ADEM

ALABAMA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT

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February 9, 2004

Mr. James I. Palmer, Jr.
Regional Administrator
U.S. EPA, Region 4
Atlanta Federal Center
61 Forsyth Street, S.W.
Atlanta, Georgia 30303-8960

Dear Mr. Palmer:

As the designee of the Governor of the State of Alabama, I am providing this response to your letter of April 1, 2003, which requests the state's recommendations regarding the extent of nonattainment areas for the fine particulate (PM2.5) air quality standard. The information provided is based on monitoring data from 2001 to 2003, inclusive. Based on the monitoring data, two counties in Alabama do not meet the annual PM2.5 National Ambient Air Quality Standard (NAAQS). All monitors in the state meet the 24-hour PM2.5 NAAQS.

ADEM has the legal authority to impose reduction measures as necessary in any county near a nonattainment area, regardless of its attainment status. Accordingly, the only counties we recommend being designated as nonattainment are those with monitoring data exceeding the NAAQS.

Enclosed please find an attachment which provides data from our PM2.5 monitoring network and our recommendations for the extent of PM2.5 nonattainment areas. The enclosed appendices provide detailed information on the factors which EPA suggested be addressed in support of any nonattainment area recommended to be smaller than a metropolitan statistical area. The data are also provided in electronic format on the enclosed CD.

Birmingham Branch
110 Vulcan Road
Birmingham, Alabama 35209-4702
(205) 942-6168
(205) 941-1603 [Fax]

Decatur Branch
2715 Sandlin Road, S.W.
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Mobile Branch
2204 Perimeter Road
Mobile, Alabama 36615-1131
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4171 Commanders Drive
Mobile, Alabama 36615-1421
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As documented in the attachment, we recommend that the following counties be designated nonattainment for the Fine Particulate Matter NAAQS: Jefferson and Russell. In response to your presumptions regarding the extent of nonattainment areas, we recommend that the following Alabama counties not be included: St. Clair, Blount, Cullman, Walker, Bibb, Chilton, Shelby, Tuscaloosa (considered along with the Birmingham CMSA to address the specific concerns expressed by your staff about this county), Lee, and Macon.

Should you require additional information, please contact Mr. Ron Gore of the Air Division at (334) 271-7868.

Sincerely,

James W. Warr
Director

JWW/rdg

cc: Dalton Smith, Governor's Senior Advisor
Beverly Banister, EPA

Recommendations for Designation of Non-Attainment Areas for the PM2.5 NAAQS

Prepared by:

Alabama Department of Environmental Management

February 2004

ATTACHMENT 1

§81.301 Alabama--Ozone (PM 2.5 Standard)

Designated Area	Designation Type	Classification Type
Birmingham MSA		
Jefferson County..........	Nonattainment	
Columbus MSA		
Russell County............	Nonattainment	
Rest of State		
Autauga County	Unclassifiable/Attainment	
Baldwin County		
Barbour County		
Bibb County		
Blount County		
Bullock County		
Butler County		
Calhoun County		
Chambers County		
Cherokee County		
Chilton County		
Choctaw County		
Clarke County		
Clay County		
Cleburne County		
Coffee County		
Colbert County		
Conecuh County		
Coosa County		
Covington County		
Crenshaw County		
Cullman County		
Dale County		
Dallas County		
Dekalb County		
Elmore County		
Escambia County		
Etowah County		
Fayette County		
Franklin County		
Geneva County		
Greene County		
Hale County		
Henry County		
Houston County		
Jackson County		
Lamar County		
Lauderdale County		
Lawrence County		
Lee County		
Limestone County		
Lowndes County		
Macon County		

Madison County	Unclassifiable/Attainment	
Marengo County		
Marion County		
Marshall County		
Mobile County		
Monroe County		
Montgomery County		
Morgan County		
Perry County		
Pickens County		
Pike County		
Randolph County		
St. Clair County		
Shelby County		
Sumter County		
Tallapoosa County		
Talladega County		
Tuscaloosa County		
Walker County		
Washington County		
Wilcox County		
Winston County		

PM 2.5 Monitors

PM 2.5 DATA (2001 TO 2003) FOR THE STATE OF ALABAMA

Units are micrograms per cubic meter (µg/m³)

County	AIRS ID	Site	2001 Annual Average	2002 Annual Average	2003 Annual Average	3 Year Average
BALDWIN	10030010	Fairhope	10.6	10.4*	12.2	11.0*
CLAY	10270001	Ashland	12.8	13.2	13.4	13.1
COLBERT	10331002	Muscle Shoals	12.8*	12.8*	12.9	12.8*
DE KALB	10491003	Crossville	14.7*	14.4*	15.0	14.7*
ESCAMBIA	10530002	Brewton	12.5	11.9	12.7	12.4
ETOWAH	10550010	Gadsden	15.3*	14.8*	14.3	14.8*
HOUSTON	10690002	Dothan	14.0	13.0*	13.8*	13.6*
JEFFERSON	10730023	N. Birmingham[1]	19.1	17.5	17.4	18.0
JEFFERSON	10731005	McAdory	15.0	15.0	14.2	14.7
JEFFERSON	10731009	Providence	13.4	12.2	12.3	12.6
JEFFERSON	10732003	Wylam[1]	17.9	16.6	15.7	16.7
JEFFERSON	10732006	Hoover	15.6	14.4	14.2	14.7
JEFFERSON	10735002	Pinson	14.3	13.4	13.5	13.7
JEFFERSON	10735003	Corner	14.7	13.4	13.6	13.9
MADISON	10890014	Huntsville	14.6	13.8	13.8	14.1
MOBILE	10970002	St. Thomas	12.9	12.1	12.8	12.6
MOBILE	10972005	Bay Road	12.3*	10.6	12.6	11.8*
MONTGOMERY	11010007	Montgomery	14.4	14.6	14.0	14.3
RUSSELL	11130001	Phenix City	15.6	15.1	15.4	15.3
SHELBY	11170006	Pelham	14.7	13.6	14.9*	14.4*
SUMTER	11190002	Sumter	12.1	11.7	12.1	12.0
TALLADEGA	11210002	Childersburg	14.6	14.1	15.4	14.7

*Monitoring data does not meet completeness requirements in 40 CFR Part 50 APP N.
Note: Only monitors that operated during each of the three years are shown on this table.
1 – The North Birmingham and Wylam monitors are a community monitoring zone with a 3-year average of 17.4 µg/m³.

24-HOUR PM 2.5 DATA (2000 TO 2002) FOR THE STATE OF ALABAMA

Units are micrograms per cubic meter (µg/m³)

County	AIRS ID	Site	2001 98th Percentile	2002 98th Percentile	2003 98th Percentile	3 Year Average
BALDWIN	10030010	Fairhope	21.5	22.9	29.1	24.5
CLAY	10270001	Ashland	28.5	27.0	30.5	28.7
COLBERT	10331002	Muscle Shoals	28.7	33.5	29.1	30.4
DE KALB	10491003	Crossville	31.1	31.8	31.4	31.4
ESCAMBIA	10530002	Brewton	23.5	25.1	29.7	26.1
ETOWAH	10550010	Gadsden	34.1	33.7	29.4	32.4
HOUSTON	10690002	Dothan	26.6	26.7	34.3	29.2
JEFFERSON	10730023	N. Birmingham	42.8	37.6	39.1	39.8
JEFFERSON	10731005	McAdory	42.7	35.9	35.3	38.0
JEFFERSON	10731009	Providence	32.2	34.5	29.9	32.2
JEFFERSON	10732003	Wylam	32.9	35.7	33.7	34.1
JEFFERSON	10732006	Hoover	28.7	32.7	26.7	29.4
JEFFERSON	10735002	Pinson	32.3	33.3	28.6	31.4
JEFFERSON	10735003	Corner	29.7	34.3	29.5	31.1
MADISON	10890014	Huntsville	29.7	34.1	26.9	30.2
MOBILE	10970002	St. Thomas	26.2	23.9	30.5	26.9
MOBILE	10972005	Bay Road	26.7	22.8	29.4	26.3
MONTGOMERY	11010007	Montgomery	27.8	28.7	31.4	29.3
RUSSELL	11130001	Phenix City	33.8	35.0	32.0	33.6
SHELBY	11170006	Pelham	29.6	32.7	30.8	31.0
SUMTER	11190002	Sumter	27.0	25.5	31.3	27.9
TALLADEGA	11210002	Childersburg	31.1	30.4	31.0	30.8

Note: Only monitors that operated during each of the three years are shown on this table.

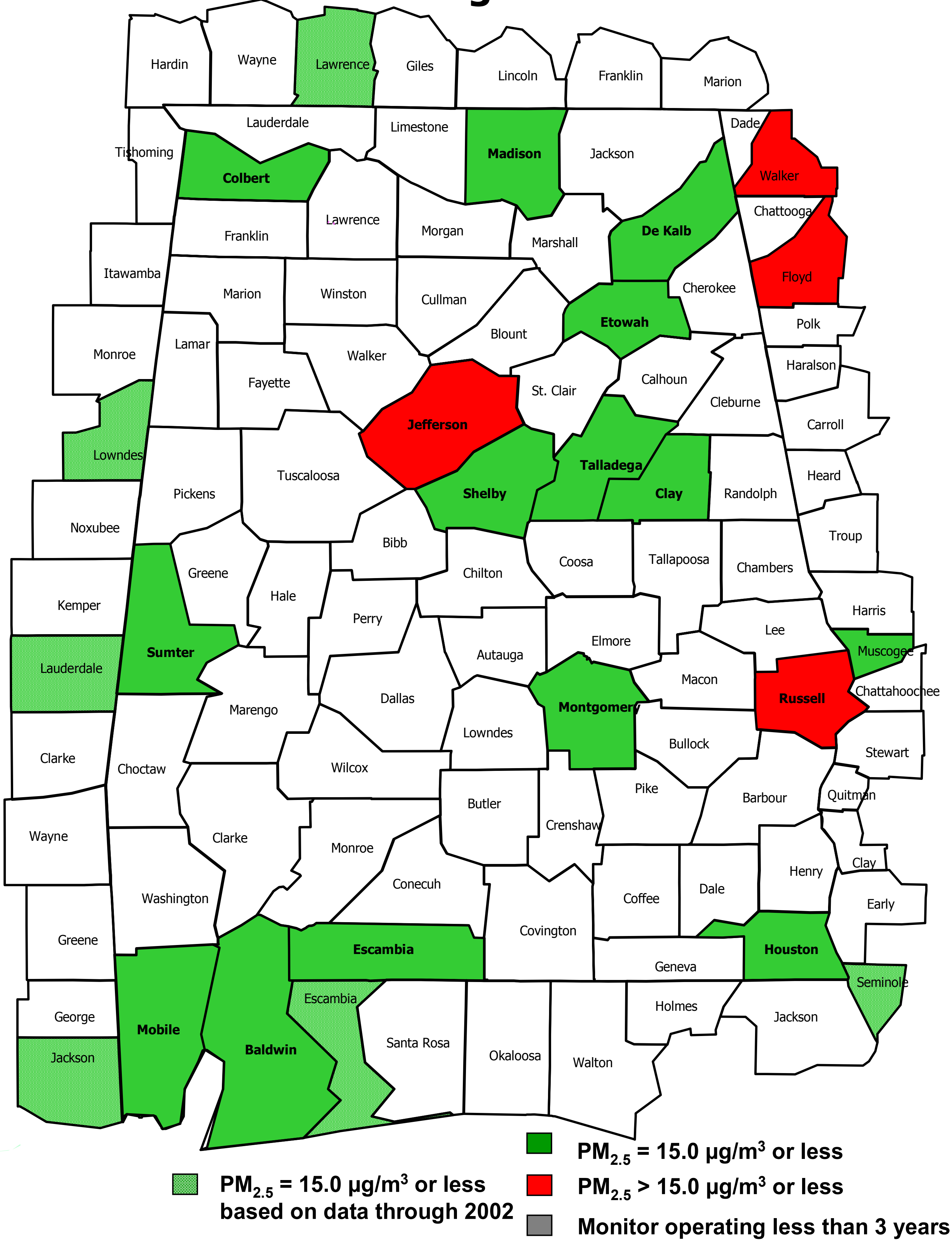
PM2.5 Concentrations in Areas Adjoining Alabama

The table below presents $PM_{2.5}$ monitoring data for states adjacent to Alabama. The data presented are for the counties in those states bordering Alabama. The map on the following page details the location of these counties in relation to the state.

AIRS ID	County	3 Year Average
131150005	Floyd Co, GA	15.7
132150001	Muscogee Co, GA	14.7
132150011	Muscogee Co, GA	14.3
132950002	Walker Co, GA	15.6
120330004	Escambia Co, FL	12.1*
121171002	Seminole Co, FL	9.8*
280750003	Lauderdale Co, MS	13.7*
280870001	Lowndes Co, MS	14.1*
280590006	Jackson Co, MS	12.2*
470990002	Lawrence Co, TN	12.6*

* Value for 3 year average uses 2000-2002 data

PM Fine Concentrations in Alabama and Surrounding Counties



Appendix A

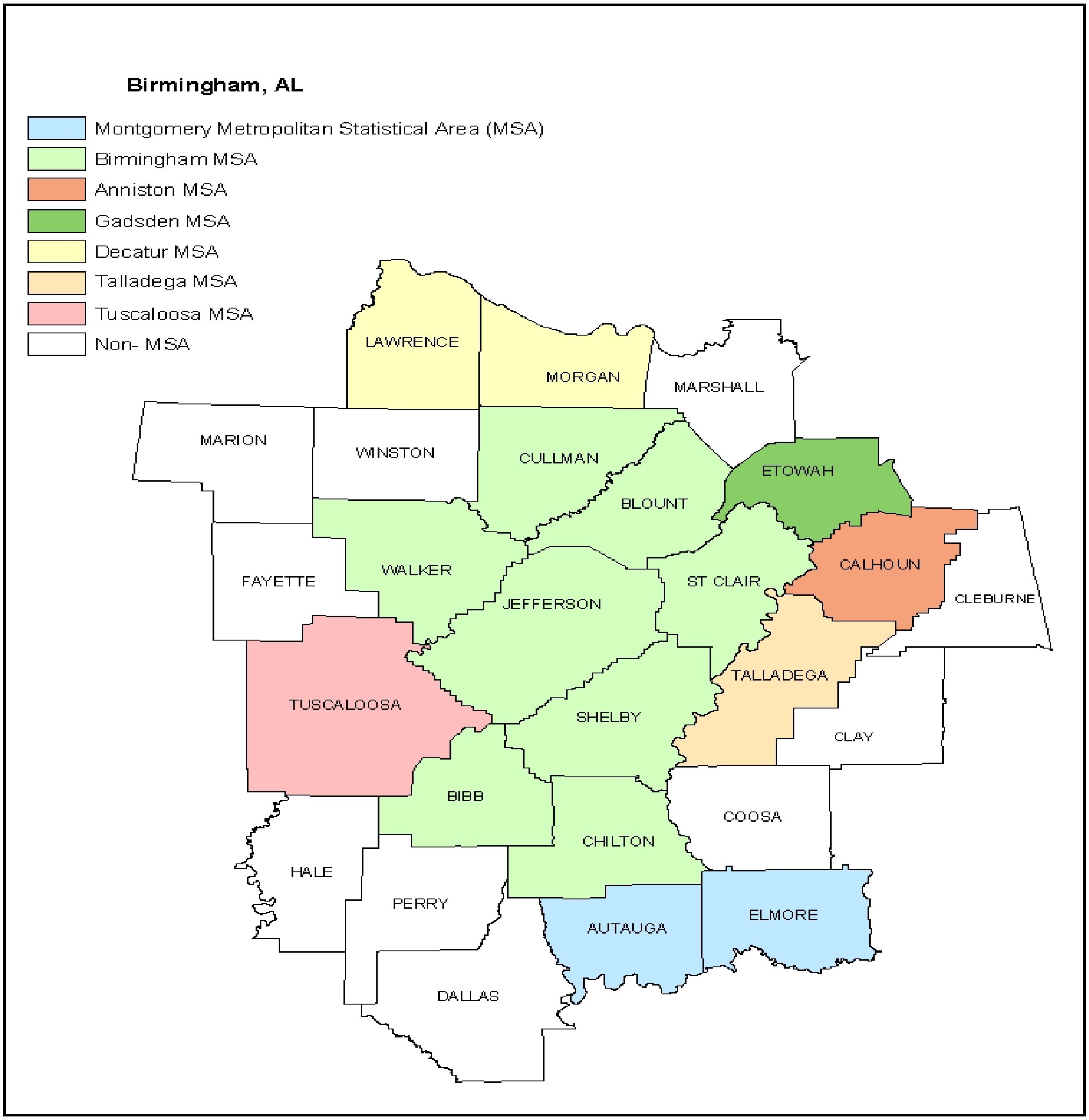
ADEM recommends that the Birmingham Nonattainment Area (NAA) for the fine particulate matter (PM2.5) NAAQS exclude Bibb, Blount, Chilton, Cullman, Shelby, St. Clair, Tuscaloosa and Walker Counties. EPA guidance (dated April 1, 2003) states that the State must address how specific factors affect the drawing of the nonattainment boundary when proposing the exclusion of an area that potentially contributes to the ambient air quality of a nearby nonattainment area. Full discussion of each of these factors for the Birmingham NAA is provided in this Appendix.

The factors that provide the most compelling evidence to exclude Bibb, Blount, Chilton, Cullman, Shelby, St. Clair, Tuscaloosa and Walker Counties from the Birmingham NAA are listed below:

- Population density and degree of urbanization
- Monitoring data (for Shelby County)
- Location of emission sources
- Annual emissions
- Traffic (Daily VMT)
- Commuting patterns
- Meteorology

A. Emissions and air quality in adjacent areas (including adjacent C/MSAs)

The counties and Metropolitan/Micropolitan Statistical Areas (MSAs) adjacent to the Birmingham Combined Metropolitan Statistical Area (CMSA) are depicted in Figure 1. To evaluate emissions for the counties in the Birmingham CMSA and Tuscaloosa County, ADEM obtained the 1999 annual NOx, VOC, SO2, PM2.5 and NH3 emission estimates from EPA's recommended web site[1]. Table 1 lists these emissions which include all anthropogenic sources (i.e. point, area, mobile, and nonroad mobile) for counties in the Birmingham CMSA and Tuscaloosa.



[1] http://www.emissionsonline.org/nei99v3/index.htm

Table 1 Annual Emissions for Birmingham CMSA and Tuscaloosa

County	Annual VOC Emissions	Ranking for VOC	Annual NOx Emissions	Ranking for NOx	Annual SO2 Emissions	Ranking for SO2	Annual PM2.5 Emissions	Ranking for PM2.5	Annual NH3 Emissions	Ranking for NH3
Bibb	4,134	9	1,623	9	176	9	2,180	8	363	9
Blount	5,041	8	2,803	8	426	8	2,293	7	3,457	2
Chilton	5,448	7	3,231	7	454	7	2,100	9	763	7
Cullman	9,752	5	4,299	6	936	6	3,188	6	7,053	1
Jefferson*[M]	50,076	1	75,503	1	82,825	3	20,326	1	1,214	5
Shelby*[M]	12,762	3	40,928	2	106,780	1	5,214	2	542	8
St Clair	9,231	6	7,624	5	1,031	5	3,521	5	1,538	3
Tuscaloosa[M]	22,773	2	12,294	4	5,070	4	4,417	4	979	6
Walker*[M]	10,014	4	33,732	3	98,762	2	4,440	3	1,382	4

*County has one or more utility plants located within its boundaries
[M] County has a PM2.5 monitor

Many rural counties in Alabama, as well as the southeastern U.S., have considerable ammonia (NH3) emissions resulting primarily from concentrated animal feeding operations and fertilizer production and application. For information purposes, data on estimated ammonia emissions is presented in this section since present knowledge indicates that ammonia emissions can play a key role in PM2.5 formation. However, due to a lack of effective controls for these sources of ammonia and the uncertainties in methods for estimating emissions of ammonia, ammonia emissions are not considered to be a significant factor in the determination of which counties to include in PM2.5 nonattainment areas. Should effective controls for sources of ammonia become available in the future, the lack of a nonattainment area designation would not preclude ADEM, under its existing regulations, from requiring controls in a county if such controls are deemed necessary.

As shown in Table 1, emissions in Bibb and Chilton are significantly less than emissions in surrounding counties. A logical conclusion would be that emissions from these counties will not play a significant role outside their boundaries.

Blount, Cullman and St. Clair have low emissions in comparison with the rest of the area for all pollutants with the exception of NH3. Emissions in Bibb, Blount, Chilton, Cullman and St. Clair collectively account for 26% of the VOC emissions, 11% of the NOx emissions, 1% of the SO2 emissions and 28% of the PM2.5 emissions in the CMSA plus Tuscaloosa County. <u>This factor fortifies the recommendation to exclude Bibb, Blount, Chilton, Cullman and St. Clair Counties from the Birmingham NAA.</u>

For Tuscaloosa, although ranked 2nd in VOC emissions, it is still less than half that of Jefferson County's emissions. The impact of the NOx emissions in Shelby and Walker has been and will be lessened by the 1-hour ozone attainment SIP for the Birmingham NAA and the NOx SIP call. It is unlikely that emissions from Walker significantly contributed to PM2.5 concentrations in Jefferson given the relative infrequency of winds blowing from Walker towards Jefferson on days with elevated PM2.5 concentrations. (See Section G.) As Shelby County ranks highest in SO2 emissions in the area, the lack of a nonattainment area designation will not preclude ADEM from requiring controls as necessary in Shelby County

The PM2.5 monitors in Tuscaloosa and Walker have only been operational since 2002. Except for Jefferson and Shelby Counties, there are no other PM monitors sited in any other counties in the Birmingham CMSA. Monitors in nearby Clay and Talladega Counties indicate attainment of the PM2.5 NAAQS; however, <u>no conclusion can be made in regards to air quality impacts from adjacent areas.</u>

B. Population density and degree of urbanization (significant difference from surrounding areas)

To evaluate the various aspects of population, ADEM obtained the 1993 to 2002 population estimates for the Birmingham CMSA and Tuscaloosa from the Alabama State Data Center[2]. Information on business data (i.e. retail employment and manufacturing employment) was obtained from the U.S. Census Bureau's *County Business Patterns.*

Population densities were calculated by dividing the population estimates by the land area (in square miles) of each county. Figure 2 depicts the population densities for counties in the Birmingham CMSA and Tuscaloosa. Bibb, Blount, Chilton, Cullman, St. Clair and Walker have much smaller land areas and population density than Jefferson County. As seen in Figure 2, Bibb has a very small population density in comparison with surrounding counties. Even when considering that Tuscaloosa's land area is larger than Jefferson County's, its population density is much smaller. While Shelby County's population density is the 2nd largest among surrounding counties, it is merely one-third of Jefferson's population density. <u>This population density factor fortifies the recommendation to exclude Bibb, Blount, Chilton, Cullman, St. Clair, Shelby, Tuscaloosa and Walker Counties from the Birmingham NAA.</u>

Population trends/data are presented in Figures 3 and 4. Figure 3 demonstrates that the combined population total of the counties surrounding Jefferson County remain less than 50% of Jefferson's population. Further, Table 2 demonstrates that the combined urban population of all counties except Jefferson represents approximately 33% of the urban population of the entire area. <u>These population factors fortify the recommendation that the Birmingham NAA only include Jefferson County.</u>

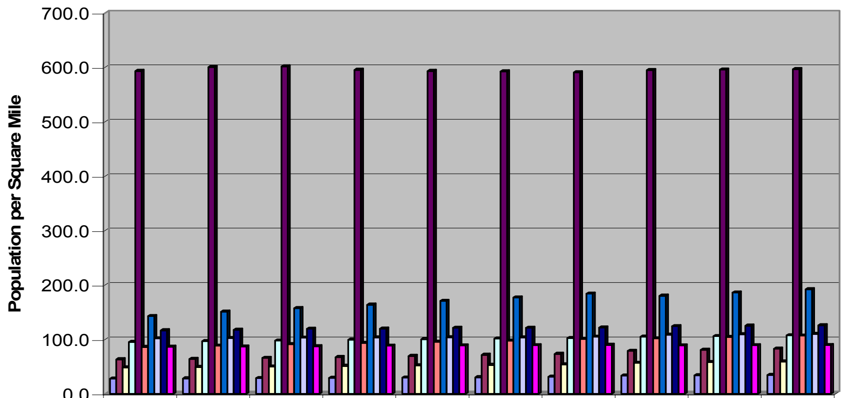
Table 2 Urban Population for Birmingham CMSA and Tuscaloosa

County Name	% Urban[3]	1990 Population	1990 Urban Population	% of CMSA Total 1990 Urban Population	% Urban	2002 Population	2002 Urban Population	% of CMSA Total 2002 Urban Population
Bibb	32%	16,650	5,311	0.7%	19%	21,622	4,108	0.8%
Blount	12%	39,408	4,847	0.6%	9%	53,545	4,819	0.7%
Chilton	24%	32,519	7,805	1.0%	12%	41,137	4,936	1.1%
Cullman	20%	67,796	13,559	1.7%	24%	79,424	19,062	1.8%
Jefferson	89%	652,078	582,958	71.6%	89%	664,031	593,644	67.4%
St. Clair	28%	50,090	14,125	1.7%	13%	67,781	8,812	2.2%
Shelby	59%	100,131	59,378	7.3%	64%	152,780	97,779	10.3%
Tuscaloosa	71%	151,035	107,235	13.2%	71%	167,027	118,621	13.5%
Walker	28%	67,654	18,943	2.3%	23%	71,211	16,379	2.3%
Totals	69%	1,177,361	814,161	100.0%	66%	1,318,558	868,160	100.0%

[2] The Alabama State Data Center (ASDC) is a network of 27 public agencies working together through a cooperative agreement with the U.S. Bureau of the Census to facilitate use and delivery of Census and other data to the public. Internet site: http://cber.cba.ua.edu/est_prj.html

[3] Based on the 1990 U.S. Census

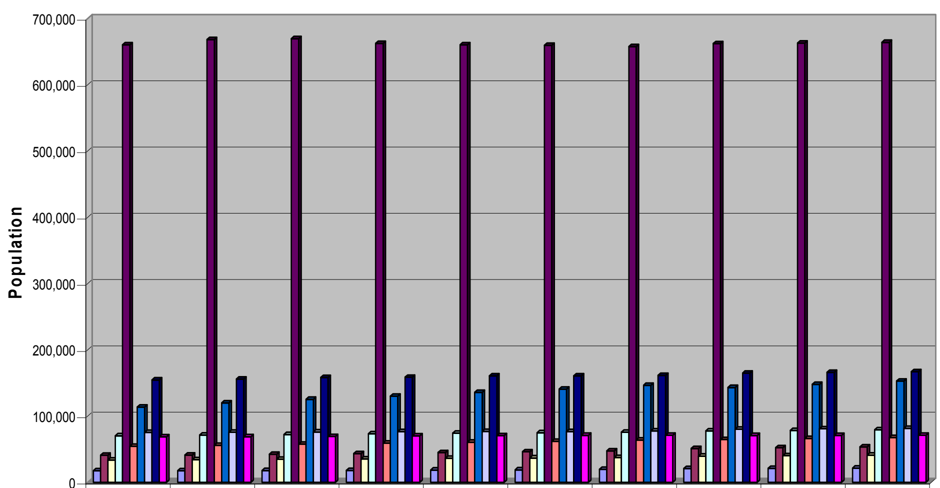
Birmingham CMSA Population Density



	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Bibb	28.0	28.3	28.9	29.3	29.9	30.4	31.5	33.5	34.1	34.7
Blount	63.5	64.1	66.0	67.4	69.6	71.7	73.4	79.0	81.0	82.9
Chilton	48.5	49.3	50.2	51.3	52.4	53.2	54.2	57.0	58.2	59.3
Cullman	95.4	96.8	97.9	99.4	100.4	101.5	102.5	104.9	106.2	107.5
Jefferson	593.3	600.5	601.7	595.3	593.3	592.7	590.8	595.0	595.9	596.8
St. Clair	86.0	88.3	91.2	93.7	95.7	97.8	100.7	102.1	104.5	106.9
Shelby	142.9	150.9	157.6	163.7	170.8	177.0	184.2	180.3	186.2	192.2
Talladega	102.0	102.4	103.0	103.7	104.0	103.6	104.8	108.6	109.4	110.1
Tuscaloosa	116.6	117.6	119.5	119.8	121.3	121.3	121.8	124.4	125.2	126.0
Walker	86.4	86.7	87.4	88.3	89.0	89.4	89.8	89.0	89.3	89.6

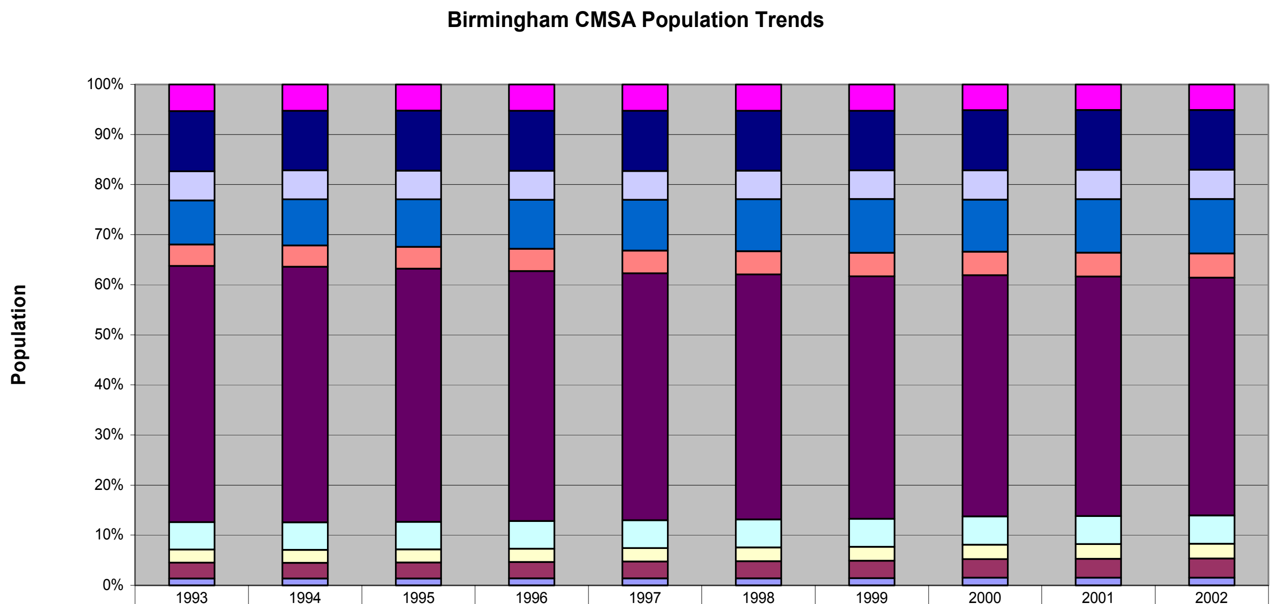
Figure 2 Population Densities for Birmingham CMSA and Tuscaloosa

Birmingham CMSA County Population Trends



	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Bibb	17,422	17,612	17,958	18,227	18,595	18,926	19,601	20,826	21,223	21,622
Blount	40,998	41,366	42,587	43,548	44,930	46,266	47,411	51,024	52,284	53,545
Chilton	33,666	34,191	34,847	35,640	36,360	36,918	37,604	39,593	40,362	41,137
Cullman	70,449	71,459	72,298	73,433	74,152	74,994	75,661	77,483	78,452	79,424
Jefferson	660,131	668,146	669,520	662,344	660,119	659,524	657,422	662,047	663,039	664,031
St. Clair	54,528	56,013	57,811	59,389	60,694	62,003	63,852	64,742	66,260	67,781
Shelby	113,583	119,966	125,314	130,133	135,752	140,715	146,392	143,293	148,038	152,780
Talladega	75,466	75,734	76,206	76,671	76,913	76,633	77,521	80,321	80,878	81,441
Tuscaloosa	154,555	155,906	158,421	158,799	160,805	160,768	161,435	164,875	165,952	167,027
Walker	68,681	68,921	69,458	70,182	70,684	71,027	71,318	70,713	70,962	71,211

Figure 3 Population Data for Birmingham CMSA and Tuscaloosa



	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Walker	68,681	68,921	69,458	70,182	70,684	71,027	71,318	70,713	70,962	71,211
Tuscaloosa	154,555	155,906	158,421	158,799	160,805	160,768	161,435	164,875	165,952	167,027
Talladega	75,466	75,734	76,206	76,671	76,913	76,633	77,521	80,321	80,878	81,441
Shelby	113,583	119,966	125,314	130,133	135,752	140,715	146,392	143,293	148,038	152,780
St. Clair	54,528	56,013	57,811	59,389	60,694	62,003	63,852	64,742	66,260	67,781
Jefferson	660,131	668,146	669,520	662,344	660,119	659,524	657,422	662,047	663,039	664,031
Cullman	70,449	71,459	72,298	73,433	74,152	74,994	75,661	77,483	78,452	79,424
Chilton	33,666	34,191	34,847	35,640	36,360	36,918	37,604	39,593	40,362	41,137
Blount	40,998	41,366	42,587	43,548	44,930	46,266	47,411	51,024	52,284	53,545
Bibb	17,422	17,612	17,958	18,227	18,595	18,926	19,601	20,826	21,223	21,622

Figure 4 Population Distribution for Birmingham CMSA and Tuscaloosa

Tables 3, 4 and 5 show the trends in the Total Employment, Manufacturing Employment, and Retail Employment, respectively, for the counties of the Birmingham CMSA and Tuscaloosa. Figure 5 demonstrates that the number of Total Employees for the counties surrounding Jefferson is 35% of the area total. <u>This factor fortifies the recommendation that the Birmingham NAA only include Jefferson County.</u>

Some of the counties in the Birmingham CMSA and Tuscaloosa experienced slight growth in total employment with Shelby showing a significant increase of 18.9 %. Although this seems significant, Shelby County's total employment is less than 11% of the area total.

All counties experienced a decrease in manufacturing employment with the exception of Chilton (9.1%) and Tuscaloosa (4.9%). While there is some increase in Retail employment for all but St. Clair (-11.4%) and Tuscaloosa (-4.0%), these increases are dwarfed by the amount of retail employment in Jefferson. <u>This factor fortifies the recommendation that the Birmingham NAA only include Jefferson County.</u>

Table 3 Total Employees

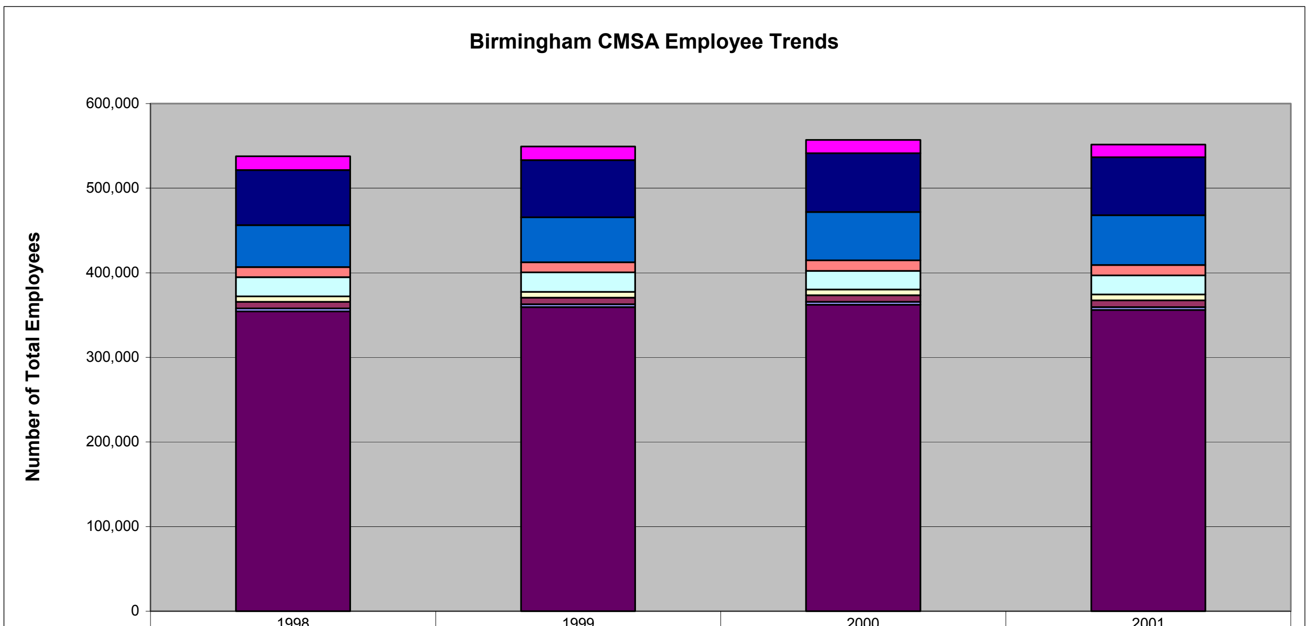
County	1998	1999	2000	2001	% Change 1998-2001	% of 2001 Area Total
Bibb	3,636	3,383	3,403	3,294	-9.4%	0.6%
Blount	7,670	7,817	7,868	8,131	6.0%	1.5%
Chilton	6,471	6,611	6,820	6,903	6.7%	1.3%
Cullman	22,680	23,047	21,824	22,526	-0.7%	4.1%
Jefferson	354,243	359,434	362,120	356,034	0.5%	64.6%
St. Clair	11,944	11,987	12,510	12,169	1.9%	2.2%
Shelby	49,635	53,329	57,081	59,016	18.9%	10.7%
Tuscaloosa	65,228	67,473	69,610	68,658	5.3%	12.4%
Walker	16,159	16,220	15,828	14,796	-8.4%	2.7%
Area Total	**537,666**	**549,301**	**557,064**	**551,527**	**2.6%**	**100.0%**

Table 4 Manufacturing Employment

County	1998	1999	2000	2001	% Change 1998-2001	% of 2001 Area Total
Bibb	932	814	795	534	-42.7%	0.8%
Blount	2,605	2,645	2,396	2,501	-4.0%	3.7%
Chilton	1,234	1,229	1,332	1,346	9.1%	2.0%
Cullman	6,852	6,753	6,079	5,933	-13.4%	8.7%
Jefferson	38,118	36,341	36,189	34,876	-8.5%	51.3%
St. Clair	3,273	3,062	3,351	3,239	-1.0%	4.8%
Shelby	6,140	6,021	6,146	5,955	-3.0%	8.8%
Tuscaloosa	11,593	12,460	12,952	12,158	4.9%	17.9%
Walker	1,883	1,974	1,725	1,450	-23.0%	2.1%
Area Total	**72,630**	**71,299**	**70,965**	**67,992**	**-6.4%**	**100.0%**

Table 5 Retail Employment

County	1998	1999	2000	2001	% Change 1998-2001	% of 2001 CMSA Total
Bibb	565	548	552	710	25.7%	1.0%
Blount	1,235	1,272	1,274	1,270	2.8%	1.8%
Chilton	1,492	1,549	1,650	1,723	15.5%	2.4%
Cullman	3,220	3,316	3,477	3,409	5.9%	4.7%
Jefferson	42,759	42,204	43,117	42,817	0.1%	59.0%
St. Clair	1,667	1,711	1,681	1,477	-11.4%	2.0%
Shelby	5,727	6,423	7,159	7,416	29.5%	10.2%
Tuscaloosa	10,399	9,763	10,112	9,978	-4.0%	13.8%
Walker	3,500	3,600	3,997	3,745	7.0%	5.2%
Total	**70,564**	**70,386**	**73,019**	**72,545**	**2.8%**	**100.0%**



	1998	1999	2000	2001
Walker	16,159	16,220	15,828	14,796
Tuscaloosa	65,228	67,473	69,610	68,658
Shelby	49,635	53,329	57,081	59,016
St. Clair	11,944	11,987	12,510	12,169
Cullman	22,680	23,047	21,824	22,526
Chilton	6,471	6,611	6,820	6,903
Blount	7,670	7,817	7,868	8,131
Bibb	3,636	3,383	3,403	3,294
Jefferson	354,243	359,434	362,120	356,034

Figure 5 Total Employees

C. Monitoring data representing PM2.5 concentrations in local areas and larger areas (urban or regional scale)

Table 6 demonstrates that two PM2.5 monitors (North Birmingham and Wylam are considered a single community monitoring zone) in Jefferson County exceeded the PM2.5 NAAQS. Further, it demonstrates that Shelby has an attaining monitor. Figure 6 identifies the PM2.5 monitoring sites which provided the 2000, 2001 and 2002 data for the Birmingham CMSA and Tuscaloosa. Monitors in Ashland and Gadsden had insufficient data recovery; however, available data is presented. During this time period the PM2.5 monitors in Tuscaloosa and Walker Counties had only been operational for one year. This fortifies the recommendation that Shelby County be excluded from the Birmingham NAA.

Table 6 Monitoring Data

County	AIRS ID	Site	Weighted Annual Mean			3-Year Avg. 2001-2003
			2001	2002	2003	
Clay	01-027-0001	Ashland*	12.8	13.2	13.4	13.1
Etowah	01-055-0010	Gadsden*	15.3	14.8	14.3	14.8
Jefferson	01-073-0023/2003	N. Bham/Wylam	18.5	17.1	16.6	17.4
Jefferson	01-073-2006	Hoover	15.6	14.4	14.2	14.7
Jefferson	01-073-1005	McAdory	15.0	15.0	14.2	14.7
Jefferson	01-073-5002	Pinson	14.3	13.4	13.5	13.7
Jefferson	01-073-5003	Corner	14.7	13.4	13.6	13.9
Jefferson	01-073-1009	Providence	13.4	12.2	12.3	12.6
Shelby	01-117-0006	Pelham*	14.7	13.6	14.9	14.4
Talladega	01-121-0002	Childersburg	14.6	14.1	15.4	14.7

*Monitor does not meet data completeness requirements.

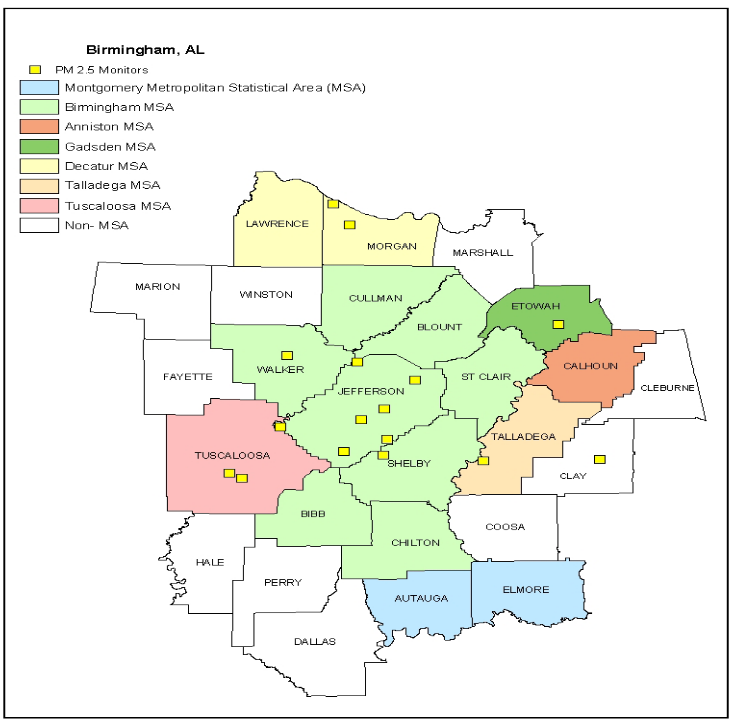


Figure 6 Monitoring Sites in the Birmingham CMSA and Tuscaloosa

D. Location of emission sources

Figure 7 depicts the location of large point sources in the Birmingham CMSA and Tuscaloosa. The base map was created using Geographical Information Systems (GIS) with coordinates supplied by the facilities. Tables 7 through 16 present the distribution of emissions (in tons per year of NOx, VOC, SO2, PM2.5, NH3) among point, area[4], and mobile sources in the Birmingham CMSA and Tuscaloosa. Figures 8 though 12 illustrate this data. Figure 13 presents the emission densities for the Birmingham CMSA and Tuscaloosa.

As shown in Table 1, Tuscaloosa VOC emissions are the 2nd highest in the area; however, they are only 45% of Jefferson's VOC emissions. The combined VOC emissions of Shelby, Tuscaloosa and Walker are less than the VOC emissions of Jefferson County. Wind analyses discussed in Section G indicate that it is unlikely that emissions from Tuscaloosa and Walker significantly impact Jefferson County on days with elevated PM2.5. Shelby County VOC emissions account for less than 10% of the VOC emissions in the entire area. (See Figure 8)

Jefferson's NOx emissions are larger than the NOx emissions of Shelby and Walker Counties combined. Shelby and Walker individually have larger SO2 emissions than Jefferson. The overwhelming majority of NOx and SO2 emissions in Shelby and Walker Counties are from point sources (over 82% NOx and over 99% SO2). The vast majority of the NOx and SO2 emissions in Shelby and Walker are due to a large utility located in each of the counties. ADEM has the legal authority to require the installation of controls as necessary on either or both of these utilities. Jefferson County PM2.5 emissions are 43% of the total area's PM2.5 emissions.

Cullman has the largest amount of NH3 emissions. Tuscaloosa, St. Clair, Cullman, Chilton, Blount and Bibb each have smaller emission densities than Jefferson, except for NH3. The factors discussed in this Section collectively fortify the recommendation to exclude Walker, Tuscaloosa, Shelby, St. Clair, Cullman, Chilton, Blount and Bibb from the Birmingham NAA. Walker and Tuscaloosa County's exclusions were also based on the meteorological discussion in Section G.

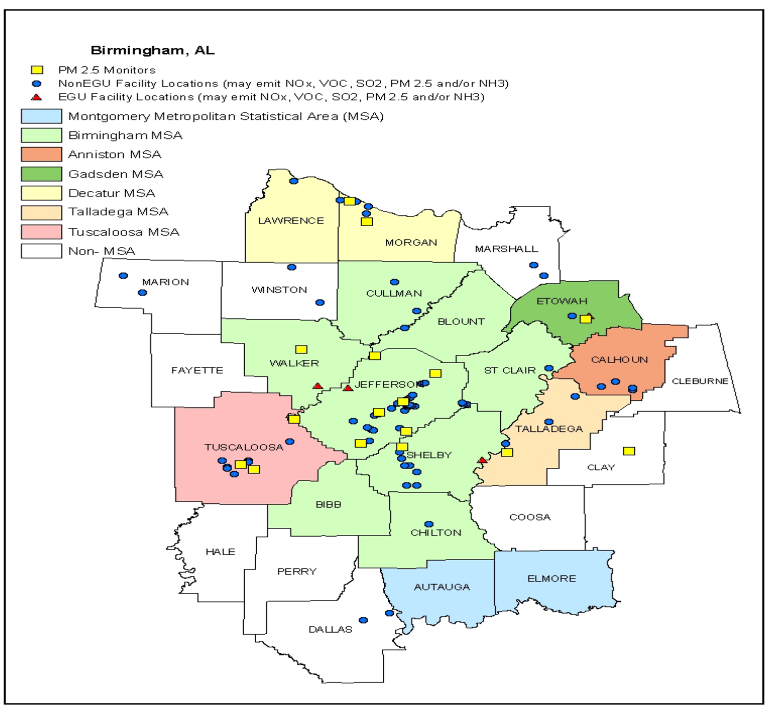


Figure 7 Location of Large Point Sources in the Birmingham CMSA and Tuscaloosa

[4] Area sources include the nonroad mobile sources

Table 7 NOx Annual Emissions (Tons)

County	Point		Area		Onroad Mobile		Total	
	TPY	*% of CMSA Total*	*TPY*	*% of CMSA Total*	*TPY*	*% of CMSA Total*	*TPY*	*% of CMSA Total*
Bibb	64	0.1%	901	4.1%	659	1.3%	1,623	0.9%
Blount	62	0.1%	1,039	4.7%	1,702	3.4%	2,803	1.5%
Chilton	422	0.4%	740	3.4%	2,068	4.1%	3,231	1.8%
Cullman	377	0.3%	1,019	4.7%	2,902	5.8%	4,299	2.4%
Jefferson	40,747	37.1%	9,396	42.9%	25,360	50.5%	75,503	41.5%
St Clair	2,271	2.1%	2,013	9.2%	3,340	6.7%	7,624	4.2%
Shelby	33,942	30.9%	2,614	11.9%	4,372	8.7%	40,928	22.5%
Tuscaloosa	2,670	2.4%	2,268	10.4%	7,356	14.7%	12,294	6.8%
Walker	29,378	26.7%	1,911	8.7%	2,443	4.9%	33,732	18.5%
Total	**109,934**		**21,901**		**50,202**		**182,037**	

Table 8 Cumulative NOx Contributions

County Name	Factor	Annual 1999 Emissions (tons)	% of Area Total Emissions	Cumulative %
Jefferson	Point Source NOx Emissions (tons)	40,747	22.4%	22.4%
Shelby	Point Source NOx Emissions (tons)	33,942	18.6%	41.0%
Walker	Point Source NOx Emissions (tons)	29,378	16.1%	57.2%
Jefferson	Mobile Source NOx Emissions (tons)	25,360	13.9%	71.1%
Jefferson	Area Source NOx Emissions (tons)	9,396	5.2%	76.3%
Tuscaloosa	Mobile Source NOx Emissions (tons)	7,356	4.0%	80.3%
Shelby	Mobile Source NOx Emissions (tons)	4,372	2.4%	82.7%
St Clair	Mobile Source NOx Emissions (tons)	3,340	1.8%	84.5%
Cullman	Mobile Source NOx Emissions (tons)	2,902	1.6%	86.1%
Tuscaloosa	Point Source NOx Emissions (tons)	2,670	1.5%	87.6%
Shelby	Area Source NOx Emissions (tons)	2,614	1.4%	89.0%
Walker	Mobile Source NOx Emissions (tons)	2,443	1.3%	90.4%
St Clair	Point Source NOx Emissions (tons)	2,271	1.2%	91.6%
Tuscaloosa	Area Source NOx Emissions (tons)	2,268	1.2%	92.9%
Chilton	Mobile Source NOx Emissions (tons)	2,068	1.1%	94.0%
St Clair	Area Source NOx Emissions (tons)	2,013	1.1%	95.1%
Walker	Area Source NOx Emissions (tons)	1,911	1.0%	96.2%
Blount	Mobile Source NOx Emissions (tons)	1,702	0.9%	97.1%
Blount	Area Source NOx Emissions (tons)	1,039	0.6%	97.7%
Cullman	Area Source NOx Emissions (tons)	1,019	0.6%	98.2%
Bibb	Area Source NOx Emissions (tons)	901	0.5%	98.7%
Chilton	Area Source NOx Emissions (tons)	740	0.4%	99.1%
Bibb	Mobile Source NOx Emissions (tons)	659	0.4%	99.5%
Chilton	Point Source NOx Emissions (tons)	422	0.2%	99.7%
Cullman	Point Source NOx Emissions (tons)	377	0.2%	99.9%
Bibb	Point Source NOx Emissions (tons)	64	0.0%	100.0%
Blount	Point Source NOx Emissions (tons)	62	0.0%	100.0%
Area Total Emissions		**182,037**		

Table 9 VOC Annual Emissions (Tons)

County	Point		Onroad Mobile		Area		Total	
	TPY	*% of CMSA Total*	*TPY*	*% of CMSA Total*	*TPY*	*% of CMSA Total*	*TPY*	*% of CMSA Total*
Bibb	238	1.7%	462	1.3%	3,434	4.3%	4,134	3.2%
Blount	60	0.4%	1,154	3.2%	3,827	4.8%	5,041	3.9%
Chilton	615	4.3%	1,362	3.8%	3,471	4.4%	5,448	4.2%
Cullman	1,179	8.3%	1,952	5.4%	6,621	8.4%	9,752	7.5%
Jefferson	7,090	50.1%	18,626	51.8%	24,360	30.8%	50,076	38.7%
St Clair	246	1.7%	2,177	6.1%	6,808	8.6%	9,231	7.1%
Shelby	935	6.6%	3,043	8.5%	8,784	11.1%	12,762	9.9%
Tuscaloosa	3,303	23.4%	5,301	14.7%	14,169	17.9%	22,773	17.6%
Walker	475	3.4%	1,871	5.2%	7,667	9.7%	10,014	7.7%
Total	**14,141**		**35,948**		**79,142**		**129,231**	

Table 10 Cumulative VOC Contributions

County Name	Factor	Annual 1999 Emissions (tons)	% of Area Total Emissions	Cumulative %
Jefferson	Area Source VOC Emissions (tons)	24,360	18.8%	18.8%
Jefferson	Mobile Source VOC Emissions (tons)	18,626	14.4%	33.3%
Tuscaloosa	Area Source VOC Emissions (tons)	14,169	11.0%	44.2%
Shelby	Area Source VOC Emissions (tons)	8,784	6.8%	51.0%
Walker	Area Source VOC Emissions (tons)	7,667	5.9%	57.0%
Jefferson	Point Source VOC Emissions (tons)	7,090	5.5%	62.4%
St Clair	Area Source VOC Emissions (tons)	6,808	5.3%	67.7%
Cullman	Area Source VOC Emissions (tons)	6,621	5.1%	72.8%
Tuscaloosa	Mobile Source VOC Emissions (tons)	5,301	4.1%	76.9%
Blount	Area Source VOC Emissions (tons)	3,827	3.0%	79.9%
Chilton	Area Source VOC Emissions (tons)	3,471	2.7%	82.6%
Bibb	Area Source VOC Emissions (tons)	3,434	2.7%	85.2%
Tuscaloosa	Point Source VOC Emissions (tons)	3,303	2.6%	87.8%
Shelby	Mobile Source VOC Emissions (tons)	3,043	2.4%	90.2%
St Clair	Mobile Source VOC Emissions (tons)	2,177	1.7%	91.8%
Cullman	Mobile Source VOC Emissions (tons)	1,952	1.5%	93.3%
Walker	Mobile Source VOC Emissions (tons)	1,871	1.4%	94.8%
Chilton	Mobile Source VOC Emissions (tons)	1,362	1.1%	95.8%
Cullman	Point Source VOC Emissions (tons)	1,179	0.9%	96.8%
Blount	Mobile Source VOC Emissions (tons)	1,154	0.9%	97.7%
Shelby	Point Source VOC Emissions (tons)	935	0.7%	98.4%
Chilton	Point Source VOC Emissions (tons)	615	0.5%	98.9%
Walker	Point Source VOC Emissions (tons)	475	0.4%	99.2%
Bibb	Mobile Source VOC Emissions (tons)	462	0.4%	99.6%
St Clair	Point Source VOC Emissions (tons)	246	0.2%	99.8%
Bibb	Point Source VOC Emissions (tons)	238	0.2%	100.0%
Blount	Point Source VOC Emissions (tons)	60	0.0%	100.0%
Area Total Emissions		**129,231**		

Table 11 SO2 Annual Emissons (Tons)

County	Point		Area		Onroad Mobile		Total	
	TPY	*% of CMSA Total*	*TPY*	*% of CMSA Total*	*TPY*	*% of CMSA Total*	*TPY*	*% of CMSA Total*
Bibb	13	0.0%	137	2.4%	27	1.4%	176	0.1%
Blount	83	0.0%	275	4.8%	68	3.6%	426	0.1%
Chilton	13	0.0%	363	6.3%	78	4.1%	454	0.2%
Cullman	22	0.0%	803	14.0%	111	5.8%	936	0.3%
Jefferson	81,150	28.1%	725	12.6%	950	49.9%	82,825	27.9%
St Clair	614	0.2%	291	5.1%	125	6.6%	1,031	0.3%
Shelby	106,405	36.8%	208	3.6%	167	8.8%	106,780	36.0%
Tuscaloosa	2,670	0.9%	2,121	37.0%	278	14.6%	5,070	1.7%
Walker	97,851	33.9%	813	14.2%	98	5.1%	98,762	33.3%
Total	**288,821**		**5,737**		**1,903**		**296,461**	

Table 12 Cumulative SO2 Contributions

County Name	Factor	Annual 1999 Emissions (tons)	% of Area Total Emissions	Cumulative %
Shelby	Point Source SO2 Emissions (tons)	106,405	35.9%	35.9%
Walker	Point Source SO2 Emissions (tons)	97,851	33.0%	68.9%
Jefferson	Point Source SO2 Emissions (tons)	81,150	27.4%	96.3%
Tuscaloosa	Point Source SO2 Emissions (tons)	2,670	0.9%	97.2%
Tuscaloosa	Area Source SO2 Emissions (tons)	2,121	0.7%	97.9%
Jefferson	Mobile Source SO2 Emissions (tons)	950	0.3%	98.2%
Walker	Area Source SO2 Emissions (tons)	813	0.3%	98.5%
Cullman	Area Source SO2 Emissions (tons)	803	0.3%	98.8%
Jefferson	Area Source SO2 Emissions (tons)	725	0.2%	99.0%
St Clair	Point Source SO2 Emissions (tons)	614	0.2%	99.2%
Chilton	Area Source SO2 Emissions (tons)	363	0.1%	99.3%
St Clair	Area Source SO2 Emissions (tons)	291	0.1%	99.4%
Tuscaloosa	Mobile Source SO2 Emissions (tons)	278	0.1%	99.5%
Blount	Area Source SO2 Emissions (tons)	275	0.1%	99.6%
Shelby	Area Source SO2 Emissions (tons)	208	0.1%	99.7%
Shelby	Mobile Source SO2 Emissions (tons)	167	0.1%	99.7%
Bibb	Area Source SO2 Emissions (tons)	137	0.0%	99.8%
St Clair	Mobile Source SO2 Emissions (tons)	125	0.0%	99.8%
Cullman	Mobile Source SO2 Emissions (tons)	111	0.0%	99.9%
Walker	Mobile Source SO2 Emissions (tons)	98	0.0%	99.9%
Blount	Point Source SO2 Emissions (tons)	83	0.0%	99.9%
Chilton	Mobile Source SO2 Emissions (tons)	78	0.0%	100.0%
Blount	Mobile Source SO2 Emissions (tons)	68	0.0%	100.0%
Bibb	Mobile Source SO2 Emissions (tons)	27	0.0%	100.0%
Cullman	Point Source SO2 Emissions (tons)	22	0.0%	100.0%
Chilton	Point Source SO2 Emissions (tons)	13	0.0%	100.0%
Bibb	Point Source SO2 Emissions (tons)	13	0.0%	100.0%
Area Total Emissions		**296,461**		

Table 13 PM2.5 Annual Emissions (Tons)

County	Point		Area		Onroad Mobile		Total	
	TPY	% of CMSA Total	TPY	% of CMSA Total	TPY	% of CMSA Total	TPY	% of CMSA Total
Bibb	133	1.2%	2,032	5.7%	15	1.4%	2,180	4.6%
Blount	16	0.1%	2,239	6.3%	39	3.5%	2,293	4.8%
Chilton	113	1.0%	1,943	5.4%	44	4.1%	2,100	4.4%
Cullman	36	0.3%	3,089	8.7%	63	5.8%	3,188	6.7%
Jefferson	8,683	79.5%	11,097	31.1%	546	50.1%	20,326	42.6%
St Clair	144	1.3%	3,305	9.3%	71	6.6%	3,521	7.4%
Shelby	1,083	9.9%	4,035	11.3%	95	8.8%	5,214	10.9%
Tuscaloosa	345	3.2%	3,913	11.0%	159	14.6%	4,417	9.3%
Walker	367	3.4%	4,018	11.3%	56	5.1%	4,440	9.3%
Total	**10,921**		**35,669**		**1,090**		**47,680**	

Table 14 Cumulative PM2.5 Contributions

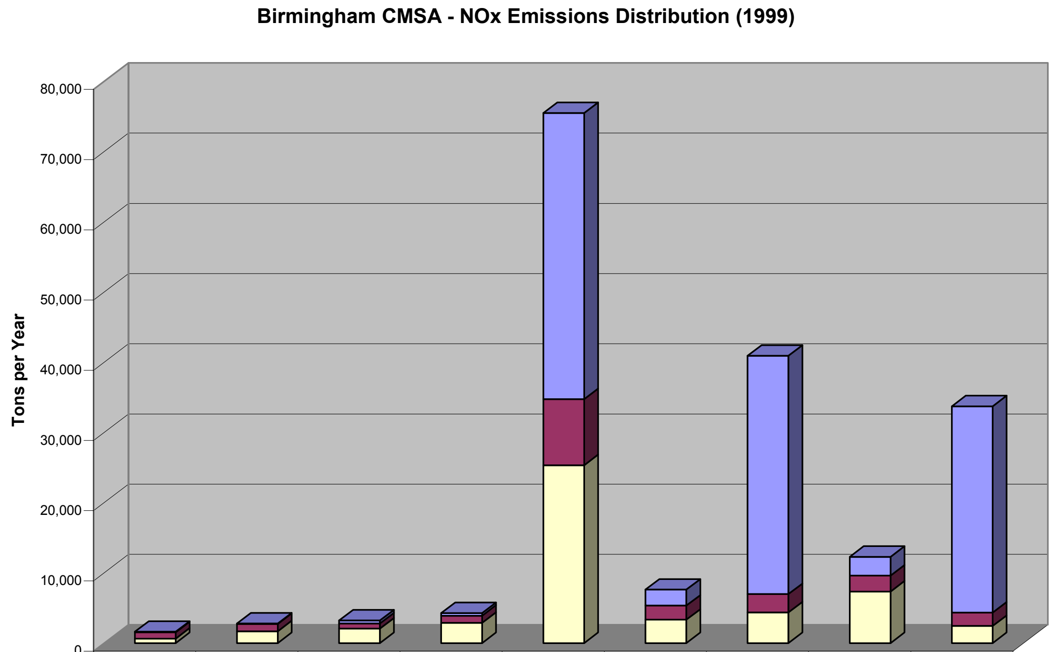
County Name	Factor	Annual 1999 Emissions (tons)	% of Area Total Emissions	Cumulative %
Jefferson	Area Source PM2.5 Emissions (tons)	11,097	23.3%	23.3%
Jefferson	Point Source PM2.5 Emissions (tons)	8,683	18.2%	41.5%
Shelby	Area Source PM2.5 Emissions (tons)	4,035	8.5%	49.9%
Walker	Area Source PM2.5 Emissions (tons)	4,018	8.4%	58.4%
Tuscaloosa	Area Source PM2.5 Emissions (tons)	3,913	8.2%	66.6%
St Clair	Area Source PM2.5 Emissions (tons)	3,305	6.9%	73.5%
Cullman	Area Source PM2.5 Emissions (tons)	3,089	6.5%	80.0%
Blount	Area Source PM2.5 Emissions (tons)	2,239	4.7%	84.7%
Bibb	Area Source PM2.5 Emissions (tons)	2,032	4.3%	88.9%
Chilton	Area Source PM2.5 Emissions (tons)	1,943	4.1%	93.0%
Shelby	Point Source PM2.5 Emissions (tons)	1,083	2.3%	95.3%
Jefferson	Mobile Source PM2.5 Emissions (tons)	546	1.1%	96.4%
Walker	Point Source PM2.5 Emissions (tons)	367	0.8%	97.2%
Tuscaloosa	Point Source PM2.5 Emissions (tons)	345	0.7%	97.9%
Tuscaloosa	Mobile Source PM2.5 Emissions (tons)	159	0.3%	98.3%
St Clair	Point Source PM2.5 Emissions (tons)	144	0.3%	98.6%
Bibb	Point Source PM2.5 Emissions (tons)	133	0.3%	98.8%
Chilton	Point Source PM2.5 Emissions (tons)	113	0.2%	99.1%
Shelby	Mobile Source PM2.5 Emissions (tons)	95	0.2%	99.3%
St Clair	Mobile Source PM2.5 Emissions (tons)	71	0.1%	99.4%
Cullman	Mobile Source PM2.5 Emissions (tons)	63	0.1%	99.6%
Walker	Mobile Source PM2.5 Emissions (tons)	56	0.1%	99.7%
Chilton	Mobile Source PM2.5 Emissions (tons)	44	0.1%	99.8%
Blount	Mobile Source PM2.5 Emissions (tons)	39	0.1%	99.9%
Cullman	Point Source PM2.5 Emissions (tons)	36	0.1%	99.9%
Blount	Point Source PM2.5 Emissions (tons)	16	0.0%	100.0%
Bibb	Mobile Source PM2.5 Emissions (tons)	15	0.0%	100.0%
Area Total Emissions		**47,680**		

Table 15 NH3 Annual Emissions (Tons)

County	Point		Area		Onroad Mobile		Total	
	TPY	*% of CMSA Total*	*TPY*	*% of CMSA Total*	*TPY*	*% of CMSA Total*	*TPY*	*% of CMSA Total*
Bibb	0	0.0%	340	2.2%	23	1.4%	363	2.1%
Blount	0	0.0%	3,400	21.7%	57	3.6%	3,457	20.0%
Chilton	0	0.0%	698	4.5%	65	4.1%	763	4.4%
Cullman	0	0.0%	6,960	44.4%	93	5.8%	7,053	40.8%
Jefferson	5	13.4%	415	2.6%	794	49.9%	1,214	7.0%
St Clair	0	0.0%	1,434	9.1%	105	6.6%	1,537	8.9%
Shelby	2	5.7%	400	2.6%	140	8.8%	542	3.1%
Tuscaloosa	25	77.1%	721	4.6%	233	14.6%	979	5.7%
Walker	1	3.9%	1,300	8.3%	81	5.1%	1,382	8.0%
Total	**33**		**15,667**		**1,590**		**17,290**	

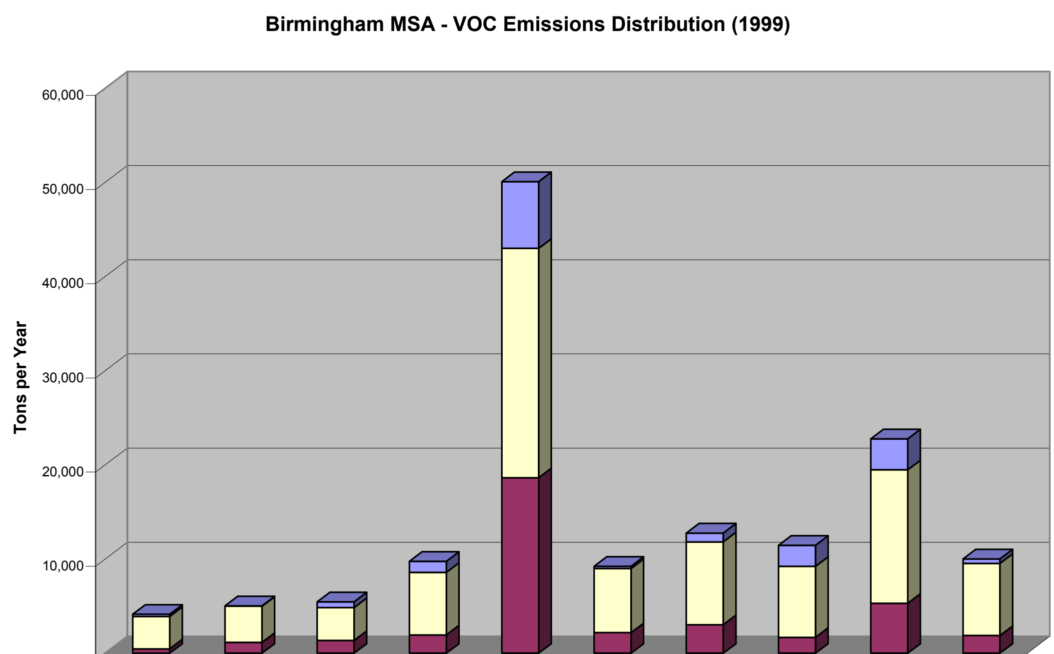
Table 16 Cumulative NH3 Contributions

County Name	Factor	Annual 1999 Emissions (tons)	% of Area Total Emissions	Cumulative %
Cullman	Area Source NH3 Emissions (tons)	6,960	40.3%	40.3%
Blount	Area Source NH3 Emissions (tons)	3,400	19.7%	59.9%
St Clair	Area Source NH3 Emissions (tons)	1,434	8.3%	68.2%
Walker	Area Source NH3 Emissions (tons)	1,300	7.5%	75.7%
Jefferson	Mobile Source NH3 Emissions (tons)	794	4.6%	80.3%
Tuscaloosa	Area Source NH3 Emissions (tons)	721	4.2%	84.5%
Chilton	Area Source NH3 Emissions (tons)	698	4.0%	88.5%
Jefferson	Area Source NH3 Emissions (tons)	415	2.4%	90.9%
Shelby	Area Source NH3 Emissions (tons)	400	2.3%	93.2%
Bibb	Area Source NH3 Emissions (tons)	340	2.0%	95.2%
Tuscaloosa	Mobile Source NH3 Emissions (tons)	233	1.3%	96.6%
Shelby	Mobile Source NH3 Emissions (tons)	140	0.8%	97.4%
St Clair	Mobile Source NH3 Emissions (tons)	105	0.6%	98.0%
Cullman	Mobile Source NH3 Emissions (tons)	93	0.5%	98.5%
Walker	Mobile Source NH3 Emissions (tons)	81	0.5%	99.0%
Chilton	Mobile Source NH3 Emissions (tons)	65	0.4%	99.4%
Blount	Mobile Source NH3 Emissions (tons)	57	0.3%	99.7%
Tuscaloosa	Point Source NH3 Emissions (tons)	25	0.1%	99.8%
Bibb	Mobile Source NH3 Emissions (tons)	23	0.1%	100.0%
Jefferson	Point Source NH3 Emissions (tons)	4	0.0%	100.0%
Shelby	Point Source NH3 Emissions (tons)	2	0.0%	100.0%
Walker	Point Source NH3 Emissions (tons)	1	0.0%	100.0%
Bibb	Point Source NH3 Emissions (tons)	0	0.0%	100.0%
Blount	Point Source NH3 Emissions (tons)	0	0.0%	100.0%
Chilton	Point Source NH3 Emissions (tons)	0	0.0%	100.0%
Cullman	Point Source NH3 Emissions (tons)	0	0.0%	100.0%
St Clair	Point Source NH3 Emissions (tons)	0	0.0%	100.0%
Area Total Emissions		**17,291**		



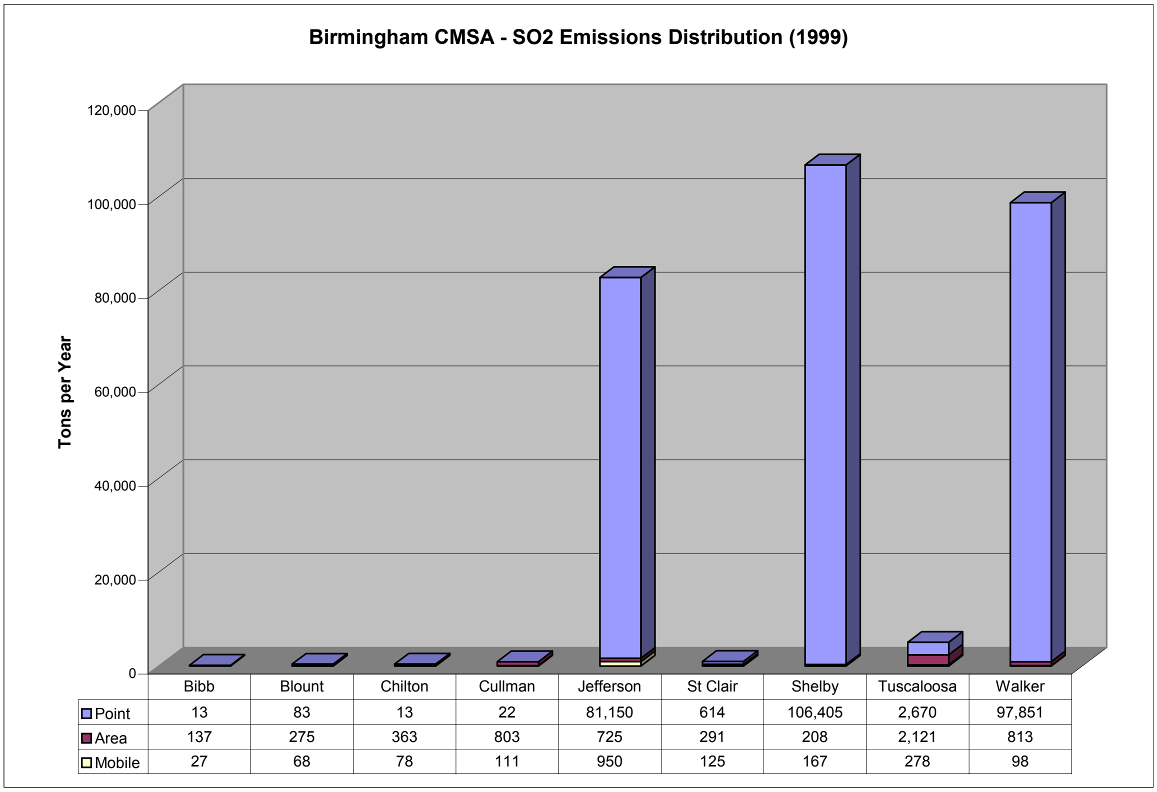
	Bibb	Blount	Chilton	Cullman	Jefferson	St Clair	Shelby	Tuscaloosa	Walker
Point	64	62	422	377	40,747	2,271	33,942	2,670	29,378
Area	901	1,039	740	1,019	9,396	2,013	2,614	2,268	1,911
Mobile	659	1,702	2,068	2,902	25,360	3,340	4,372	7,356	2,443

Figure 8 NOx Emissions for the Birmingham CMSA and Tuscaloosa



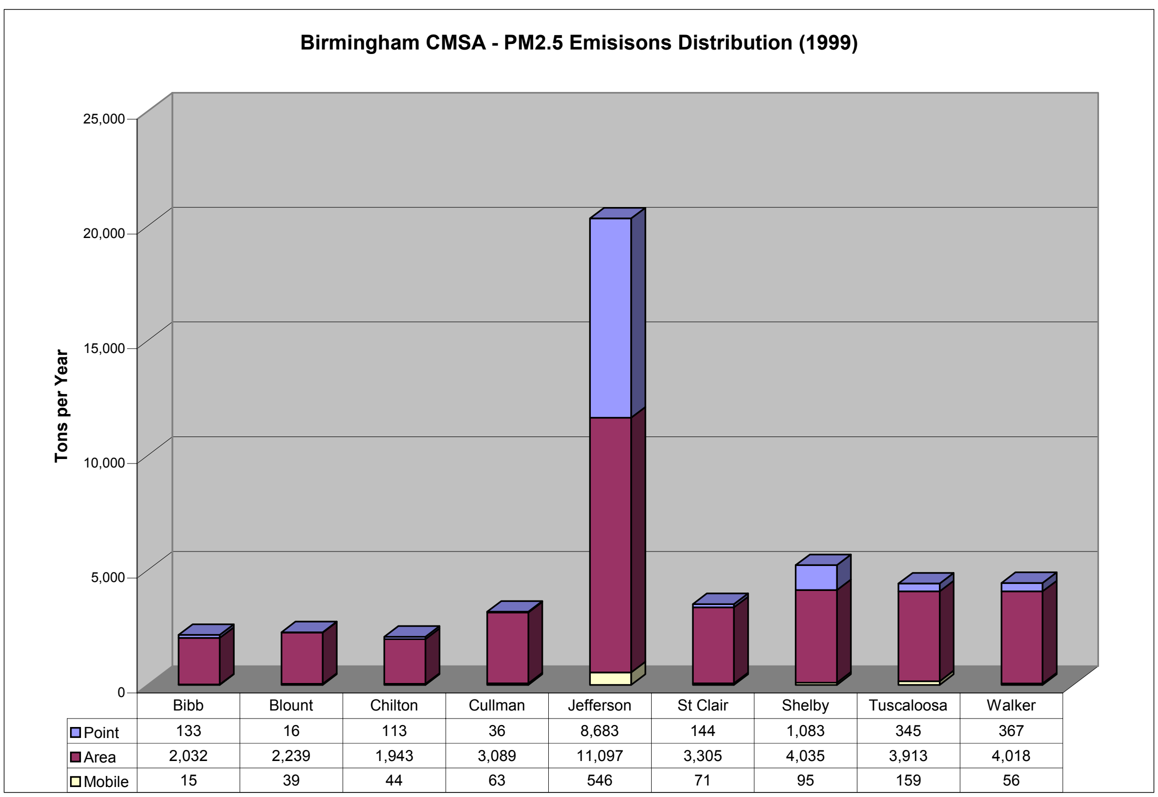
	Bibb	Blount	Chilton	Cullman	Jefferson	St Clair	Shelby	Talladega	Tuscaloosa	Walker
Point	238	60	615	1,179	7,090	246	935	2,232	3,303	475
Area	3,434	3,827	3,471	6,621	24,360	6,808	8,784	7,545	14,169	7,667
Mobile	462	1,154	1,362	1,952	18,626	2,177	3,043	1,680	5,301	1,871

Figure 9 VOC Emissions for the Birmingham CMSA and Tuscaloosa



	Bibb	Blount	Chilton	Cullman	Jefferson	St Clair	Shelby	Tuscaloosa	Walker
Point	13	83	13	22	81,150	614	106,405	2,670	97,851
Area	137	275	363	803	725	291	208	2,121	813
Mobile	27	68	78	111	950	125	167	278	98

Figure 10 SO2 Emissions for the Birmingham CMSA and Tuscaloosa



	Bibb	Blount	Chilton	Cullman	Jefferson	St Clair	Shelby	Tuscaloosa	Walker
Point	133	16	113	36	8,683	144	1,083	345	367
Area	2,032	2,239	1,943	3,089	11,097	3,305	4,035	3,913	4,018
Mobile	15	39	44	63	546	71	95	159	56

Figure 11 PM2.5 Emissions for the Birmingham CMSA and Tuscaloosa

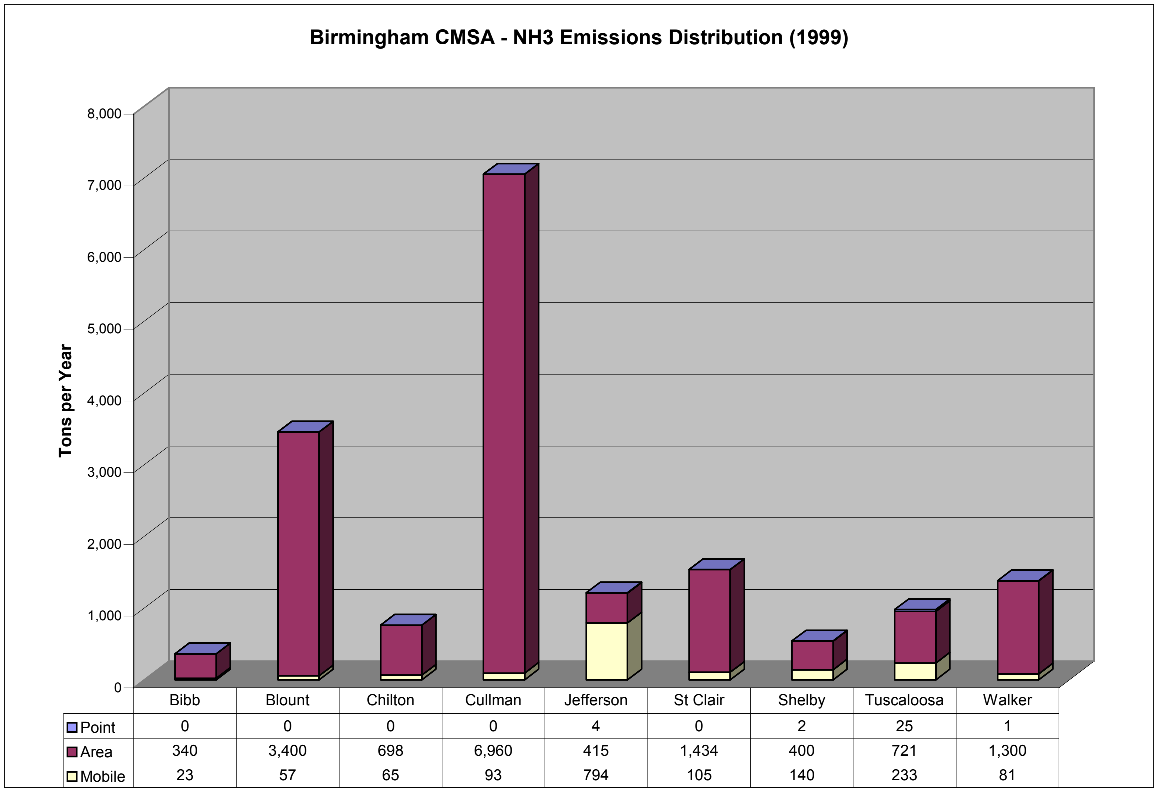


Figure 12 NH3 Emissions for the Birmingham MSA and Tuscaloosa

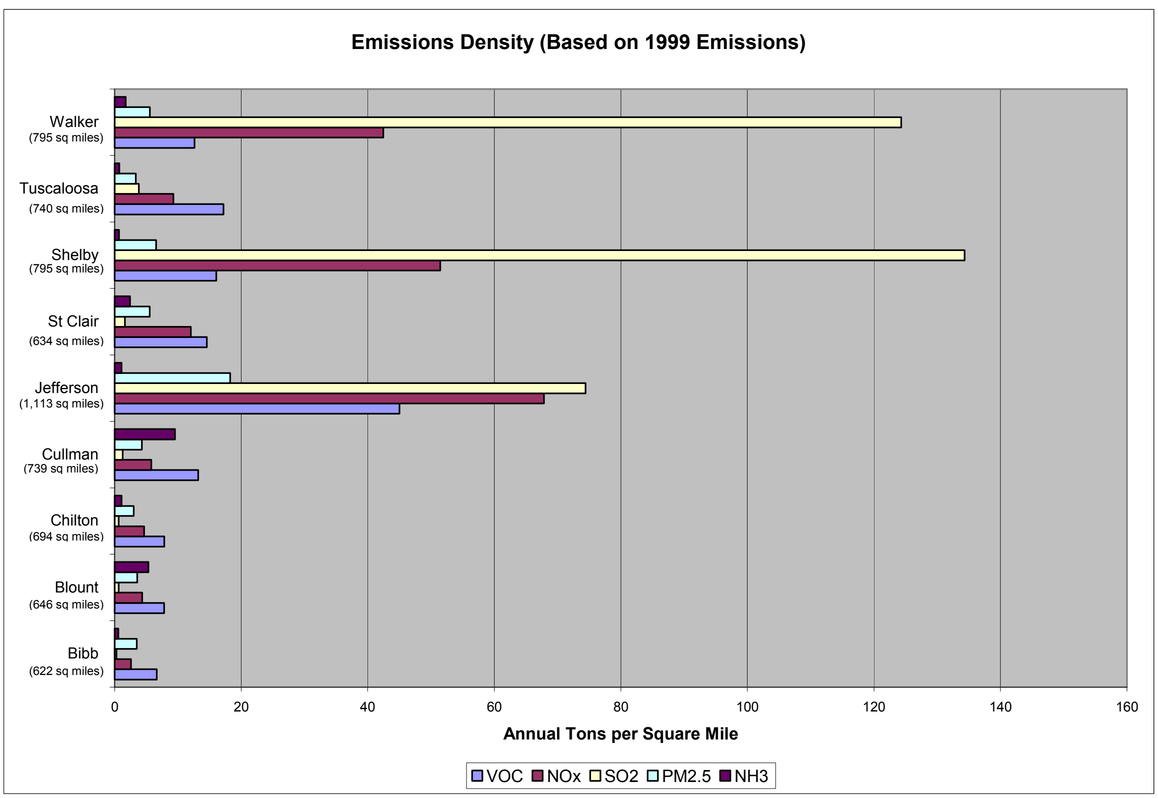


Figure 13 Emissions Density for the Birmingham CMSA and Tuscaloosa

E. Traffic and Commuting Patterns

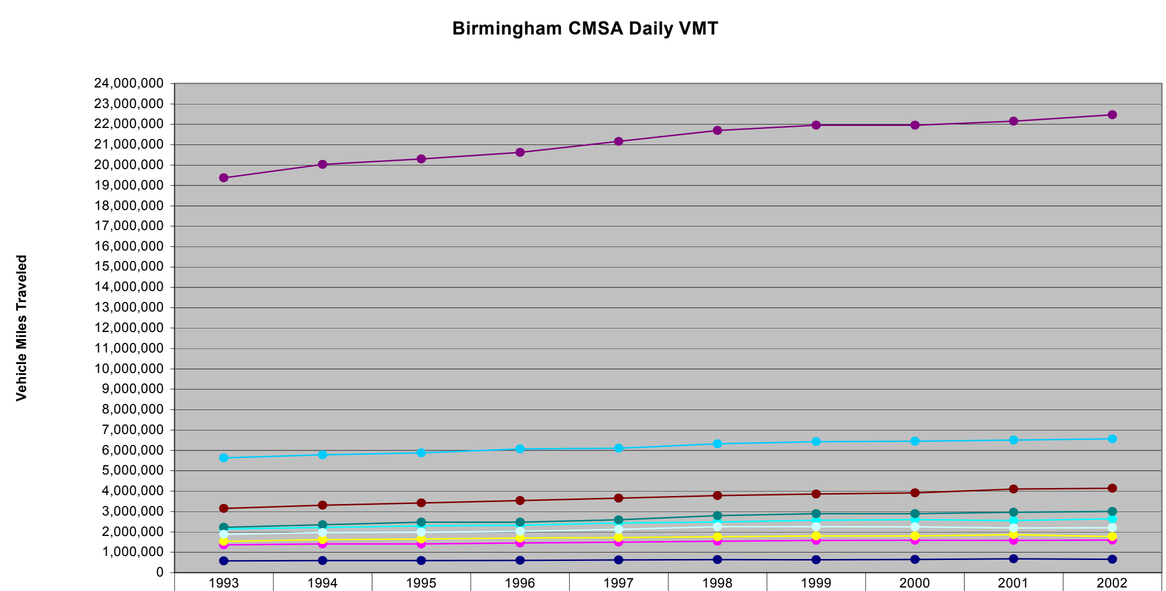
Estimates of the Daily Vehicle Miles Traveled (DVMT) were obtained from the Alabama Department of Transportation and the commuting patterns were obtained from the U.S. Census Bureau web site. The commuting patterns available were based on the 2000 U.S. Census. Table 17 presents the 1993 and 2002 Daily VMT estimates for the Birmingham CMSA and Tuscaloosa. Figure 14 demonstrates the trend from 1993 to 2002 for each county. Figure 15 presents the breakdown of 2002 Daily VMT into urban and rural. Figure 16 presents the commuting patterns among the Birmingham CMSA and Tuscaloosa.

Table 17 shows that the Daily VMT for Jefferson comprises approximately 50% of the combined area total of Daily VMT. Table 17 also demonstrates that all other counties individually comprise less than 15% of the total daily VMT. Figure 15 shows that all counties except for Jefferson and Shelby have greater than 50% rural VMT. Shelby has 58% urban and Jefferson has 89% urban VMT. Shelby County on-road mobile source NOx emissions account for less than 3% of the total NOx emissions in the area. Further, any impact from Shelby mobile source NOx emissions will be mitigated by Tier II and national low sulfur fuel standards. These factors fortify the recommendation to exclude Bibb, Blount, Chilton, Cullman, St. Clair, Shelby, Tuscaloosa and Walker Counties from the Birmingham NAA.

Figure 16 indicates that all counties have some degree of commuting into Jefferson County; however, the impact of this commuting will be lessened by Tier II and the national low sulfur fuel standards. Therefore, this factor was not considered to play a significant role in the recommendation that the Birmingham NAA only include Jefferson County.

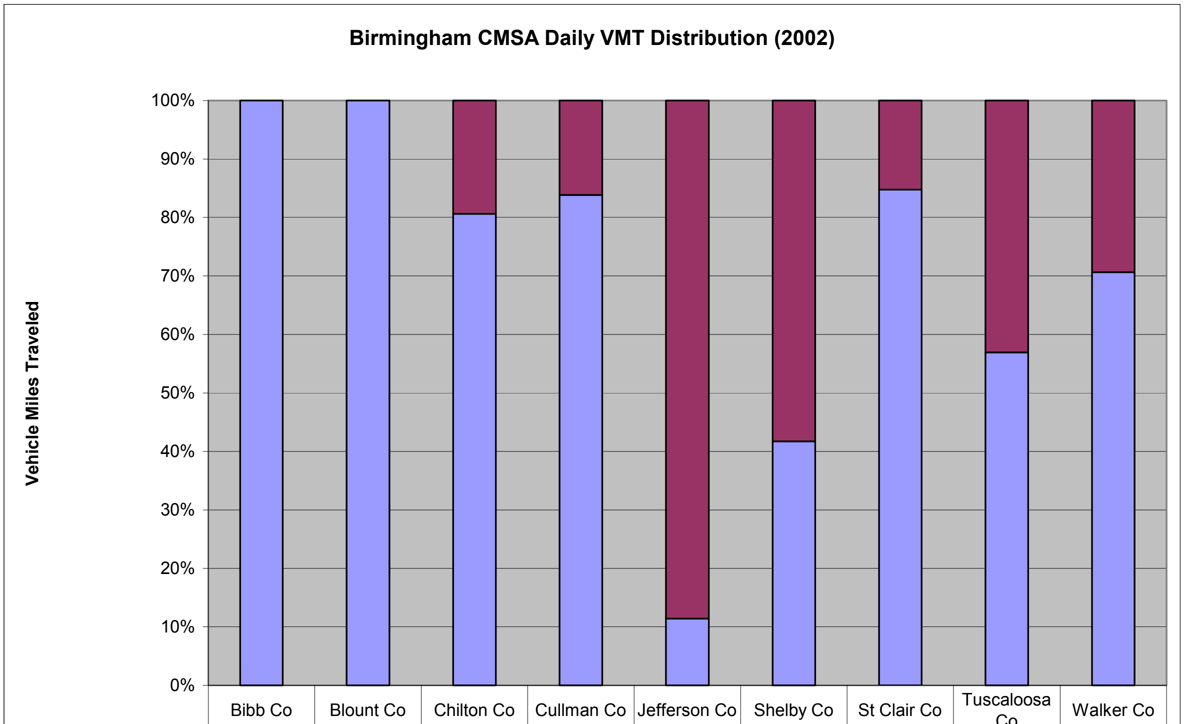
Table 17 Daily VMT for the Birmingham CMSA and Tuscaloosa

County	1993 Daily VMT	2002 Daily VMT	Daily VMT Change (1993-2002)	% Change	% of Area 2002 Daily VMT
Bibb	571,386	650,576	79,190	13.9%	1.4%
Blount	1,361,416	1,590,667	229,251	16.8%	3.5%
Chilton	1,529,548	1,765,198	235,650	15.4%	3.9%
Cullman	2,138,946	2,644,284	505,338	23.6%	5.9%
Jefferson	19,365,985	22,462,846	3,096,861	16.0%	49.9%
St. Clair	3,153,562	4,135,243	981,681	31.1%	9.2%
Shelby	2,220,947	2,996,080	775,133	34.9%	6.7%
Tuscaloosa	5,628,028	6,558,672	930,644	16.5%	14.6%
Walker	1,881,311	2,201,665	320,354	17.0%	4.9%
Total	37,851,129	45,005,231	7,154,102	18.9%	100.0%



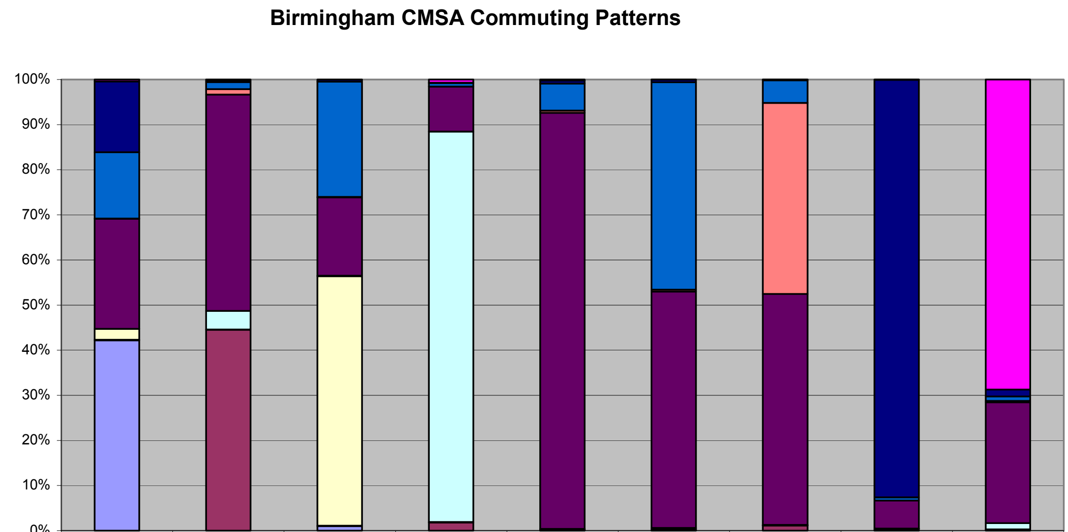
	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Bibb Co	571,386	587,311	591,663	598,606	621,840	631,766	624,276	644,770	669,694	650,576
Blount Co	1,361,416	1,403,021	1,407,014	1,452,865	1,493,996	1,542,384	1,571,675	1,579,631	1,576,698	1,590,667
Chilton Co	1,529,548	1,616,634	1,649,764	1,687,282	1,717,290	1,753,198	1,799,589	1,794,546	1,858,548	1,765,198
Cullman Co	2,138,946	2,211,026	2,289,162	2,323,234	2,429,603	2,478,120	2,565,204	2,590,801	2,549,781	2,644,284
Jefferson Co	19,365,985	20,028,042	20,297,167	20,615,792	21,156,010	21,690,292	21,951,545	21,953,933	22,148,272	22,462,846
Shelby Co	3,153,562	3,299,570	3,413,894	3,538,743	3,651,901	3,779,696	3,855,247	3,906,718	4,098,753	4,135,243
St Clair Co	2,220,947	2,348,050	2,470,192	2,469,106	2,585,118	2,791,197	2,894,061	2,886,654	2,962,332	2,996,080
Tuscaloosa Co	5,628,028	5,782,920	5,871,756	6,066,197	6,103,961	6,319,580	6,427,232	6,442,142	6,493,719	6,558,672
Walker Co	1,881,311	1,956,042	1,979,300	2,022,128	2,119,281	2,250,681	2,251,511	2,249,780	2,193,250	2,201,665

Figure 14 Daily VMT Trend for the Birmingham CMSA and Tuscaloosa



	Bibb Co	Blount Co	Chilton Co	Cullman Co	Jefferson Co	Shelby Co	St Clair Co	Tuscaloosa Co	Walker Co
Urban Daily VMT	0	0	341,866	426,798	19,900,034	2,409,323	456,731	2,823,354	646,084
Rural Daily VMT	650,576	1,590,667	1,423,332	2,217,486	2,562,812	1,725,919	2,539,349	3,735,318	1,555,581

Figure 15 Rural vs Urban Daily VMT



	Reside in Bibb Co	Reside in Blount Co	Reside in Chilton Co	Reside in Cullman Co	Reside in Jefferson Co	Reside in Shelby Co	Reside in St. Clair Co	Reside in Tuscaloosa Co	Reside in Walker Co
Work in Walker Co	33	75	0	198	735	28	11	84	17,293
Work in Tuscaloosa Co	1,189	44	73	30	1,884	408	40	65,331	385
Work in Shelby Co	1,116	312	3,747	219	17,351	32,573	1,256	487	245
Work in St_ Clair Co	9	237	14	9	1,363	321	10,648	19	68
Work in Jefferson Co	1,849	9,669	2,552	2,851	265,661	37,119	12,870	4,385	6,746
Work in Cullman Co	0	820	16	24,760	405	36	13	36	353
Work in Chilton Co	183	16	8,115	23	73	249	13	16	20
Work in Blount Co	13	8,966	15	522	550	27	290	0	47
Work in Bibb Co	3,199	2	149	0	114	112	2	273	2

Figure 16 Commuting Patterns for the Birmingham CMSA and Tuscaloosa

F. Expected Growth (including extent, pattern, and rate of growth)

There is little information available about expected growth. Table 18 provides population growth estimates that were obtained from the Census Bureau for the Birmingham CMSA and Tuscaloosa. All counties are expected to have a population increase. Jefferson County's projected population is expected to remain about 44% of the area's total.

Since no other information about expected growth is available, and population growth estimates are not enough to influence a decision about determining a nonattainment area, this factor presents no compelling reason to include any other counties other than Jefferson in the Birmingham NAA.

Table 18 Population Projections for the Birmingham CMSA and Tuscaloosa

County Name	1993	2002	2015	2025	% Change 1993-2002	% Change 2002-2015	% Change 2015-2025
Bibb	17,422	21,622	26,910	30,749	24.1%	24.5%	14.3%
Blount	40,998	53,545	70,005	81,713	30.6%	30.7%	16.7%
Chilton	33,666	41,137	51,347	59,022	22.2%	24.8%	14.9%
Cullman	70,449	79,424	91,341	98,897	12.7%	15.0%	8.3%
Jefferson	660,131	664,031	682,336	701,651	0.6%	2.8%	2.8%
St. Clair	54,528	67,781	87,614	102,121	24.3%	29.3%	16.6%
Shelby	113,583	152,780	216,308	265,083	34.5%	41.6%	22.5%
Tuscaloosa	154,555	167,027	180,779	190,524	8.1%	8.2%	5.4%
Walker	68,681	71,211	73,529	73,970	3.7%	3.3%	0.6%

G. Meteorology

Meteorology can play a major role in the transport of $PM_{2.5}$ and its secondary formation. While the processes involved in formation of secondary $PM_{2.5}$ are not well understood, the transport issue is somewhat more straight forward and lends itself to an analysis based on prevailing wind directions in the region under consideration. Therefore, wind analyses were accomplished to determine the extent to which wind directions in the Birmingham MSA could be correlated with high $PM_{2.5}$ days.

In the first analysis, wind roses from the National Weather Service station at the Birmingham International Airport were developed. During the last three years (2000-2002), the Birmingham area showed the highest frequency of winds from the north with a secondary maximum of southerly winds. (see Figure A-1). When one considers only the days when the maximum 24-hour average $PM_{2.5}$ in the area was greater than 15 $\mu g/m^3$, the general pattern changes only slightly, with the most notable change being an increase in frequencies for easterly winds. (See Figure A-2). However, on those days when the maximum 24-hour average $PM_{2.5}$ in the area was greater than 30 $\mu g/m^3$, the wind blew overwhelmingly from the north through southeast directions, with the most frequent direction being from the east. This phenomenon is clearly seen in Figure A-3.

In addition to examining wind roses, backward trajectories were created, using the National Weather Service's HYSPLIT program, to examine the path air parcels followed for the 24 hours prior to mid-day for each day the peak 24-hour $PM_{2.5}$ exceeded 30 $\mu g/m^3$. The results are summarized in Table 19. Of the 24-hour trajectories ending at the surface in Birmingham, 72% originated from the north through southeast directions. For the trajectories ending at 500 meters and 1000 meters above ground level over Birmingham, 59% came from these directions. When one looks at the days when the peak 24-hour $PM_{2.5}$ exceeded 40 $\mu g/m^3$, the case is even clearer, with 78% of the trajectories at all levels originating from the north through southeast directions. These trajectories are included as Figures A-4 through A-12.

With the predominant winds during high $PM_{2.5}$ days blowing toward Jefferson County from the north through southeast, those counties to the south through northwest (Chilton, Bibb, Tuscaloosa, and Walker) most likely did not contribute to $PM_{2.5}$ exceedances in the Birmingham presumptive NAA. <u>This factor fortifies the recommendation to exclude Bibb, Chilton, Tuscaloosa and Walker Counties from the Birmingham NAA.</u> Based on meteorology alone, it is not possible to determine whether those counties to the north through southeast of Jefferson County (Cullman, Blount, St. Clair, Shelby and Talladega) contributed to $PM_{2.5}$ exceedances in the Birmingham presumptive NAA.

Table 19 – Backward Trajectory Analysis

	N through SE			SSE through NNW		
	Surface	500m AGL	1000m AGL	Surface	500m AGL	1000m AGL
2000	15*	10	9	5	10	11
2001	8	8	9	3	3	2
2002	5	5	5	3	3	3
Total	28	23	23	11	16	16
Percentage	72%	59%	59%	28%	41%	41%

* Numbers represent the times the 24-hour back trajectory started from the given sectors.

H. Geography/Topography (mountain ranges or other air basin boundaries)

The geography/topography of an area can influence the creation and transport of $PM_{2.5}$. The Birmingham MSA is located in North Central Alabama in both Jefferson and Shelby counties. The city is situated in the foothills of the Appalachians, about 300 miles inland from the Gulf of Mexico. With the hills running northeast to southwest, the city itself lies in the Birmingham-Big Canoe Valley. Off to the north and west the terrain levels out to the Cumberland Plateau. To the south and east, there is rougher terrain, such as the Cahaba Ridge and Valley and the Coosa Ridge and Valley. The northwestern half of Jefferson County is included in the Cumberland Plateau, while all of Shelby County consists of several ridges and valleys.

The topography of the Birmingham area is very complex and it is suspected that it plays a large role in $PM_{2.5}$ formation and transport. However, there are no monitoring data or air quality analyses to demonstrate the extent of its influence. Therefore, data to support the inclusion or exclusion of counties in a MSA based on topography is insufficient

Tuscaloosa is located in Western Alabama in Tuscaloosa County and is about 50 miles southwest of Birmingham and about 240 miles inland from the Gulf of Mexico. The eastern part of the county is rather hilly but becomes somewhat flatter as one moves further west and south away from the Appalachian foothills of Jefferson County. The Black Warrior River traverses the county from northeast to southwest and flows through a broad, flat plain from the city of Tuscaloosa southwestward to the Bibb County line. The Sipsey River flows from north to south in the western portion of the county.

There is no clear relationship between the topography of Tuscaloosa County and PM2.5 formation and transport in the Tuscaloosa area.

I. Jurisdictional Boundaries

Bibb, Blount, Chilton, Jefferson, St. Clair, Shelby, Tuscaloosa and Walker are within the Birmingham Metropolitan Intrastate Air Quality Control Region (40 CFR, § 81.41). Cullman is in the Tennessee River Valley-Cumberland Mountains Interstate Air Quality Control Region (40 CFR § 81.72). The Birmingham/Hoover/Cullman Combined Statistical Area includes Bibb, Blount, Chilton, Cullman, Jefferson, St. Clair, Shelby and Walker. The Tuscaloosa MSA includes Tuscaloosa, Green and Hale Counties.

The Jefferson County Department of Health holds jurisdiction within the county boundaries of Jefferson County for which monitoring data demonstrates the counties to be in nonattainment for the PM2.5 standard. The ADEM holds jurisdiction for the other eight counties (Bibb, Blount, Chilton, Cullman, St. Clair, Shelby, Tuscaloosa and Walker). The State monitor in Shelby supports this county to be in attainment. <u>Discussion elsewhere in this document demonstrates the State's recommendation that the Birmingham NAA only include Jefferson County.</u>

J. Level of Control of Emission Sources

Since 1979, statewide reasonably available control technology (RACT) has been in place for volatile organic compounds (VOCs) as found under ADEM Admin. Code Chapter 335-3-6. Also in place since 1990, has been the institution of statewide regulations for the control of evaporative emissions in the gasoline marketing chain, commonly referred as 'Stage 1' vapor recovery. Over the 31-year history of Alabama's air pollution control program, the State has been delegated the authority to implement other standards of performance such as the New Source Performance Standards (NSPS), National Emission Standards for Hazardous Air Pollutants (NESHAPs), and the federal Prevention of Significant Deterioration (PSDS) regulations for protection of degradation of clean air areas.

Additionally, the EPA has required a NOx SIP Call for 22 states, including Alabama that, by 2004, will result in large reductions in NOx emissions from major utilities, large industrial boilers, and gas turbines, and cement kilns. Alabama's NOx SIP was approved by EPA on July 16, 2001. At the national level, EPA has finalized the Tier 2 vehicle/national fuel standards, which take effect beginning in 2004. However, the States have already begun to realize the benefits of cleaner vehicles with the National Low Emission Vehicle standards with the 2001 model year vehicles.

Figure A-1- Birmingham Wind Rose – All Days – 2000-2002

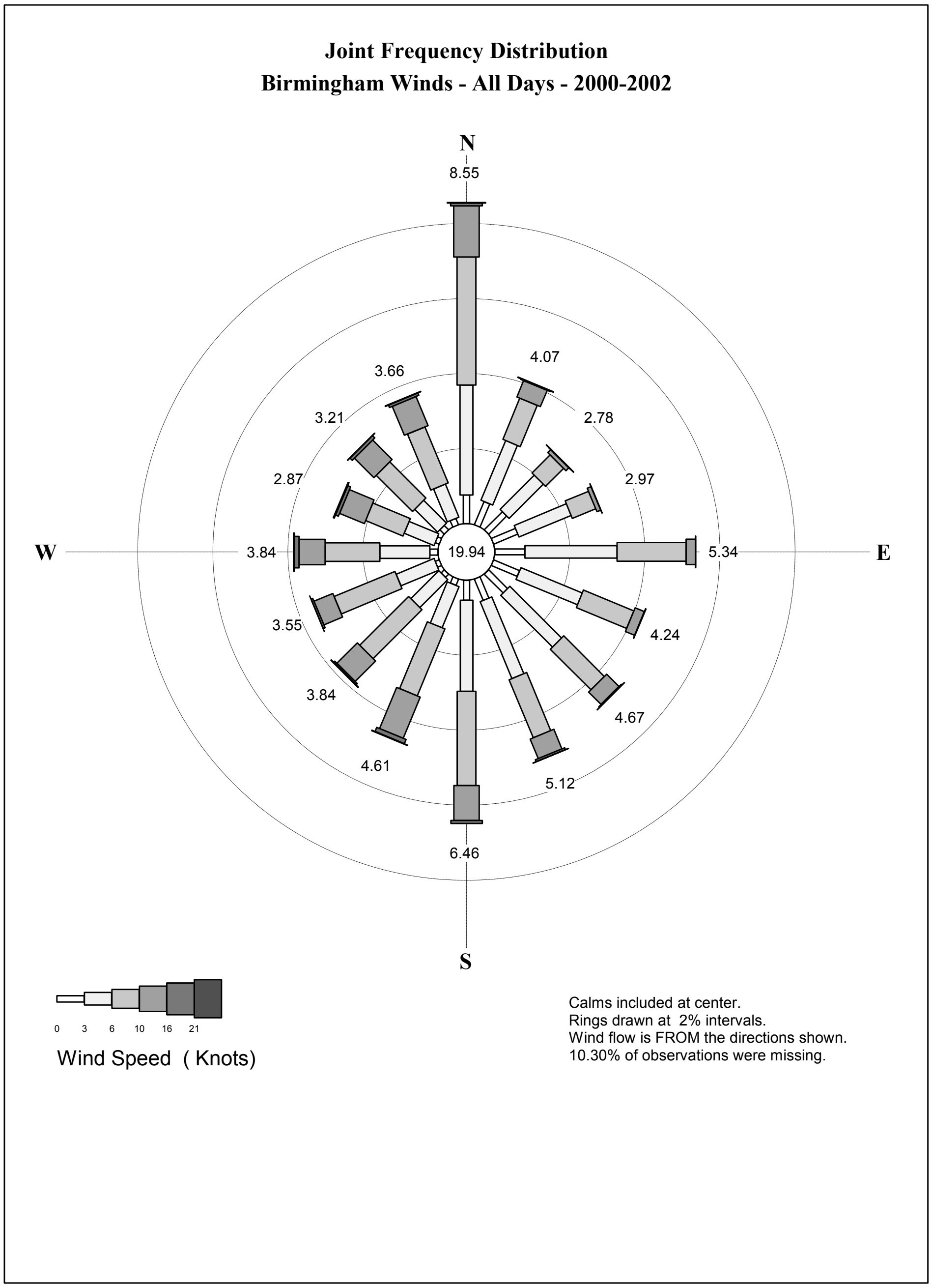


Figure A-2 – Birmingham Winds – Days PM2.5>15μg/m3 – 2000-2002

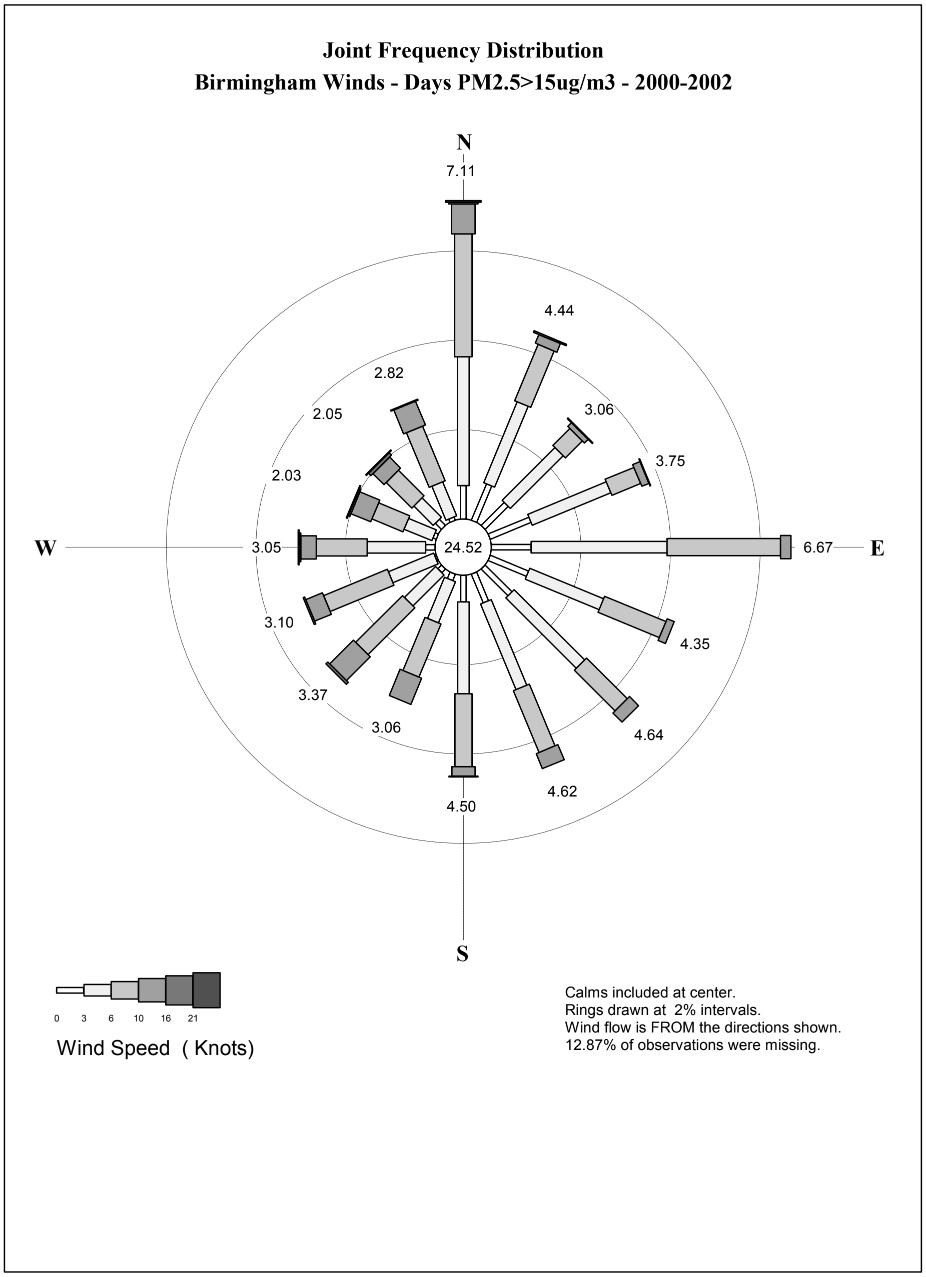
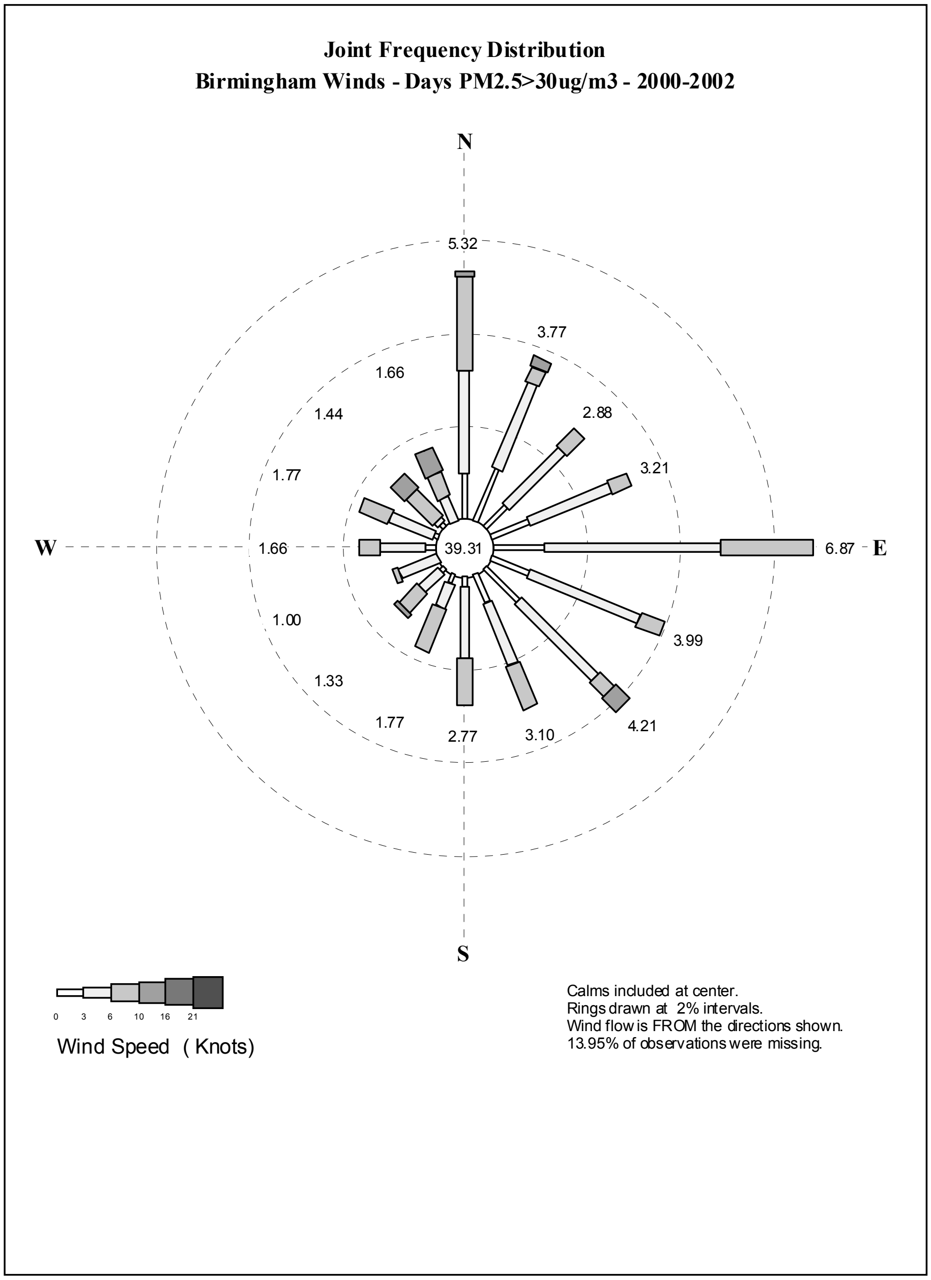
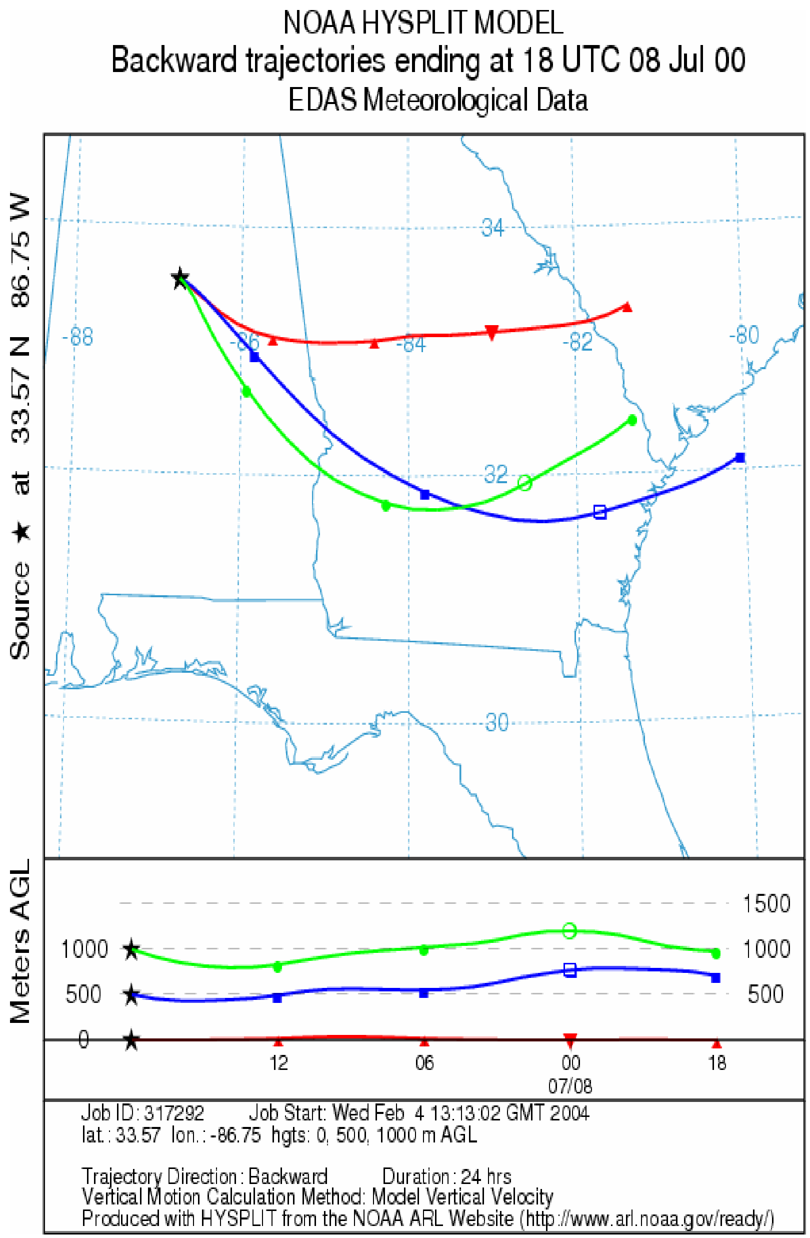
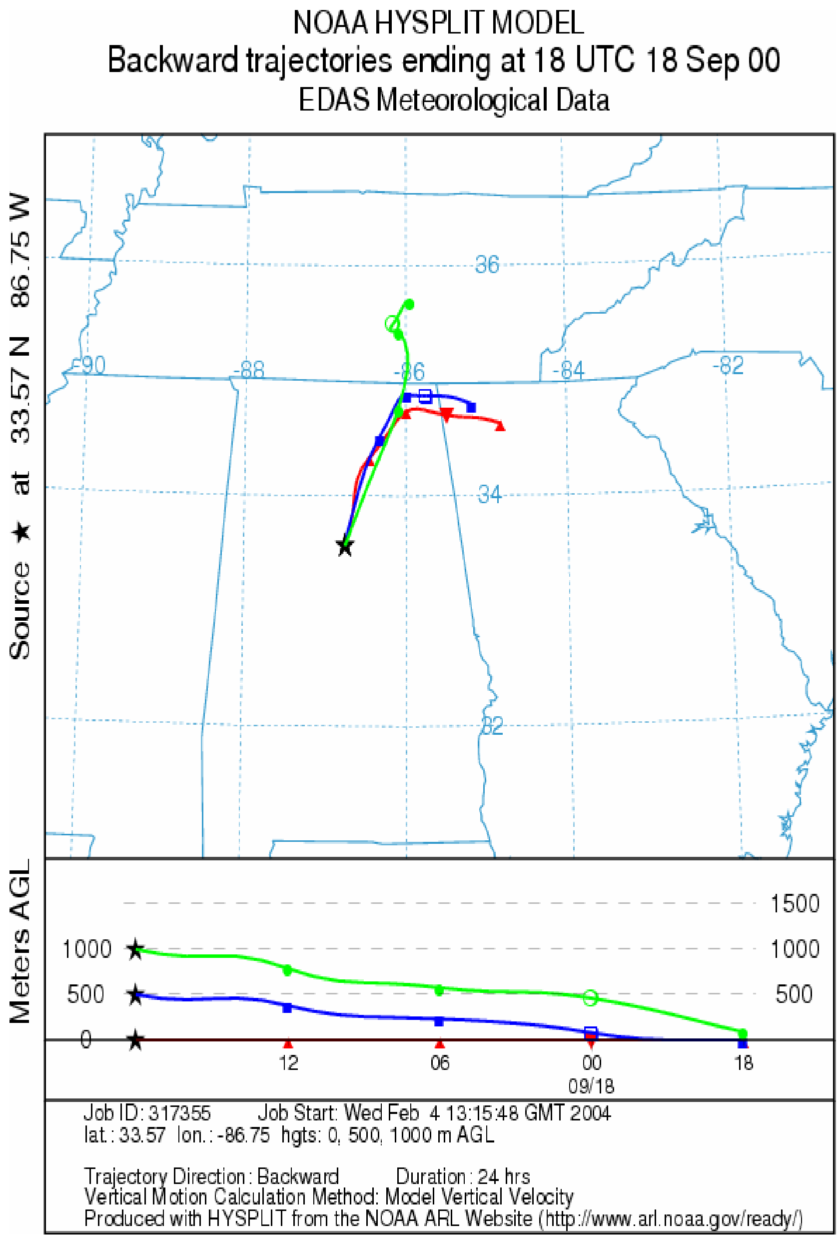


Figure A-3 – Birmingham Winds – Days PM2.5>30µg/m3 – 2000-2002




NOAA HYSPLIT MODEL
Backward trajectories ending at 18 UTC 08 Jul 00
EDAS Meteorological Data
Source ★ at 33.57 N 86.75 W
Meters AGL
Job ID: 317292 Job Start: Wed Feb 4 13:13:02 GMT 2004
lat.: 33.57 lon.: -86.75 hgts: 0, 500, 1000 m AGL
Trajectory Direction: Backward Duration: 24 hrs
Vertical Motion Calculation Method: Model Vertical Velocity
Produced with HYSPLIT from the NOAA ARL Website (http://www.arl.noaa.gov/ready/)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Meters AGL
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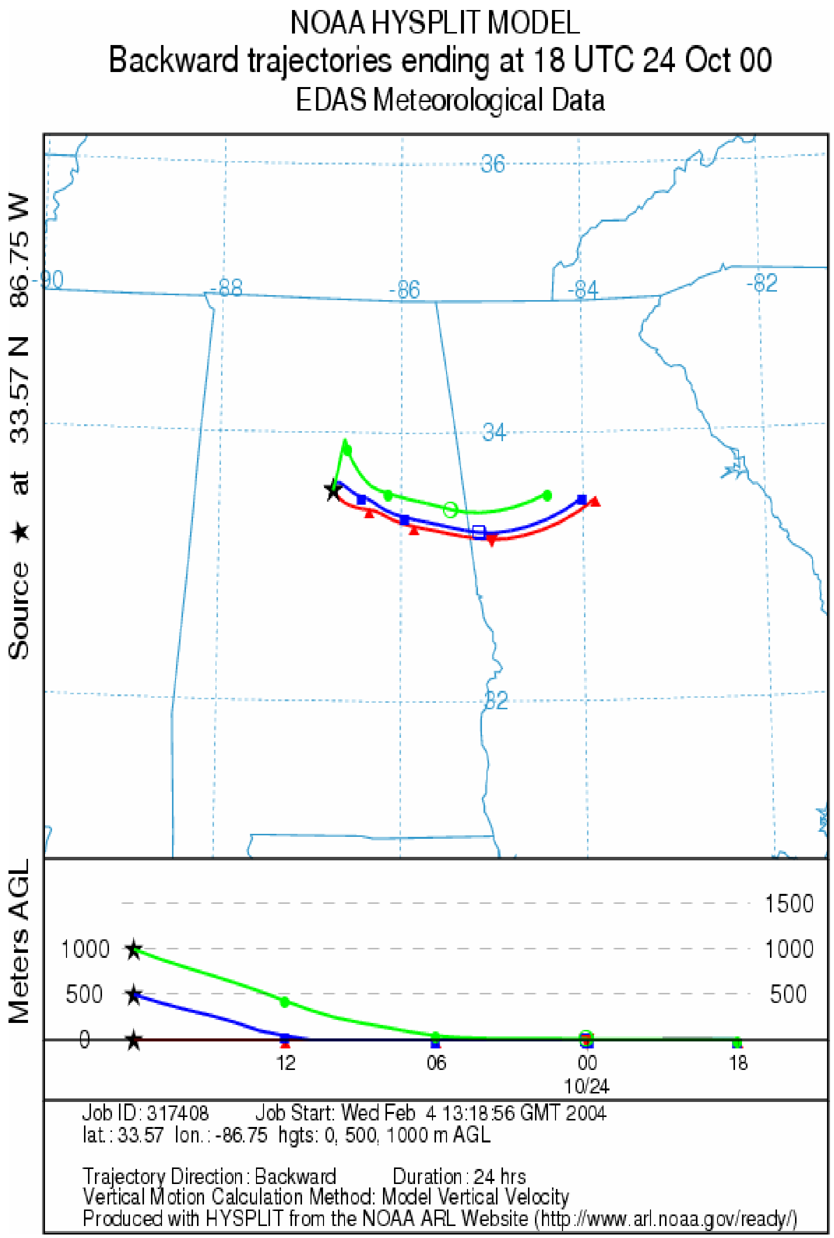
Produced with HYSPLIT from the NOAA ARL Website (http://www.arl.noaa.gov/ready/)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Backward trajectories ending at 18 UTC 24 Oct 00
EDAS Meteorological Data
Source ★ at 33.57 N 86.75 W
Meters AGL
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1000
500
0
12
06
00
18
10/24
Job ID: 317408 Job Start: Wed Feb 4 13:18:56 GMT 2004
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Vertical Motion Calculation Method: Model Vertical Velocity
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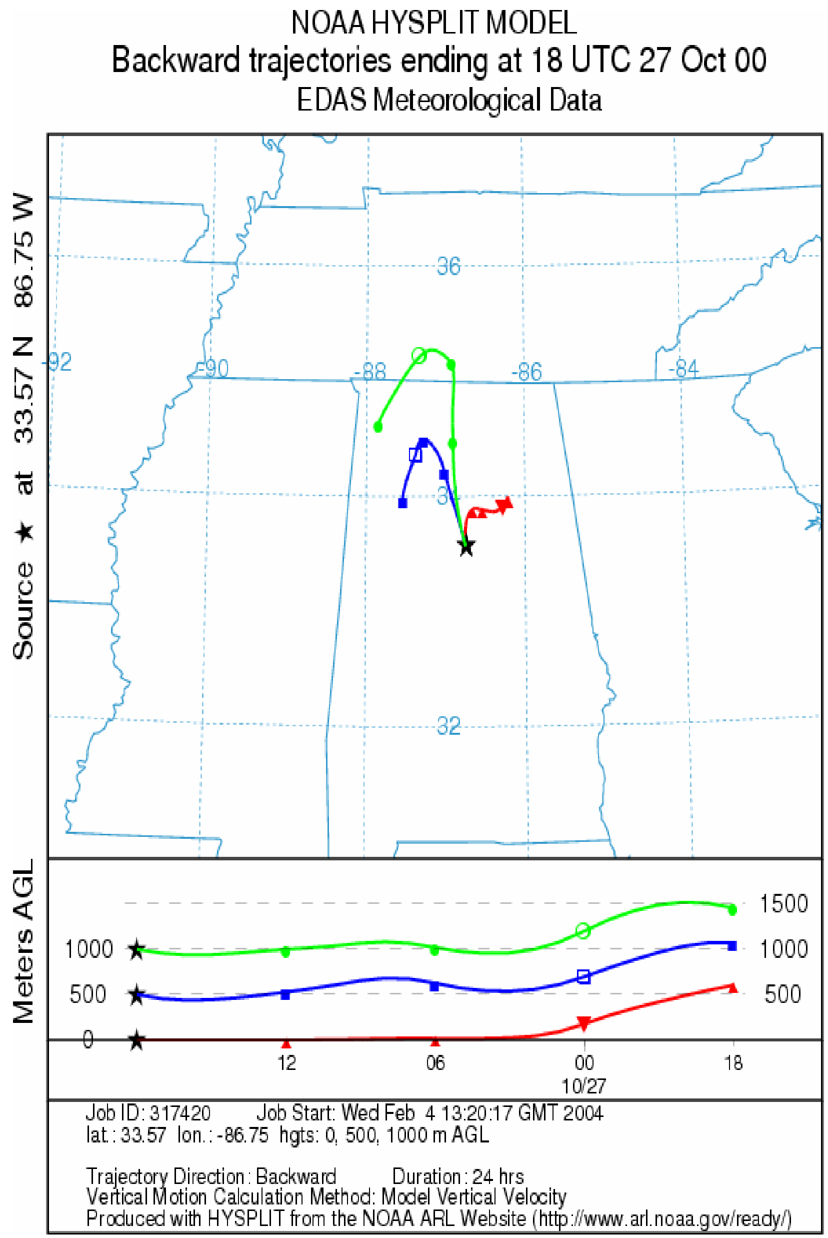
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Backward trajectories ending at 18 UTC 27 Oct 00
EDAS Meteorological Data
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Meters AGL
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10/27
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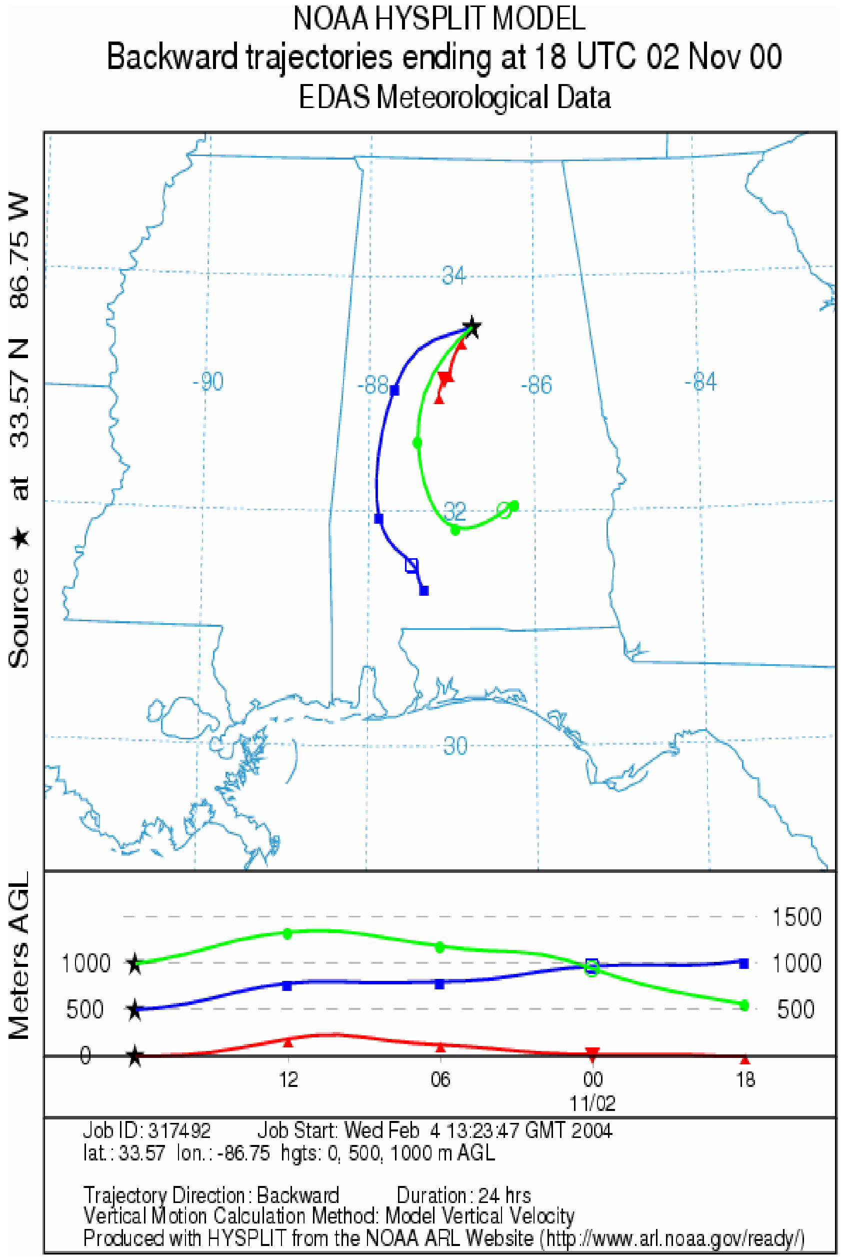

NOAA HYSPLIT MODEL
Backward trajectories ending at 18 UTC 02 Nov 00
EDAS Meteorological Data
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-86
-84
Meters AGL
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500
0
12
06
00
18
11/02
Job ID: 317492 Job Start: Wed Feb 4 13:23:47 GMT 2004
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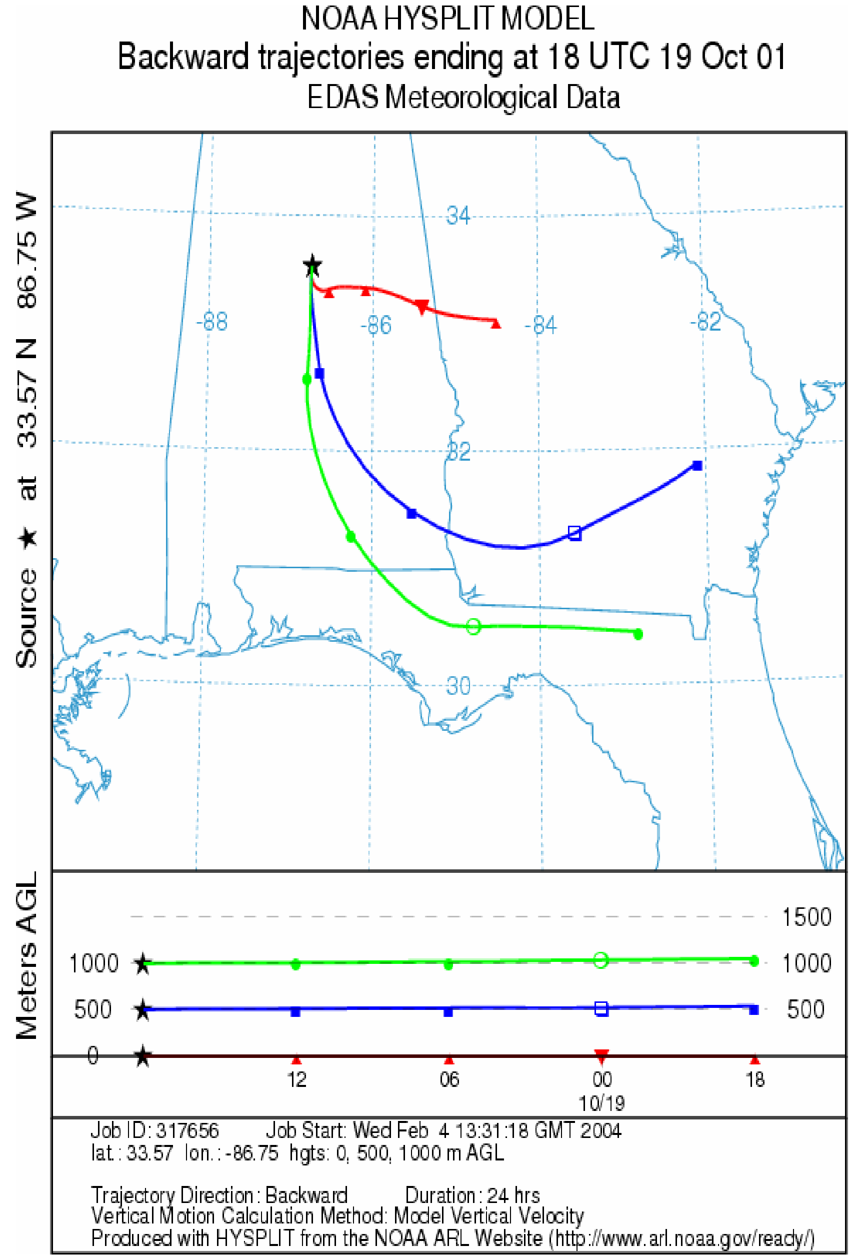
Vertical Motion Calculation Method: Model Vertical Velocity
Produced with HYSPLIT from the NOAA ARL Website (http://www.arl.noaa.gov/ready/)



NOAA HYSPLIT MODEL
Backward trajectories ending at 18 UTC 19 Oct 01
EDAS Meteorological Data
Source ★ at 33.57 N 86.75 W
34
32
30
-88
-86
-84
-82
Meters AGL
1500
1000
500
0
12
06
00
18
10/19
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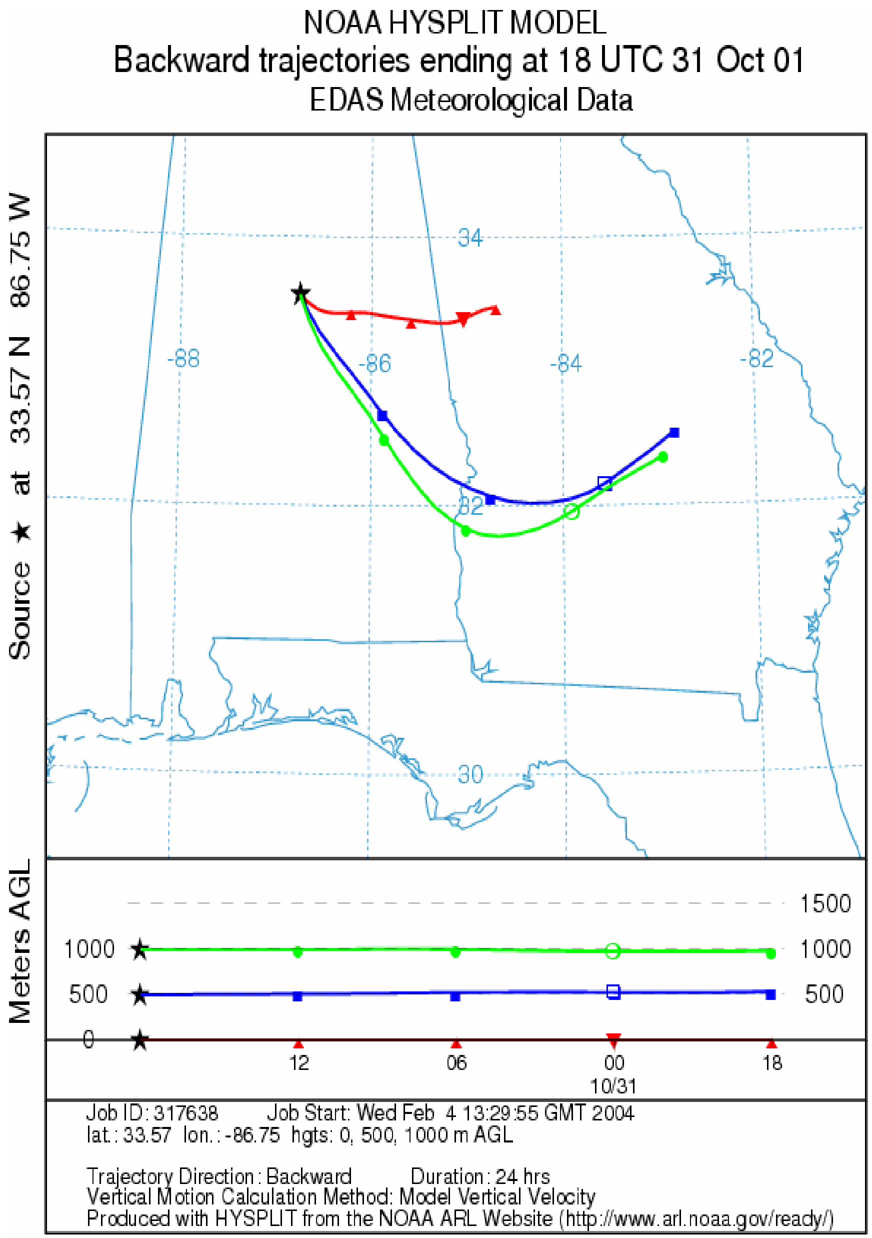
Trajectory Direction: Backward Duration: 24 hrs
Vertical Motion Calculation Method: Model Vertical Velocity
Produced with HYSPLIT from the NOAA ARL Website (http://www.arl.noaa.gov/ready/)


NOAA HYSPLIT MODEL
Backward trajectories ending at 18 UTC 31 Oct 01
EDAS Meteorological Data
Source ★ at 33.57 N 86.75 W
Meters AGL
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18
Job ID: 317638 Job Start: Wed Feb 4 13:29:55 GMT 2004
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Vertical Motion Calculation Method: Model Vertical Velocity
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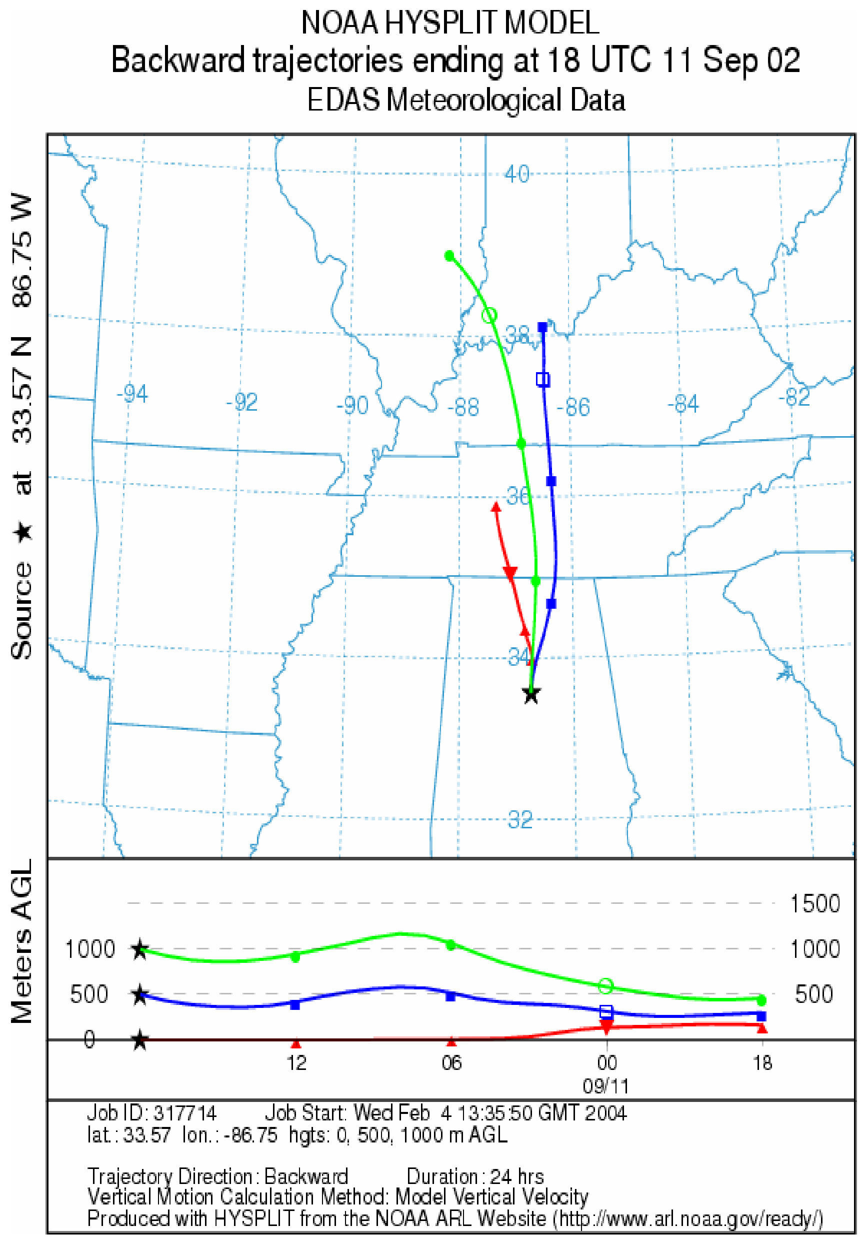
NOAA HYSPLIT MODEL
Backward trajectories ending at 18 UTC 11 Sep 02
EDAS Meteorological Data
Source ★ at 33.57 N 86.75 W
Meters AGL
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lat.: 33.57 lon.: -86.75 hgts: 0, 500, 1000 m AGL
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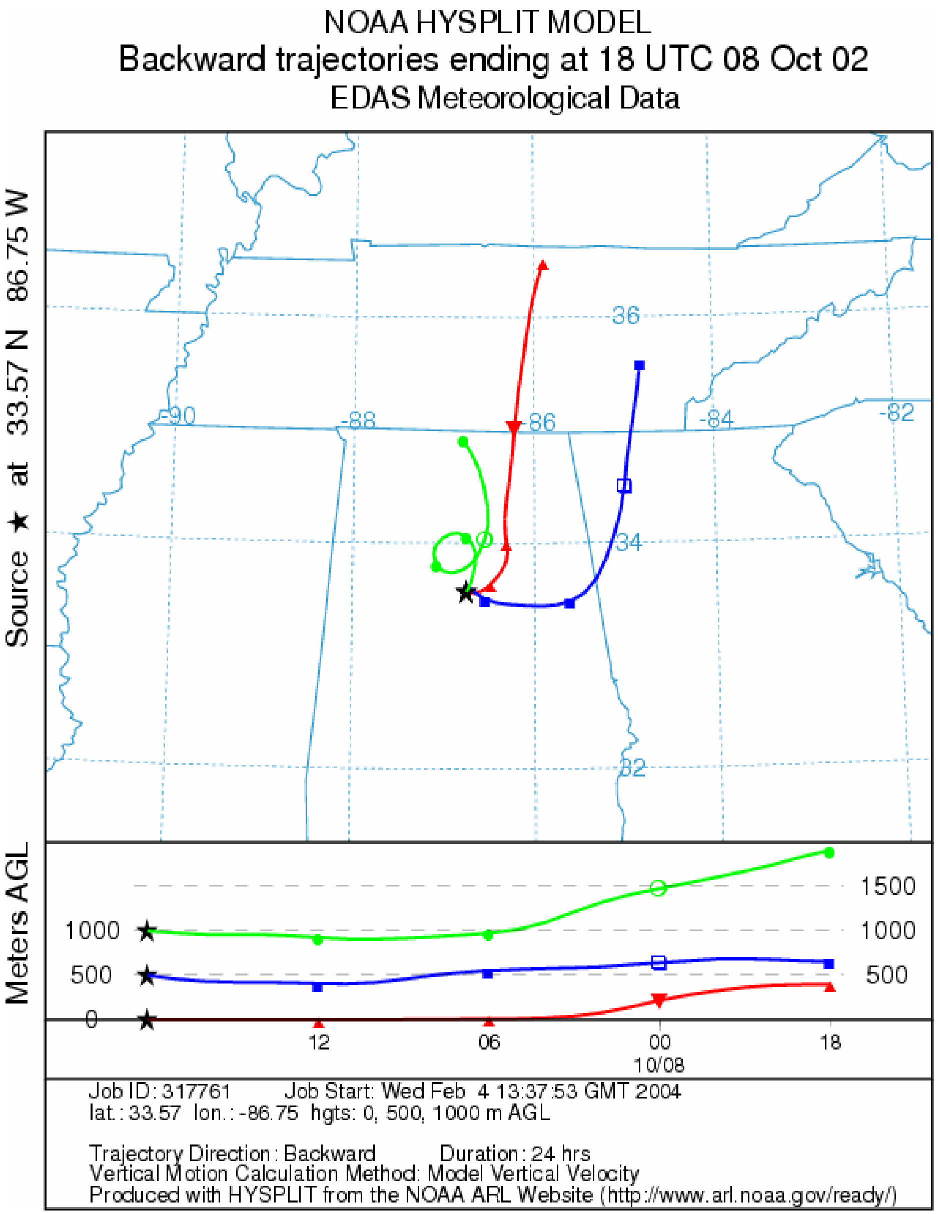
Vertical Motion Calculation Method: Model Vertical Velocity
Produced with HYSPLIT from the NOAA ARL Website (http://www.arl.noaa.gov/ready/)


NOAA HYSPLIT MODEL
Backward trajectories ending at 18 UTC 08 Oct 02
EDAS Meteorological Data
Source ★ at 33.57 N 86.75 W
36
-90
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-86
-84
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32
Meters AGL
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10/08
Job ID: 317761 Job Start: Wed Feb 4 13:37:53 GMT 2004
lat.: 33.57 lon.: -86.75 hgts: 0, 500, 1000 m AGL
Trajectory Direction: Backward Duration: 24 hrs
Vertical Motion Calculation Method: Model Vertical Velocity
Produced with HYSPLIT from the NOAA ARL Website (http://www.arl.noaa.gov/ready/)

Appendix B

ADEM recommends that the Russell Nonattainment Area for the annual NAAQS for fine particulates (PM2.5) consist of Russell County only and exclude Lee and Macon Counties. EPA guidance (dated April 1, 2003) states that if a state wishes to propose a nonattainment area boundary for an urban area that is smaller than the CMSA boundary, the state must address how certain factors affect the drawing of the nonattainment boundary. Therefore, a discussion of these factors for the Russell Nonattainment Area is provided in this Appendix.

The factors that provide the most compelling evidence to exclude Lee and Macon Counties are listed below:

- Total annual emissions in comparison to Russell County
- Population density and degree of urbanization in comparison to Russell County
- Expected growth
- Traffic patterns (Daily VMT)
- Level of control of emission sources
- Location of emission sources (i.e. the lack of significant point sources)
- Regional emission reductions
- Monitoring data

A. Emissions and air quality in adjacent areas (including adjacent Statistical Areas)

The counties adjacent to the Columbus/Auburn/Opelika CMSA, with the exception of the Georgia Counties included in the CMSA and those in the Montgomery CMSA, are depicted in Figure 1. To evaluate emissions for these counties, ADEM obtained the 1999 annual NOx, SO2, VOC, NH3, and PM2.5 emission estimates from the EPA's recommended website[5]. Table 1 lists these emissions which include all anthropogenic sources (i.e. point, area, mobile, and nonroad mobile) for the counties that are adjacent to Russell County.

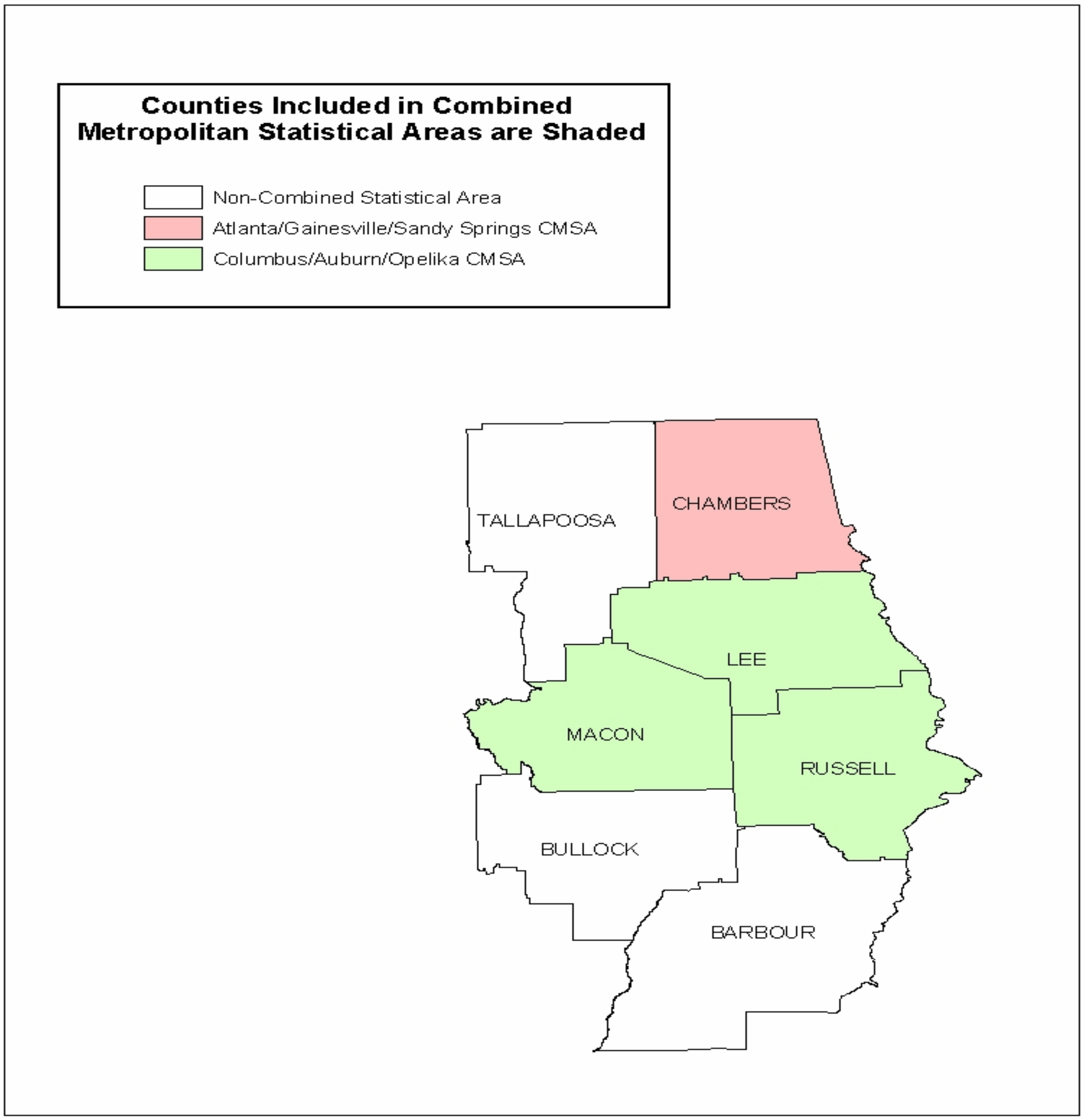


Figure 1 Columbus/Auburn/Opelika CMSA and Surrounding Counties

5 http://www.emissionsonline.org/nei99v3/index.htm

Table 1 1999 Annual Emissions for Counties Adjacent to Russell County

County	VOC (Tons)	VOC Ranking	NOx (Tons)	NOx Ranking	SO2 (Tons)	SO2 Ranking	NH3 (Tons)	NH3 Ranking	PM2.5 (Tons)	PM2.5 Ranking
Barbour	7,295	2	3,327	3	410	5	801	1	3,567	1
Bullock	1,091	7	602	7	90	7	539	3	443	7
Chambers	4,308	5	2,283	5	502	4	515	4	1,425	5
Lee	7,952	1	4,957	2	1,364	2	588	2	1,856	4
Macon	2,824	6	1,994	6	206	6	433	6	1,082	6
Russell	6,273	4	5,931	1	2,415	1	391	7	2,019	3
Tallapoosa	6,567	3	2,629	4	628	3	493	5	2,339	2

[M] County has a PM monitor

As shown in Table 1, Russell County ranks first among surrounding counties in the emission of NOx and SO2, falls in the middle of the list for PM2.5 and VOC emissions, and is last in NH3 emissions.

Lee County ranks high in VOC and NOx emissions. These emissions can be largely attributed to on-road mobile source emissions. National programs such as the Tier 2 standards and on-road diesel regulations will mitigate the impact of these emissions. As seen in Table 1, there is no significant disparity in emissions between the counties inside the CMSA and those counties outside the CMSA.

Based on wind data, those counties to the north, south, and west of the CMSA would not significantly contribute to the nonattainment area's air quality on days with high PM fine concentrations. This will be discussed in further detail in Section G.

Many rural counties in Alabama, as well as the southeastern U.S., have considerable ammonia (NH3) emissions resulting primarily from concentrated animal feeding operations and fertilizer production and application. For information purposes, data on estimated ammonia emissions is presented in this section since present knowledge indicates that ammonia emissions can play a key role in PM2.5 formation. However, due to a lack of effective controls for these sources of ammonia and the uncertainties in methods for estimating emissions of ammonia, ammonia emissions were not considered to be a significant factor in the determination of which counties to include in PM2.5 nonattainment areas. Should effective controls for sources of ammonia become available in the future, the lack of a nonattainment area designation would not preclude ADEM, under its existing regulations, from requiring controls in a county if such controls are deemed necessary.

B. Population density and degree of urbanization including commercial development

To evaluate the various aspects of population, ADEM obtained the 1993 to 2002 population estimates for Russell County and surrounding counties from the Alabama State Data Center[6]. Information on business data (i.e. retail employment and manufacturing employment) was obtained from the U.S. Census Bureau's County Business Patterns.

Population densities were calculated by dividing the population estimates by the land area of each county (in square miles). Figure 2 depicts the population densities for the counties in the Columbus/Auburn/Opelika CMSA.

Auburn University is located in Lee County. In 2002, student enrollment was 23,276, and the number of university employees was 9,441. While the population figures for Lee County are higher than that of Russell County, it is important to note that 32,717 of the population in Lee County in 2002 could be attributed to this institution.

While Macon County has the second highest land area in the Columbus/Auburn/Opelika CMSA (611 sq. mi.), it has a total population and population density that is approximately half of that of Russell County.

<u>This factor fortifies the recommendation to exclude Macon County from the Russell nonattainment area</u>.

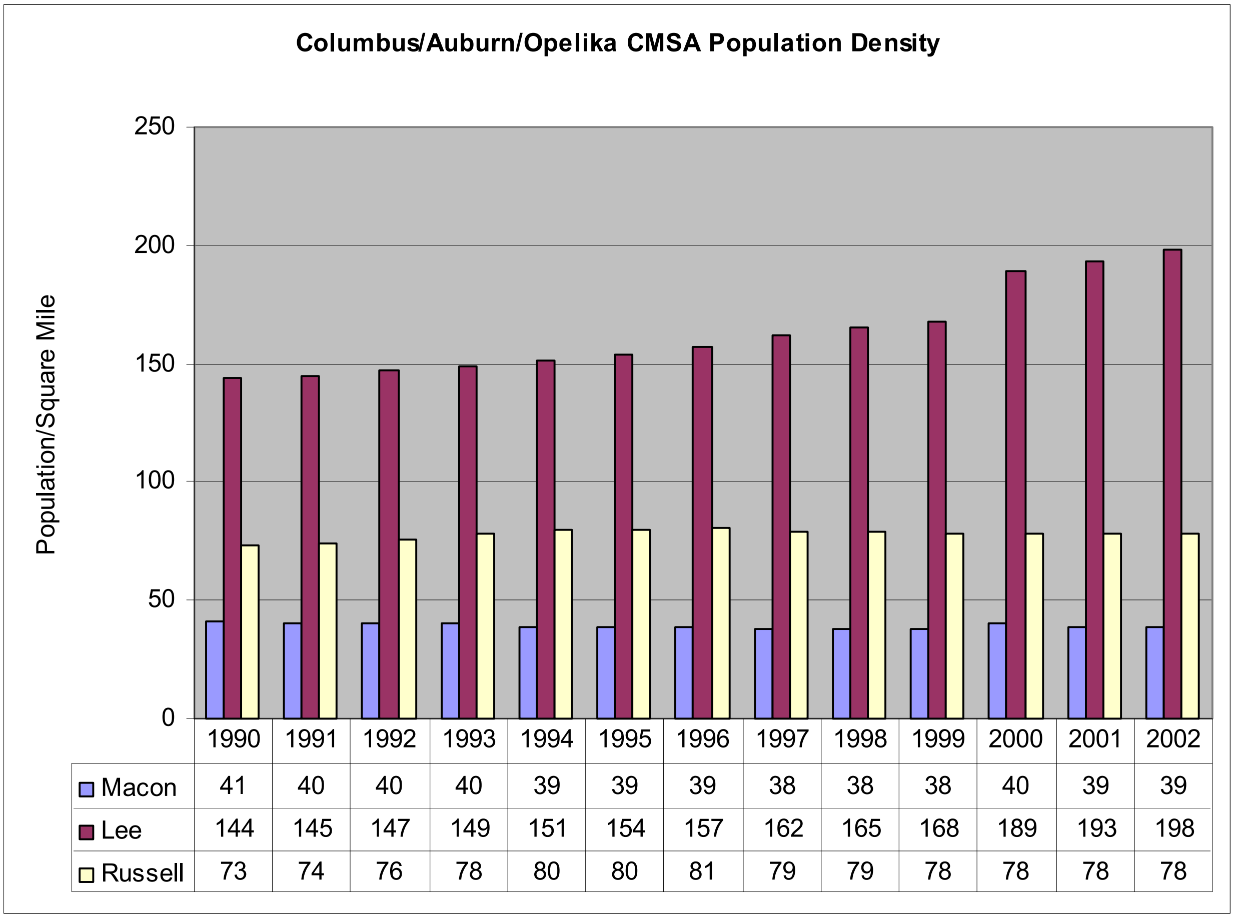
Lee County has the largest population (120,284) in the Columbus/Auburn/Opelika CMSA but has the smallest land area (609 sq. mi.). In comparison, the land area of Russell County is 641 sq.mi. This elevates Lee County's population density (198/sq. mi.), which surpasses that of Russell County (78/sq. mi.). As discussed in Section D, the primary impact of the Lee County population on PM2.5 concentrations is from mobile source emissions. Mobile source emissions will be mitigated by the national ultra low sulfur fuel and Tier 2 vehicle standards.

<u>Total population and population density was not an influencing factor in our recommendation to exclude Lee County from the Russell nonattainment area.</u>

Table 2 Columbus/Auburn/Opelika CMSA Population

County	1993	2002	Population Change (1993-2002)	% Change	% of Area 2002 Population
Macon	24,411	23,944	-467	-1.9%	12.3%
Lee	90,982	120,284	29,302	32.2%	61.9%
Russell	49,955	50,219	264	0.5%	25.8%
Area Total	**165,348**	**194,447**	**29,099**	**17.6%**	**100%**

[6] The Alabama State Data Center (ASDC) is a network of 27 public agencies working together through a cooperative agreement with the U.S. Bureau of the Census to facilitate use and delivery of Census and other data to the public. Internet site: http://cber.cba.ua.edu/est_prj.html

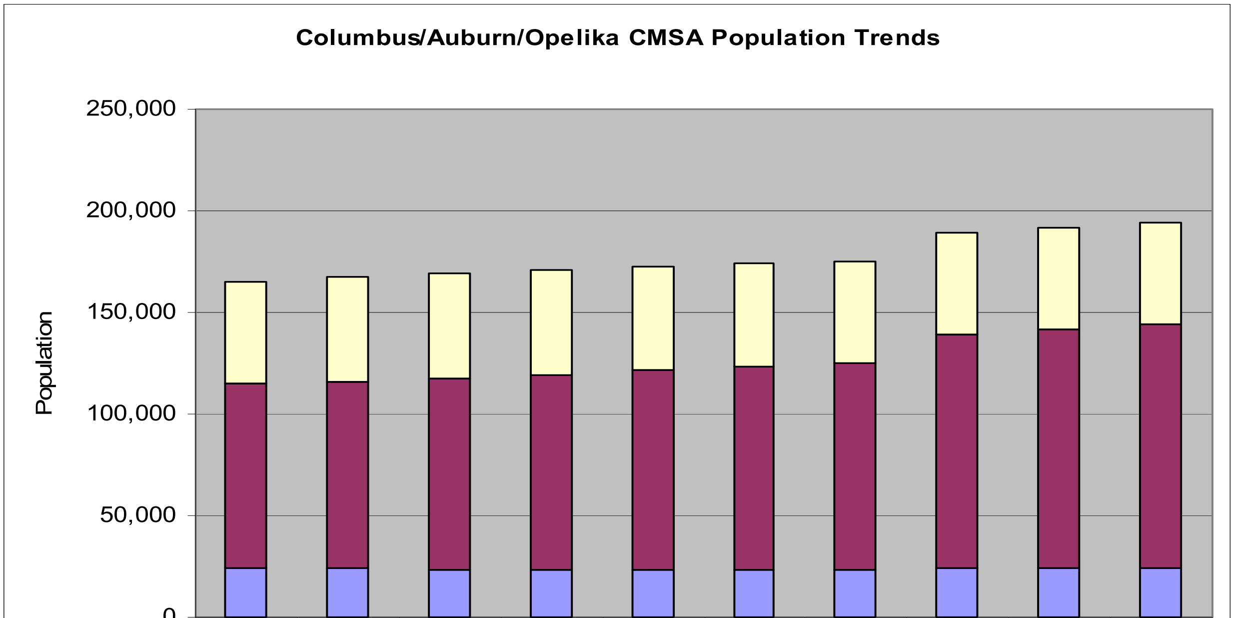


	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Macon	41	40	40	40	39	39	39	38	38	38	40	39	39
Lee	144	145	147	149	151	154	157	162	165	168	189	193	198
Russell	73	74	76	78	80	80	81	79	79	78	78	78	78

Figure 2 Population Density for Columbus/Auburn/Opelika CMSA

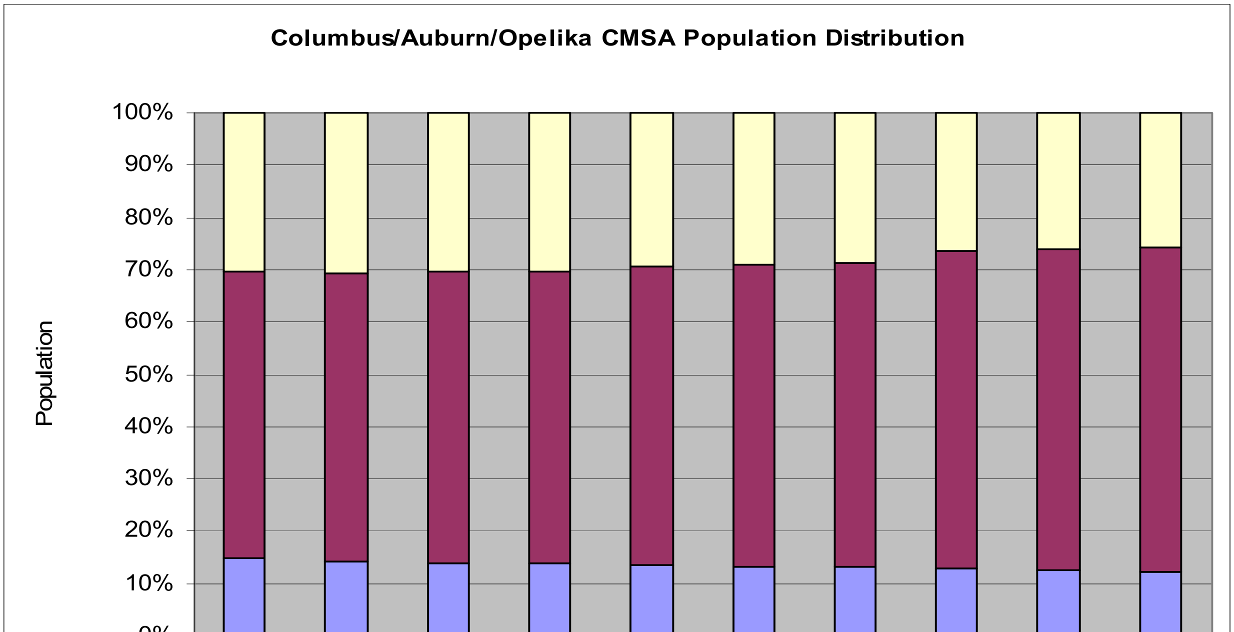
Table 2 compares the 1993 and 2002 population estimates. Population data is also presented in Figures 3 and 4. Through this period, Russell County's population increased by a small amount, Macon County's population decreased by a small amount, and Lee County experienced a modest increase in population.

<u>Again, population data was not an influencing factor in our recommendation to exclude Lee County from the Russell nonattainment area</u>.



	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Russell	49,955	51,493	51,372	51,602	50,739	50,387	50,071	49,756	49,994	50,219
Lee	90,982	91,671	93,808	95,427	98,412	100,444	102,164	115,092	117,691	120,284
Macon	24,411	23,971	23,573	23,527	23,280	22,951	22,993	24,105	24,029	23,944

Figure 3 Population Data for Columbus/Auburn/Opelika CMSA



	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Russell	30.2%	30.8%	30.4%	30.2%	29.4%	29.0%	28.6%	26.3%	26.1%	25.8%
Lee	55.0%	54.9%	55.6%	56.0%	57.1%	57.8%	58.3%	60.9%	61.4%	61.9%
Macon	14.8%	14.3%	14.0%	13.8%	13.5%	13.2%	13.1%	12.8%	12.5%	12.3%

Figure 4 Population Distribution for Columbus/Auburn/Opelika CMSA

The amount and percent of urbanized population in the Columbus/Auburn/Opelika CMSA in 1990 and 2000 is presented in Table 3. This data clearly shows that Macon County has an insignificant urban population in comparison to Russell County. Macon County accounts for only 10% of the total area's urban population.

This factor fortifies the recommendation to exclude Macon County from the Russell nonattainment area.

Lee County has an urban population that is similar to Russell County. However, urban population data was not an influencing factor in our recommendation to exclude Lee County from the Russell nonattainment area.

Table 3 Urban Population for Columbus/Auburn/Opelika CMSA

County	1990 Population	1990 Urban Population	% Urban	% of Area Total 1990 Urban Population	2000 Population	2000 Urban Population	% Urban	% of Area Total 2000 Urban Population
Russell	46,961	30,525	65%	29%	49,756	31,895	64%	26%
Lee	87,491	62,119	71%	59%	115,092	77,197	67%	64%
Macon	24,879	12,191	49%	12%	24,105	12,005	50%	10%

Tables 4, 5, and 6 show the trends in Total Employment, Manufacturing Employment, and Retail Employment, respectively, for the Columbus/Auburn/Opelika CMSA. Figure 5 demonstrates that the number of Total Employees for Macon County is only 12.8% of the area total. In fact, Macon County shows a slight downward trend of 1.9% over the demonstrated period. This factor fortifies the recommendation to exclude Macon County from the Russell nonattainment area.

Lee County contributes the majority of the workforce to the Columbus/Auburn/Opelika CMSA as a whole. However, this was not an influencing factor in our recommendation to exclude Lee County from the Russell nonattainment area.

Table 4 Total Employees

County	1998	1999	2000	2001	% Change 1998-2001	% of 2001 Area Total
Russell	10,868	12,411	11,165	10,241	-5.8%	20.9%
Lee	30,235	30,768	32,271	32,564	7.7%	66.3%
Macon	6,429	6,287	6,347	6,304	-1.9%	12.8%
Area Total	**47,532**	**49,466**	**49,783**	**49,109**	**3.3%**	**100%**

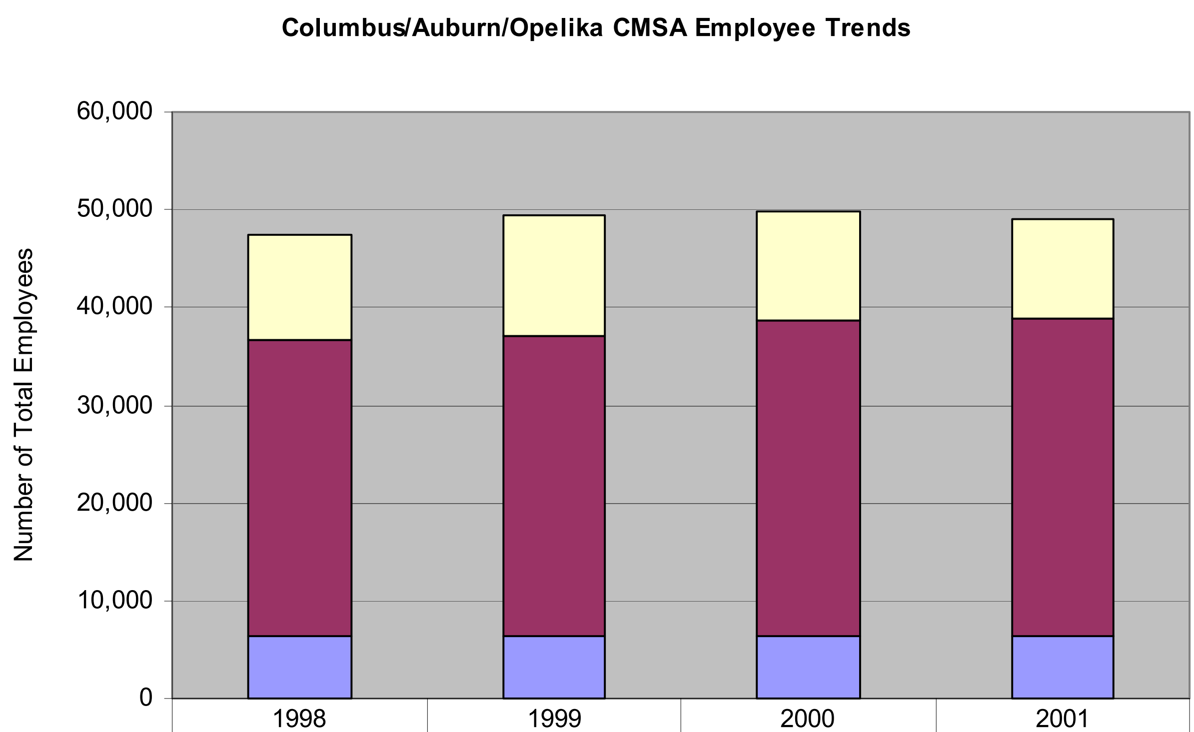
Table 5 Manufacturing Employees

County	1998	1999	2000	2001	% Change 1998-2001	% of 2001 Area Total
Russell	3,454	4,087	3,092	2,250	-34.9%	
Lee	6,598	7,081	6,890	6,217	-5.8%	
Macon	84	47	20-99*	20-99*		
Area Total	**10,136**	**11,215**				

*The U.S. Census Bureau's *County Business Patterns* only provided an estimated range for this category, therefore this table could not be completed.

Table 6 Retail Employees

	1998	1999	2000	2001	% Change 1998-2001	% of 2001 Area Total
Russell	1,830	1,928	1,989	1,883	2.9%	25.1%
Lee	5,836	5,407	5,298	5,205	-10.8%	69.3%
Macon	467	424	414	417	-10.7%	5.6%
Area Total	**8,133**	**7,759**	**7,701**	**7,505**	**-7.7%**	**100%**



	1998	1999	2000	2001
Russell	10,868	12,411	11,165	10,241
Lee	30,235	30,768	32,271	32,564
Macon	6,429	6,287	6,347	6,304

Figure 5 Total Employees for Columbus/Auburn/Opelika CMSA

C. Monitoring data representing PM2.5 concentrations in local areas and larger areas (urban or regional scale)

Table 7 presents the PM2.5 monitoring data for Russell County. The table shows that the Russell County monitor exceeded the annual NAAQS for PM2.5. Figure 6 maps the Russell County PM2.5 monitoring site which provided the 2001, 2002, and 2003 data for the Columbus/Auburn/Opelika CMSA. There are no other PM2.5 monitors located in the area.

Table 7 Russell Area PM2.5 Monitoring Data

County	AIRS ID	Site	2001 Average	2002 Average	2003 Average	3-Year Average
Russell	011130001	Phenix City	15.6	15.1	15.4	15.3

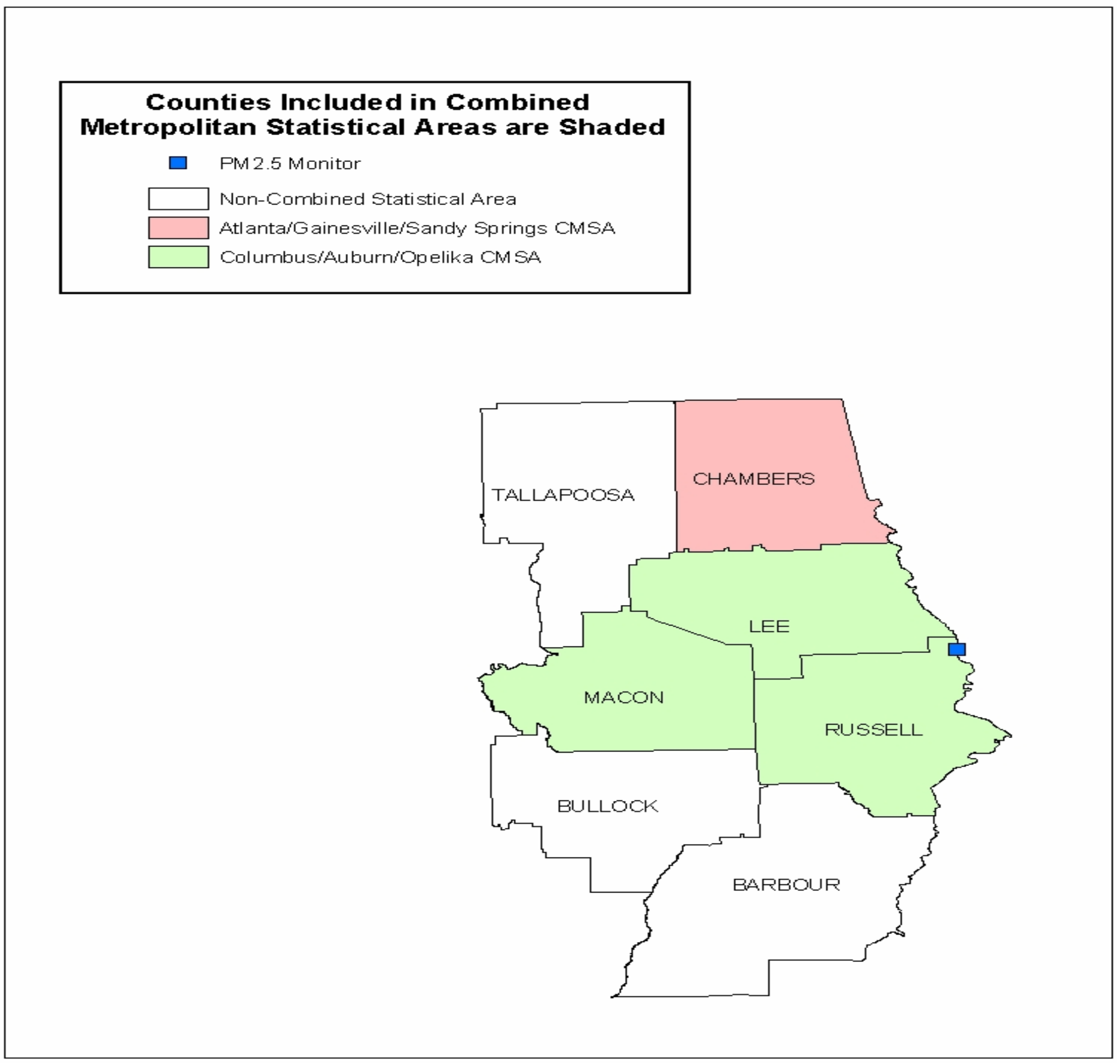


Figure 6 PM2.5 Monitoring Site in the Columbus/Auburn/Opelika CMSA

D. Location of Emission Sources

Figure 7 depicts the location of large point sources in the Columbus/Auburn/Opelika CMSA and surrounding counties. The base map was created in GIS using coordinates supplied by the facilities. Tables 8-17 present the distribution of NOx, VOC, SO2, PM2.5, and NH3 emissions (in tons per year) among point, area, and mobile sources in the Russell County area. Figures 8-12 illustrate this data. Figure 13 presents the emission densities for the counties in the Russell County area.

Macon County has no large point sources. In addition, the emissions data clearly shows that emissions from Macon County, with the exception of NH3, are well below that of Russell and Lee Counties. <u>This factor fortifies the recommendation to exclude Macon County from the Russell nonattainment area</u>.

Lee County contributes the majority of the VOC and NH3 to the CMSA as a whole. However, Russell County leads Lee County in emissions of NOx, SO2, and PM2.5. 87% of the NOx emissions in Lee County are from mobile sources. 40% of the VOC emissions in Lee County are from mobile sources. Any impact of Lee County mobile source emissions on PM2.5 concentrations will be mitigated by the national ultra low sulfur diesel, low sulfur gasoline and Tier II vehicle standards. In addition, analysis of wind data (see Section G) indicates that Lee County emissions do not significantly contribute to PM2.5 concentrations in Russell County on days with elevated PM2.5 concentrations. <u>This factor fortifies the recommendation to exclude Lee County from the Russell nonattainment area</u>

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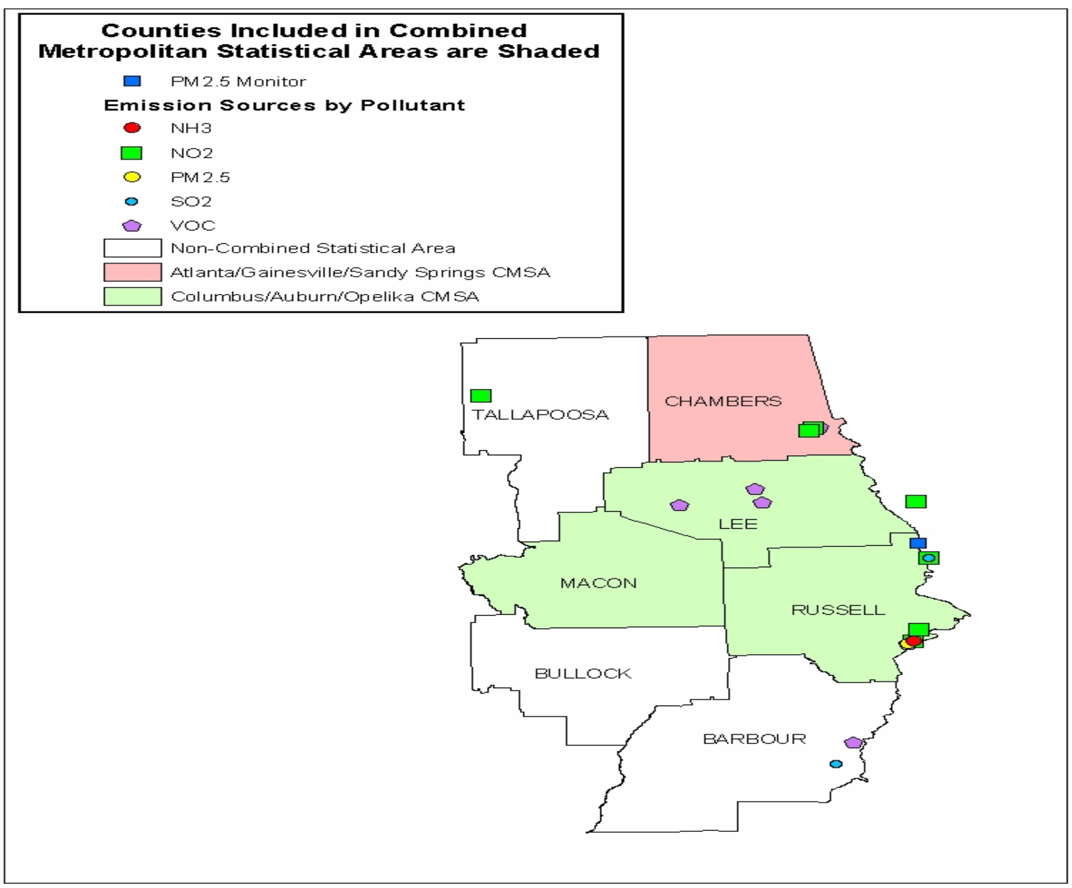


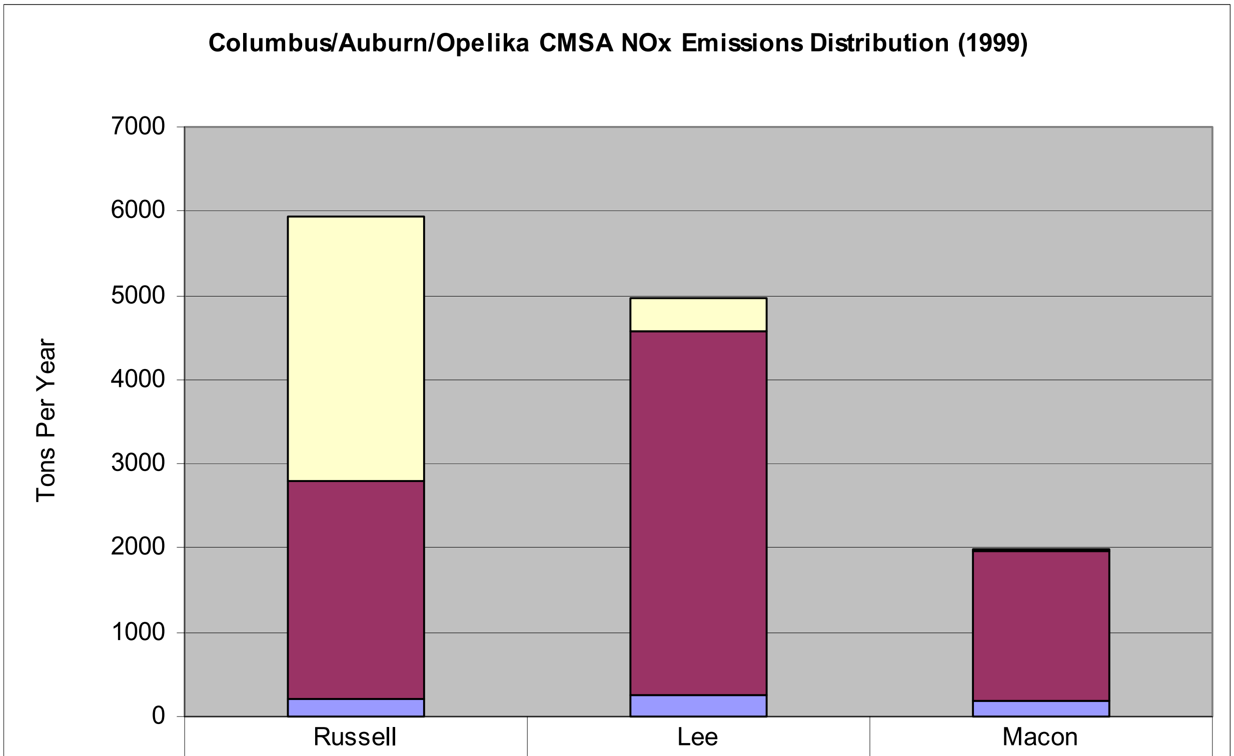
Figure 7 Major Point Sources in the Columbus/Auburn/Opelika CMSA and Surrounding Counties

Table 8 NOx Annual Emissions (Tons)

FIPS Code	County	Point		Area		Mobile		Total Emissions	
1113	**Russell**	3,145	88.7%	202	31.5%	2,583	29.7%	5,930	46.0%
1081	**Lee**	377	10.7%	258	40.2%	4,321	49.7%	4,956	38.5%
1087	**Macon**	22	0.6%	182	28.3%	1,789	20.6%	1,993	15.5%
Total Emissions		**3,544**		**642**		**8,693**		**12,879**	

Table 9 Cumulative NOx Contributions

County	Factor	Annual 1999 Emissions (Tons)	% of Area's Total Emissions	Cumulative %
Lee	**Mobile Source NOx Emissions (Tons)**	4,321	33.6%	33.6%
Russell	**Point Source NOx Emissions (Tons)**	3,145	24.4%	58.0%
Russell	**Mobile Source NOx Emissions (Tons)**	2,583	20.1%	78.1%
Macon	**Mobile Source NOx Emissions (Tons)**	1,789	13.9%	92.0%
Lee	**Point Source NOx Emissions (Tons)**	377	2.9%	94.9%
Lee	**Area Source NOx Emissions (Tons)**	258	2.0%	96.9%
Russell	**Area Source NOx Emissions (Tons)**	202	1.6%	98.5%
Macon	**Area Source NOx Emissions (Tons)**	182	1.3%	99.8%
Macon	**Point Source NOx Emissions (Tons)**	22	0.2%	100.0%
	Area's Total Emissions	**12,879**		



	Russell	Lee	Macon
Point	3,145	377	22
Mobile	2,583	4,321	1,789
Area	202	258	182

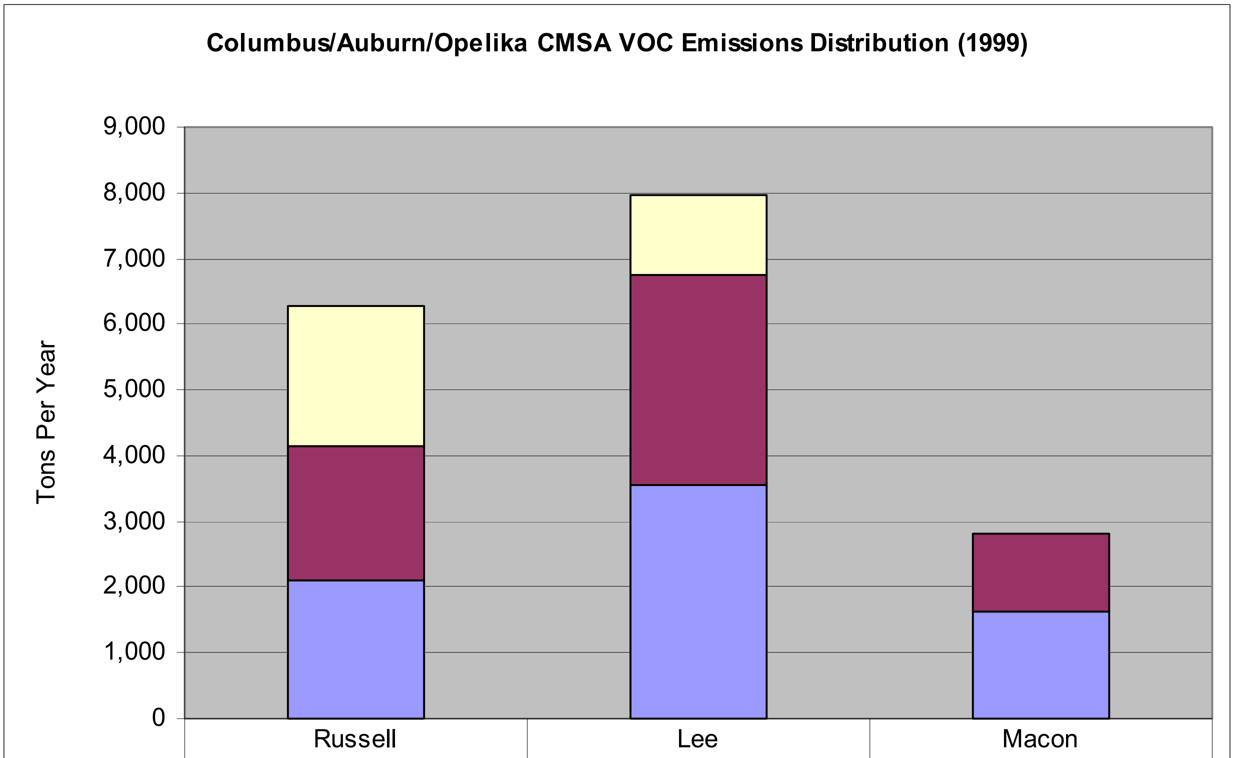
Figure 8 NOx Emissions for Columbus/Auburn/Opelika CMSA

Table 10 VOC Annual Emissions (Tons)

FIPS Code	County	Point		Area		Mobile		Total Emissions	
1113	**Russell**	2,128	63.6%	2,111	28.9%	2,034	31.8%	6,273	36.8%
1081	**Lee**	1,214	36.3%	3,552	48.7%	3,186	49.7%	7,952	46.6%
1087	**Macon**	2	0.1%	1,633	22.4%	1,188	18.5%	2,823	16.6%
Total Emissions		**3,344**		**7,296**		**6,408**		**17,048**	

Table 11 Cumulative VOC Contributions

County	Factor	Annual 1999 Emissions (Tons)	% of Area's Total Emissions	Cumulative %
Lee	**Area Source VOC Emissions (Tons)**	3,552	20.8%	20.8%
Lee.	**Mobile Source VOC Emissions (Tons)**	3,186	18.7%	39.5%
Russell	**Point Source VOC Emissions (Tons)**	2,128	12.5%	52.0%
Russell	**Area Source VOC Emissions (Tons)**	2,111	12.4%	64.4%
Russell	**Mobile Source VOC Emissions (Tons)**	2,034	11.9%	76.3%
Macon	**Area Source VOC Emissions (Tons)**	1,633	9.6%	85.9%
Lee	**Point Source VOC Emissions (Tons)**	1,214	7.1%	93.0%
Macon	**Mobile Source VOC Emissions (Tons)**	1,188	7.0%	100.0%
Macon	**Point Source VOC Emissions (Tons)**	2	0.0%	100.0%
	Area's Total Emissions	**17,048**		



	Russell	Lee	Macon
Point	2,128	1,214	2
Mobile	2,034	3,186	1,188
Area	2,111	3,552	1,633

Figure 9 VOC Emissions for Columbus/Auburn/Opelika CMSA

Table 12 SO2 Annual Emissions (Tons)

FIPS Code	County	Point		Area		Mobile		Total Emissions	
1113	**Russell**	1,848	95.6%	455	27.5%	111	28.0%	2,414	60.6%
1081	**Lee**	74	3.8%	1,082	65.5%	207	52.1%	1,363	34.2%
1087	**Macon**	11	0.6%	116	7.0%	79	19.9%	206	5.2%
Total Emissions		**1,933**		**1,653**		**397**		**3,983**	

Table 13 Cumulative SO2 Contributions

County	Factor	Annual 1999 Emissions (Tons)	% of Area's Total Emissions	Cumulative %
Russell	**Point Source SO2 Emissions (Tons)**	1,848	46.4%	46.4%
Lee	**Area Source SO2 Emissions (Tons)**	1,082	27.2%	73.6%
Russell	**Area Source SO2 Emissions (Tons)**	455	11.4%	85.0%
Lee	**Mobile Source SO2 Emissions (Tons)**	207	5.2%	90.2%
Macon	**Area Source SO2 Emissions (Tons)**	116	2.9%	93.1%
Russell	**Mobile Source SO2 Emissions (Tons)**	111	2.8%	95.9%
Macon	**Mobile Source SO2 Emissions (Tons)**	79	1.9%	97.8%
Lee	**Point Source SO2 Emissions (Tons)**	74	1.9%	99.7%
Macon	**Point Source SO2 Emissions (Tons)**	11	0.3%	100.0%
	Area's Total Emissions	**3,983**		

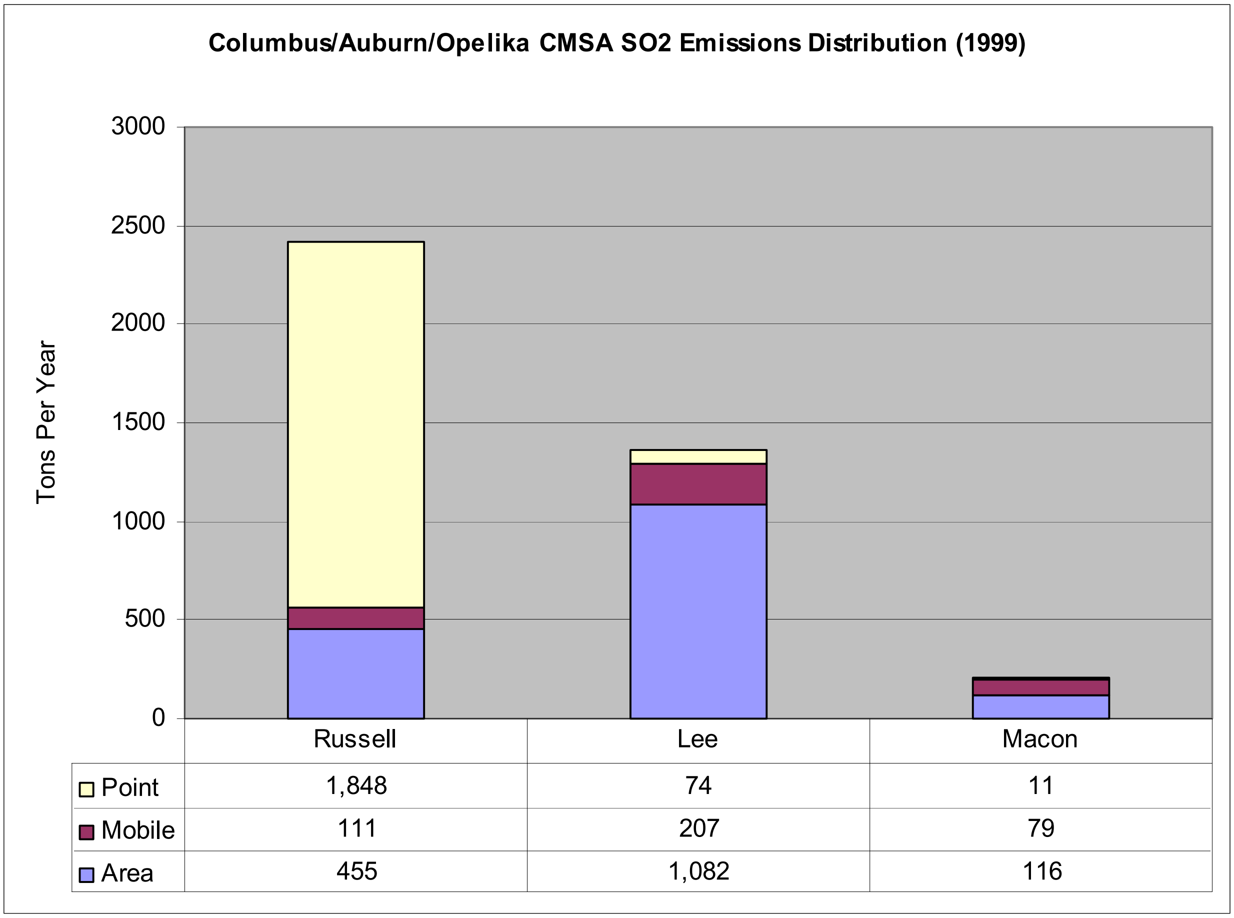


Figure 10 SO2 Emissions for Columbus/Auburn/Opelika CMSA

Table 14 PM2.5 Annual Emissions (Tons)

FIPS Code	County	Point		Area		Mobile		Total Emissions	
1113	**Russell**	735	82.5%	1,211	31.8%	73	28.8%	2,019	40.7%
1081	**Lee**	147	16.5%	1,574	41.3%	135	53.1%	1,856	37.5%
1087	**Macon**	9	1.0%	1,027	26.9%	46	18.1%	1,082	21.8%
Total Emissions		**891**		**3,812**		**254**		**4,957**	

Table 15 Cumulative PM2.5 Contributions

County	Factor	Annual 1999 Emissions (Tons)	% of Area's Total Emissions	Cumulative %
Lee	**Area Source PM Emissions (Tons)**	1,574	31.8%	31.8%
Russell	**Area Source PM Emissions (Tons)**	1,211	24.4%	56.2%
Macon	**Area Source PM Emissions (Tons)**	1,027	20.7%	76.9%
Russell	**Point Source PM Emissions (Tons)**	735	14.8%	91.7%
Lee	**Point Source PM Emissions (Tons)**	147	3.0%	94.7%
Lee	**Mobile Source PM Emissions (Tons)**	135	2.7%	97.4%
Russell	**Mobile Source PM Emissions (Tons)**	73	1.5%	98.9%
Macon	**Mobile Source PM Emissions (Tons)**	46	0.9%	99.8%
Macon	**Point Source PM Emissions (Tons)**	9	0.2%	100.0%
	Area's Total Emissions	**4,957**		

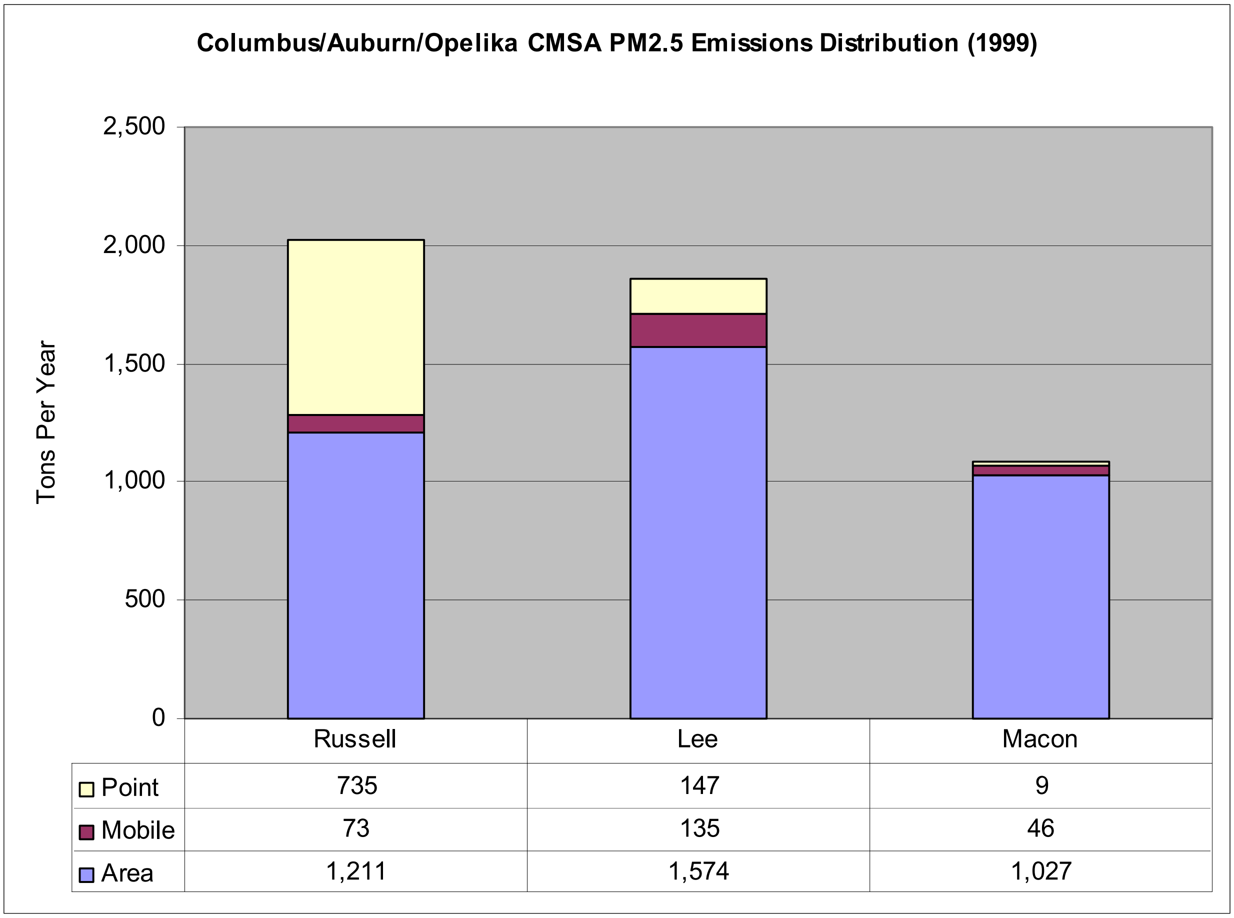


Figure 11 PM2.5 Emissions for Columbus/Auburn/Opelika CMSA

Table 16 NH3 Annual Emissions (Tons)

FIPS Code	County	Point		Area		Mobile		Total Emissions	
1113	**Russell**	5	55.6%	317	27.2%	69	29.5%	391	27.7%
1081	**Lee**	4	44.4%	467	40.0%	116	49.6%	587	41.7%
1087	**Macon**	0	0.0%	383	32.8%	49	20.9%	432	30.6%
Total Emissions		**9**		**1,167**		**234**		**1,410**	

Table 17 Cumulative NH3 Contributions

County	Factor	Annual 1999 Emissions (Tons)	% of Area's Total Emissions	Cumulative %
Lee	**Area Source NH3 Emissions (Tons)**	467	33.1%	33.1%
Macon	**Area Source NH3 Emissions (Tons)**	383	27.2%	60.3%
Russell	**Area Source NH3 Emissions (Tons)**	317	22.5%	82.8%
Lee	**Mobile Source NH3 Emissions (Tons)**	116	8.2%	91.0%
Russell	**Mobile Source NH3 Emissions (Tons)**	69	4.8%	95.8%
Macon	**Mobile Source NH3 Emissions (Tons)**	49	3.5%	99.3%
Russell	**Point Source NH3 Emissions (Tons)**	5	0.4%	99.7%
Lee	**Point Source NH3 Emissions (Tons)**	4	0.3%	100.0%
Macon	**Point Source NH3 Emissions (Tons)**	0	0.0%	100.0%
	Area's Total Emissions	**1,410**		

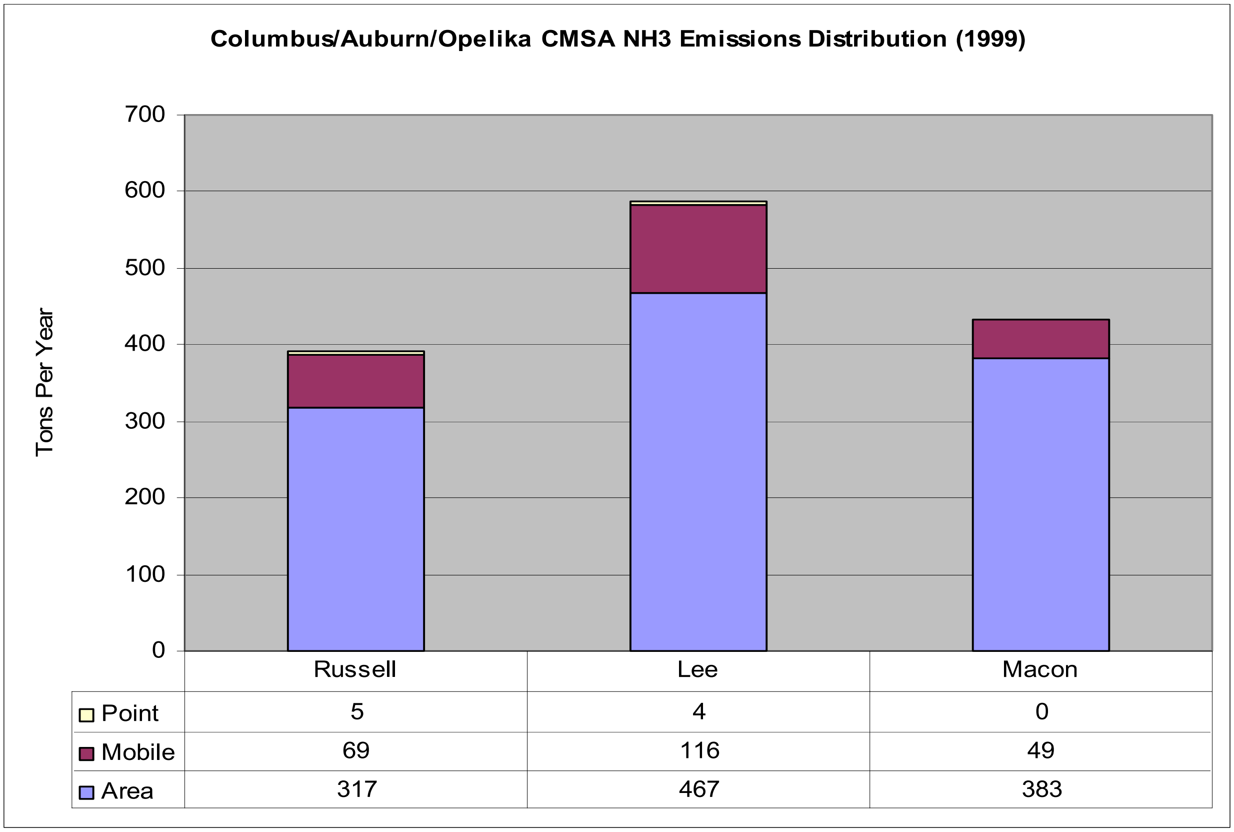


Figure 12 NH3 Emissions for Columbus/Auburn/Opelika CMSA

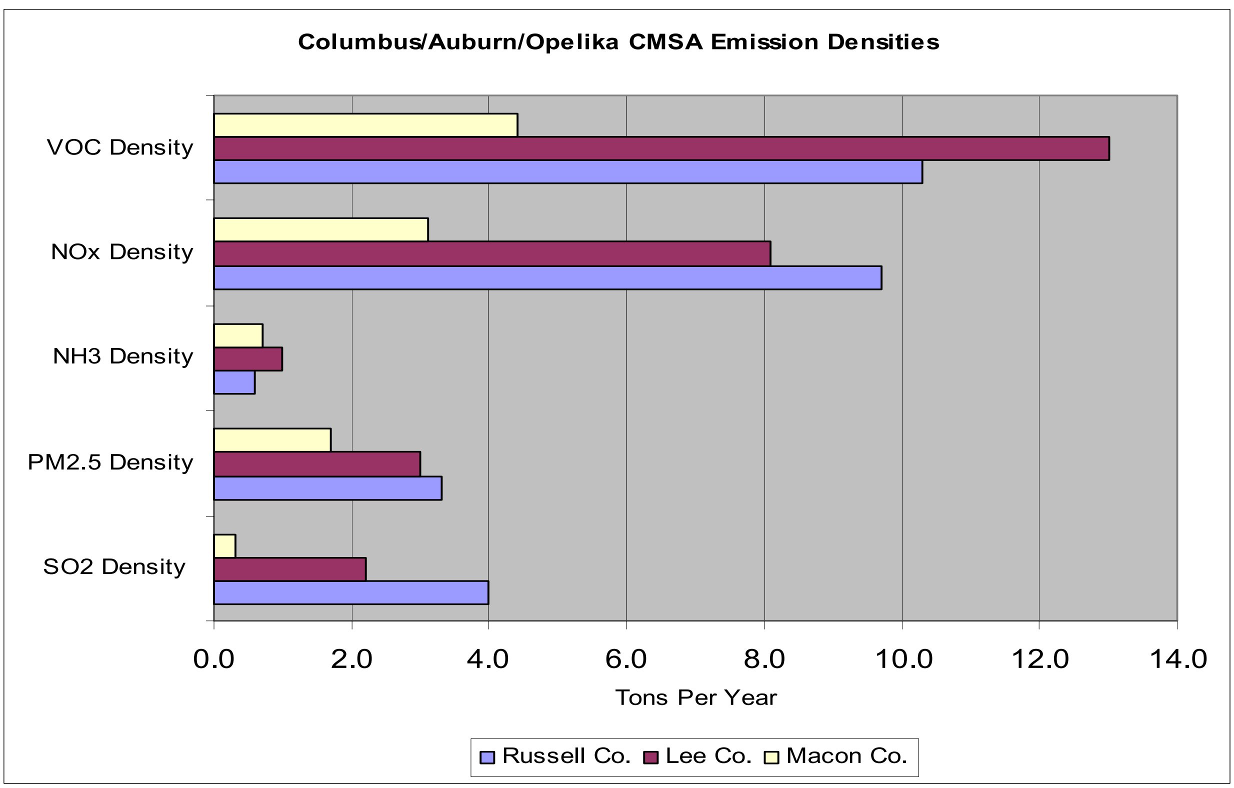


Figure 13 Emission Densities for Columbus/Auburn/Opelika CMSA

E. Traffic and Commuting Patterns

Estimates of the Daily Vehicle Miles Traveled (DVMT) were obtained from the Alabama Department of Transportation, and the commuting patterns were obtained from the U.S. Census Bureau website. The commuting patterns available were based on the 1990 U.S. Census. Table 18 presents the 1993 and 2001 DVMT estimates for the Columbus/Auburn/Opelika CMSA, and Figure 14 demonstrates the trend from 1993 to 2001 for each county. Figure 15 presents the breakdown of 2001 DVMT into urban and rural. Figure 16 presents the commuting patterns in the Columbus/Auburn/Opelika CMSA.

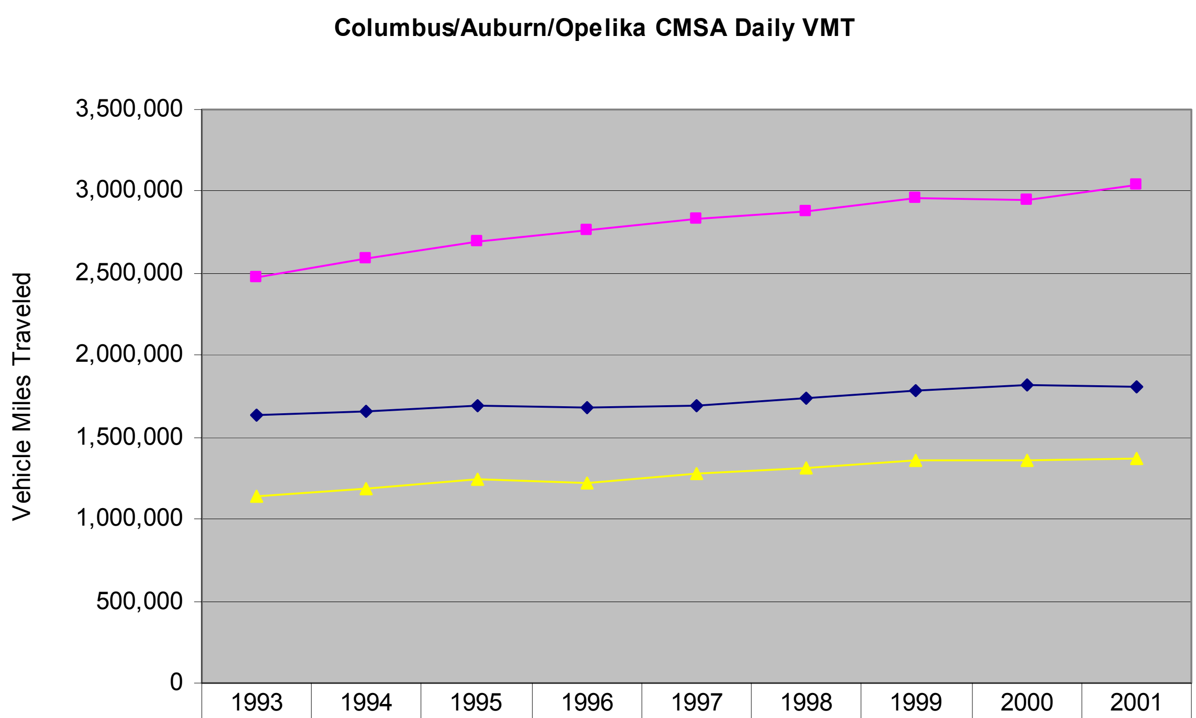
Table 18 shows that the DVMT for Macon County is less than that of Russell and Lee Counties. Figure 16 shows that there is very little commuting from Macon County into Russell and Lee Counties. <u>This factor fortifies the recommendation to exclude Macon County from the Russell nonattainment area</u>.

Table 18 shows that Lee County's DVMT exceeds that of Russell and Macon Counties. However, Figure 16 shows that there is not substantial commuting from Lee County into Russell and Macon Counties. National control measures such as the low sulfur gasoline and Tier 2 and on-road diesel standards should mitigate much of the emissions attributed to mobile sources in Lee County. Therefore, the impact of the mobile source emissions from Lee County should decrease.

<u>This factor fortifies the recommendation to exclude Lee County from the Russell nonattainment area</u>.

Table 18 Daily VMT for Columbus/Auburn/Opelika CMSA

	1993	2001	Daily VMT Change (1993-2001)	% Change	% of CMSA 2001 Daily VMT
Russell	1,629,982	1,806,545	176,563	10.8%	29.1%
Lee	2,475,656	3,036,790	561,134	22.7%	48.8%
Macon	1,136,463	1,375,462	238,999	21.0%	22.1%
Total	**5,242,101**	**6,218,797**	**976,696**	**18.6%**	**100.0%**



	1993	1994	1995	1996	1997	1998	1999	2000	2001
Russell	1,629,982	1,654,125	1,697,776	1,680,224	1,692,891	1,738,179	1,780,570	1,824,485	1,806,545
Lee	2,475,656	2,585,025	2,699,596	2,760,127	2,827,060	2,882,779	2,963,166	2,946,022	3,036,790
Macon	1,136,463	1,185,237	1,242,622	1,224,670	1,276,891	1,315,153	1,355,484	1,353,712	1,375,462

Figure 14 Daily VMT Trend for Columbus/Auburn/Opelika CMSA

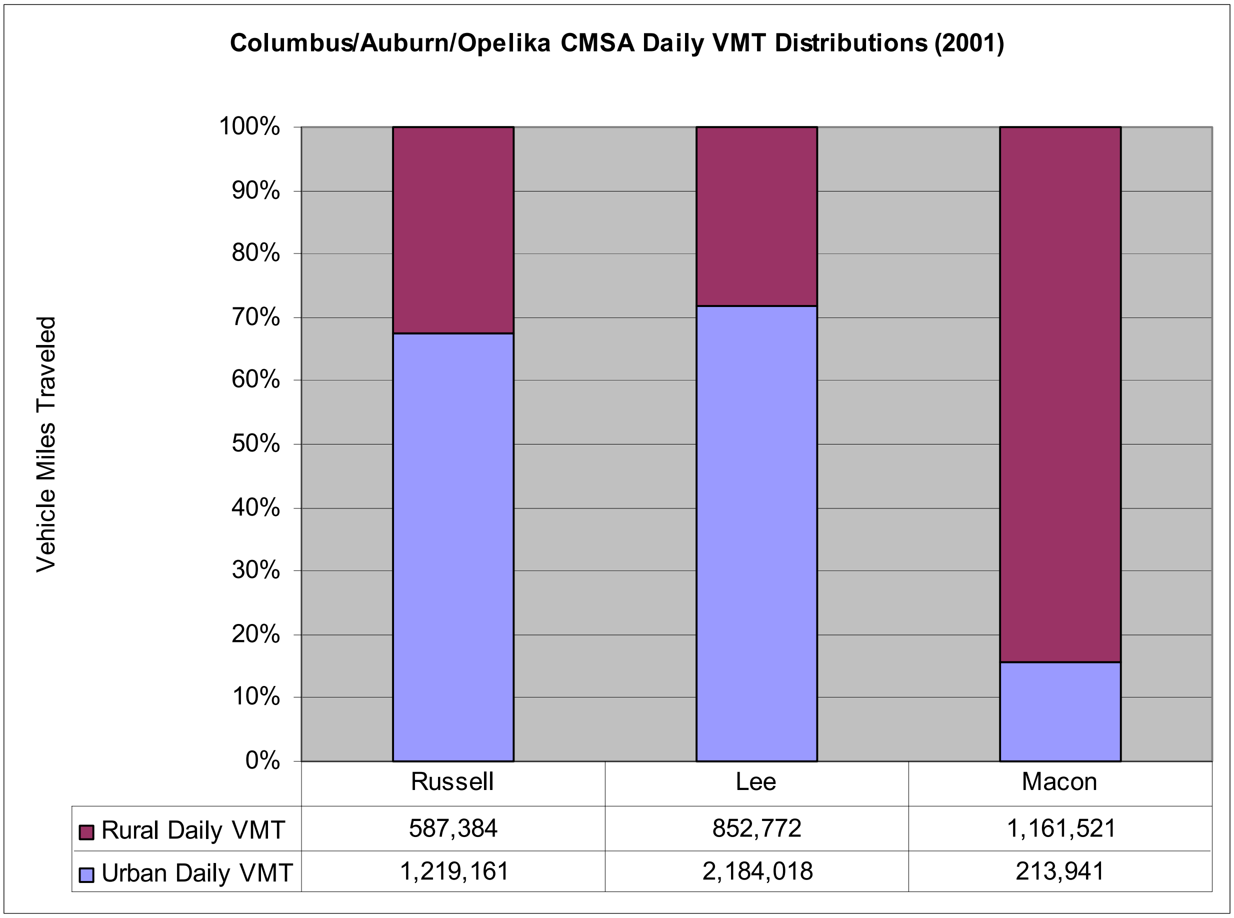
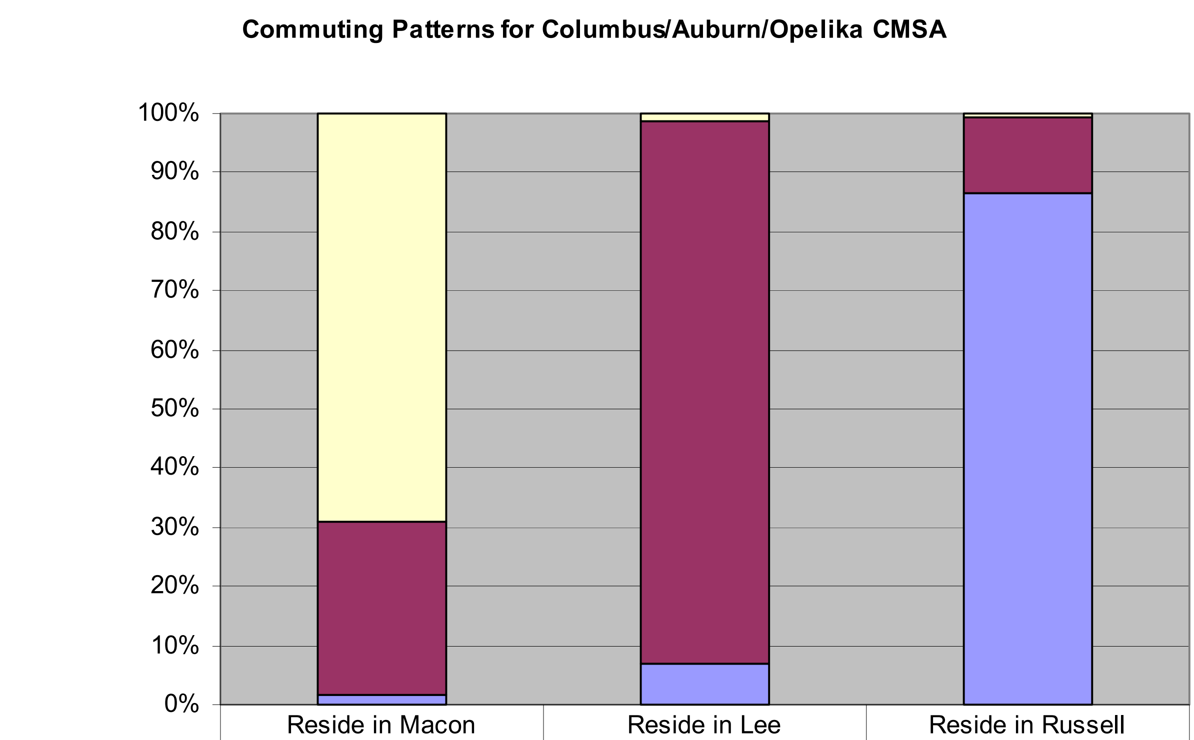


Figure 15 Rural vs Urban Daily VMT for Columbus/Auburn/Opelika CMSA

Figure 15 demonstrates that Macon County has a limited amount of urban Daily VMT. This factor fortifies the recommendation to exclude Macon County from the Russell nonattainment area.

Lee County has the highest urban Daily VMT in the Columbus/Auburn/Opelika CMSA. This is expected because of Lee County's population compared to that of Russell County.

Because of the implementation of the national vehicle and fuel standards discussed above, this factor presents no compelling reason to include Lee County in the Russell nonattainment area.



	Reside in Macon	Reside in Lee	Reside in Russell
Work in Macon	4,203	478	53
Work in Lee	1,789	35,549	1,048
Work in Russell	102	2,682	7,051

Figure 16 Commuting Patterns for Columbus/Auburn/Opelika CMSA

Figure 16 indicates that there is no significant commuting into Russell County from Lee or Macon Counties. <u>This strengthens our recommendation to not include Lee or Macon Counties in the Russell nonattainment area.</u>

F. Expected Growth (including extent, pattern, and rate of growth)

There is little information available about expected growth. Table 19 provides population growth estimates that were supplied by the U.S. Census Bureau. The estimates show significant growth expected in Lee County; Russell shows a very modest growth; and Macon shows a decrease in population. Since no other information about expected growth is available, and population growth estimates are not enough to influence a decision about designating a nonattainment area, this factor presents no compelling reason to include Lee and Macon Counties in the Russell nonattainment area.

Table 19 Population Projections for the Columbus/Auburn/Opelika CMSA

County	1993	2000	2002	2015	2025	% Change 1993-2002	% Change 2002-2015	% Change 2015-2025
Russell	49,955	49,756	50,219	53,147	55,198	0.5%	5.8%	3.9%
Lee	90,982	115,092	120,284	154,474	179,495	32.2%	28.4%	16.2%
Macon	24,411	24,105	23,944	23,095	22,505	-1.9%	-3.5%	-2.6%

G. Meteorology

It is clear that meteorology plays a major role in the formation and transport of PM2.5. During 2000-2002, PM2.5 levels in Phenix City exceeded the annual average over the three-year period. A wind analysis using wind data from the Columbus, Georgia Airport was completed to evaluate the predominant wind direction(s) in Phenix City over the 3-year period on all days, and days with daily PM2.5 concentrations over 15 µg/m3, 25 µg/m3, and 30 µg/m3. As seen in the wind rose in Figures 17-20, there is a large easterly component to the winds during the 3-year time period.

In addition to examining wind roses, backward trajectories were created, using the National Weather Service's HYSPLIT program, to determine the path air parcels followed for the 24 hours prior to mid-day for each day the peak 24-hour PM2.5 concentration exceeded 30 µg/m3. Back trajectory analyses were performed to supplement the wind roses due to a lack of wind data in the immediate vicinity of the monitoring site. The threshold was exceeded on twelve days in the three-year period. The frequency that the trajectory passed over each county adjacent to Russell County was noted. The results are summarized in Figures 21-26 and in Table 20. For example, of the 24-hour trajectories ending at the surface in Russell County, the most common path was over Georgia Counties and the least common was over Bullock County and Barbour County. Note that the percentages exceed 100%; some trajectories passed over more than one county. In conclusion the wind roses and back trajectories are similar in showing predominant wind patterns.

Table 20 Back Trajectory Analysis

Adjacent County	Surface		500 Meters AGL		1000 Meters AGL	
	Number	Frequency	Number	Frequency	Number	Frequency
Lee	3	25%	3	25%	3	25%
Macon	1	8%	2	25%	3	25%
Bullock	1	8%	1	8%	2	16%
Barbour	1	8%	1	8%	1	8%
GA Counties	11	91%	7	58%	7	58%

H. Geography/Topography (mountain ranges or other air basin boundaries)

Phenix City is located in Eastern Alabama in Russell County and is about 70 miles east of Montgomery and 183 miles inland from the Gulf of Mexico.

The northern part of the county is somewhat hilly but becomes flatter as one moves west or south away from the influence of the Appalachian foothills. The Chattahoochee River traverses the county from the northeast to southeast through a flat plain along the Alabama /Georgia state border.

There is no clear relationship between topography of Russell County and PM2.5 formation and transport in the Phenix City area.

I. Jurisdictional Boundaries

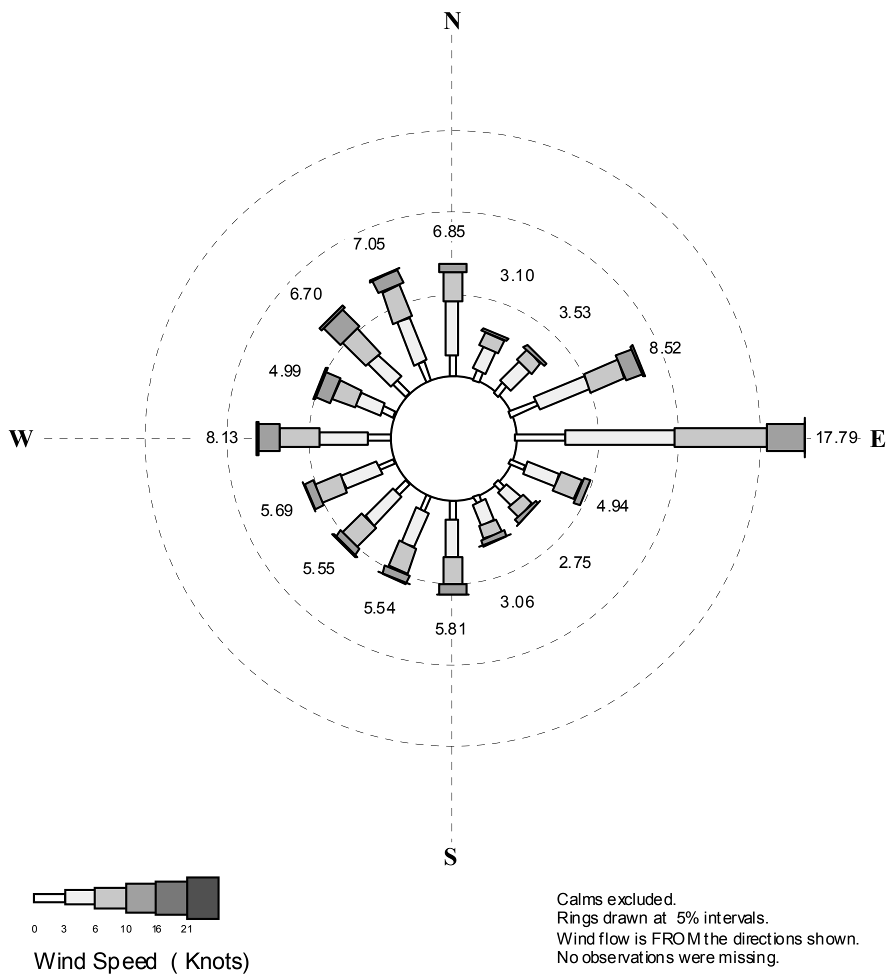
Russell, Lee, and Macon Counties are in the Columbus (Georgia) – Phenix City (Alabama) Interstate Air Quality Control Region (40 CFR 81.58). Russell, Lee, and Macon Counties are in the jurisdiction of the State of Alabama under the purview of the ADEM. The State's monitor located in Russell County supports representative data for Russell County being recommended as the PM2.5 nonattainment boundary. Discussion elsewhere in this document demonstrates the State's recommendations for exclusion of Lee and Macon Counties as a part of the PM2.5 nonattainment boundary.

J. Level of Control of Emission Sources

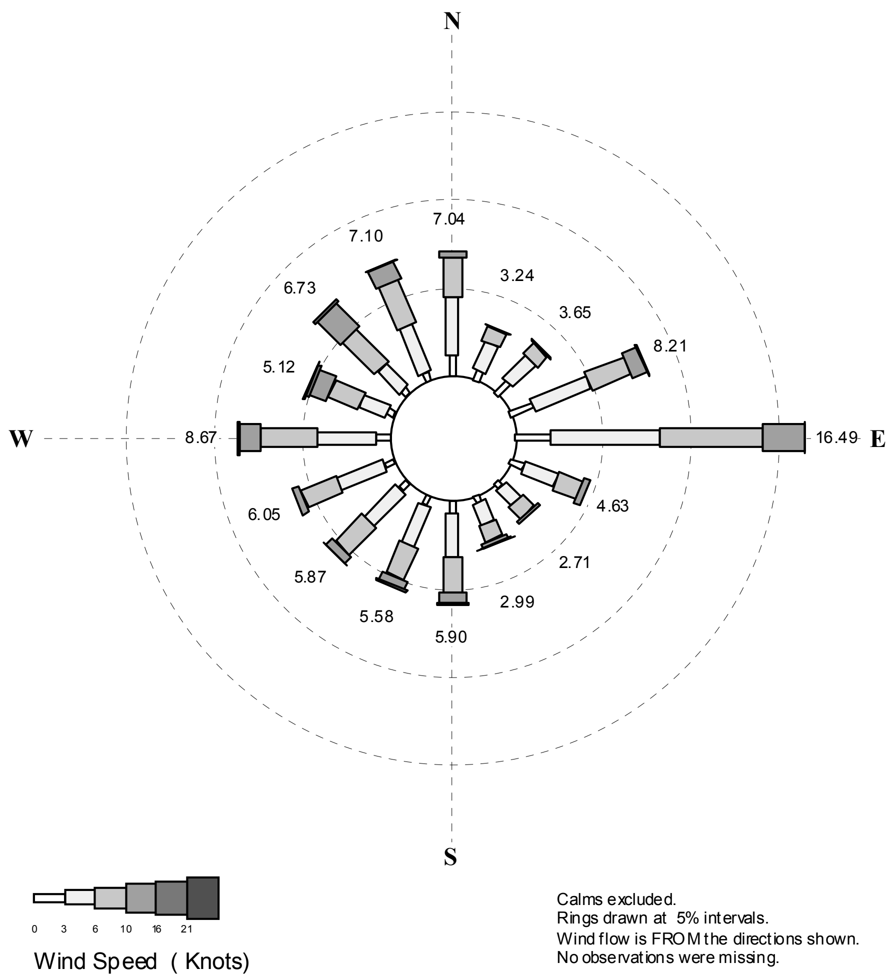
Since 1979, statewide reasonably available control technology (RACT) has been in place for volatile organic compounds (VOCs) as found under ADEM Admin. Code Chapter 335-3-6. Also in place since 1990, has been the institution of statewide regulations for the control of evaporative emissions in the gasoline marketing chain, commonly referred to as 'Stage I' vapor recovery. Over the past 31-year history of Alabama's air pollution control program, the state has been delegated the authority to implement other standards of performance, such as, the New Source Performance Standards (NSPS), National Emission Standards for Hazardous Air Pollutants (NESHAPs), and the federal Prevention of Significant Deterioration (PSD) regulations for protection from degradation of clean air areas.

Additionally, the EPA has required a NOX SIP Call for 22 states, including the northern two-thirds of Alabama, that by 2004 will result in large reductions in NOX emissions from major utilities, large industrial boilers, gas turbines, and cement kilns. Alabama's NOx SIP was approved by EPA on July 16, 2001. At the national level, EPA has finalized the Tier 2 vehicle/national fuel standards, which take effect beginning in 2004. However, the States have already begun to realize the benefits of cleaner vehicles with the National Low Emission Vehicle standards with the 2001 model year vehicles.

Joint Frequency Distribution
COLUMBUS WINDS- ALL DAYS- 2000-2002
FIGURE 17



Joint Frequency Distribution
COLUMBUS WINDS-PM 2.5> 15ug/m3-2000-2002
FIGURE 18

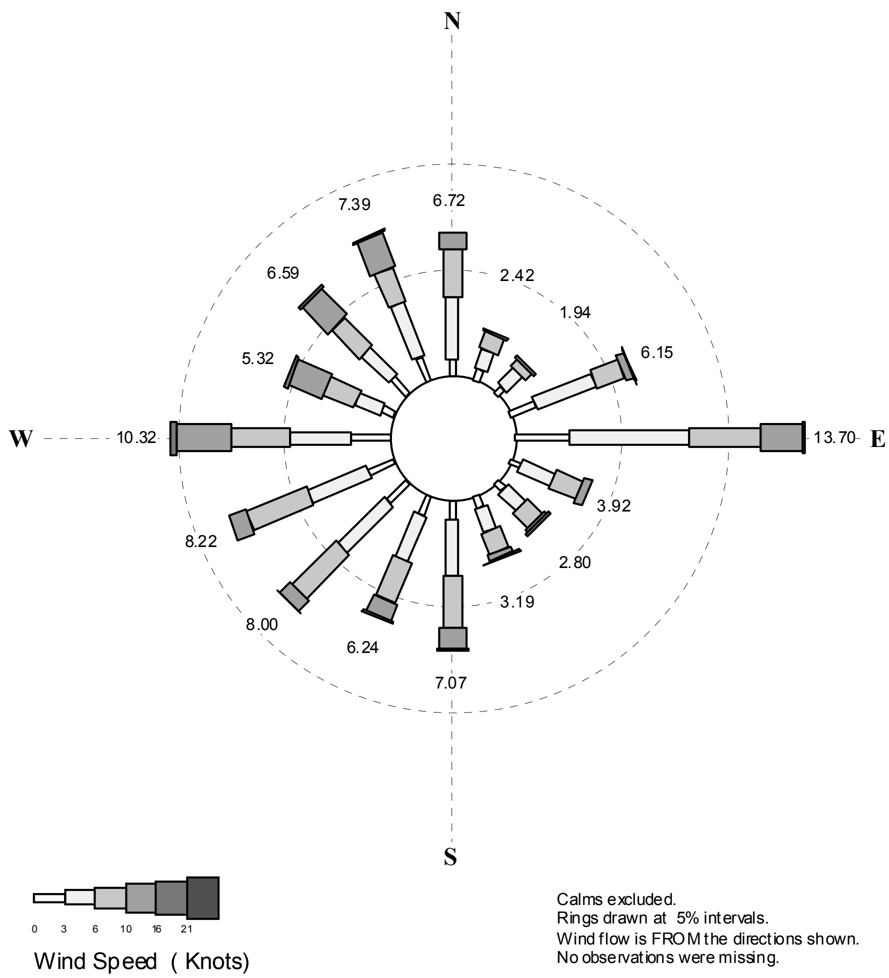


Calms excluded.
Rings drawn at 5% intervals.
Wind flow is FROM the directions shown.
No observations were missing.

Joint Frequency Distribution

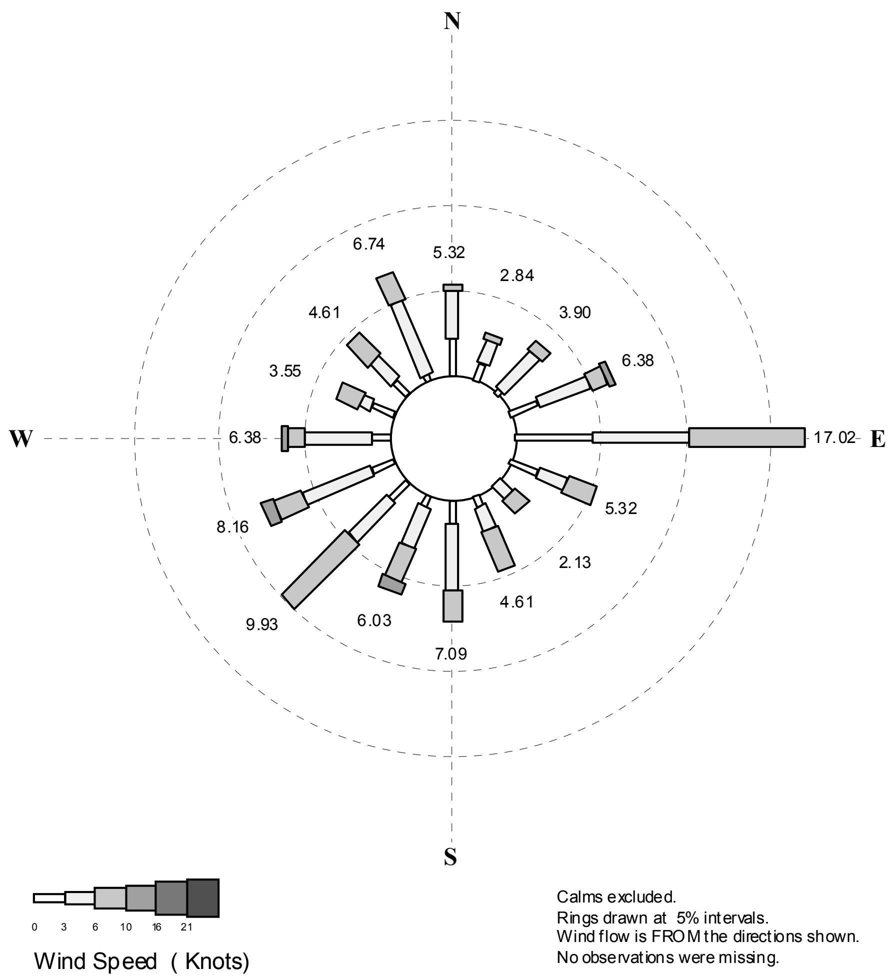
COLUMBUS WINDS- DAYS PM2.5>25ug/m3-2000-2002

FIGURE 19

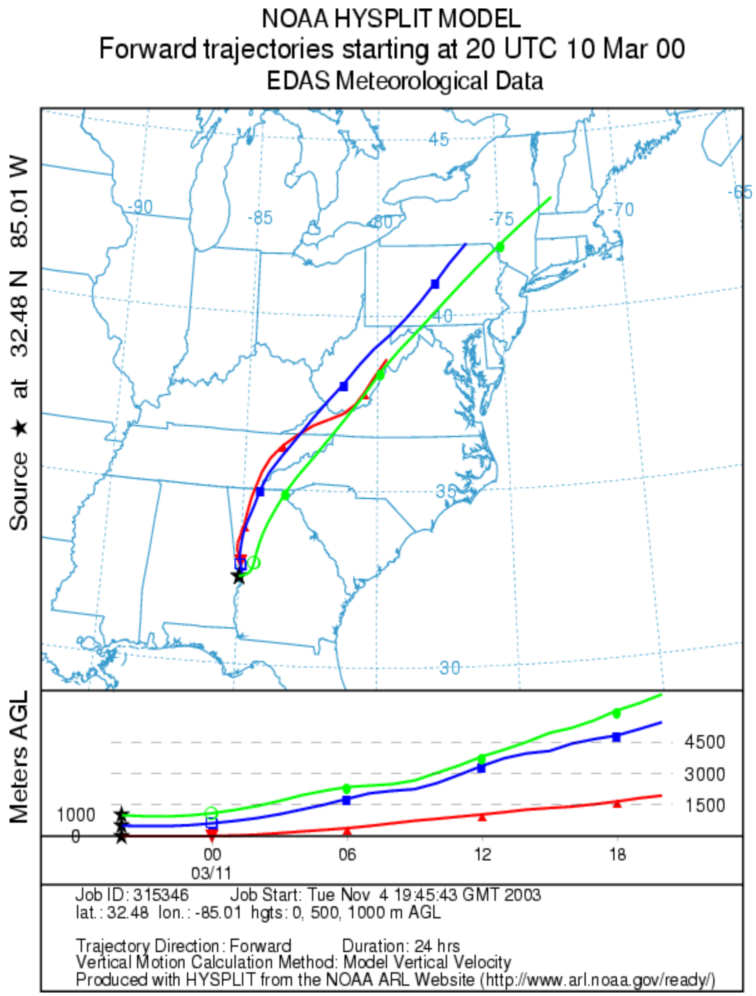


Calms excluded.
Rings drawn at 5% intervals.
Wind flow is FROM the directions shown.
No observations were missing.

Joint Frequency Distribution
COLUMBUS WINDS- DAYS PM2.5> 30 ug/m3-2000-2002
FIGURE 20



Calms excluded.
Rings drawn at 5% intervals.
Wind flow is FROM the directions shown.
No observations were missing.



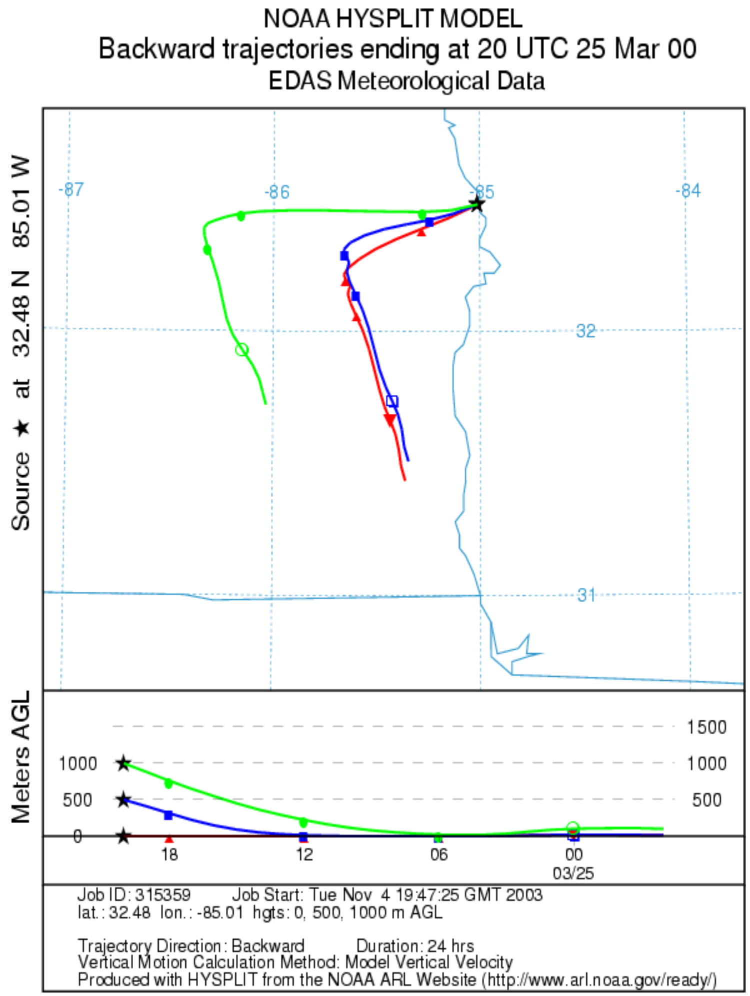


Figure 21 Back Trajectory Analysis

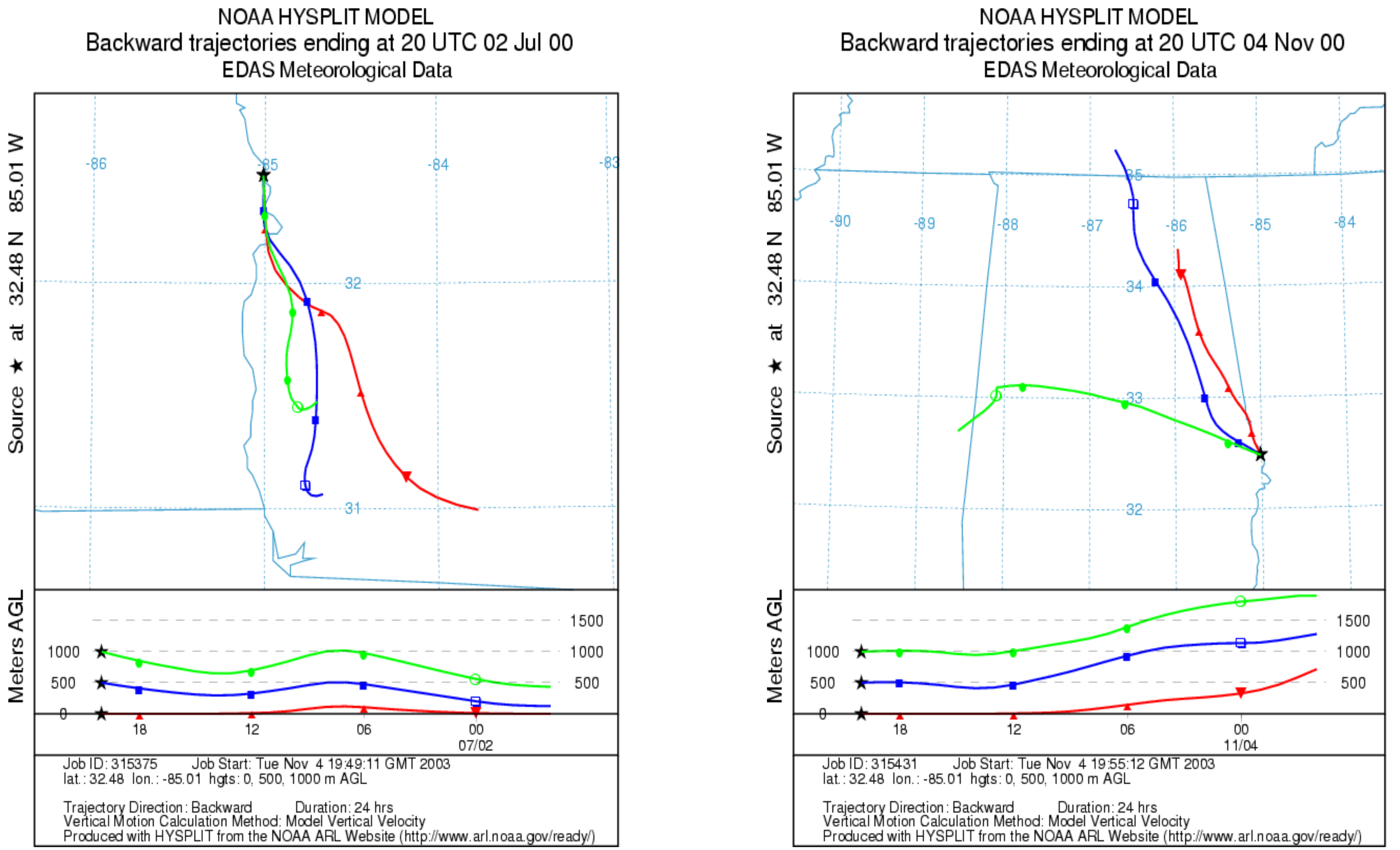
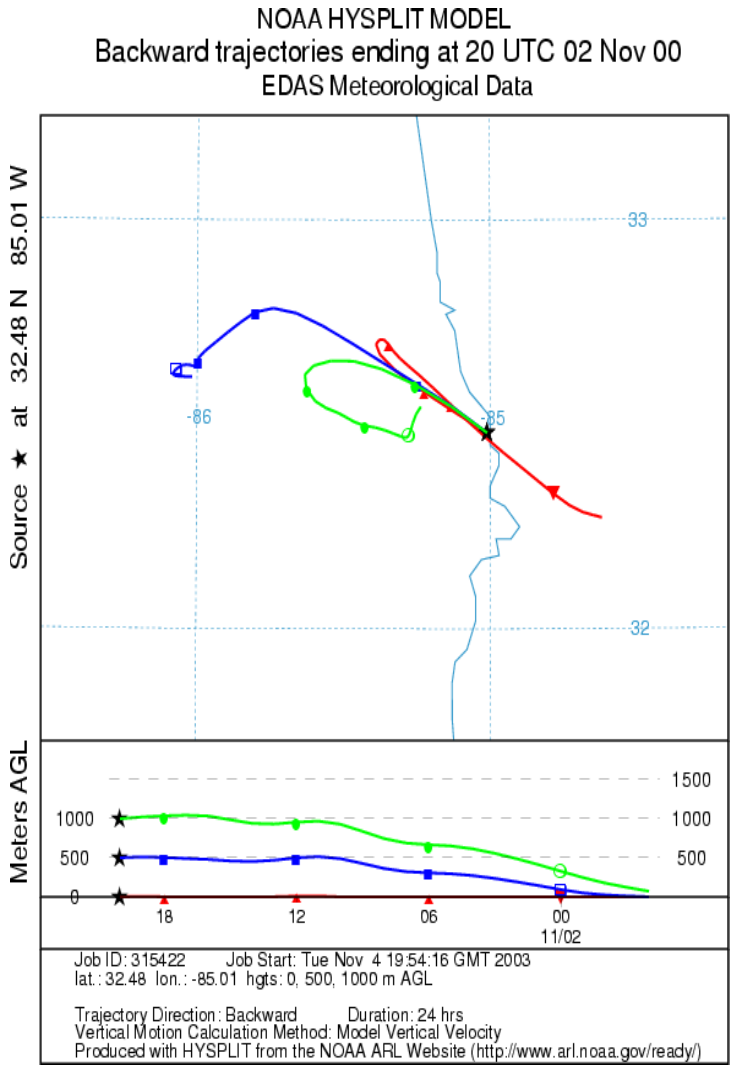


Figure 22 Back Trajectory Analysis



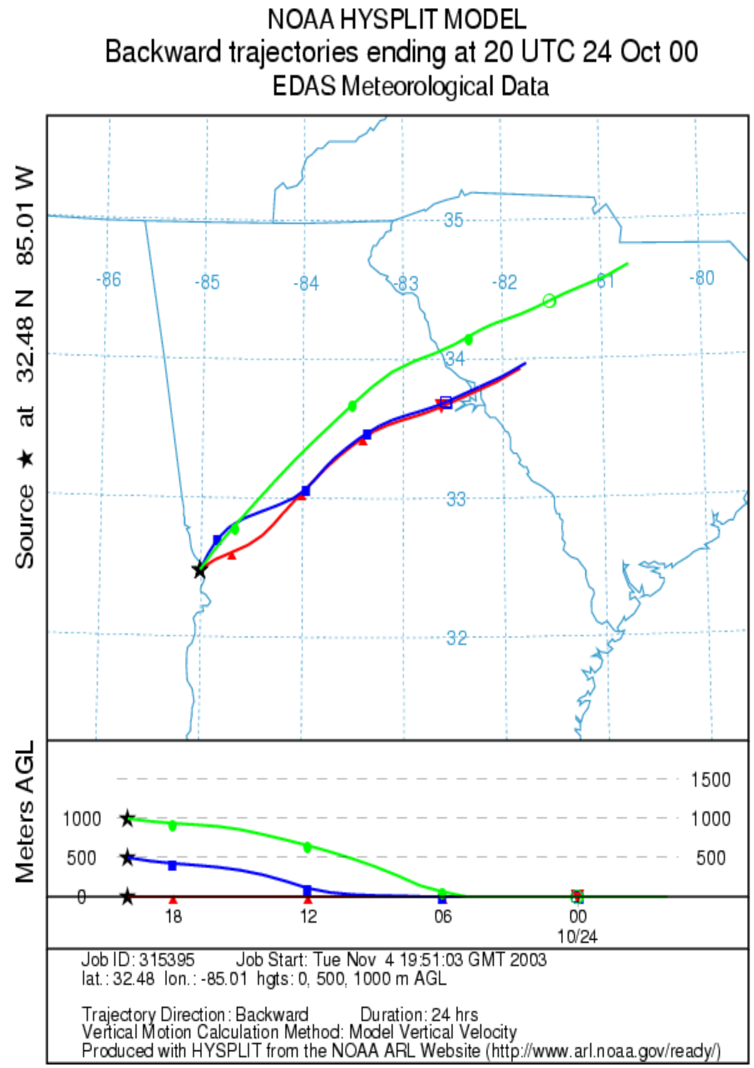


Figure 23 Back Trajectory Analysis

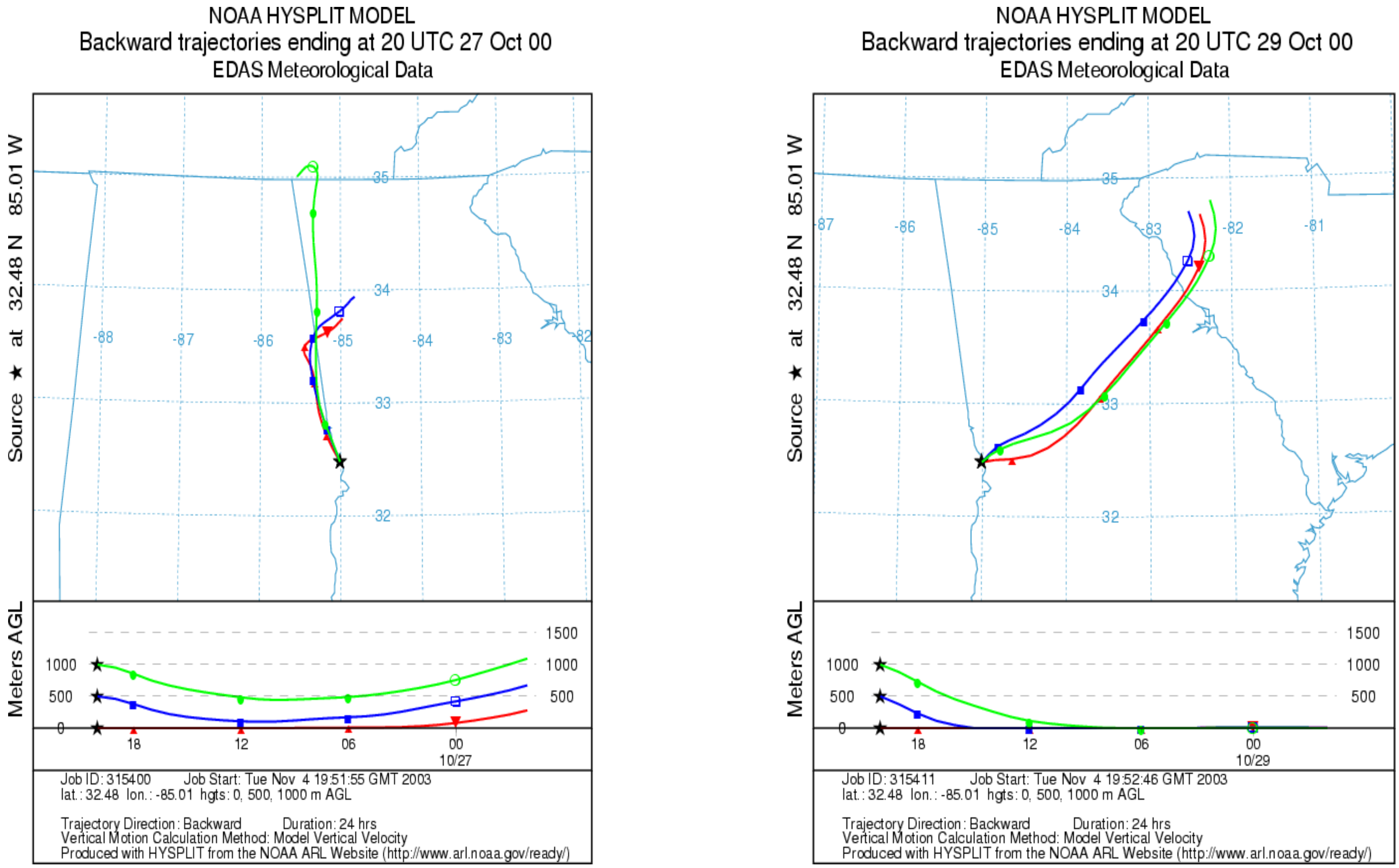


Figure 24 Back Trajectory Analysis

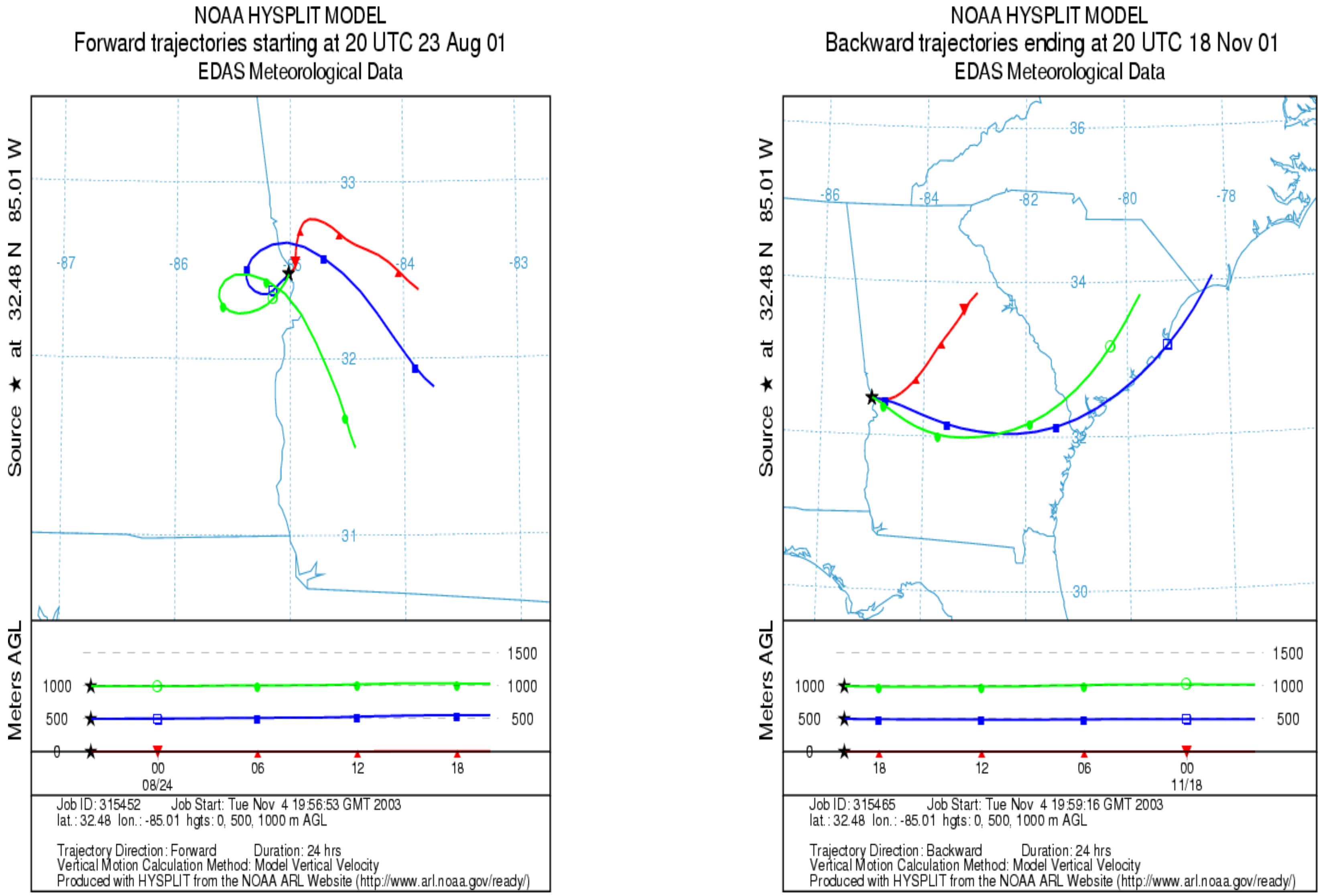


Figure 25 Back Trajectory Analysis

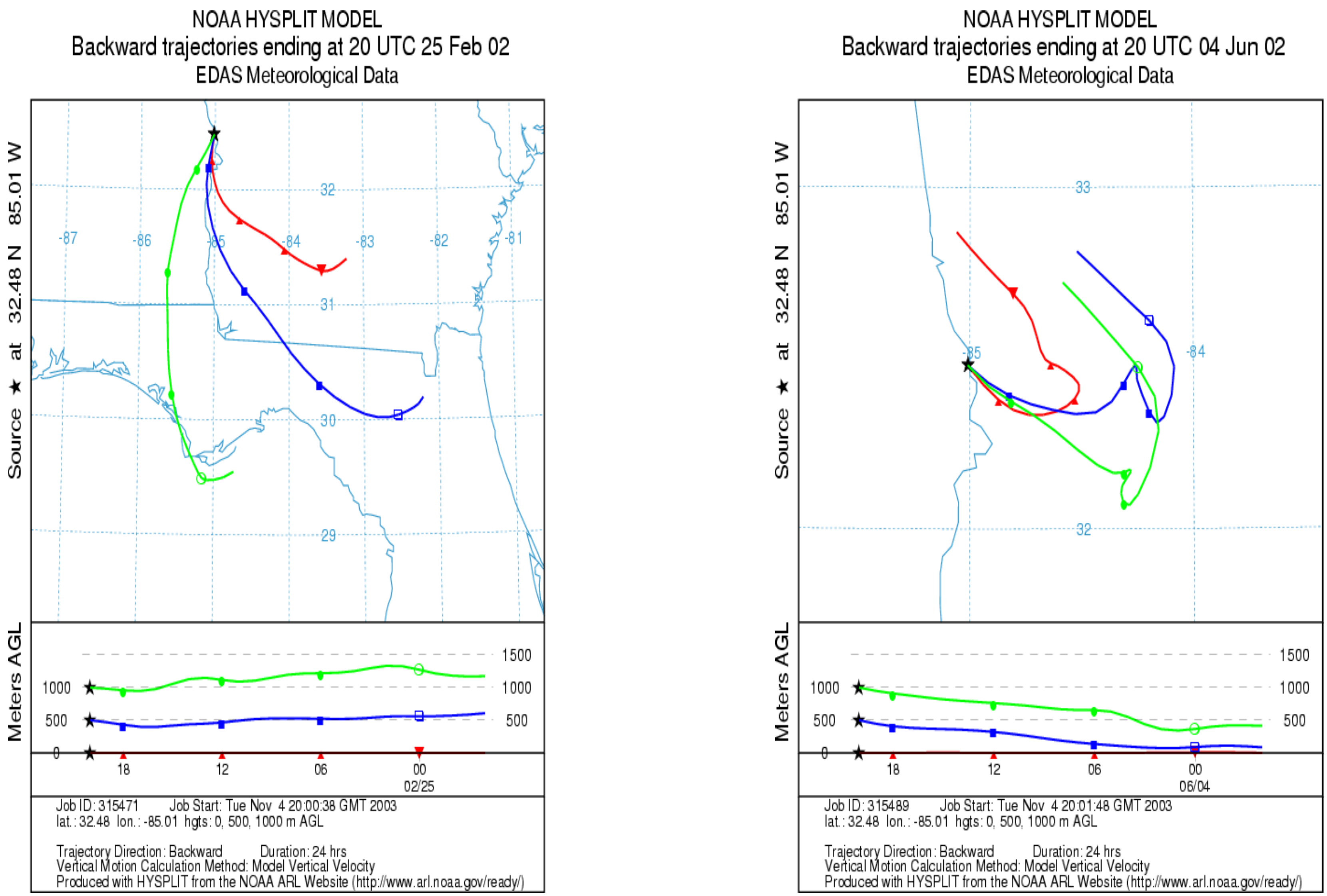


Figure 26 Back Trajectory Analysis