concentration was high.

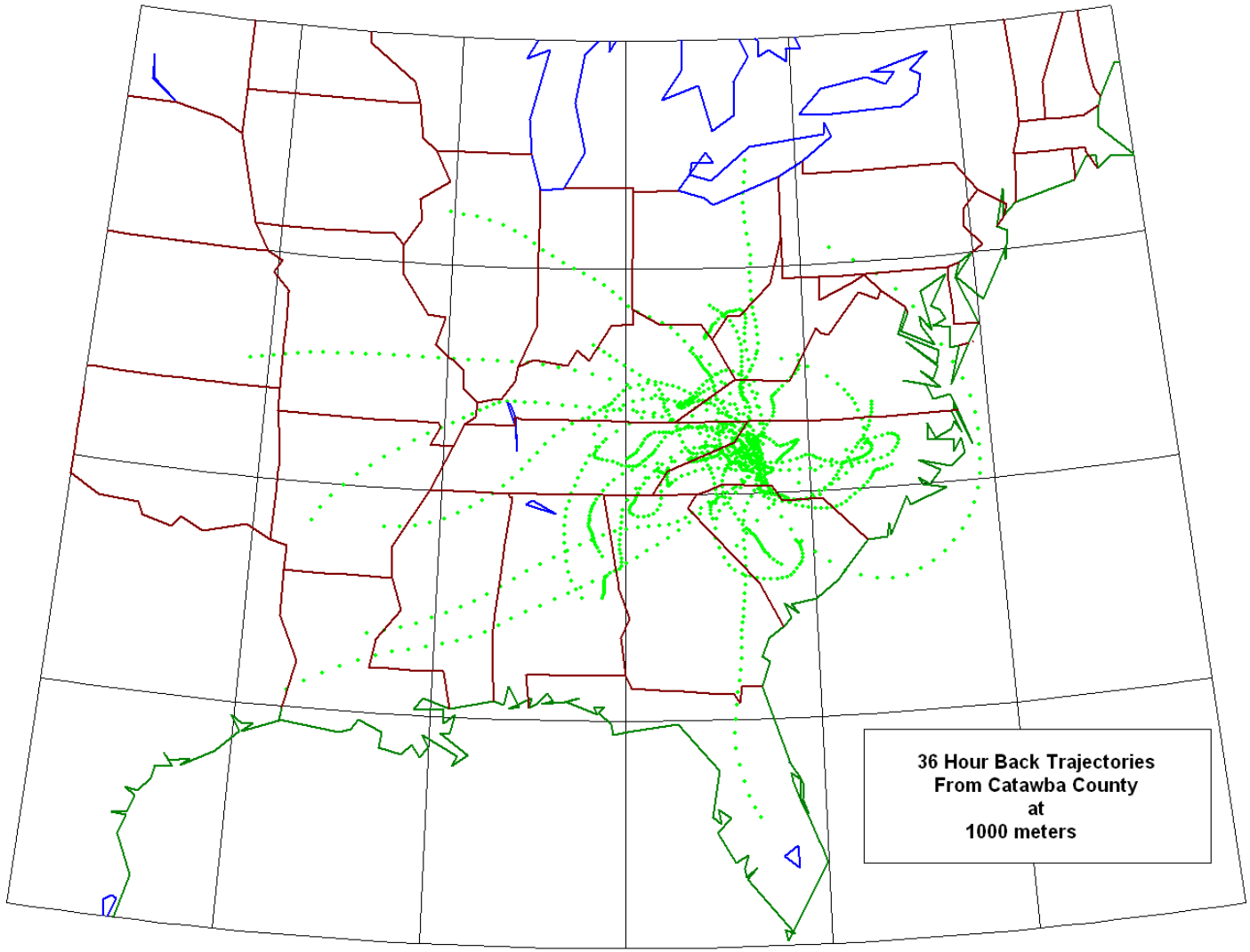


FIG 4. 36-hour back trajectories at 1000 meters from the Catawba County site for days when the $PM_{2.5}$ concentration was high.

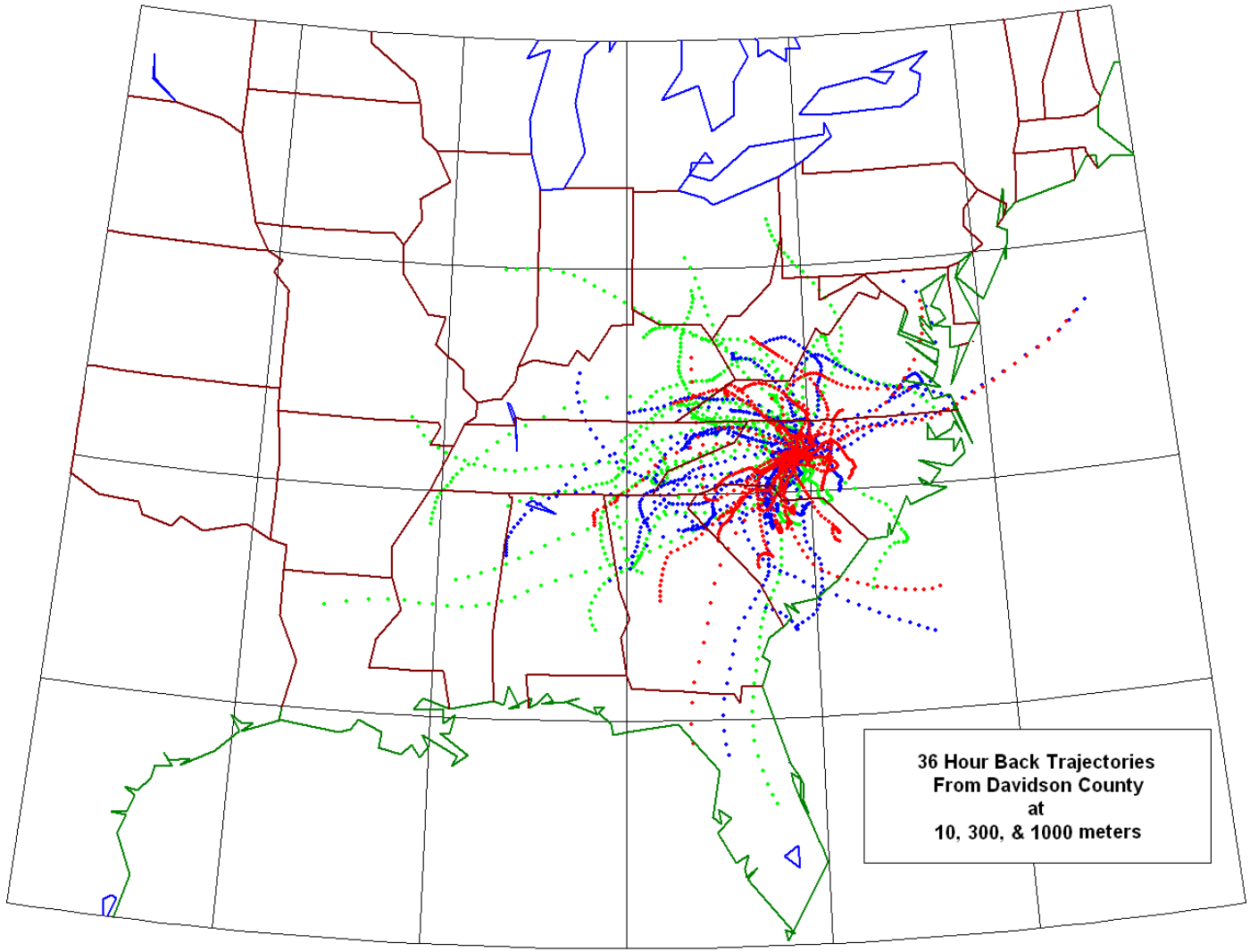


FIG 5. As in Figure 1, except for Davidson County.

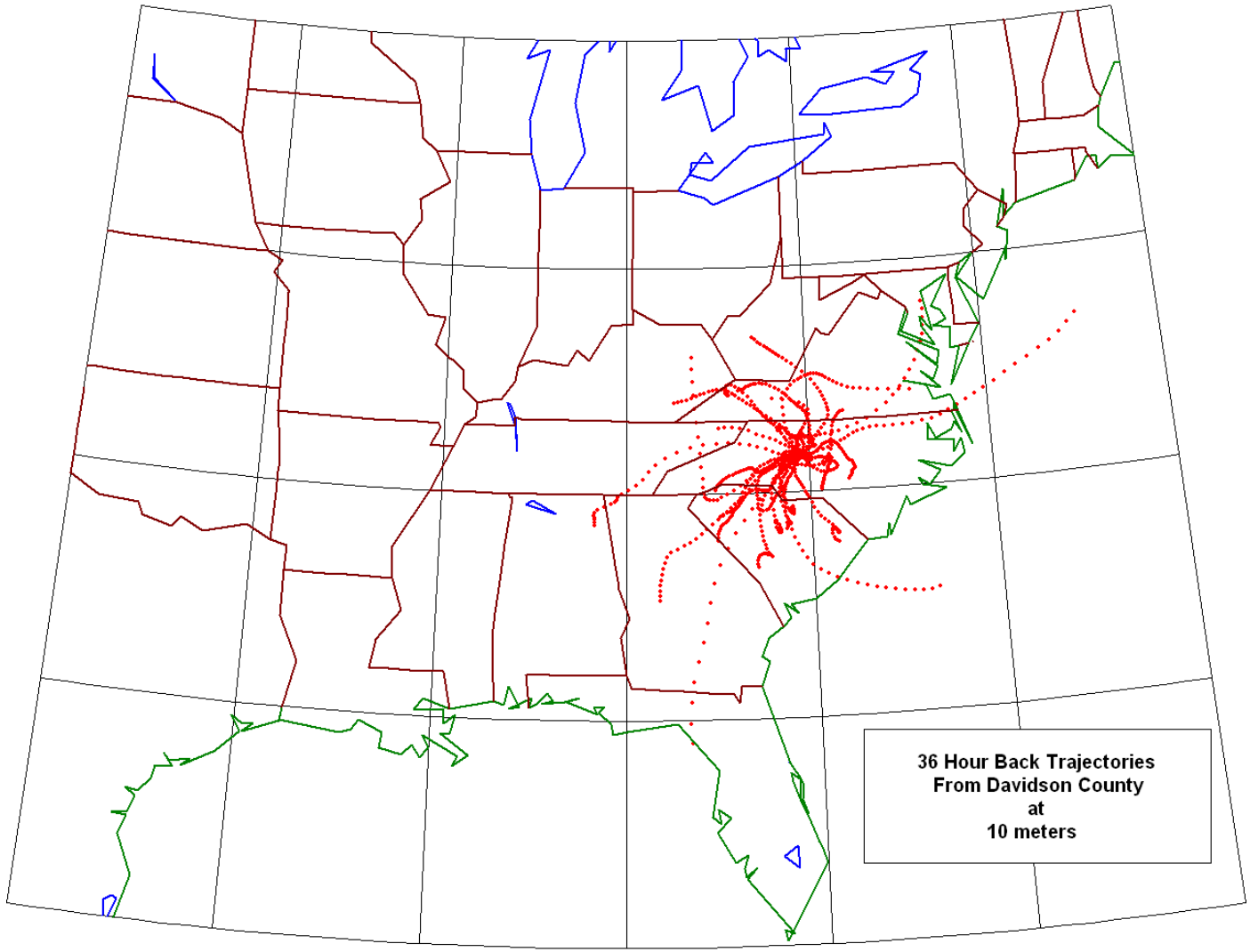


FIG 6. As in Figure 2, except for Davidson County.

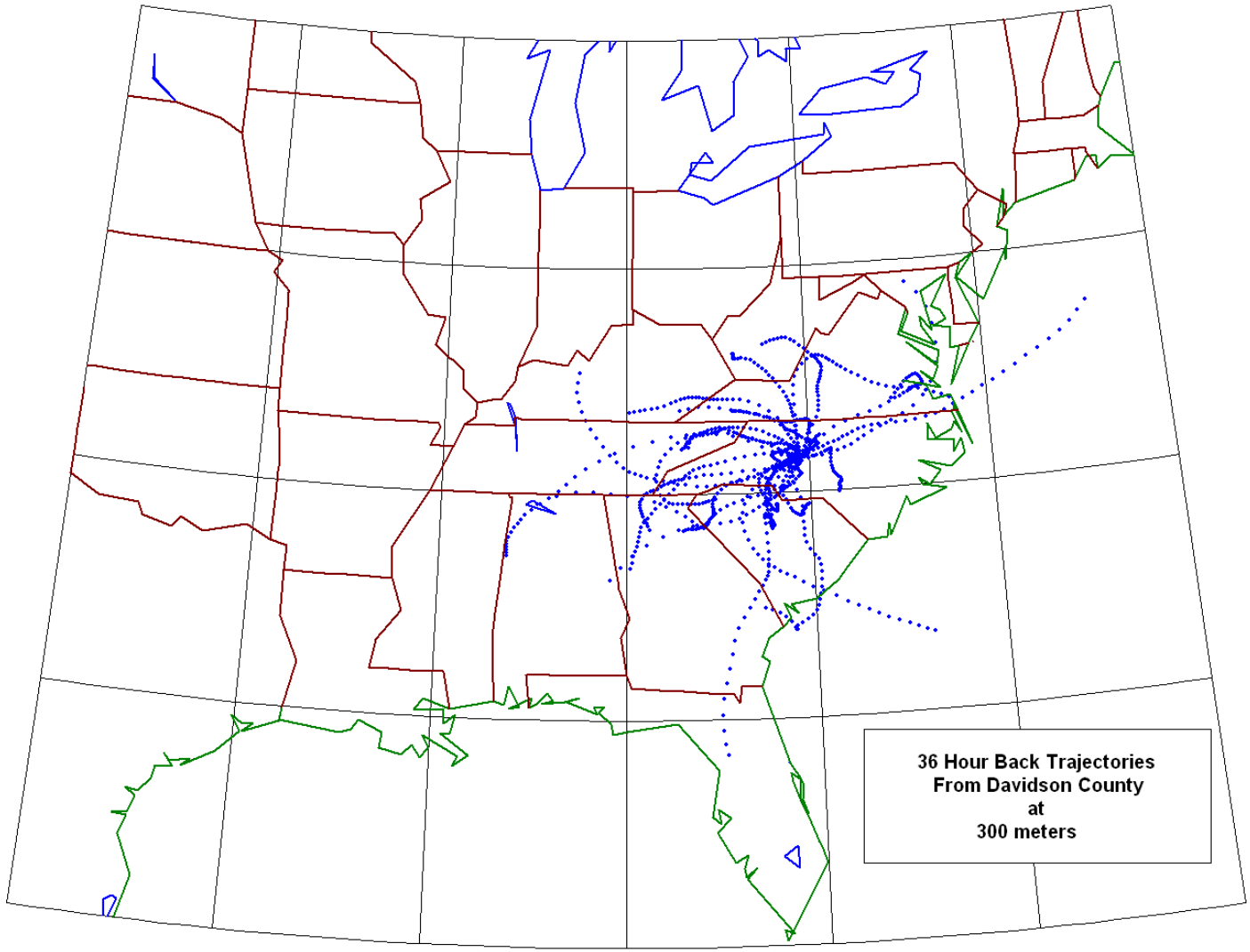


FIG 7. As in Figure 3, except for Davidson County.

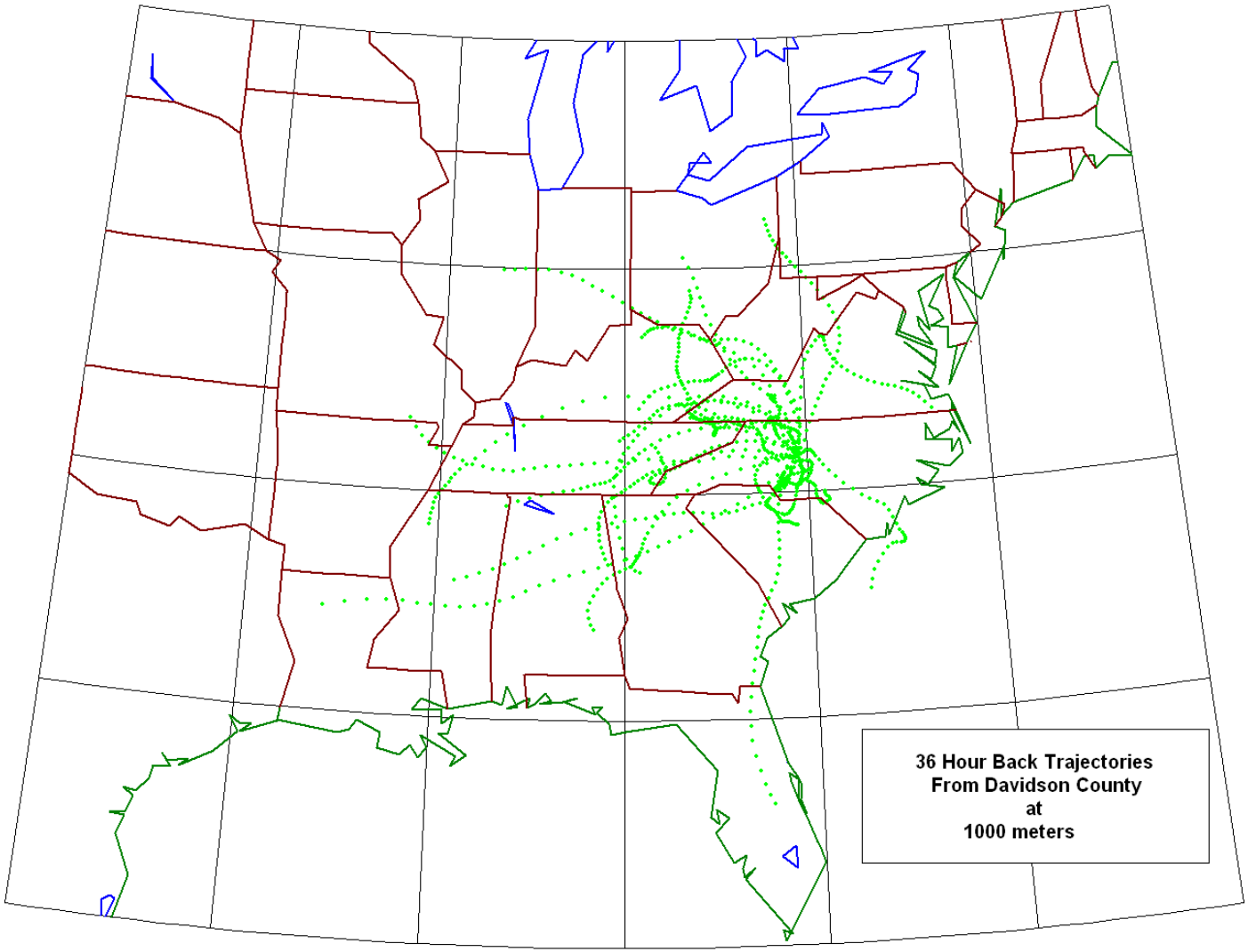


FIG 8. As in Figure 4, except for Davidson County.

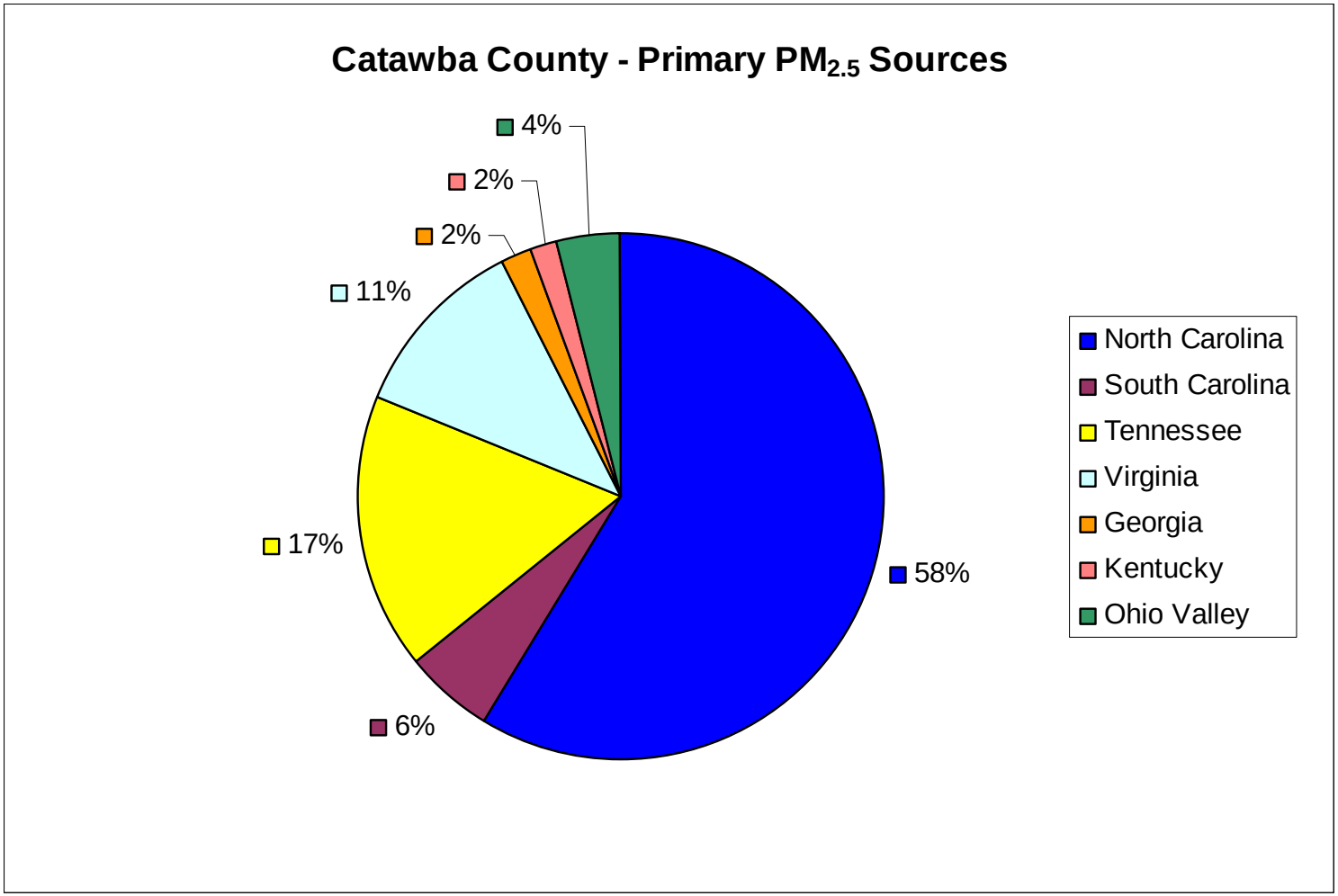


FIG 9. Percent of the days for which HYSPLIT back trajectories were run for the Catawba County $PM_{2.5}$ monitor for which each region was determined to be a primary source. Dark Blue: North Carolina; Burgundy: South Carolina; Yellow: Tennessee; Light Blue: Virginia; Orange: Georgia; Pink: Kentucky; Green: Ohio Valley.

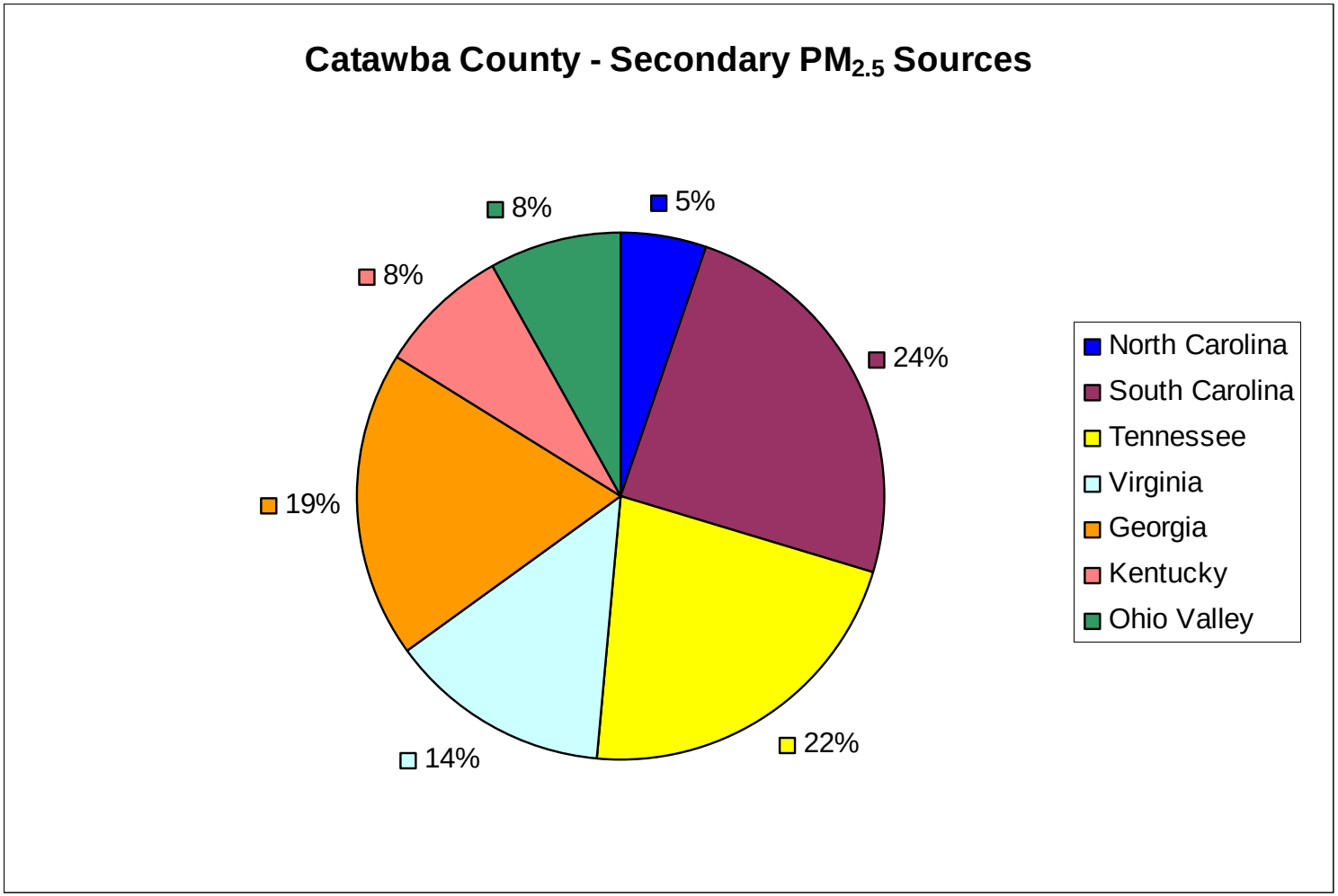


FIG 10. Percent of the days for which HYSPLIT back trajectories were run for the Catawba County $PM_{2.5}$ monitor for which each region was determined to be a secondary source. Dark Blue: North Carolina; Burgundy: South Carolina; Yellow: Tennessee; Light Blue: Virginia; Orange: Georgia; Pink: Kentucky; Green: Ohio Valley.

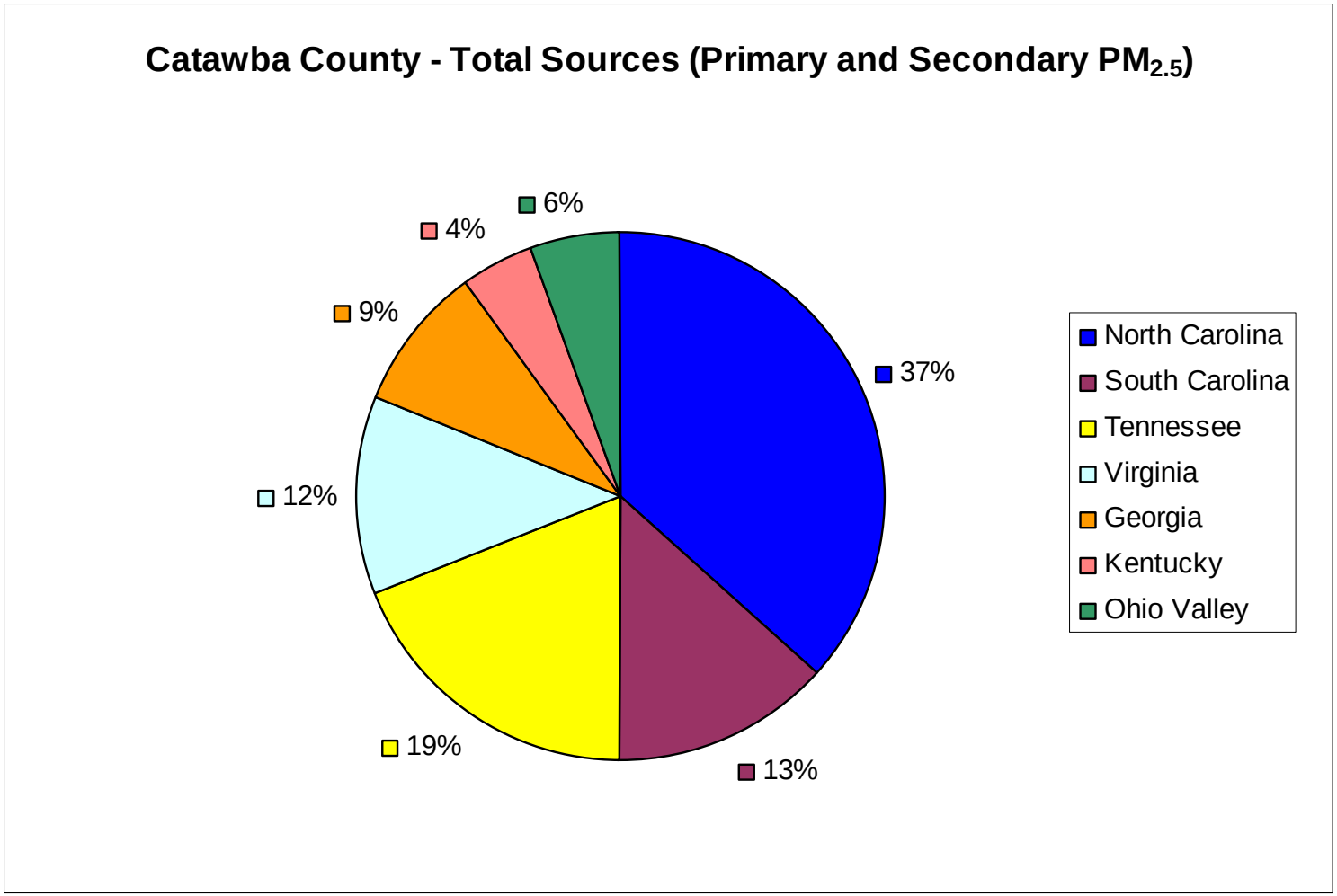


FIG 11. Percent of the days for which HYSPLIT back trajectories were run for the Catawba County $PM_{2.5}$ monitor for which each region was determined to be a primary source, secondary source, or both. Dark Blue: North Carolina; Burgundy: South Carolina; Yellow: Tennessee; Light Blue: Virginia; Orange: Georgia; Pink: Kentucky; Green: Ohio Valley.

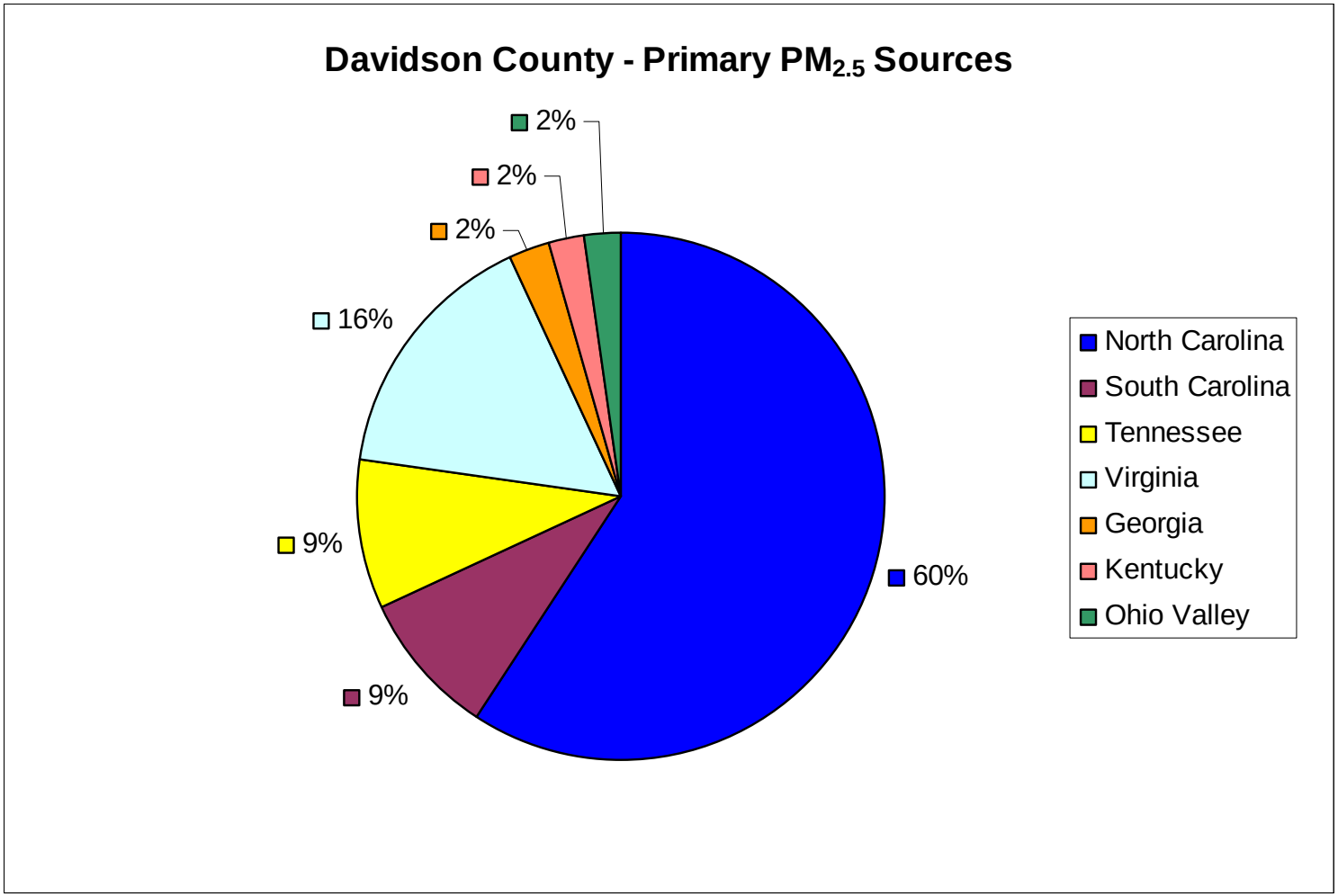


FIG 12. Percent of the days for which HYSPLIT back trajectories were run for the Davidson County $PM_{2.5}$ monitor for which each region was determined to be a primary source. Dark Blue: North Carolina; Burgundy: South Carolina; Yellow: Tennessee; Light Blue: Virginia; Orange: Georgia; Pink: Kentucky; Green: Ohio Valley.

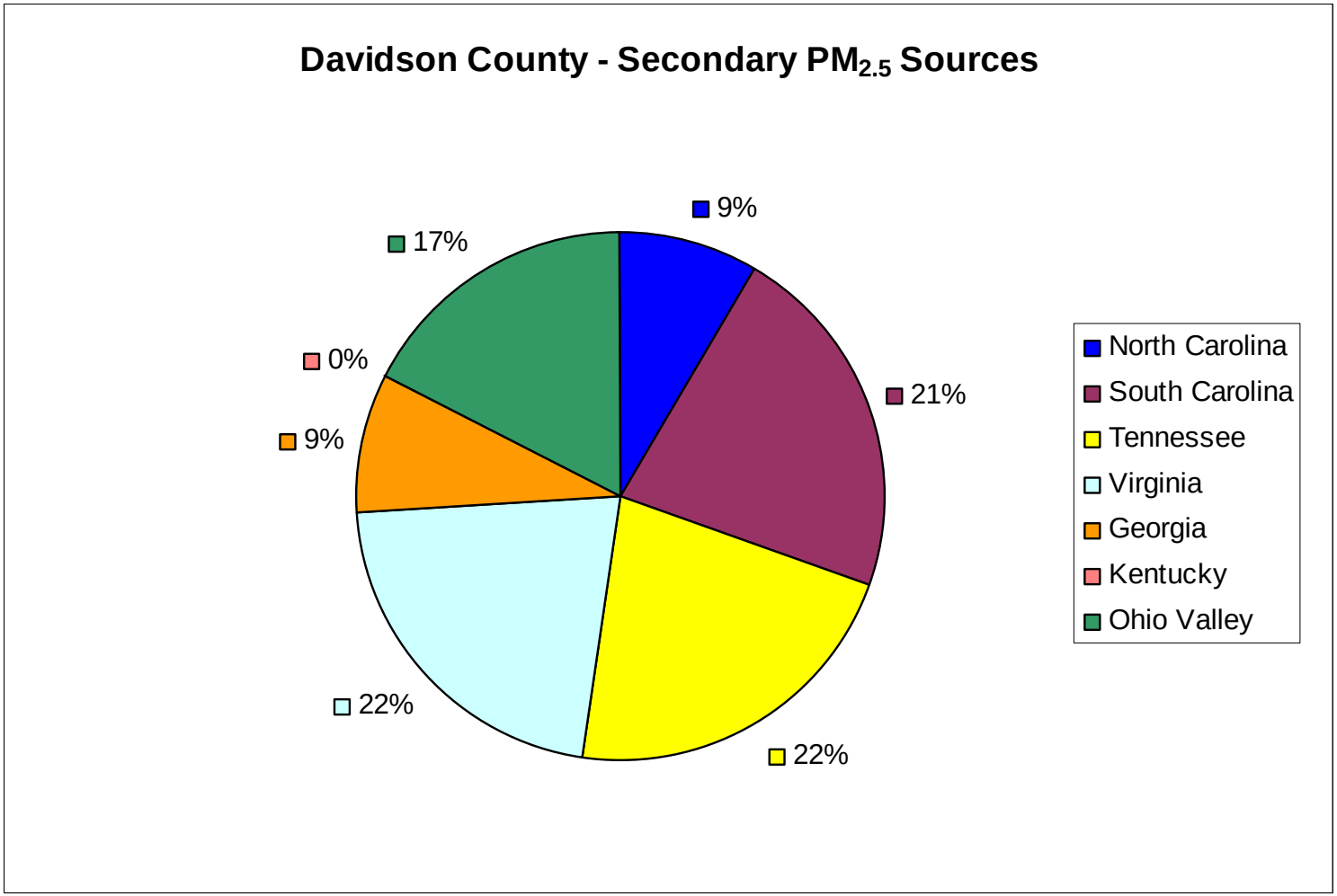


FIG 13. Percent of the days for which HYSPLIT back trajectories were run for the Davidson County $PM_{2.5}$ monitor for which each region was determined to be a secondary source. Dark Blue: North Carolina; Burgundy: South Carolina; Yellow: Tennessee; Light Blue: Virginia; Orange: Georgia; Pink: Kentucky; Green: Ohio Valley.

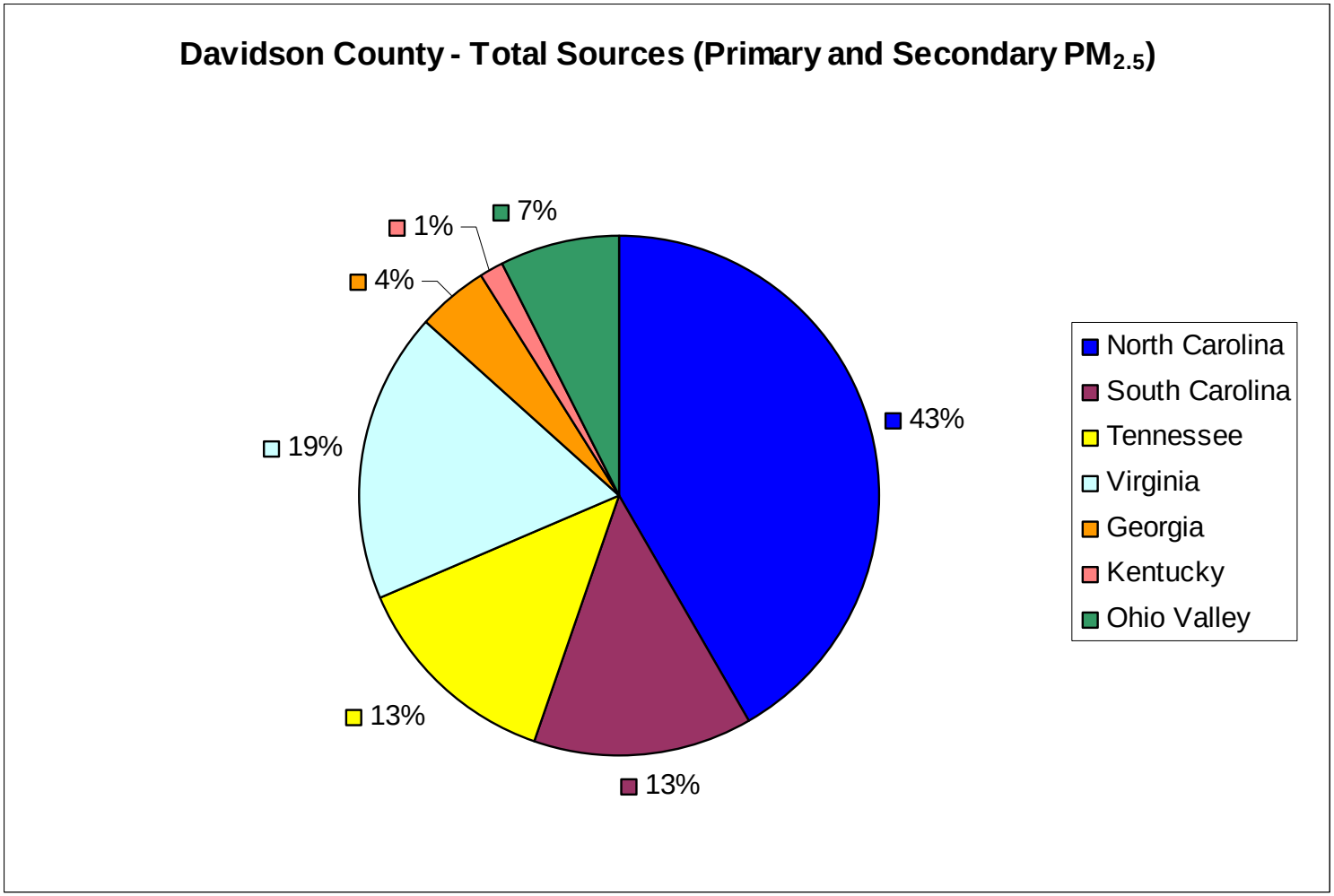


FIG 14. Percent of the days for which HYSPLIT back trajectories were run for the Davidson County $PM_{2.5}$ monitor for which each region was determined to be a primary source, secondary source, or both. Dark Blue: North Carolina; Burgundy: South Carolina; Yellow: Tennessee; Light Blue: Virginia; Orange: Georgia; Pink: Kentucky; Green: Ohio Valley.

Appendix D

Federal, State, and Local Control Strategies

Federal and State Initiatives to Help Reduce $PM_{2.5}$

Because of concerns for the health impact of fine particulate matter, EPA has developed several national control programs to address one of the major contributors to the problem, mobile sources. Below is a summary of the Heavy Duty Engine Standards and the Low-Sulfur Diesel Fuel Program as promulgated by EPA. DAQ has estimated the benefits of these national programs out to 2015 and has calculated a reduction of approximately 45 percent in mobile sources NOx emissions by that time.

Heavy Duty Engine Standards

- The rule requires on-board diagnostic (OBD) systems for engines between 8,500 and 14,000 pounds to be phased-in, beginning in 2005. These systems will identify the failure of emissions control system components.
- Vehicles less than 14,000 pounds gross vehicle weight rating are subject to emission standards and testing similar to the current program for light-duty vehicles and light-duty trucks.
- Heavy duty diesel engines will be required to meet 0.01 grams PM per brake-horsepower-hour in the 2007 model year.
- Heavy duty gasoline engines will be subject to the same 0.01 grams PM per brake-horsepower-hour based on a phase-in requiring 50 percent compliance in the 2008 model year and 100 percent compliance in the 2009 model year.
- EPA estimates the benefits of this program in conjunction with the low sulfur diesel program to be a 90 percent reduction from 2000 PM levels from heavy duty engines nationwide.
- EPA estimates that by 2030 (when the heavy-duty fleet is completely replaced and the low sulfur diesel fuel program is fully implemented) that the annual emissions of PM will be reduced by 109,000 tons.

Low-Sulfur Diesel Fuel

- Refiners will be required to reduce the sulfur content of their fuels from 500 ppm to 15 ppm beginning June 1, 2006.
- Terminals will be required to meet the 15 ppm sulfur standard as of July 15, 2006.
- Retail stations and fleets will be subject to the 15 ppm standard effective September 1, 2006.

State Initiatives

In addition to the federal efforts to control PM, the State has adopted the Clean Smokestacks Act, committed $250,000 to a Clean School Bus initiative in 2004, and received a grant from EPA to pilot truck stop electrification. Each of these State initiatives is summarized below.

Clean Smokestacks Act (CSA)

- CSA requires significant actual NOx and SO_2 emissions reductions year round from coal-fired power plants in North Carolina. The act differs from federal rules, which applies only seasonal NOx controls and allow utilities to buy pollution

credits from other states instead of cutting air pollution from power plants in the state. No trading is allowed outside of NC in the CSA.

- North Carolina's utilities must reduce actual emissions of nitrogen oxides (NOx) from 245,000 tons in 1998 to 56,000 tons by 2009 (77% reduction). Utilities also must reduce actual sulfur dioxide (SO_2) emissions from 489,000 tons in 1998 to 250,000 tons by 2009 (49% reduction) and to 130,000 tons by 2013 (73% reduction). This represents about a one-third reduction of the total NOx emissions and a one-half reduction of the total SO_2 emissions from all sources in North Carolina.

- Air pollution has reduced visibility in the Smoky Mountains from 93 miles to between 24 and 36 miles (National Park Service report, "Clearing the Air at Great Smoky Mountains National Park", September 1999). The act will help North Carolina reach its goal of improving visibility in the mountains and from other scenic vistas in North Carolina by reducing pollution from North Carolina sources that contribute to the problem. Because air pollutants from sources in other states significantly contribute to our mountain air quality problem, the act states an intention of using all means available to achieve air quality improvements in those states as well.

Clean Air Bill

The Clean Air Bill, passed in 1999, is aimed at reducing motor vehicle emissions across North Carolina. The bill:

- Establishes statewide goals for cutting emissions of nitrogen oxides, the major ozone-forming pollutant in North Carolina, and for reducing the growth of vehicle miles traveled in the state.

- Sets goals for the purchase of low-emission vehicles for the state motor fleet, and encourage the purchase of such vehicles for buses used by public school and transportation systems.

OBDII Emissions Inspection Program

- Requires 1996 and newer vehicles to receive an emissions inspection in 48 counties across the State (previously only 9 counties had an emissions inspection program). The program is currently being phased in according to the following schedule:

    - July 1, 2003 – Cabarrus, Durham, Forsyth, Gaston, Guilford, Lincoln, Mecklenburg, Orange, and Wake.

    - July 1, 2003 - Catawba, Cumberland, Davidson, Iredell, Johnston, and Rowan.

    - Jan. 1, 2004 - Alamance, Chatham, Franklin, Lee, Lincoln, Moore, Randolph, and Stanly.

    - July 1, 2004 - Buncombe, Cleveland, Granville, Harnett, and Rockingham.

- Jan. 1, 2005 - Edgecombe, Lenoir, Nash, Pitt, Robeson, Wayne, and Wilson.
- July 1, 2005 - Burke, Caldwell, Haywood, Henderson, Rutherford, Stokes, Surry, and Wilkes.
- Jan. 1, 2006 - Brunswick, Carteret, Craven, New Hanover, and Onslow.

- The inspection will address all emissions from motor vehicles including NOx, VOCs, and CO (the previous program only addressed VOC and CO emissions).
- OBDII can reduce NOx emissions by an average of 9 percent in 2010 and VOC emissions by 10 percent for the same year.

Clean School Bus Initiative/Mobile Source Emission Reduction Grants

North Carolina submitted a grant application for $1 million to EPA to participate in the Clean School Bus USA Program. As part of that grant, North Carolina committed $250,000 in matching funds to retrofit as many buses as possible. The grant was not awarded; however, North Carolina is committed to this project and will move forward through the State Mobile Source Emission Reduction Grant Process. The current focus for the grants are Clean School Buses and therefore grant applications for schools will be given more weight.

- The Mobile Source Emission Reduction Grant Process funds approximately $800,000 annually.
- The grants will be awarded in March 2004.
- The emission benefits from this grant process will vary based on the technology used by the grantee. EPA estimates that the suggested technologies can reduce PM emissions between 10 and 90 percent.

Truck Stop Electrification Grant

- In 2003, North Carolina along with South Carolina and Georgia received a $1.5 million grant to install 150 electrified truck stop parking spaces in the 3 states. This grant is a pilot project that will help to demonstrate to the trucking industry the ease of implementation of such a program that could be used nationwide.
- North Carolina will have 50 parking spaces converted to electricity. The estimated emission reductions for North Carolina is one ton per year (tpy) of particulate matter, 20 tpy NOx, 2 tpy VOC, 16 tpy CO, and 2,225 tpy CO2.

$PM_{2.5}$ Forecasting

Air quality forecasts are an essential part of North Carolina's strategy for reducing particle and ozone pollution. The Forsyth County Environmental Affairs Department

(FCEAD) has issued year-round particle forecasts since 2000 for the Triad area. FCEAD will include Davidson County in the Triad forecast region by May 1, 2004. A TEOM (tapered element oscillating microbalance) has been located in Davidson County to aid in the forecasting. The N.C. Division of Air Quality (DAQ) meteorologists issue a daily particle forecast for the Charlotte area and will add the Hickory area to the forecasting region by May 1, 2004. Meteorologists issue the daily particle forecasts at 3 p.m. for the following day. The color-coded forecasts predict whether particle levels are likely to be good (green), moderate (yellow), unhealthy for sensitive groups (orange), unhealthy (red), or very unhealthy (purple). On high particle days, the forecasts advise people to protect their health by avoiding strenuous exercise and suggest ways to reduce pollution, such as driving less, conserving energy, and stopping outdoor burning. The ozone and particle forecasts are part of the DAQ Air Awareness Program, which aims to increase public awareness about air pollution, its causes, and ways to prevent it. In addition to forecasts, the Air Awareness program sends notifications to news media and air coalitions in the forecast areas. Coalition members volunteer to help to disseminate the message and help to reduce emissions through voluntary actions.