July 14, 2003

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 February 27, 2003, which requests the state's recommendations regarding the extent of non-attainment areas for the eight-hour ozone air quality standard. The information provided is based on monitoring data from 2000 to 2002, inclusive.

The underlying principle in developing our recommendations is EPA's air quality modeling, which indicates that the decrease in ozone concentrations that is predicted to result from several national and regional emissions reduction initiatives will be sufficient to bring all areas of Alabama into attainment of the new 8-hour ozone standard by the year 2007. Since additional local controls are unlikely to be required in order for these areas to meet this new National Ambient Air Quality Standard (NAAQS), it seems unnecessary to designate any counties as non-attainment areas except those with monitored data exceeding the standard. Further, ADEM has legal authority to impose reduction measures as necessary in any county near a nonattainment area, regardless of its attainment status. Thus, the only counties we recommend being designated as non-attainment are those with monitored data exceeding the NAAQS.

Enclosed please find an attachment which provides data from our ozone monitoring network and our recommendations for the extent of ozone non-attainment areas. The enclosed appendices provide detailed information on the

factors which EPA suggested be addressed in support of any non-attainment area recommended to be smaller than a metropolitan statistical area. The data are also provided in electronic format on the enclosed CD.

As documented in the attachment, we recommend that the following counties be designated non-attainment for the 8-hour ozone NAAQS: Jefferson, Shelby, and Morgan. In response to your presumptions regarding the extent of non-attainment areas, we recommend that the following Alabama counties not be included: St. Clair, Blount, Tuscaloosa (considered along with the Birmingham MSA to address the specific concerns expressed by your staff about this county), and Lawrence.

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: Beverly Banister, EPA

Recommendations
for
Designation of Non-Attainment Areas
for the
8-Hour Ozone NAAQS

Prepared by:

Alabama Department of Environmental Management

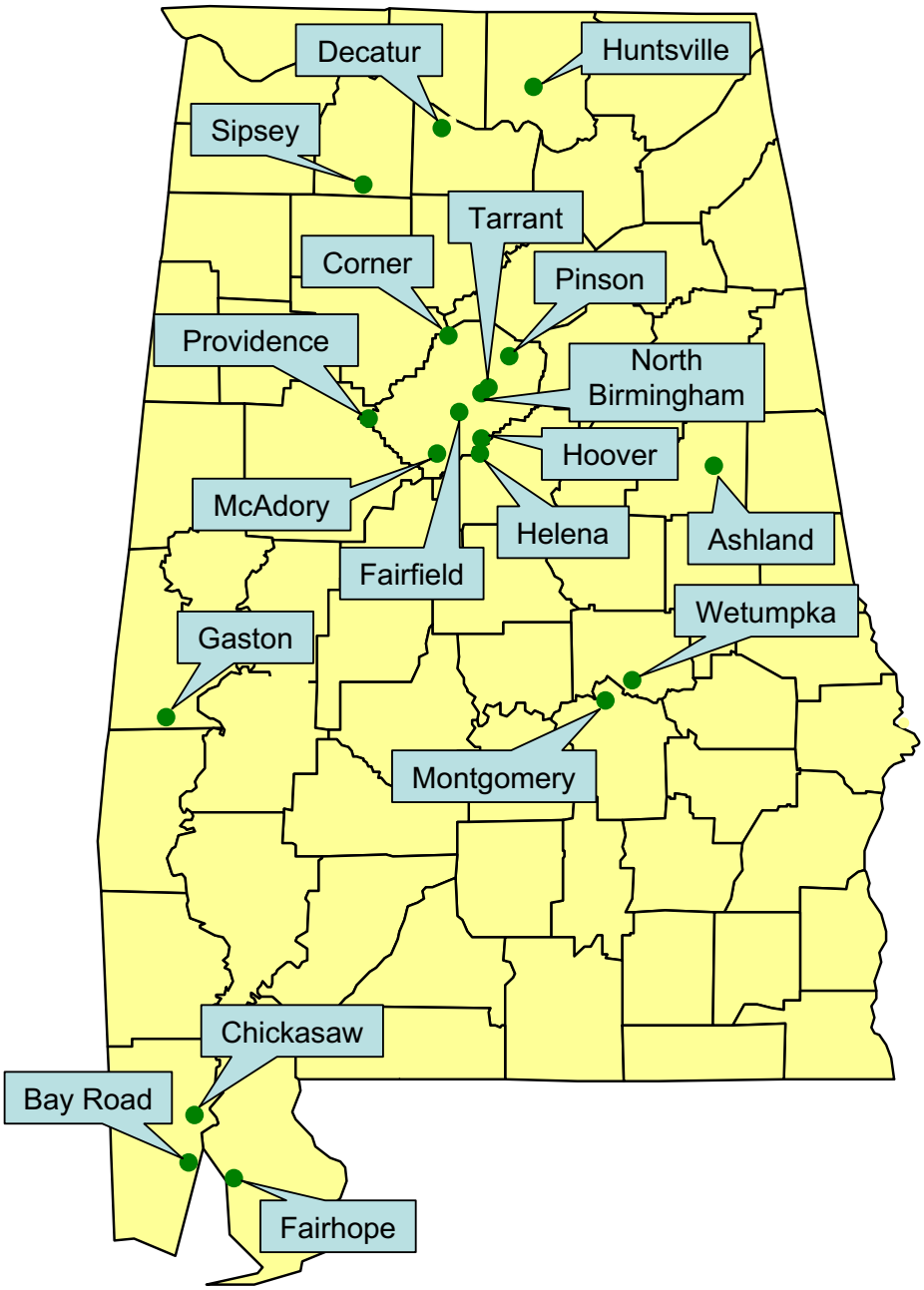
July 2003

ATTACHMENT 1

OZONE DATA (2000 TO 2002) FOR THE STATE OF ALABAMA

County	AIRS ID	Site	2000 4th Max	2001 4th Max	2002 4th Max	3 Year Average
Sumter	01-119-0002	Gaston	0.080	0.072	0.078	0.076
Shelby	01-117-0004	Helena	0.099	0.089	0.090	**0.092**
Montgomery	01-101-1002	Montgomery	0.086	0.077	0.081	0.081
Mobile	01-097-2005	Bay Road	0.093	0.071	0.079	0.081
Mobile	01-097-0003	Chickasaw	0.089	0.076	0.075	0.080
Baldwin	01-003-0010	Fairhope	0.097	0.078	0.072	0.082
Lawrence	01-079-0002	Sipsey	0.083	0.071	0.080	0.078
Elmore	01-051-0001	Wetumpka	0.084	0.077	0.080	0.080
Clay	01-027-0001	Ashland	0.080	0.083	0.083	0.082
Jefferson	01-073-1003	Fairfield	0.086	0.078	0.084	0.082
Jefferson	01-073-2006	Hoover	0.092	0.086	0.086	**0.088**
Jefferson	01-073-1005	McAdory	0.094	0.084	0.081	**0.086**
Jefferson	01-073-5002	Pinson	0.089	0.080	0.078	0.082
Jefferson	01-073-6002	Tarrant	0.085	0.080	0.083	0.082
Jefferson	01-073-5003	Corner	0.087	0.081	0.083	0.083
Jefferson	01-073-1009	Providence	0.088	0.086	0.087	**0.087**
Jefferson	01-073-0023	North Bham	0.085	0.079	0.082	0.082
Madison	01-089-0014	Huntsville	0.088	0.080	0.078	0.082
Morgan	01-103-0011	Decatur	0.091	0.077	0.087	**0.085**

Ozone Monitor Locations



§81.301 Alabama--Ozone (8-Hour Standard)

Designated Area	Designation Type	Classification Type
Birmingham Area		
Jefferson County.....	Nonattainment	
Shelby County.....	Nonattainment	
Decatur Area		
Morgan 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	Unclassifiable/Attainment
Lowndes County	
Macon County	
Madison County	
Marengo County	
Marion County	
Marshall County	
Mobile County	
Monroe County	
Montgomery County	
Perry County	
Pickens County	
Pike County	
Randolph County	
Russell County	
St. Clair County	
Sumter County	
Talladega County	
Tallapoosa County	
Tuscaloosa County	
Walker County	
Washington County	
Wilcox County	
Winston County	

Estimated Impact of "On the Way Controls" On 8-Hour Ozone Design Values in Alabama

EPA has performed Urban Airshed Modeling[1] to estimate the impact of Heavy Duty Diesel Engine (HDE) Standards and Highway Diesel Fuel Sulfur Control on future 8-hour ozone levels in the 48 contiguous states including Alabama. This modeling also included the effects of the NOx SIP call. When the predicted changes in ozone concentrations resulting from these controls are applied to current design values, resulting future year design values in Alabama are below the 8-hour standard. Thus, significant emissions reductions resulting from national and regional initiatives will likely enable all areas of Alabama to attain the 8-hour ozone standard without additional local controls. Since additional local controls are unlikely to be required in order for local areas to meet the NAAQS, it seems unnecessary to designate any counties as non-attainment areas except those with monitored data exceeding the standard. This modeling performed by EPA is discussed in more detail below.

EPA performed the Urban Airshed Modeling to estimate the impact of Heavy Duty Diesel Engine (HDE) Standards and Highway Diesel Fuel Sulfur Control on future 8-hour ozone levels in the state of Alabama. This modeling also included the effects of the NOx SIP call and national low sulfur gasoline. The results show that when these controls are implemented, all monitors in the state of Alabama are expected to attain the 8-hour ozone standard by 2007. When the relative reduction factors obtained from this modeling are applied to current design values (2000-2002), resulting 2007 design values are below the 8-hour standard and demonstrate no need for further local controls. The results of this analysis are presented in the table below.

Modeling performed in support of Heavy Duty Engine and Vehicle Standards and Highway Diesel Fuel Sulfur Control.

Model Assumptions

- Model-UAM-V (version 3.01)
- Episodes modeled- June, July, and August 1995
- 2007 Base Modeling
  - Heavy Duty Engine and Vehicle Standards and Highway Diesel Fuel (HDE)
  - NOx SIP Call and Tier2/Low Sulfur Gasoline
- Grid Resolution
  - 36 kilometer grid/with 12 kilometer grid
  - 9 vertical layers up to 4 kilometers

[1] EPA Technical Support Document for the Heavy-Duty Engine and Vehicle Standards and Highway Diesel Fuel Sulfur Control Requirements – EPA420-R-00-028 December 2000.

The table below shows new design values for the base year 2007 calculated using the most recent design values (2000-2002) and the relative reduction factor (RRF) obtained by modeling the base year with the controls listed previously.

County	Monitor	Design Value 2000-2002	2007 Base RRF[2]	New Design Value 2007 Base
CLAY CO	ASHLAND	0.082	0.8211	**.067**
ELMORE CO	WETUMPKA	0.080	0.8784	**.070**
JEFFERSON CO	FAIRFIELD	0.082	0.8765	**.072**
JEFFERSON CO	MCADORY	0.086	0.8541	**.073**
JEFFERSON CO	HOOVER	0.088	0.8734	**.077**
JEFFERSON CO	PINSON	0.082	0.8634	**.071**
JEFFERSON CO	TARRANT	0.082	0.8728	**.072**
LAWRENCE CO	SIPSEY	0.078	0.8428	**.066**
MADISON CO	HUNTSVILLE	0.082	0.8743	**.072**
MOBILE CO	CHICKASAW	0.080	0.9107	**.073**
MONTGOMERY CO	MONTGOMERY	0.081	0.8835	**.072**
SHELBY CO	HELENA	0.092	0.8632	**.079**
SUMTER CO	GASTON	0.076	0.846	**.064**

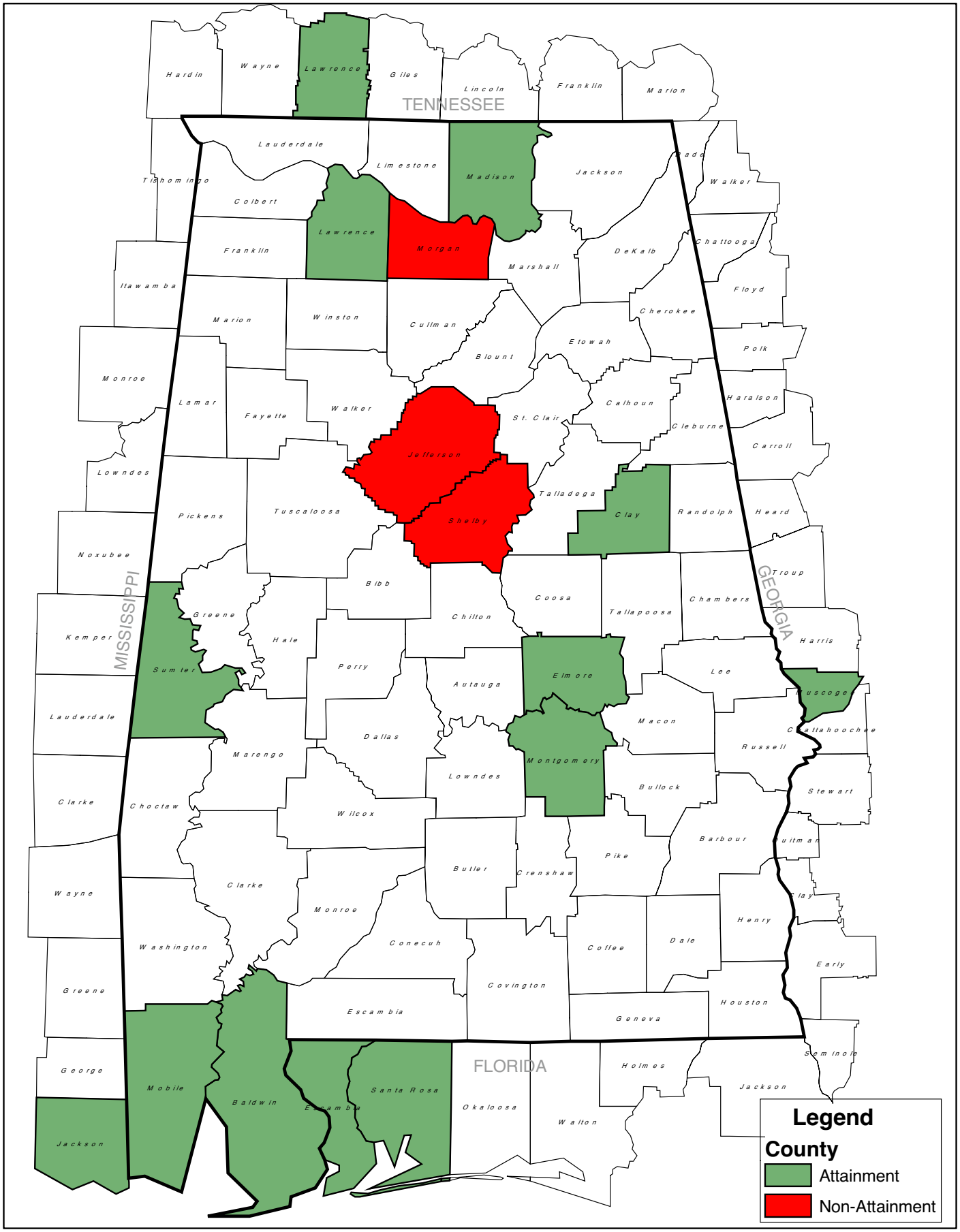
[2] Values taken from Appendix D of EPA TSD for the Heavy Duty Engine and Vehicle Standards and Highway Diesel Fuel Sulfur Control Requirements - Dec 2000.

8-Hour Ozone Concentrations in Areas Adjoining Alabama

As indicated in the table below, there are no counties bordering Alabama monitoring nonattainment for the 8-hour ozone standard. The map on the following page details the location of these counties in relation to the state.

County	Site	3 Year Average
Muscogee Co, GA	Columbus	0.080
Muscogee Co, GA	Columbus	0.084
Escambia Co, FL	Ellyson	0.076
Escambia Co, FL	NAS	0.084
Escambia Co, FL	Warrington	0.082
Santa Rosa Co, FL	Holly Navarre	0.084
Jackson Co, MS	Pascagoula	0.082
Lawrence Co, TN	Busby Road	0.078

Monitored Counties Bordering Alabama



Appendix A

ADEM recommends that the Birmingham Nonattainment Area (NAA) for the 8-hour NAAQS for ozone exclude Blount and St. Clair Counties. EPA guidance (dated March 28, 2000) states that if a State wishes to propose a nonattainment area boundary smaller than the MSA boundary, the State must address how certain factors affect the drawing of the nonattainment boundary. 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 Blount and St. Clair Counties are listed below:

- Total annual emissions of NOx and VOC in comparison to Jefferson and Shelby Counties
- Population density and degree of urbanization in comparison to Jefferson and Shelby Counties
- Location of emission sources (i.e. the lack of significant point sources)
- Limited expected growth
- Traffic (Daily VMT)
- Meteorology
- Level of control of emission sources
- Regional emission reductions

Data provided to ADEM by the Regional Planning Commission of the Greater Birmingham Area is included at the end of the appendix. ADEM referenced this data as a supplement to the data that had already been collected.

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

The counties and MSA's adjacent to the Birmingham MSA are depicted in Figure 1. To evaluate emissions for the counties adjacent to Blount and St. Clair, ADEM obtained the 1999 annual NOx and VOC 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 the counties that are adjacent to Blount and St. Clair.

Figure 1 Areas adjacent to the Birmingham MSA

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

Table 1 Annual Emissions for Areas Adjacent to Blount and St. Clair Counties

County	1999 Annual VOC Emissions (Tons)	Ranking for VOC	1999 Annual NOx Emissions (Tons)	Ranking for NOx
Blount	5,041	11	2,803	11
Calhoun	13,546	3	8,080	7
Cullman	9,752	7	4,299	9
Etowah	9,228	10	8,246*	6
Jefferson	50,076	1	75,503* [M]	1
Marshall	9,349	8	4,251	10
Shelby	12,762	4	40,928* [M]	2
St. Clair	9,231	9	7,624	8
Talladega	11,457	5	8,566	5
Tuscaloosa	22773	2	12,294[M]	4
Walker	10,014	6	33,732*	3

*County has one or more utility plants located within its boundary
[M] County has an ozone monitor (Tuscaloosa monitor has only operated for two years)

As shown in Table 1, emissions in Blount County are less than the emissions in the surrounding Counties. A logical conclusion would be that emissions from this county would not play a significant role in the air quality outside its boundaries. VOC emissions in St. Clair are only 4 TPY more than 10th ranking Etowah County. Furthermore, NOx emissions in St. Clair are merely 19% of the NOx emissions in Shelby County and 10% of the NOx emissions in Jefferson County. In addition, emissions originating from within the two Counties do not appear substantial enough to produce exceedances of the NAAQS for ozone.

The impact of Walker County NOx emissions has been lessened by controls placed on Gorgas Steam Plant beginning in May 2003. These controls are mandated by the 1-hour Ozone Attainment SIP for the Birmingham NAA.

Except for Jefferson and Shelby Counties, there are no ozone monitors sited in any counties adjacent to Blount and St. Clair. Because of the lack of available monitored air quality data for Blount and St. Clair and adjacent areas, no conclusion can be made in regard to air quality impacts from surrounding areas.

As a result of our June 2000 recommendations, EPA Region 4 requested that Tuscaloosa County's impact on the Birmingham MSA be addressed in addition to the counties listed in Table 1 above. In response to that request, Tuscaloosa County is addressed in detail in Appendix B.

B. Population Density and degree of urbanization including commercial development (significant difference from surrounding areas)

To evaluate the various aspects of population, ADEM obtained the 1993 to 2002 population estimates for the Birmingham MSA 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 of each county (in square miles). Figure 2 depicts the population densities for the counties in the Birmingham MSA. Blount and St. Clair have similar land areas (646 and 634 square miles, respectively), while Jefferson and Shelby are larger (1,113 and 795 square miles, respectively). Although the difference in the land areas skews impact of the population density factor, Blount and St. Clair have much smaller population densities than either Jefferson or Shelby. This population density factor fortifies the recommendation to exclude Blount and St. Clair from the Birmingham Nonattainment Area.

Population trends/data are presented as Figures 3 and 4. Figure 3 demonstrates that Blount and St. Clair each have a population that has remained less than 50% of Shelby County's population and less than 11% of Jefferson County's population over the years. In addition, Figure 4 demonstrates that the combined population of Blount and St. Clair Counties only represents approximately 13% of the total population for the entire Birmingham MSA. These population factors fortify the recommendation to exclude Blount and St. Clair from the Birmingham Nonattainment Area.

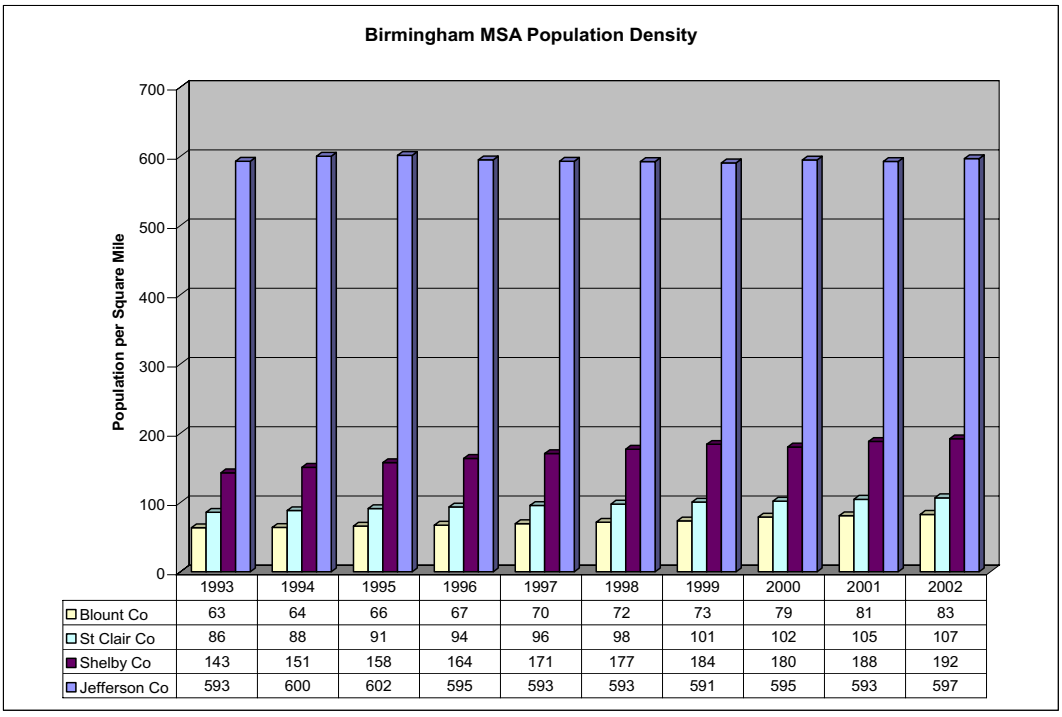
The amount and percent of urban population in the Birmingham MSA is presented in Table 2. This data clearly shows that Blount and St. Clair have an insignificant urban population in comparison to the urban population of Jefferson and Shelby. In addition, the combined urban population of Blount and St. Clair only represents approximately 4% of the total urban population for the entire Birmingham MSA. This factor fortifies the recommendation to exclude Blount and St. Clair Counties from the Birmingham Nonattainment Area.

Table 2 Urban Population for Birmingham MSA

County Name	% Urban[3]	1990 Population	1990 Urban Population	% of MSA Total 1990 Urban Population	2002 Population	2002 Urban Population	% of MSA Total 2002 Urban Population
Jefferson Co	89.4%	652,078	582,958	88.2%	664,031	593,644	83.6%
Shelby Co	59.3%	100,131	59,378	9.0%	152,780	90,599	12.8%
St Clair Co	28.2%	50,090	14,125	2.1%	67,781	19,114	2.7%
Blount Co	12.3%	39,408	4,847	0.7%	53,545	6,586	0.9%
MSA Totals	78.6%	841,707	661,308	100.0%	938,137	709,943	100.0%

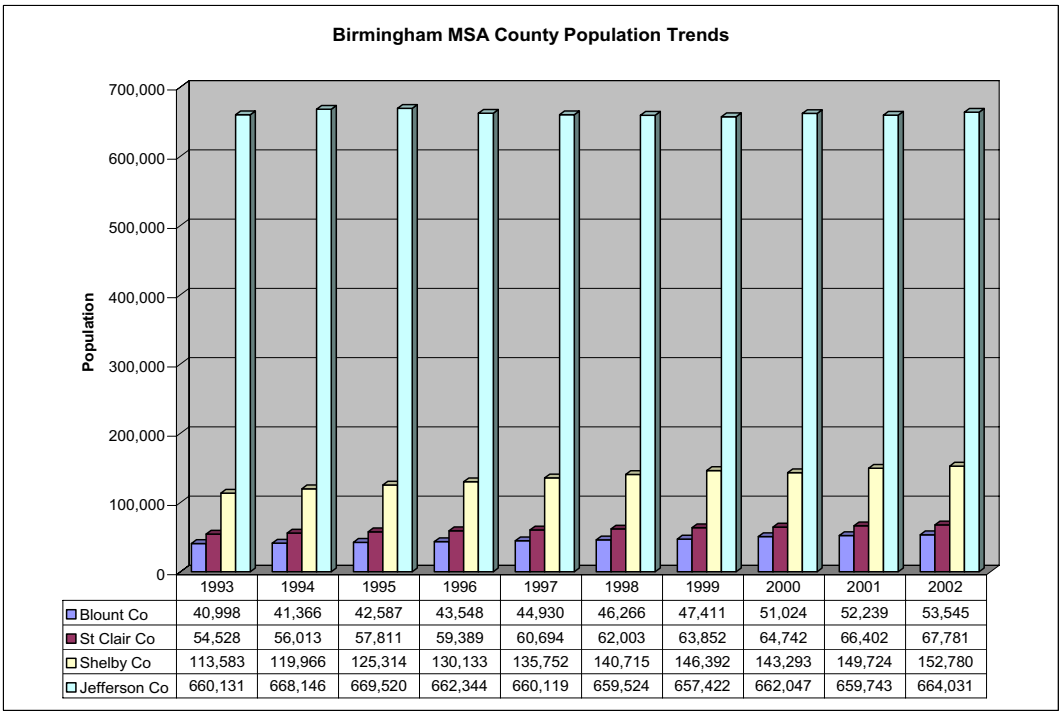
[2] The Alabama State Data Center (ASDC) is a network of 27 public agencies working together through a cooperative agreement with the U.S. Bureau of the Census to facilitate use and delivery of Census and other data to the public. Internet site: http://cber.cba.ua.edu/est_prj.html

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



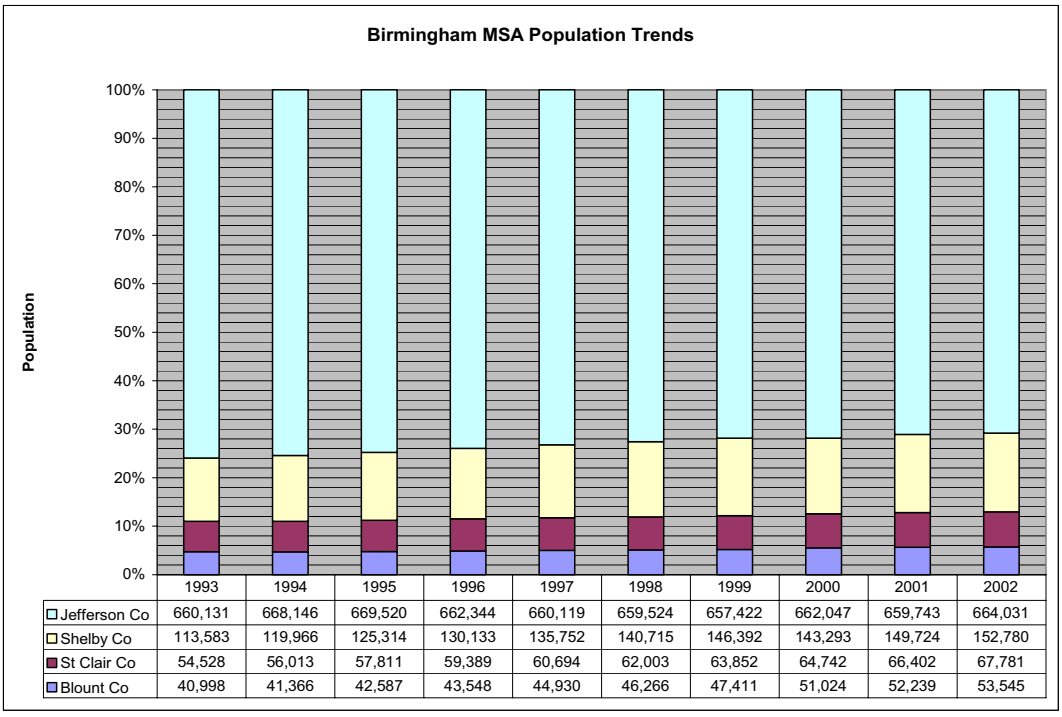
	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Blount Co	63	64	66	67	70	72	73	79	81	83
St Clair Co	86	88	91	94	96	98	101	102	105	107
Shelby Co	143	151	158	164	171	177	184	180	188	192
Jefferson Co	593	600	602	595	593	593	591	595	593	597

Figure 2 Population Density for Birmingham MSA



	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Blount Co	40,998	41,366	42,587	43,548	44,930	46,266	47,411	51,024	52,239	53,545
St Clair Co	54,528	56,013	57,811	59,389	60,694	62,003	63,852	64,742	66,402	67,781
Shelby Co	113,583	119,966	125,314	130,133	135,752	140,715	146,392	143,293	149,724	152,780
Jefferson Co	660,131	668,146	669,520	662,344	660,119	659,524	657,422	662,047	659,743	664,031

Figure 3 Population Data for Birmingham MSA



	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Jefferson Co	660,131	668,146	669,520	662,344	660,119	659,524	657,422	662,047	659,743	664,031
Shelby Co	113,583	119,966	125,314	130,133	135,752	140,715	146,392	143,293	149,724	152,780
St Clair Co	54,528	56,013	57,811	59,389	60,694	62,003	63,852	64,742	66,402	67,781
Blount Co	40,998	41,366	42,587	43,548	44,930	46,266	47,411	51,024	52,239	53,545

Figure 4 Population Distribution for Birmingham MSA

Tables 3, 4, and 5 show the trends in Total Employment, Manufacturing Employment, and Retail Employment, respectively, for the counties in the Birmingham MSA. Figure 5 demonstrates that the number of Total Employees for Blount and St. Clair is not substantial in comparison to Jefferson and Shelby. This factor fortifies the recommendation to exclude Blount and St. Clair Counties from the Birmingham Nonattainment Area.

The counties in the Birmingham MSA experienced slight growth in total employment, with Shelby County showing the most significant increase at 18.9%. All counties experienced a decrease in manufacturing employment. While there is some increase in retail employment for all but St. Clair County (-11.4%), the slight increase that Blount County experiences is dwarfed by the 29.5% increase in Shelby County. This factor further fortifies the recommendation to exclude Blount and St. Clair Counties from the Birmingham Nonattainment Area.

Table 3 Total Employees

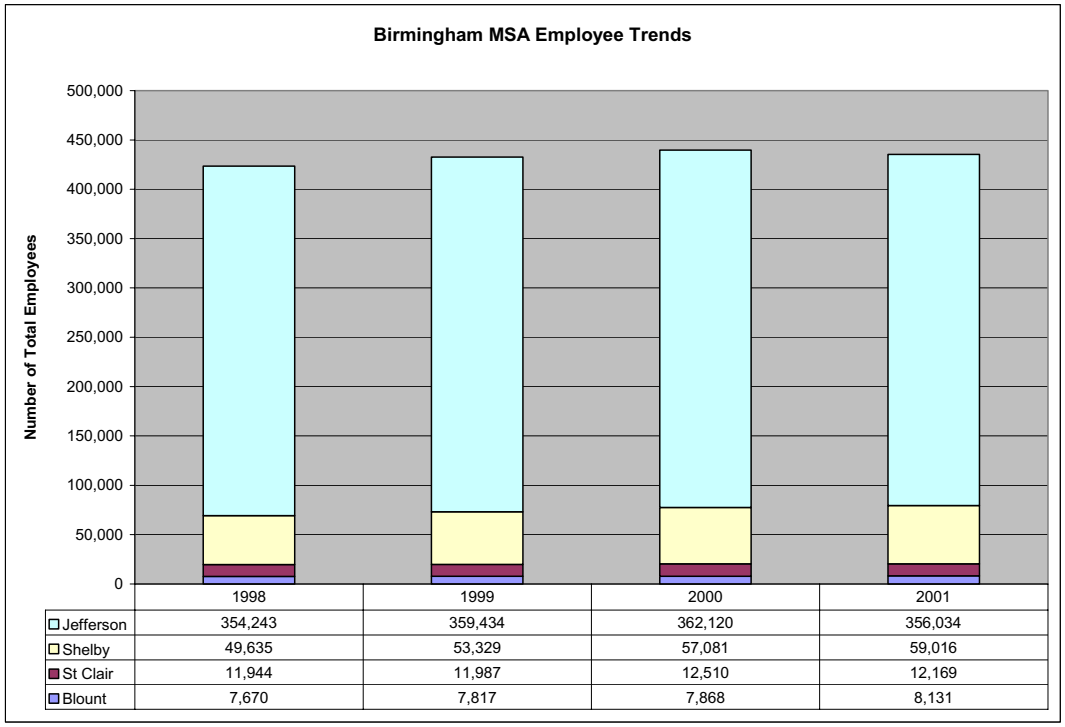
	1998	1999	2000	2001	% Change 1998-2001	% of 2001 MSA Total
Jefferson	354,243	359,434	362,120	356,034	0.5%	81.8%
Shelby	49,635	53,329	57,081	59,016	18.9%	13.5%
St Clair	11,944	11,987	12,510	12,169	1.9%	2.8%
Blount	7,670	7,817	7,868	8,131	6.0%	1.9%
MSA Total	423,492	432,567	439,579	435,350	2.8%	100.0%

Table 4 Manufacturing Employees

	1998	1999	2000	2001	% Change 1998-2001	% of 2001 MSA Total
Jefferson	38,118	36,341	36,189	34,876	-8.5%	74.9%
Shelby	6,140	6,021	6,146	5,955	-3.0%	12.8%
St Clair	3,273	3,062	3,351	3,239	-1.0%	6.9%
Blount	2,605	2,645	2,396	2,501	-4.0%	5.4%
MSA Total	50,136	48,069	48,082	46,571	-7.1%	100.0%

Table 5 Retail Employees

	1998	1999	2000	2001	% Change 1998-2001	% of 2001 MSA Total
Jefferson	42,759	42,204	43,117	42,817	0.1%	80.8%
Shelby	5,727	6,423	7,159	7,416	29.5%	14.0%
St Clair	1,667	1,711	1,681	1,477	-11.4%	2.8%
Blount	1,235	1,272	1,274	1,270	2.8%	2.4%
MSA Total	51,388	51,610	53,231	52,980	3.1%	100.0%



	1998	1999	2000	2001
Jefferson	354,243	359,434	362,120	356,034
Shelby	49,635	53,329	57,081	59,016
St Clair	11,944	11,987	12,510	12,169
Blount	7,670	7,817	7,868	8,131

Figure 5 Total Employees for Birmingham MSA

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

Table 6 demonstrates that several ozone monitors in Jefferson and Shelby Counties exceed the 8-hour NAAQS for ozone. Figure 6 identifies the ozone monitoring sites which provided the 2000, 2001, and 2002 data for the Birmingham MSA. During this time period, all ozone monitoring sites were located in Jefferson and Shelby. The recommendation to exclude Blount and St. Clair was not influenced by monitoring data because of the lack of ozone monitoring data outside of Jefferson and Shelby Counties.

Table 6 Birmingham MSA Ozone Monitoring Data

County	AIRS ID	Site	2000 4th Max	2001 4th Max	2002 4th Max	3 Year Average
Jefferson	01-073-1003	Fairfield (G)	0.086	0.078	0.084	**0.082**
Jefferson	01-073-2006	Hoover (F)	0.092	0.086	0.086	**0.088**
Jefferson	01-073-1005	McAdory (E)	0.094	0.084	0.081	**0.086**
Jefferson	01-073-5002	Pinson (H)	0.089	0.080	0.078	**0.082**
Jefferson	01-073-6002	Tarrant (I)	0.085	0.080	0.083	**0.082**
Jefferson	01-073-5003	Corner	0.087	0.081	0.083	**0.083**
Jefferson	01-073-1009	Providence	0.088	0.086	0.088	**0.087**
Jefferson	01-073-0023	North Bham	0.085	0.079	0.082	**0.082**
Shelby	01-117-0004	Helena (Q)	0.099	0.089	0.090	**0.092**

Figure 6 Ozone Monitoring Sites in Birmingham MSA and Adjacent Areas

D. Location of Emission Sources

Figure 7 depicts the location of large point sources in the Birmingham MSA and surrounding Counties. The base map was created using Geographical Information Systems (GIS) with coordinates supplied by the facilities. Tables 7 and 8 present the distribution of NOx emissions (in tons per year) among point, area[4], and mobile sources in the Birmingham MSA. Tables 9 and 10 present the same information for VOC emissions. Figures 8 and 9 illustrate this data. Figure 10 presents the emission densities for the counties in the Birmingham MSA.

Blount and St. Clair only account for 8.2% of the total annual NOx emissions and 18.5% of the total annual VOC emissions in the Birmingham MSA. Each county also has a smaller emissions density than Jefferson and Shelby. The lack of large point sources of NOx or VOC emissions located in Blount and St. Clair Counties, the minimal area and mobile source emissions, and the smaller emissions densities fortify the recommendation to exclude Blount and St. Clair Counties from the Birmingham NAA.

Figure 7 Location of Large Points Sources in Birmingham MSA

[4] Area sources include the nonroad mobile sources

Table 7 NOx Annual Emissions (Tons)

FIPS Code	Name	Point		Area		Mobile		Total Emissions	
01073	Jefferson Co	40,070	52.9%	9,396	62.4%	25,360	72.9%	75,503	59.5%
01117	Shelby Co	33,942	44.1%	2,614	17.3%	4,372	12.6%	40,928	32.3%
01115	St Clair Co	2,271	2.9%	2,013	13.4%	3,340	9.6%	7,624	6.0%
01009	Blount Co	62	0.1%	1,038	6.9%	1,702	4.9%	2,802	2.2%
MSA Total Emissions		**77,022**		**15,061**		**34,774**		**126,857**	

Table 8 Cumulative NOx Contributions

County Name	Factor	Annual 1999 Emissions (Tons)	% of MSA Total Emissions	Cumulative %
Jefferson Co	Point Source NOx Emissions (tons)	40,747	32.2%	32.2%
Shelby Co	Point Source NOx Emissions (tons)	33,942	26.6%	58.8%
Jefferson Co	Mobile Source NOx Emissions (tons)	25,360	20.0%	78.8%
Jefferson Co	Area Source NOx Emissions (tons)	9,396	7.4%	86.3%
Shelby Co	Mobile Source NOx Emissions (tons)	4,372	3.5%	89.7%
St Clair Co	Mobile Source NOx Emissions (tons)	3,340	2.6%	92.3%
Shelby Co	Area Source NOx Emissions (tons)	2,614	2.1%	94.4%
St Clair Co	Point Source NOx Emissions (tons)	2,271	1.8%	96.2%
St Clair Co	Area Source NOx Emissions (tons)	2,013	1.6%	97.8%
Blount Co	Mobile Source NOx Emissions (tons)	1,702	1.3%	99.1%
Blount Co	Area Source NOx Emissions (tons)	1,038	0.8%	100.0%
Blount Co	Point Source NOx Emissions (tons)	62	0.0%	100.0%
	MSA Total Emissions	***126,857***		

Table 9 VOC Annual Emissions (Tons)

FIPS Code	Name	Point		Area		Mobile		Total Emissions	
01073	Jefferson Co	7,090	85.1%	24,360	55.6%	18,626	74.5%	50,076	64.9%
01117	Shelby Co	935	11.2%	8,784	20.1%	3,043	12.2%	12,762	16.6%
01115	St Clair Co	246	3.0%	6,808	15.6%	2,177	8.7%	9,231	12.0%
01009	Blount Co	60	0.7%	3,827	8.7%	1,154	4.6%	5,041	6.5%
MSA Total Emissions		**8,331**		**43,779**		**25,000**		**77,110**	

Table 10 Cumulative VOC Contributions

County Name	Factor	Annual 1996 Emissions (Tons)	% of MSA Total Emissions	Cumulative %
Jefferson Co	Area Source VOC Emissions (tons)	24,360	31.6%	31.6%
Jefferson Co	Mobile Source VOC Emissions (tons)	18,626	24.2%	55.7%
Shelby Co	Area Source VOC Emissions (tons)	8,784	11.4%	67.1%
Jefferson Co	Point Source VOC Emissions (tons)	7,090	9.2%	76.3%
St Clair Co	Area Source VOC Emissions (tons)	6,808	8.8%	85.2%
Blount Co	Area Source VOC Emissions (tons)	3,827	5.0%	90.1%
Shelby Co	Mobile Source VOC Emissions (tons)	3,043	3.9%	94.1%
St Clair Co	Mobile Source VOC Emissions (tons)	2,177	2.8%	96.9%
Blount Co	Mobile Source VOC Emissions (tons)	1,154	1.5%	98.4%
Shelby Co	Point Source VOC Emissions (tons)	935	1.2%	99.6%
St Clair Co	Point Source VOC Emissions (tons)	246	0.3%	99.9%
Blount Co	Point Source VOC Emissions (tons)	60	0.1%	100.0%
	MSA Total Emissions	***77,110***		

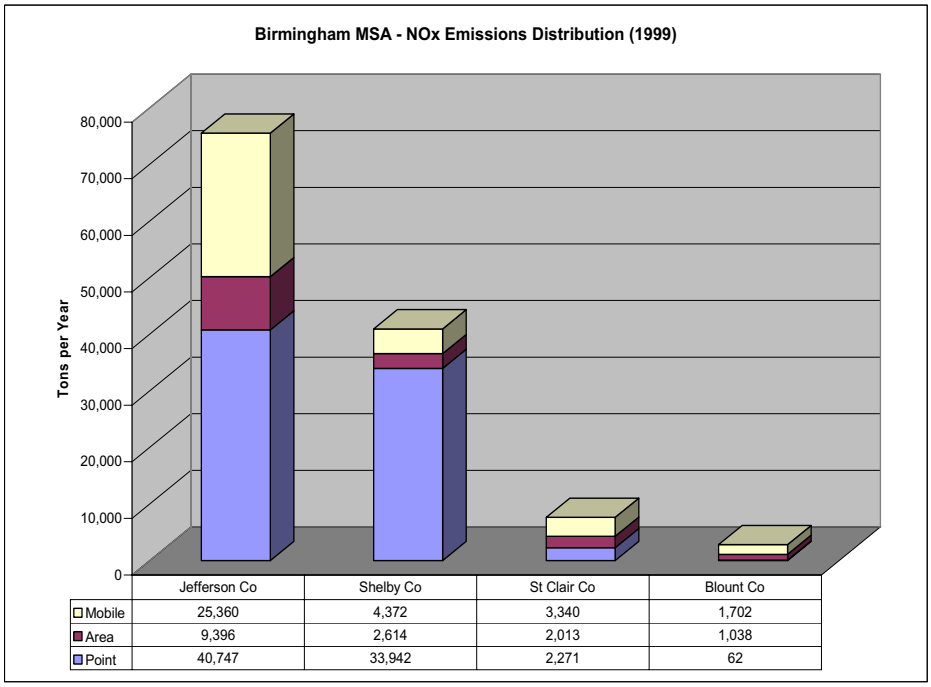


Figure 8 NOx Emissions for Birmingham MSA

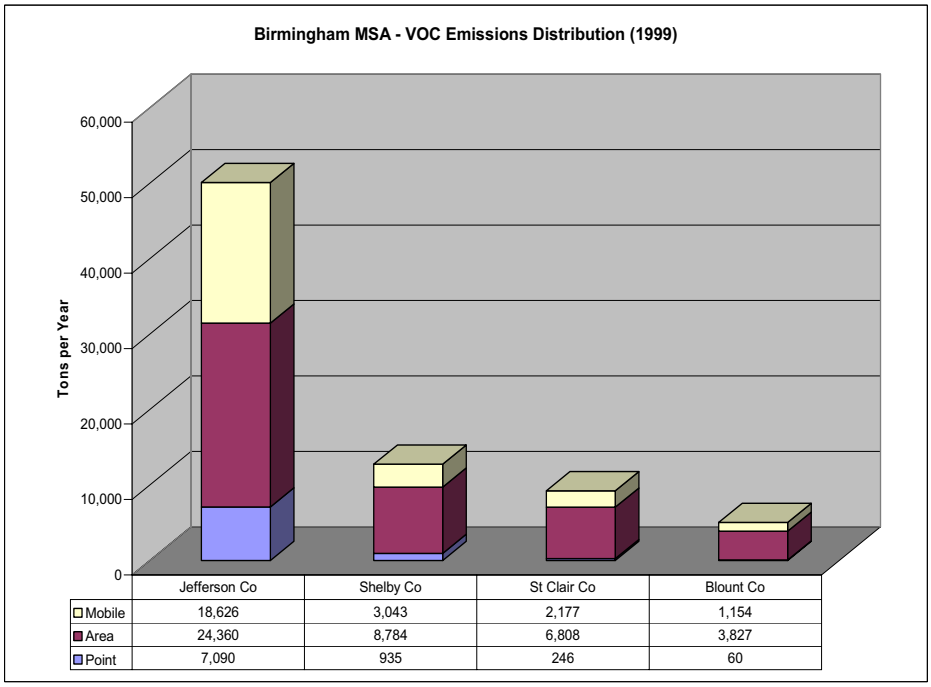


Figure 9 VOC Emissions for Birmingham MSA

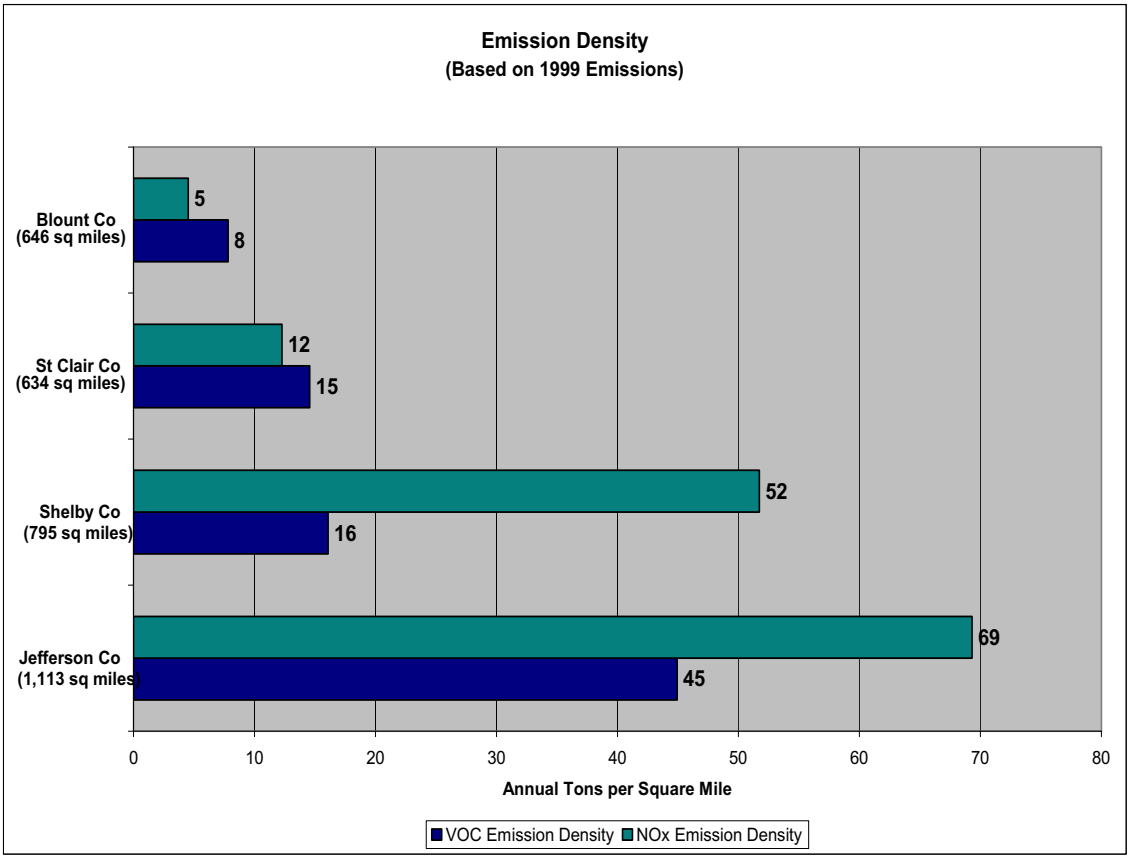


Figure 10 Emission Density for Birmingham MSA

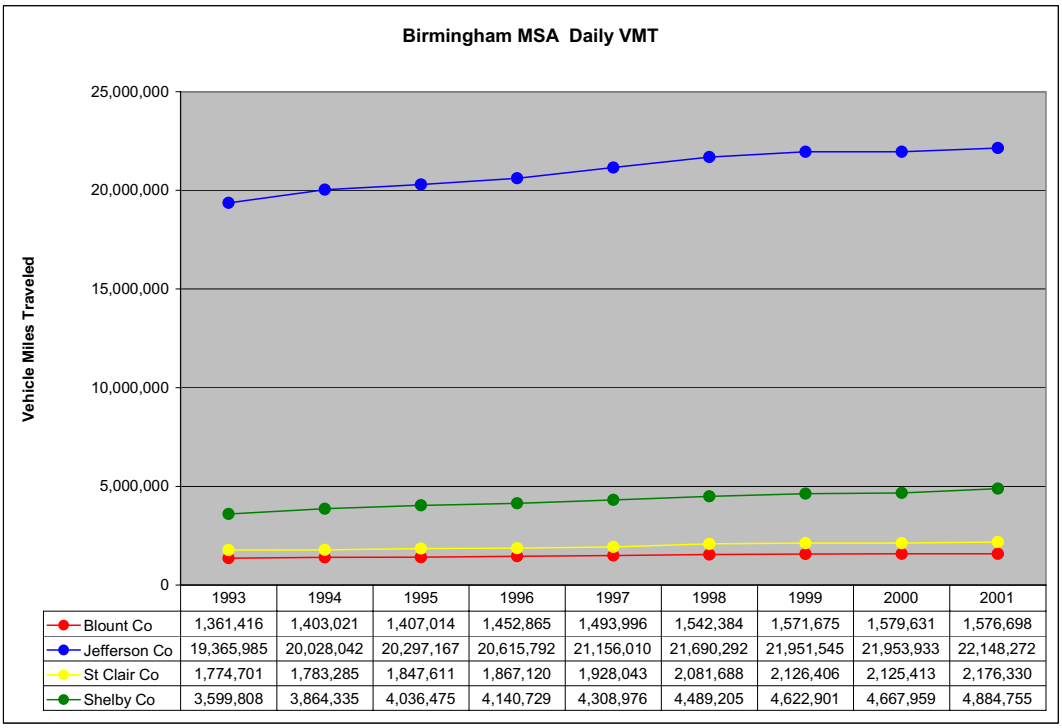
E. Traffic and Commuting Patterns

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 1990 U.S. Census. Table 11 presents the 1993 and 2001 Daily VMT estimates for the Counties in the Birmingham MSA and Figure 11 demonstrates the trend from 1993 to 2001 for each county. Figure 12 presents the breakdown of 2001 Daily VMT into urban and rural. Figure 13 presents the commuting patterns among the Counties in the Birmingham MSA.

Table 11 shows that the Daily VMT for Blount and St. Clair combined comprise approximately 12.6% of the Daily VMT for the Birmingham MSA. Figure 12 demonstrates that Blount has no urban Daily VMT and St. Clair only has a minimal amount of urban Daily VMT. The low percentage of Daily VMT and the limited amount of urban Daily VMT fortify the recommendation to exclude Blount and St. Clair Counties from the Birmingham Nonattainment Area.

Table 11 Daily VMT for Birmingham MSA

County	1993 Daily VMT	2001 Daily VMT	Daily VMT Change (1993-2001)	% Change	% of MSA 2001 Daily VMT
Jefferson Co	19,365,985	22,148,272	2,782,287	14.4%	73.8%
Shelby Co	3,153,562	4,098,753	1,731,193	54.9%	13.7%
St Clair Co	2,220,947	2,176,330	-44,617	-2.0%	7.3%
Blount Co	1,361,416	1,576,698	215,282	15.8%	5.3%
MSA Total	***26,101,910***	***30,000,053***	***4,684,145***	***15.4%***	***100.0%***



	1993	1994	1995	1996	1997	1998	1999	2000	2001
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
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
St Clair Co	1,774,701	1,783,285	1,847,611	1,867,120	1,928,043	2,081,688	2,126,406	2,125,413	2,176,330
Shelby Co	3,599,808	3,864,335	4,036,475	4,140,729	4,308,976	4,489,205	4,622,901	4,667,959	4,884,755

Figure 11 Daily VMT Trend for Birmingham MSA

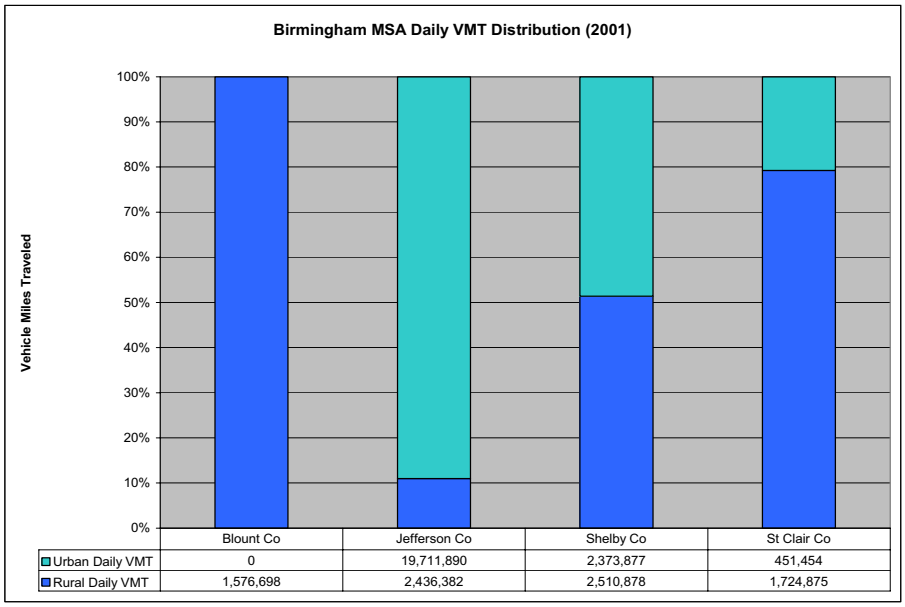


Figure 12 Rural vs Urban Daily VMT for Birmingham MSA

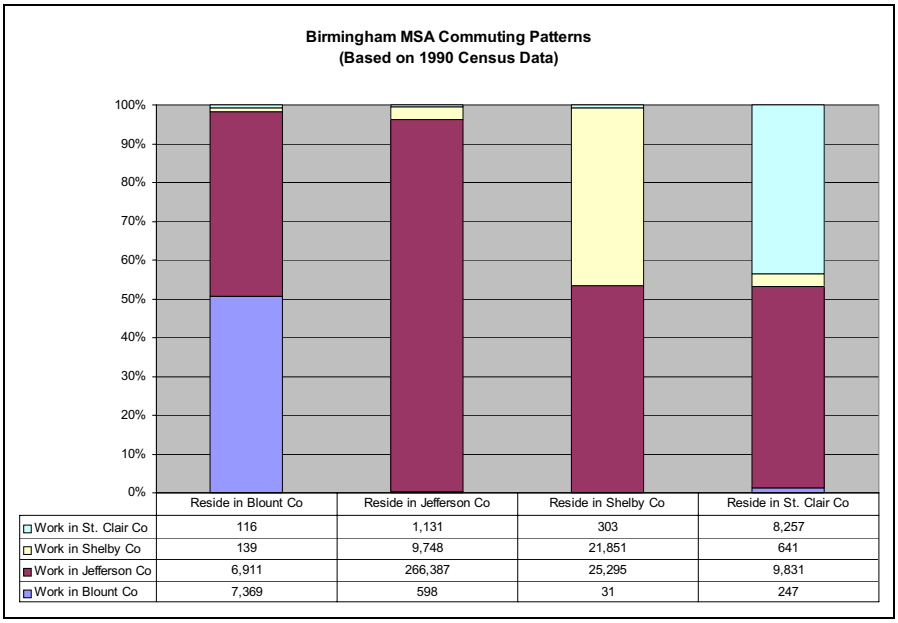


Figure 13 Commuting Patterns for Birmingham MSA

Although Figure 13 indicates that there is significant commuting from Blount and St. Clair into Jefferson County, 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 to exclude Blount and St. Clair from the Birmingham Nonattainment Area.

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

There is little information available about expected growth. Table 12 provides population growth estimates that were supplied by the Regional Planning Commission of the Greater Birmingham Area. The estimates show significant growth expected for Shelby, Blount, and St. Clair Counties, with the most significant growth expected in Shelby County. There has been no major source growth in Blount or St. Clair for the past 20 years. 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 Blount and St. Clair in the Birmingham Nonattainment Area.

Table 12 Population Projections for Birmingham MSA

County Name	1993	2002	2015	2025	% Change 1993-2002	% Change 2002-2015	% Change 2015-2025
Blount Co	40,998	53,545	70,005	68,868	30.6%	30.7%	-1.6%
St Clair Co	54,528	67,781	87,614	97,104	24.3%	29.3%	10.8%
Shelby Co	113,583	152,780	216,308	275,092	34.5%	41.6%	27.2%
Jefferson Co	660,131	664,031	682,336	704,552	0.6%	2.8%	3.3%

G. Meteorology

It is clear that meteorology plays a major role in the formation and transport of ozone. In the Birmingham area in particular, wind direction and speed are important indicators to where ozone forms and travels. In the 2000-2002 ozone seasons, ozone levels exceeded the 8-hour standard on fifty-three days over the three-year period.

A wind analysis was accomplished to determine the extent to which wind directions could be correlated with high ozone. During the last three ozone seasons, the May – September winds in the Birmingham area had no prevalent direction although there was a marked minimum of winds blowing from the northwest quadrant (see Figure A-1). When one considers only the daytime (6AM-6PM) winds (Figure A-2), the general pattern changes only slightly. However, on those days when the 8-hour ozone standard was exceeded in the Birmingham area, the wind blew overwhelmingly from the north through east-southeast directions. This phenomenon is clearly seen in Figure A-3 (all hours) and Figure A-4 (daytime hours only).

To examine the feasibility of ozone and its precursors being transported out of Blount and St. Clair Counties into Jefferson and Shelby Counties and therefore contributing to the problem in the latter, an additional analysis was completed. Of the 53 ozone exceedance days in the area, only 14 times did the monitors closest to Blount and St. Clair Counties (Pinson, Corner and Leeds) register exceedances. Please refer back to Figure 6 in Section C for locations of ozone monitors in the Jefferson/Shelby County area. Of those 14 days, only 2 had an average 6AM-6PM wind direction from the north through southeast directions. On one of those days, June 12, 2002, seven of the ten monitors in the Birmingham area recorded exceedances.

In summary, meteorology plays an important role in ozone formation and transport. Based on wind analyses, Jefferson County monitor data, and on relatively low emissions in Blount and St. Clair Counties, it is highly unlikely that emissions from those counties significantly impact the Jefferson/Shelby County area on ozone exceedance days. Therefore it seems reasonable to exclude Blount and St. Clair Counties from the nonattainment area.

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

The geography/topography of an area definitely influences the creation and transport of ozone. Birmingham 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. As seen in Figure 1 of point G, there is a large northeast component of wind in the Birmingham Area. This implies drainage into the area at night as winds channel down the valleys.

The topography of the Birmingham area is very complex and it is suspected that it plays a large role in ozone formation and transport. However, there is no monitoring data or air quality analysis 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.

I. Jurisdictional Boundaries

Within the Birmingham Metropolitan Intrastate air quality control region (40 CFR, §81.41), the current 1-hour nonattainment area consists of Jefferson and Shelby Counties. The Jefferson County Department of Health holds jurisdiction within the county boundaries of Jefferson County for which monitoring data demonstrates the county to be in nonattainment for the eight-hour standard. The ADEM holds jurisdiction for Blount, St. Clair and Shelby Counties. The State's monitor in Shelby County supports this county to be in nonattainment. Discussion elsewhere in this document demonstrates the State's recommendations for exclusion of Blount and St. Clair Counties as a part of the 8-hour 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 as 'Stage I' 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 regulations for protection of degradation of clean air areas. In addition, the Jefferson County Department of Health has in place a level of VOC regulations within its boundaries that are more stringent than state requirements.

Under the 1-hour attainment demonstration plan for the Birmingham area, which was approved by EPA on November 7, 2001, the state required further nitrogen oxide reductions from electric generating plants beyond that required by the Acid Rain program, as well as, the continuance of cleaner gasoline being sold in the area. Additionally, as discussed under regional emission reductions, the EPA has required a NO_X SIP Call for 22 states, including Alabama that, by 2004, will result in large reductions in NO_X 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

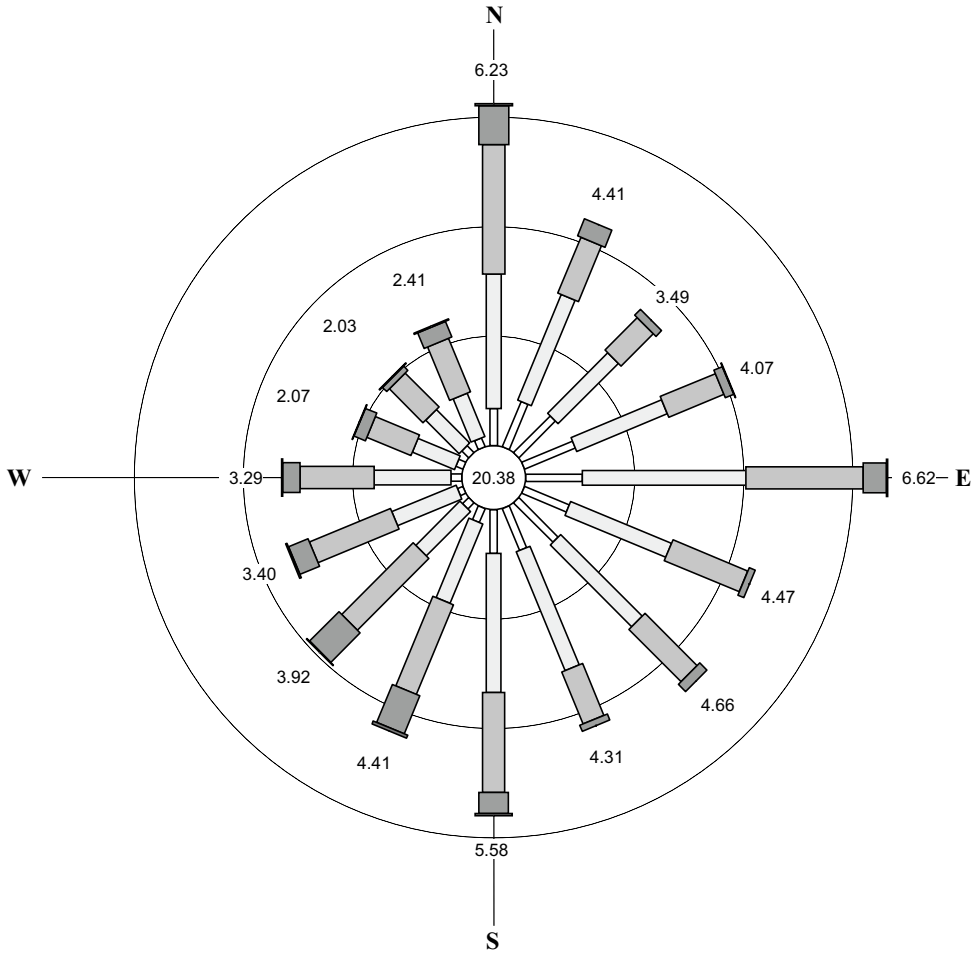
the national level, EPA has finalized the Tier 2 vehicle/national fuel standards, which take effect beginning in 2004. However, the States have already begun to realize the benefits of cleaner vehicles with the National Low Emission Vehicle standards with the 2001 model year vehicles.

K. Regional Emission Reductions

EPA performed Urban Airshed Modeling to estimate the impact of implementation of the NO_X SIP Call, heavy duty diesel engine standards, highway diesel fuel control, and Tier II national fuel standards. The results obtained from EPA for Alabama demonstrate that the reductions in 8-hour ozone resulting from these national programs will be sufficient to bring all monitored areas of Alabama into attainment of the 8-hour standard by 2007. These results are documented in Attachment 1. Since additional local controls are unlikely to be required in order for Birmingham to meet the NAAQS, it is unnecessary to designate Counties as nonattainment beyond those with monitoring data exceeding the standard. Further, the lack of a nonattainment designation in a county does not preclude ADEM from requiring controls in the county if controls are deemed necessary.

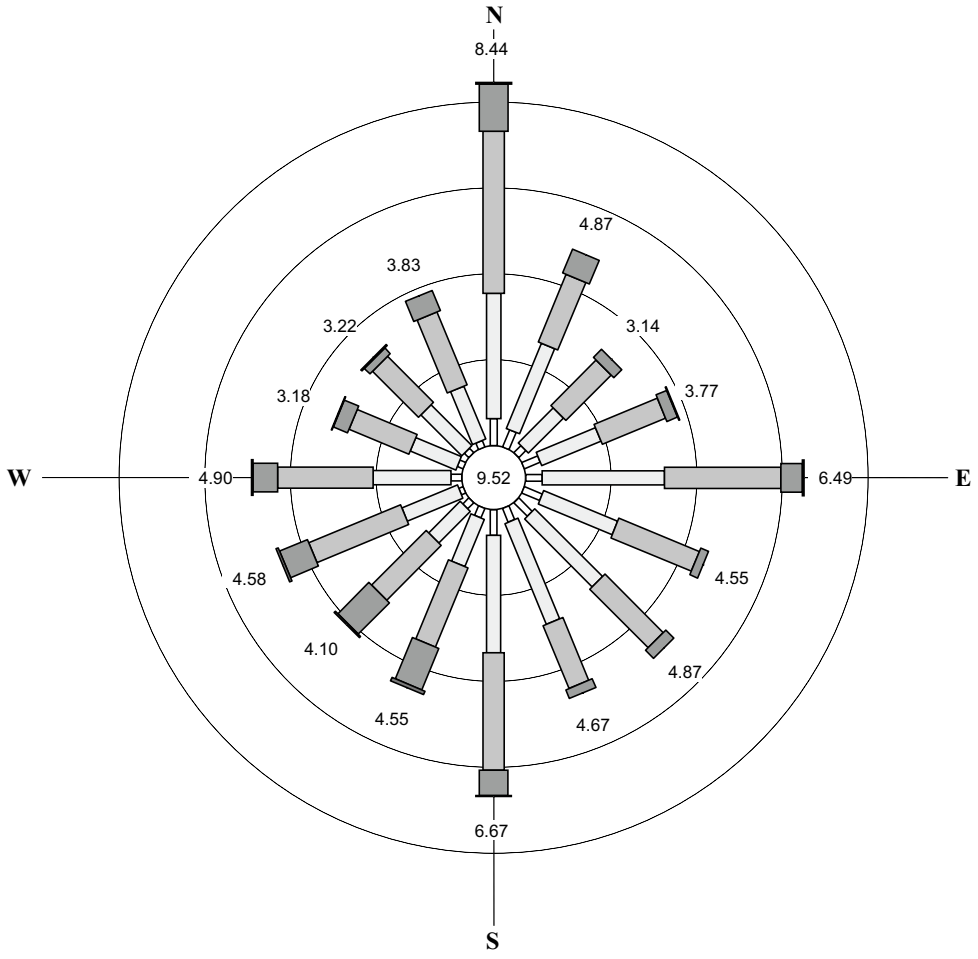
Figure A-1

Birmingham May-Sep, All Hours - 2000-2002



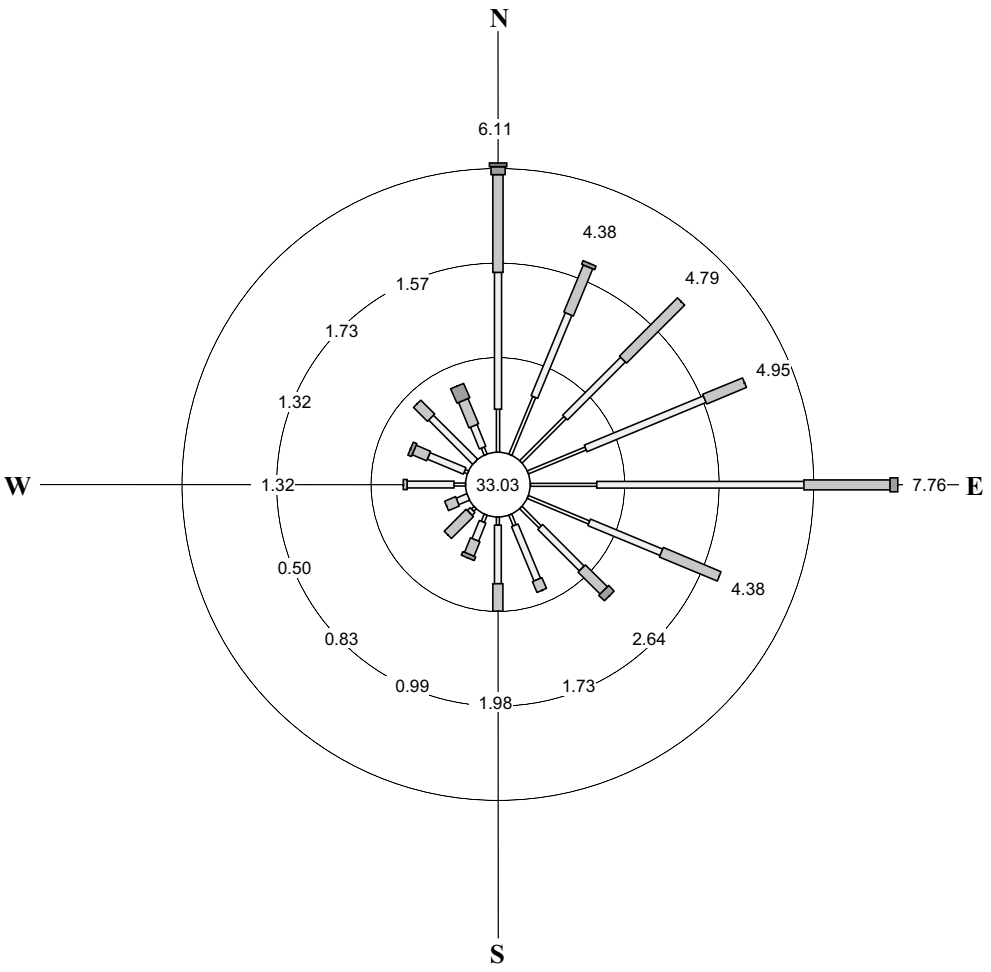
Calms included at center.
Rings drawn at 2% intervals.
Wind flow is FROM the directions shown.
14.24% of observations were missing.

Figure A-2
Birmingham May-Sep, 6AM-6PM - 2000-2002



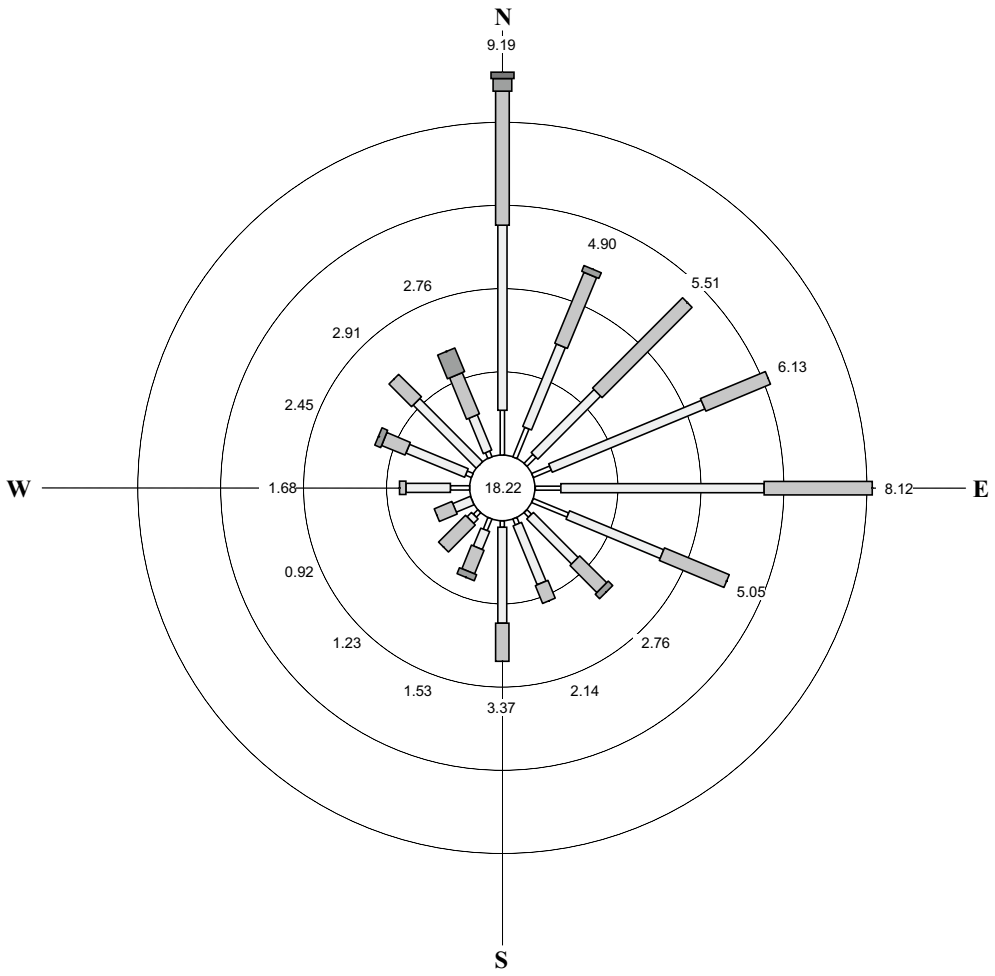
Calms included at center.
Rings drawn at 2% intervals.
Wind flow is FROM the directions shown.
14.66% of observations were missing.

Figure A-3
Birmingham Exceedance Days, All Hours - 2000-2002



Calms included at center.
Rings drawn at 2% intervals.
Wind flow is FROM the directions shown.
19.98% of observations were missing.

Figure A-4
Birmingham Exceedance Days, 6AM-6PM - 2000-2002



Calms included at center.
Rings drawn at 2% intervals.
Wind flow is FROM the directions shown.
21.13% of observations were missing.

BIRMINGHAM URBANIZED AREA

AREA/ YEAR	POPULATION	URBANIZED	% TOTAL URBANIZED *(URBAN POP/ MSA POP)*
JEFFERSON COUNTY			
1990	651,520	569,946	91.67%
1999	657,422	NA	NA
2005	664,960	NA	NA
2025	704,552	NA	NA
SHELBY COUNTY			
1990	99,363	51,757	8.33%
1999	146,392	NA	NA
2005	171,740	NA	NA
2025	275,092	NA	NA
ST. CLAIR COUNTY			
1990	49,811	0	0.00%
1999	63,852	NA	NA
2005	69,210	NA	NA
2025	97,104	NA	NA
BLOUNT COUNTY			
1990	39,248	0	0.00%
1999	47,411	NA	NA
2005	51,430	NA	NA
2025	68,868	NA	NA
MSA TOTAL			
1990	839,942	621,703	74.02%
1999	915,077	NA	NA
2005	957,340	NA	NA
2025	1,145,616	NA	NA
WALKER COUNTY			
1990	67,670	0	0.00%
1999	71,318	NA	NA
2005	73,730	NA	NA
2025	84,904	NA	NA

NA= NOT AVAILABLE

RPC OF GREATER BIRMINGHAM
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SOURCES: US CENSUS BUREAU

POPULATION ESTIMATES & PROJECTIONS
OF COUNTIES IN THE
BIRMINGHAM MSA

AREA	1990	% OF TOTAL MSA	1999	% OF TOTAL MSA	2005	% OF TOTAL MSA	2025	% OF TOTAL MSA	% CHANGE 90-99	% CHANGE 90-25	POP. DENSITY '90	POP
JEFFERSON	651,520	77.57%	657,422	71.84%	664,960	69.46%	704,552	61.88%	0.91%	8.14%	585.4	
SHELBY	99,363	11.83%	146,392	16.00%	171,740	17.94%	275,092	24.16%	47.33%	176.86%	125.1	
ST. CLAIR	49,811	5.93%	63,852	6.98%	69,210	7.23%	90,980	7.99%	28.19%	82.65%	78.7	
BLOUNT	39,248	4.67%	47,411	5.18%	51,430	5.37%	67,880	5.96%	20.80%	72.95%	60.8	
TOTAL MSA	***839,942***	**100.00%**	***915,077***	**100.00%**	***957,340***	**100.00%**	***1,138,504***	**100.00%**	***8.95%***	***35.55%***	***263.6***	
WALKER	67,670	NA	71,318	NA	73,730	NA	82,100	NA	5.39%	21.32%	85.2	

RPC of Greater Birmingham
D:\General Stats\90_99MSAPOP.xls
* Sources:
1990 - US CENSUS BUREAU
1999 EST - US CENSUS BUREAU
2005 - WOODS & POOLE ECONOMICS
2025 - W & P ECONOMICS (EXTRAPOLATED)

POPULATION DENSITY
OF COUNTIES IN THE
BIRMINGHAM MSA
(PERSONS PER SQ. MILE)

AREA	SQ. MILES	POP 1990	POP. DENSITY '90	POP 1999	POP. DENSITY '99	POP 2005	POP. DENSITY '05	POP 2025	POP. DENSITY '25
JEFFERSON	1,113	651,520	585.4	657,422	590.7	664,960	597.4	704,552	633.0
SHELBY	794	99,363	125.1	146,392	184.4	171,740	216.3	275,092	346.5
ST. CLAIR	633	49,811	78.7	63,852	100.9	69,210	109.3	90,980	153.4
BLOUNT	646	39,248	60.8	47,411	73.4	51,430	79.6	67,880	106.6
TOTAL MSA	***3,186***	***839,942***	***263.6***	***915,077***	***287.2***	***957,340***	***300.5***	***1,138,504***	***359.6***
WALKER	794	67,670	85.2	71,318	89.8	73,730	92.9	82,100	106.9

RPC of Greater Birmingham
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* Sources:
1990 - US CENSUS BUREAU
1999 EST - US CENSUS BUREAU
2005 - WOODS & POOLE ECONOMICS
2025 - W & P ECONOMICS (EXTRAPOLATED)

COMMUTERS INTO JEFFERSON COUNTY
FROM THE GREATER BIRMINGHAM AREA

A	B	C	D	C	D	E	F	E	F	G
COUNTY OF ORIGIN	**WORKING IN JEFFCO 1990**	**% OF TOTAL 1990 JEFFCO EMP**	**% OF POP. WORKING IN JEFFCO 1990**	**POPULATION 1990**	**POPULATION 1997**	**POPULATION 2025**	**% OF TOTAL 1990 JEFFCO EMP**	**WORKING IN JEFFCO 1997**	**% OF TOTAL 1997 JEFFCO EMP**	**WORKI IN JEFFC**
JEFFERSON COUNTY	266,387	80.22%	40.89%	651,520	660,119	704,552	80.22%	269,903	75.17%	288,0
SHELBY COUNTY	25,295	7.62%	25.46%	99,363	135,752	275,092	7.62%	34,559	9.62%	70,03
ST. CLAIR COUNTY	9,831	2.96%	19.74%	49,811	60,694	90,980	2.96%	11,979	3.34%	17,95
BLOUNT COUNTY	6,911	2.08%	17.61%	39,248	44,930	67,880	2.08%	7,912	2.20%	11,95
WALKER COUNTY	5,849	1.76%	8.64%	67,670	71,318	82,100	1.76%	6,164	1.72%	7,09
TUSCALOOSA COUNTY	2,635	0.79%	1.75%	150,522	160,805	216,840	0.79%	2,815	0.78%	3,79
CHILTON COUNTY	1,872	0.56%	5.77%	32,458	36,360	46,770	0.56%	2,097	0.58%	2,69
BIBB COUNTY	1,191	0.36%	7.19%	16,576	18,595	23,200	0.36%	1,336	0.37%	1,66
OTHERS	12,089	3.64%	27.04%	NA	NA	NA	3.64%	22,289	6.21%	31,93
TOTAL JEFFCO EMPLOYMENT	***332,060***	***100.00%***						***359,053***	***100.00%***	***436,7***
TOTAL COMMUTING TO JEFFCO	***65,673***	***19.78%***		***455,648***	***528,454***	***802,862***	***100%***	***89,150***	***24.83%***	***147,1***
SOURCE/ FORMULAS	*1990 CENSUS*	*(POP 1990/ 1990 JEFFCO TOTAL)*	*(B/ POP 1990)*	*1990 CENSUS*	*1997 CENSUS EST.*	*RPC PROJECTIONS*	*(B/ 1990 JEFFCO TOTAL)*	*((POP 1997- POP 1990)*C)+B*	*(E/ 1997 JEFFCO TOTAL)*	*((POP 2025-POP*

JEFFCO TOTAL EMPLOYMENT :

1990 CENSUS	332,060
1997 RPC EMPLOYMENT FILE	359,053
2025 RPC PROJECTIONS	436,767

RPC OF GREATER BIRMINGHAM
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EMPL SOURCE: 1990 US CENSUS BUREAU
1997 RPC EMPLOYMENT FILE
2025 RPC PROJECTIONS

COUNTY POPULATION:

COUNTY	POP 1990	POP 1997	POP 2025
332060			
359053			
436767			
JEFFERSON COUNTY	651,520	660,119	704,552
SHELBY COUNTY	99,363	135,752	275,092
ST. CLAIR COUNTY	49,811	60,694	90,980
BLOUNT COUNTY	39,248	44,930	67,880
WALKER COUNTY	67,670	71,318	82,100
TUSCALOOSA COUNTY	150,522	160,805	216,840
CHILTON COUNTY	32,458	36,360	46,770
BIBB COUNTY	16,576	18,595	23,200
OTHERS	NA	NA	NA

COMMUTERS INTO THE BIRMINGHAM MPO AREA
FROM SELECTED SURROUNDING COUNTIES
2000

COUNTY OF ORIGIN	% OF TOTAL WORKFORCE 2000 (COUNTY OF ORIGIN)	WORKING IN MPO AREA 2000	WORKING IN JEFFERSON COUNTY 2000	WORKING IN SHELBY COUNTY 2000	% OF TOTAL MPO EMPLOYMENT 2000	% OF TOTAL COMMUTERS TO MPO AREA 2000
BIBB COUNTY	37.65%	2,965	1,849	1,116	0.7%	4.8%
BLOUNT COUNTY	44.85%	9,981	9,669	312	2.4%	16.0%
CHILTON COUNTY	36.73%	6,299	2,552	3,747	1.5%	10.1%
JEFFERSON COUNTY	96.77%	283,012	265,661	17,351	68.2%	NA
SHELBY COUNTY	94.47%	69,692	37,119	32,573	16.8%	NA
ST. CLAIR COUNTY	50.86%	14,126	12,870	1,256	3.4%	22.7%
TUSCALOOSA COUNTY	6.65%	4,872	4,385	487	1.2%	7.8%
WALKER COUNTY	25.47%	6,991	6,746	245	1.7%	11.2%
OTHER	1.28%	16,957	14,219	2,738	4.1%	27.3%
TOTAL MPO EMPLOYMENT	100%	414,895	355,070	59,825	100%	15%*
TOTAL COMMUTING TO MPO	100%	62,191	89,409	27,252	100%	100%

RPC OF GREATER BIRMINGHAM

F:\COMMUTING 2000\MPO90_00.XLS

Mar-03

** The total number of commuters as a percentage of the total MPO employment. Commuters make up 15% of the MPO employmen*

COMMUTERS INTO JEFFERSON COUNTY, ALABAMA
FROM SELECTED SURROUNDING COUNTIES
1990 - 2000

COUNTY OF ORIGIN	% OF TOTAL WORKFORCE 2000 (COUNTY OF ORIGIN)	WORKING IN JEFFERSON COUNTY 1990	WORKING IN JEFFERSON COUNTY 2000	% OF TOTAL EMPLOYMENT 1990	% OF TOTAL EMPLOYMENT 2000	% OF TOTAL COMMUTERS TO JEFFERSON COUNTY 1990	% OF TOTAL COMMUTERS TO JEFFERSON COUNTY 2000
BIBB COUNTY	23.48%	1,191	1,849	0.4%	0.5%	1.8%	2.1%
BLOUNT COUNTY	43.45%	6,911	9,669	2.1%	2.7%	10.5%	10.8%
CHILTON COUNTY	14.88%	1,872	2,552	0.6%	0.7%	2.9%	2.9%
JEFFERSON COUNTY	90.84%	266,387	265,661	80.2%	74.8%	NA	NA
SHELBY COUNTY	50.32%	25,295	37,119	7.6%	10.5%	38.5%	41.5%
ST. CLAIR COUNTY	46.34%	9,831	12,870	3.0%	3.6%	15.0%	14.4%
TUSCALOOSA COUNTY	5.98%	2,635	4,385	0.8%	1.2%	4.0%	4.9%
WALKER COUNTY	24.58%	5,849	6,746	1.8%	1.9%	8.9%	7.5%
OTHER	NA	12,089	14,219	3.6%	4.0%	18.4%	15.9%
TOTAL JEFFCO EMPLOYMENT	100%	332,060	355,070	100%	100%	100.0%	100%
TOTAL COMMUTING TO JEFFCO	100%	65,673	89,409	19.8%	25.2%		

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F:\COMMUTING 2000\JEFFCO90_00.XLS

Mar-03

Appendix B

ADEM recommends that the Birmingham Nonattainment Area for the 8-hour NAAQS for ozone not be expanded to include Tuscaloosa County. EPA guidance (dated March 28, 2000) states that the State must address how certain 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 Tuscaloosa County is provided in this Appendix.

The factors that provide the most compelling evidence to exclude Tuscaloosa County are listed below:

- Density of emissions of NOx and VOC in comparison to Jefferson and Shelby Counties
- Population density and population growth in comparison to Jefferson and Shelby Counties
- Traffic growth(Daily VMT)
- Meteorology
- Level of control of emission sources
- Regional emission reductions

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

Tuscaloosa's location relative to the Birmingham MSA is depicted in Figure 1. To evaluate emissions for Tuscaloosa County, ADEM obtained the 1999 annual NOx and VOC 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 Tuscaloosa.

Figure 1 Location of Tuscaloosa County in relation to the Birmingham MSA

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

Table 1 Annual Emissions for Tuscaloosa and the Birmingham NAA

County	1999 Annual VOC Emissions (Tons)	Ranking for VOC	1999 Annual NOx Emissions (Tons)	Ranking for NOx
Jefferson	50,076	1	75,503* [M]	1
Shelby	12,762	3	40,928* [M]	2
Tuscaloosa	22,773	2	12,294 [M]	3

*County has one or more utility plants located within its boundary
[M] County has an ozone monitor

As shown in Table 1, VOC emissions in Tuscaloosa County are greater than VOC emissions in Shelby County but less than half the VOC emissions in Jefferson County. NOx emissions in Tuscaloosa County are less than one-third of the NOx emissions in Shelby County and less than one-fourth of the NOx emissions in Jefferson County. NOx emissions in Tuscaloosa do not appear to be substantial enough to produce exceedances of the NAAQS for ozone. Past photochemical modeling efforts have shown ozone formation to be NOx-limited due to the abundance of VOC emissions from natural (biogenic) sources.

The ozone monitor sited in Tuscaloosa has only been operational since 2001. Because of the lack of available monitored air quality data for Tuscaloosa County, no conclusion can be made in regard to air quality impacts.

Evaluating the emissions and air quality in adjacent areas provides no compelling indicator as to whether Tuscaloosa should be included or excluded from the Birmingham Nonattainment Area.

B. Population Density and degree of urbanization including commercial development (significant difference from surrounding areas)

To evaluate the various aspects of population, ADEM obtained the 1993 to 2002 population estimates for Tuscaloosa and the Birmingham NAA 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 of each county (in square miles). Figure 2 depicts the population densities for Tuscaloosa, Jefferson, and Shelby Counties. Tuscaloosa has a larger land area (1,324 square miles) than Jefferson and Shelby (1,113 and 795 square miles, respectively). Although the difference in the land areas skews impact of the population density factor, Tuscaloosa has a smaller population density than either Jefferson or Shelby. This population density factor fortifies the recommendation to exclude Tuscaloosa from the Birmingham Nonattainment Area.

Population trends/data are presented as Figures 3 and 4. Figure 3 demonstrates that Tuscaloosa has a population that that has remained approximately 25% of Jefferson County's population over the years. In addition, Figure 4 demonstrates that the population of Tuscaloosa County only represents approximately 17% of the total population for the entire tri-county area. These population factors fortify the recommendation to exclude Tuscaloosa from the Birmingham Nonattainment Area.

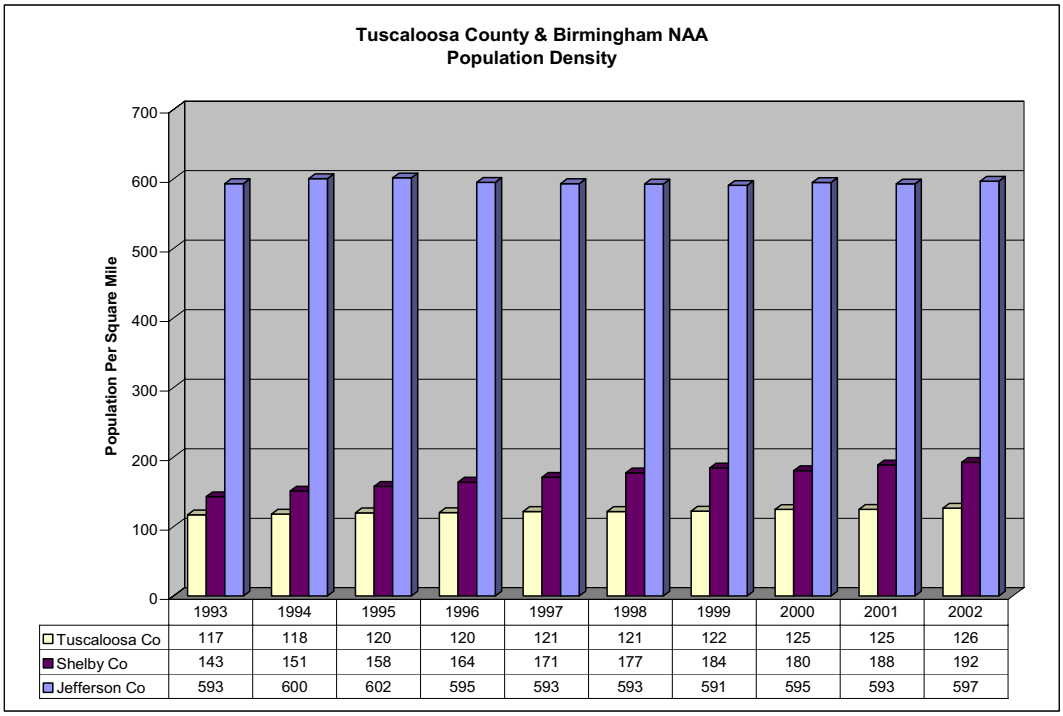
The amount and percent of urban population in the Tuscaloosa MSA and the Birmingham NAA is presented in Table 2. This data clearly shows that Tuscaloosa's urban population growth from 1990 to 2002 (10.6%) is insignificant in comparison to the urban population growth of Shelby County from 1990 to 2002 (52.6%). In addition, the urban population of Tuscaloosa only represents approximately 15% of the total urban population for the entire tri-county area. This factor fortifies the recommendation to exclude Tuscaloosa county from the Birmingham Nonattainment Area.

Table 2 Urban Population for Tuscaloosa and Birmingham NAA

County Name	% Urban[3]	1990 Population	1990 Urban Population	% of Area Total 1990 Urban Population	2002 Population	2002 Urban Population	% of Area Total 2002 Urban Population
Jefferson Co	89.4%	652,078	582,958	77.8%	664,031	593,644	73.9%
Shelby Co	59.3%	100,131	59,378	7.9%	152,780	90,599	11.3%
Tuscaloosa Co	71.0%	151,035	107,235	14.3%	167,027	118,589	14.8%
Area Totals	100.0%	903,244	749,571	100.0%	983,838	802,832	100.0%

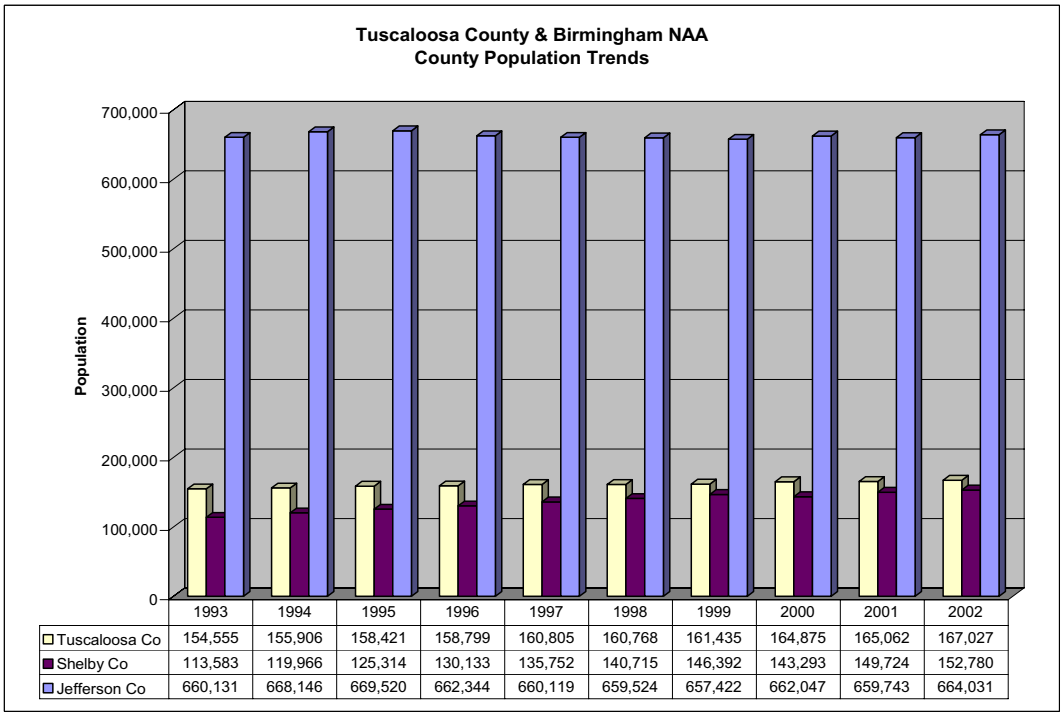
[2] The Alabama State Data Center (ASDC) is a network of 27 public agencies working together through a cooperative agreement with the U.S. Bureau of the Census to facilitate use and delivery of Census and other data to the public. Internet site: http://cber.cba.ua.edu/est_prj.html

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



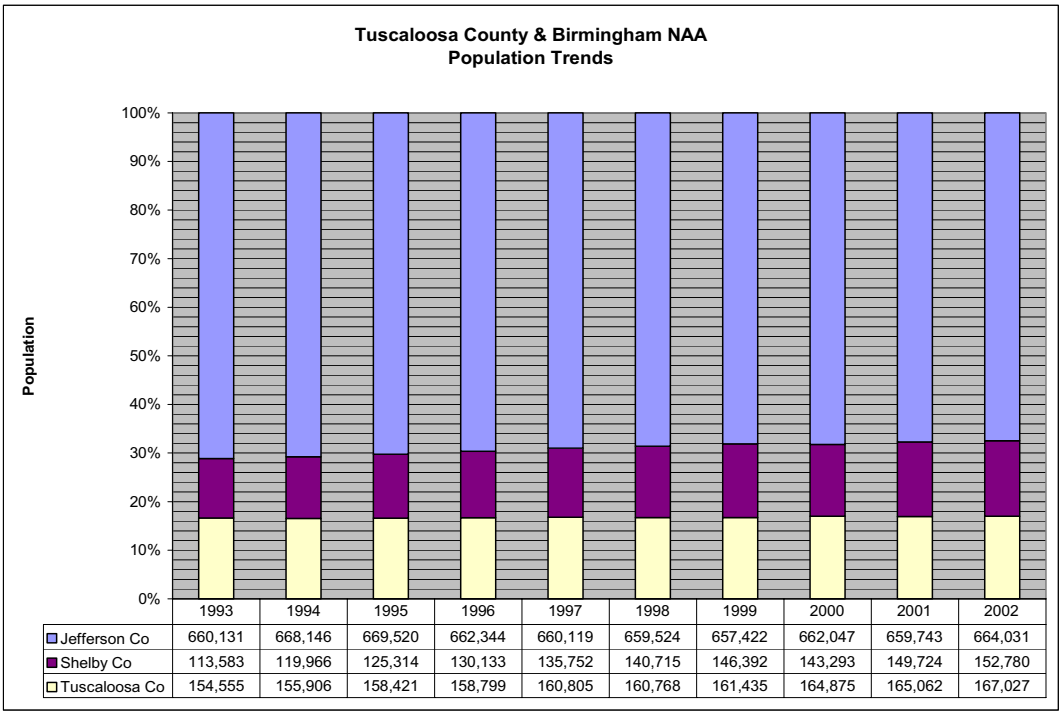
	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Tuscaloosa Co	117	118	120	120	121	121	122	125	125	126
Shelby Co	143	151	158	164	171	177	184	180	188	192
Jefferson Co	593	600	602	595	593	593	591	595	593	597

Figure 2 Population Density for Tuscaloosa and Birmingham NAA



	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Tuscaloosa Co	154,555	155,906	158,421	158,799	160,805	160,768	161,435	164,875	165,062	167,027
Shelby Co	113,583	119,966	125,314	130,133	135,752	140,715	146,392	143,293	149,724	152,780
Jefferson Co	660,131	668,146	669,520	662,344	660,119	659,524	657,422	662,047	659,743	664,031

Figure 3 Population Data for Tuscaloosa and Birmingham NAA



	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Jefferson Co	660,131	668,146	669,520	662,344	660,119	659,524	657,422	662,047	659,743	664,031
Shelby Co	113,583	119,966	125,314	130,133	135,752	140,715	146,392	143,293	149,724	152,780
Tuscaloosa Co	154,555	155,906	158,421	158,799	160,805	160,768	161,435	164,875	165,062	167,027

Figure 4 Population Distribution for Tuscaloosa and Birmingham NAA

Tables 3, 4, and 5 show the trends in Total Employment, Manufacturing Employment, and Retail Employment, respectively, for Tuscaloosa, Jefferson and Shelby Counties. Figure 5 demonstrates that the number of Total Employees for Tuscaloosa comprises only 14.2% of the area's total. This factor fortifies the recommendation to exclude Tuscaloosa County from the Birmingham Nonattainment Area.

Table 3 Total Employees

	1998	1999	2000	2001	% Change 1998-2001	% of 2001 Area Total
Jefferson	354,243	359,434	362,120	632,120	0.5%	73.6%
Shelby	49,635	53,329	57,081	59,016	18.9%	12.2%
Tuscaloosa	65,228	67,473	69,610	68,658	5.3%	14.2%
Area Total	469,106	480,236	488,811	483,708	3.1%	100.0%

Table 4 Manufacturing Employees

	1998	1999	2000	2001	% Change 1998-2001	% of 2001 Area Total
Jefferson	38,118	36,341	36,189	34,876	-15.2%	65.8%
Shelby	6,140	6,021	6,146	5,955	-34.9%	11.2%
Tuscaloosa	11,593	12,460	12,952	12,158	15.9%	23.0%
MSA Total	55,851	54,822	55,287	52,989	-4.9%	100.0%

Table 5 Retail Employees

	1998	1999	2000	2001	% Change 1998-2001	% of 2001 Area Total
Jefferson	42,759	42,204	43,117	42,817	0.1%	71.1%
Shelby	5,727	6,423	7,159	7,416	29.5%	12.3%
Tuscaloosa	10,399	9,763	10,112	9,978	-4.0%	16.6%
MSA Total	58,885	58,390	60,388	60,211	2.3%	100.0%

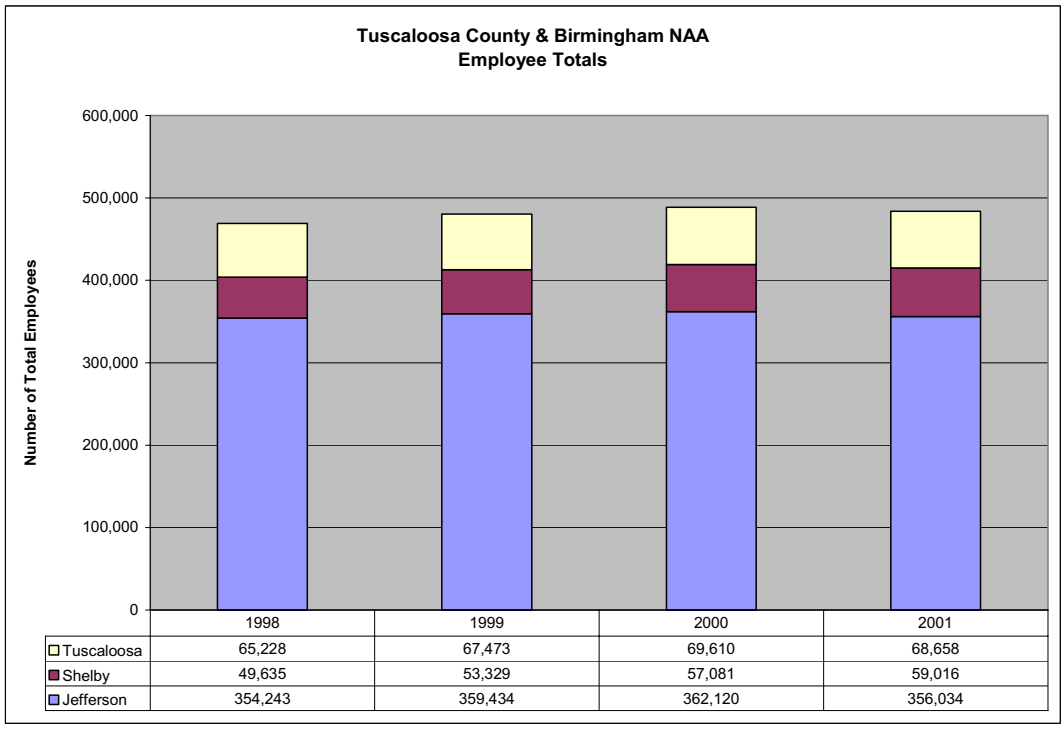


Figure 5 Total Employees for Tuscaloosa and Birmingham NAA

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

Table 6 presents the ozone monitoring data for the Jefferson and Shelby Counties. Figure 6 identifies the ozone monitoring sites which provided the 2000, 2001, and 2002 data for Jefferson and Shelby Counties. During this time period, the ozone monitoring site in Tuscaloosa County had only been operational for two ozone seasons. The recommendation to exclude Tuscaloosa County was not influenced by monitoring data because of the lack of ozone monitoring data for Tuscaloosa County.

Table 6 Birmingham MSA Ozone Monitoring Data

County	AIRS ID	Site	2000 4th Max	2001 4th Max	2002 4th Max	3 Year Average
Jefferson	01-073-1003	Fairfield (G)	0.086	0.078	0.084	**0.082**
Jefferson	01-073-2006	Hoover (F)	0.092	0.086	0.086	**0.088**
Jefferson	01-073-1005	McAdory (E)	0.094	0.084	0.081	**0.086**
Jefferson	01-073-5002	Pinson (H)	0.089	0.080	0.078	**0.082**
Jefferson	01-073-6002	Tarrant (I)	0.085	0.080	0.083	**0.082**
Jefferson	01-073-5003	Corner	0.087	0.081	0.083	**0.083**
Jefferson	01-073-1009	Providence	0.088	0.086	0.088	**0.087**
Jefferson	01-073-0023	North Bham	0.085	0.079	0.082	**0.082**
Shelby	01-117-0004	Helena (Q)	0.099	0.089	0.090	**0.092**

Figure 6 Ozone Monitoring Sites in Birmingham MSA and Adjacent Areas

D. Location of Emission Sources

Figure 7 depicts the location of large point sources in the Tuscaloosa and Birmingham MSAs and surrounding counties. The base map was created using Geographical Information Systems (GIS) with coordinates supplied by the facilities. Tables 7 and 8 present the distribution of NOx emissions (in tons per year) among point, area[4], and mobile sources in the Tuscaloosa MSA and the Birmingham NAA. Tables 9 and 10 present the same information for VOC emissions. Figures 8 and 9 illustrate this data. Figure 10 presents the emission densities for Tuscaloosa, Jefferson, and Shelby counties.

Tuscaloosa County only accounts for 10% of the total annual NOx emissions and 27% of the total annual VOC emissions in the tri-county area. Tuscaloosa also has a significantly less emissions density than Jefferson and Shelby. These factors fortify the recommendation to exclude Tuscaloosa from the Birmingham Nonattainment Area.

Figure 7 Location of Large Points Sources in Tuscaloosa MSA and Birmingham MSA

[4] Area sources include the nonroad mobile sources

Table 7 NOx Annual Emissions (Tons)

FIPS Code	Name	Point		Area		Mobile		Total Emissions	
01073	Jefferson Co	40,747	52.7%	9,396	65.8%	25,360	68.4%	75,503	58.7%
01117	Shelby Co	33,942	43.9%	2,614	18.3%	4,372	11.8%	40,928	31.8%
01125	Tuscaloosa Co	2,670	3.4%	2,269	15.9%	7,356	19.8%	12,295	9.5%
MSA Total Emissions		**77,359**		**14,279**		**37,088**		**128,726**	

Table 8 Cumulative NOx Contributions

County Name	Factor	Annual 1999 Emissions (Tons)	% of MSA Total Emissions	Cumulative %
Jefferson Co	Point Source NOx Emissions (tons)	40,747	31.6%	31.6%
Shelby Co	Point Source NOx Emissions (tons)	33,942	26.4%	58.0%
Jefferson Co	Mobile Source NOx Emissions (tons)	25,360	19.7%	77.7%
Jefferson Co	Area Source NOx Emissions (tons)	9,396	7.3%	85.0%
Tuscaloosa Co	Mobile Source NOx Emissions (tons)	7,356	5.7%	90.7%
Shelby Co	Mobile Source NOx Emissions (tons)	4,372	3.4%	94.1%
Tuscaloosa Co	Point Source NOx Emissions (tons)	2,670	2.1%	96.2%
Shelby Co	Area Source NOx Emissions (tons)	2,614	2.0%	98.2%
Tuscaloosa Co	Area Source NOx Emissions (tons)	2,269	1.8%	100.0%
	MSA Total Emissions	***128,726***		

Table 9 VOC Annual Emissions (Tons)

FIPS Code	Name	Point		Area		Mobile		Total Emissions	
01073	Jefferson Co	7,090	62.6%	24,360	51.5%	18,626	69.1%	50,076	58.5%
01117	Shelby Co	935	8.3%	8,784	18.6%	3,043	11.3%	12,762	14.9%
01125	Tuscaloosa Co	3,303	29.2%	14,169	29.9%	5,301	19.7%	22,773	26.6%
MSA Total Emissions		**11,328**		**47,313**		**26,970**		**85,611**	

Table 10 Cumulative VOC Contributions

County Name	Factor	Annual 1999 Emissions (Tons)	% of MSA Total Emissions	Cumulative %
Jefferson Co	Area Source VOC Emissions (tons)	24,360	28.4%	28.5%
Jefferson Co	Mobile Source VOC Emissions (tons)	18,626	21.8%	50.2%
Tuscaloosa Co	Area Source VOC Emissions (tons)	14,169	16.5%	66.8%
Shelby Co	Area Source VOC Emissions (tons)	8,784	10.3%	77.0%
Jefferson Co	Point Source VOC Emissions (tons)	7,090	8.3%	85.1%
Tuscaloosa Co	Mobile Source VOC Emissions (tons)	5,301	6.2%	91.5%
Tuscaloosa Co	Point Source VOC Emissions (tons)	3,303	3.9%	95.4%
Shelby Co	Mobile Source VOC Emissions (tons)	3,043	3.5%	98.9%
Shelby Co	Point Source VOC Emissions (tons)	935	1.1%	100.0%
	MSA Total Emissions	***85,611***		

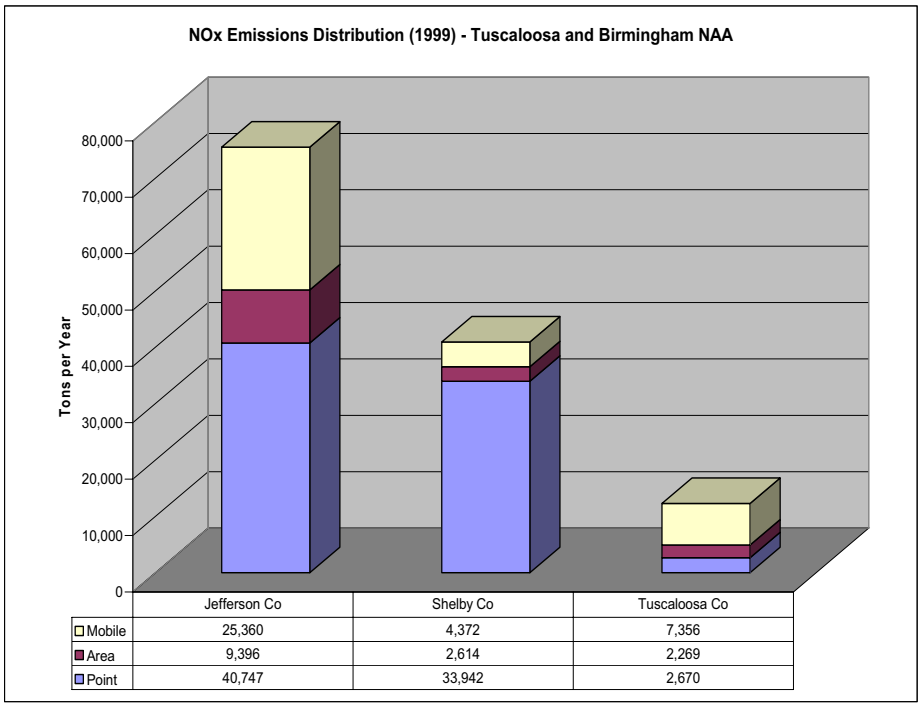


Figure 8 NOx Emissions for Tuscaloosa and Birmingham NAA

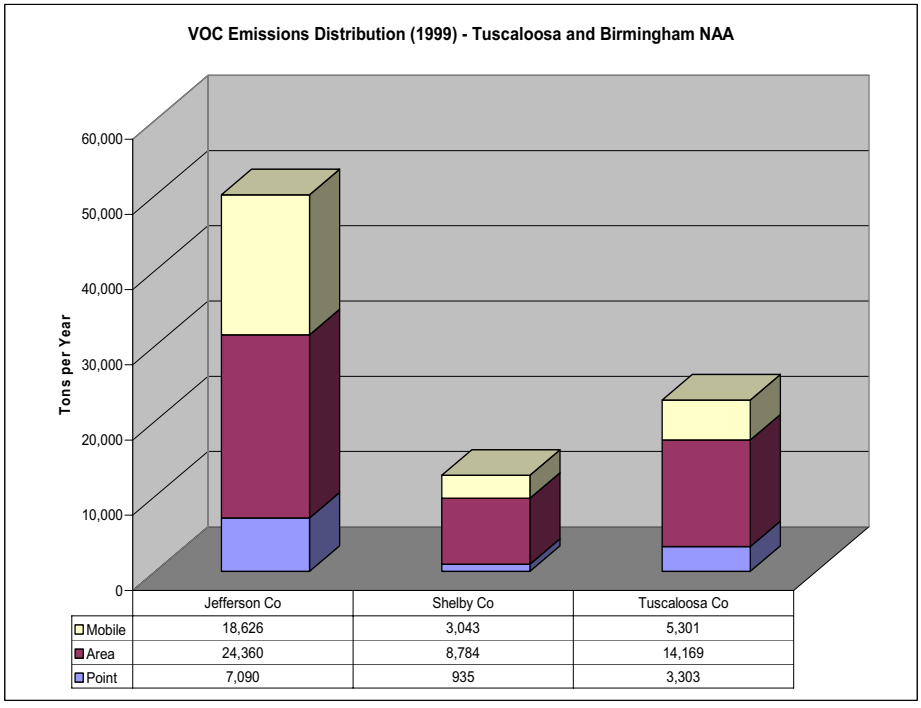


Figure 9 VOC Emissions for Tuscaloosa and Birmingham NAA

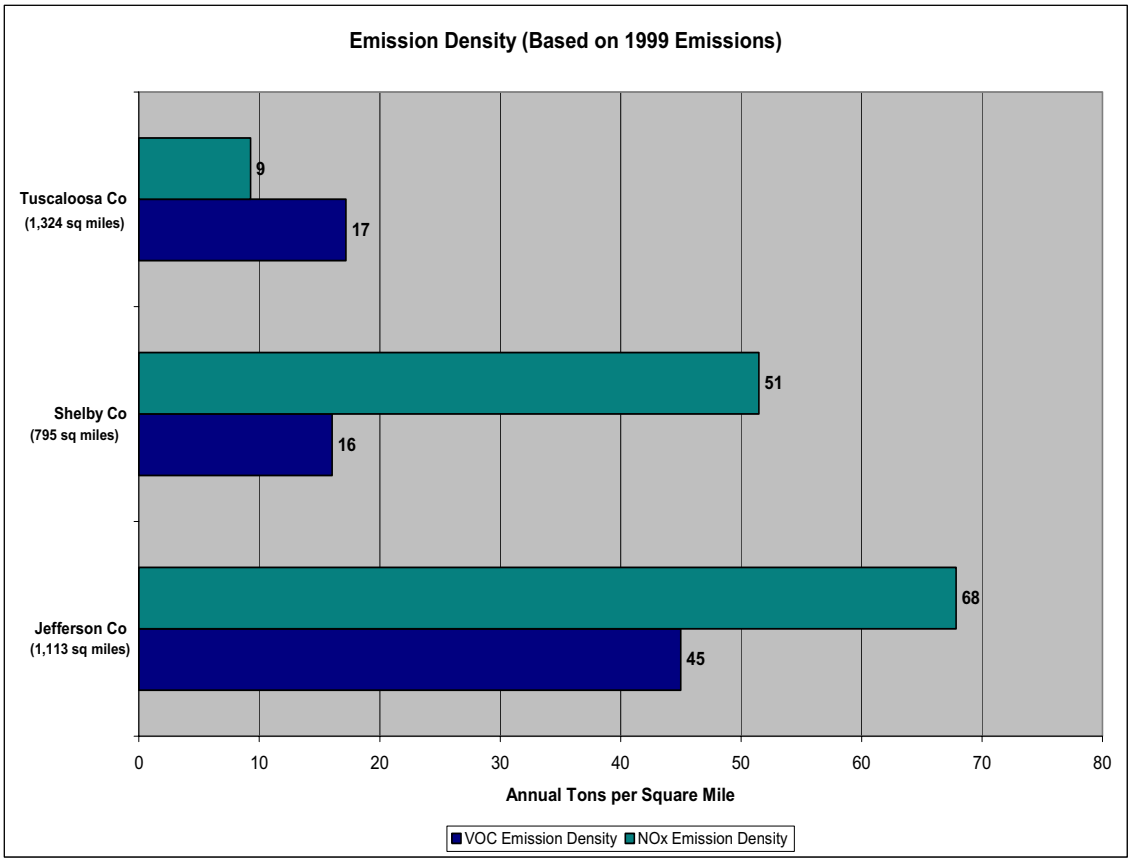


Figure 10 Emission Density for Tuscaloosa and Birmingham NAA

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 1990 U.S. Census. Table 11 presents the 1993 and 2001 Daily VMT estimates for Tuscaloosa, Jefferson, and Shelby counties. Figure 11 presents the commuting patterns among the counties in the tri-county area.

Table 11 shows that the Daily VMT for Tuscaloosa comprises approximately 20% of the Daily VMT for the tri-county area. Table 11 further demonstrates Tuscaloosa's VMT growth has been minimal. Figure 11 indicates that there is very limited commuting from Tuscaloosa into Jefferson (4%) and Shelby (0.3%). The minimal VMT growth and limited commuting fortify the recommendation to exclude Tuscaloosa County from the Birmingham Nonattainment Area.

Table 11 Daily VMT for Tuscaloosa and Birmingham NAA

County	1993 Daily VMT	2001 Daily VMT	Daily VMT Change (1993-2001)	% Change	% of Area 2001 Daily VMT
Jefferson Co	19,365,985	22,148,272	2,782,287	14.4%	67.6%
Shelby Co	3,153,562	4,098,753	945,190	54.9%	12.5%
Tuscaloosa Co	5,628,028	6,493,719	865,691	15.4%	19.8%
Area Total	***28,147,575***	***32,740,744***	***4,593,168***	***19.1%***	***100.0%***

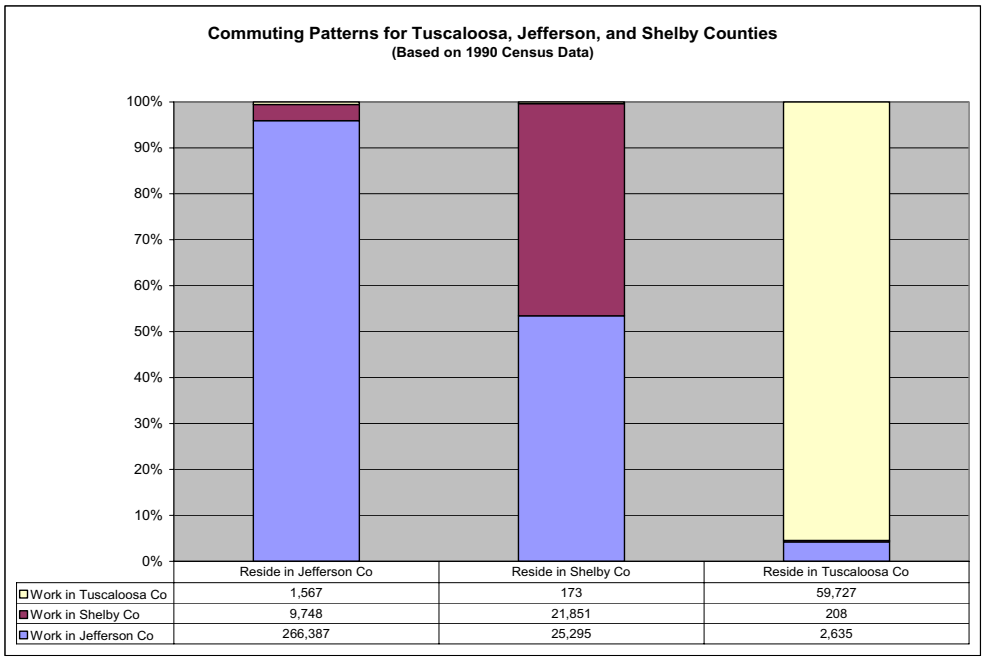


Figure 11 Commuting Patterns for Tuscaloosa and Birmingham NAA

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

There is little information available about expected growth. Table 12 provides population growth estimates that were supplied by the Regional Planning Commission of the Greater Birmingham Area and the Alabama Data Center. The estimates show insignificant growth expected for Tuscaloosa and Jefferson Counties, with significant growth expected in Shelby County. 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 Tuscaloosa in the Birmingham Nonattainment Area.

Table 12 Population Projections for Tuscaloosa and Birmingham NAA

County Name	1993	2002	2015	2025	% Change 1993-2002	% Change 2002-2015	% Change 2015-2025
Tuscaloosa Co	154,555	167,027	180,779	190,524	8.1%	8.2%	5.4%
Shelby Co	113,583	152,780	216,308	275,092	34.5%	41.6%	27.2%
Jefferson Co	660,131	664,031	682,336	704,552	0.6%	2.8%	3.3%

G. Meteorology

It is clear that meteorology plays a major role in the formation and transport of ozone. During the 2000-2002 ozone seasons, ozone levels exceeded the 8-hour standard on fifty-three days in the Birmingham area. The 8-hour standard was exceeded a total of three times at the Tuscaloosa monitor during the 2001 and 2002 seasons. The Tuscaloosa monitor was not operational before 2001.

A wind analysis was accomplished to determine the extent to which wind directions could be correlated with high ozone. During the last three ozone seasons, the May – September winds in the Birmingham area had no prevalent direction although there was a marked minimum of winds blowing from the northwest quadrant (see Figure B-1). When one considers only the daytime (6AM-6PM) winds (Figure B-2), the general pattern changes only slightly. However, on those days when the 8-hour ozone standard was exceeded in the Birmingham area, the wind blew overwhelmingly from the north through east-southeast directions. This phenomenon is clearly seen in Figure B-3 (all hours) and Figure B-4 (daytime hours only).

To examine the feasibility of ozone and its precursors being transported out of Tuscaloosa County into Jefferson and Shelby Counties and therefore contributing to the problem in the latter, an additional analysis was completed. Of the 53 ozone exceedance days in the area, the monitors closest to Tuscaloosa County (Providence and McAdory) registered exceedances on 21 days. Of those 21 days, only 3 had an average 6AM-6PM wind direction from the southwest through northwest directions, i.e., from the direction of Tuscaloosa County. Please refer back to Figure 6 in Section C for locations of ozone monitors in the Jefferson/Shelby/Tuscaloosa County area. On the three exceedance days in Tuscaloosa, the prevailing daytime winds at the Birmingham airport were from the north through east, i.e., toward Tuscaloosa County.

In addition to the internal analyses at ADEM, a study was prepared for the Ozone Task Force of the West Alabama Chamber of Commerce by Almon Associates and TTL, Inc. This study, entitled “A Comparison of Ozone Levels and Wind Direction - Tuscaloosa, Jefferson, and Shelby Counties, Alabama - June 1 Through September 30, 2001 and 2002”, examined the wind directions at the Birmingham International Airport, the Shelby County Airport and the Tuscaloosa Municipal Airport and compared them to ozone levels for the 2001 and 2002 seasons. This study, which is attached, concluded that the 1-hour and 8-hour ozone exceedances and high ozone levels tend to occur in the Birmingham MSA when winds are from the north, northeast, east and southeast. When winds are from the south, southwest, and west, ozone levels tend to be at their lower levels. For the Tuscaloosa MSA ozone levels tend to be high when the local winds are from the north and south. Therefore, it appears that there is no discernable contributory relationship between the two areas.

In summary, meteorology plays an important role in ozone formation and transport. Based on wind analyses and monitor data, it is highly unlikely that emissions from the Tuscaloosa MSA significantly impact the Birmingham MSA on ozone exceedance days.

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

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 ozone formation and transport in the Tuscaloosa area.

I. Jurisdictional Boundaries

Tuscaloosa County is in the Birmingham Metropolitan Intrastate Air Quality Control Region (40 CFR §81.41). The Tuscaloosa MSA consists only of Tuscaloosa County and this MSA is within the jurisdiction of the State of Alabama under the purview of ADEM. Adjacent to the Tuscaloosa MSA is the Birmingham 1-Hour Nonattainment Area consisting of Jefferson and Shelby Counties. The Jefferson County Department of Health holds jurisdiction within the county boundaries of Jefferson County for which monitoring data demonstrates the county to be in nonattainment for the eight-hour standard. The ADEM holds jurisdiction for Shelby County. The State's monitor in Shelby County supports this county to be in nonattainment. Discussion elsewhere in this document demonstrates the State's recommendations for exclusion of Tuscaloosa County as a part of the 8-hour 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 as 'Stage I' 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 regulations for protection of degradation of clean air areas.

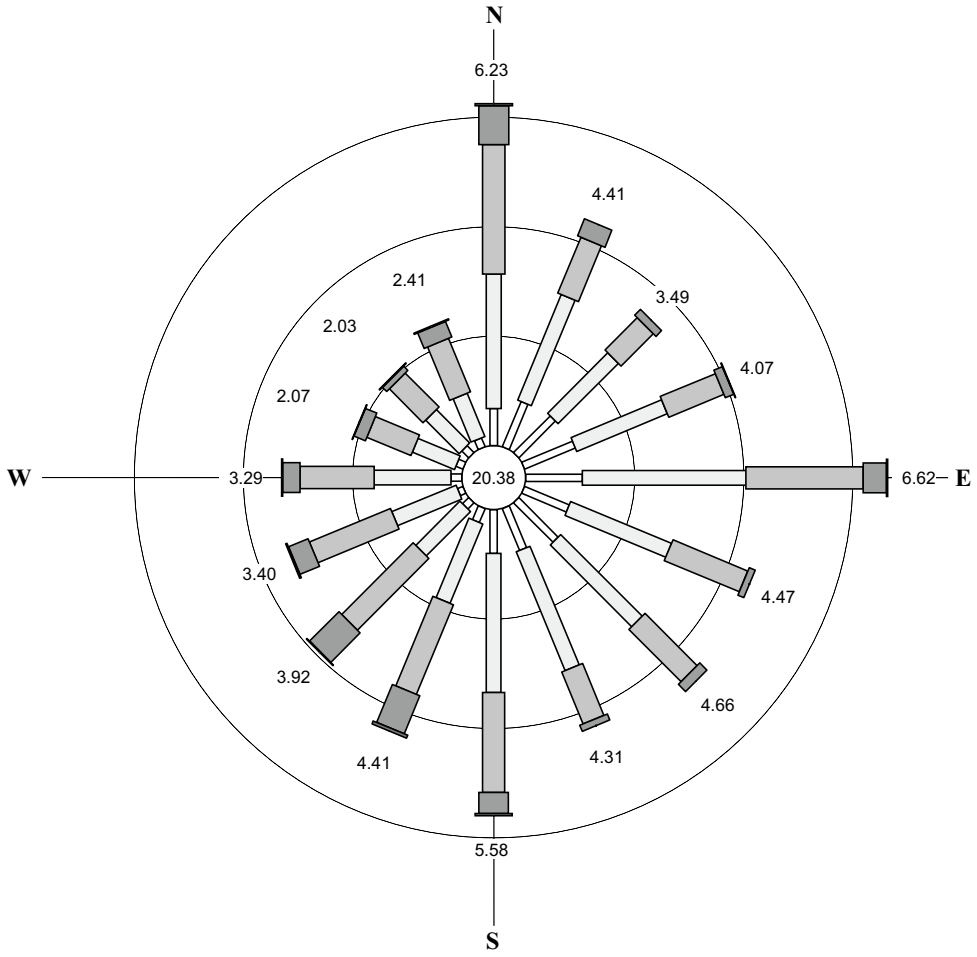
Additionally, as discussed under regional emission reductions, the EPA has required a NO_X SIP Call for 22 states, including Alabama that, by 2004, will result in large reductions in NO_X emissions from major utilities, large industrial boilers and gas turbines, and cement kilns. Alabama's NOx SIP was 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.

K. Regional Emission Reductions

EPA performed Urban Airshed Modeling to estimate the impact of implementation of the NO_X SIP Call, heavy duty diesel engine standards, highway diesel fuel control, and Tier II national fuel standards. The results obtained from EPA for Alabama demonstrates that the reductions in 8-hour ozone resulting from these national programs will be sufficient to bring all monitored areas of Alabama into attainment of the 8-hour standard by 2007. These results are documented in Attachment 1. Because a monitor has not been operational in Tuscaloosa County for at least three years, modeling was not performed for that area. However, modeling performed for nearby areas including the Birmingham NAA indicates that the entire area should attain the 8-hour standard beginning in 2007. Since additional local controls are unlikely to be required in order for Birmingham to meet the NAAQS, it is unnecessary to designate counties as nonattainment beyond those with monitoring data exceeding the standard. Further, the lack of a nonattainment designation in a county does not preclude ADEM from requiring controls in the county if controls are deemed necessary.

Figure B-1

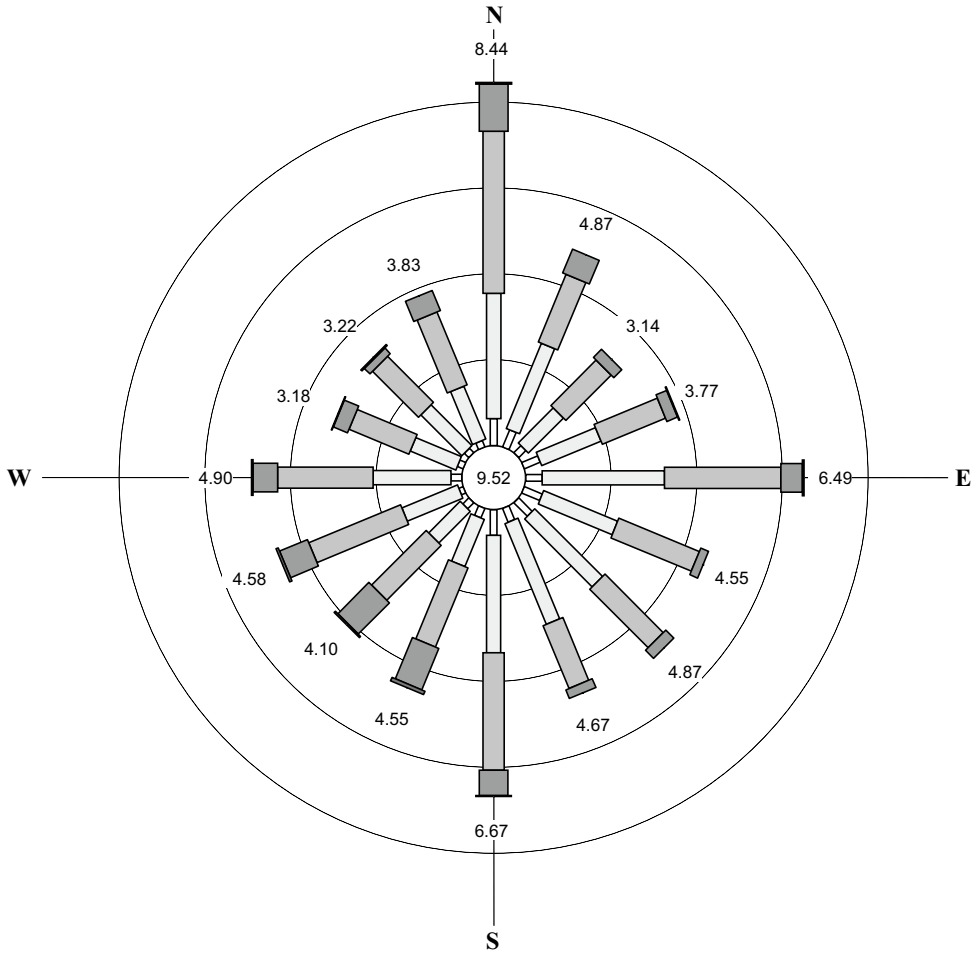
Birmingham May-Sep, All Hours - 2000-2002



Calms included at center.
Rings drawn at 2% intervals.
Wind flow is FROM the directions shown.
14.24% of observations were missing.

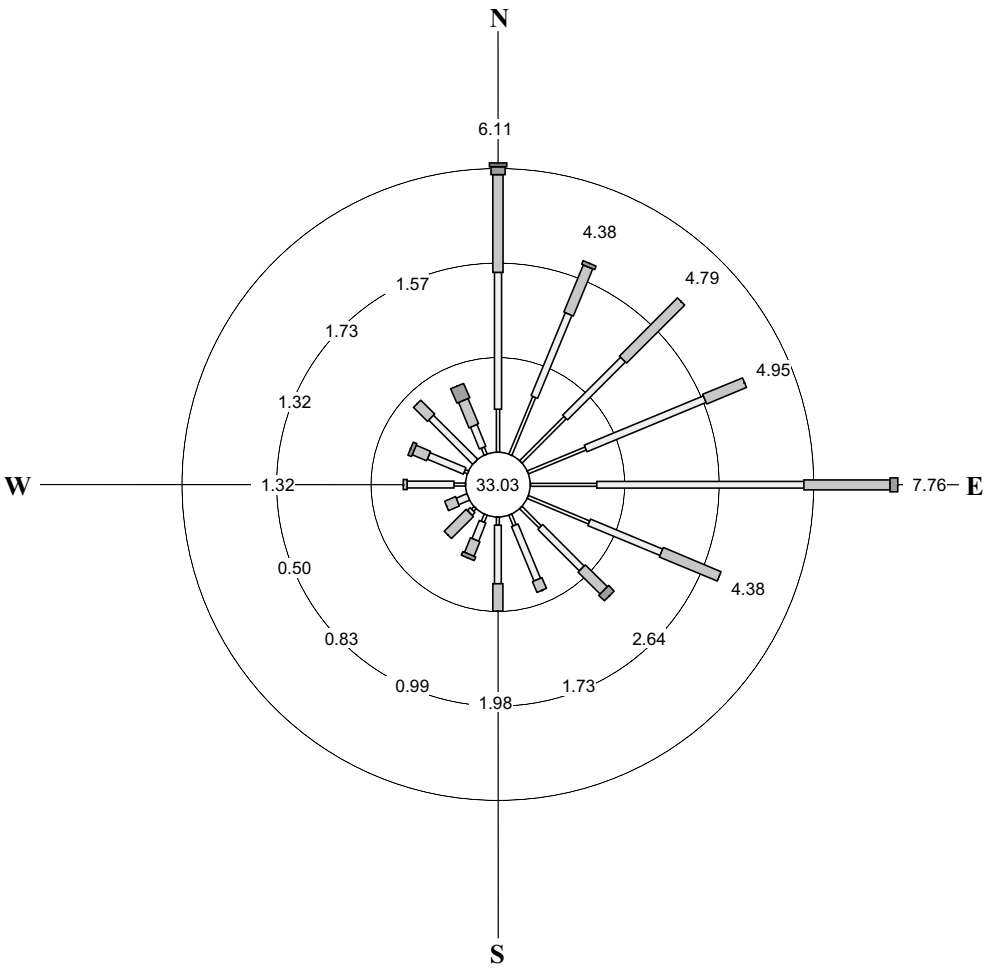
Figure B-2

Birmingham May-Sep, 6AM-6PM - 2000-2002



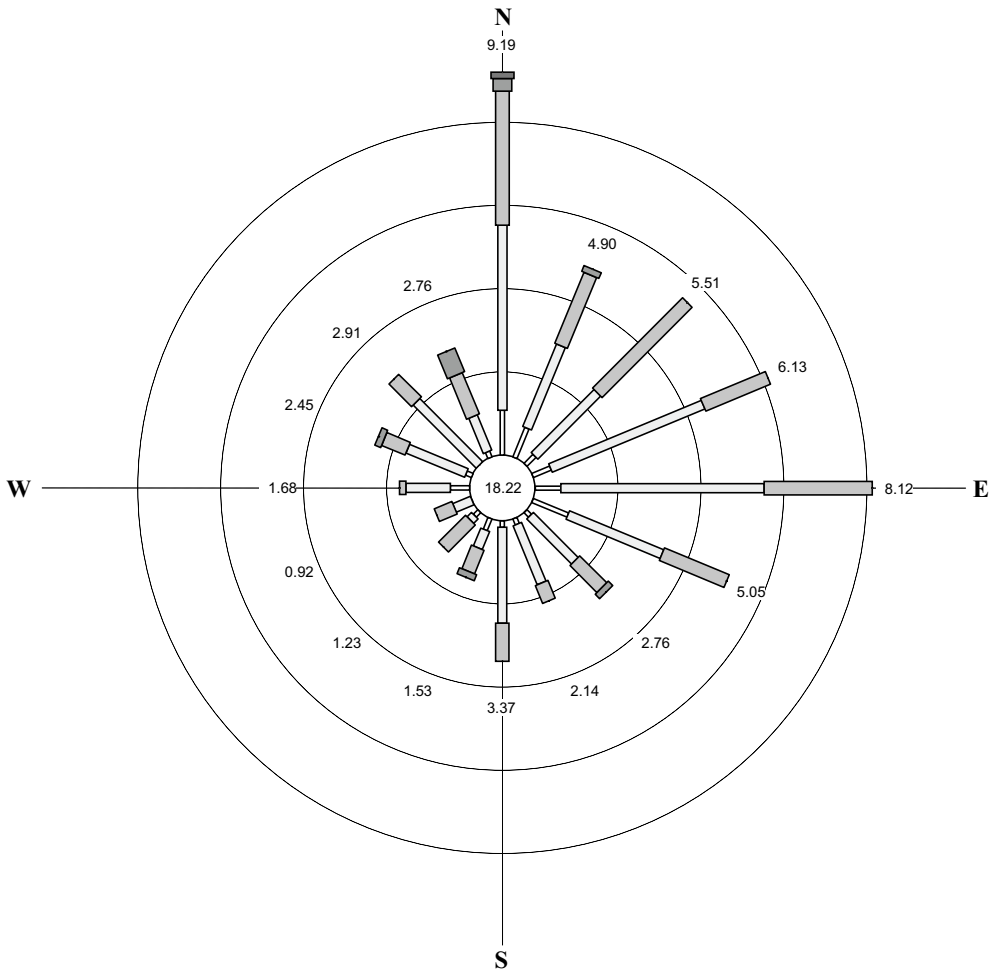
Calms included at center.
Rings drawn at 2% intervals.
Wind flow is FROM the directions shown.
14.66% of observations were missing.

Figure B-3
Birmingham Exceedance Days, All Hours - 2000-2002



Calms included at center.
Rings drawn at 2% intervals.
Wind flow is FROM the directions shown.
19.98% of observations were missing.

Figure B-4
Birmingham Exceedance Days, 6AM-6PM - 2000-2002



Calms included at center.
Rings drawn at 2% intervals.
Wind flow is FROM the directions shown.
21.13% of observations were missing.

A Comparison of Ozone Levels and Wind Direction

Tuscaloosa, Jefferson, and Shelby Counties, Alabama

Ozone Task Force
The West Alabama Chamber of Commerce

May 2003

Prepared by
Almon Associates, Inc.
TTL, Inc.

Sycamores on the Black Warrior River

A Comparison of Ozone Levels and Wind Direction
Tuscaloosa, Jefferson and Shelby Counties, Alabama
June 1 through September 30, 2001 and 2002

Executive Summary

The purpose of this report is to identify correlations between wind direction and ground level ozone in the Tuscaloosa Metropolitan Statistical Area (MSA) and in the Birmingham MSA (Jefferson and Shelby counties). The analysis correlates wind data from the Tuscaloosa, Birmingham, and Shelby County Airports with daily 1-Hour and 8-Hour ozone levels. The ozone levels used for the correlations were recorded at 11 monitoring stations located within the three counties during the two monitoring seasons June 1 through September 30, 2001 and 2002.

The report identifies the two MSAs included in the study and illustrates their physical location. Generally, the Tuscaloosa MSA is located to the west and southwest of the Birmingham MSA. Additionally, correlations of ground level ozone with wind direction are included in the report. These correlations illustrate that, in general, average ground level ozone levels within the study area are at their lowest levels when winds are from the south, southwest, and west. Additionally, average ground level ozone levels within the study area are at their highest levels when winds are from the north, northeast, east, and southeast. Based on the data presented in this report, conclusions can be drawn that at times when the wind direction is from the Tuscaloosa MSA to the Birmingham MSA, ground level ozone levels are generally at their lowest levels. Therefore, based on wind direction, the Tuscaloosa MSA does not contribute to ground level ozone levels in the Birmingham MSA.

A Comparison of Ozone Levels and Wind Direction
Tuscaloosa, Jefferson and Shelby Counties, Alabama
June 1 through September 30, 2001 and 2002

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A Comparison of Ozone Levels and Wind Direction
Tuscaloosa, Jefferson and Shelby Counties, Alabama
June 1 through September 30, 2001 and 2002

I. INTRODUCTION

This comparison analysis is of wind direction and the highest daily 1-Hour and 8-Hour Average Ozone Levels recorded at 11 monitoring stations in Tuscaloosa, Jefferson and Shelby Counties, Alabama, during the two monitoring seasons June 1 through September 30, 2001 and 2002.

Because wind data was not recorded at the ozone monitoring stations and the size of the study area (nearly 3,000 square miles), wind data from three National Weather Service (NWS) stations was used for comparison. The stations are those located at the Tuscaloosa, Birmingham, and Shelby County Airports.

The purpose of this comparison is to examine the relationship between wind direction and ozone levels in the area of these three counties.

II. BACKGROUND

The study area is part or all of three counties in west and central Alabama. Jefferson and Shelby Counties are part of the Birmingham Metropolitan Statistical Area (MSA). Tuscaloosa County is the Tuscaloosa MSA. The Study Area General Location Map (Figure 1.) shows the overall area while the Study Area Map (Figure 2) shows the location of ozone monitoring and weather stations.

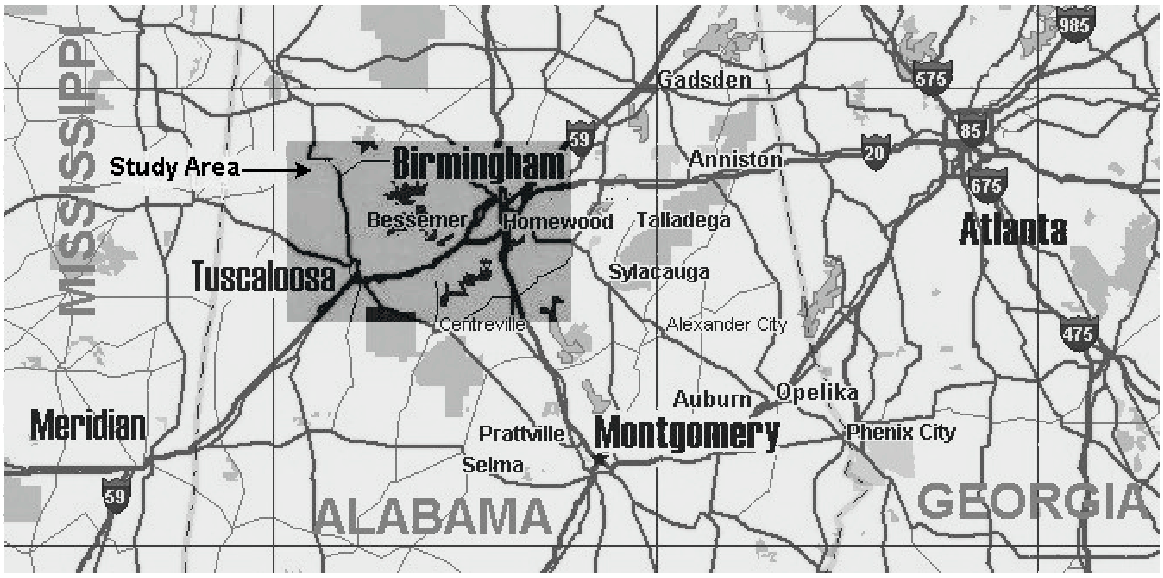


Figure 1. Study Area General Location Map

The U.S. Environmental Protection Agency (EPA) has designated the Birmingham MSA as a Marginal Non-Attainment Area for Ozone. In recent years there have been exceedances of the 1-Hour and 8-Hour Ozone Standards at some of the monitoring stations. Those with exceedances of the 1-hour standard are indicated with a white dot and are located in Shelby and Jefferson Counties. The Tuscaloosa MSA adjoins the Birmingham MSA along the southwestern boundary of Jefferson County as shown on Figure 2. In 2001 an ozone monitoring station was established near Tuscaloosa; there have been no 1-hour exceedances at this monitor.

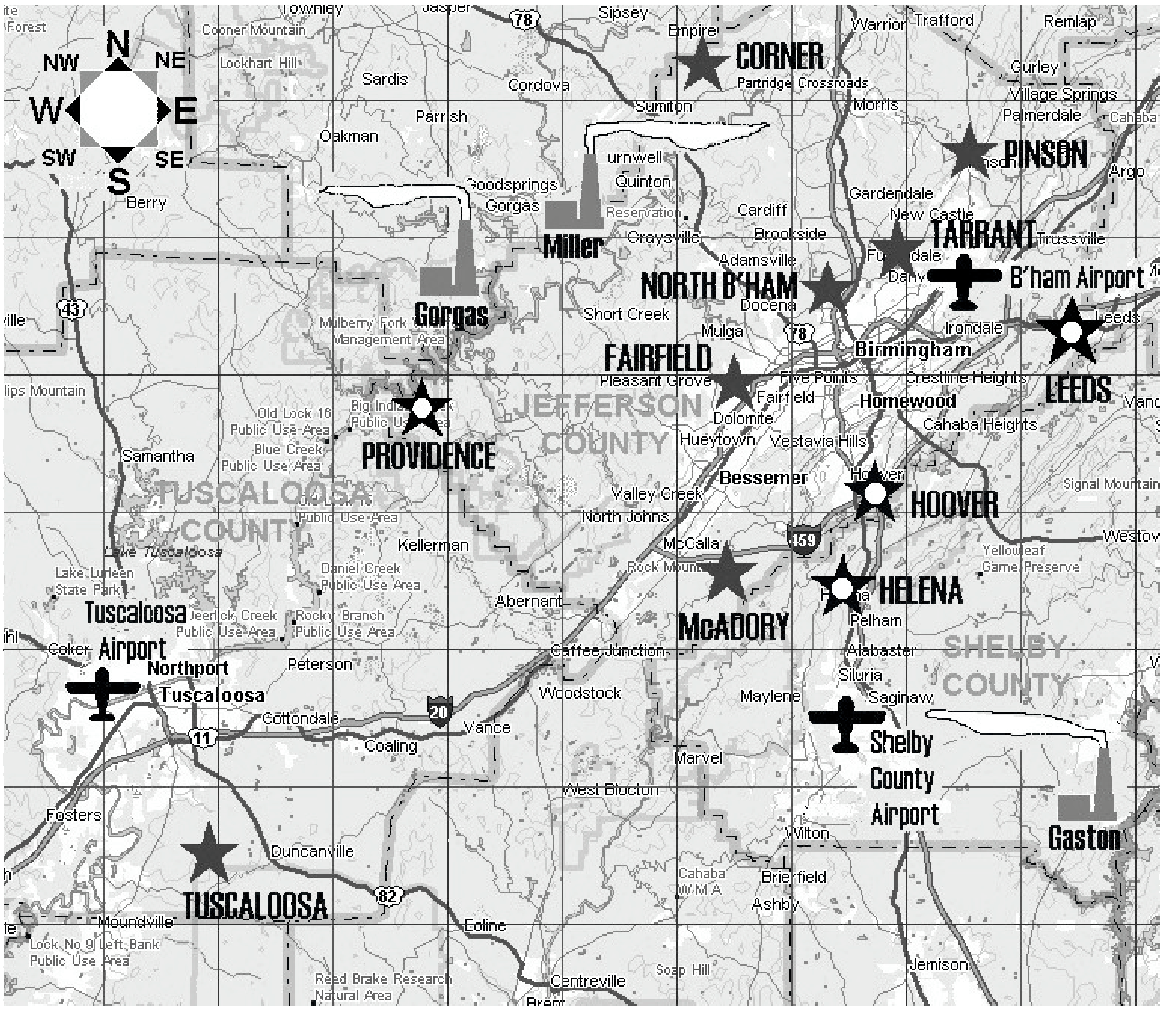


Figure 2. Study Area Map

III. DATA

The Jefferson County Health Department and the Alabama Department of Environmental Management (ADEM) provided data for the 2001 and 2002 monitoring seasons. Table 1 lists the ozone monitoring stations in the study area. Wind data was obtained for 2001 and 2002 for the Tuscaloosa, Birmingham, and Shelby County Airports respectively from the following three websites:

- http://www.srh.noaa.gov/bmx/climate/tcl/tclcli.html
- http://www.srh.noaa.gov/bmx/climate/bhm/bhmcli.html
- http://www.srh.noaa.gov/bmx/climate/others/eetcli.html

Table 1. Ozone Monitoring Stations Birmingham and Tuscaloosa MSAs

Station Number	Name	County	MSA
01-117-1003	Helena	Shelby	Birmingham
01-073	Providence	Jefferson	Birmingham
01-073-1005	McAdory	Jefferson	Birmingham
01-125-1010	Tuscaloosa	Tuscaloosa	Tuscaloosa
01-073	Leeds	Jefferson	Birmingham
01-073-2006	Hoover	Jefferson	Birmingham
01-073-1003	Fairfield	Jefferson	Birmingham
01-073	North Birmingham	Jefferson	Birmingham
01-073-5002	Pinson	Jefferson	Birmingham
01-073-6002	Tarrant	Jefferson	Birmingham
01-073	Corner	Jefferson	Birmingham

Typically ozone-monitoring seasons are for the period March 1st through October 31st of a calendar year. Because high ozone levels are more often observed during the warmest months and the amount of data involved, this study examines data (1-hour and 8-hour highest daily averages) for the 4-month period June 1st through September 30th of the 2001 and 2002 monitoring seasons. Because data was collected at 11 stations for 122 days during each season and wind direction at three different NWS stations was considered, more that 8,000 data points were examined.

The wind direction data used in this analysis was described on the NWS website as being the "2-Minute Direction,, at the Birmingham Airport and the "Fast Direction,, at the Tuscaloosa and Shelby County Airports. Additionally all three weather stations list the "Peak Direction,, for each day. With few exceptions the "Peak Direction,, was within 30^o or less of the direction used.

NWS wind directions are designated in 10^o increments from a north azimuth, in other words these bearings range from 010^o to 360^o. 360^o corresponds with north, while 090^o, 180^o, and 270^o correspond with east, south and west respectively. The urbanized area of the Tuscaloosa MSA can be said to be generally southwest or about 235^o from the urbanized area of the Birmingham MSA. Additionally for some charts wind direction is indicated using the 8 primary and secondary directions. Therefore azimuth headings were grouped in the following ranges:

- North 340^o-020^o
- Northeast 030^o-060^o
- East 070^o-110^o
- Southeast 120^o-150^o
- South 160^o-200^o

- Southwest 210°-240°
- West 250°-290°
- Northwest 300°-330°

IV. ANALYSIS

The analysis of this data must be in broad general terms for the following reasons:

- Large size of the study area
- No wind data from monitoring sites
- High variability of wind direction

Therefore comments and observations are of general trends.

a. Wind Direction

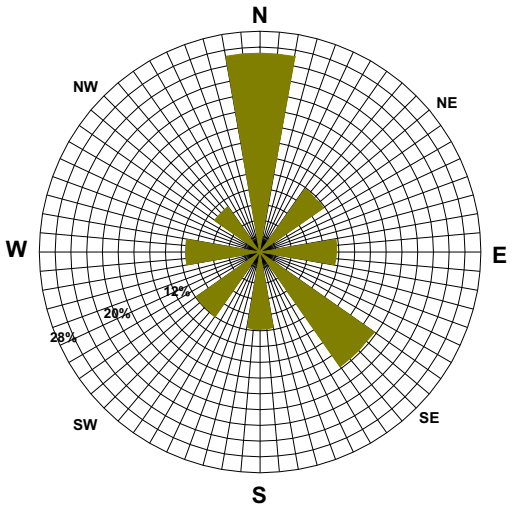
Wind directions recorded at the three NWS weather stations in the project area were sorted, and totaled by station and year. Additionally averages of the two years of data by direction were calculated by station and as a composite. As can be seen on Table 2, when the composite directions are calculated, winds were more frequently (65.9% of the time) from the north, northwest, south and southeast while those from the southwest, west, east and northeast were the less frequent (34.1% of the time). Most often winds were from the north (20.0% of the time); least often they were from the southwest (7.3% of the time).

Table 2. Compilation of Wind Directions by Year and NWS Station

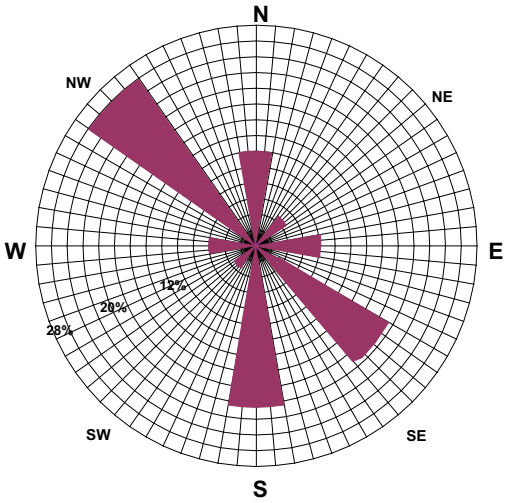
NWS Weather Station	N	NE	E	SE	S	SW	W	NW
2002 Birmingham Airport Wind Direction	35	12	17	23	10	8	10	7
2002 Shelby County Airport Wind Direction	9	8	16	26	21	5	5	30
2002 Tuscaloosa Airport Wind Direction	25	18	14	8	28	9	11	7
2001 Birmingham Airport Wind Direction	30	12	7	20	14	16	13	10
2001 Shelby County Airport Wind Direction	20	3	4	20	28	3	9	32
2001 Tuscaloosa Airport Wind Direction	25	15	10	4	30	12	10	13
Totals	**144**	**68**	**68**	**101**	**131**	**53**	**58**	**99**
Percent Composite all Stations (2002 & 2001)	**20.0%**	**9.4%**	**9.4%**	**14.0%**	**18.2%**	**7.3%**	**8.0%**	**13.7%**
Percent B'ham NWS Sta. (2002 & 2001)	**26.6%**	**9.8%**	**9.8%**	**17.6%**	**9.8%**	**9.8%**	**9.4%**	**7.0%**
Percent Shelby Co. NWS Sta. (2002 & 2001)	**12.1%**	**4.6%**	**8.4%**	**19.2%**	**20.5%**	**3.3%**	**5.9%**	**25.9%**
Percent Tuscaloosa NWS Sta. (2002 & 2001)	**20.9%**	**13.8%**	**10.0%**	**5.0%**	**24.3%**	**8.8%**	**8.8%**	**8.4%**

Examination of the data for each individual weather station reveals that at the Birmingham Airport, winds are most frequently from the north and southeast and least frequently from the northwest and west. At the Shelby County Airport winds are most frequently from the northwest and south and least frequently from the southwest and northeast. At the Tuscaloosa Airport winds are most frequently from the north and south and least frequently from the southeast, west, southwest and northwest.

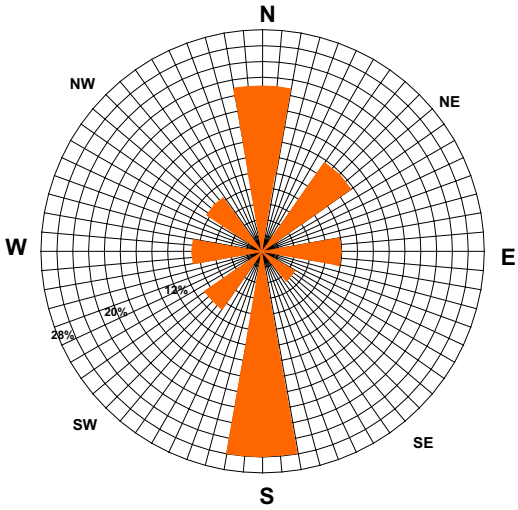
Figure 3 presents radial plots of wind direction frequencies at each of the three weather stations and a composite of all three as listed on Table 2.



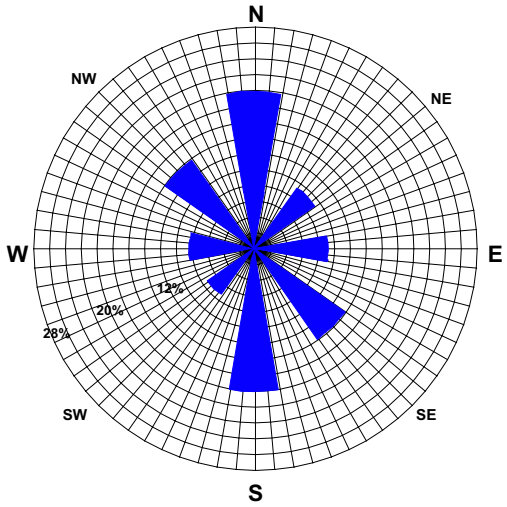
Birmingham Airport NWS Station



Shelby County Airport NWS Station



Tuscaloosa Airport NWS Station

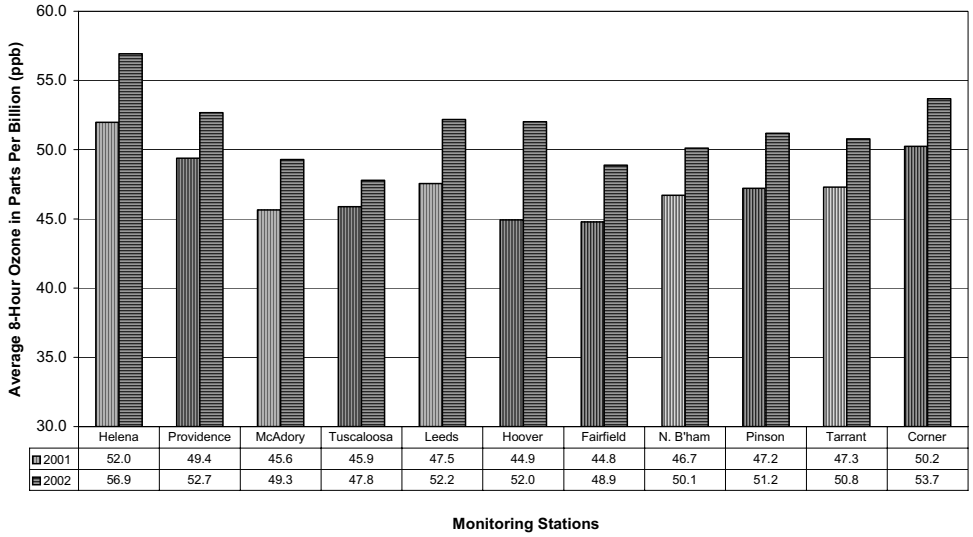


Composite of All Three NWS Stations

Figure 3. Radial Plots of Wind Direction Frequency

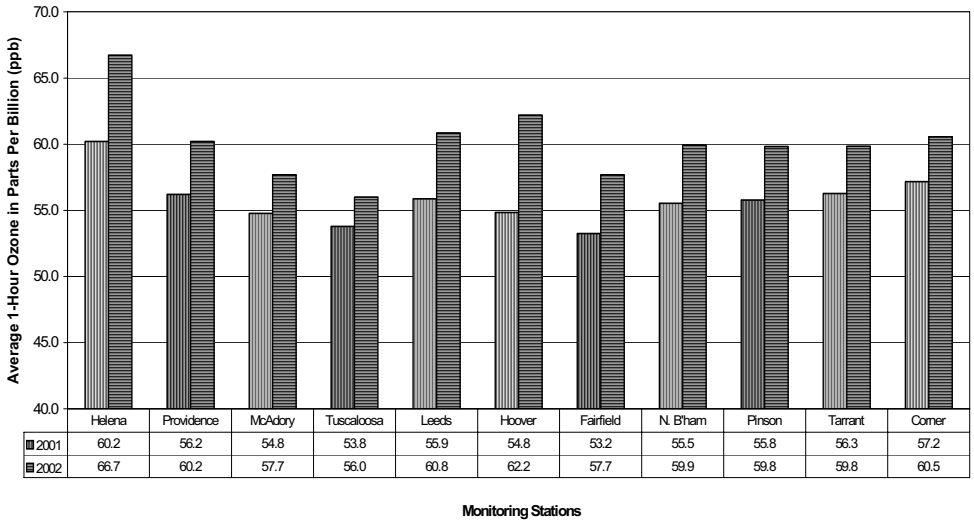
b. Average Ozone Levels

The average ozone levels for the highest 8-hour and 1-hour readings for the 2001 and 2002 monitoring seasons at all 11 stations in the study area were calculated and are shown on Figures 4 and 5. For the 2002-monitoring season Helena recorded the highest average 8-hour and 1-hour readings at 56.9 parts per billion (ppb) and 66.7 ppb respectively while Tuscaloosa recorded the lowest averages at 47.8 ppb and 56.0 ppb. For the 2001 monitoring season Helen again recorded the highest average 8-hour and 1-hour readings at 52.0 ppb and 60.2 ppb respectively while Fairfield recorded the lowest averages at 44.8 ppb and 53.2 ppb. It should be noted that 2001 average levels at Tuscaloosa were only slightly higher at 45.9 ppb and 53.8 ppb.



	Helena	Providence	McAdory	Tuscaloosa	Leeds	Hoover	Fairfield	N. B'ham	Pinson	Tarrant	Corner
2001	52.0	49.4	45.6	45.9	47.5	44.9	44.8	46.7	47.2	47.3	50.2
2002	56.9	52.7	49.3	47.8	52.2	52.0	48.9	50.1	51.2	50.8	53.7

Figure 4. Average 8-Hour Ozone by Monitor, June 1 to September 30, 2001 & 2002



	Helena	Providence	McAdory	Tuscaloosa	Leeds	Hoover	Fairfield	N. B'ham	Pinson	Tarrant	Corner
2001	60.2	56.2	54.8	53.8	55.9	54.8	53.2	55.5	55.8	56.3	57.2
2002	66.7	60.2	57.7	56.0	60.8	62.2	57.7	59.9	59.8	59.8	60.5

Figure 5. Average 1-Hour Ozone by Monitor, June 1 to September 30, 2001 & 2002

Further examination of average ozone levels consisted of sorting the readings by wind direction and then averaging them. This was done for all 11 monitoring stations using wind directions at the three NWS stations in the study area for the 8-hour and 1-hour levels for the 2001 and 2002-monitoring seasons. These averages were compiled and plotted on a series of bar graphs that are shown on Figures 7 through 18 in the Appendix.

The lowest and highest 8-hour and 1-hour season averages for 2002 and 2001 in relation to wind directions recorded at the Birmingham, Shelby County, and Tuscaloosa Airport NWS Weather Stations were compiled and are shown on Tables 3 and 4. As can be seen on Table 3 the lowest average ozone levels occurred most often when winds were from the south, southwest, and west. Conversely as shown on Table 4, the highest average ozone levels occurred most often when the winds were from the north, northeast, east, and southeast.

Table 3. Lowest Ozone Averages by Wind Direction

Parameter	Figure	N	NE	E	SE	S	SW	W	NW
2002 8-hour Averages B'ham Airport Wind Direction	7								
2002 8-hour Averages Shelby Airport Wind Direction	8								
2002 8-hour Averages Tuscaloosa Airport Wind Direction	9								
2001 8-hour Averages B'ham Airport Wind Direction	10								
2001 8-hour Averages Shelby Airport Wind Direction	11								
2001 8-hour Averages Tuscaloosa Airport Wind Direction	12								
2002 1-hour Averages B'ham Airport Wind Direction	13								
2002 1-hour Averages Shelby Airport Wind Direction	14								
2002 1-hour Averages Tuscaloosa Airport Wind Direction	15								
2001 1-hour Averages B'ham Airport Wind Direction	16								
2001 1-hour Averages Shelby Airport Wind Direction	17								
2001 1-hour Averages Tuscaloosa Airport Wind Direction	18								
Totals		**0**	**0**	**0**	**2**	**11**	**8**	**8**	**1**

Table 4. Highest Ozone Averages by Wind Direction

Parameter	Figure	N	NE	E	SE	S	SW	W	NW
2002 8-hour Averages B'ham Airport Wind Direction	7								
2002 8-hour Averages Shelby Airport Wind Direction	8								
2002 8-hour Averages Tuscaloosa Airport Wind Direction	9								
2001 8-hour Averages B'ham Airport Wind Direction	10								
2001 8-hour Averages Shelby Airport Wind Direction	11								
2001 8-hour Averages Tuscaloosa Airport Wind Direction	12								
2002 1-hour Averages B'ham Airport Wind Direction	13								
2002 1-hour Averages Shelby Airport Wind Direction	14								
2002 1-hour Averages Tuscaloosa Airport Wind Direction	15								
2001 1-hour Averages B'ham Airport Wind Direction	16								
2001 1-hour Averages Shelby Airport Wind Direction	17								
2001 1-hour Averages Tuscaloosa	18								
Totals		**8**	**8**	**7**	**5**	**0**	**0**	**0**	**2**

c. Exceedances and Wind Direction

Exceedances of the 1-hour and 8-hour standards occurred during both monitoring seasons. Table 5 lists the 8-hour standard exceedances. Since 1-hour standard exceedances are relatively rare, all 1-hour levels of 105 ppb or higher are listed on Table 6. Actual exceedances of either standard are highlighted on both tables.

Table 5. Exceedances of the 8-Hour Ozone Standard, June 1 to September 30, 2001 &2002

Date	NWS Stations. Wind Direction North Azimuth			Ozone Monitoring Stations 8-Hour Ozone Exceedances in parts per billion (ppb)										
	Bh	Sb	Tu	Hel.	Prov.	McA.	Tusc.	Leeds	Hoov.	Fair.	N. Bh.	Pin.	Tarr.	Cor.
6/25/01	80	40	80	87										
7/7/01	340	350	40	87										
7/16/01	140	150	200									85		
7/18/01	20	180	230					91				86		
7/23/01	60	360	340		86	85								
7/24/01	180	150	180	85	92	107	102							
8/3/01	20	350	360	89	88	90				86				
8/15/01	130	190	220	93					87		90			85
8/21/01	40	310	310	91										
8/22/01	50	360	30		93									
8/23/01	120	290	190	89				97	86	90	96	98	102	
8/24/01	50	310	230	104					93					
8/25/01	180	320	190	97					88		87			
6/3/02	10	250	190	89					86					
6/4/02	150	150	140	86										91
6/12/02	20	90	180	101				112	98	90	101	95	102	
6/18/02	120	170	120		92									
7/1/02	60	40	260	85					85					
7/6/02	10	290	360				86							
8/3/02	50	120	10		85									
8/6/02	40	310	350	86										
8/7/02	90	80	20		91									
8/8/02	20	150	200		95					88	88			
8/21/02	140	150	340	86					86	89				
9/4/02	350	320	40	85	88									
9/5/02	150	130	20	85										
9/10/02	20	340	320	110	87		92		96					
9/11/02	330	330	10	98										86
9/12/02	120	120	290	90					85					

The relationship of the ozone limit exceedances listed on Tables 5 and 6 and wind direction was examined by use of radial plots that show arrows oriented on wind direction azimuth headings for each of the three NWS stations in the study area on exceedance or high ozone days at any of the 11 monitoring stations.

Figures 19 and 20 in the Appendix show wind direction arrows on days of 8-hour limit exceedances for the 2001 and 2002 monitoring seasons.

Table 6. Exceedances of the 1-Hour Ozone Standard, June 1 to September 30, 2002 & 2002

Date	NWS Stations. Wind Direction North Azimuth			Ozone Monitoring Stations 1-Hour Ozone Exceedances and Readings of 85 or larger in parts per billion (ppb)										
	Bh	Sb	Tu	Hel.	Prov.	McA.	Tusc.	Leeds	Hoov.	Fair.	N. Bh.	Pin.	Tarr.	Cor.
7/7/01	340	350	40	112										
7/18/01	20	180	230					113						
7/23/01	60	360	340				106							
7/24/01	180	150	180		123	127	109							
8/3/01	20	350	360		107	114								
8/15/01	130	190	220	106							112			
8/23/01	120	290	190							118	108	112	140	
8/24/01	50	310	230	134							112			
8/25/01	180	320	190	113										
6/4/02	150	150	140	112				127						107
6/12/02	20	90	180	113					106	111	115	106	111	
7/1/02	60	40	260						105					
7/7/02	120	80	80		110									
8/3/02	50	120	10		106									
8/7/02	90	80	20		106									
8/8/02	20	150	200		111					105				
8/21/02	140	150	340	106						106				
9/10/02	20	340	320	127					115					
9/12/02	120	120	290	105										

As shown on Figure 19 in the Appendix the plot for wind direction measured at the Birmingham Airport during the 2002 season, the most frequent wind direction recorded on exceedance days is 020^{o} or slightly east of north. Other frequently recorded directions are from the southeast and northwest. There were no exceedances recorded when the wind direction at the Birmingham Airport was from the direction of Tuscaloosa. At the Shelby County Airport the most frequently recorded wind directions on exceedance days were the southeast, east, and northwest. There were two exceedances days with wind from the southwest. Because of the location of the Shelby County Airport, this direction is from the general area of Bibb County, part of the Birmingham MSA. At the Tuscaloosa Airport wind directions on exceedance days were generally from the north and south.

As shown on Figure 20 in the Appendix the plot for wind direction measured at the Birmingham Airport during the 2001 season the most frequent wind directions recorded on exceedance days were from the general northeast, southeast and south directions. At the Shelby County Airport the most frequently recorded wind directions on exceedance days were from the northeast, north, southeast, and south. There were no exceedances of the 8-hour limit when the wind direction at either of these airports was from the Tuscaloosa direction. At the Tuscaloosa Airport the most frequently recorded directions were from the south, southwest, and north.

Exceedances of the 1-hour ozone limit are relatively rare. Therefore for this study levels of 105 parts per billion (ppb) or greater were designated as “high,, and were plotted in reference to wind direction.

Figures 21 and 22 in the Appendix show wind direction arrows on days of 1-hour limit exceedances and high ozone readings for the 2001 and 2002 monitoring seasons.

As shown on Figure 21 in the Appendix the plot for wind direction measured at the Birmingham Airport during the 2002 monitoring season, 1-hour levels of 105 ppb or greater were recorded 11 times when the wind direction was 020^{o} at the Birmingham Airport. Other high readings occurred when the wind was from the southeast. At the Shelby County Airport the most frequently recorded wind direction on high ozone days were the east and southeast. At the Tuscaloosa Airport wind directions on high ozone days were generally from the south, southeast and northwest.

As shown on Figure 22 in the Appendix the plot for wind direction recorded at the Birmingham Airport during the 2001 monitoring season, 1-hour levels of 105 ppb or greater were recorded when wind directions at the Birmingham Airport were from the northeast, southeast, and south. At the Shelby County Airport high ozone levels occurred when the wind direction was from the northwest, north, and south. At the Tuscaloosa Airport wind directions were generally from the north, south and southwest on high ozone days. During the 2001 monitoring season no wind directions from the Tuscaloosa were recorded at the Birmingham or Shelby County Airports when the 1-hour level was 105 ppb or higher.

d. Scatter Plots

The relationship of ozone levels and wind direction by azimuth was examined graphically by the use of scatter plots. These plots were created by plotting the 8-hour and 1-hour ozone readings recorded at all eleven monitoring stations for the 2001 and 2002 monitoring seasons in relation to wind direction recorded at the three NWS weather stations in the study area. Each scatter plot contains approximately 1320 data points. The 12 scatter plots are shown on Figures 23 through 34 in the Appendix.

Figures 23 through 25 are plots of the 8-hour readings for the 2002-monitoring season. As can be see on these plots the lower readings generally occur with wind directions in the range of 170^{o} to 320^{o} (south to northwest). Higher readings tend to occur with wind directions in the ranges of 010^{o} to 170^{o} (north to south) and 310^{o} to 340^{o} (northwest to north).

Figures 26 through 28 are plots of the 8-hour readings for the 2001-monitoring season. As can be see on these plots the lower readings generally occur with wind directions in the range of 200^{o} to 330^{o} (south to northwest). Higher readings tend to occur with wind directions in the ranges of 310^{o} to 080^{o} (northwest to east) and 160^{o} to 230^{o} (south to southwest).

Figures 29 through 31 are plots of the 1-hour readings for the 2002-monitoring season. As can be see on these plots the lower readings generally occur with wind directions in the range of 170^{o} to

320^{o} (south to northwest). Higher readings tend to occur with wind directions in the ranges of 010^{o} to 200^{o} (north to south) and 310^{o} to 340^{o} (northwest to north).

Figures 32 through 34 are plots of the 1-hour readings for the 2001-monitoring season. As can be see on these plots the lower readings generally occur with wind directions in the range of 210^{o} to 290^{o} (southwest to northwest). Higher readings tend to occur with wind directions in the ranges of 050^{o} to 230^{o} (northeast to southwest) and 310^{o} to 150^{o} (northwest to southeast).

Since the 1-hour and 8-hour scatter plots tended to exhibit similar trends, radial scatter plots of only the 8-hour data were prepared and examined. These plots are shown on Figures 35 through 40 in the Appendix.

For wind directions recorded at the Birmingham Airport NWS Station higher ozone levels for both seasons tend to occur with generally northeast, southeast and south winds. Lower levels occur with generally southwest, east and northwest winds.

For wind directions recorded at the Shelby County Airport NWS Station higher ozone levels for both seasons tend to occur with generally northwest, southeast and east winds. Lower levels occur with generally southwest and northeast winds.

For wind directions recorded at the Tuscaloosa Airport NWS Station higher ozone levels for both seasons tend to occur with generally northwest, east, and southeast winds. Lower levels occur with generally southwest, east and west winds.

V. SUMMARY AND CONCLUSIONS

Over 8,000 data points were considered for the periods June 1 through September 31, 2001 and 2002. The data considered consisted of highest daily average 1-hour and 8-hour ozone levels recorded at 11 monitoring stations in a three county area and wind direction recorded at three NWS Weather Stations. Through various methods the following characteristics were considered:

- Wind Direction Frequency
- Average Ozone Levels
- Exceedances and Wind Direction
- Scatter Plots

a. Wind Direction Frequency

In general terms winds in the study area are most frequently from the northwest, north, southeast and south. Conversely winds from the southwest, west, east and northeast are the least frequent. As shown on The Study Area Map (Figure 2) winds from the northwest would carry emissions from two large stationary sources, the Gorgas and Miller Steam Plants, toward the most heavily developed parts of the Birmingham MSA. Winds from the southeast would carry emissions from the Gaston Steam Plant toward the most heavily developed suburban areas of Shelby and south Jefferson County.

b. Average Ozone Levels

Average ozone levels at all monitors were calculated for both monitoring seasons. As shown on Figures 4 and 5 some of the highest average levels occurred in suburban communities (Hoover, Helena, and Leeds) that are located along heavily traveled transportation corridors such as I-65, I-20/59, I-459, and U.S. 280. At the same time relatively high averages occurred at two monitors located in relatively rural areas (Providence and Corner).

In a further examination, average ozone levels were sorted into eight directions. As shown on Table 3 the lowest average ozone readings occurred with south, southwest and west winds. While as shown on Table 4 the highest averages occurred with north, northeast, east and southeast winds.

c. Exceedances and Wind Direction

Tables 5 and 6 list exceedances and high ozone levels, wind directions and monitoring stations for the 2001 and 2002 monitoring seasons. While Figures 19 through 22 in the Appendix show directional arrows for the same data. When these exceedance and high ozone days occurred, the most common wind directions were from the north, east, southeast and south.

Exceedances of the 8-hour standard occurred at four or more monitoring stations on the same day on five occasions. On July 24, 2001, exceedances were recorded at Helena, Providence, McAdory, and Tuscaloosa. On that day, winds were from the south and southeast. On August 3, 2001, exceedances were recorded at Helena, Providence, McAdory, and Fairfield. Winds on that day were from the north. On August 15, 2001, exceedances were recorded at Helena, Hoover, North Birmingham, and Corner. Winds on that day at the nearest NWS stations (Birmingham and Shelby County Airports) were from the south and southeast. On August 23, 2001, Exceedances were recorded at Helena, Leeds, Hoover, Fairfield, North Birmingham, Pinson, and Tarrant. Winds on that day at the nearest NWS stations (Birmingham and Shelby County Airports) were from the northeast and northwest. On June 12, 2002, exceedances were recorded at Helena, Leeds, Hoover, Fairfield, north Birmingham, Pinson, and Tarrant. Winds on that day at the nearest NWS stations (Birmingham and Shelby County Airports) were from the north and east.

Exceedances of the 1-hour standard and high ozone days (reading of 85 ppb or higher) occurred on the same at three or more monitoring stations on three occasions. On July 24, 2001, an exceedance was recorded at McAdory and high levels were recorded at Providence and Tuscaloosa. On that day winds were from the south and southeast. On August 23, 2001, an exceedance was recorded at Tarrant and high levels were recorded at Fairfield, North Birmingham, and Pinson. Winds on that day at the nearest NWS stations (Birmingham and Shelby County Airports) were from the northeast and northwest. On June 12, 2002, high levels were recorded at Helena, Hoover, Fairfield, North

Birmingham, Pinson, and Tarrant. Winds on that day at the nearest NWS stations (Birmingham and Shelby County Airports) were from the north and east.

d. Scatter Plots

Scatter plots are a convenient way to look at all the data plotted on by azimuth. These plots are shown on Figures 23 through 34 in the Appendix. In general these plots confirm the general observations made earlier that high ozone levels occur with winds that range from the north to southeast while lower ozone levels occur with winds that range from the south to west. The radial scatter plots shown on Figures 35 through 38 present the same 8-hour data.

In conclusion 1-hour and 8-hour ozone exceedances and high ozone levels tend to occur in the Birmingham MSA when winds are from the north, northeast, east and southeast. When winds are from the south, southwest and west ozone levels tend to be at their lower levels. For the Tuscaloosa MSA ozone levels tend to be high when winds are from the north and south. Therefore, it appears that there in no discernable contributory relationship between the two areas.

A Comparison of Ozone Levels and Wind Direction
Tuscaloosa, Jefferson and Shelby Counties, Alabama
June 1 through September 31, 2001 and 2002

Appendix

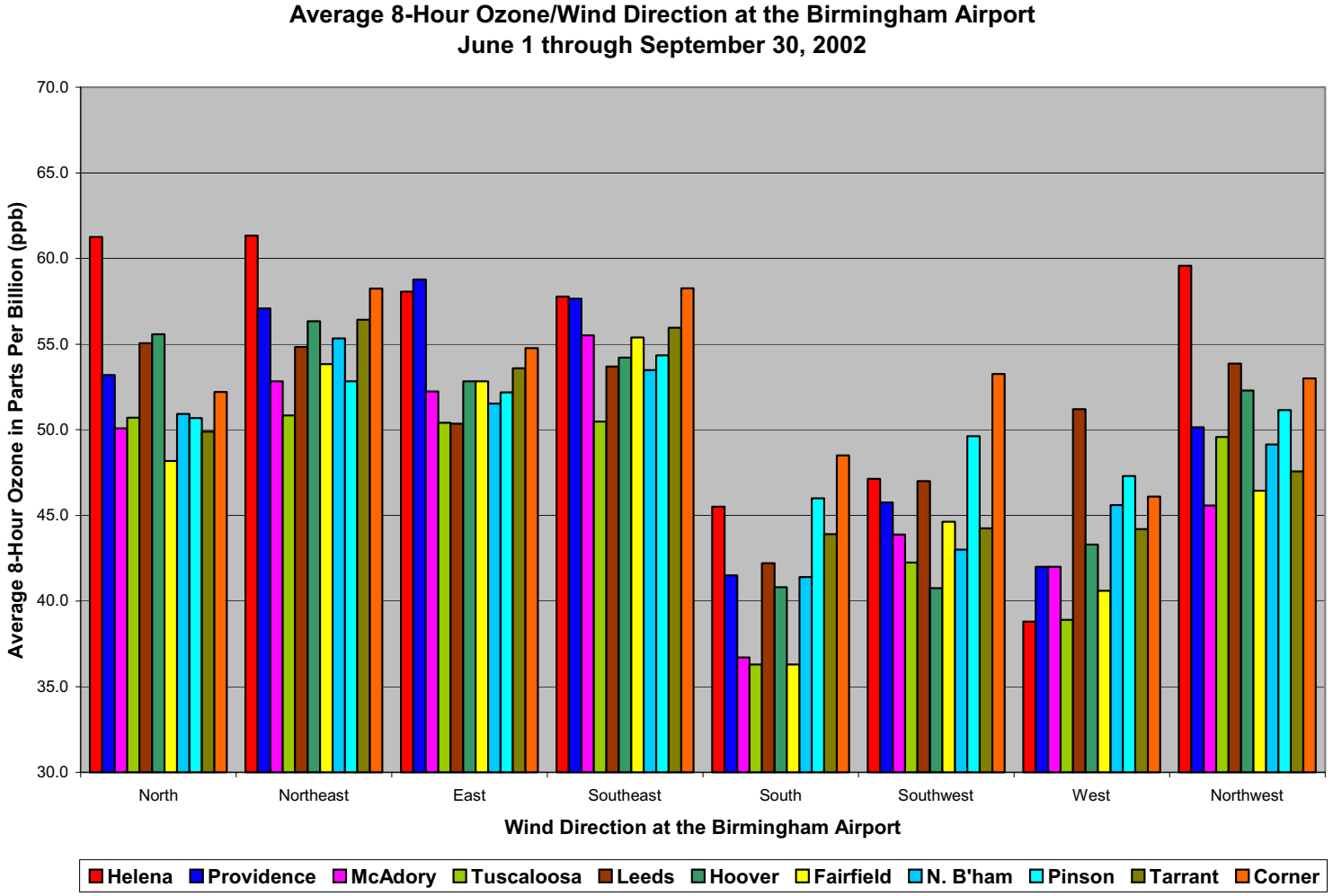


Figure 7. Average 8-Hour Ozone/Wind Direction at the Birmingham Airport, 2002

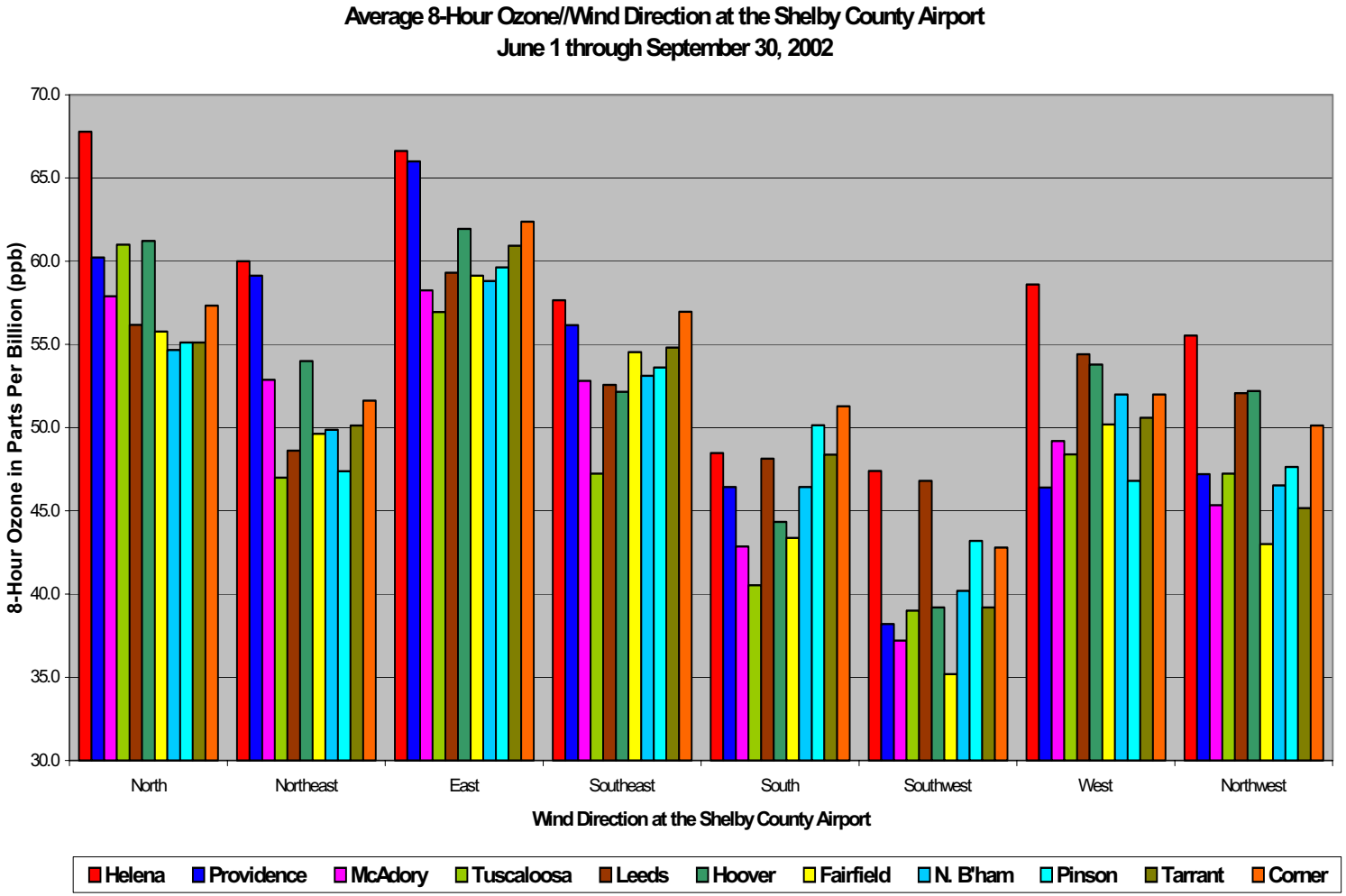


Figure 8. Average 8-Hour Ozone/Wind Direction at the Shelby County Airport, 2002

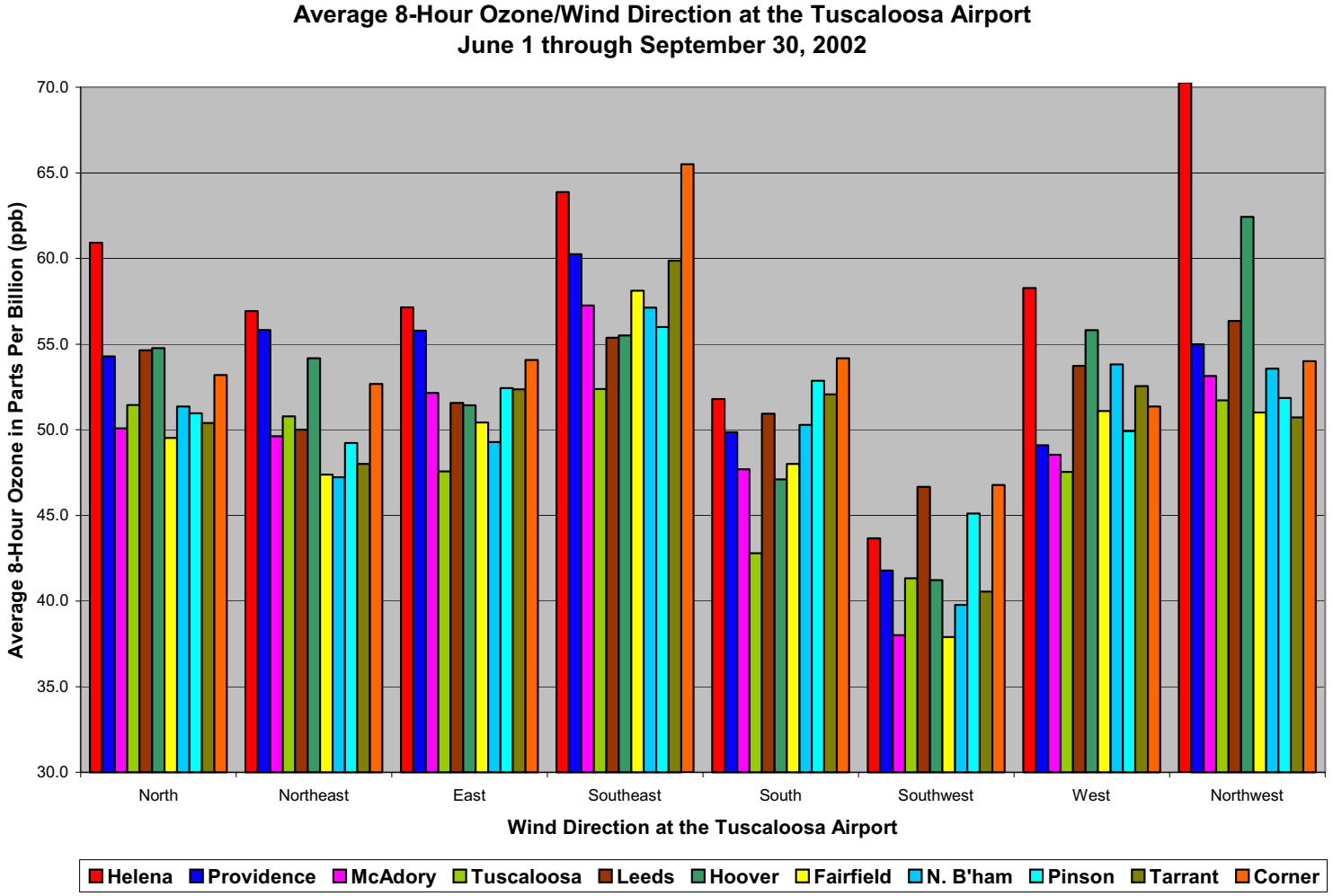


Figure 9. Average 8-Hour Ozone/Wind Direction at the Tuscaloosa Airport, 2002

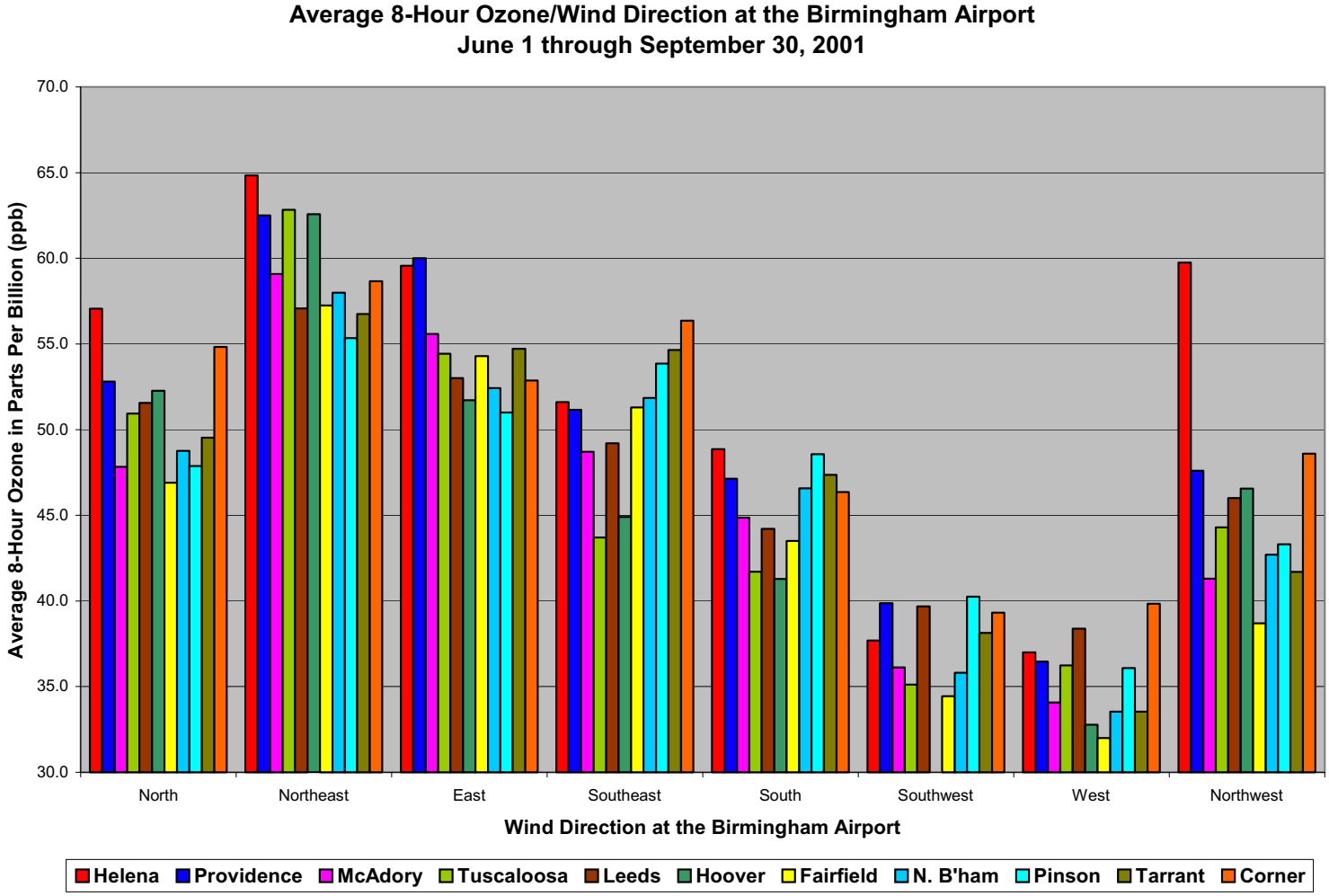


Figure 10. Average 8-Hour Ozone/Wind Direction at the Birmingham Airport, 2001

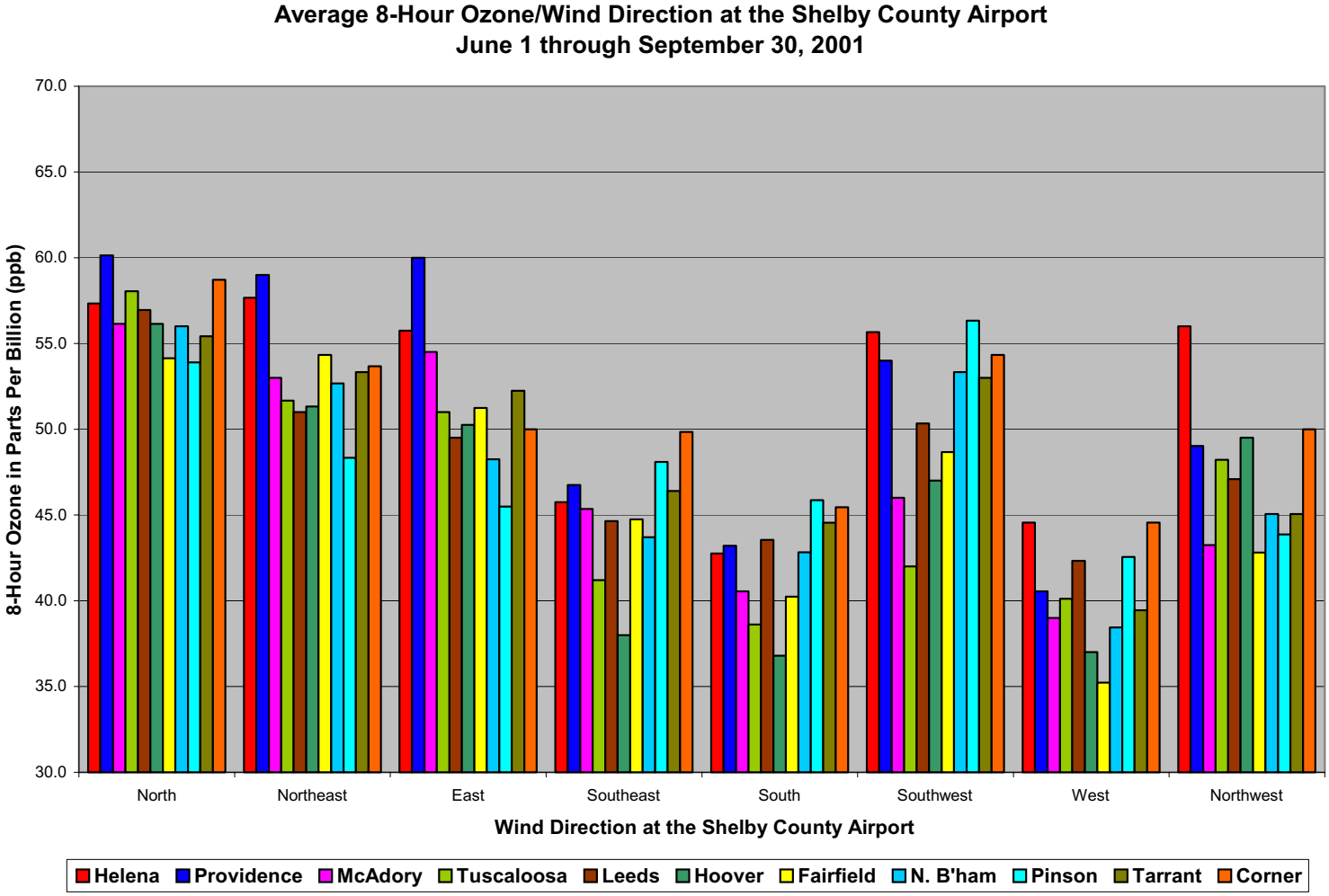


Figure 11. Average 8-Hour Ozone/Wind Direction at the Shelby County Airport, 2001

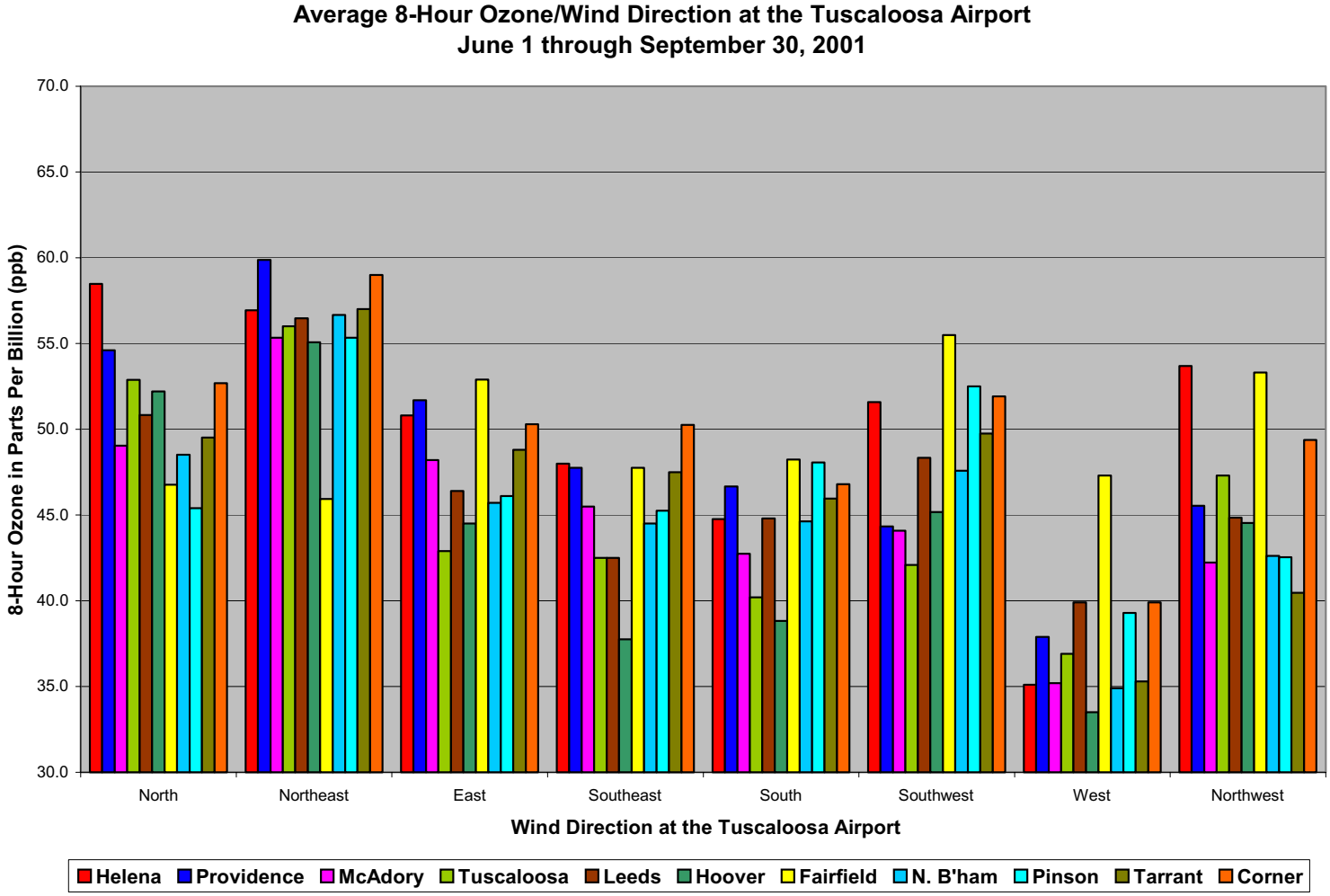


Figure 12. Average 8-Hour Ozone/Wind Direction at the Tuscaloosa Airport, 2001

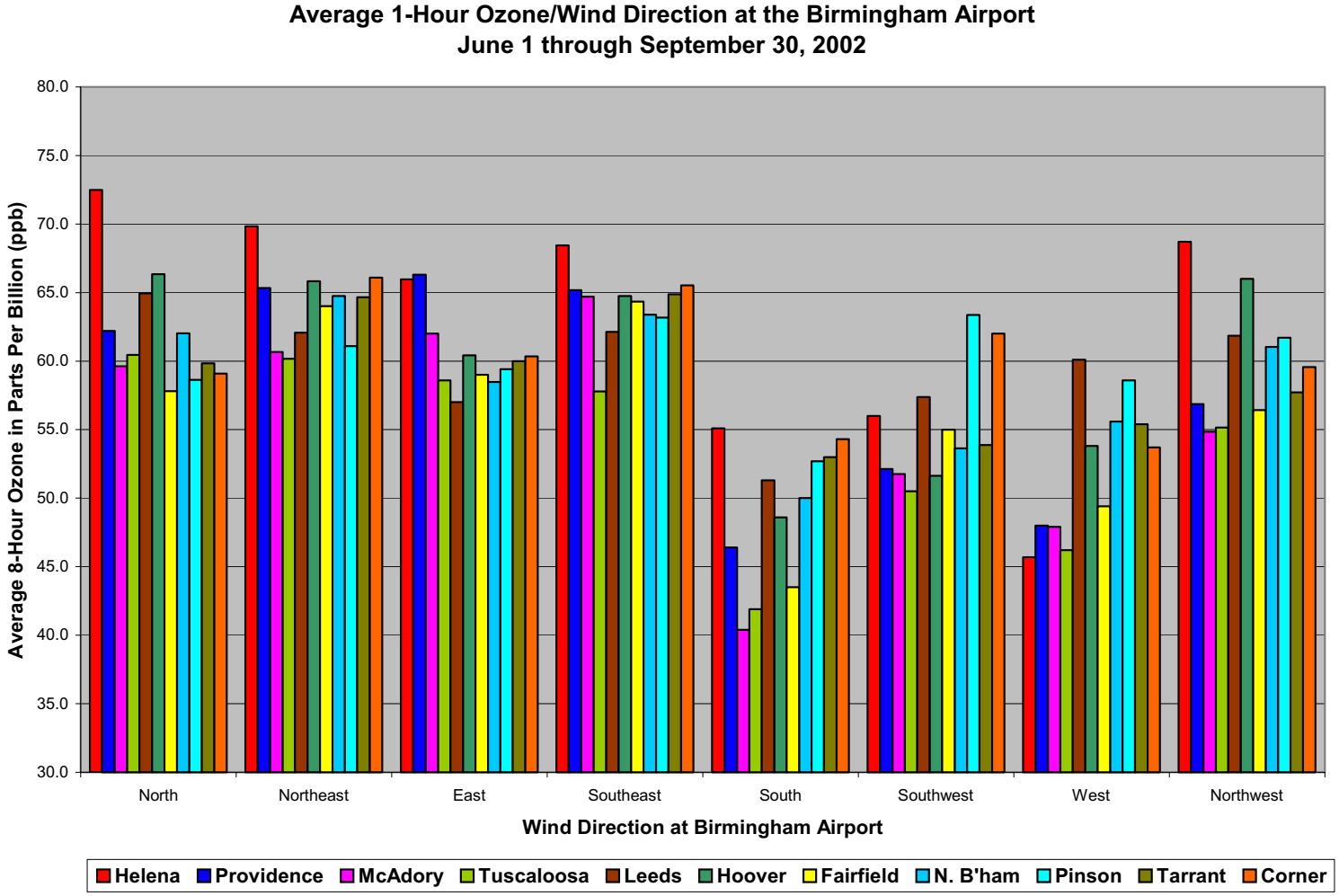


Figure 13. Average 1-Hour Ozone/Wind Direction at the Birmingham Airport, 2002

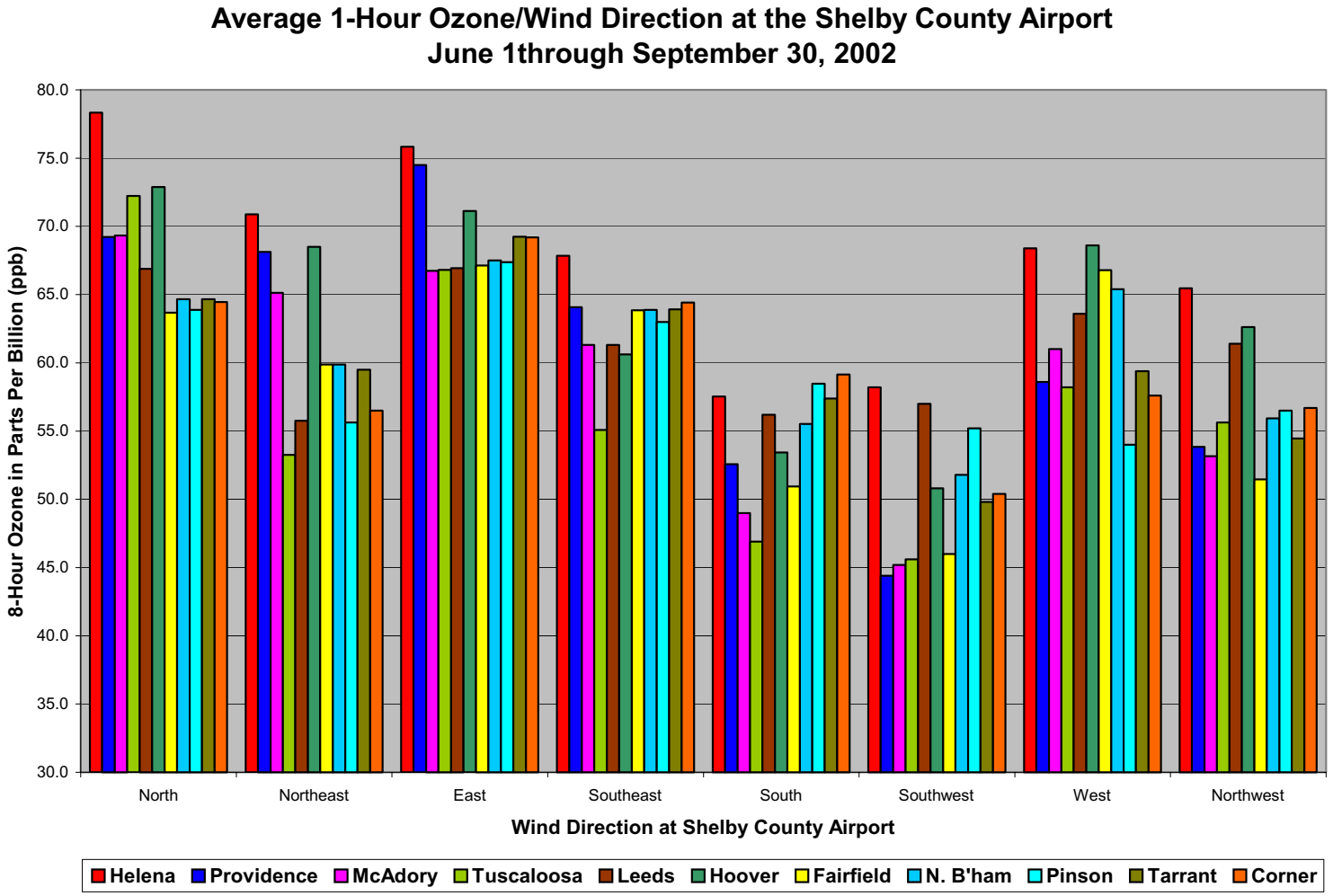


Figure 14. Average 1-Hour Ozone/Wind Direction at the Shelby County Airport, 2002

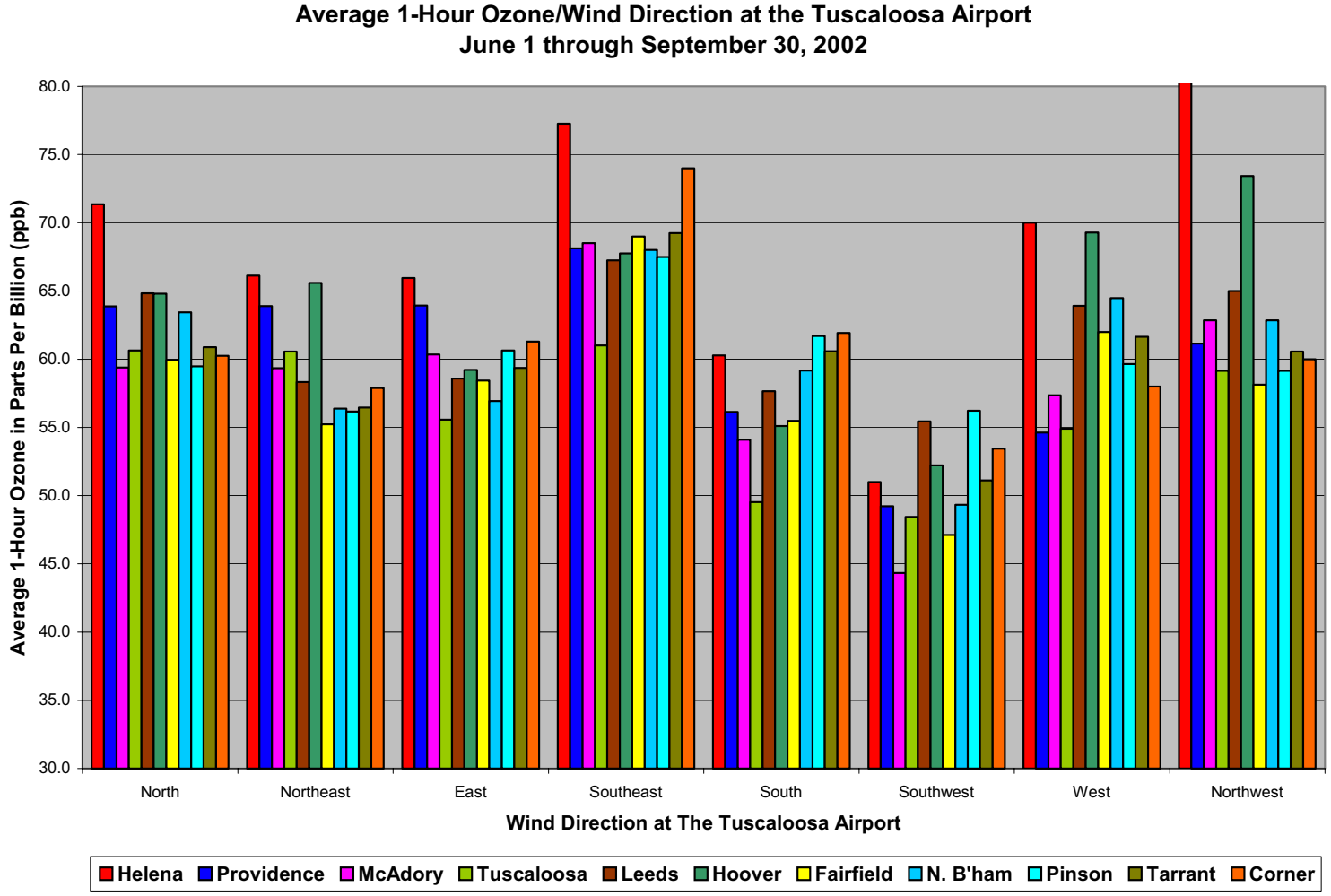


Figure 15. Average 1-Hour Ozone/Wind Direction at the Tuscaloosa Airport, 2002

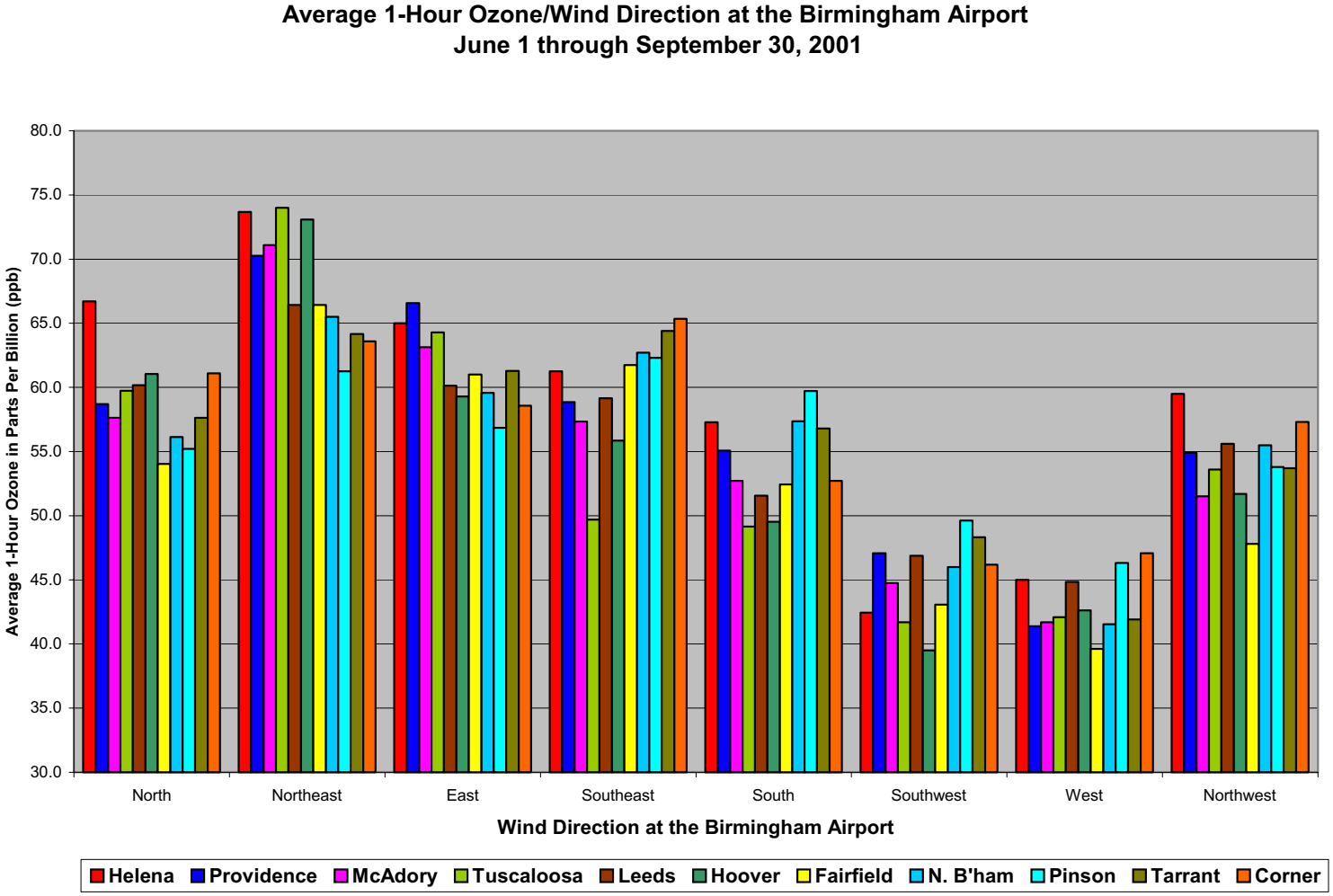


Figure 16. Average 1-Hour Ozone/Wind Direction at the Birmingham Airport, 2001

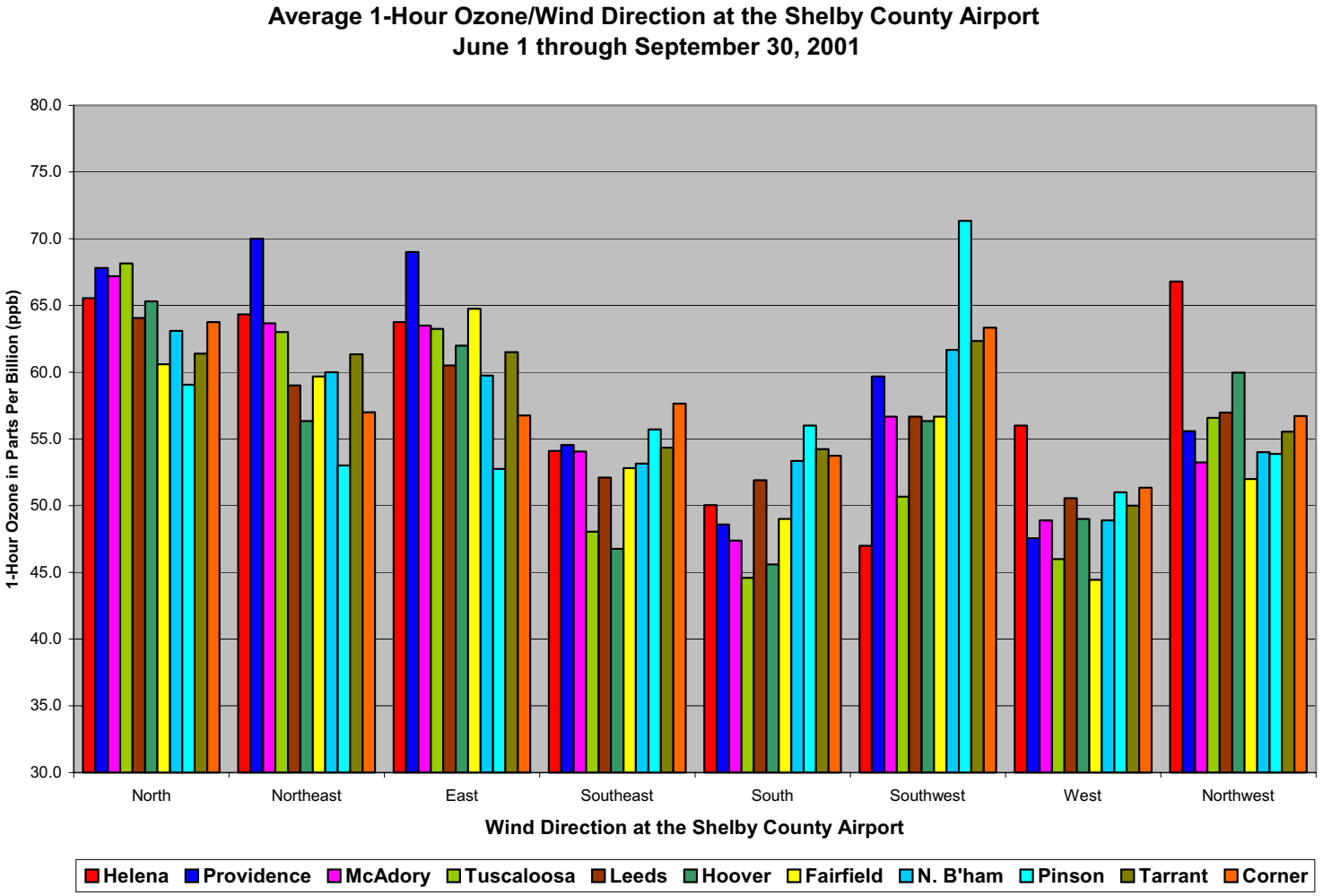


Figure 17. Average 8-Hour Ozone/Wind Direction at the Shelby County Airport, 2001

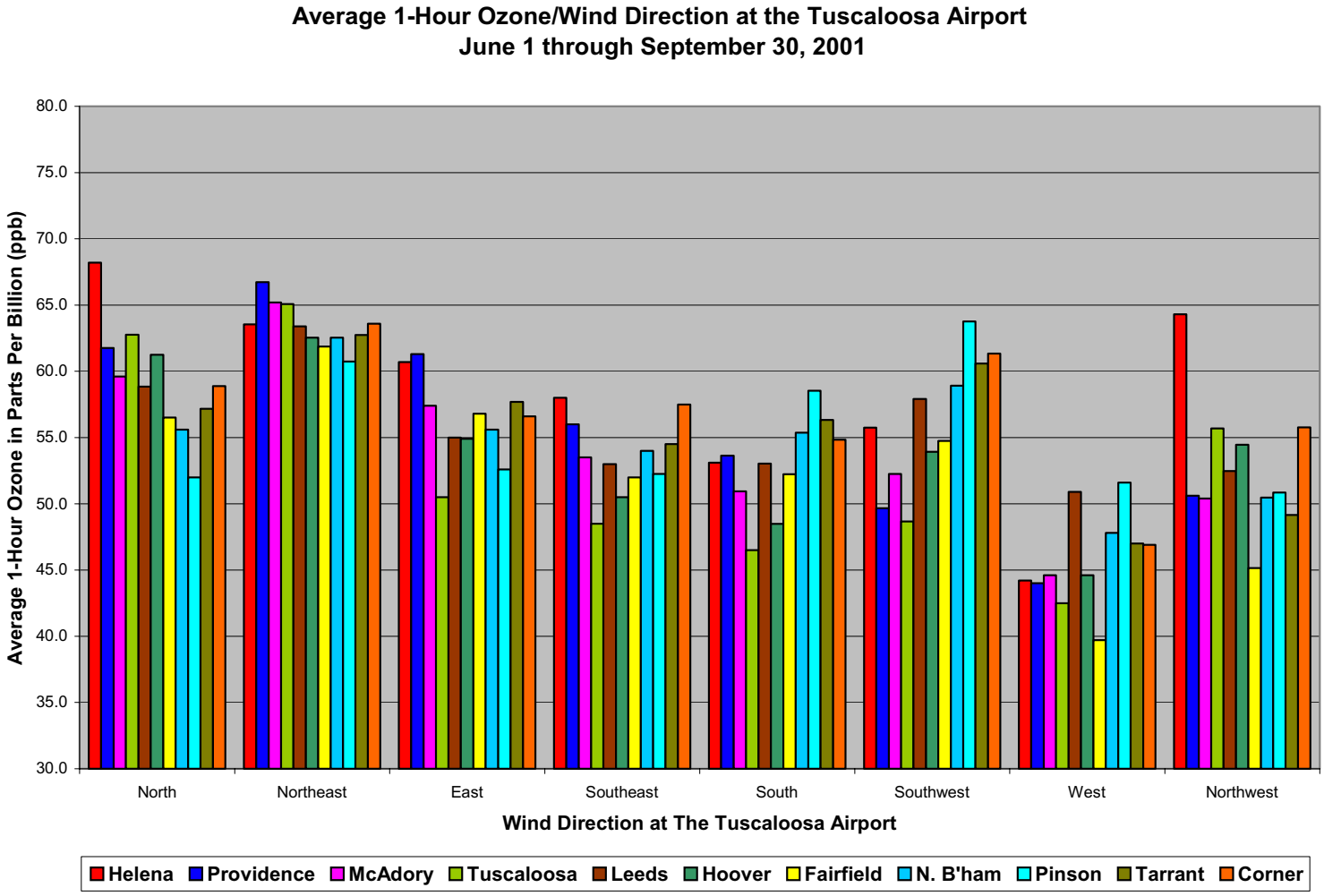


Figure 18. Average 1-Hour Ozone/Wind Direction at the Tuscaloosa Airport, 2001

Figure 19. Radial Plot of 8-Hour Exceedances, 2002

Figure 20. Radial Plot of 8-Hour Exceedances, 2001

Figure 21. Radial Plot of 1-Hour Exceedances and High Ozone Days (>105 ppb), 2002

Figure 22. Radial Plot of 1-Hour Exceedances and High Ozone Days (>105 ppb), 2001

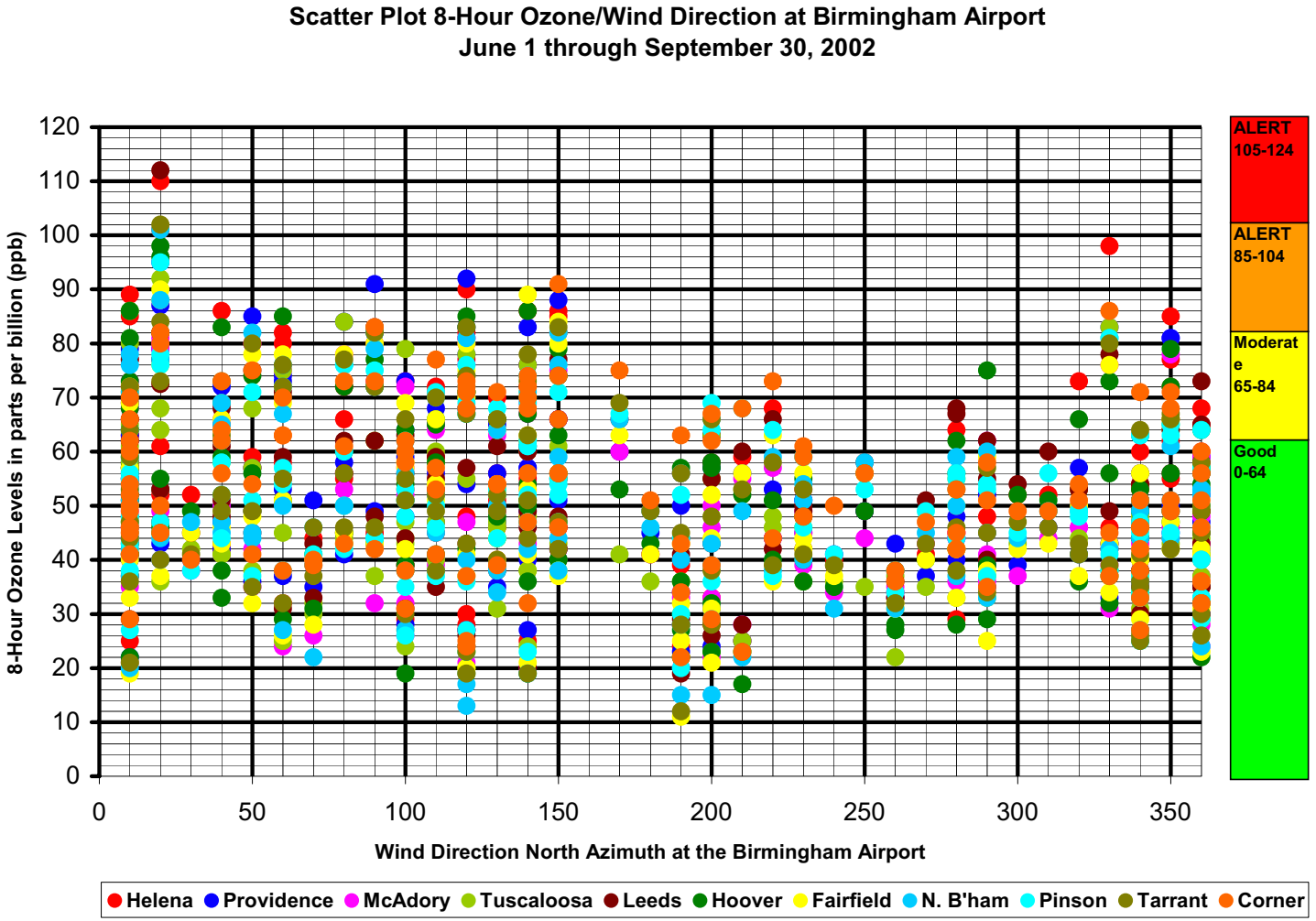


Figure 23. Scatter Plot of 8-Hour Ozone Levels all Monitoring Stations, Birmingham Airport Wind Direction, 2002

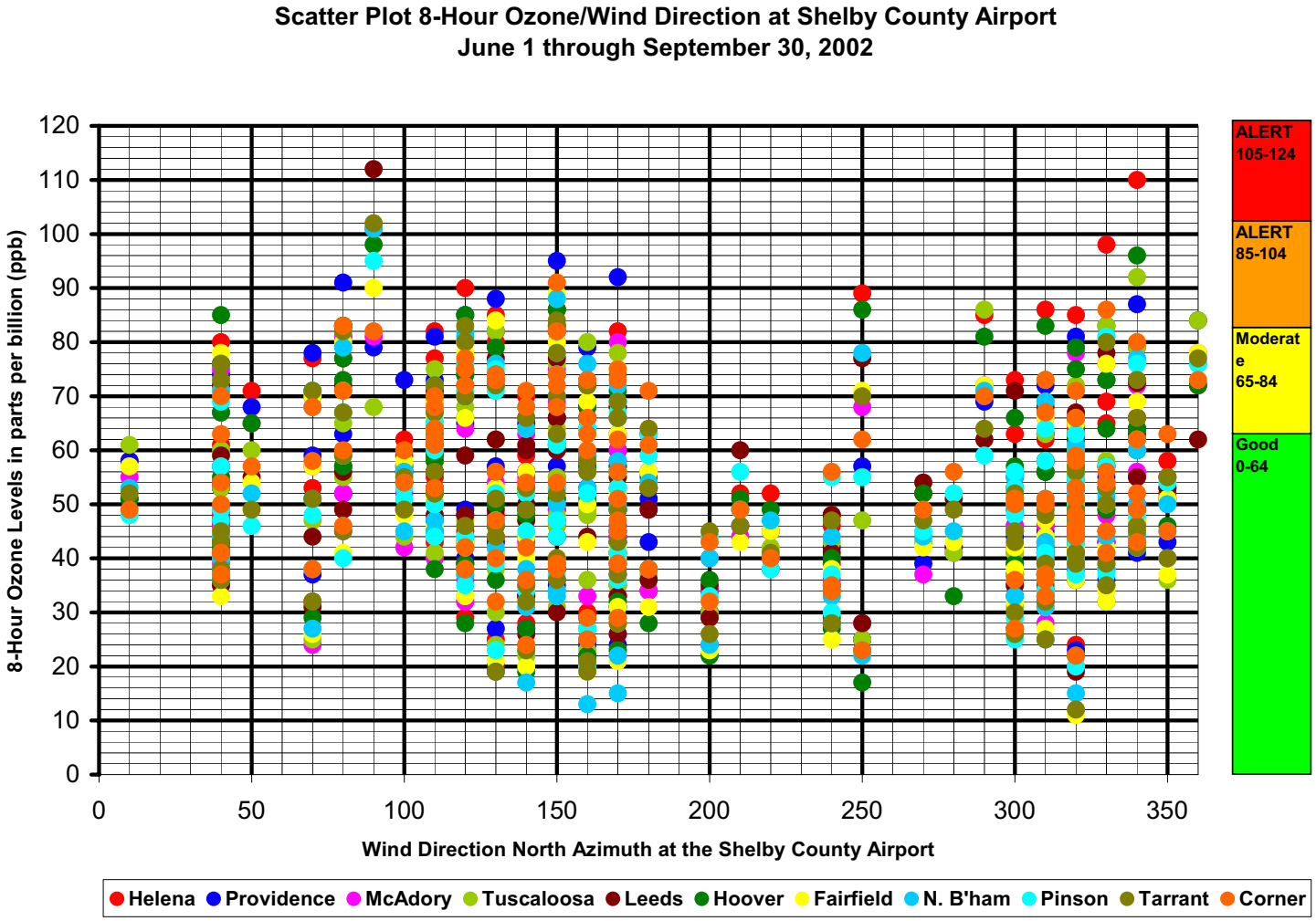


Figure 24. Scatter Plot of 8-Hour Ozone Levels all Monitoring Stations, Shelby County Airport Wind Direction, 2002

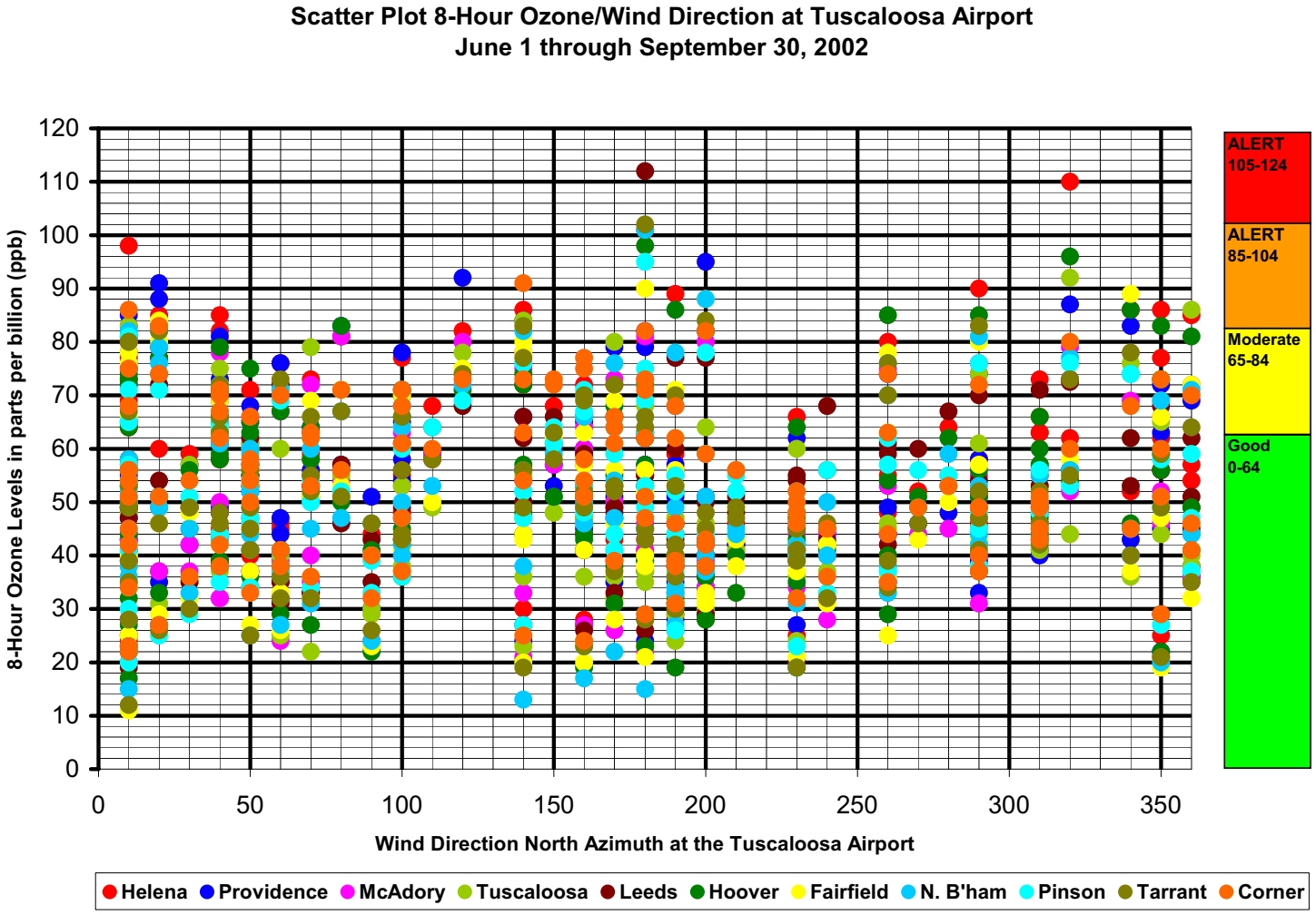


Figure 25. Scatter Plot of 8-Hour Ozone Levels all Monitoring Stations, Tuscaloosa Airport Wind Direction, 2002

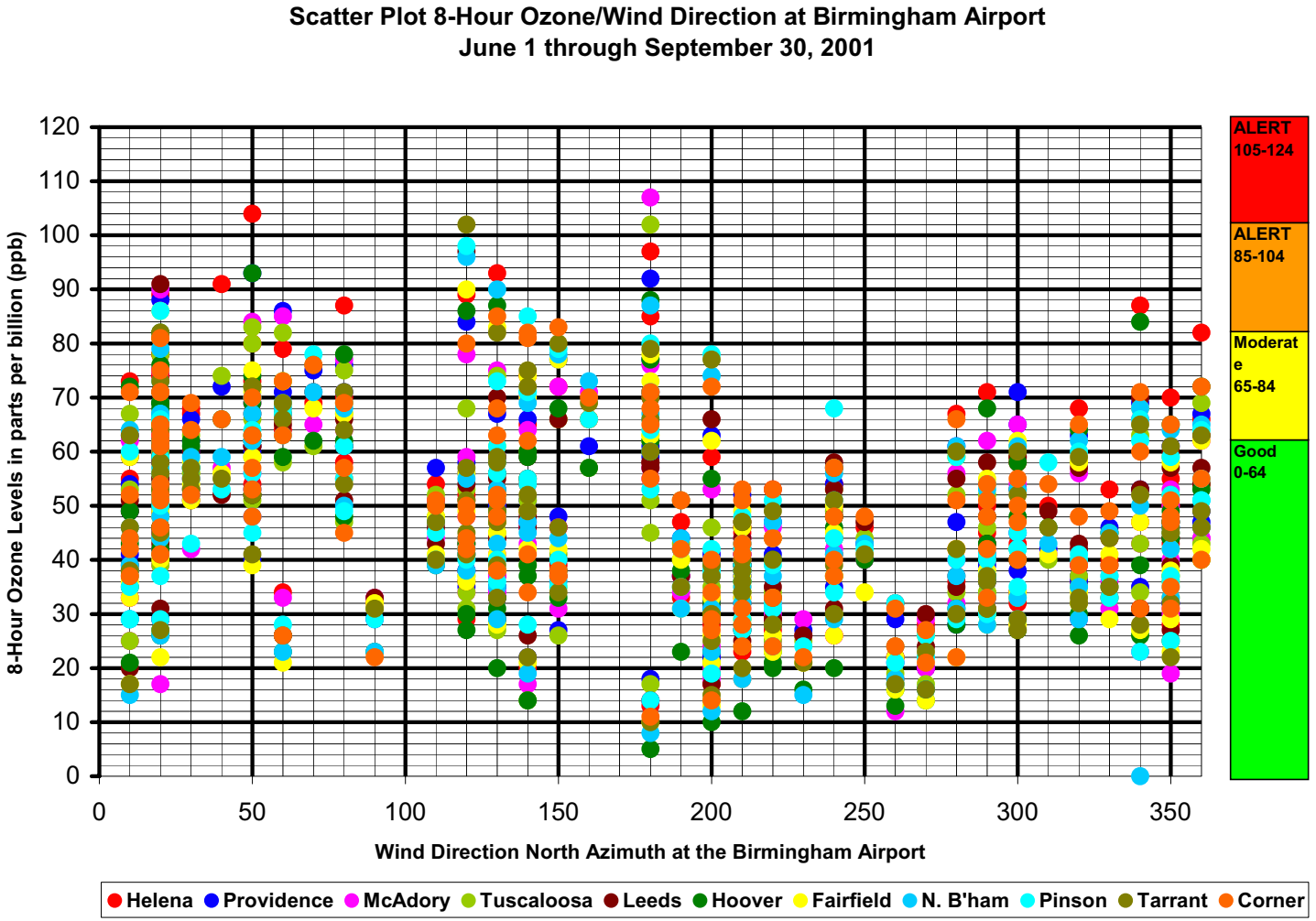


Figure 26. Scatter Plot of 8-Hour Ozone Levels all Monitoring Stations, Birmingham Airport Wind Direction, 2001

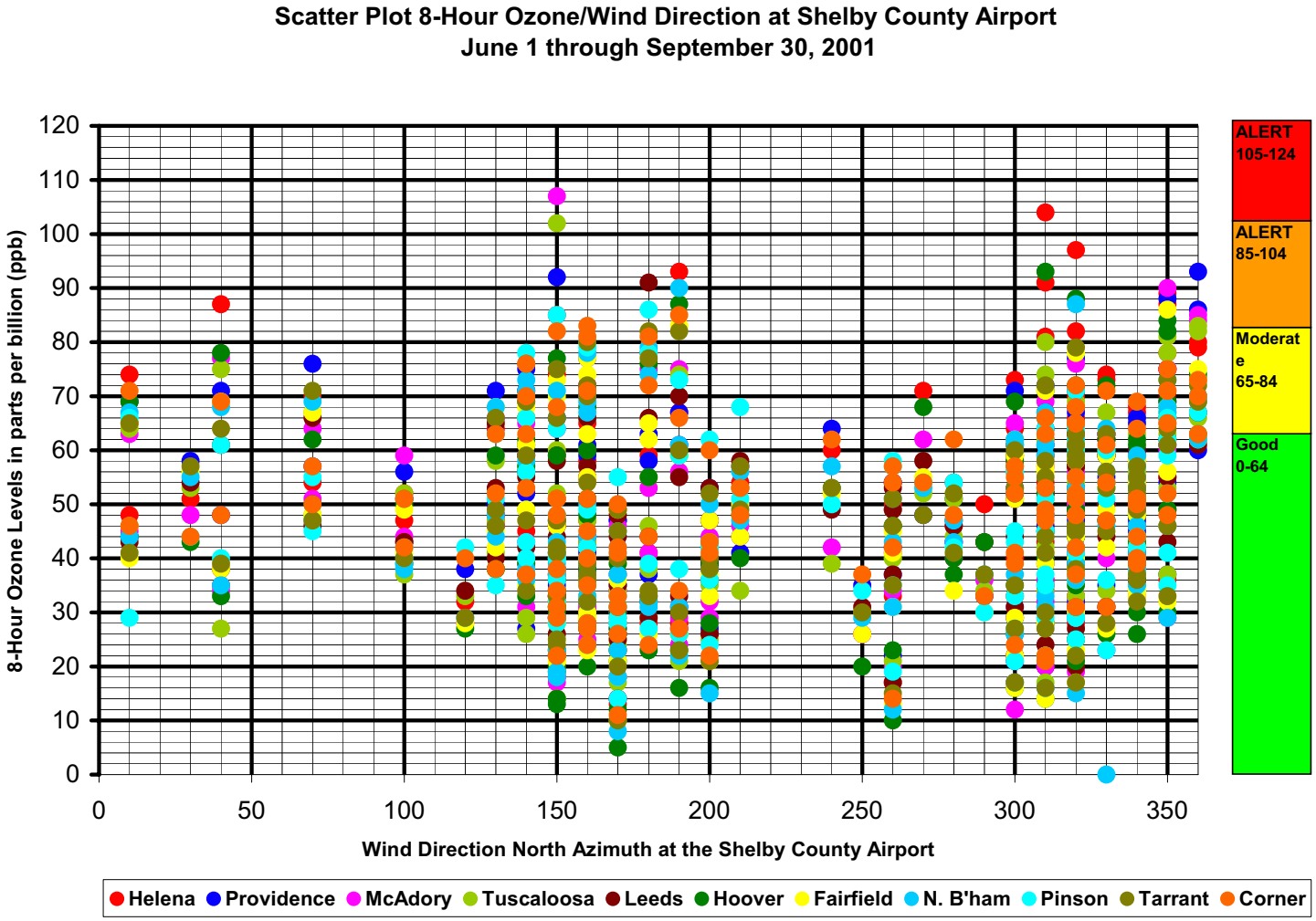


Figure 27. Scatter Plot of 8-Hour Ozone Levels all Monitoring Stations, Shelby County Airport Wind Direction, 2001

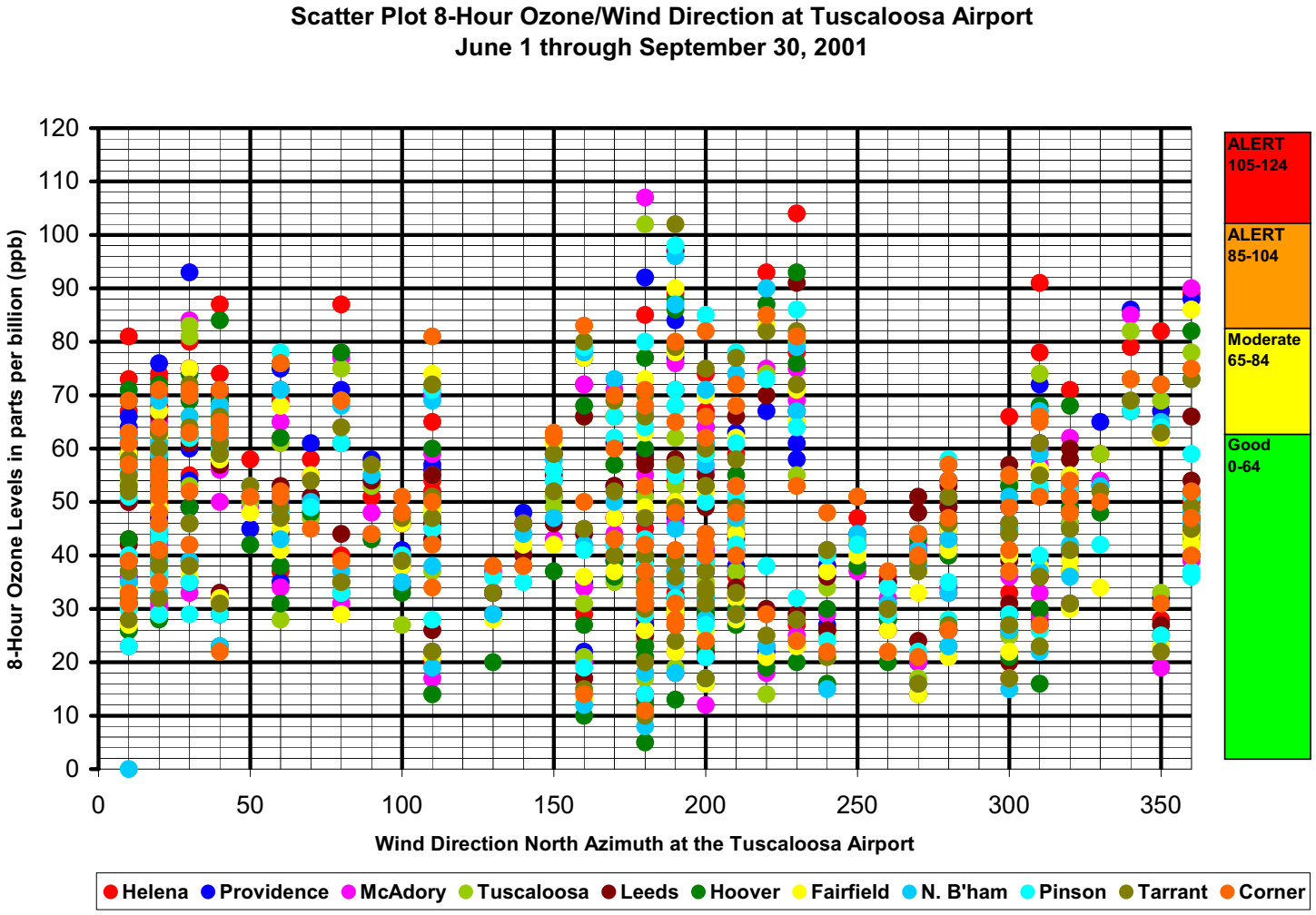


Figure 28. Scatter Plot of 8-Hour Ozone Levels all Monitoring Stations, Tuscaloosa Airport Wind Direction, 2001

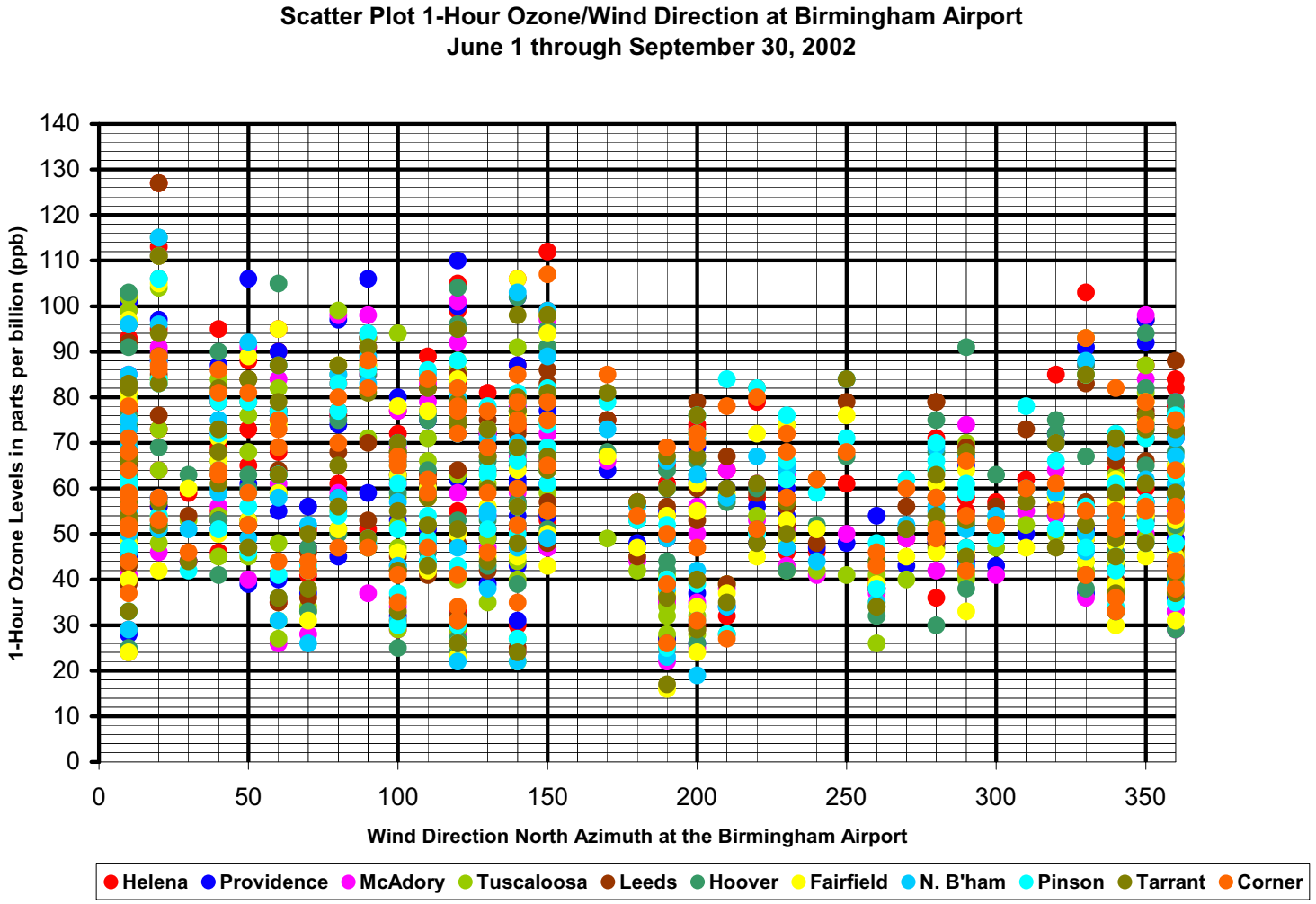


Figure 29. Scatter Plot of 1-Hour Ozone Levels all Monitoring Stations, Birmingham Airport Wind Directions, 2002

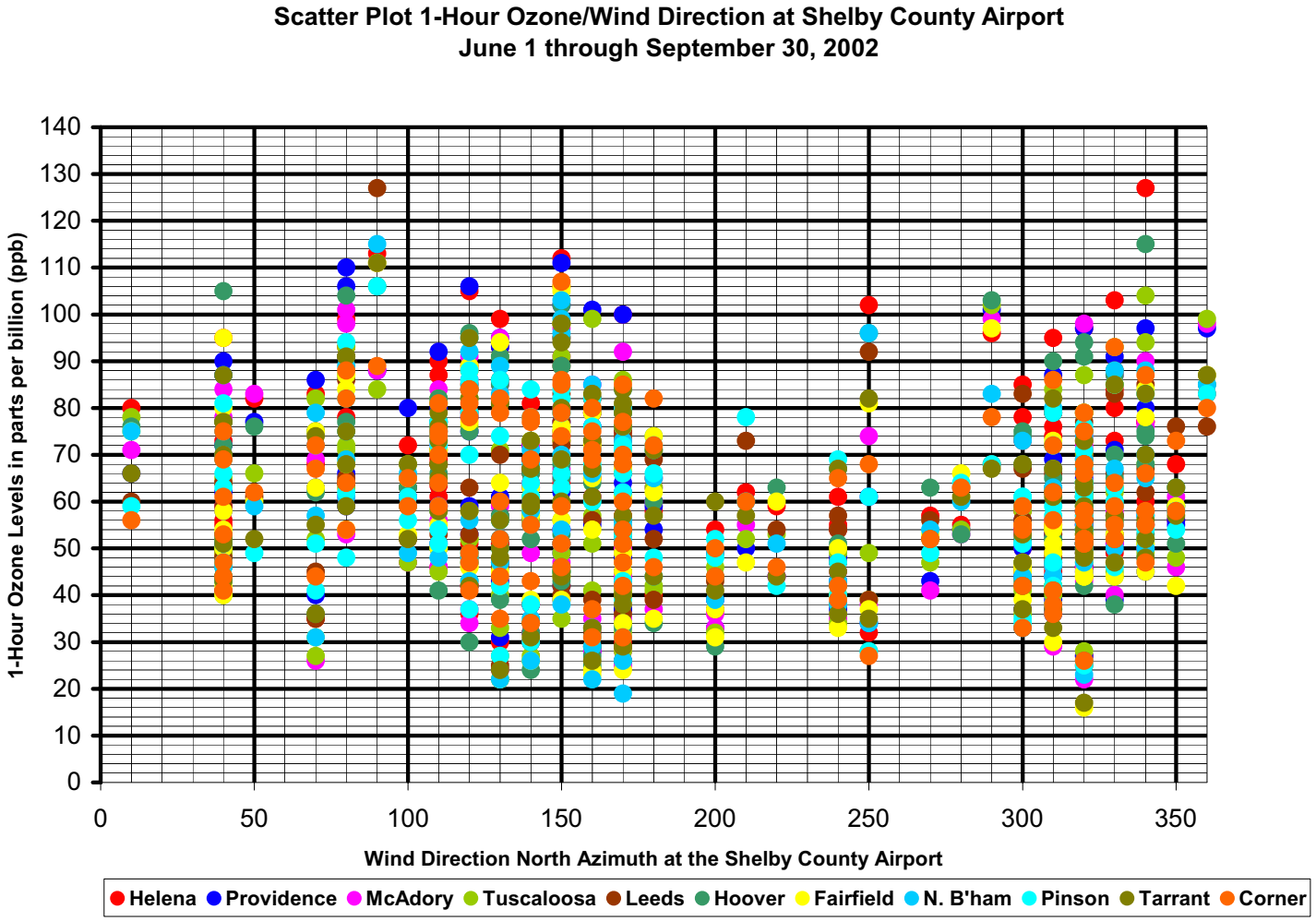


Figure 30. Scatter Plot of 1-Hour Ozone Levels all Monitoring Stations, Shelby County Airport Wind Direction, 2002

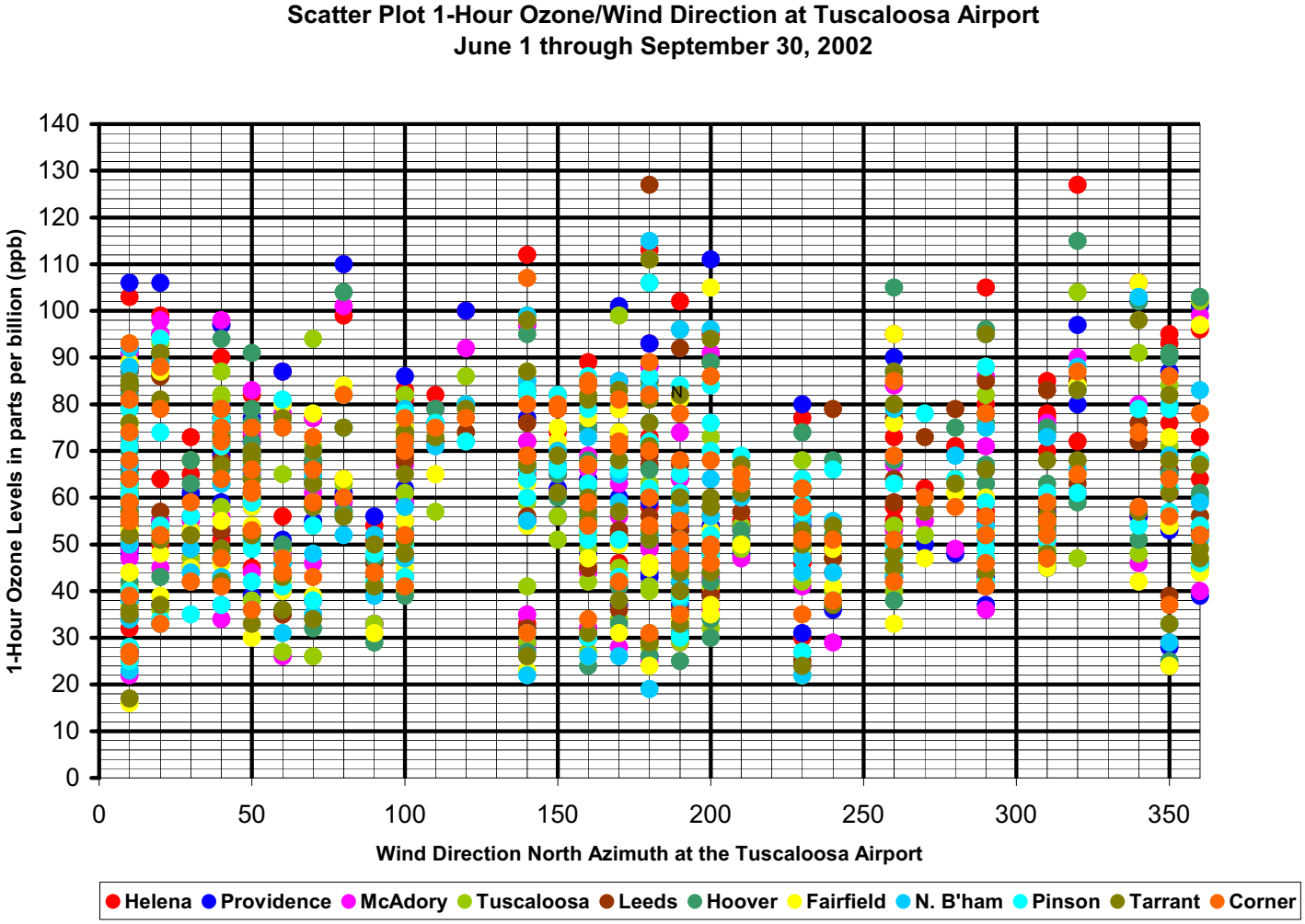


Figure 31. Scatter Plot of 1-Hour Ozone Levels all Monitoring Stations, Tuscaloosa Airport Wind Direction, 2002

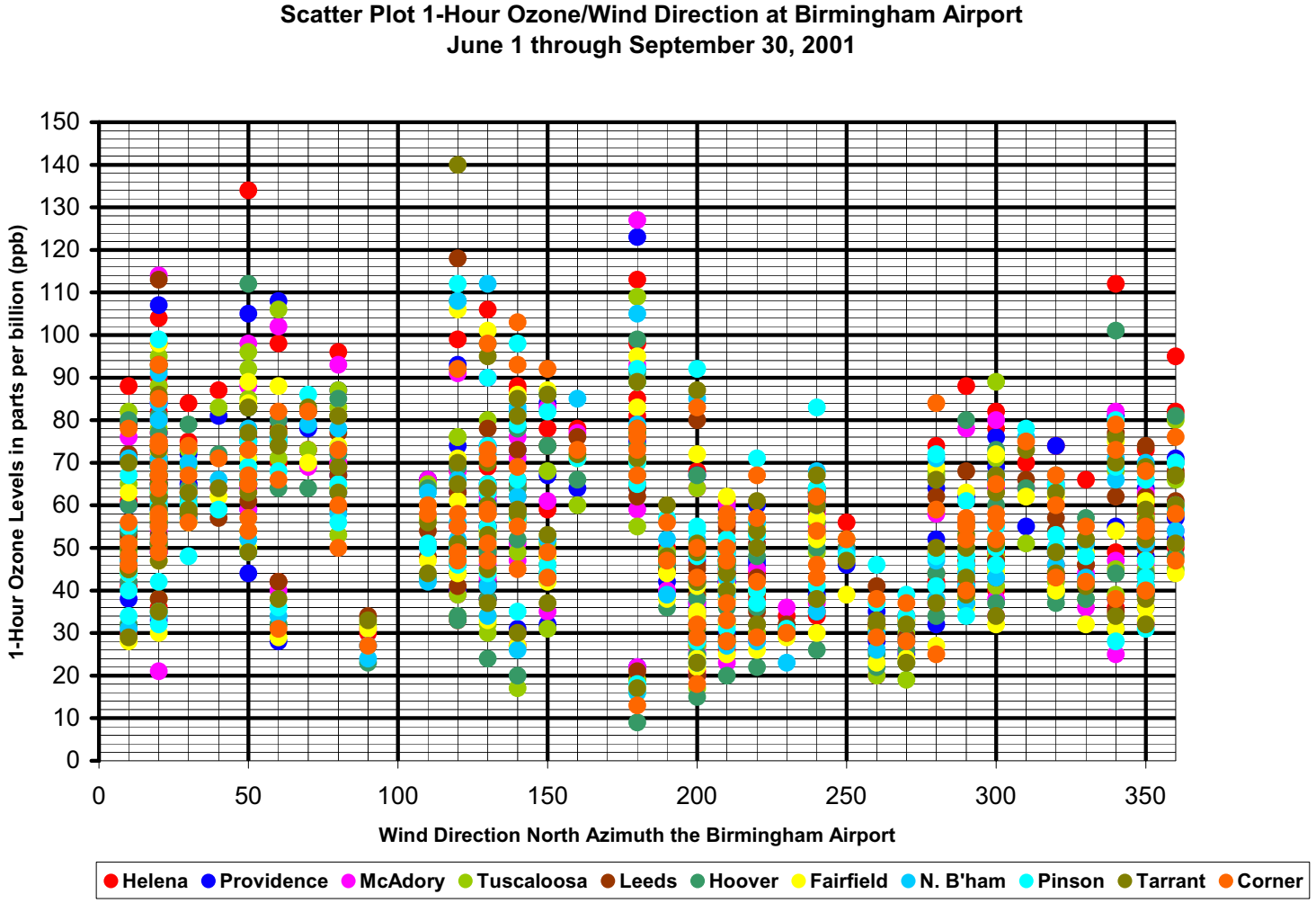


Figure 32. Scatter Plot of 1-Hour Ozone Levels all Monitoring Stations, Birmingham Airport Wind Direction, 2001

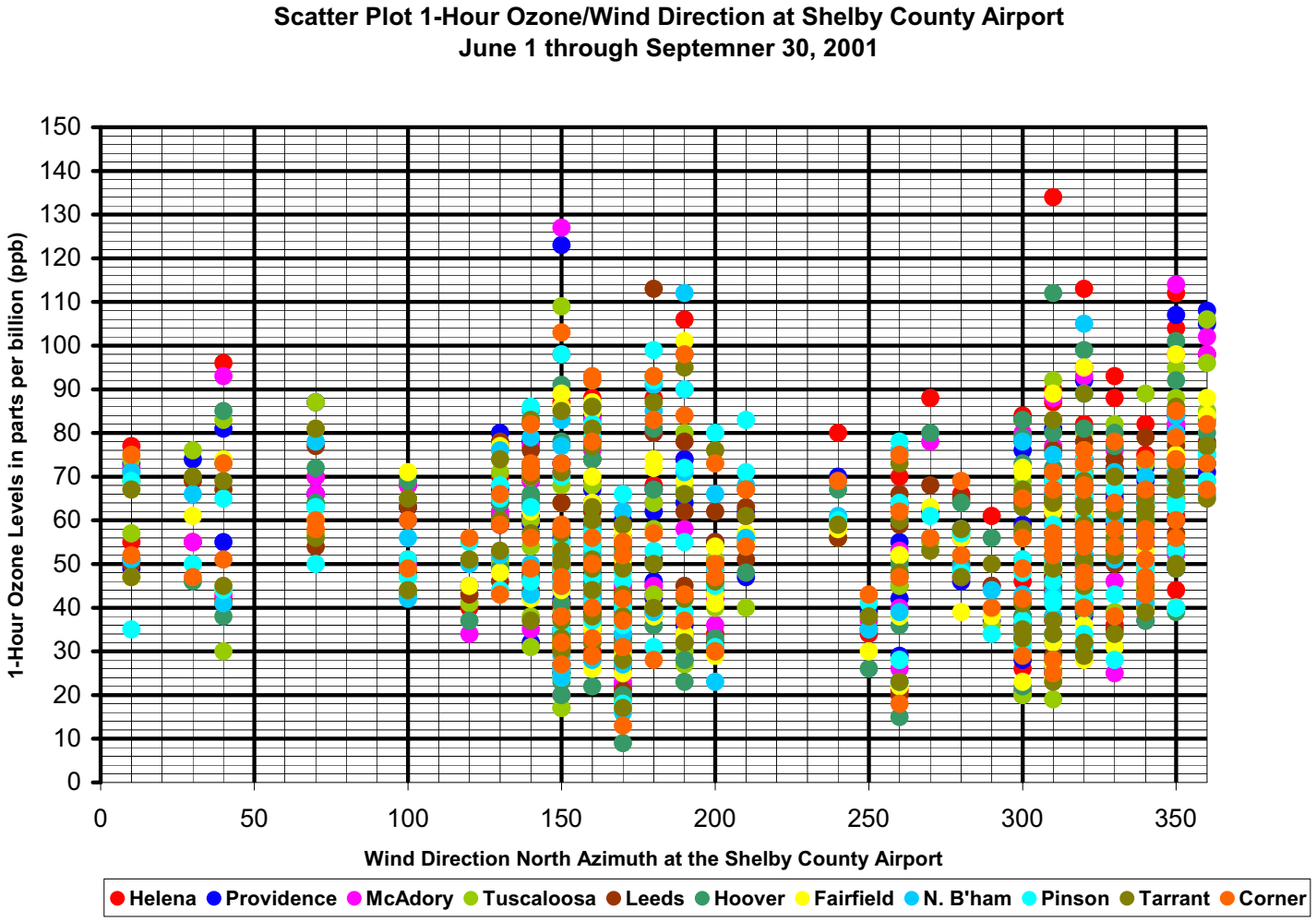


Figure 33. Scatter Plot of 1-Hour Ozone Levels all Monitoring Stations, Shelby County Airport Wind Direction, 2001

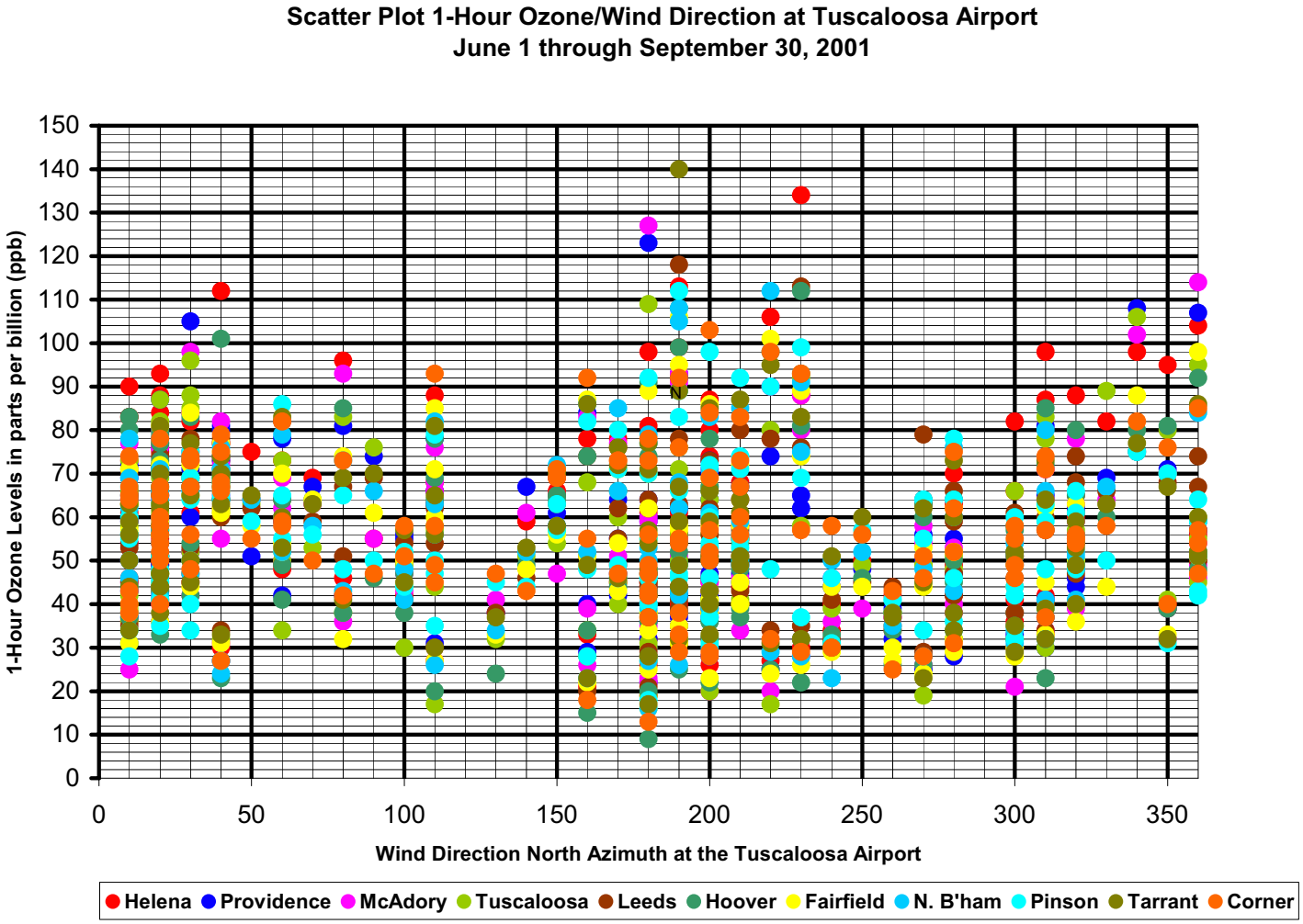


Figure 34. Scatter Plot of 1-Hour Ozone Levels all Monitoring Stations, Tuscaloosa Airport Wind Direction, 2001

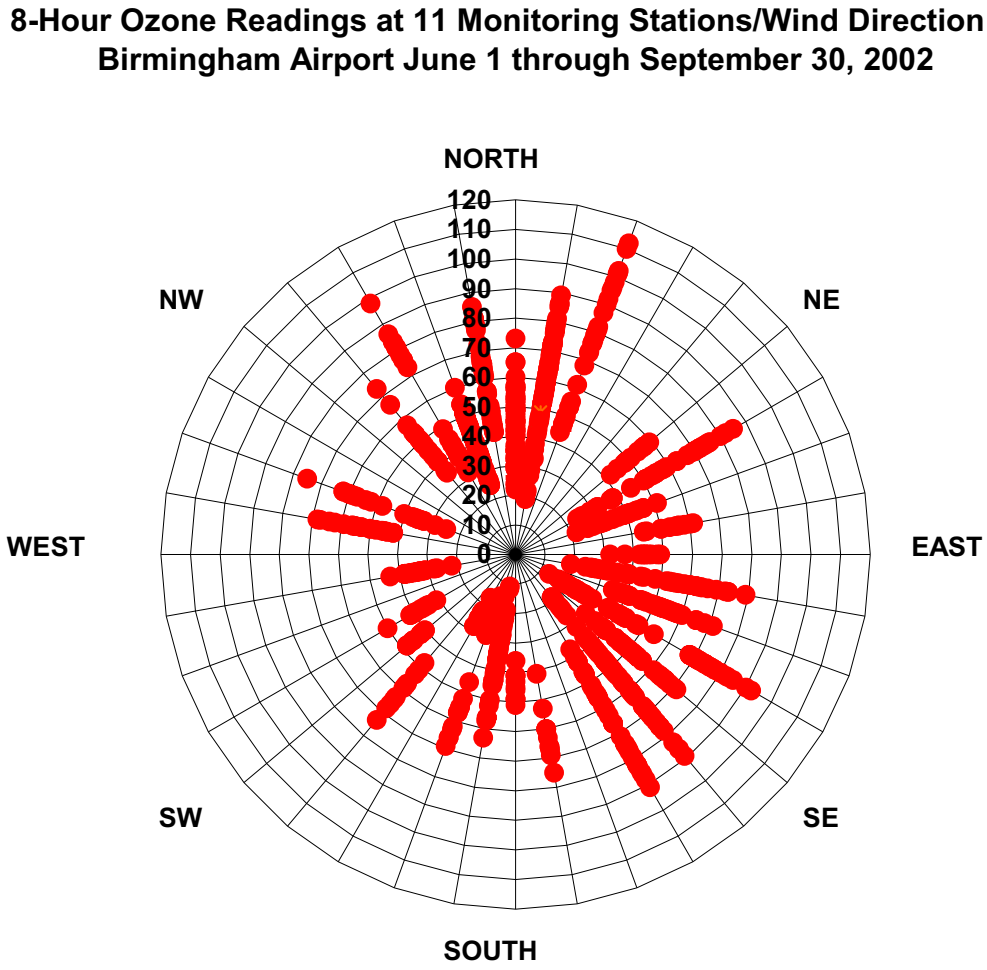


Figure 35. Radial Scatter Plot of 8-Hour Ozone Levels all Monitoring Stations, Birmingham Airport Wind Direction, 2002

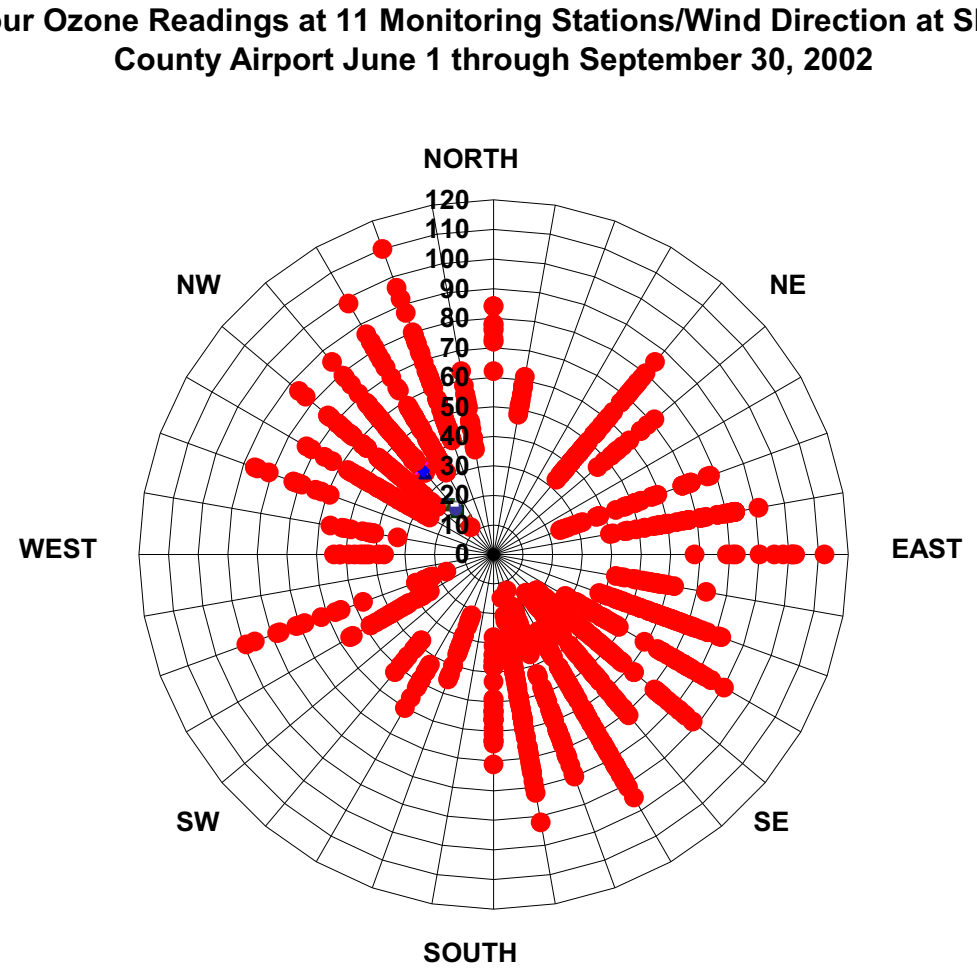


Figure 36. Radial Scatter Plot of 8-Hour Ozone Levels all Monitoring Stations, Shelby County Airport Wind Direction, 2002

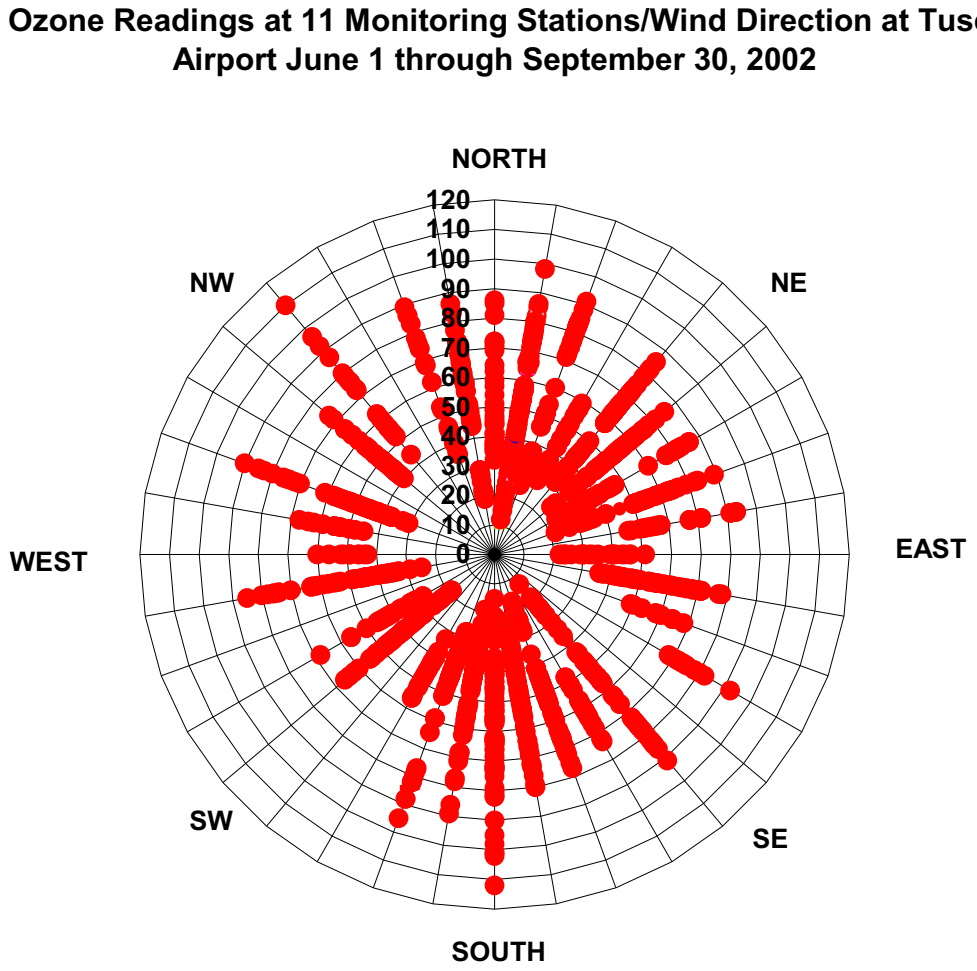


Figure 37. Radial Scatter Plot of 8-Hour Ozone Levels all Monitoring Stations,Tuscaloosa Airport Wind Direction, 2002

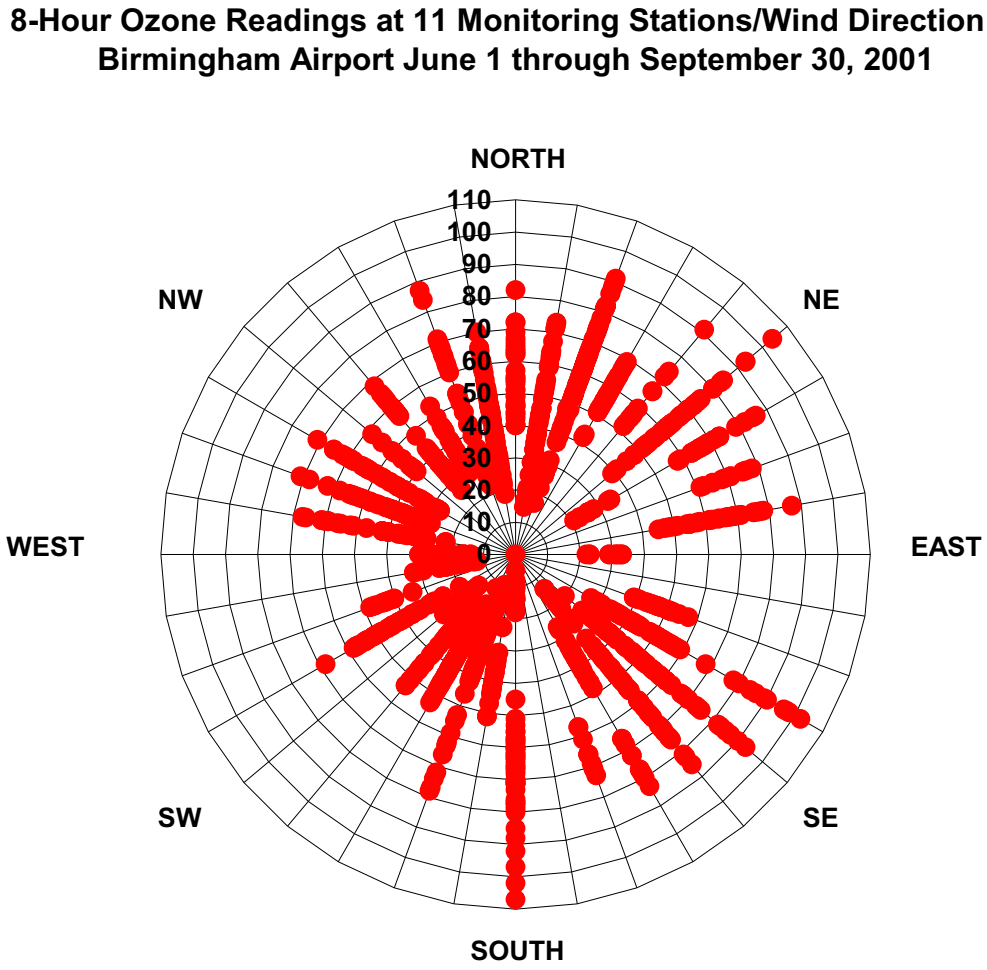


Figure 38. Radial Scatter Plot of 8-Hour Ozone Levels all Monitoring Stations, Birmingham Airport Wind Direction, 2001

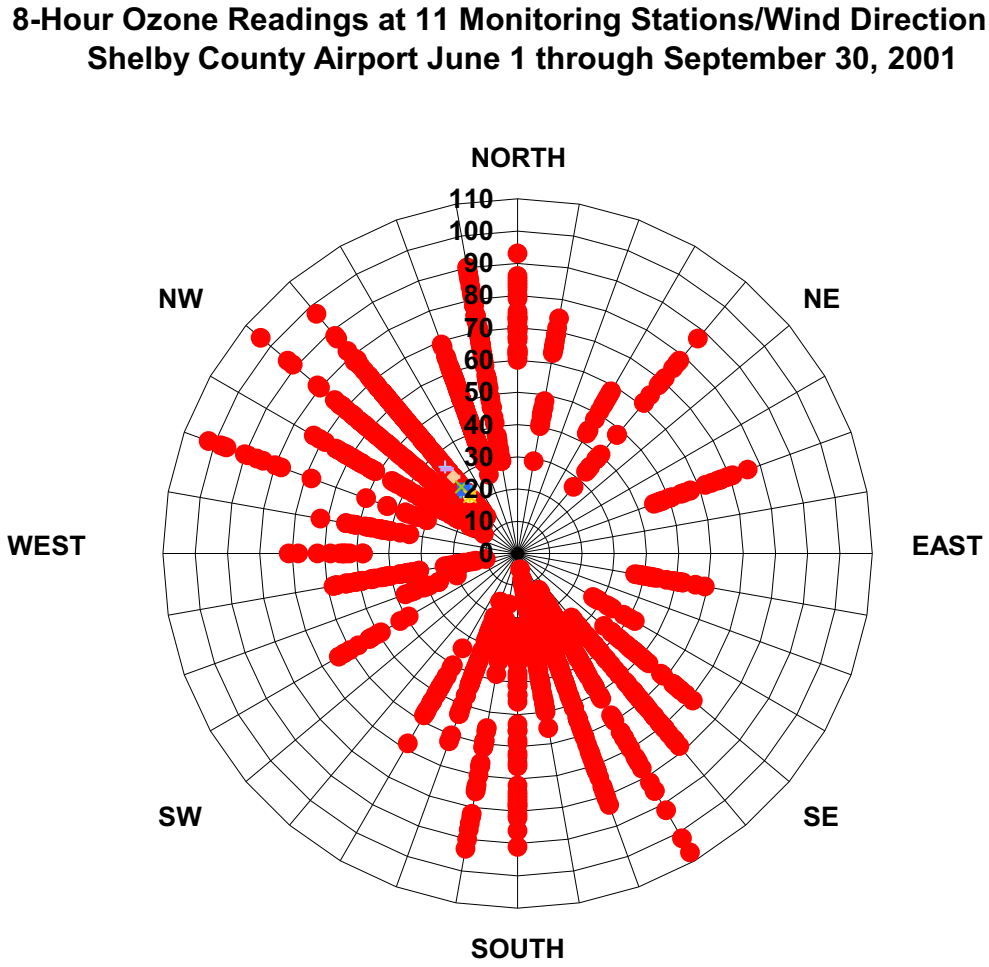


Figure 39. Radial Scatter Plot of 8-Hour Ozone Levels all Monitoring Stations, Shelby County Airport Wind Direction, 2001

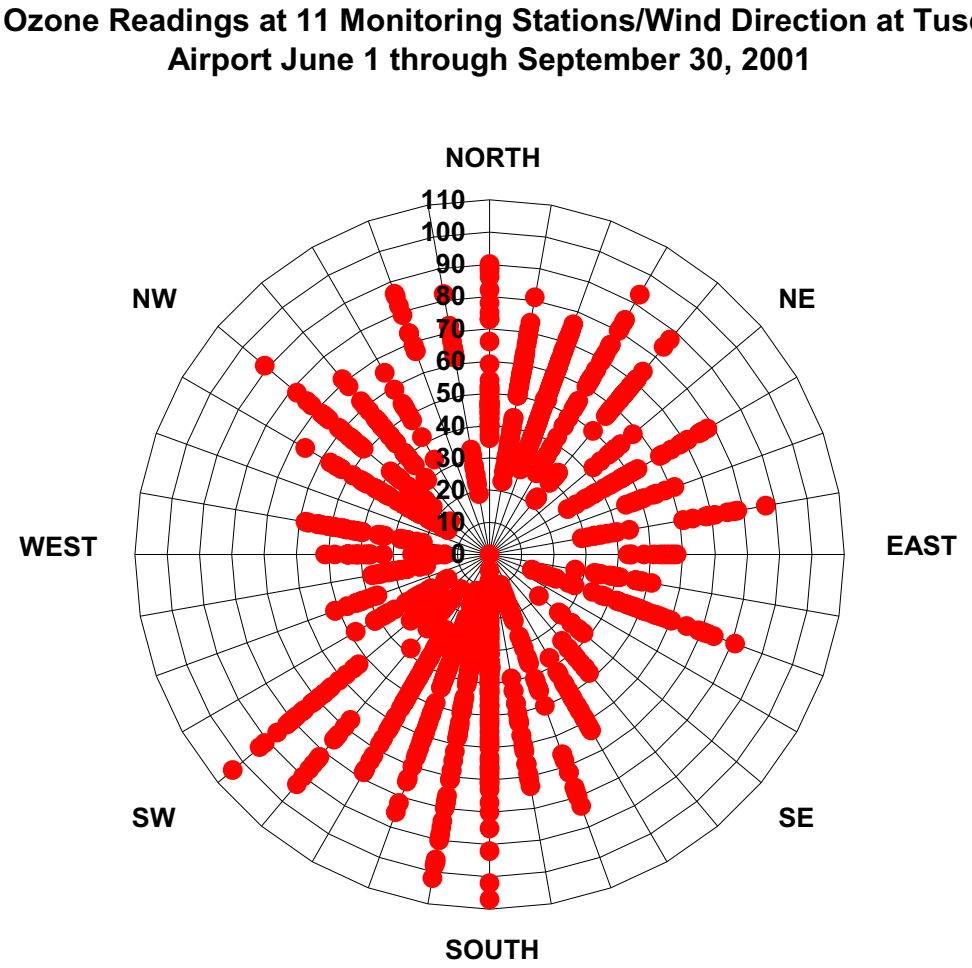


Figure 40. Radial Scatter Plot of 8-Hour Ozone Levels all Monitoring Stations, Tuscaloosa Airport Wind Direction, 2001

Appendix C

ADEM recommends that the Decatur Nonattainment Area for the 8-hour NAAQS for ozone exclude Lawrence County. EPA guidance (dated March 28, 2000) states that if a State wishes to propose a nonattainment area boundary smaller than the MSA boundary, the State must address how certain factors affect the drawing of the nonattainment boundary. Therefore, a discussion of these factors for the Decatur Nonattainment Area is provided in this Appendix.

The factors that provide the most compelling evidence to exclude Lawrence County are listed below:

- Population density and degree of urbanization in comparison to Morgan County
- Location of emission sources (i.e. the lack of significant point sources)
- Level of control of emission sources
- Regional emission reductions
- Monitoring data
- Traffic Patterns

Emissions from the adjoining Huntsville MSA are addressed in Appendix D. They will be examined with comparisons to the emissions of Morgan County.

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

The counties and MSA's adjacent to the Decatur MSA are depicted in Figure 1. To evaluate emissions for counties adjacent to Lawrence County, ADEM obtained the 1999 annual NOx and VOC emission estimates from the EPA's recommended website[1]. 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 Lawrence.

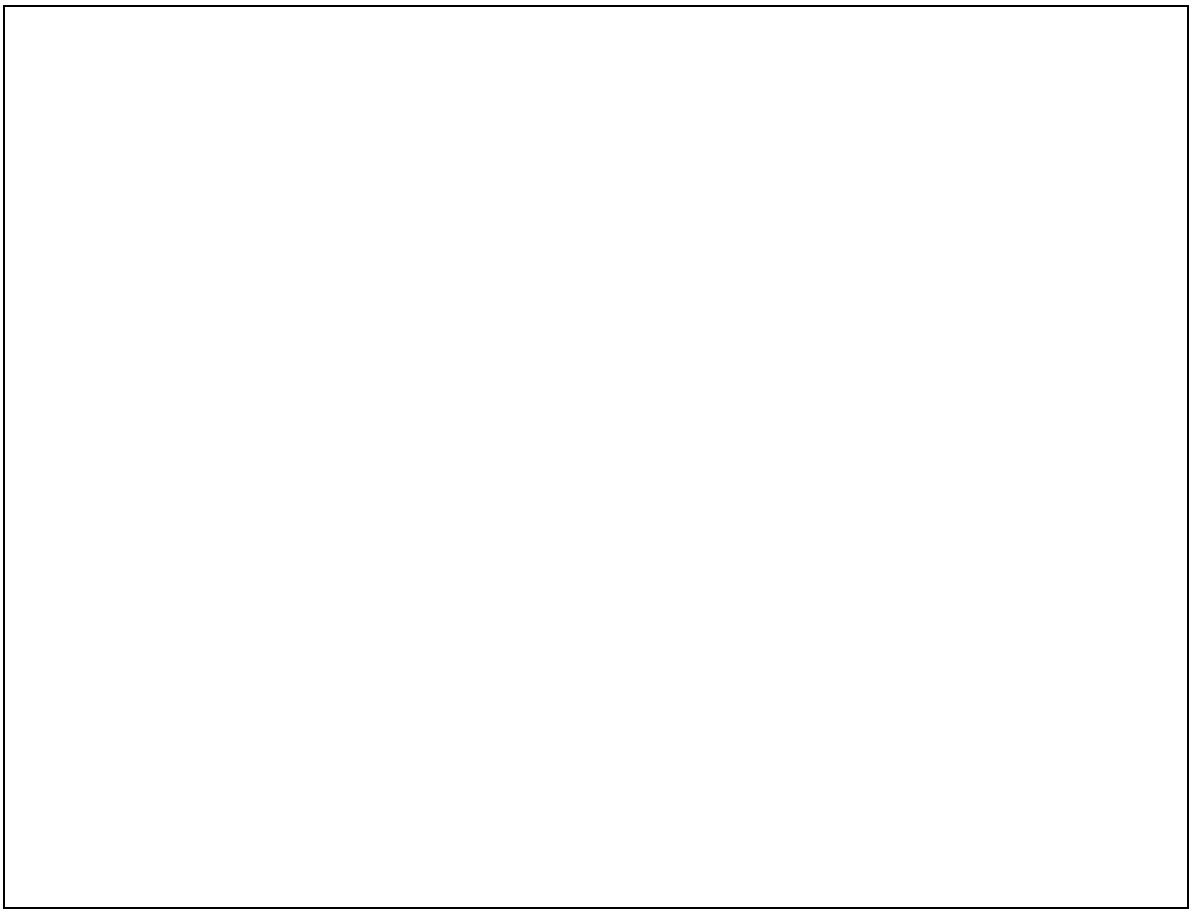


Figure 1 Areas adjacent to the Decatur MSA

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

Table 1 Annual Emissions for Areas Adjacent to Morgan County

County	1999 Annual VOC Emissions (Tons)	Ranking for VOC	1999 Annual NOx Emissions (Tons)	Ranking for NOx
Cullman	9,763	3	4,531	4
Lawrence[M]	5,817	6	5,777	3
Limestone	7,628	5	4,426	6
Madison[M]	18,537	2	11,753	1
Marshall	9,363	4	4,479	5
Morgan[M]	19,112	1	11,575	2

[M] County has an ozone monitor

As shown in Table 1, VOC emissions in Lawrence County are smaller than any adjacent county. In addition, NOx emissions in Lawrence County are less than half of the NOx emissions in Morgan County.

Morgan County has a design value above the 8-hour NAAQS for ozone based on monitoring data for 2000, 2001, and 2002, while the design values for Lawrence and Madison Counties meet the 8-hour NAAQS for ozone based on the same years of data. There were no other ozone monitoring sites in this area during this time period; therefore, there is limited air quality information. Additionally, there is no distinct disparity in emissions among the adjacent areas.

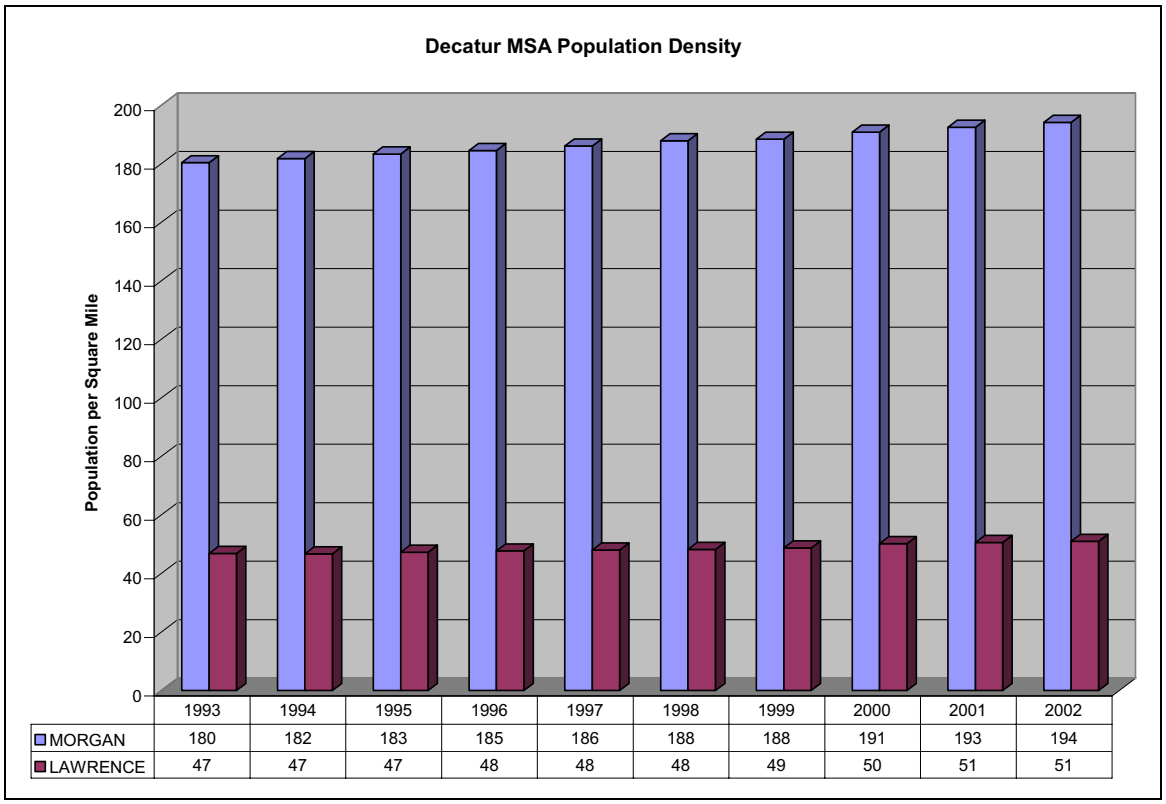
Evaluating the emissions and air quality in adjacent areas provides no compelling indicator as to whether Lawrence should be included or excluded from the Decatur Nonattainment Area.

Emissions from the Huntsville MSA are addressed in Appendix D.

B. Population Density and degree of urbanization including commercial development (significant difference from surrounding areas)

To evaluate the various aspects of population, ADEM obtained the 1993 to 2002 population estimates for the Decatur MSA 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 of each county (in square miles). Figure 2 depicts the population densities for the counties in the Decatur MSA. Morgan has a smaller land area than Lawrence (582 sq. mi. versus 693 sq. mi., respectively) which skews the impact of the population density factor. Even considering this factor, Lawrence has a significantly smaller population density than Morgan. This population density factor fortifies the recommendation to exclude Lawrence County from the Decatur Nonattainment Area.



	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
MORGAN	180	182	183	185	186	188	188	191	193	194
LAWRENCE	47	47	47	48	48	48	49	50	51	51

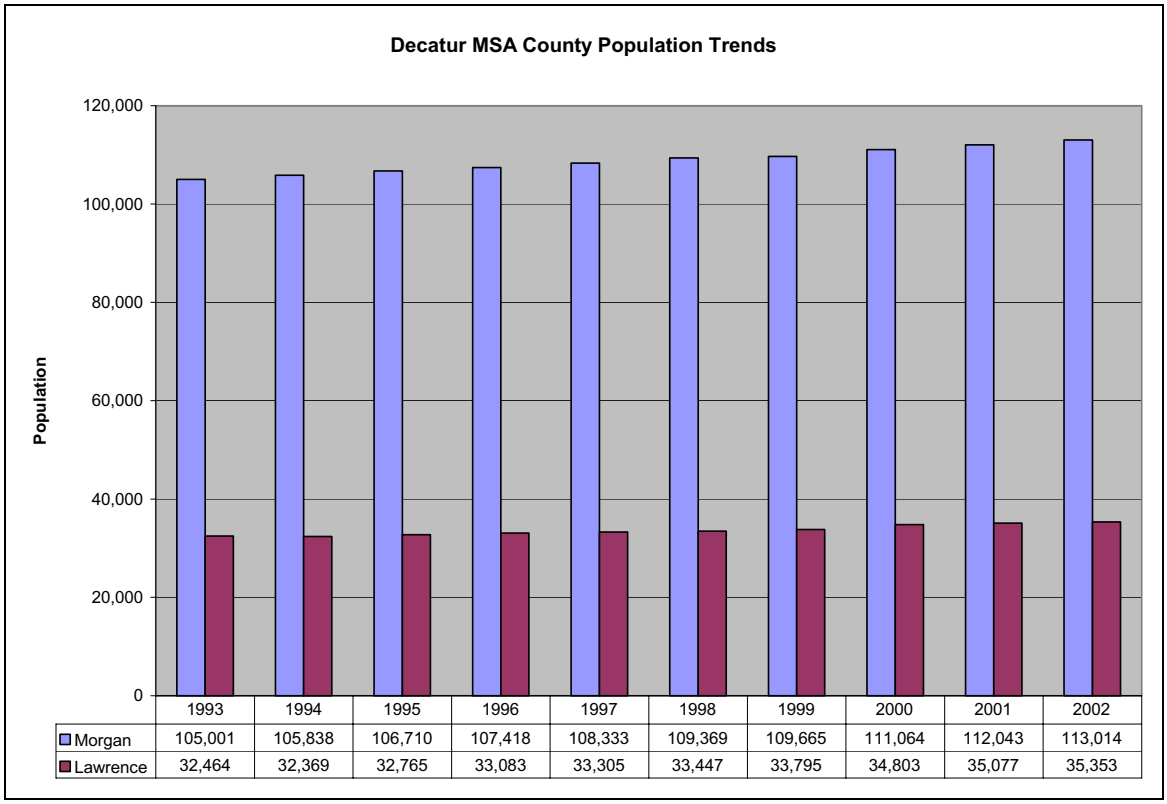
Figure 2 Population Density for Decatur MSA

[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

Table 2 compares the 1993 and 2000 population estimates. Population data is also presented in Figures 3 and 4. This data reveals that Morgan has a significantly higher population than Lawrence. There has been no significant growth in Lawrence; in fact, population is growing at about the same rate in each county. Morgan has consistently represented over 75% of the Decatur MSA's population. These population factors fortify the recommendation to exclude Lawrence from the Decatur Nonattainment Area.

Table 2 Decatur MSA Population

County	1993	2002	Population Change (1993-2002)	% Change	% of MSA 2002 Population
Morgan	105,001	113,014	8,013	7.6%	76.2%
Lawrence	32,464	35,353	2,889	8.9%	23.8%
MSA Total	137,465	148,367	10,902	7.9%	100.0%



	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Morgan	105,001	105,838	106,710	107,418	108,333	109,369	109,665	111,064	112,043	113,014
Lawrence	32,464	32,369	32,765	33,083	33,305	33,447	33,795	34,803	35,077	35,353

Figure 3 Population Data for Decatur MSA

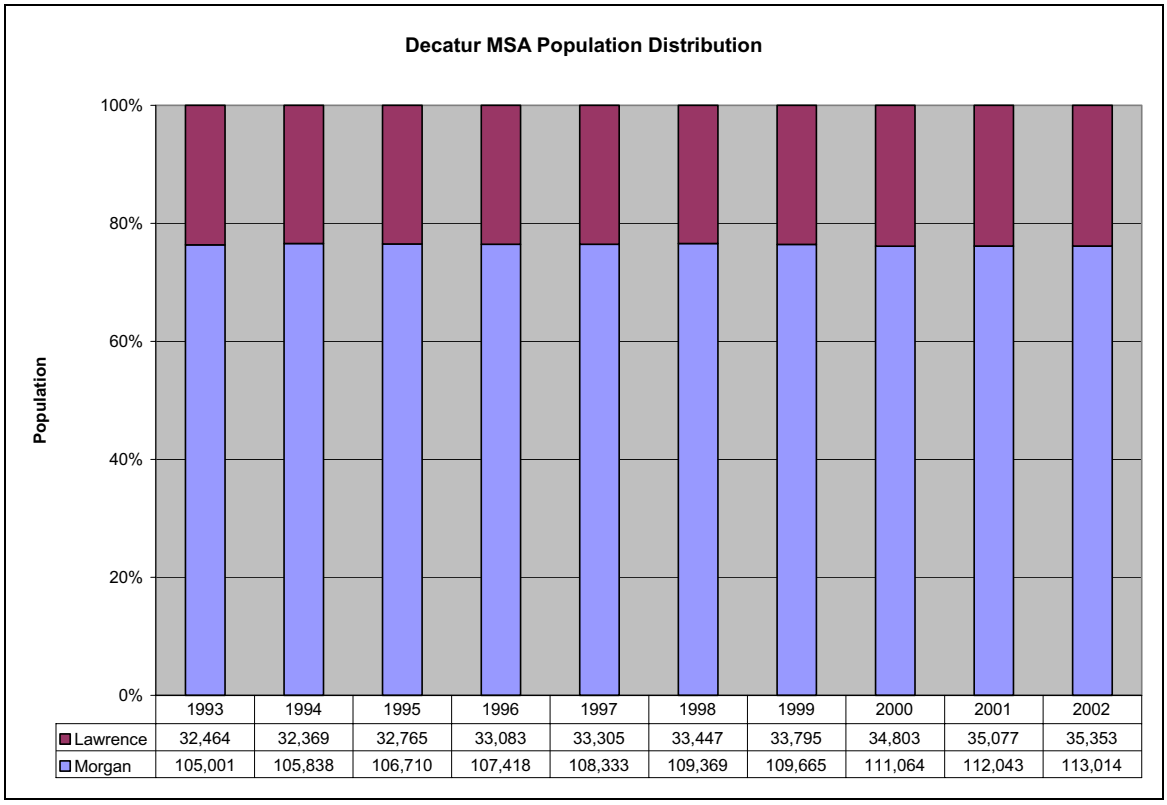


Figure 4 Population Distribution for Decatur MSA

The amount and percent of urbanized population in the Decatur MSA is presented in Table 3. This data clearly shows that Lawrence has an insignificant urban population in comparison to Morgan. This factor fortifies the recommendation to exclude Lawrence County from the Decatur Nonattainment Area.

Table 3 Urban Population for Decatur MSA

County Name	% Urban[3]	1990 Population	1990 Urban Population	% of MSA Total 1990 Urban Population	2002 Population	2002 Urban Population	% of MSA Total 2002 Urban Population
Morgan	63.5%	100,043	63,495	95.1%	113,014	71,727	95.2%
Lawrence	10.3%	31,513	3,248	4.9%	35,353	3,644	4.8%
MSA Totals	50.7%	131,556	66,743	100.0%	148,367	75,371	100.0%

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

Tables 4, 5, and 6 show the trends in Total Employment, Manufacturing Employment, and Retail Employment, respectively, for the Decatur MSA. Figure 5 demonstrates that the number of Total Employees for Lawrence is not substantial in comparison to Morgan. In addition, Morgan and Lawrence show similar growth trends in employment, none of which show remarkable growth. This factor fortifies the recommendation to exclude Lawrence County from the Decatur Nonattainment Area.

Table 4 Total Employees

	1998	1999	2000	2001	% Change 1998-2001	% of 2001 MSA Total
Morgan	45,996	45,719	46,656	46,206	0.5%	90.5%
Lawrence	5,828	5,517	5,389	4,872	-16.4%	9.5%
MSA Total	51,824	51,236	52,045	51,078	-1.4%	100.0%

Table 5 Manufacturing Employees

	1998	1999	2000	2001	% Change 1998-2001	% of 2001 MSA Total
Morgan	14,697	14,375	14,404	13,816	-6.0%	88.1%
Lawrence	1,750	2,206	2,103	1,866	6.6%	11.9%
MSA Total	16,447	16,581	16,507	15,682	-4.7%	100.0%

Table 6 Retail Employees

	1998	1999	2000	2001	% Change 1998-2001	% of 2001 MSA Total
Morgan	6,432	6,505	6,253	6,342	-1.4%	89.5%
Lawrence	745	819	786	745	0%	10.5%
MSA Total	7,177	7,324	7,039	7,087	-1.3%	100.0%

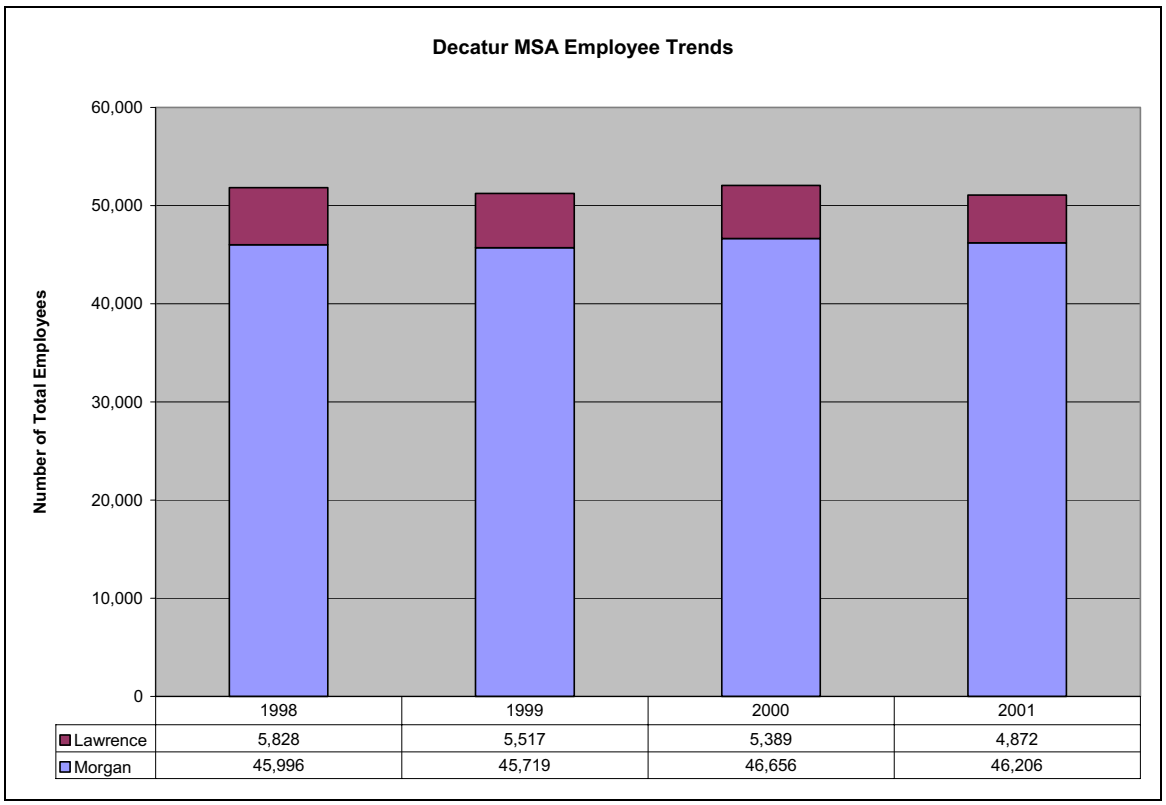


Figure 5 Total Employees for Decatur MSA

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

Table 7 presents the ozone monitoring data for the Decatur MSA and surrounding areas. The table shows that the Morgan County monitor exceeds the 8-hour NAAQS for ozone while the Lawrence County monitor meets the 8-hour NAAQS for ozone. Figure 6 maps these ozone monitoring sites which provided the 2000, 2001, and 2002 data for the Decatur MSA. The recommendation to exclude Lawrence is supported by monitoring data that shows Lawrence is meeting the 8-hour NAAQS for ozone.

Table 7 Decatur MSA Ozone Monitoring Data

County	AIRS ID	Site	2000 4th Max	2001 4th Max	2002 4th Max	3 Year Average
Morgan	01-103-0011	Decatur	0.091	0.077	0.087	0.085
Lawrence	01-079-0002	Sipsey	0.083	0.071	0.080	0.078
Madison	01-089-0014	Huntsville	0.088	0.080	0.078	0.082

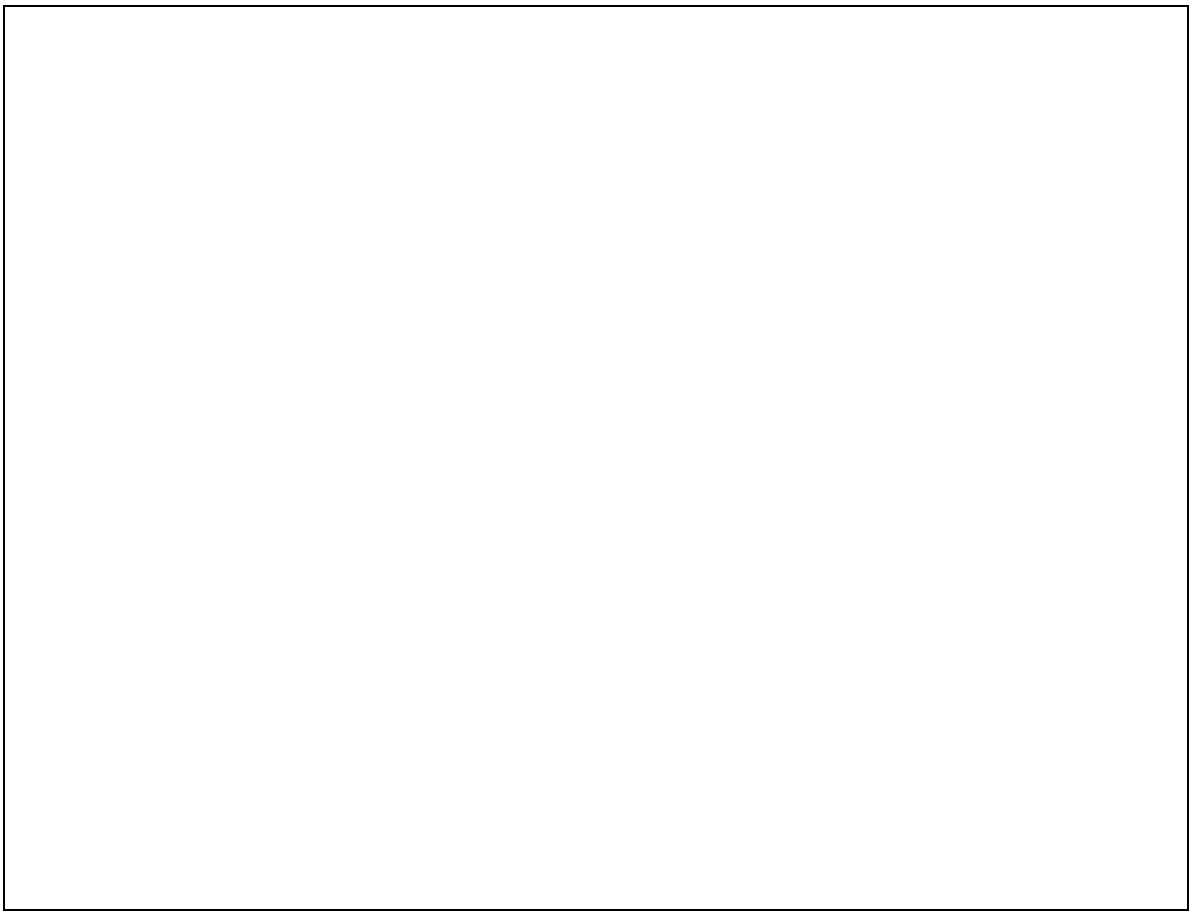


Figure 6 Ozone Monitoring Sites in Decatur MSA and Adjacent Areas

D. Location of Emission Sources

Figure 7 depicts the location of large point sources in the Decatur MSA and surrounding counties. The base map was created in GIS using coordinates supplied by the facilities. Tables 8 and 9 present the distribution of NOx emissions (in tons per year) among point, area[4], and mobile sources in the Decatur MSA. Tables 10 and 11 present the same information for VOC emissions. Figures 8 and 9 illustrate this data. Figure 10 presents the emission densities for the counties in the Decatur MSA.

Lawrence County only accounts for 33% of the total annual NOx emissions and 23% of the total annual VOC emissions in the Decatur MSA. In addition, Lawrence has a significantly lower emission density than Morgan. The lack of large point sources of NOx or VOC emissions located in Lawrence, the minimal area and mobile source emissions, and the smaller emission densities fortify the recommendation to exclude Lawrence from the Decatur Nonattainment Area.

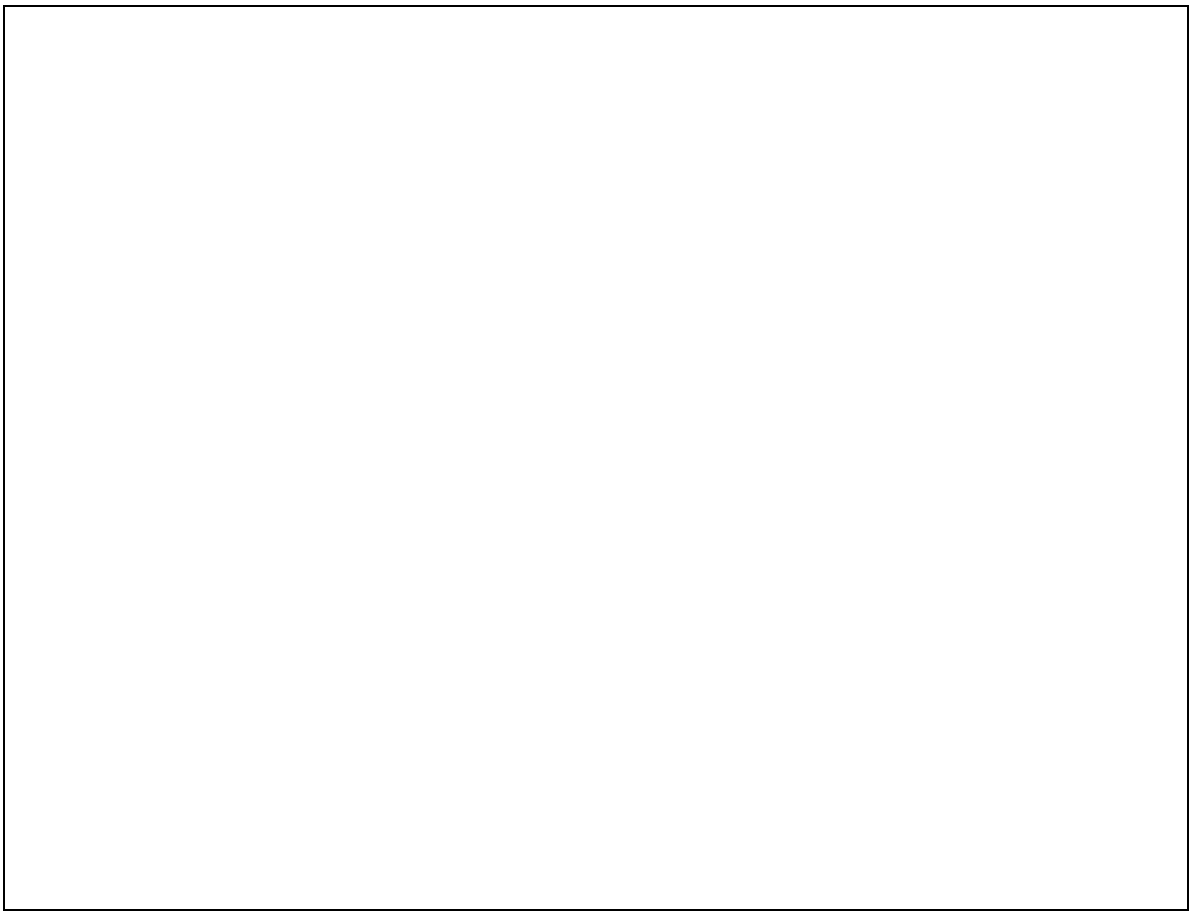


Figure 7 Location of Large Point Sources in Decatur MSA

[4] Area sources include the nonroad mobile sources

Table 8 NOx Annual Emissions (Tons)

FIPS Code	Name	Point		Area		Mobile		Total Emissions	
1103	Morgan Co	5,526	59.9%	2,057	68.1%	3,992	78.1%	11,575	66.7%
1079	Lawrence Co	3,694	40.1%	963	31.9%	1,120	21.9%	5,777	33.3%
MSA Total Emissions		**9,220**		**3,020**		**5,112**		**17,352**	

Table 9 Cumulative NOx Contributions

County Name	Factor	Annual 1999 Emissions (Tons)	% of MSA Total Emissions	Cumulative %
Morgan Co	Point Source NOx Emissions (Tons)	5,526	31.8%	31.8%
Morgan Co	Mobile Source NOx Emissions (Tons)	3,992	23.0%	54.8%
Lawrence Co	Point Source NOx Emissions (Tons)	3,694	21.3%	76.1%
Morgan Co	Area Source NOx Emissions (Tons)	2,057	11.9%	87.9%
Lawrence Co	Mobile Source NOx Emissions (Tons)	1,120	6.5%	94.4%
Lawrence Co	Area Source NOx Emissions (Tons)	963	5.5%	100.0%
	MSA Total Emissions	**17,352**		

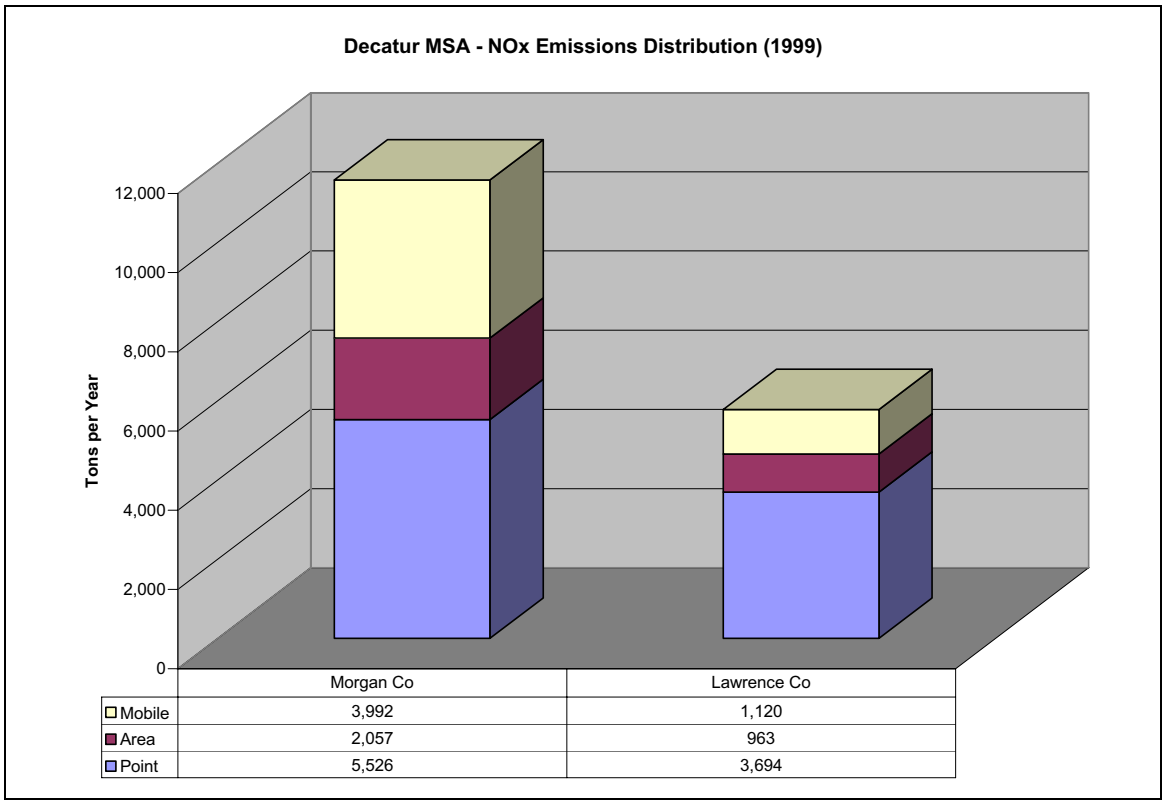


Figure 8 NOx Emissions for Decatur MSA

Table 10 VOC Annual Emissions (Tons)

FIPS Code	Name	Point		Area		Mobile		Total Emissions	
1103	Morgan Co	6,218	82.7%	9,736	72.3%	3,158	80.3%	19,112	76.7%
1079	Lawrence Co	1,303	17.3%	3,739	27.7%	775	19.7%	5,817	23.3%
MSA Total Emissions		**7,521**		**13,475**		**3,933**		**24,929**	

Table 11 Cumulative VOC Contributions

County Name	Factor	Annual 1999 Emissions (Tons)	% of MSA Total Emissions	Cumulative %
Morgan Co	Area Source VOC Emissions (Tons)	9,736	39.1%	39.1%
Morgan Co	Point Source VOC Emissions (Tons)	6,218	24.9%	64.0%
Lawrence Co	Area Source VOC Emissions (Tons)	3,739	15.0%	79.0%
Morgan Co	Mobile Source VOC Emissions (Tons)	3,158	12.7%	91.7%
Lawrence Co	Point Source VOC Emissions (Tons)	1,303	5.2%	96.9%
Lawrence Co	Mobile Source VOC Emissions (Tons)	775	3.1%	100.0%
	MSA Total Emissions	**24,929**		

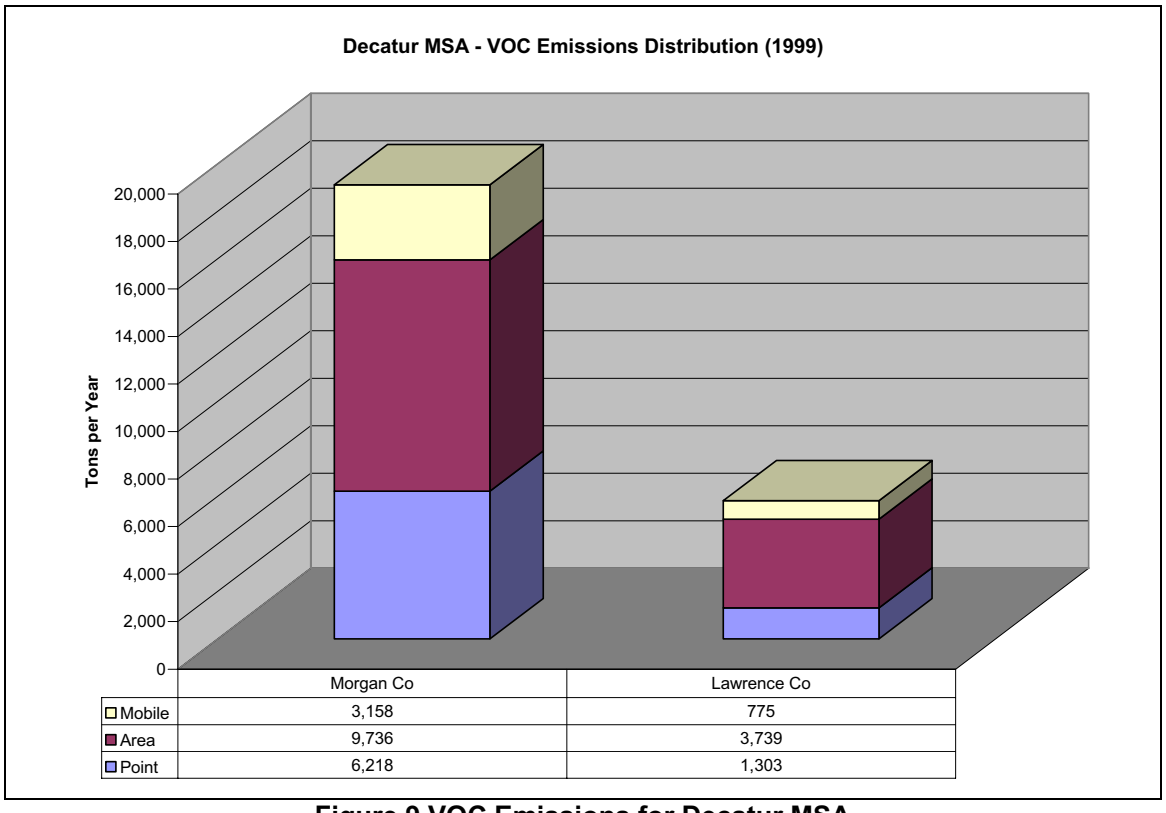


Figure 9 VOC Emissions for Decatur MSA

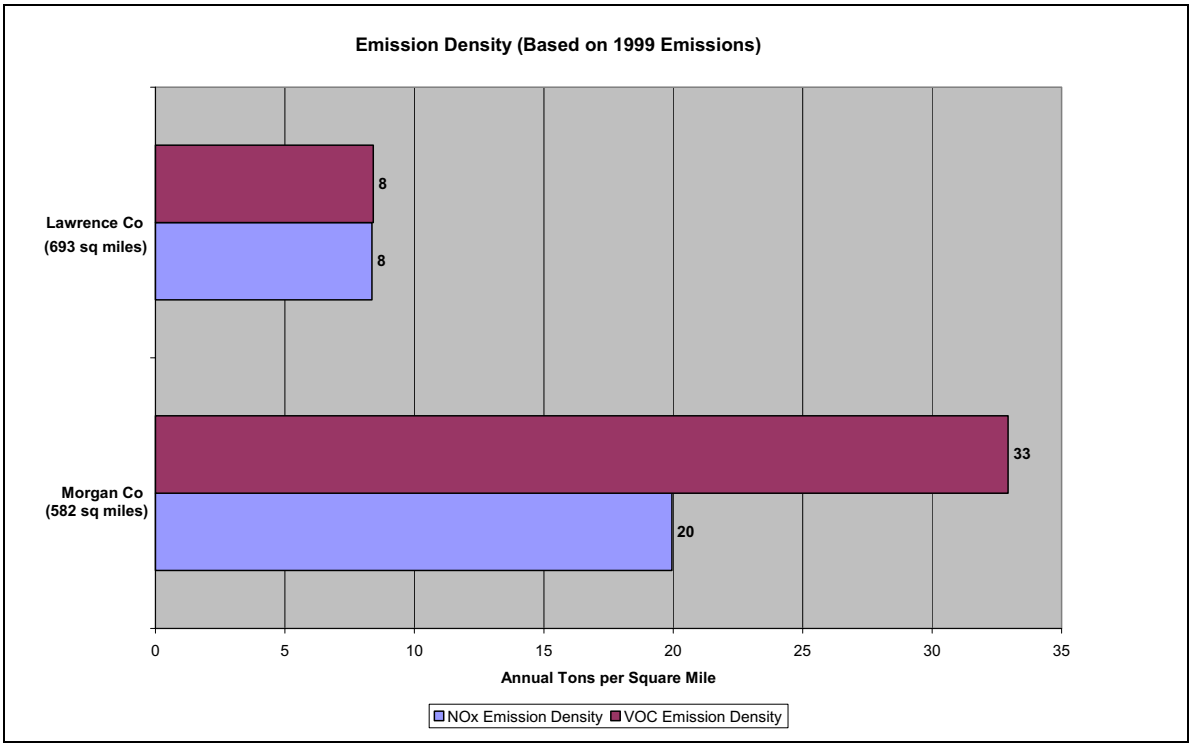


Figure 10 Emission Density for Decatur MSA

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 1990 U.S. Census. Table 12 presents the 1990 and 2001 Daily VMT estimates for the Decatur MSA, and Figure 11 demonstrates the Daily VMT trend from 1990 to 2001 for each county. Figure 12 presents the rural and urban distribution of Daily VMT. Figure 13 presents the commuting patterns within the Decatur MSA.

Table 12 shows that the Daily VMT for Lawrence comprises approximately 24% of the Daily VMT for the Decatur MSA. However, Figure 12 demonstrates that the majority of this Daily VMT occurs in rural areas; thereby, it is not expected to significantly impact the air quality. These factors fortify the recommendation to exclude Lawrence County from the Decatur Nonattainment Area.

However, Figure 13 indicates that there is significant commuting from Lawrence into Morgan. The impact of commuting between counties will be lessened by the national low sulfur fuel standards. Therefore, this factor was not considered to play a significant role in the recommendation to exclude Lawrence from the Decatur Nonattainment Area.

Table 12 Daily VMT for Decatur MSA

County	1990 Daily VMT	2001 Daily VMT	Daily VMT Change (1990-2001)	% Change	% of MSA 2001 Daily VMT
Morgan Co	2,750,737	3,447,434	696,697	25.3%	76.4%
Lawrence Co	857,461	1,065,238	207,777	24.2%	23.6%
MSA Total	***3,608,198***	***4,512,672***	***904,474***	***25.1%***	100.0%

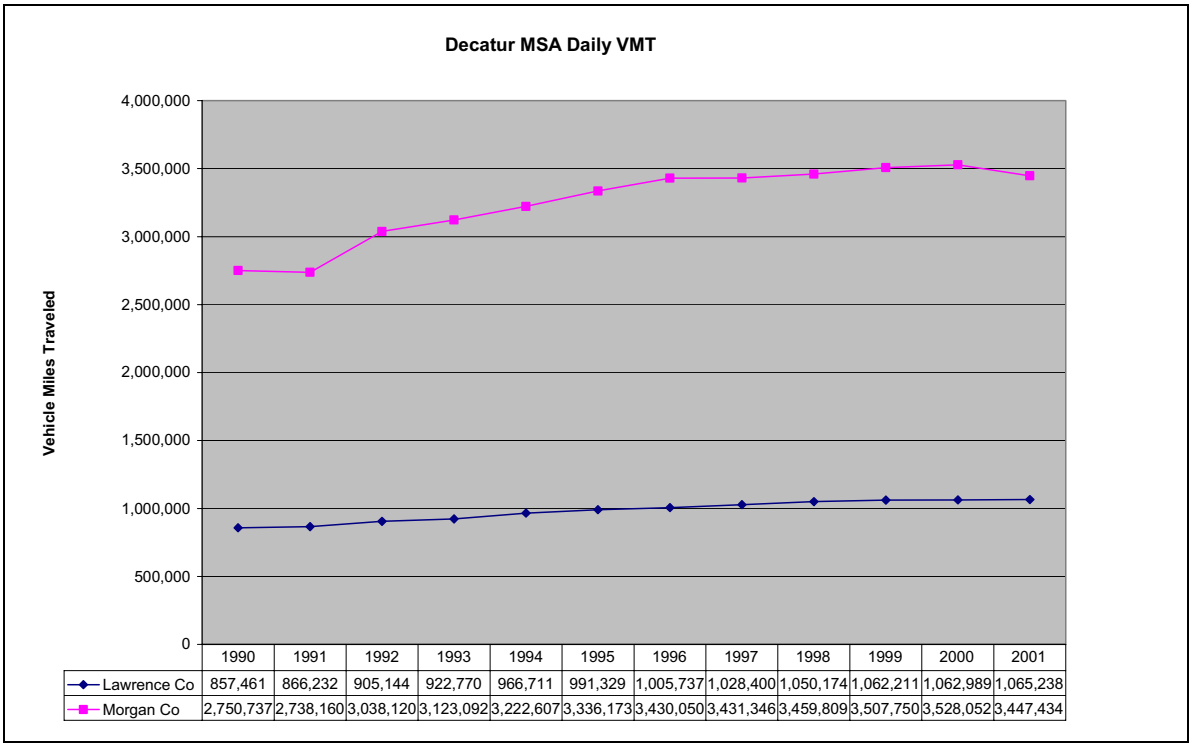


Figure 11 Daily VMT Trend for Decatur MSA

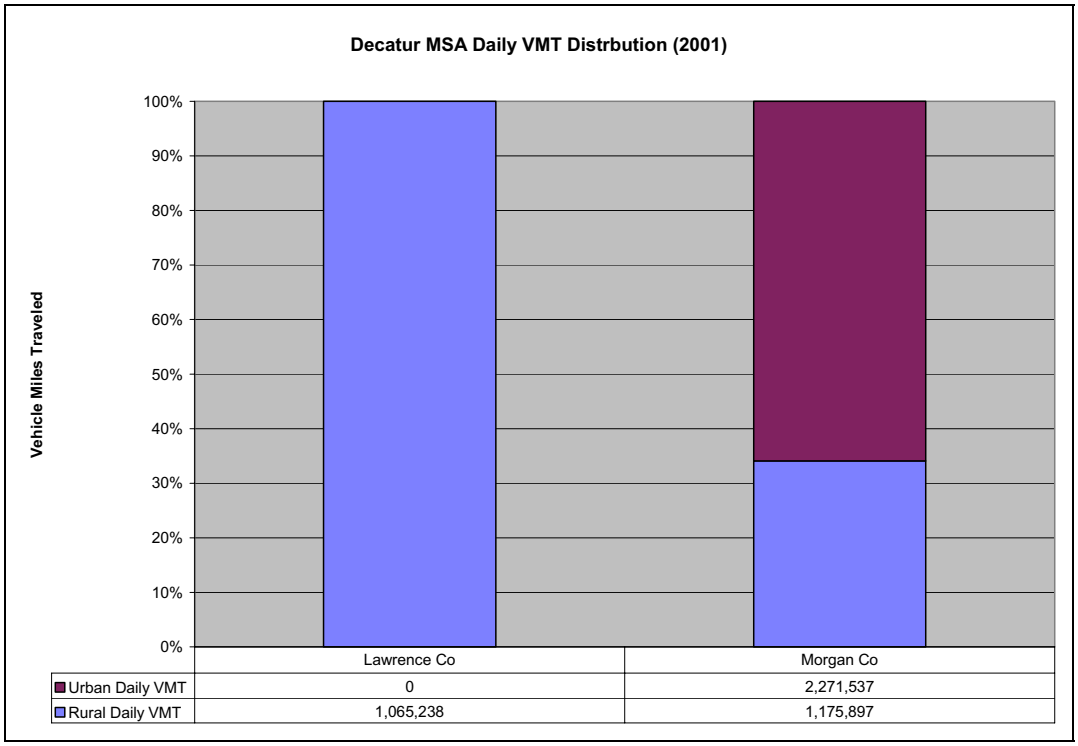


Figure 12 Rural vs Urban Daily VMT for Decatur MSA

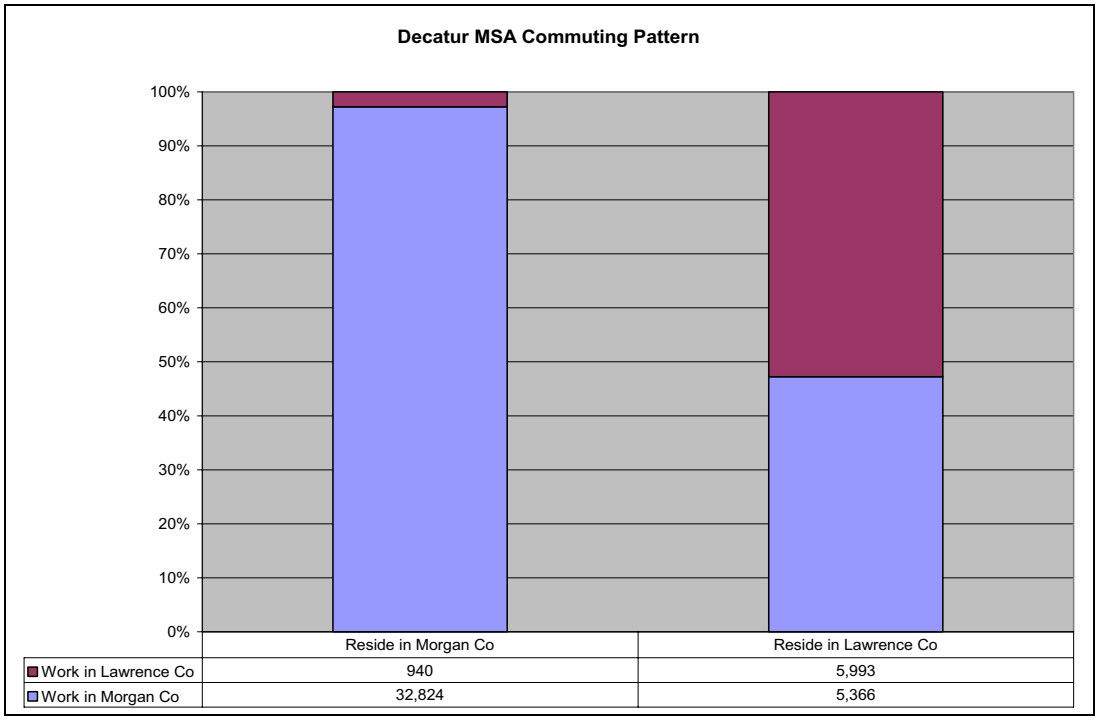


Figure 13 Commuting Patterns for Decatur MSA

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

There is little information available about expected growth. Table 13 provides population growth estimates that were obtained from the Alabama Data Center. The estimates do not show that significant growth is expected in either county. 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 did not play a role in the recommendation to exclude Lawrence from the Decatur Nonattainment Area.

Table 13 Population Projections for Decatur MSA

County Name	1993	2002	2015	2025	% Change 1993-2002	% Change 2002-2015	% Change 2015-2025
Morgan	105,001	113,014	124,358	131,112	7.6%	10.0%	5.4%
Lawrence	32,464	35,353	38,347	39,664	8.9%	8.5%	3.4%

G. Meteorology

It is clear that meteorology plays a major role in the formation and transport of ozone. During the 2000-2002 ozone seasons, ozone levels in Decatur exceeded the proposed eight hour standard on approximately 13 days over the three year period. The nearby Huntsville monitor exceeded the standard on only 6 of the 13 days suggesting a possible disconnect in ozone concentrations in the two areas. A preliminary wind analysis was completed to evaluate the dominant wind direction(s) in Decatur during the ozone season (April – October) on exceedance days. Due to a lack of wind data from Decatur, wind data from the Huntsville airport was used in this analysis. As seen in the wind rose in Figure C-1, there is a large easterly component to the winds during the "O_3 season daytime hours", corresponding to 6 am – 6 pm. A similar pattern is shown in Figure C-2 for all exceedance day hours.

However, a different depiction of the surface winds arises when using the National Oceanic and Atmospheric Administration model HYSPLIT. HYSPLIT is a model in which air parcel back trajectories are calculated. As seen in the HYSPLIT model back trajectory runs in Figures C-3 through C-15, no dominant wind direction can be identified on the ozone days evaluated. This implies, as suspected, that wind direction is a function of many variables, including synoptic scale weather systems, surface level heating and terrain influenced wind flows in the Decatur area. Thus, analysis of meteorological data associated with ozone exceedance days in Decatur is inconclusive.

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

The geography/topography of an area definitely influences the creation and transport of ozone. The Decatur area is located in Northeast Alabama in the southern extremities of the Appalachians on the Tennessee River. The area is surrounded by mountains and located on the Cumberland Plateau. Due to the variability of the terrain in the area and the lack of monitoring data or air quality analyses to evaluate the complex wind patterns that would promote the creation of ozone, the conclusion is that there is insufficient data to support the inclusion or exclusion of counties in the designation process.

I. Jurisdictional Boundaries

The Decatur MSA is in the Tennessee River Valley air quality control region (40 CFR 81.72). Morgan County and the adjoining county (Lawrence) in the MSA are in the jurisdiction of the State of Alabama under the purview of the ADEM. There are no current 1-hour nonattainment areas near these two counties. The State's monitor located in Morgan supports representative data for Morgan County being recommended as the 8-hour nonattainment boundary. Discussion elsewhere in this document demonstrates the State's recommendations for exclusion of Lawrence County as a part of the 8-hour 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 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 of degradation of clean air areas.

Additionally, as discussed under regional emission reductions, the EPA has required a NO_X SIP Call for 22 states, including Alabama, that by 2004, will result in large reductions in NO_X 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.

K. Regional Emission Reductions

EPA performed Urban Airshed Modeling to estimate the impact of implementation of the NO_X SIP Call, heavy duty diesel engine standards, highway diesel fuel sulfur control, and Tier II national fuel standards. The results obtained from EPA for Alabama demonstrates that the reductions in 8-hour ozone resulting from these national programs will be sufficient to bring all monitored areas of Alabama into attainment of the 8-hour standard by 2007. These results are documented in Attachment 1. Since additional local controls are unlikely to be required for Decatur to meet the NAAQS, it is unnecessary to designate counties nonattainment beyond those with monitored data exceeding the NAAQS. Further, the lack of a nonattainment designation in a county does not preclude ADEM from requiring controls in the county if controls are deemed necessary.

FIGURE C-3

FIGURE C-4

FIGURE C-5

FIGURE C-6

FIGURE C-7

FIGURE C-8

FIGURE C-9

FIGURE C-1O

FIGURE C-11

FIGURE C-12

FIGURE C-13

FIGURE C-14

FIGURE C-15

Appendix D

ADEM recommends that the Decatur Nonattainment area for the 8-hour NAAQS for ozone not include any portion of the Huntsville MSA. EPA guidance (dated March 28, 2000) states that a State must address how certain factors affect the drawing of the nonattainment boundary. Therefore, a discussion of these factors for the Huntsville MSA is provided in this Appendix. The Huntsville MSA consists of two counties: Madison and Limestone.

The factors that provide the most compelling evidence to exclude Madison County from the Decatur Nonattainment area are listed below:

- Monitoring data
- Commuting Patterns
- Location of emission sources (i.e. the lack of significant point sources)
- Level of control of emission sources
- Regional emission reductions

The factors that provide the most compelling evidence to exclude Limestone County from the Decatur Nonattainment area include:

- Total annual emissions of NOx and VOC
- Population density
- Location of emission sources (i.e. the lack of significant point sources)
- Daily VMT
- Level of control of emission sources
- Regional emission reductions

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

The Huntsville MSA's location relative to the Decatur MSA is depicted in Figure 1. To evaluate emissions for the Huntsville MSA, ADEM obtained the 1999 annual NOx and VOC emission estimates from the EPA's recommended website[1]. Table 1 lists these emissions which include all anthropogenic sources (i.e. point, area, mobile, and nonroad mobile) for the adjacent Decatur MSA.

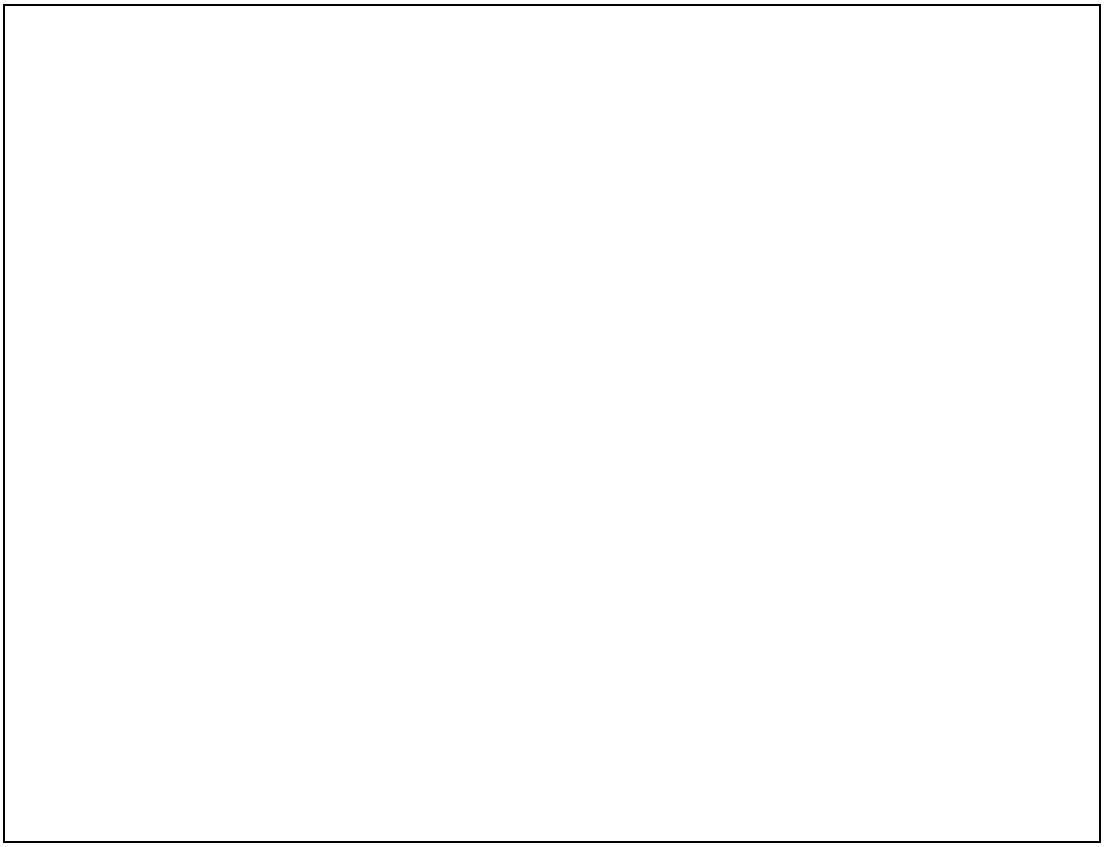


Figure 1 Areas adjacent to the Huntsville MSA

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

Table 1 Annual Emissions for Area Adjacent to Madison County

County	1999 Annual VOC Emissions (Tons)	Ranking for VOC	1999 Annual NOx Emissions (Tons)	Ranking for NOx
Limestone	7,628	3	4,426	3
Madison[M]	18,537	2	11,753	1
Morgan[M]	19,112	1	11,575	2

[M] County has an ozone monitor

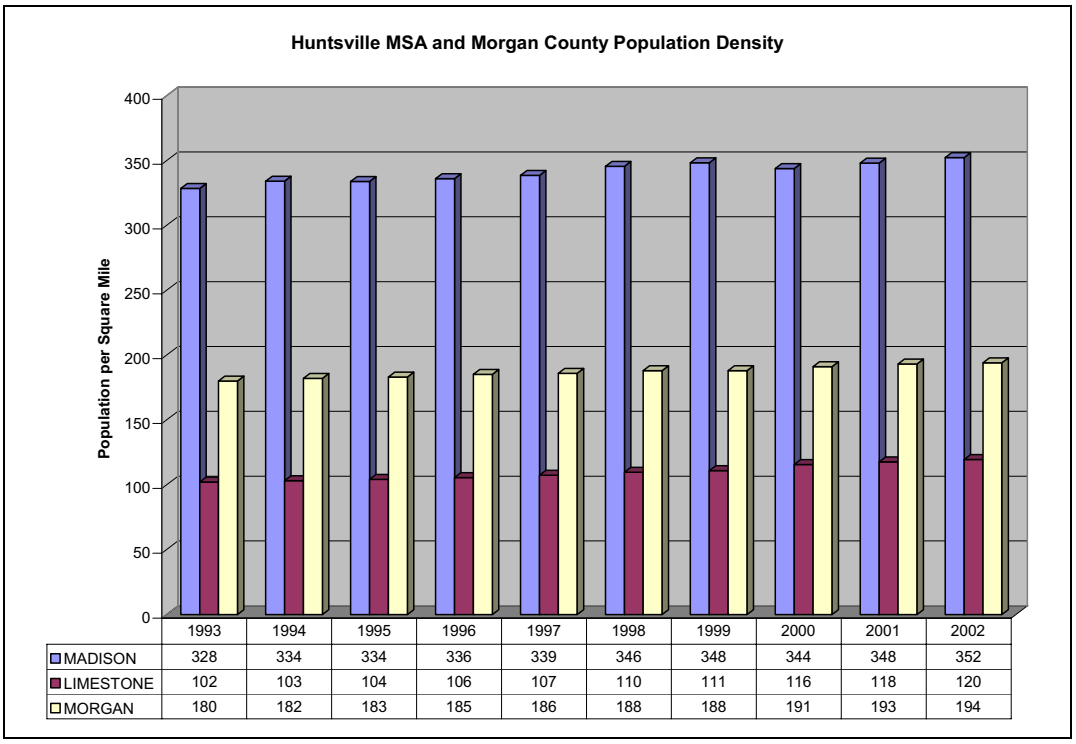
As shown in Table 1, emissions in Limestone County are less than half of the emissions in Madison and Morgan Counties. Further, emissions in Limestone County do not appear to be substantial enough to produce exceedances of the NAAQS for ozone. Morgan County has a design value above the 8-hour NAAQS for ozone based on monitoring data for 2000, 2001, and 2002, while the design values for Madison County, as well as Lawrence County of the Decatur MSA, meet the 8-hour NAAQS for ozone based on the same years of data. There were no other ozone monitoring sites in this area during this time period.

Evaluating the emissions and air quality in adjacent areas provides no directly compelling indicator as to whether the Huntsville MSA should be included or excluded as an 8-hour ozone nonattainment area. There are no factors that indicate contribution of emissions from adjacent areas.

B. Population Density and degree of urbanization including commercial development (significant difference from surrounding areas)

To evaluate the various aspects of population, ADEM obtained the 1993 to 2002 population estimates for the Huntsville MSA and Morgan County 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 of each county (in square miles). Figure 2 depicts the population densities for the counties in the Huntsville MSA and Morgan County. No significant changes in population density are indicated. The population density factor fortifies the recommendation to exclude Limestone County from the Decatur nonattainment area.



	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
MADISON	328	334	334	336	339	346	348	344	348	352
LIMESTONE	102	103	104	106	107	110	111	116	118	120
MORGAN	180	182	183	185	186	188	188	191	193	194

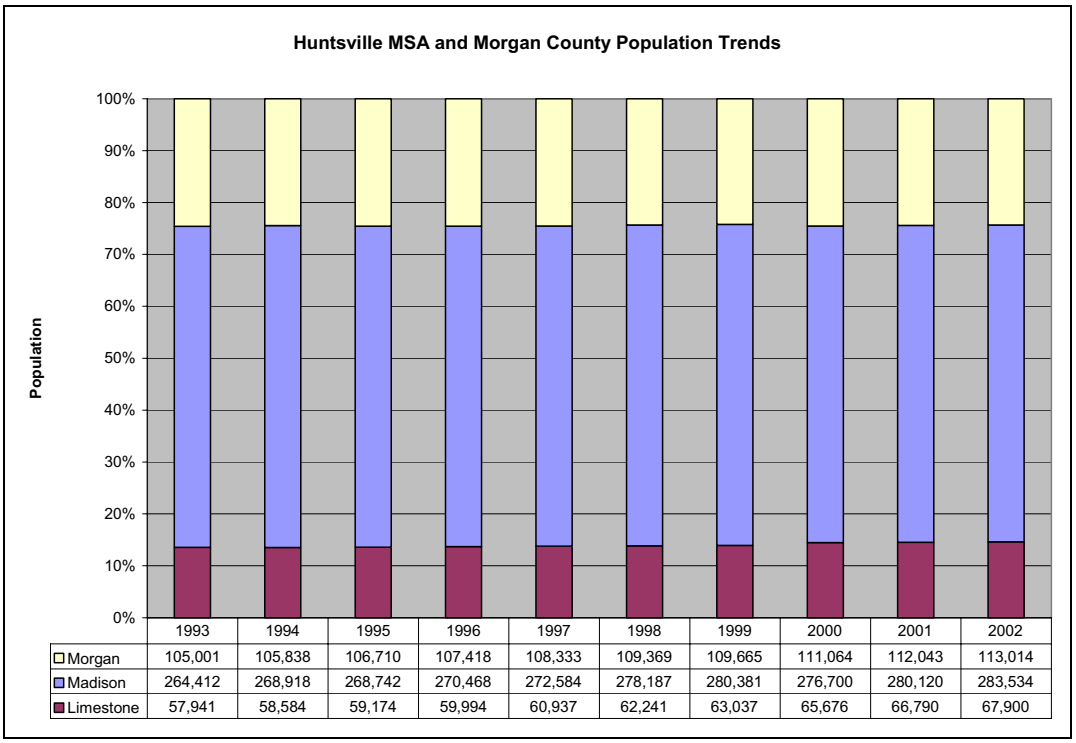
Figure 2 Population Density for Huntsville MSA and Morgan County

[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

Table 2 compares the 1993 and 2002 population estimates. Population data is also presented in Figure 3. This data reveals that there has been some growth in the Huntsville MSA; in fact, population is growing at about the same rate in Madison and Limestone Counties.

Table 2 Huntsville MSA and Morgan County Population

County	1993	2002	Population Change (1993-2002)	% Change	% of MSA 2002 Population
Madison	264,412	283,534	19,122	7.2%	61.0%
Limestone	57,941	67,900	9,959	17.2%	14.6%
Morgan	105,001	113,014	8,013	7.6%	24.3%
Area Total	427,354	464,448	37,094	8.7%	100.0%



	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Morgan	105,001	105,838	106,710	107,418	108,333	109,369	109,665	111,064	112,043	113,014
Madison	264,412	268,918	268,742	270,468	272,584	278,187	280,381	276,700	280,120	283,534
Limestone	57,941	58,584	59,174	59,994	60,937	62,241	63,037	65,676	66,790	67,900

Figure 3 Population Data for Huntsville MSA and Morgan County

The amount and percent of urbanized population in the Huntsville MSA and Morgan County is presented in Table 3. This data clearly shows that there has been some growth in the Huntsville MSA's urban population. As discussed in Section D, the primary influence from the Madison County population on NOx emissions is from the mobile source category. Any impacts on ozone concentrations from mobile source NOx emissions will be mitigated by the national low sulfur fuel standards and other ongoing national mobile source emission reduction initiatives.

Table 3 Urban Population for Huntsville MSA and Morgan County

County Name	% Urban[3]	1990 Population	1990 Urban Population	% of Area Total 1990 Urban Population	2002 Population	2002 Urban Population	% of Area Total 2002 Urban Population
Madison	78.1%	238,912	186,609	69.9%	283,534	221,462	70.4%
Limestone	31.1%	54,135	16,846	6.3%	67,900	21,129	6.7%
Morgan	63.5%	100,043	63,495	23.8%	113,014	71,764	22.8%
Area Total	67.9%	393,090	266,950	100.0%	464,448	314,356	100.0%

Tables 4, 5, and 6 show the trends in Total Employment, Manufacturing Employment, and Retail Employment, respectively, for the Huntsville MSA and Morgan County. Madison and Limestone show similar growth trends in employment, none of which show remarkable growth. Figure 4 demonstrates that there has not been substantial growth in the number of Total Employees for Madison and Limestone Counties. This factor fortifies the recommendation to exclude Limestone County from the 8-hour ozone nonattainment area. As previously stated, the primary influence of the Madison County population on ozone concentrations in the area is from mobile source NOx emissions. This influence will be mitigated by the lower sulfur fuel standards and other national programs. Further, Section E indicates insignificant commuting from Madison County into Morgan County.

Table 4 Total Employees

	1998	1999	2000	2001	% Change 1998-2001	% of 2001 Area Total
Madison	119,763	123,197	126,771	130,045	8.6%	67.3%
Limestone	16,425	16,713	17,309	17,031	3.7%	8.8%
Morgan	45,996	45,719	46,656	46,206	0.5%	23.9%
Area Total	182,184	185,629	190,736	193,282	6.1%	100.0%

Table 5 Manufacturing Employees

	1998	1999	2000	2001	% Change 1998-2001	% of 2001 Area Total
Madison	26,727	23,655	23,352	23,489	-12.1%	53.3%
Limestone	6,672	6,591	6,917	6,772	1.5%	15.4%
Morgan	14,697	14,375	14,404	13,816	-6.0%	31.3%
Area Total	48,096	44,621	44,673	44,077	-8.4%	100.0%

Table 6 Retail Employees

	1998	1999	2000	2001	% Change 1998-2001	% of 2001 Area Total
Madison	16,605	16,632	16,885	17,132	3.2%	65.6%
Limestone	2,611	2,465	2,535	2,657	1.8%	10.2%
Morgan	6,432	6,505	6,253	6,342	-1.4%	24.3%
Area Total	25,648	25,602	25,673	26,131	1.9%	100.0%

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

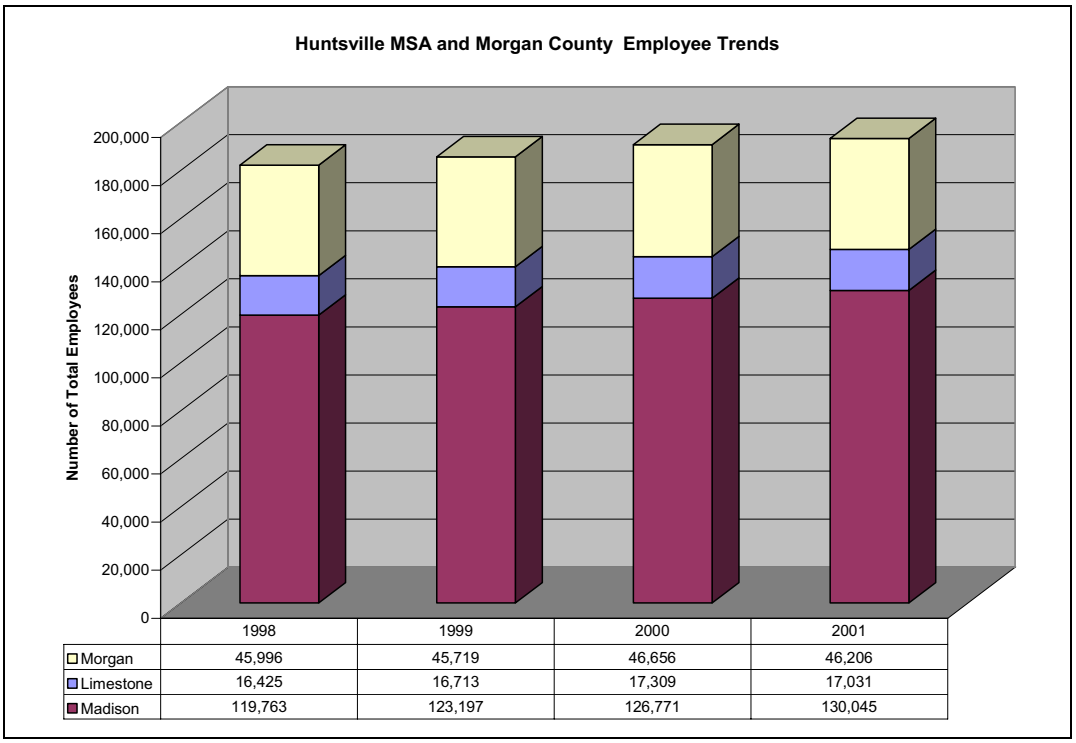


Figure 4 Total Employees for Huntsville MSA and Morgan County

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

Table 7 presents the ozone monitoring data for the Huntsville MSA and surrounding areas. The table shows that the Morgan County monitor exceeds the 8-hour NAAQS for ozone while the Madison County monitor meets the 8-hour NAAQS for ozone. Figure 5 maps these ozone monitoring sites which provided the 2000, 2001, and 2002 data for the Huntsville MSA. The recommendation to exclude Madison County is supported by monitoring data that shows Madison is meeting the 8-hour NAAQS for ozone.

Table 7 Huntsville MSA Ozone Monitoring Data

County	AIRS ID	Site	2000 4th Max	2001 4th Max	2002 4th Max	3 Year Average
Morgan	01-103-0011	Decatur	0.091	0.077	0.087	0.085
Lawrence	01-079-0002	Sipsey	0.083	0.071	0.080	0.078
Madison	01-089-0014	Huntsville	0.088	0.080	0.078	0.082

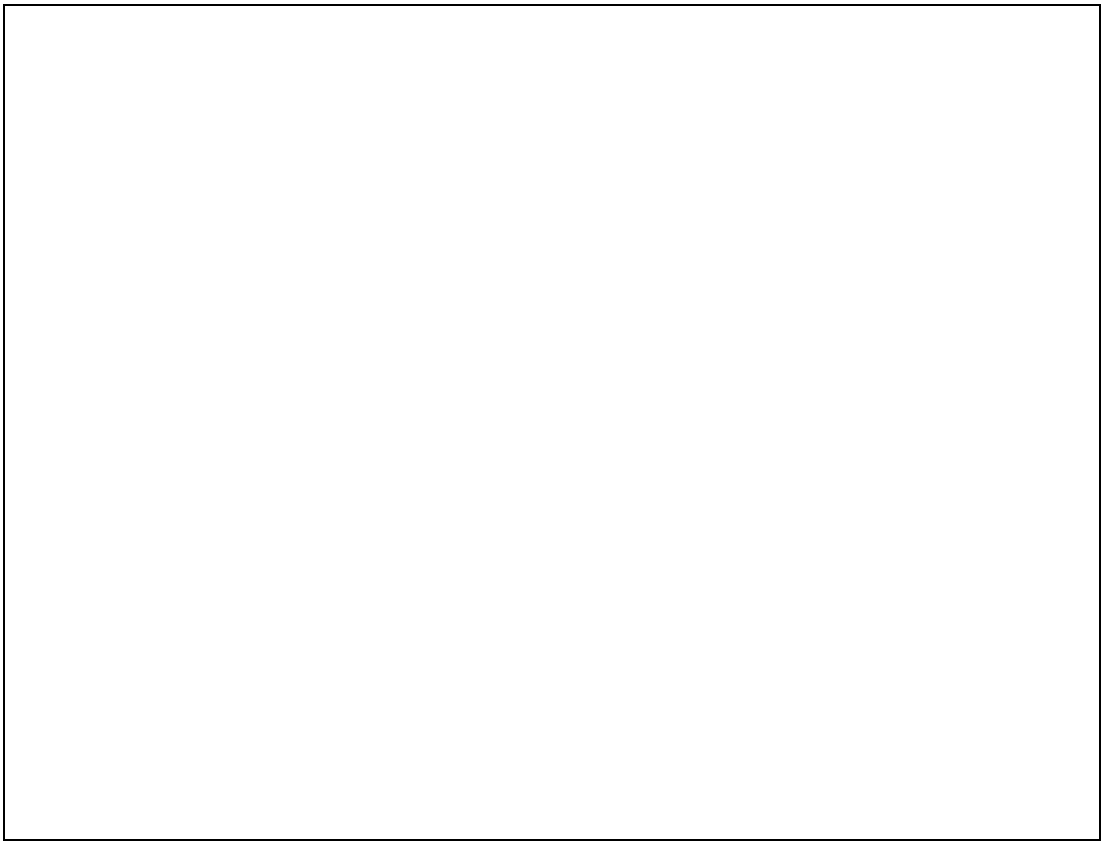


Figure 5 Ozone Monitoring Sites in Huntsville MSA and Adjacent Areas

D. Location of Emission Sources

Figure 6 depicts the location of large point sources in the Huntsville MSA and surrounding counties. The base map was created in GIS using coordinates supplied by the facilities. Tables 8 and 9 present the distribution of NOx emissions (in tons per year) among point, area[4], and mobile sources in Madison County in comparison to the NOx emissions distribution in Morgan County. Tables 10 and 11 present the same information for VOC emissions. Figures 8 and 9 illustrate this data. Figure 10 presents the emission densities for Madison and Morgan Counties.

Morgan and Madison Counties are comparable in total NOx as well as VOC emissions, despite disparities among the specific source categories. The majority of Madison County NOx emissions are from mobile sources, whereas mobile and point sources both contribute significantly to Morgan County NOx emissions. Only about 3.5% of Madison County's NOx emissions are from point sources. The lack of large point sources of NOx or VOC located in Madison and Limestone Counties fortifies the recommendation to exclude these counties from the Decatur NAA.

Over 60% of the NOx emissions in Madison and Limestone Counties are from the mobile source sector. Limestone County mobile source NOx emissions are less than half of the mobile source NOx emissions in Madison County. Any impact from Madison County mobile source NOx emissions will be mitigated by the national low sulfur fuel program that will be phased in beginning in 2004. Other national initiatives pertaining to mobile sources will mitigate the impact of Madison County mobile source NOx emissions including the following: nonroad diesel engines and fuel rule; tighter tailpipe standards for cars and trucks beginning in 2004; lower sulfur diesel fuel; heavy duty diesel engine standards. Morgan has a smaller land area than Madison (582 versus 805, respectively) which skews the impact of the population density factor. Considering this factor, emission densities for both counties are also comparable.

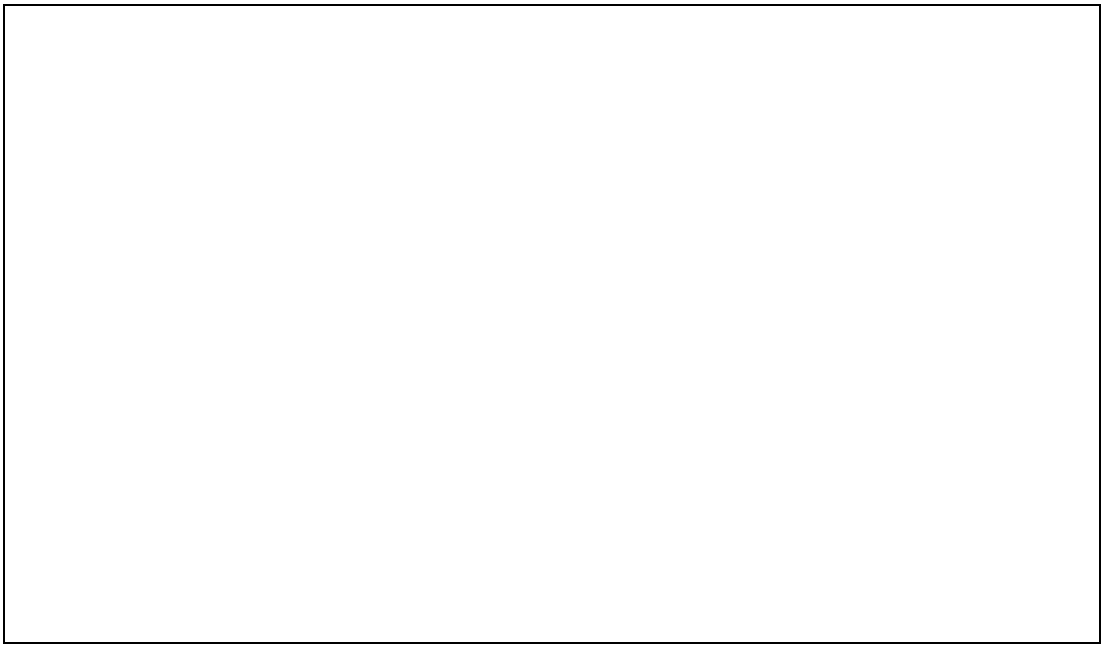


Figure 6 Location of Large Point Sources in Huntsville MSA

[4] Area sources include the nonroad mobile sources

Table 8 NOx Annual Emissions (Tons)

FIPS Code	Name	Point		Area		Mobile		Total Emissions	
1089	Madison Co	412	6.7%	4,079	54.2%	7,262	51.5%	11,753	42.3%
1103	Morgan Co	5,526	90.2%	2,057	27.4%	3,992	28.3%	11,575	41.7%
1083	Limestone Co	191	3.1%	1,385	18.4%	2,850	20.2%	4,426	15.9%
Area Total Emissions		**6,129**		**7,521**		**14,104**		**27,754**	

Table 9 Cumulative NOx Contributions

County Name	Factor	Annual 1999 Emissions (Tons)	% of Area Total Emissions	Cumulative %
Madison Co	Mobile Source NOx Emissions (Tons)	7,262	26.2%	26.2%
Morgan Co	Point Source NOx Emissions (Tons)	5,526	19.9%	46.1%
Madison Co	Area Source NOx Emissions (Tons)	4,079	14.7%	60.8%
Morgan Co	Mobile Source NOx Emissions (Tons)	3,992	14.4%	75.2%
Limestone Co	Mobile Source NOx Emissions (Tons)	2,850	10.3%	85.5%
Morgan Co	Area Source NOx Emissions (Tons)	2,057	7.4%	92.9%
Limestone Co	Area Source NOx Emissions (Tons)	1,385	5.0%	97.9%
Madison Co	Point Source NOx Emissions (Tons)	412	1.5%	99.3%
Limestone Co	Point Source NOx Emissions (Tons)	191	0.7%	100.0%
	Area Total Emissions	**27,754**		

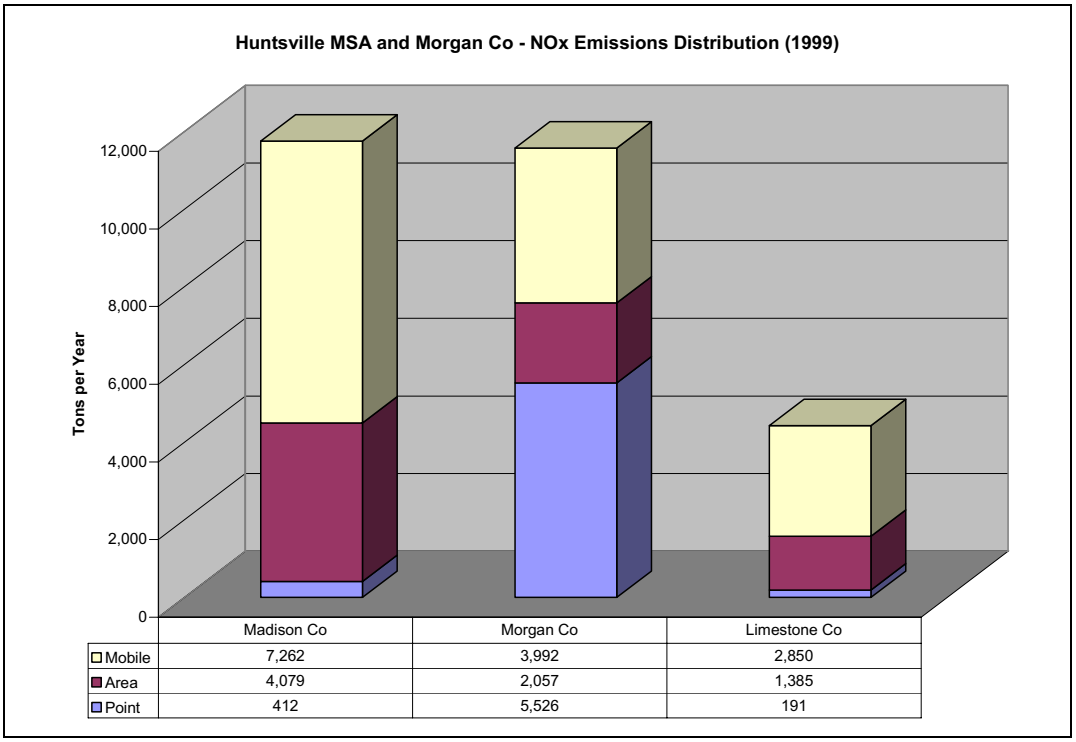


Figure 7 NOx Emissions for Madison and Morgan Counties

Table 10 VOC Annual Emissions (Tons)

FIPS Code	Name	Point		Area		Mobile		Total Emissions	
1089	Madison Co	148	2.2%	12,522	45.2%	5,867	53.4%	18,537	40.9%
1103	Morgan Co	6,218	94.5%	9,736	35.1%	3,158	28.7%	19,112	42.2%
1083	Limestone Co	215	3.3%	5,449	19.7%	1,964	17.9%	7,628	16.8%
Area Total Emissions		**6,581**		**27,707**		**10,989**		**45,277**	

Table 11 Cumulative VOC Contributions

County Name	Factor	Annual 1999 Emissions (Tons)	% of Area Total Emissions	Cumulative %
Madison Co	Area Source VOC Emissions (Tons)	12,522	27.7%	27.7%
Morgan Co	Area Source VOC Emissions (Tons)	9,736	21.5%	49.2%
Morgan Co	Point Source VOC Emissions (Tons)	6,218	13.7%	62.9%
Madison Co	Mobile Source VOC Emissions (Tons)	5,867	13.0%	75.9%
Limestone Co	Area Source VOC Emissions (Tons)	5,449	12.0%	87.9%
Morgan Co	Mobile Source VOC Emissions (Tons)	3,158	7.0%	94.9%
Limestone Co	Mobile Source VOC Emissions (Tons)	1,964	4.3%	99.2%
Limestone Co	Point Source VOC Emissions (Tons)	215	0.5%	99.7%
Madison Co	Point Source VOC Emissions (Tons)	148	0.3%	100.0%
Area Total Emissions		**45,277**		

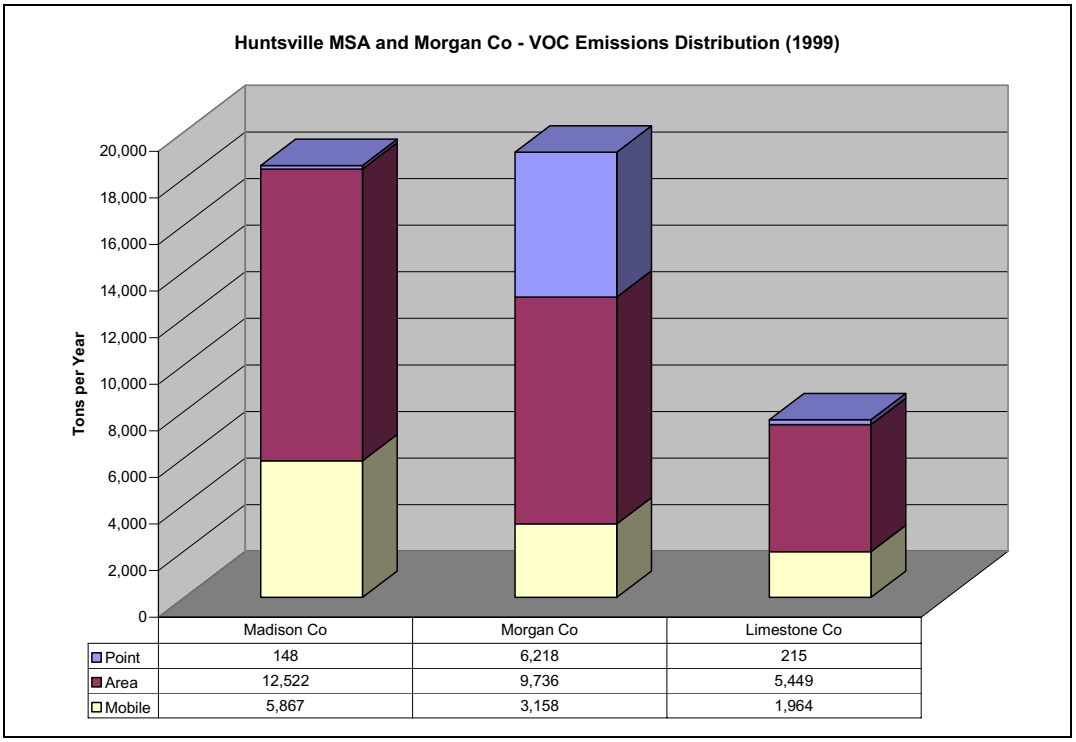


Figure 8 VOC Emissions for Madison and Morgan Counties

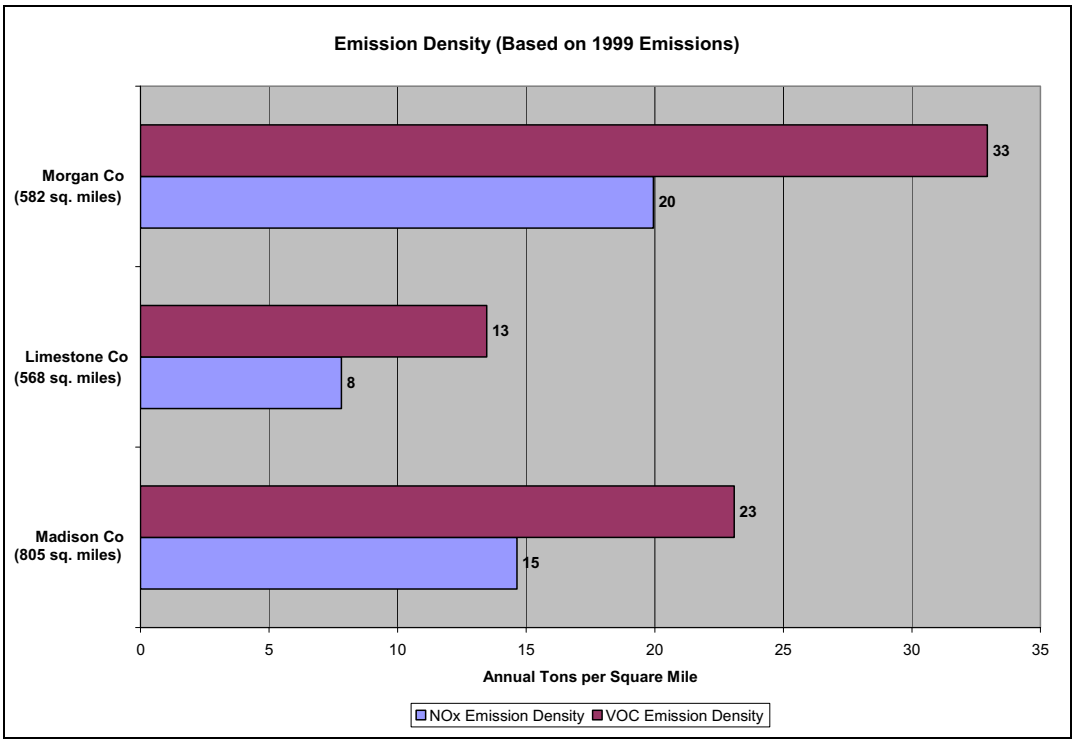


Figure 9 Emission Density for Madison and Morgan Counties

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 US Census Bureau web site. The commuting patterns available were based on the 1990 US Census. Table 12 presents the 1990 and 2001 Daily VMT estimates for the Huntsville MSA and Morgan County, and Figure 10 demonstrates the Daily VMT trend from 1990 to 2001 for each county. Figure 11 presents the rural and urban distribution of Daily VMT for the Huntsville MSA and Morgan County. Figure 12 presents the commuting patterns between Madison and Morgan Counties.

Table 12 shows that the Daily VMT for the Huntsville MSA has increased over the period of eleven years. Figure 11 demonstrates the Daily VMT for rural and urban areas. As stated in Section D, any impact from Madison County mobile source emissions will be mitigated by the national low sulfur fuel program and other national programs that are being phased in.

Figure 12 indicates that there is insignificant commuting between Madison and Morgan Counties. The impact of commuting between the two counties is negligible and will be further lessened by the national low sulfur fuel standards. This factor fortifies the recommendation to exclude the Huntsville MSA as an 8-hour ozone nonattainment area.

Table 12 Daily VMT for Huntsville MSA and Morgan County

County	1990 Daily VMT	2001 Daily VMT	Daily VMT Change (1990-2001)	% Change	% of Area 2001 Daily VMT
Madison Co	4,879,828	6,278,132	1,398,304	28.7%	52.0%
Limestone Co	2,042,931	2,349,040	306,109	15.0%	19.5%
Morgan Co	2,750,737	3,447,434	696,697	25.3%	28.6%
Area Total	**9,673,496**	**12,074,606**	**2,401,110**	**24.8%**	**100.0%**

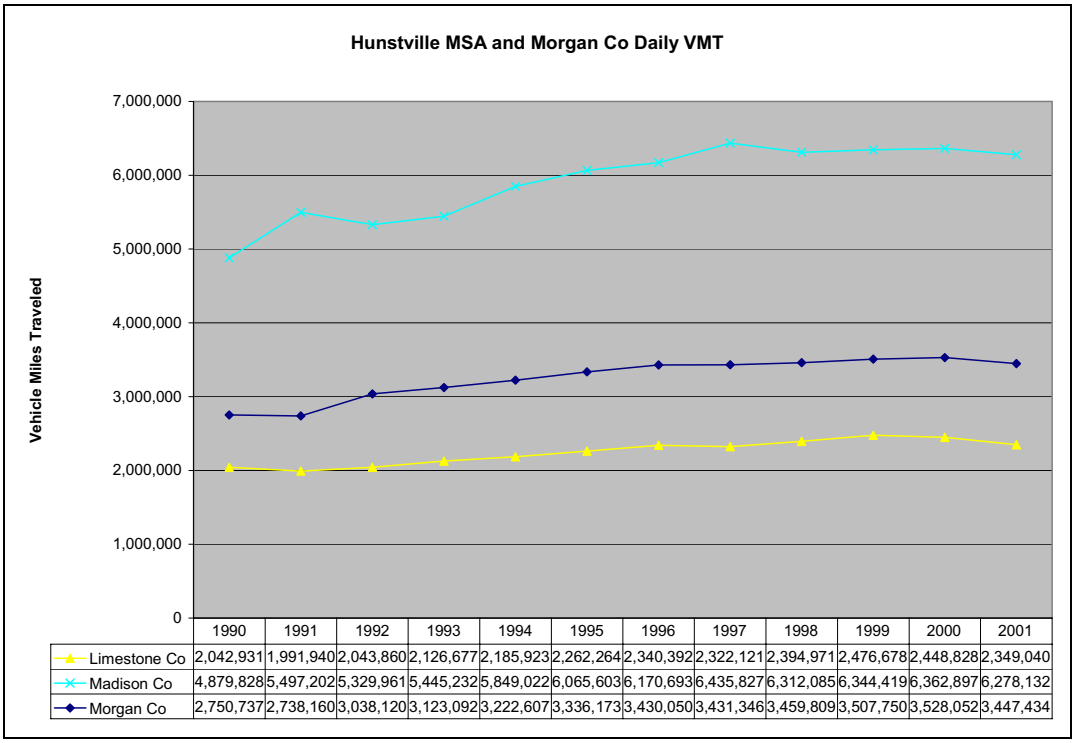


Figure 10 Daily VMT Trend for Huntsville MSA

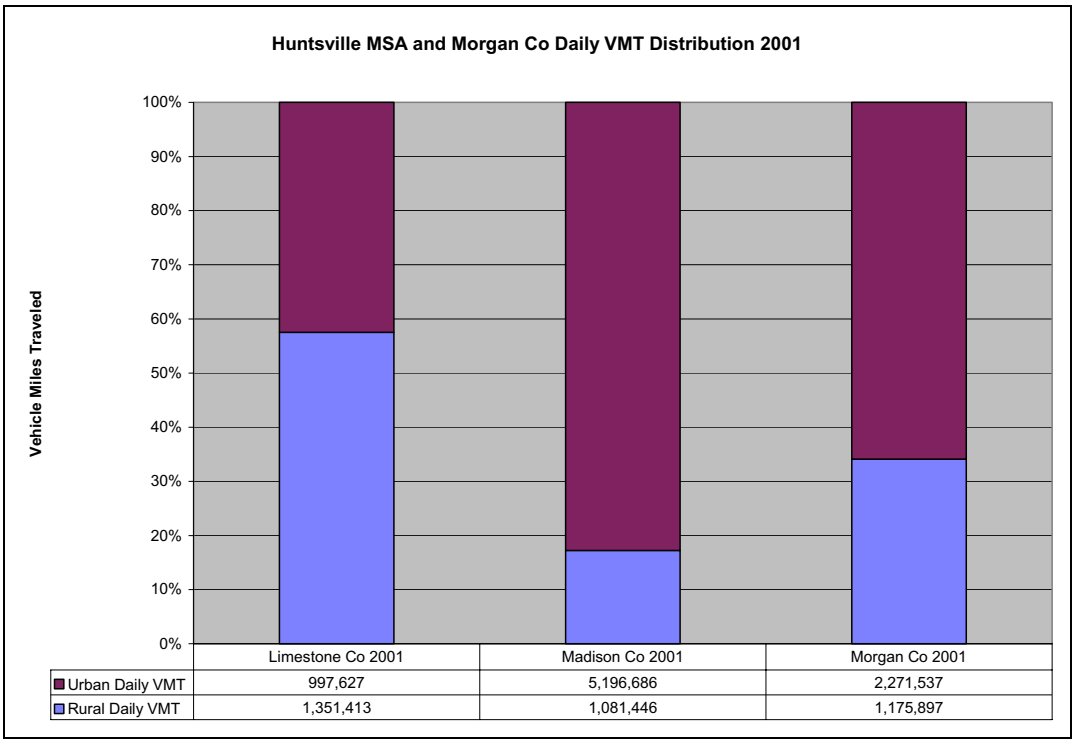


Figure 11 Rural vs Urban Daily VMT for Huntsville MSA

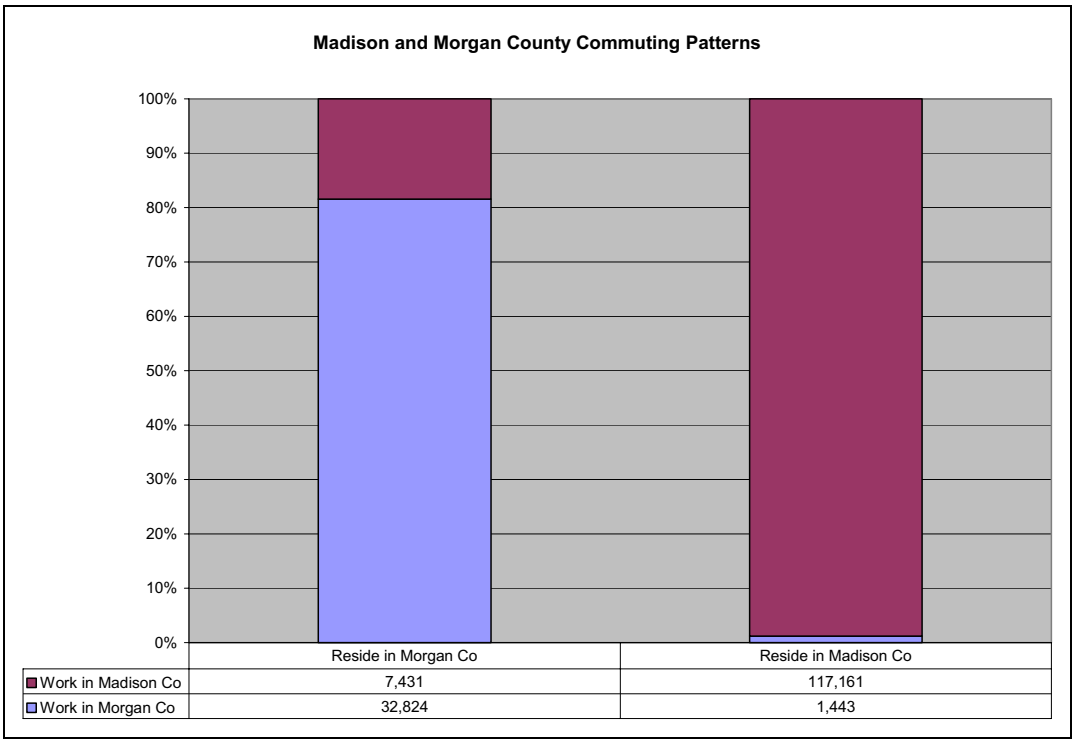


Figure 12 Commuting Patterns for Madison and Morgan Counties

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

There is little information available about expected growth. Table 13 provides population growth estimates that were obtained from the Alabama Data Center. The estimates do not show that significant growth is expected in either county. 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 did not play a role in the recommendation to exclude the Huntsville MSA as an 8-hour ozone nonattainment area.

Table 13 Population Projections for Huntsville MSA

County Name	1990	2002	2015	2025	% Change 1990-2002	% Change 2002-2015	% Change 2015-2025
Madison	238,912	283,534	324,153	349,713	18.7%	14.3%	7.9%
Limestone	54,135	67,900	81,747	90,865	25.4%	20.4%	11.2%

G. Meteorology

It is clear that meteorology plays a major role in the formation and transport of ozone. During the 2000-2002 ozone seasons, ozone levels in Huntsville exceeded the proposed 8-hour standard on approximately 8 days over the three year period. The nearby Decatur monitor exceeded the standard on 6 of the 8 days. A preliminary wind analysis was completed to evaluate the predominant wind direction(s) in Huntsville during the ozone season (April – October) on exceedance days. Wind data from the Huntsville airport was used in this analysis. As seen in the wind rose in Figure D-1, there is no dominant wind direction during the "O_3 season daytime hours", corresponding to 6 am – 6 pm. A similar pattern is shown in Figure D-2 for all exceedance day hours.

A similar depiction of the surface winds is shown when using the National Oceanic and Atmospheric Administration model HYSPLIT. HYSPLIT is a model in which air parcel back trajectories are calculated. As seen in the HYSPLIT model back trajectory runs in Figures D-3 through D-10, no dominant wind direction can be identified on the ozone days evaluated. This implies, as suspected, that wind direction is a function of many variables, including synoptic scale weather systems, surface level heating and terrain influenced wind flows in the Huntsville area.

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

The geography/topography of an area definitely influences the creation and transport of ozone. The Huntsville area is located in Northeast Alabama in the southern extremities of the Appalachians on the Cumberland Plateau. The area is surrounded by mountains, and the Tennessee River, which bends to the south. Due to the variability of the terrain in the area and the lack of monitoring data or air quality analyses to evaluate the complex wind patterns that would promote the creation of ozone, the conclusion is that there is insufficient data to support the inclusion or exclusion of counties in the designation process.

I. Jurisdictional Boundaries

The Department has received and shared data with the Tennessee Department of Environment and Conservation (40 CFR, §81.72). Within the Tennessee River Valley-Cumberland Mountains Interstate air quality control region, there are no MSAs shared between the states of Tennessee and Alabama. The City of Huntsville is the local air program whose jurisdictional boundaries are the Huntsville city limits. The remainder of Madison County and the adjoining county (Limestone) in the MSA are in the jurisdiction of the State air program under the purview of the ADEM. Adjacent to the Huntsville MSA is the Decatur MSA consisting of Morgan and Lawrence Counties. The State of Alabama holds jurisdiction within Morgan County, in which the State's monitor is located which supports representative data for Morgan County being recommended as the 8-hour nonattainment boundary. The monitor in Huntsville supports representative data for the recommendation that Madison County be excluded as an 8-hour ozone nonattainment area. Discussion elsewhere in this document demonstrates the State's recommendations for exclusion of the Huntsville MSA as a part of the 8-hour 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 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 of degradation of clean air areas.

Additionally, as discussed under regional emission reductions, the EPA has required a NO_X SIP Call for 22 states, including Alabama, that by 2004, will result in large reductions in NO_X 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.

K. Regional Emission Reductions

EPA performed Urban Airshed Modeling to estimate the impact of implementation of the NO_X SIP Call, heavy duty diesel engine standards, highway diesel fuel sulfur control, and Tier II national fuel standards. The results obtained from EPA for Alabama demonstrates that the reductions in 8-hour ozone resulting from these national programs will be sufficient to bring all monitored areas of Alabama into attainment of the 8-hour standard by 2007. These results are documented in Attachment 1. Since additional local controls are unlikely to be required for Decatur to meet the NAAQS, it is unnecessary to designate counties nonattainment beyond those with monitored data exceeding the NAAQS. Further, the lack of a nonattainment designation in a county does not preclude ADEM from requiring controls in the county if controls are deemed necessary.

FIGURE D-3

FIGURE D-4

FIGURE D-5

FIGURE D-6

FIGURE D-7

FIGURE D-8

FIGURE D-9

FIGURE D-10