Five Year Ambient Air Monitoring Network Assessment For the State of Alabama

July 1, 2015

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Introduction

This document is intended to detail the five year network assessment performed by the ambient air monitoring agencies in the State of Alabama. In Alabama, these agencies are the Alabama Department of Environmental Management, ADEM, the Jefferson County Department of Health, JCDH, and the City of Huntsville Division of Natural Resources and Environmental Management, HDNREM. The requirement to submit an assessment of the air quality surveillance system is provided for in §58.10, (d) which states:

> *"The State, or where applicable local, agency shall perform and submit to the EPA Regional Administrator an assessment of the air quality surveillance system every 5 years to determine, at a minimum, if the network meets the monitoring objectives defined in appendix D to this part, whether new sites are needed, whether existing sites are no longer needed and can be terminated, and where new technologies are appropriate for incorporation in the ambient air monitoring network. The network assessment must consider the ability of existing and proposed sites to support air quality characterization for areas with relatively high populations of susceptible individuals (e.g., children with asthma), and, for any sites that are being proposed for discontinuance, the effect on data users other than the agency itself, such as nearby States and Tribes or health effects studies. For $PM_{2.5}$, the assessment also must identify needed changes to population-oriented sites. The State, or where applicable local, agency must submit a copy of this 5-year assessment, along with a revised annual network plan to the Regional Administrator. The first assessment is due July 1, 2010."*

This document will be organized by pollutants, such as, ozone, particulate matter, sulfur dioxide, and nitrogen dioxide and others. Within each section, the following items will be discussed. Each agency will assess these factors for the portion of the network in their jurisdiction.

- Whether the network meets the monitoring objectives defined in Appendix D.
- Whether new monitoring sites are needed.
- Whether existing sites are no longer needed and can be terminated.
- Whether new technologies are appropriate for incorporation into the air monitoring network.
- The ability of existing and proposed sites to support air quality characterization in areas with high populations of susceptible individuals (e.g., children with asthma).
- Whether site discontinuance would have an adverse impact on other data users or health studies.
- Whether population oriented monitors are located properly.

In order to assess the network's suitability for the seven objectives listed above each agency will consider the following:

- Statewide and local level population statistics.
- Statewide ambient air monitoring network pollutant concentration trends for the past 5 years.

- Network suitability to measure the appropriate spatial scale of representativeness for selected pollutants.
- Monitoring data spatial redundancy or gaps that need to be eliminated.
- Programmatic trends or shifts in emphasis or funding that lead toward different data needs.

Other considerations that are taken into account include:

- Statewide and local level emission source trends, characteristics, and inventories.
- Statewide plans to modify, add, or remove emission sources.
- Statewide and local level meteorological impacts on pollutant concentrations.
- Potential impacts of pollutant and precursor transport on measured concentrations.

Each year these agencies prepare a separate document that details the annual network review and description. For 2015, this document was placed on ADEM's website on June 2 to begin a 30 day public review period. This document can be accessed at the following link:

http://adem.alabama.gov/programs/air/airquality/2015AmbientAirPlan.pdf

Or by contacting:

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Several of the topics in this assessment, such as Appendix D requirements, are covered in detail in the annual review and will be referenced from this document.

Definitions and Acronyms

AAQM	ambient air quality monitoring
AAQMP	Ambient Air Quality Monitoring Plan
ADEM	Alabama Department of Environmental Management
Appendix D	Volume 40, Code of Federal Regulations, part 58, Appendix D
AQS	air quality system
Avg	average
Bham	Birmingham
CBSA	Core Based Statistical Area
CFR	*Code of Federal Regulations*
CSA	Consolidated Statistical Area
EPA	Environmental Protection Agency
FEM	Federal Equivalent Method
FRM	Federal Reference Method
HDNREM	Huntsville Division of Natural Resources and Environmental Management
hr	hour
hi-vol	high-volume PM_{10} sampler
JCDH	Jefferson County Department of Health
Low-vol	low-volume particulate sampler
m^3	cubic meter
min	minute
ml	milliliter
MSA	metropolitan statistical area
NAAQS	national ambient air quality standard
NCore	National core monitoring (multi-pollutant)
O_3	ozone
PAMS	photochemical air monitoring station
Pb	lead
PM	particulate matter
$PM_{2.5}$	particulate matter less than 2.5 micrometers diameter
PM_{10}	particulate matter less than 10 micrometer diameter
$PM_{10-2.5}$	particulate matter less than 10 microns but greater than 2.5 microns
QA	quality assurance
QAPP	Quality Assurance Project Plan
QC	quality control
SLAMS	state and local air monitoring station
SO_2	sulfur dioxide
SPM	special purpose monitor
STN	($PM_{2.5}$) Speciation Trends Network
TEOM	Tapered Element Oscillating Microbalance (Rupprecht and Patashnick Co.)
TPY	Tons per Year
TSP	total suspended particulate
URG	URG-3000N $PM_{2.5}$ Speciation monitoring carbon-specific sampler
USEPA	United States Environmental Protection Agency
° C	degree Celsius
$\mu g/m^3$	micrograms (of pollutant) per cubic meter (of air sampled)

Strategy for Ranking Sites in the Network

This assessment is intended to determine that adequacy of the current network to meet the monitoring objectives in the state. It is intended to identify the need for additional monitors or to determine if some monitors may be redundant. In this regard a ranking system was developed to provide a frame work for making these decisions. While this assessment may identify areas that could benefit from additional monitoring, it must be realized that monitoring resources are limited at both the state and local and national levels. Therefore goals may be established to provide additional monitoring but these will be dependent on future funding sources and/or may require equivalent offsets in existing monitoring efforts.

The following ranking system has been developed to assist with network decisions. Monitors which are assigned a higher rank will be determined to have a higher importance in the network. For example, some monitors will be required in the 40CFR58, appendix D federal regulations and must be maintained and should receive a high rank. For general considerations, a rank of 20 or greater indicates that the monitor has high importance in the network.

Table 1 Ranking Matrix

Category	Point value	Comment
Appendix D required	10	Must be retained
NCORE required	10	Must be retained
Potential to exceed NAAQS	1 to 5	Important for $pm_{2.5}$ frequency and method decisions
Potential to exceed 95% of the NAAQS	1 to 5	Combined with population to determined Appendix D requirements
Potential to exceed 85% of the NAAQS	1 to 5	Combined with population to determined Appendix D requirements
Located in complex terrain	1 to 5	May represent unique air shed in the network
Used for AQI reporting	3	MSAs greater than 350,000 population report AQI daily
Used to fill spatial needs for Airnow reporting	3	Monitors may be needed to present a more accurate and representative map.
Used in outside health studies	5	
Located in unique areas	5	Near road way, Near emission points
Background monitor	5	Used for App. D requirement and modeling studies
Transport monitor	5	Used for App. D requirement and modeling studies
Required collocated	10	Required for Appendix A, QA decision making
Community concerns	10	Requested by the community to address specific concerns
Forecasting	10	Monitors in and outside of an MSA may be needed to perform required forecasting.
Potential to be affected by proposed changes to NAAQS level or Monitoring regulations	20	Changes to the NAAQS are expected for $PM_{2.5}$, Ozone, and the SO_2/NO_2 secondary standards within the next 5 years.

Population Distribution

Since much of the requirements for monitoring in Appendix D of part 58 are based on populations and metropolitan statistical areas, this section will describe the current population distribution throughout Alabama and changes over the last decade that could have an effect on whether the current network is continuing to meet the original objectives.

State Wide Population Changes

The maps below were prepared using data from the US Census Bureau and the maps in Figure 1 were generated use the University of Alabama website below. The base year for comparison is 1990. For this analysis the change in population is presented starting in 1999 since this is the year that most $PM_{2.5}$ monitors were deployed in Alabama. These maps indicate an increase in population in Baldwin County, Autauga County, Elmore County, Shelby County, Russell County and in northeast Alabama, especially in Madison County. These counties are generally associated with metropolitan statistical areas, MSAs. In the same time period there has been a decrease in population in mostly rural Southwest Alabama. In neighboring states there has been a general growth in the coastal areas and a tremendous growth in population in the metropolitan Atlanta area.

Population Data Source: https://www.nhgis.org/
Population Maps 1950 – 2010 Source:
http://alabamamaps.ua.edu/Interactive%20Maps/Demographics/PopChange/popchange.html

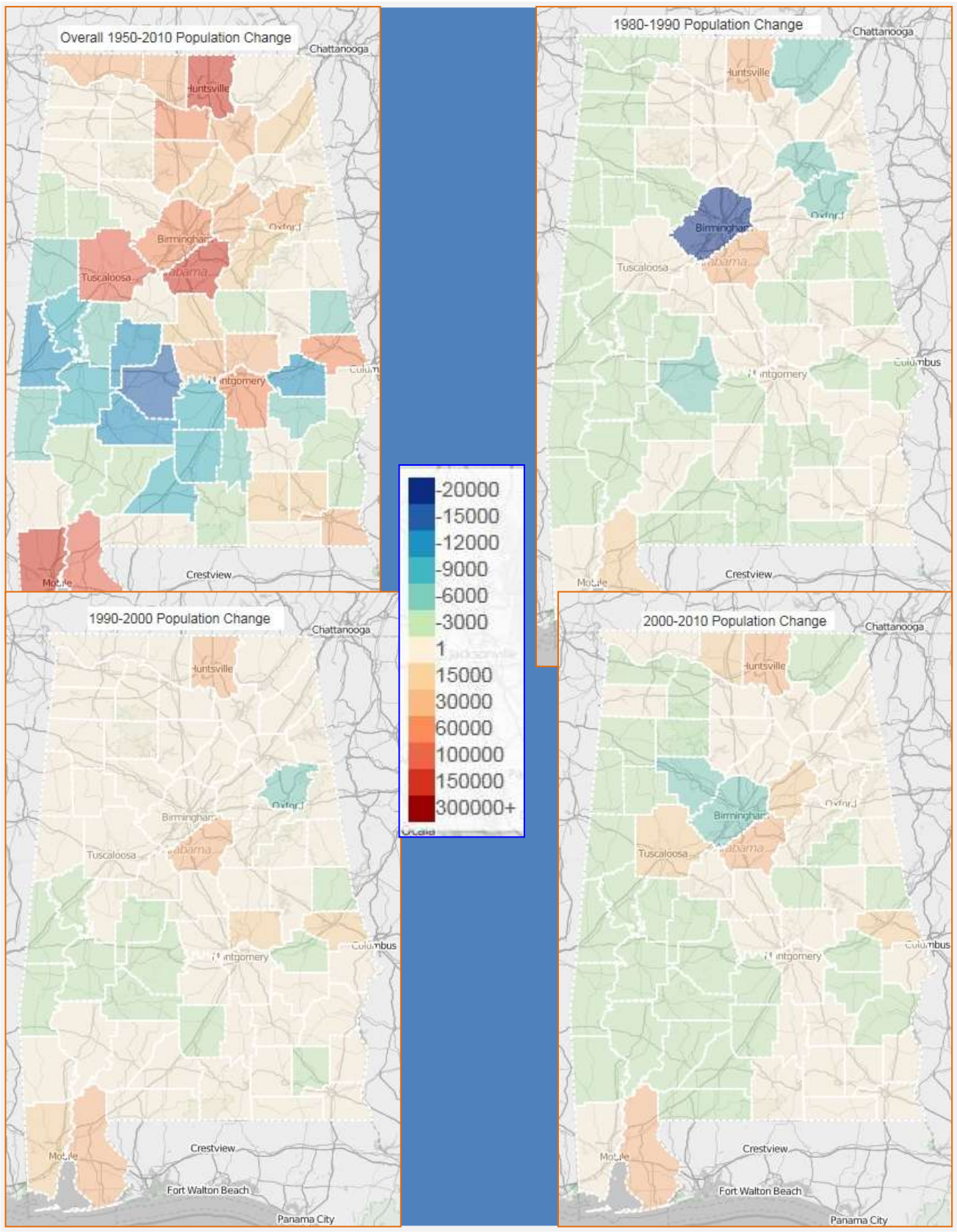


Figure 1 Population Change Maps, 1950 - 2010

Figure 2 Population Change by County from 2010 to 2014

Change in CBSA Boundries Since 2010

Figure 3 Metropolitan Statistical Areas

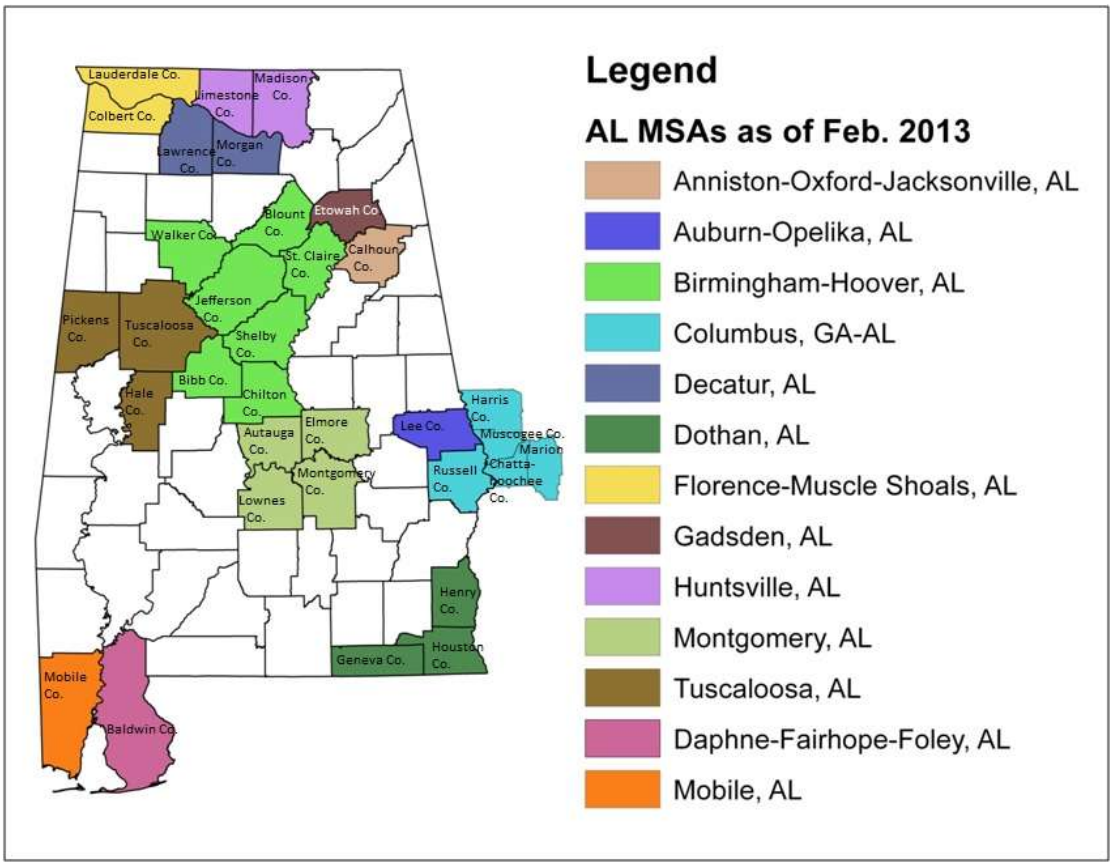


Table 2 Core Based Statistical Areas in Alabama

CBSA Title	Metropolitan/Micropolitan Statistical Area	County/County Equivalent	2014 CBSA Population Estimate
Anniston-Oxford-Jacksonville, AL	Metropolitan Statistical Area	Calhoun County	115916
Auburn-Opelika, AL	Metropolitan Statistical Area	Lee County	154255
Birmingham-Hoover, AL	Metropolitan Statistical Area	Bibb, Blount, Chilton, Jefferson, St. Clair, Shelby, Walker	1263739
Columbus, GA-AL	Metropolitan Statistical Area	Russell, Chattahoochee GA, Harris GA, Marion GA, Muscogee GA	314005
Daphne-Fairhope-Foley, AL	Metropolitan Statistical Area	Baldwin County	200111
Decatur, AL	Metropolitan Statistical Area	Lawrence, Morgan	153084
Dothan, AL	Metropolitan Statistical Area	Geneva, Henry, Houston	148095
Florence-Muscle Shoals, AL	Metropolitan Statistical Area	Colbert, Lauderdale	147639
Gadsden, AL	Metropolitan Statistical Area	Etowah County	103531
Mobile, AL	Metropolitan Statistical Area	Mobile County	415123
Huntsville, AL	Metropolitan Statistical Area	Limestone, Madison	441086
Montgomery, AL	Metropolitan Statistical Area	Autauga, Elmore, Lowndes, Montgomery	373141
Talladega-Sylacauga, AL	Micropolitan Statistical Area	Coosa, Talladega	92208
Albertville, AL	Micropolitan Statistical Area	Marshall County	94636
Cullman, AL	Micropolitan Statistical Area	Cullman County	81289
Enterprise, AL	Micropolitan Statistical Area	Coffee County	50909
Ozark, AL	Micropolitan Statistical Area	Dale County	49484
Scottsboro, AL	Micropolitan Statistical Area	Jackson County	52665
Selma, AL	Micropolitan Statistical Area	Dallas County	41711
Tuscaloosa, AL	Metropolitan Statistical Area	Hale, Pickens, Tuscaloosa	237761
Troy, AL	Micropolitan Statistical Area	Pike County	33389

Meteorological Data

Wind Roses

Wind Roses were created using five years of one minute ASOS data from six areas of the state. The wind roses used 5 years of data (2010-2014). Wind Roses were prepared for pollutants which are monitored year-round such as particulate matter and sulfur dioxide. Also, wind roses were prepared for data collected during the ozone monitoring season, March 1 through October 31.

Meteorology in the Birmingham MSA

It is known that meteorology plays a major role in the formation and transport of ozone. In the Birmingham area, wind direction and speed are important indicators to where ozone forms and travels. In the 2010-2014 ozone seasons, the wind rose showed a predominately east-northeasterly flow. The 2010-2014 wind rose for PM 2.5 showed a predominately east-northeasterly flow with a northerly secondary maximum.

Meteorology In The Huntsville MSA

It is known that meteorology plays a major role in the formation and transport of ozone. In the Huntsville area, wind direction and speed are important indicators to where ozone forms and travels. In the 2010-2014 ozone seasons, the wind rose showed a predominately southeasterly flow. The 2010-2014 wind rose for PM 2.5 showed a predominately southeasterly flow as well.

Meteorology In The Mobile MSA

It is known that meteorology plays a major role in the formation and transport of ozone. In the Mobile area, wind direction and speed are important indicators to where ozone forms and travels. In the 2010-2014 ozone seasons, the wind rose showed a predominately southeasterly flow with a secondary maximum from the north. The 2010-2014 wind rose for PM 2.5 showed a predominately northerly flow with a secondary maximum from the southeast.

Meteorology In The Montgomery MSA

It is known that meteorology plays a major role in the formation and transport of ozone. In the Montgomery area, wind direction and speed are important indicators to where ozone forms and travels. In the 2010-2014 ozone seasons, the wind rose showed a predominately easterly flow with a secondary maximum from the southwest. The 2010-2014 wind rose for PM 2.5 showed a predominately easterly flow as well with a secondary maximum from the northwest.

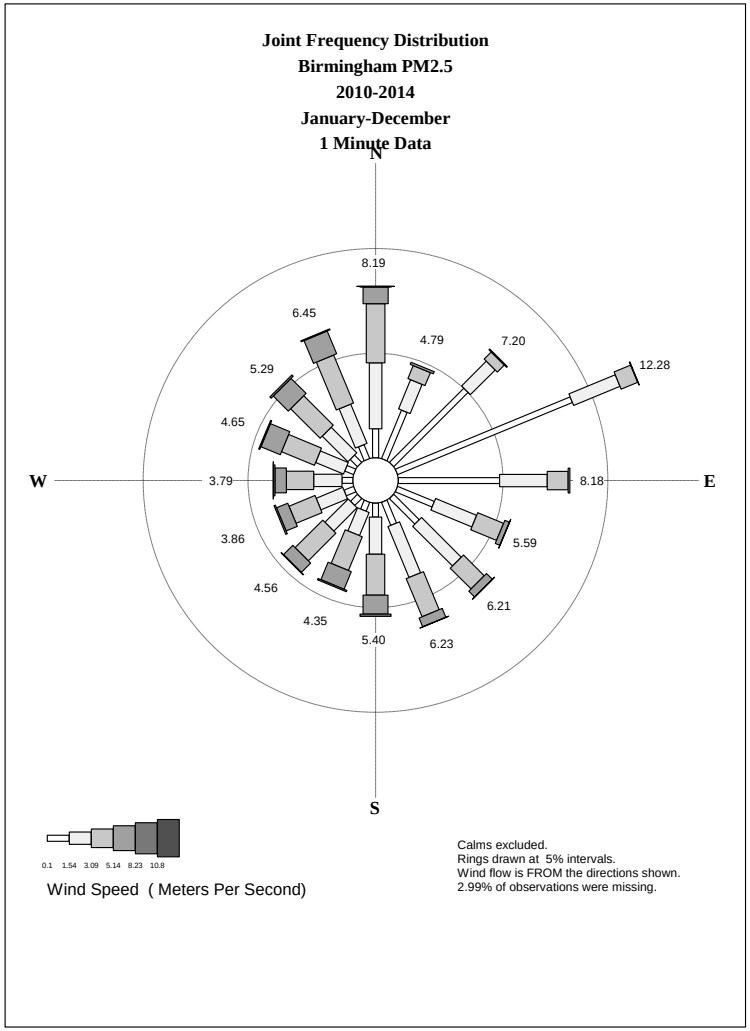
Meteorology In The Muscle Shoals MSA

It is known that meteorology plays a major role in the formation and transport of ozone. In the Muscle Shoals area, wind direction and speed are important indicators to where ozone forms and travels. In the 2010-2014 ozone seasons, the wind rose showed a predominately southeasterly flow with a secondary maximum from the south. The 2010-2014 wind rose for PM 2.5 showed a predominately southeasterly flow as well with a secondary maximum from the south.

Meteorology In The Tuscaloosa MSA

It is known that meteorology plays a major role in the formation and transport of ozone. In the Tuscaloosa area, wind direction and speed are important indicators to where ozone forms and travels. In the 2010-2014 ozone seasons, the wind rose showed a predominately southerly flow with

a secondary maximum from the north. The 2010-2014 wind rose for PM 2.5 showed a predominately northerly flow with a secondary maximum from the south.



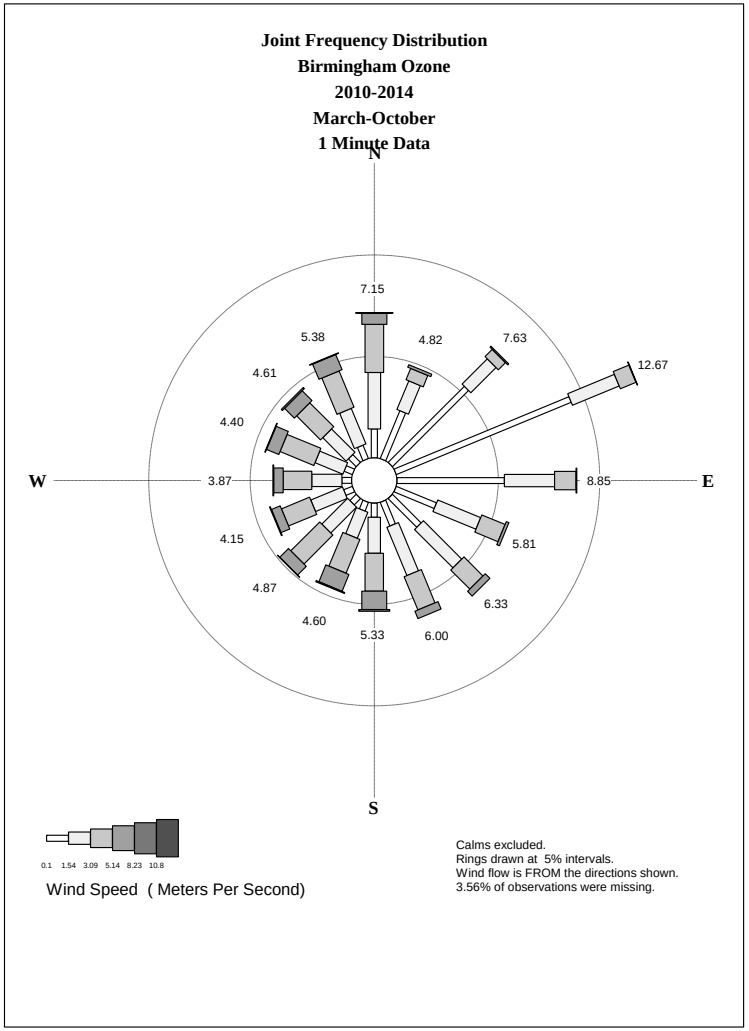
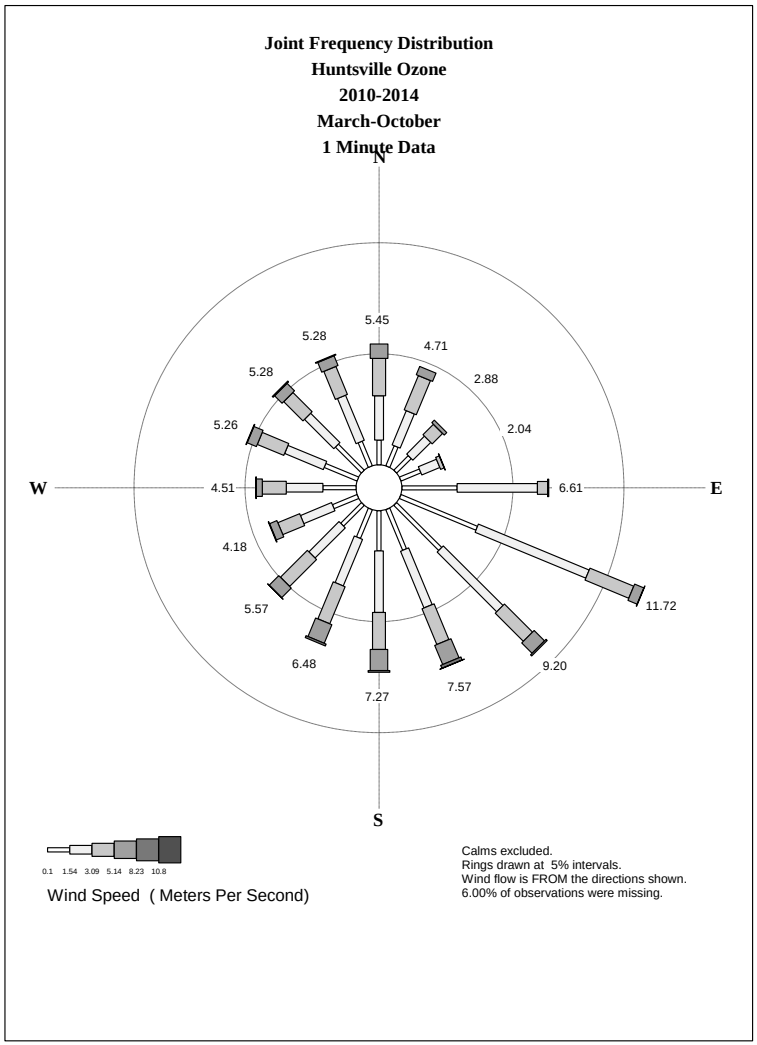


Figure 4 Birmingham Wind Roses



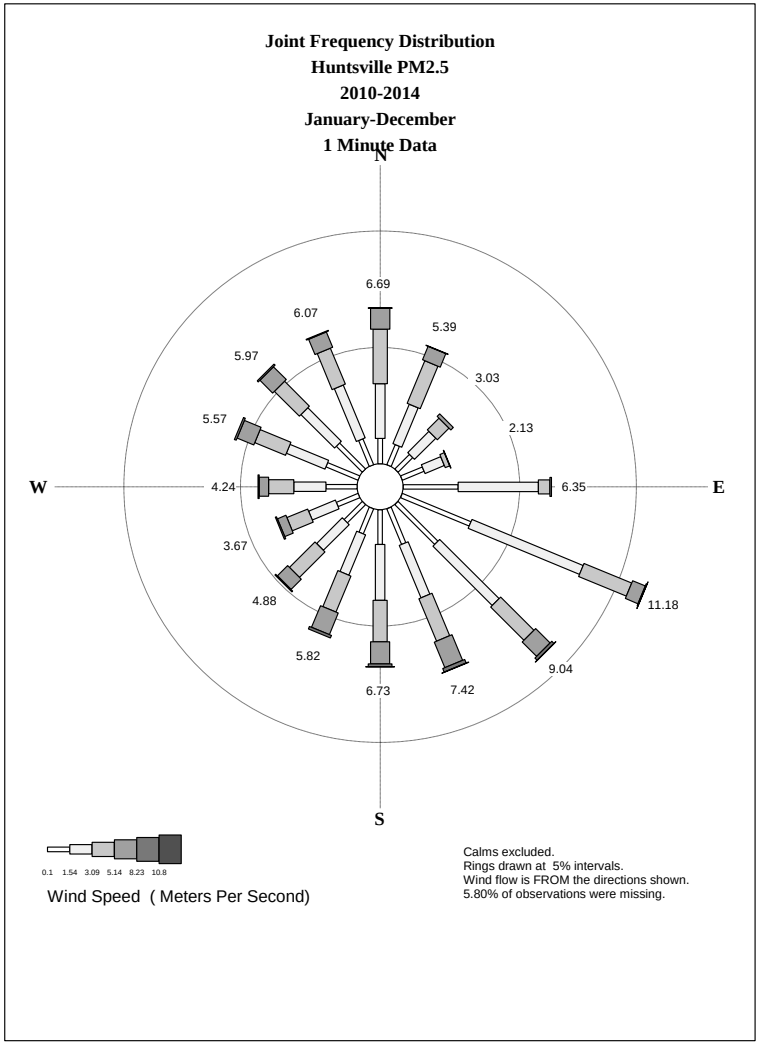
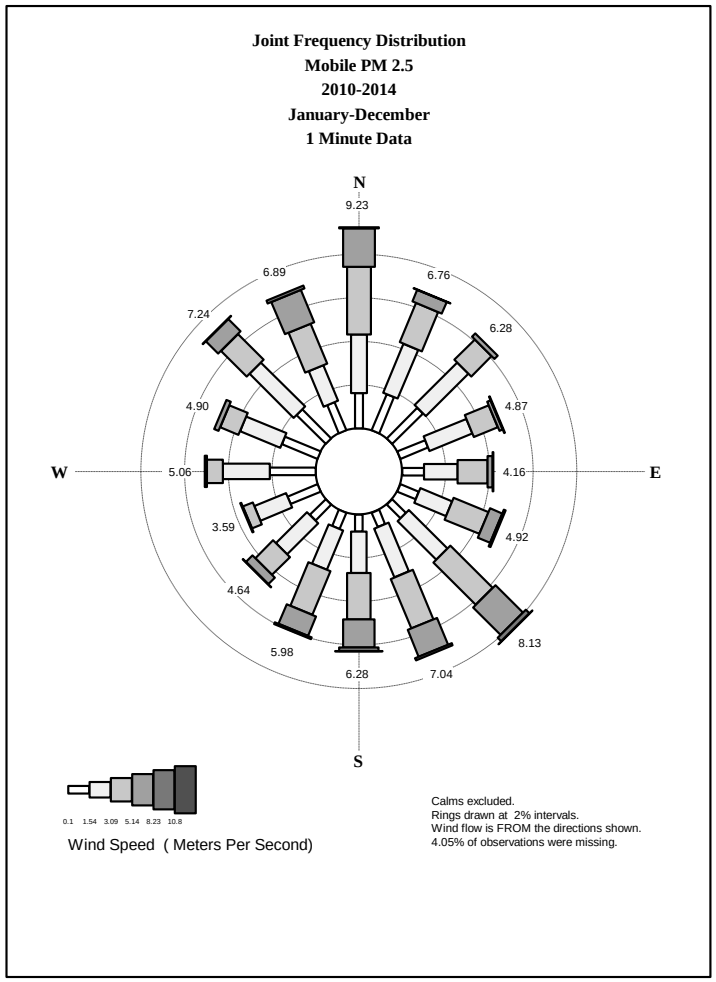


Figure 5 Huntsville Wind Roses



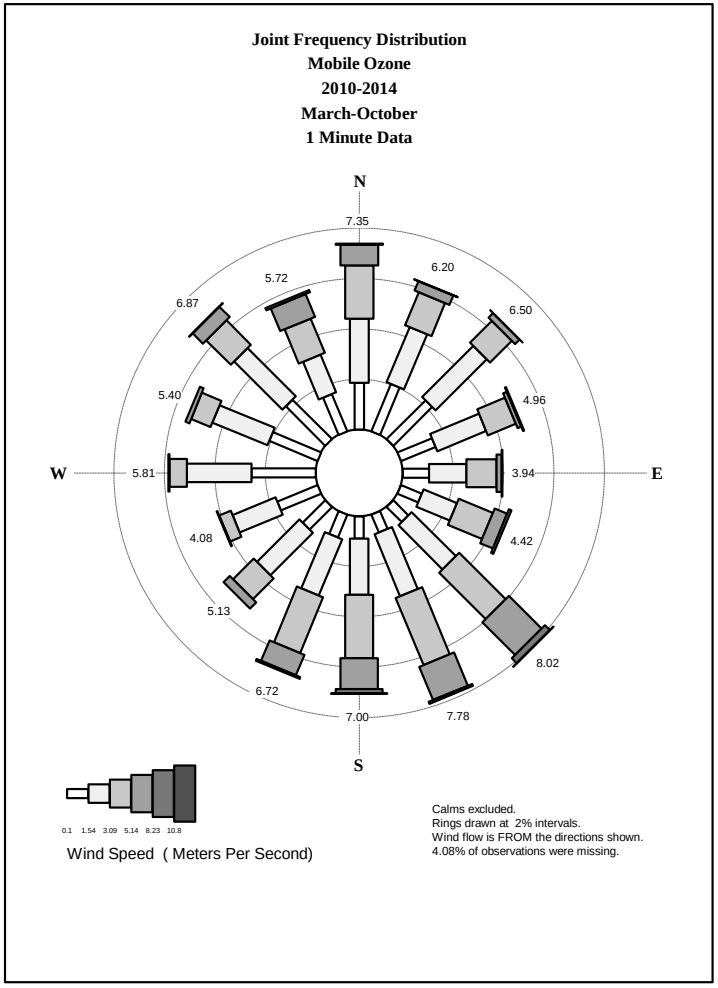
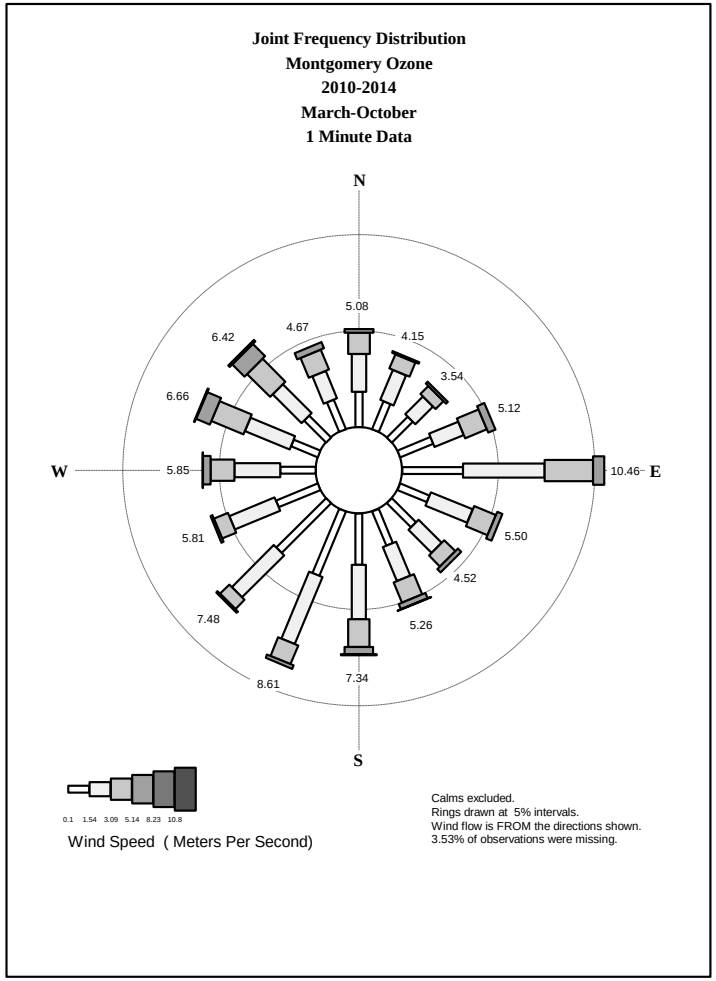


Figure 6 Mobile Wind Roses



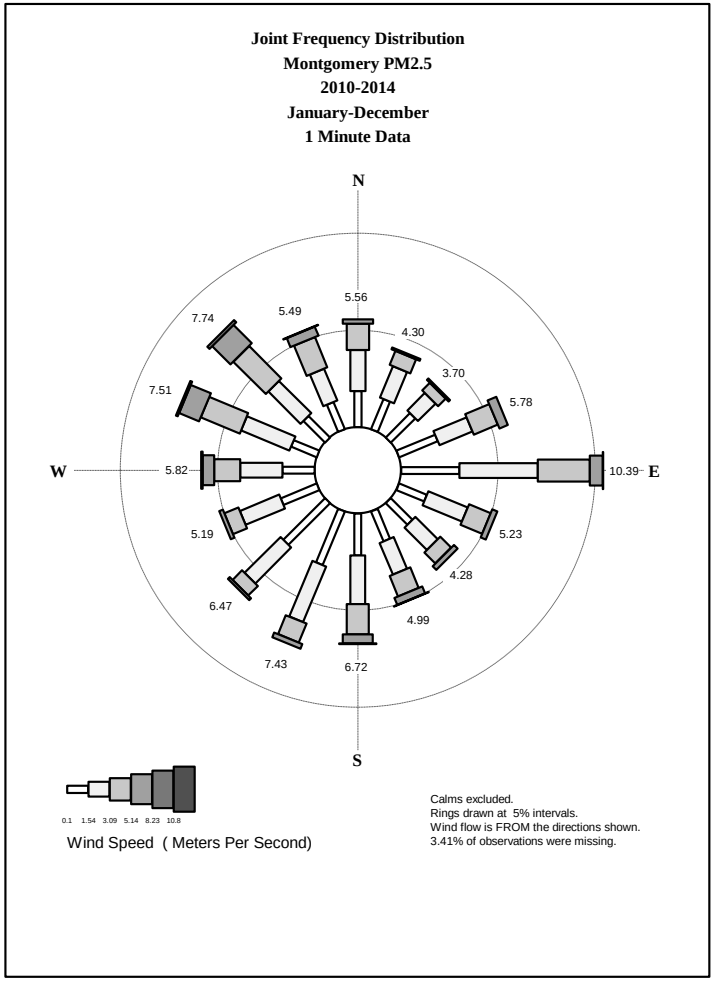
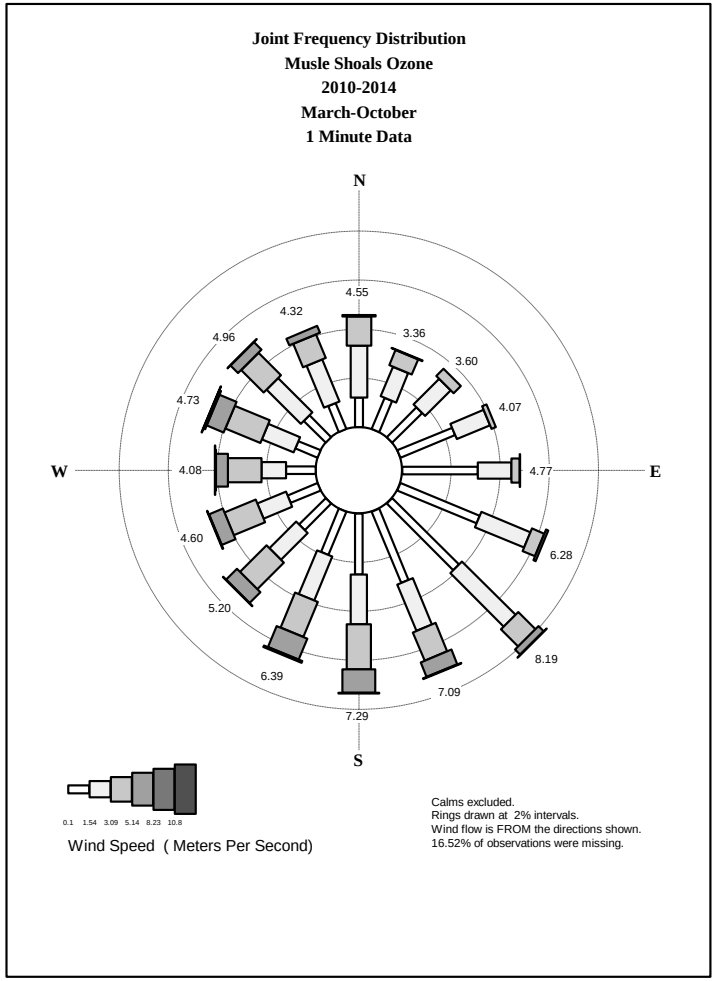


Figure 7 Montgomery Wind Roses



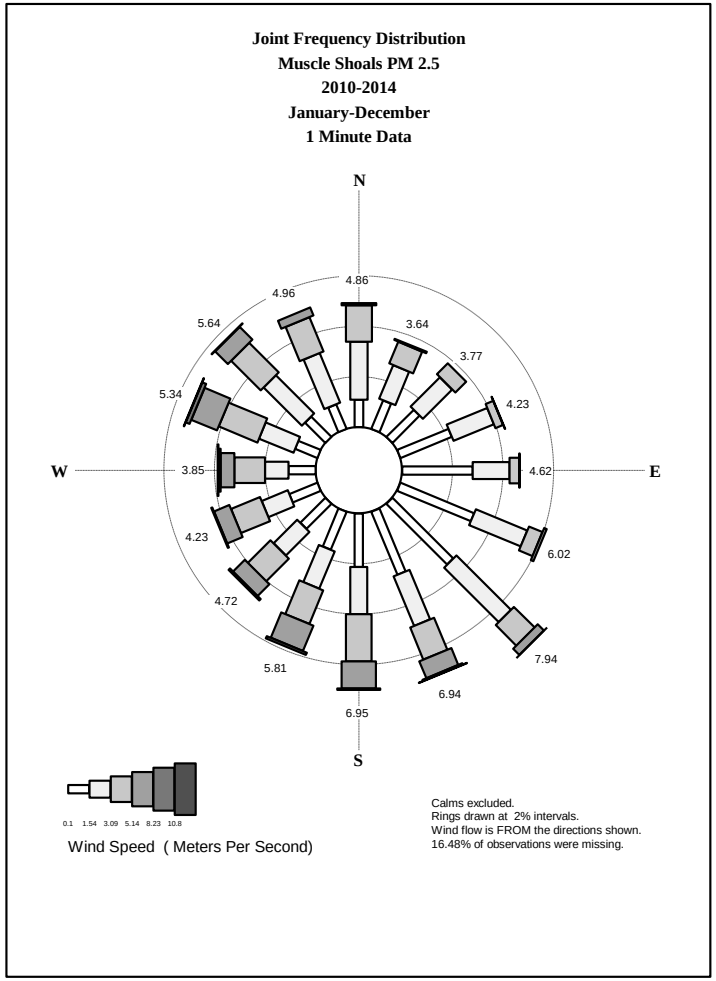
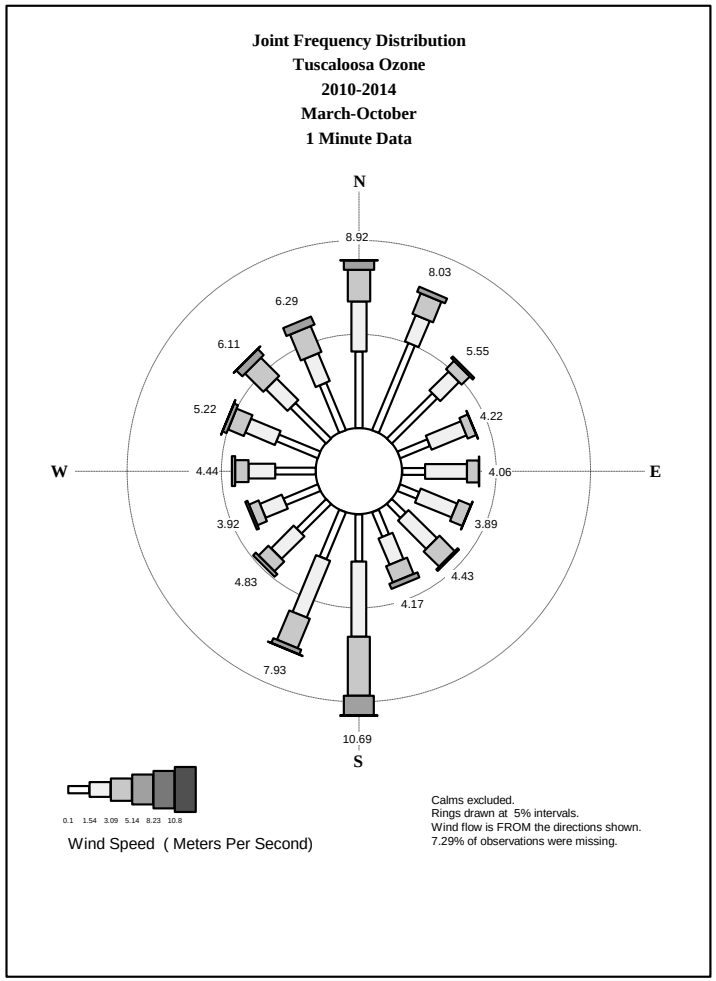


Figure 8 Muscle Shoals Wind Roses



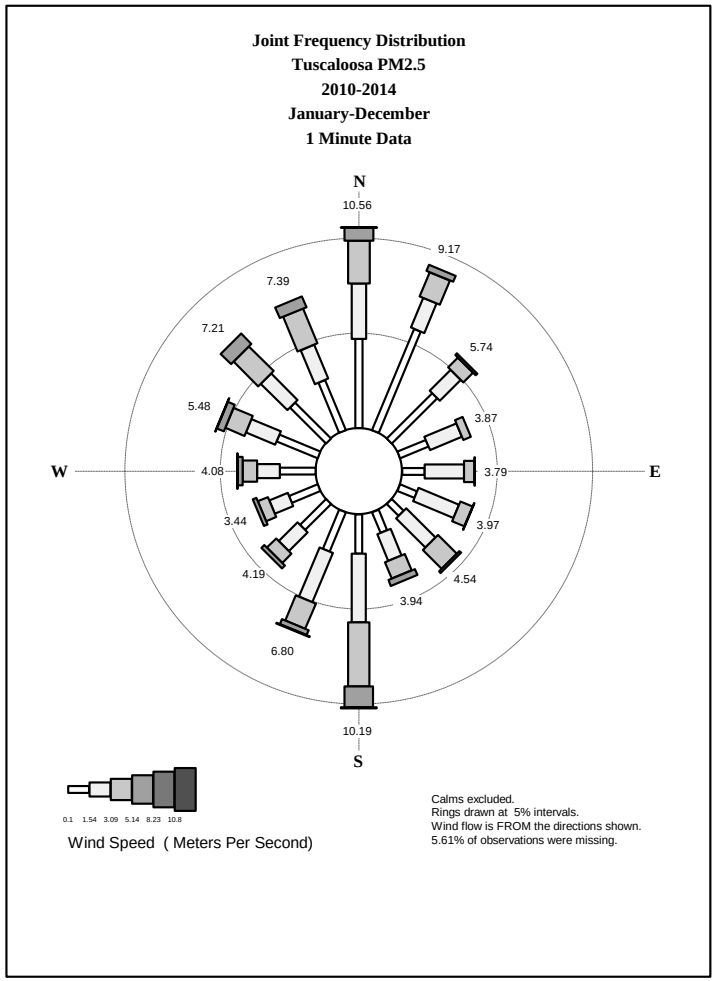


Figure 9 Tuscaloosa Wind Roses

Ozone

The ozone monitoring network as it currently exists is described in the 2015 Ambient Air Monitoring Plan. **Error! Reference source not found.** below presents a matrix of the current ozone monitors in the network and attempts to ascribe the relative importance of each monitor to the network. Since the most important ranking factors for ozone monitoring are the ability to determine NAAQS attainment status and whether the monitor is required by Appendix D, a value of 30 or greater was determined to be highly important to the network. All of the monitors in the network ranked 20 or greater. This is partly due to proposed regulations which would lower the current NAAQS from .075 ppm to a range between .070 to .060 ppm.

EPA has provided a number of tools which can aid in the assessment of whether the current sites are optimally located, whether there is redundancy in the network or whether additional monitors are needed to accurately represent the air quality in Alabama.

Updates to Ozone Monitoring since the last network assessment

The following were potential changes identified during the 2010 Network Assessment.

- The proposed rule would require three non-urban monitors. Currently there are two non–urban monitors in the network.
- The Sumter County monitor may serve as the rural site to monitor sensitive vegetation in state or federal lands.
- The Fairhope monitor would serve as the site for monitoring a micropolitan area with the potential to exceed 85% of the NAAQS.
- An additional non-urban site may be needed to monitor for transport. EPA contractors currently operate a CASTNET site in Crossville, Al., which has the potential to serve this purpose.
- All of the MSAs identified in the proposed rule as being required to have ozone monitors currently have an monitor except for the Auburn MSA. An additional site may be needed there.

The proposed rule was not promulgated and a new monitoring rule was proposed, which did not include a requirement for additional rural monitoring sites.

The Sumter County site had to be relocated approximately 4.5 miles to Ward, Alabama. This location still provides the objective of rural-background ozone site.

The new proposal does not include a requirement for monitors in large micropolitan areas. The US Census Bureau has changed the Fairhope area to a metropolitan statistical area. Evaluation of the need for monitoring in this area would be based on its status as a metropolitan statistical area.

The proposed rule does not include a requirement for additional non-urban sites, however, the CASTNET site remains and has been upgraded to meet Appendix A and E requirements.

While preparing each annual plan the number of monitors is evaluated to determine if they meet the minimum requirements of Appendix D. The current network meets all requirements and has been approved by EPA annually.

There have been two recent proposals that will affect future decisions concerning the number and placement of ozone monitors.

EPA's Proposal To Update The Air Quality Standards For Ground-Level Ozone

On Nov. 25, 2014, the U.S. Environmental Protection Agency (EPA) proposed to strengthen the National Ambient Air Quality Standards (NAAQS) for ground-level ozone, based on extensive scientific evidence about ozone's effects on public health and welfare. Some highlights of that proposal, that may affect the monitoring network are below:

Strengthening the primary (health) standard to improve public health protection

- A significantly expanded body of scientific evidence shows that ozone can cause a number of harmful effects on the respiratory system, including difficulty breathing and inflammation of the airways. For people with lung diseases such as asthma and COPD (chronic obstructive pulmonary disease), these effects can lead to emergency room visits and hospital admissions. Ozone exposure also is likely to cause premature death from lung or heart diseases.
- In addition, evidence indicates that long-term ozone exposure is likely to result in harmful respiratory effects, including the development of asthma. Asthma disproportionately affects children, families with lower incomes, and minorities, including Puerto Ricans, Native Americans/Alaska Natives and African-Americans.
- EPA is proposing that the current 8-hour ozone standard of 75 ppb is not adequate to protect public health as the law requires and that the standard should be revised to improve public health protection for millions of Americans.
- **EPA is proposing to set the health standard within a range from 65 to 70 ppb** and is seeking comment on levels for the primary standard as low as 60 ppb. The agency will accept comments on all aspects of the proposal, including on retaining the existing standard.

Strengthening the secondary (public welfare) standard to improve protection for trees, plants and ecosystems

- New studies since the last review of the standards add to evidence showing that repeated exposure to ozone reduces growth and has other harmful effects on plants and trees. These types of effects have the potential to impact ecosystems and the benefits they provide.
- **EPA is proposing to revise the level of the secondary standard to a level within the range of 65 to 70 ppb, the same range proposed for the primary standard.** The agency is proposing that a standard in this range would provide appropriate protection against the cumulative ozone exposures that can affect ecosystems through damage to plants and trees.

EPA's Proposal to Update the Ozone Monitoring Requirements

As part of the proposed revisions to the ground-level ozone standards, EPA is proposing several updates to ozone air quality monitoring requirements, including: updating the length of the ozone monitoring season in some states, which will ensure people are notified when air quality is unhealthy; revising requirements for a subset of air quality monitors known as Photochemical Assessment Monitoring Stations (PAMS); and updating the agency's Federal Reference Method for measuring ozone.

- **Ozone Monitoring Season**

EPA requires ozone monitoring only during the "ozone season" – the time of year when weather conditions are most favorable for ozone formation. This season varies by state: in some states with warmer climates, monitoring is required year-round; however, in states where the climate is colder, ozone monitoring is required for as little as four months during the summertime. During its review of the monitoring seasons across the nation,

  - EPA determined that no change was needed to Alabama's season.

- **Photochemical Assessment Monitoring Stations (PAMS) Network**

Ozone nonattainment areas classified as serious, severe, or extreme are required to operate at least two PAMS monitoring sites. These multi-pollutant monitoring sites are designed to measure ozone, the pollutants that form ozone, and meteorology in order to better understand ozone formation and to evaluate national and local ozone-reduction options. During the past 20 years, however, both monitoring technology and priorities have changed. Based on a 2011 evaluation of the PAMS network, along with consultation with EPA's independent science advisers (the Clean Air Scientific Advisory Committee) and an organization of state air agencies, EPA is proposing changes to the PAMS network design requirements to modernize and streamline the network. Some of the proposed changes include:

  - Requiring PAMS monitoring at any existing NCore site in an ozone nonattainment area instead of the current PAMS network requirements. (NCore is a multi-pollutant monitoring network for particles, gases and meteorology.) This change would improve the geographic distribution of PAMS sites, while reducing redundancy in the existing network.
  - Requiring states that operate PAMS sites to measure nitrogen dioxide, and to measure and report hourly speciated VOC measurements, using a type of monitor known as an automated gas chromatograph. EPA also is requesting comment on whether to allow the use of other, more traditional VOC monitors.
  - Establishing Enhanced Monitoring Plans to allow monitoring agencies with nonattainment areas the flexibility to determine and collect the additional data they need to better understand their ozone problems. These plans would be required for any ozone nonattainment area.

If the lower NAAQS proposed for ozone results in the Birmingham area being designated as non-attainment the NCore site would need to be upgraded to perform enhanced monitoring for some pre-cursor compounds.

Status and Timeline for EPA's New Proposals

In July 2013, the U.S. Court of Appeals for the D.C. Circuit upheld the 2008 primary ozone standard but remanded the secondary standard to EPA, on the grounds that the agency had not specified the level of air quality that was requisite to protect public welfare as required by the Clean Air Act, and had not clearly shown how the secondary standard provided this protection. The proposed revisions to the ozone standards respond to this remand.

- EPA is proposing to identify the appropriate level of protection for trees, plants and ecosystems using a seasonal index that scientists often use to assess the impact of ozone on ecosystems and vegetation. This index is known as a W126 index, named for the equation used to calculate it.
- EPA is proposing that air quality meeting a W126 index value between 13 and 17 parts per million-hours (ppm-hours), averaged over three years, would provide the degree of protection that the Clean Air Act requires. Ppm-hours is a measurement unit used to express the sum of weighted hourly ozone concentrations, combined over the 12-hour daylight period. EPA is proposing that this protection could be achieved by setting an 8-hour secondary standard in the range of 65 to 70 ppb.
- EPA is seeking comment on this target level of protection. In addition, EPA is seeking comment on achieving the necessary protection by revising the secondary standard to a W126-based standard within a range of 13 to 17 ppm-hours, averaged over three years. EPA also is seeking comment on retaining the current secondary standard.

EPA will take final action on the proposed standards by Oct. 1, 2015. Based on that date, the agency anticipates the following schedule for making area designations, if EPA revises the standards:

- By October 1 2016: States (and any tribes that choose to do so) recommend the designation for all areas of the state, or any relevant areas in Indian country, and the boundaries for those areas. To assist states and tribes in preparing their recommendations, EPA intends to update its existing designations guidance shortly after the agency takes final action on the proposal – and well before states' and tribes' recommendations are due.
- By June 1, 2017: EPA responds to states' and tribes' initial recommendations and identifies where the agency intends to modify the recommendations. States and tribes will have the opportunity to comment on EPA's response, and to provide new information and analyses for EPA to consider.
- By October 1, 2017: EPA issues final area designations; those designations likely would be based on 2014-2016 air quality data.
- 2020 to 2021: States, and any tribes that choose to do so, complete development of implementation plans, outlining how they will reduce pollution to meet the standards. State and tribal plans can include federal measures, and any local or statewide measures needed to demonstrate that a nonattainment area will meet the standards by its attainment date.
- 2020 to 2037: States are required to meet the primary (health) standard, with deadlines depending on the severity of an area's ozone problem.

- The Clean Air Act does not specify a deadline for states to meet secondary standards. EPA and states determine that date through the implementation planning process.

The Current Ozone Network

The current network is described in detail in the 2015 Alabama Consolidated Network Plan available for review at the following website:
http://www.adem.state.al.us/programs/air/airquality/2015AmbientAirPlan.pdf

A map of the currents sites is found in Figure 10.

Table 3 represents each agency's evaluation of the relative importance of the ozone sites in their jurisdiction. To determine the potential to exceed 85%, 95% or 100% of the CURRENT NAAQS, the last five 3-year design values were compared to each percentage of the NAAQS. Then the number of years where the site exceeded each level was counted. A rating of 1-5 out of the 5 design values was assigned in that category.

> For example, Helena had an 8-hour average ozone design value reading greater than 95% of .075 ppm for 4 out of 5 years, so it was assigned a 4 in that category.

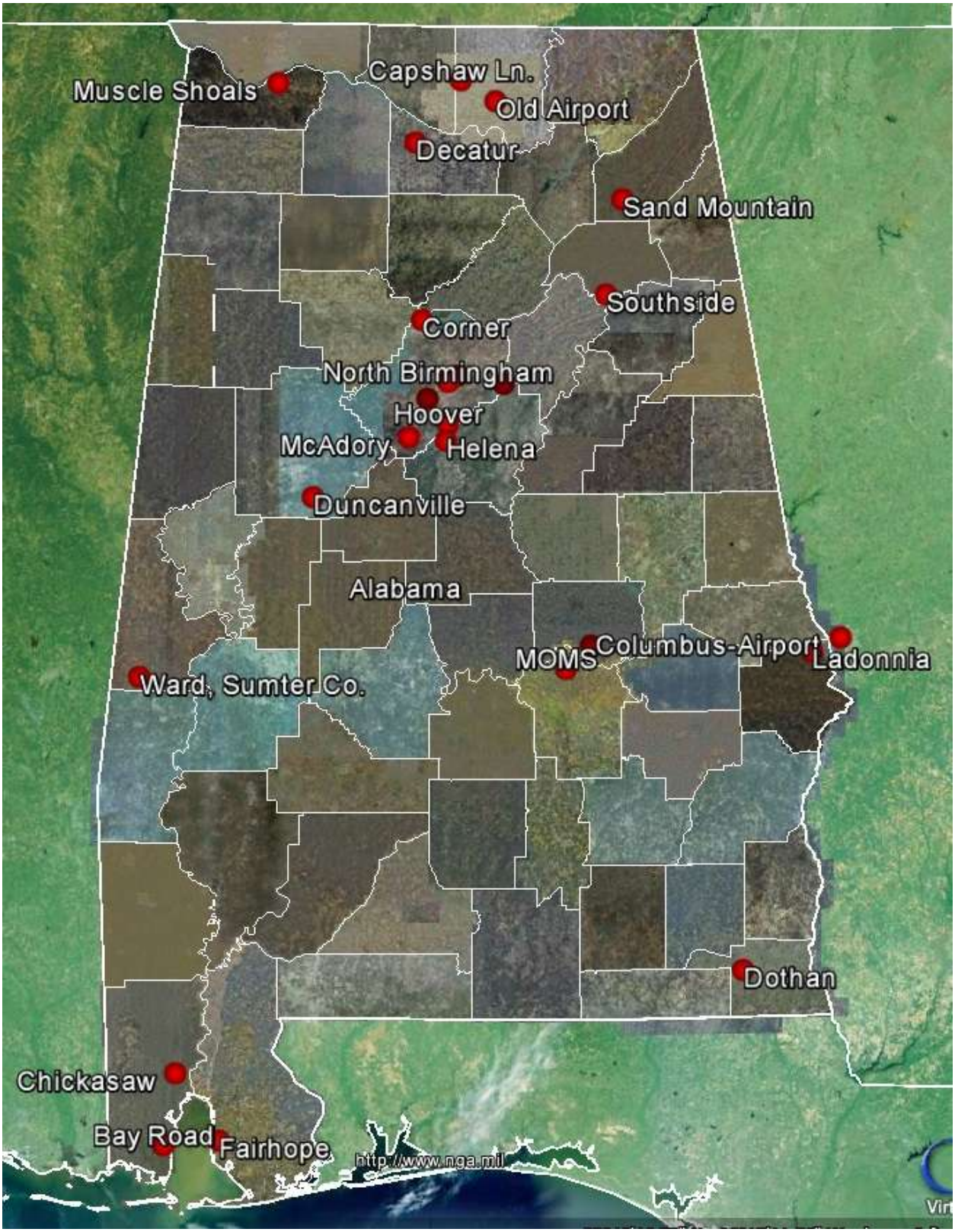


Figure 10 **Map of Existing Ozone Monitors**

Table 3 Ozone Monitor Matrix

Site Name	county code	Site Id Number	Poc	App. D req.	NCore req	Potential to exceed NAAQS	Potential to exceed 95% of the NAAQS	Potential to exceed 85% of the NAAQS	Located in complex terrain	Used for AQI	Used to fill spatial needs for Airnow	Used in outside health studies	Located in unique areas	Bkg	Transport monitor	required collocated	community concerns	Forecasting	Potential to be affected by proposed changes to NAAQS level or Monitoring regulations	Total
				10	**10**	**1 to 5**	**1 to 5**	**1 to 5**	**1 to 5**	**3**	**3**	**5**	**5**	**5**	**5**	**10**	**10**	**10**	**20**	
ADEM Sites																				
Fairhope	003	0010	1	10		0	1	5		3	3				5		10	10	20	67
Muscle Shoals	033	1002	1	10		0	0	4			3							10	20	47
DBT	051	0001	1	10		0	0	4		3	3							10	20	50
Southside	055	0011	1			0	0	0			3								20	23
Chickasaw	097	0003	1	10		0	1	5		3	3							10	20	52
Bay Road	097	2005	1	10		0	3	5		3	3						10	10	20	64
MOMS	101	1002	1	10		0	0	4		3	3							10	20	50
Decatur	103	0011	1	10		0	0	5			3							10	20	48
Ladonia	113	0002	1	10		0	0	4		3	3							10	20	50
Helena	117	0004	1	10		0	4	5		3	3							10	20	55
Sumter Co.	119	0002	1			0	0	1			3			5					20	29
Tuscaloosa Co.	125	0010	1			0	0	0			3								20	23
Dothan	069	0004	1	10		0	0	1			3								20	34
JCDH sites																				
Tarrant Elem. Sch	073	6002	1	10		2	4	5	5	3	3	5						10	20	67
Fairfield	075	1003	1			0	1	5	5	3	3	5						10	20	52
McAdory School	076	1005	1			1	4	5	5	3	3	5						10	20	56
Hoover	077	2006	1			1	4	5	5	3	3	5						10	20	56
North Birmingham	078	0023	1		10	0	2	5	5	3	3	5						10	20	63
Corner High School	079	5003	1			0	1	5	5	3	3	5						10	20	52
Leeds Elem. School	081	1010	1			1	2	5	5	3	3	5						10	20	54
HDNR Sites																				
Old Airport	089	0014	1	10		0	1	5		3	3		5					10	20	57
Capshaw Road	089	0022	1	10		0	0	4												
CASTNET Sites																				
Sand Mountain	049	9991	1			0	0	4						5						

Area Served Analysis

The area served tool uses a spatial analysis technique known as Voronoi or Thiessen polygons to show the area represented by a monitoring site. The shape and size of each polygon is dependent on the proximity of the nearest neighbors to a particular site. All points within a polygon are closer to the monitor in that polygon than to any other monitor. Once the polygons are calculated, data from the 2010 decennial census are used to find the census tract centroids within each polygon. The population represented by the polygon is calculated by summing the populations of these census tracts.

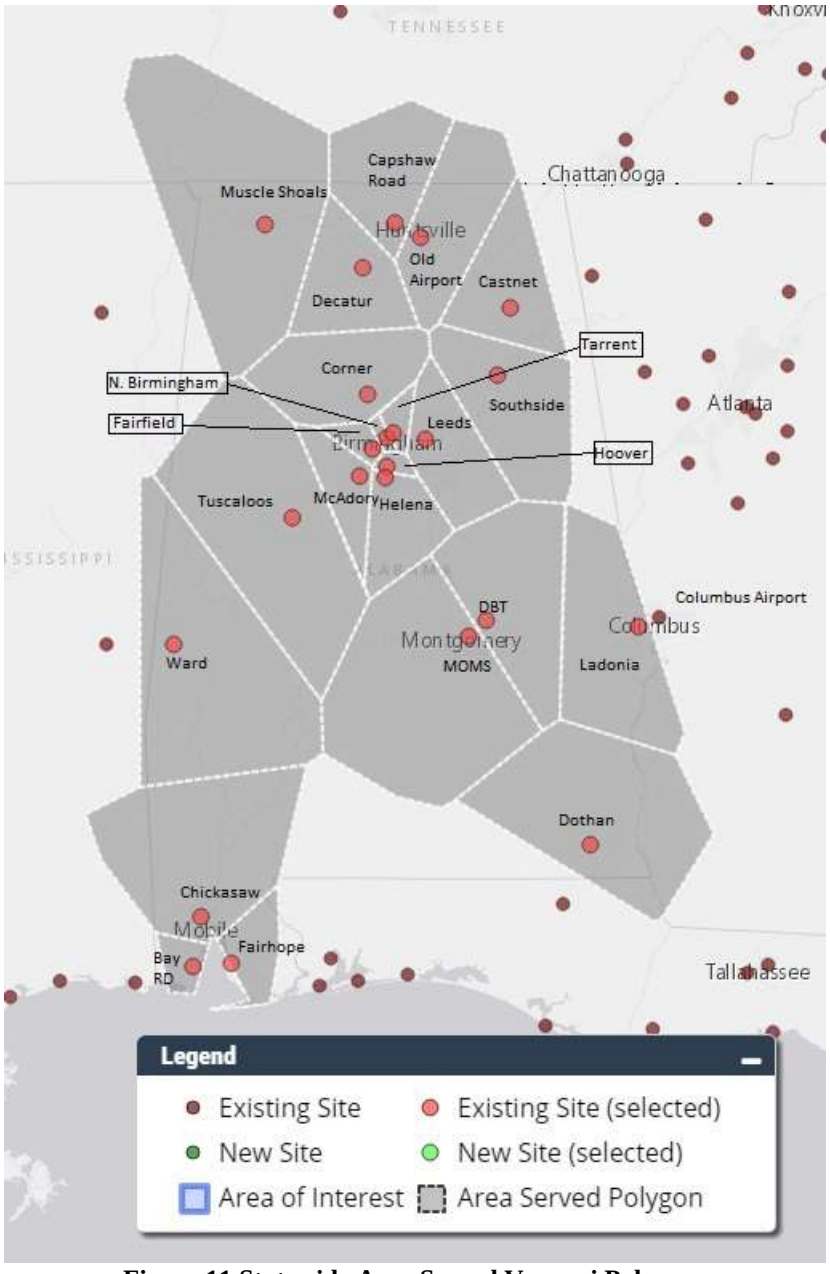


Figure 11 Statewide Area Served Voronoi Polygons

Details Maps of the Larger MSAs

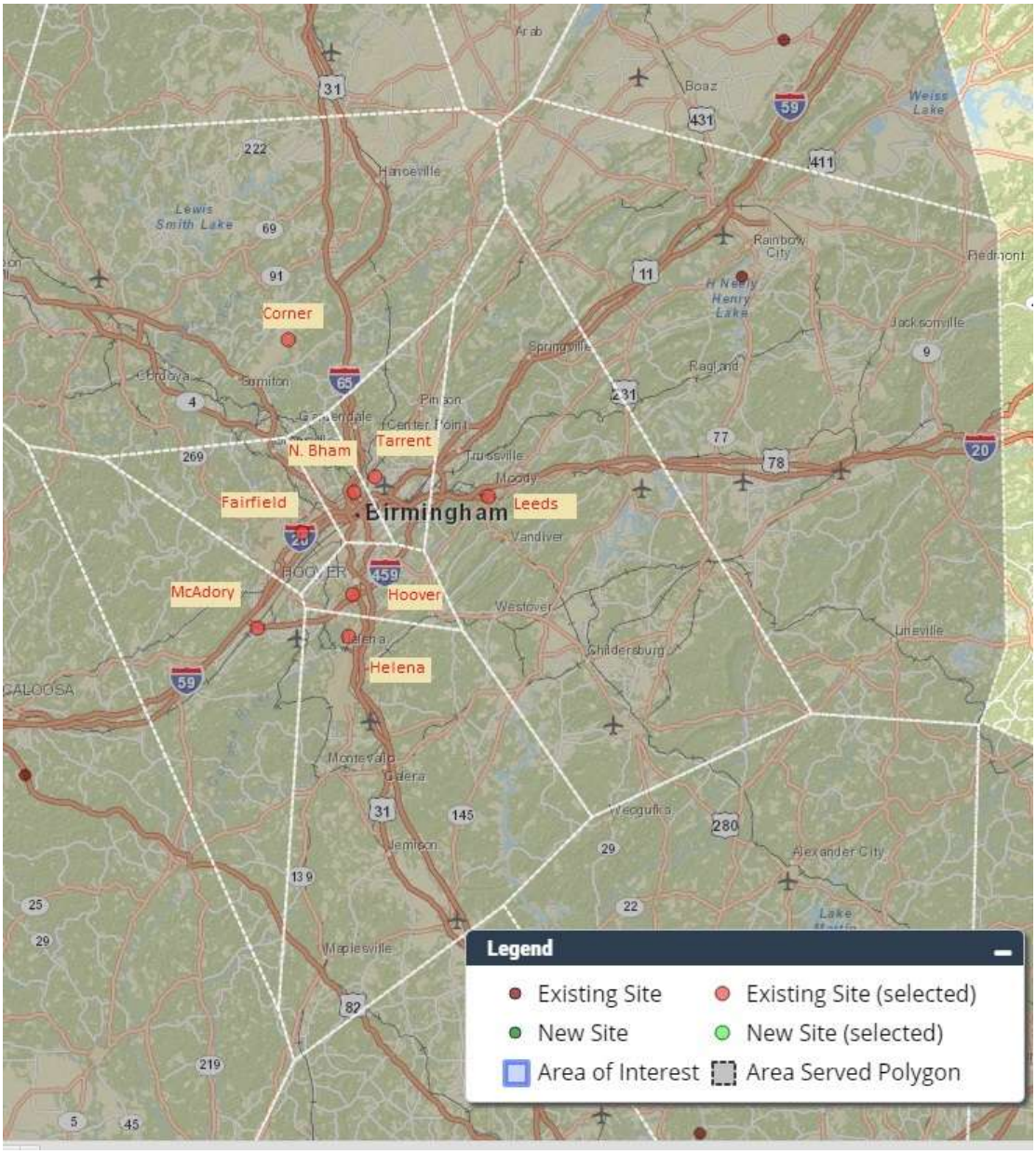


Figure 12 Area Served Map of the Birmingham MSA

Figure 13 Area Served Map of the Montgomery MSA

Figure 14 Area Served Map of the Columbus, GA-Phenix City, AL MSA

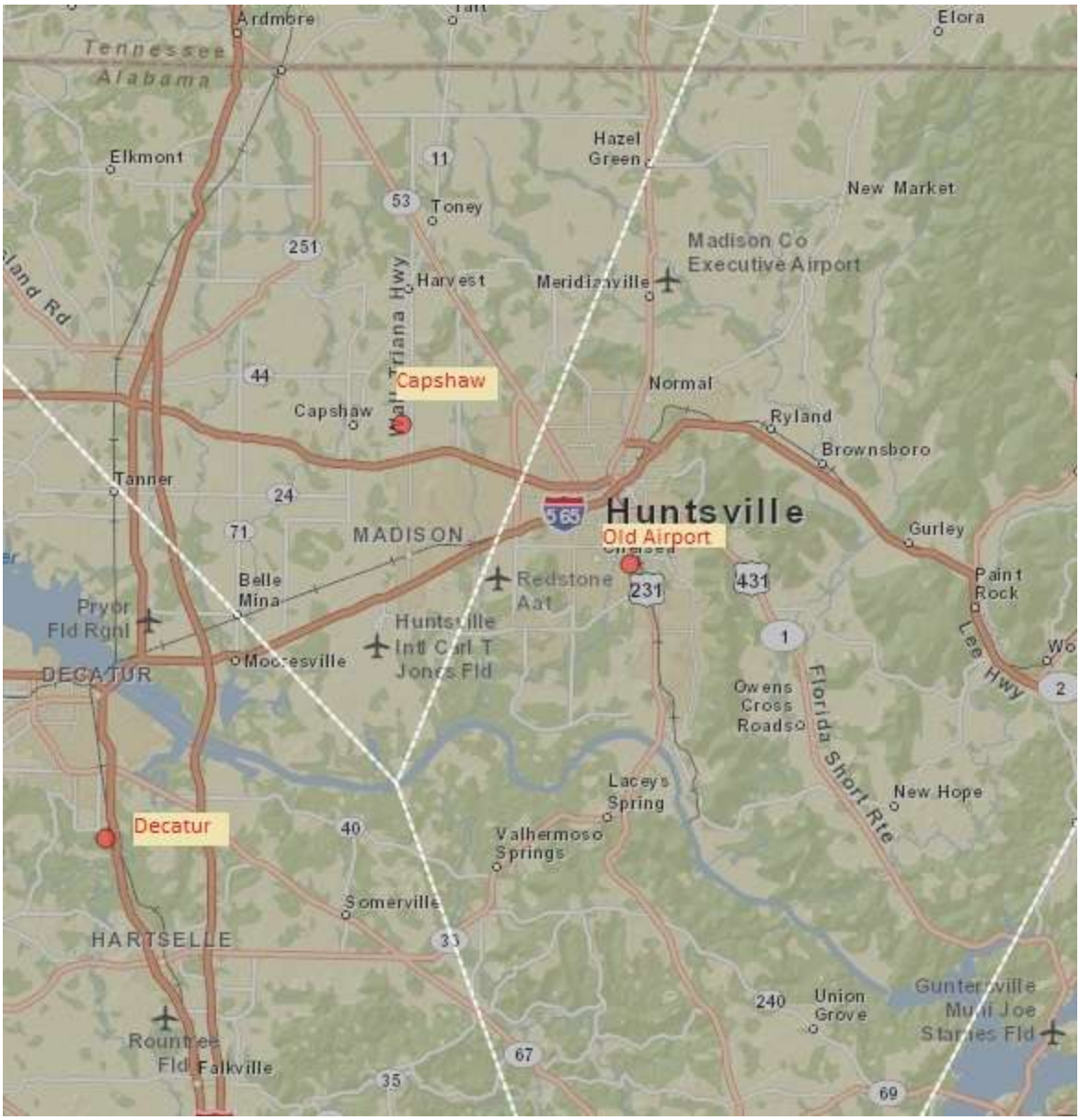


Figure 15 Area Served Map of the Huntsville and Decatur MSAs

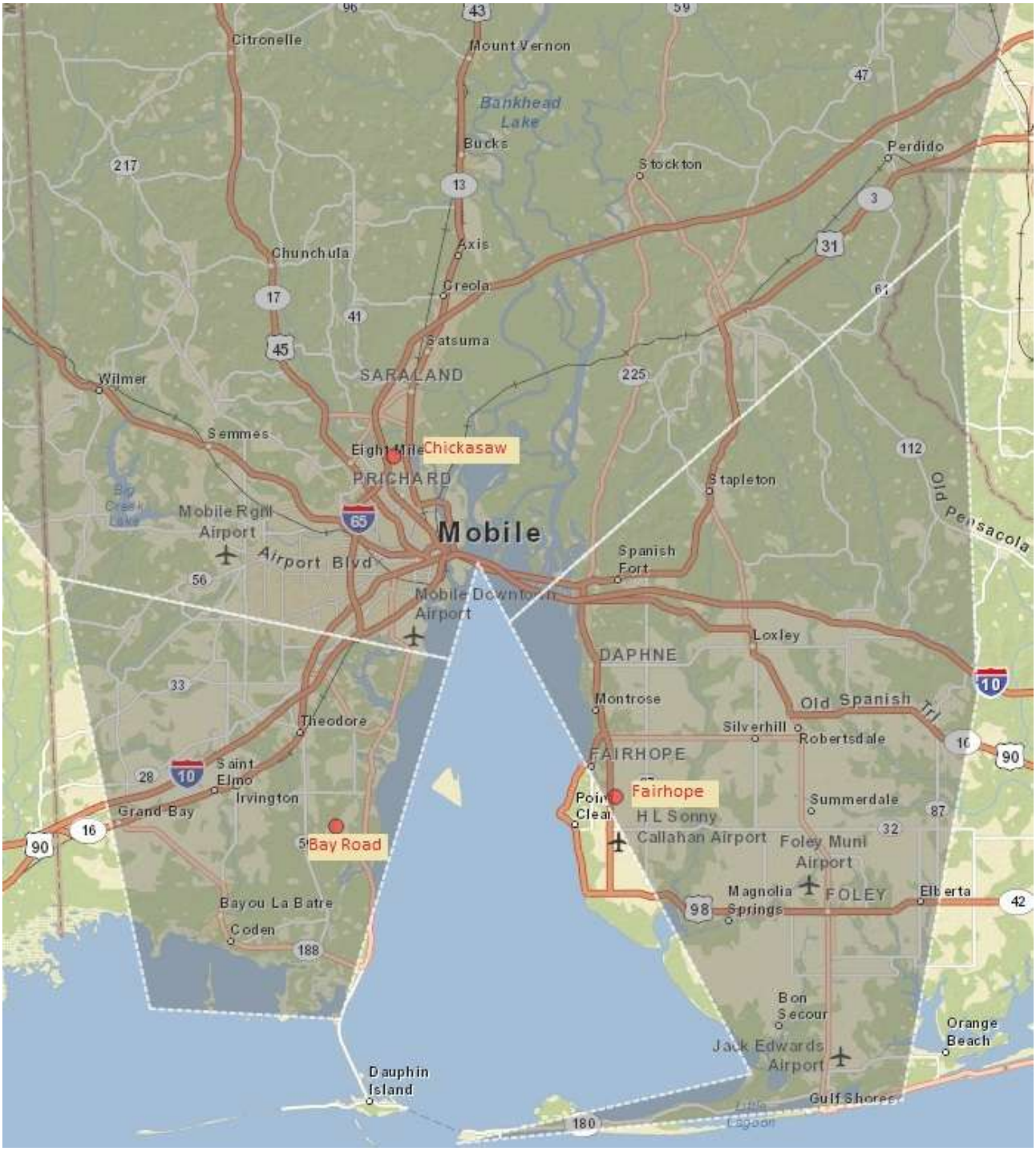


Figure 16 Area Served Map of the Mobile and Fairhope MSAs

Table 4 shows the population served by each monitor as represented by the Voronoi polygons in Figures Figure 11, Figure 12, Figure 13, Figure 14, Figure 15, and Figure 16.

It is noted that the Voronoi polygons represent a purely mathematical construct based on the proximity of sites to each other, important factors which would aid in determining the area and population served by a monitor such as emissions, meteorology and topography are not being accounted for.

Table 4 Area Server Populations and Size

Site	Total Population	Area in Square Kilometers
Fairhope	127370	1953
Muscle Shoals	371977	16056
EPA Castnet	175968	4536
DBT	141750	7594
Southside	290647	6552
Dothan	274047	12181
North Birmingham	108757	203
Fairfield	130647	614
McAdory	86216	2093
Leeds	212992	3930
Hoover	158616	306
Corner	178490	5357
Tarrent	168229	534
Old Airport	302456	5352
Capshaw	250336	4613
Chickasaw	391413	11020
Bay Road	101538	914
MOMS	418292	13982
Decatur	185557	4155
Ladonia	250115	8218
Helena	162086	2865
Ward	89771	14799
Duncanville	289907	13657

Population

Population is one component used by Appendix D to determine the number of required ozone monitors. The other factor is the design value. There are 12 MSAs in Alabama that meet the Appendix D requirements for population. Each MSA is discussed in detail in the 2015 AAQMP. Outside of the MSAs it can be seen from the maps in Figure 2 and Figure 17 that the monitors are located in the areas of highest and increasing population.

Within the Montgomery MSA, a monitor is located close to the Montgomery downtown area (MOMS, AQS ID 101-1002) and an additional monitor is located in Elmore County (AQS ID 051-0001) in an area of high population growth and within a neighborhood that is representative of other outlying neighborhoods.

Figure 2 shows that most of the growth in the Mobile area has been in Baldwin County. Mobile and Fairhope are now both metropolitan areas and are considered separately in Appendix D. There are two ozone monitors in Mobile County to the north and south of the central business district and there is a monitor located in Baldwin County in the Fairhope MSA.

After the 2010 Network Review, an additional ozone monitor was added to the Huntsville MSA to meet the Appendix D requirements based on the population. The areas of increased growth are outside of the city in all directions except the southeast. Wind data from the Huntsville area indicates that highest concentrations should be located to the northwest of the city in an area that has experienced high growth rates.

The Birmingham MSA has experienced highest growth in the north Shelby County area (Figure 2). The JCDH has monitors in the Birmingham urban area and in outlying areas around Jefferson County. In addition, ADEM operates a monitor in north Shelby County in a neighborhood representative of other high growth areas.

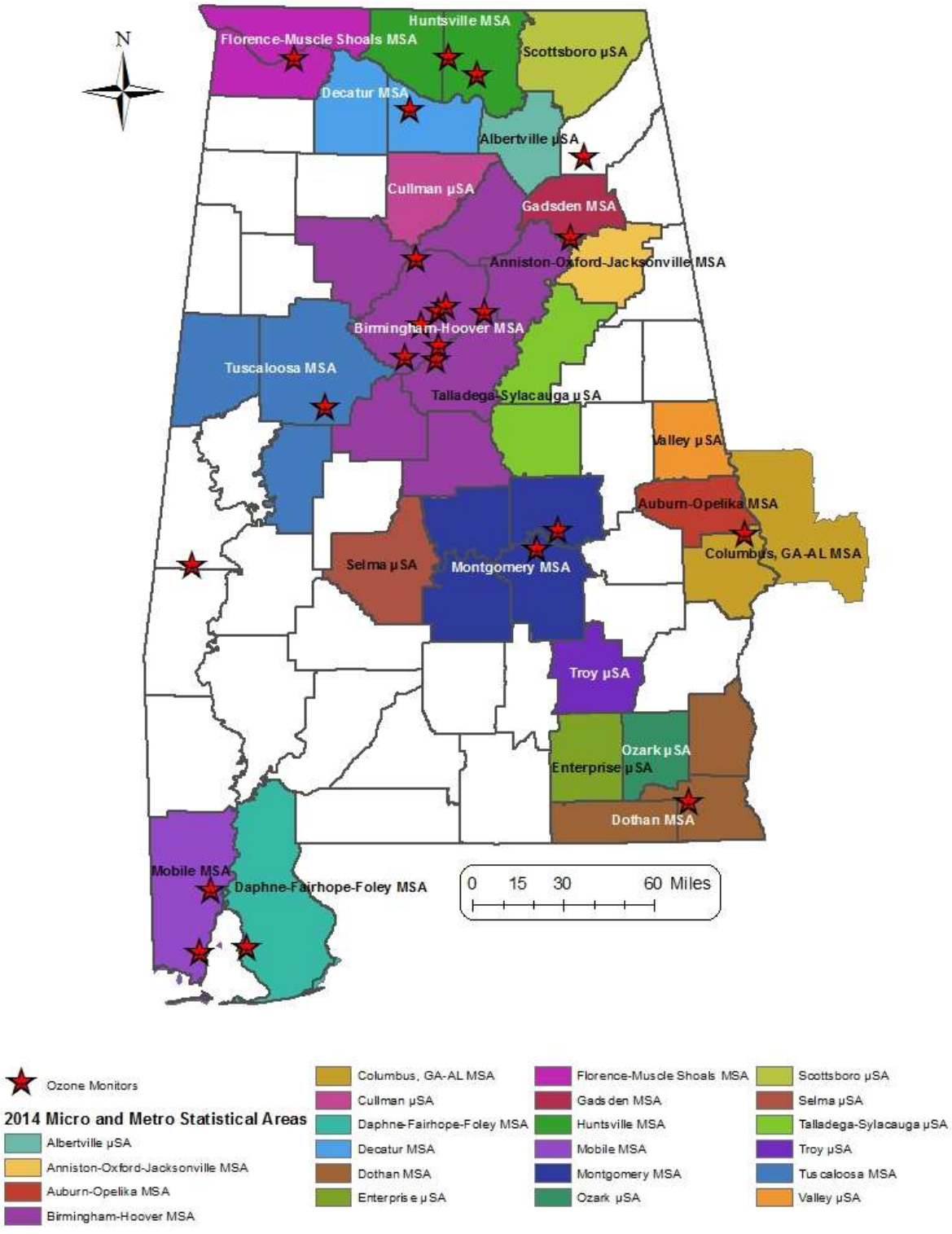


Figure 17 Micropolitan (uSA) and Metropolitan (MSA) Statistical Areas with Ozone Sites

Emissions

The map in Figure 18 shows the level of NOx emissions from point sources around the state.

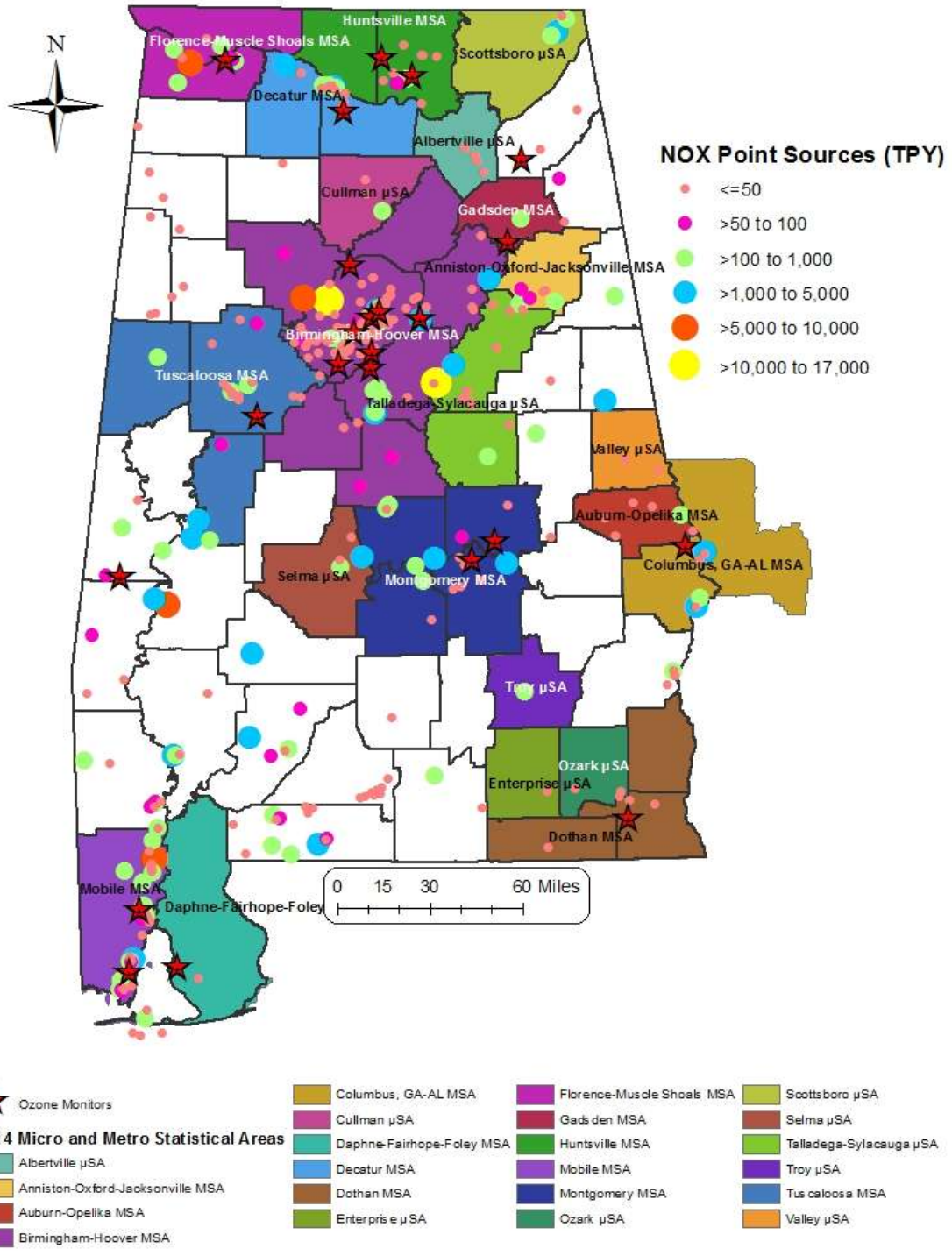


Figure 18 Statewide NOx Emissions and location of ozone monitors

Emissions in the Birmingham CSA

The counties in the Birmingham CSA are depicted in Figure 17. To evaluate emissions for these counties, ADEM obtained the 2011 annual NOx and VOC emission estimates from the National Emissions Inventory (NEI). Table 5 lists these emissions which include all anthropogenic sources (i.e. point, area, mobile, and non-road mobile) for the counties in the Birmingham CSA.

Table 5 Annual Emissions for the Birmingham CSA

County	2011 Annual VOC Emissions (Tons)	Ranking for VOC	2011 Annual Nox Emissions (Tons)	Ranking for Nox
Jefferson*$_{M}$	30,844	1	46,800	1
Shelby*$_{M}$	9,053	2	29,135	2
Walker*	6,490	3	10,202	3
Cullman	6,021	4	4,931	5
St. Clair	5,186	5	6,767	4
Bibb	4,296	6	1,207	8
Chilton	3,917	7	3,436	6
Blount	2,786	8	1,994	7

*County has one or more utility plants located within its boundary

$_{M}$ County has at least one ozone monitor

As shown in Table 5, the total emissions in Bibb, Blount, Chilton, Cullman, Walker and St.Clair Counties less than the emissions in Jefferson and Shelby Counties. Given the total amount of emissions in these counties, it is unlikely that these emissions contribute significantly to the air quality outside their boundaries. Bibb, Blount, Chilton, Cullman, Walker and St.Clair Counties account for only 42% of the total VOC emissions and only 27% of the NOx emissions in the CSA.

The impact of Walker County NOx emissions has been lessened by controls placed on Gorgas Steam Plant beginning in May 2003.

Due to these emissions and meteorology, ozone monitors in the Birmingham CSA are located in Jefferson and Shelby Counties.

Site Correlation and Removal Bias

Site Correlation Tool

The Correlation Matrix tool calculates and displays the correlation, relative difference, and distance between pairs of sites within a user selected set of air monitoring sites. Within the NetAssess App the Correlation Matrix Tool generates a graphical display and a downloadable CSV file which summarize the results for each selected site pair. The purpose of this tool is to provide a means of determining possible redundant sites that could be removed. Possible redundant sites would exhibit fairly high correlations consistently across all of their pairings and would have low average relative difference despite the distance. Usually, it is expected that correlation between sites will decrease as distance increases. However, for a regional air pollutant such as ozone, sites in the same air shed can have very similar concentrations and be highly correlated. More unique sites would exhibit the opposite characteristics. They would not be very well correlated with other sites and their relative difference would be higher than other site to site pairs. The Correlation Matrix Tool included in the NetAssess App is a modification of the CorMat tool included in the original Network Assessment Tools developed by Mike Rizzo for the 2010 5-year Network Assessment

Graphical Display

The Correlation Matrix tool generates a graphical display that summarizes the correlation, relative difference and distance between pairs of monitoring sites. Within the graphical display, the shape of the ellipses represents the Pearson correlation between sites. Circles represent zero correlation and straight diagonal lines represent a perfect correlation.

The correlation between two sites quantitatively describes the degree of relatedness between the measurements made at two sites. That relatedness could be caused by various influences including a common source affecting both sites to pollutant transport caused meteorology. The correlation, however, may indicate whether a pair of sites is related, but it does not indicate if one site consistently measures pollutant concentrations at levels substantially higher or lower than the other. For this purpose, the color of the ellipses represents the average relative difference between sites where the daily relative difference is defined as:

$$\frac{abs(s1 - s2)}{avg(s1, s2)}$$

where s1 and s2 represent the ozone concentrations at sites one and two in the pairing, abs is the absolute difference between the two sites and avg is the average of the two site concentrations. The average relative difference between the two sites is an indicator of the overall measurement similarity between the two sites. Site pairs with a lower average relative difference are more similar to each other than pairs with a larger difference. Both the correlation and the relative difference between sites are influenced by the distance by

which site pairs are separated. Usually, sites with a larger distance between them will generally be more poorly correlated and have large differences in the corresponding pollutant concentrations. The distance between site pairs in the correlation matrix graphic is displayed in kilometers in the middles of each ellipse.

This tool was applied to the most densely monitored area in the state, the Birmingham MSA, (Figure 19 Ozone Site Correlation Matrix - Birmingham MSA)

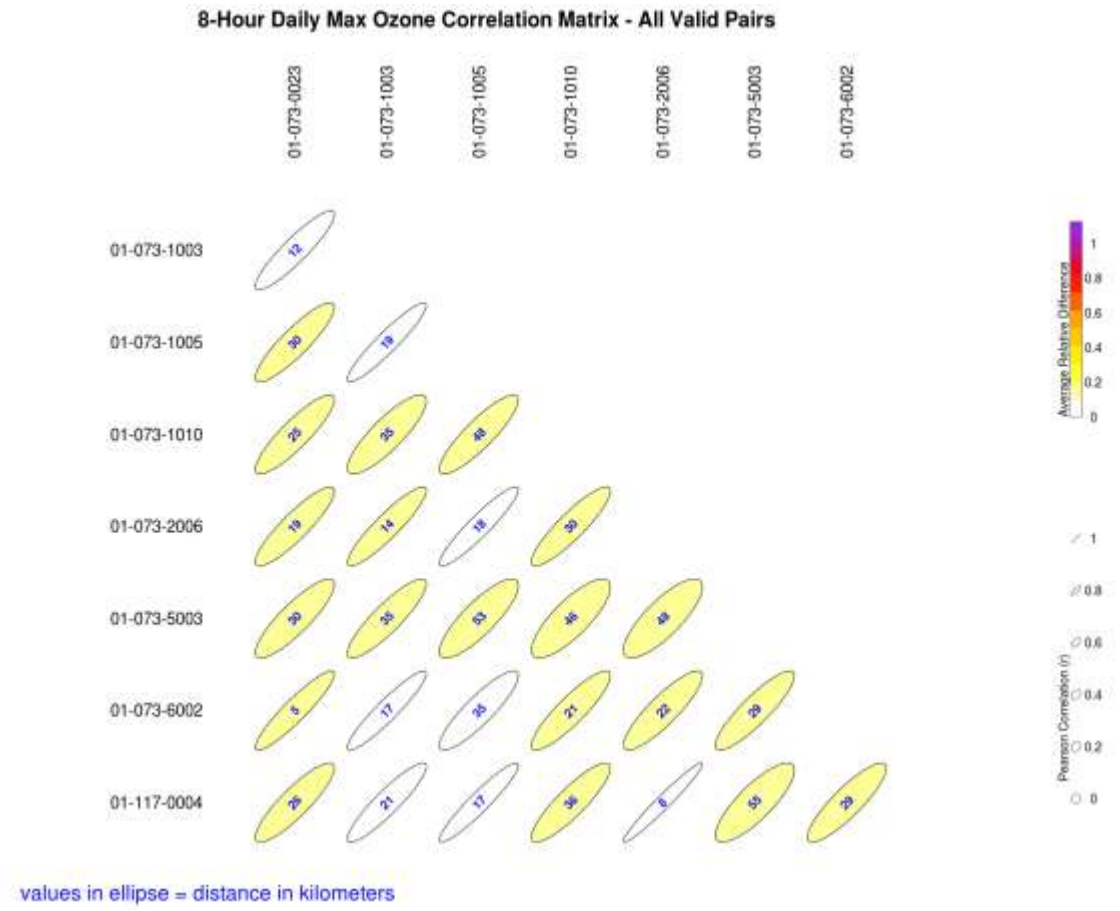


Figure 19 Ozone Site Correlation Matrix - Birmingham MSA

This analysis highlights one site pair, which are highly correlated and with low relative difference. This pair is Helena - Hoover. For these sites, a removal bias analysis was performed.

Removal Bias Analysis

Removal Bias Tool

The removal bias tool is meant to aid in determining redundant sites. The bias estimation uses the nearest neighbors to each site to estimate the concentration at the location of the site if the site had never existed. This is done using the Voronoi Neighborhood Averaging algorithm with inverse distance squared weighting where;

$$w = \frac{1}{d^2}$$

with w equal to the weight and d equal to the distance. . The squared distance allows for higher weighting on concentrations at sites located closer to the site being examined. The bias was calculated for each day at each site by taking the difference between the predicted value from the interpolation and the measured concentration. A positive average bias would mean that if the site being examined was removed, the neighboring sites would indicate that the estimated concentration would be larger than the measured concentration. Likewise, a negative average bias would suggest that the estimated concentration at the location of the site is smaller than the actual measured concentration.

Helena is in Shelby County and is representative of the growth in Northern Shelby County.

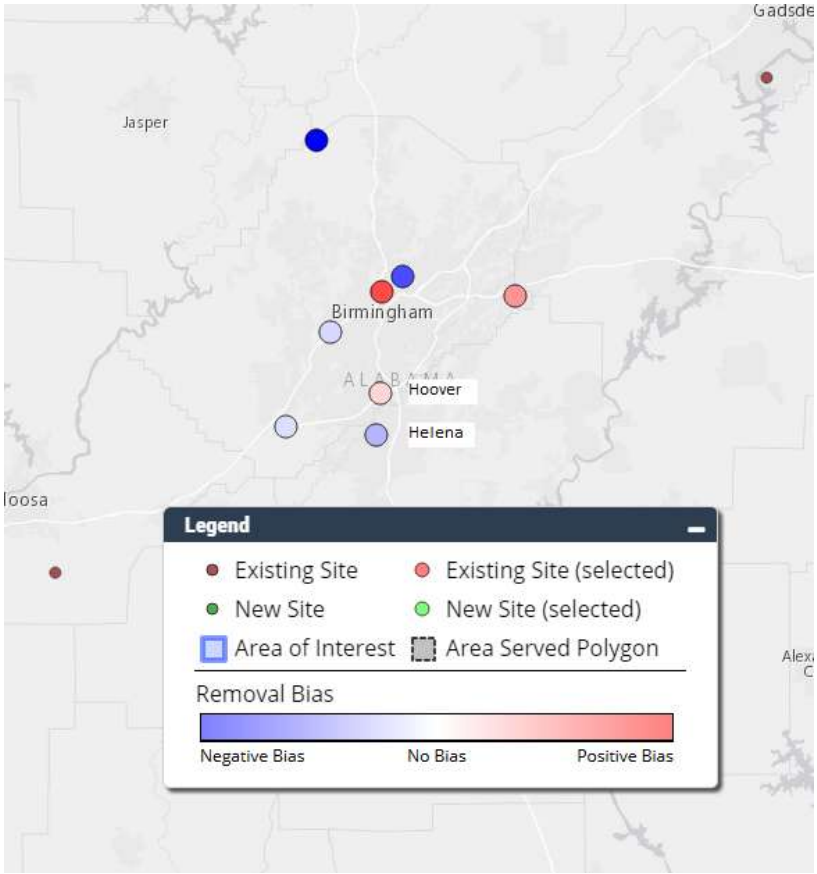


Figure 20 Removal Bias Estimate for Hoover and Tarrant Ozone Sites

This analysis (Figure 20) shows that the removal of the Hoover site would cause a slight positive bias in the network of around 1 part per billion and the removal of the Helena site would have a slightly negative bias in the network of 1 part per billion. In other words, these sites are recording concentrations that are slightly lower and higher than their neighboring sites.

Comparison on Existing Site to Proposed Levels for the NAAQS

Exceedence Probabilities

One objective of the network assessment is to determine if new sites are needed. In order to make that decision, it is helpful to have some estimation of the extreme pollution levels in areas where no monitors currently exist. NetAssess provides ozone and $PM_{2.5}$ maps of the contiguous US that can be used to make spatial comparisons regarding the probability of daily values exceeding a certain threshold.

Surface Probability Maps

The surface probability maps can be seen below. For ozone, three different thresholds can be selected. The $PM_{2.5}$ map has a threshold of 35 $\mu g/m^3$:

To clarify, these maps do not show the probability of violating the National Ambient Air Quality Standards (NAAQS). They provide information about the spatial distribution of the highest daily values for a pollutant (not, for example, the probability of the 4th highest daily 8-hour ozone maximum exceeding a threshold).

These maps are intended to be used as a spatial comparison and not for probability estimates for a single geographic point or area. The probability estimates alone should not be used to justify a new monitor. The maps should be used in conjunction with existing monitoring data. If a monitor has historically measured high values, then the probability map gives an indication of areas where you would expect to observe similar extreme values. This information, along with demographic and emissions data, could be used in a weight of evidence approach for proposing new monitor locations.

Data

The surface probability maps were created by using EPA/CDC downscaler data. Downscaler data are daily estimates of ground level ozone and $PM_{2.5}$ for every census tract in the continental US. These are statistical estimates from "fusing" photochemical modeling data and ambient monitoring data using Bayesian space-time methods. For more details on how the data were generated, see the meta data document on the EPA website.

Daily downscaler estimates for 8-hour maximum ozone and 24-hour mean $PM_{2.5}$ for the years 2007 and 2008 were obtained from the EPA website. Years 2009-2011 were obtained from the CDC's Environmental Public Health Tracking Program.

Methods for performing this analysis can be found on the LADCO website (http://ladco.github.io/NetAssessApp/tools.html.)

Three maps were created to show the probabilities of areas in Alabama exceeding 75ppb, 70 ppb and 65 ppb.

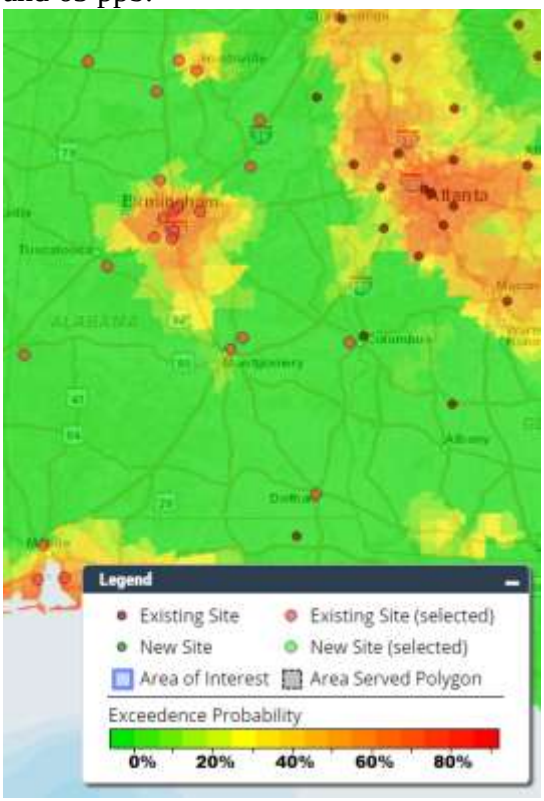


Figure 21 Exceedance Probability at 75 ppb

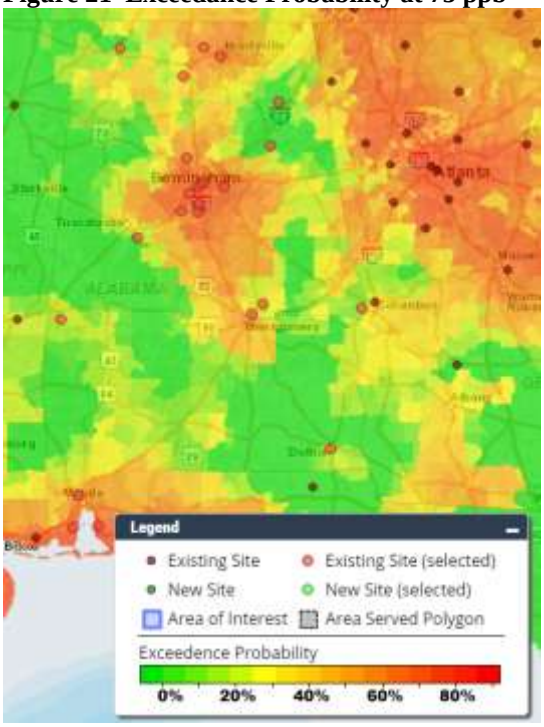


Figure 22 Exceedance Probability at 70 ppb

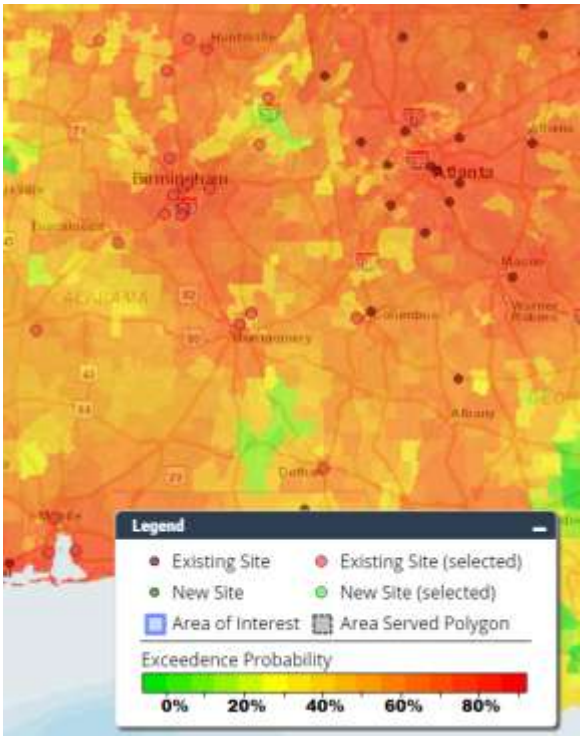


Figure 23 Exceedance Probability at 65 ppb

Additional Sites Analysis

At this time, Appendix D requirements are being met for the number of monitors in the State. Review of the proposed monitoring regulations does not indicate the need for additional monitors. A review of the population changes across the State shows one area of high growth rate that does not have a monitor. This is the Auburn-Opelika MSA. However, the close proximity of 2 monitors in the Columbus Phenix City MSA and 2 monitors in the Montgomery MSA suggest that the results of monitoring in the Auburn area would be very similar to the neighboring sites. If resources allow for an additional site, the Auburn area would be a likely candidate.

Summary of Ozone Findings and Recommendations for Change to the Ozone Network

Since the current network meets Appendix D requirements and due to expected changes to the level of the NAAQS for ozone, no changes are planned to the network at this time.

Particulate Matter Less Than 2.5 microns ($PM_{2.5}$)

The $PM_{2.5}$ network is characterized by manual monitors located in MSAs that meet the Appendix D requirements, collocated continuous monitors as required in Appendix D, collocated manual monitors for quality assurance purposes as required by Appendix A, and speciation monitors used to characterize the constituents of the particulate matter.

This network is described in the 2015 AAQMP. Table 6, Table 7, and Table 8 present the ranking matrices for these monitors. Figure 24, Figure 25, Figure 26 and Figure 27 show the locations of the various monitors.

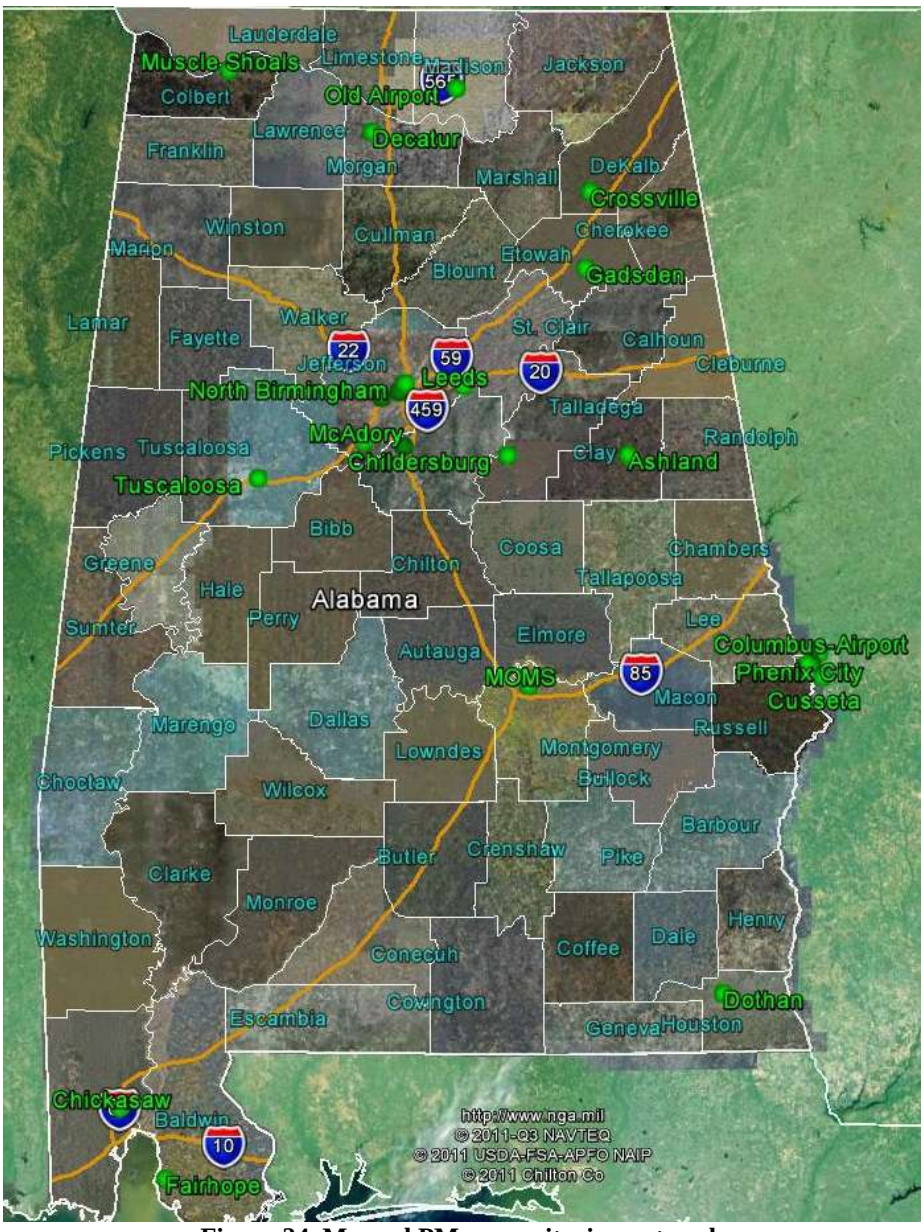


Figure 24 Manual $PM_{2.5}$ monitoring network

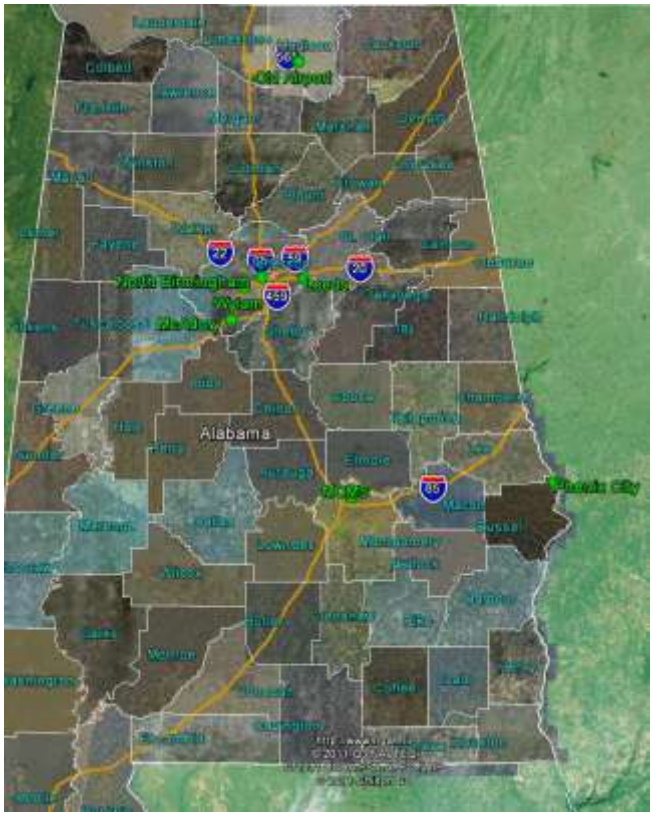


Figure 25 Collocated PM $_{2.5}$ Monitors

Figure 26 PM $_{2.5}$ Speciation Network

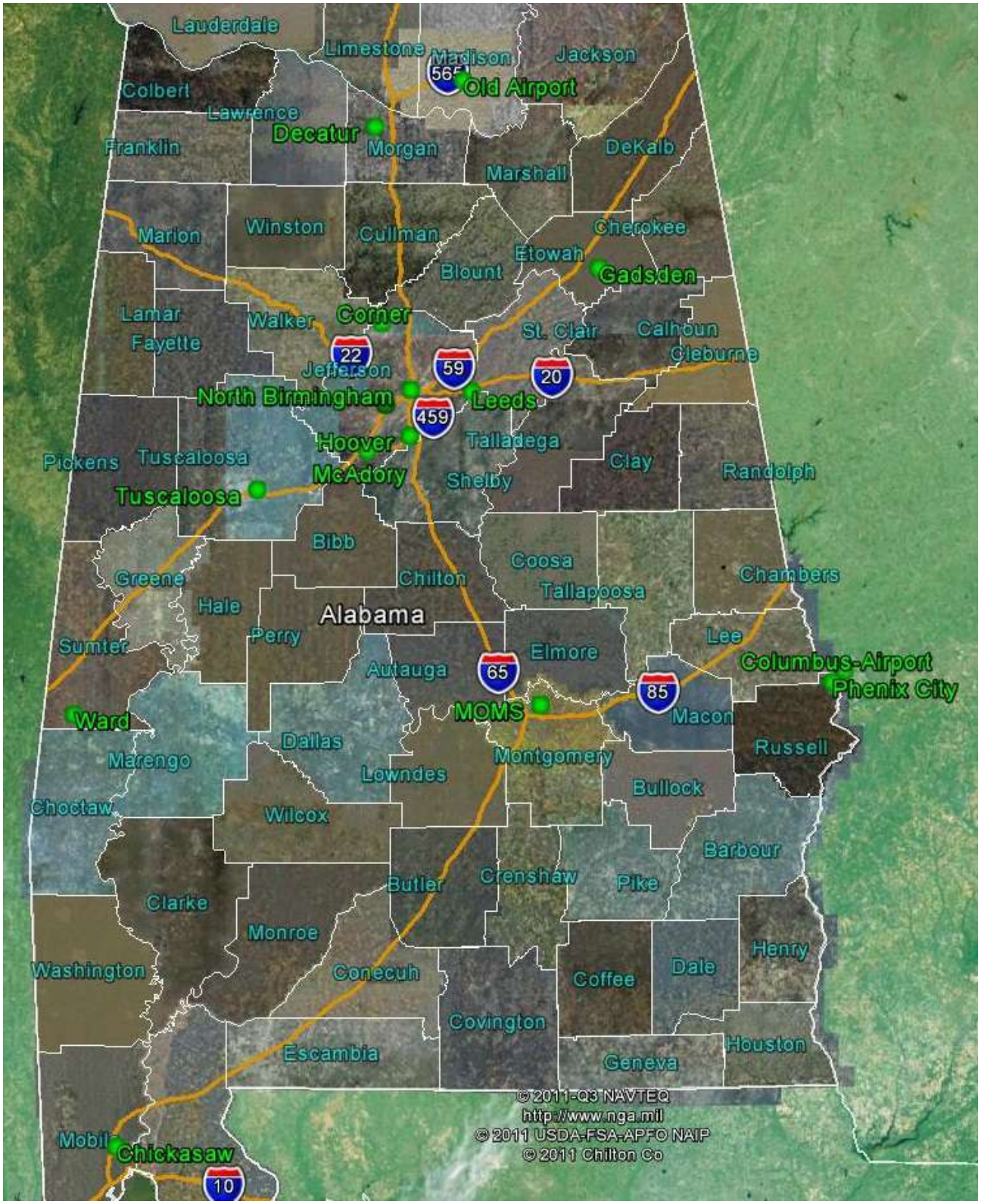


Figure 27 PM 2.5 Continuous Monitors

Table 6 Manual $PM_{2.5}$ (88101) Sites

Site Name	County	Site Id Number	Poc	Appendix D required	NCORE required	Potential to exceed NAAQS	Potential to exceed 95% of the NAAQS	Potential to exceed 85% of the NAAQS	Located in complex terrain	Used for AQI reporting	Used to fill spatial needs for Airnow reporting	Used in outside health studies	Located in unique areas	Background monitor	Transport monitor	required collocated	community concerns	Forecasting	Total
Site common name				**10**	**10**	**1 to 5**	**1 to 5**	**1 to 5**	**1 to 5**	**3**	**3**	**5**	**5**	**5**	**5**	**10**	**10**	**10**	
JCDH Sites																			
North Birmingham	073	0023	1		10	3	4	5	5			5				10			42
Wylam	073	2003	1	10		1	3	5	5			5							29
Akadelphia	073	2059	1			0	0	1											
Pinson High School*	073	5002	1	10		0	0	3	5			5							23
Hoover	073	2006	1			0	1	3	5			5							14
McAdory School	073	1005	1			0	1	4	5			5							15
Corner High School*	073	5003	1			0	0	3	5			5	5		5				23
Providence	073	1009	1			0	0	0	5			5	5	5					20
Leeds Elem. School	073	1010	1			0	3	5	5			5							18
ADEM Sites																			
Fairhope	003	0010	1			0	0	0							5		10		15
Ashland	027	0001	1	10		0	0	0							5				15
Muscle Shoals	033	1002	1			0	0	1											1
Crossville	049	1003	1	10		0	0	3						5					18
Gadsden – CC	055	0010	1	10		0	0	3											13
Dothan	069	0002	1			0	0	0											0
Mobile – Chickasaw	097	0003	1			0	0	0									10		0
Mobile - Bay Road	097	2005	1			0	0	0									10		10
Montgomery – MOMS	097	1002	1			0	0	4								10			14
Decatur	103	0011	1			0	0	2								10			12
Phenix City - Downtown	113	0001	1	10		3	3	4											20
Pelham**	117	0006	1			0	0	3											3
Childersburg	121	0002	1			0	3	4											7
Tuscaloosa - VA Hospital	125	0003	1			0	0	3											3
HDNR Sites																			
Old Airport	089	0014	1	10		0	0	3					5						18

*The Pinson & Providence sites were closed down and the Corner & Hoover sites stopped monitoring for Manual PM2.5 as of January 1, 2013.

** The ADEM lost access to the Pelham site and it was closed in June of 2015

Table 7 Manual $PM_{2.5}$ (88101) Sites Collocated Monitors

Site Name		Site Id Number	Poc	Appendix D required	NCORE required	Potential to exceed NAAQS	Potential to exceed 95% of the NAAQS	Potential to exceed 85% of the NAAQS	Located in complex terrain	Used for AQI reporting	Used to fill spatial needs for Airnow reporting	Used in outside health studies	Located in unique areas	Background monitor	Transport monitor	required collocated	community concerns	Forecasting	Total
Site common name				**10**	**10**	**1 to 5**	**1 to 5**	**1 to 5**	**1 to 5**	**3**	**3**	**5**	**5**	**5**	**5**	**10**	**10**	**10**	
North Birmingham	073	0023	2	10	10	3	4	5	5			5				10			52
Montgomery - MOMS	101	1002	2				0	4								10			14
Phenix City - Downtown	113	0001	2	10		3	3	4								10			30

Table 8 Continuous $PM_{2.5}$ (other) Sites

Site Name		Site Id Number	Poc	Appendix D required	NCORE required	Potential to exceed NAAQS	Potential to exceed 95% of the NAAQS	Potential to exceed 85% of the NAAQS	Located in complex terrain	Used for AQI reporting	Used to fill spatial needs for Airnow reporting	Used in outside health studies	Located in unique areas	Background monitor	Transport monitor	required collocated	community concerns	Forecasting	Total
Site common name				**10**	**10**	**1 to 5**	**1 to 5**	**1 to 5**	**1 to 5**	**3**	**3**	**5**	**5**	**5**	**5**	**10**	**10**	**10**	
JCDH Sites																			
North Birmingham	073	0023	3		10	3	4	5	5	5	3	5				10		10	60
Wylam	073	2003	3	10		1	3	5	5	5	3	5						10	47
Arkadelphia	073	2059	3					1											
Pinson High School	073	5002	3	10				3	5	5	3	5						10	41
Hoover	073	2006	3			0	1	3	5	5	3	5						10	32
McAdory School	073	1005	3				1	4	5	5	3	5						10	33
Corner High School	073	5003	3					3	5	5	3	5	5		5			10	41
Providence	073	1009	3						5	5	3	5	5	5				10	38
HDNR Sites																			
Old Airport	089	0014	2	10		1	1	4			3		5			10			34
ADEM Sites																			
Gadsden - CC	055	0010	3	10			1	5			3					10			29
Mobile - Chickasaw	097	0003	3					1		3	3							10	17
Montgomery - MOMS	101	1002	3				1	2		3	3							10	19
Decatur	103	0011	3				1	2			3								6
Phenix City - Downtown	113	0001	3	10		4	5	5		3	3					10		10	50
Ward	119	0002	?	10				1			3			5					19
Tuscaloosa - VA Hospital	125	0003	3				1	2			3								6

** The Pinson & Providence sites were closed down and the Corner & Hoover sites stopped monitoring for Manual PM2.5 as of January 1, 2013.
*Huntsville's Historical Site

Area Served

Voronoi Polygons were generated using the area served statistical tool. A map showing these polygons is shown in Figure 28.

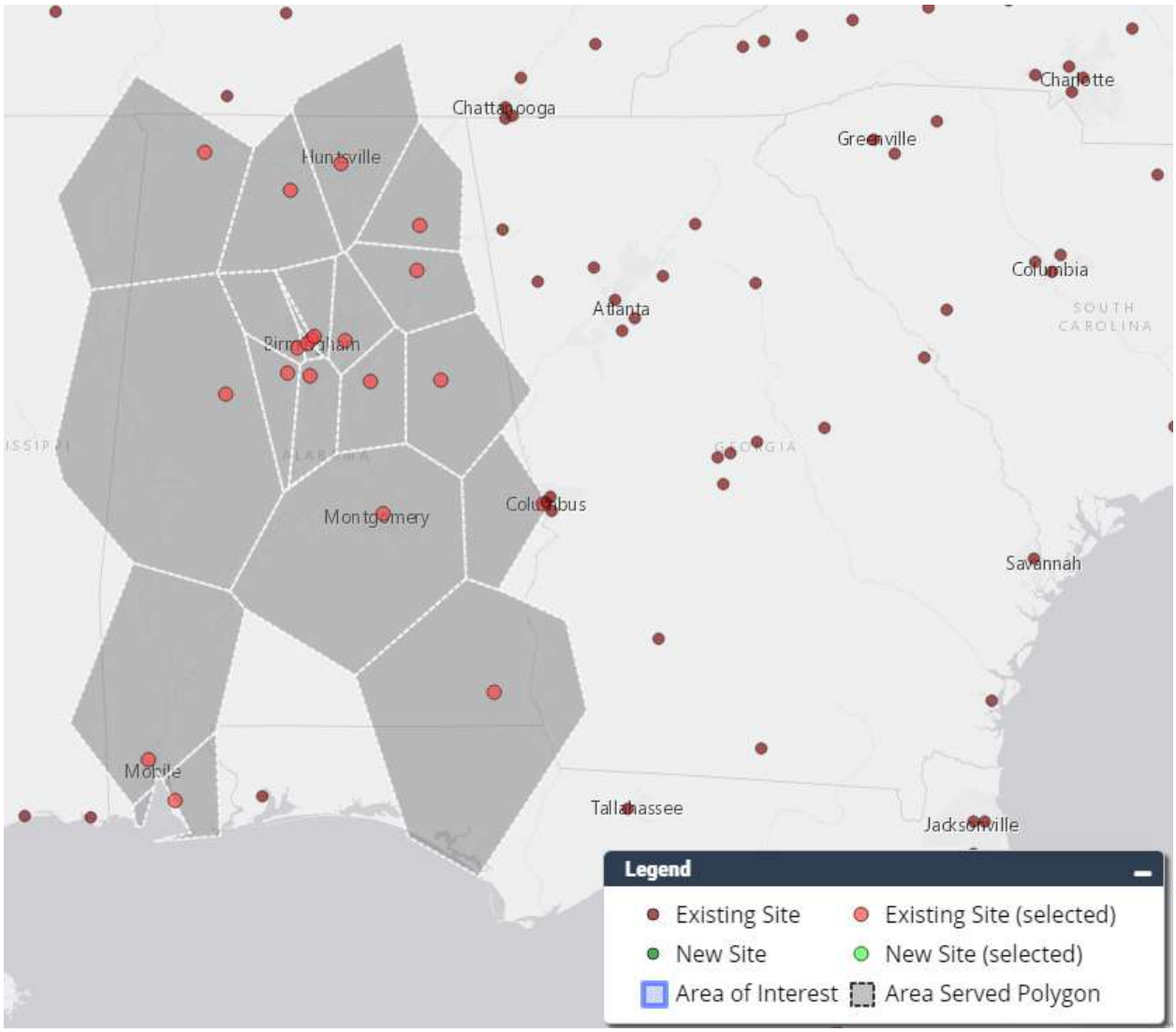


Figure 28 Statewide PM $_{2.5}$ Voronoi Polygons

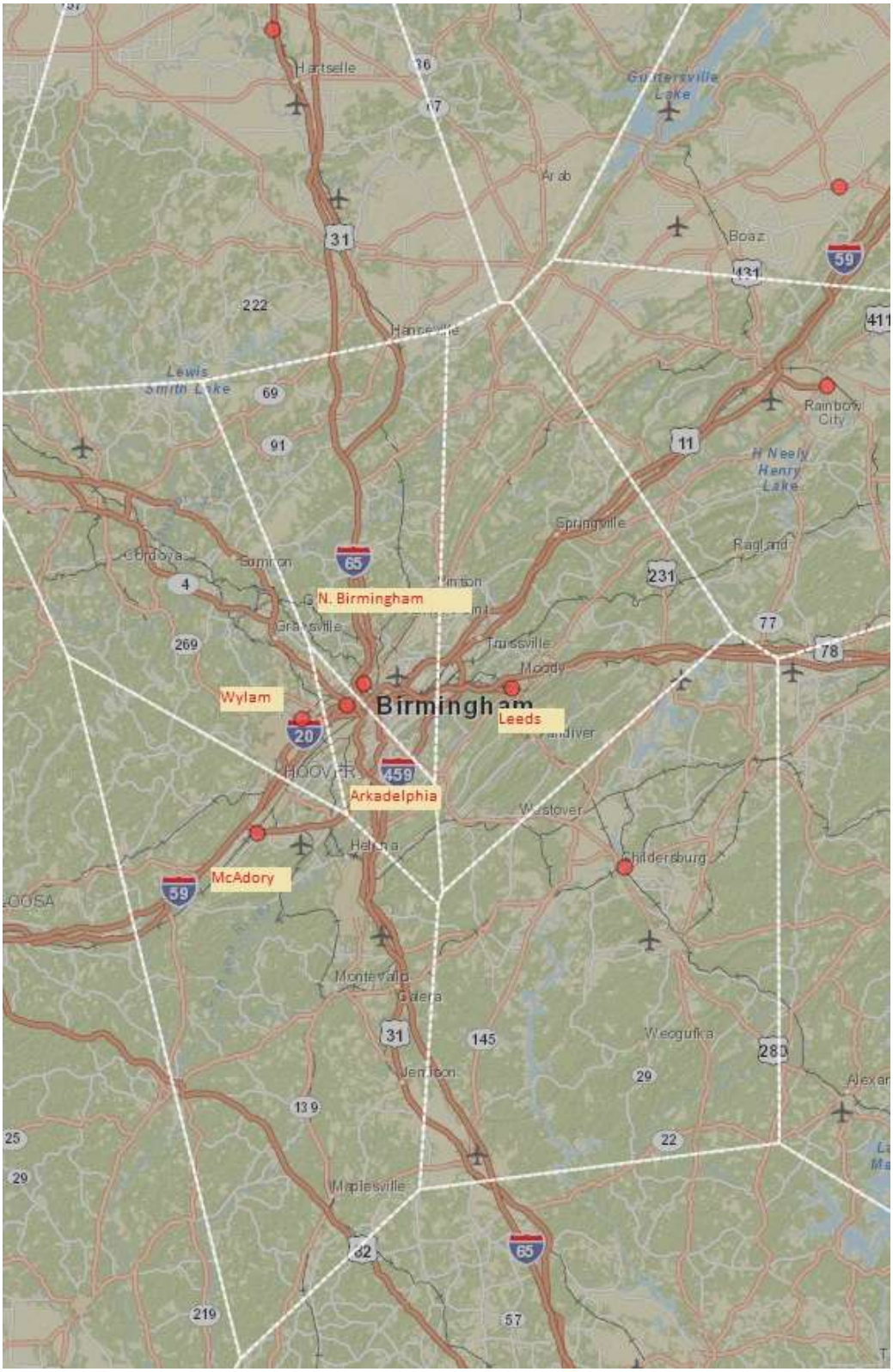


Figure 29 Birmingham Area PM 2.5 Voronoi Polygons

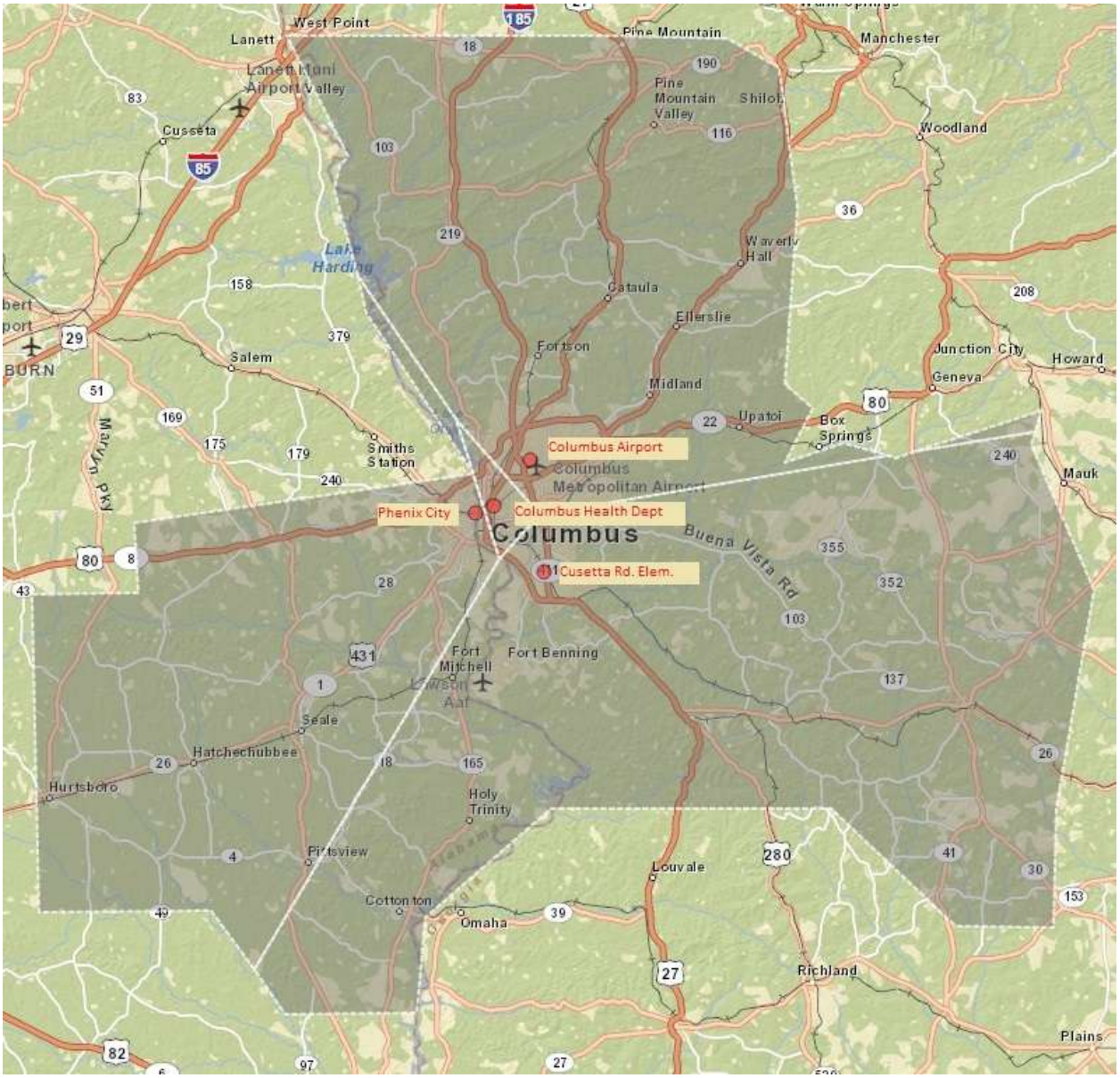


Figure 30 Columbus, GA-Phenix City, AL MSA PM 2.5 Voronoi Polygons

Table 9 shows the population served by each monitor as represented by the Voronoi polygons in Figure 28.

Table 9 Population Served by $PM_{2.5}$ monitors based on Voronoi Polygons

AQS ID	Site Name	Population	Area in Square Kilometers
01-003-0010	Fairhope	139821	2309
01-027-0001	Ashland	136048	7438
01-033-1002	Muscle Shoals	359958	14214
01-049-1003	Crossville	174417	4379
01-055-0010	Gadsden	221511	4036
01-069-0003	Dothan	589862	23812
01-073-0023	N. Birmingham	225023	1734
01-073-1005	McAdory	201795	3793
01-073-1010	Leeds	226227	2628
01-073-2003	Wylam	196758	2369
01-073-2059	Arkadelphia	205117	379
01-089-0014	Old Airport	502706	7500
01-097-0003	Chickasaw	484753	14286
01-101-1002	Montgomery	540679	19638
01-101-0011	Decatur	261599	5962
01-113-0001	Phenix City	204146	4572
01-121-0002	Childersburg	123766	3987
01-125-0004	Tuscaloosa	441530	27682

It should be noted that because the Voronoi polygons represent a purely mathematical construct based on the proximity of sites to each other, important factors which would aid in determining the area and population served by a monitor such as emissions, meteorology and topography are not being accounted for.

Population

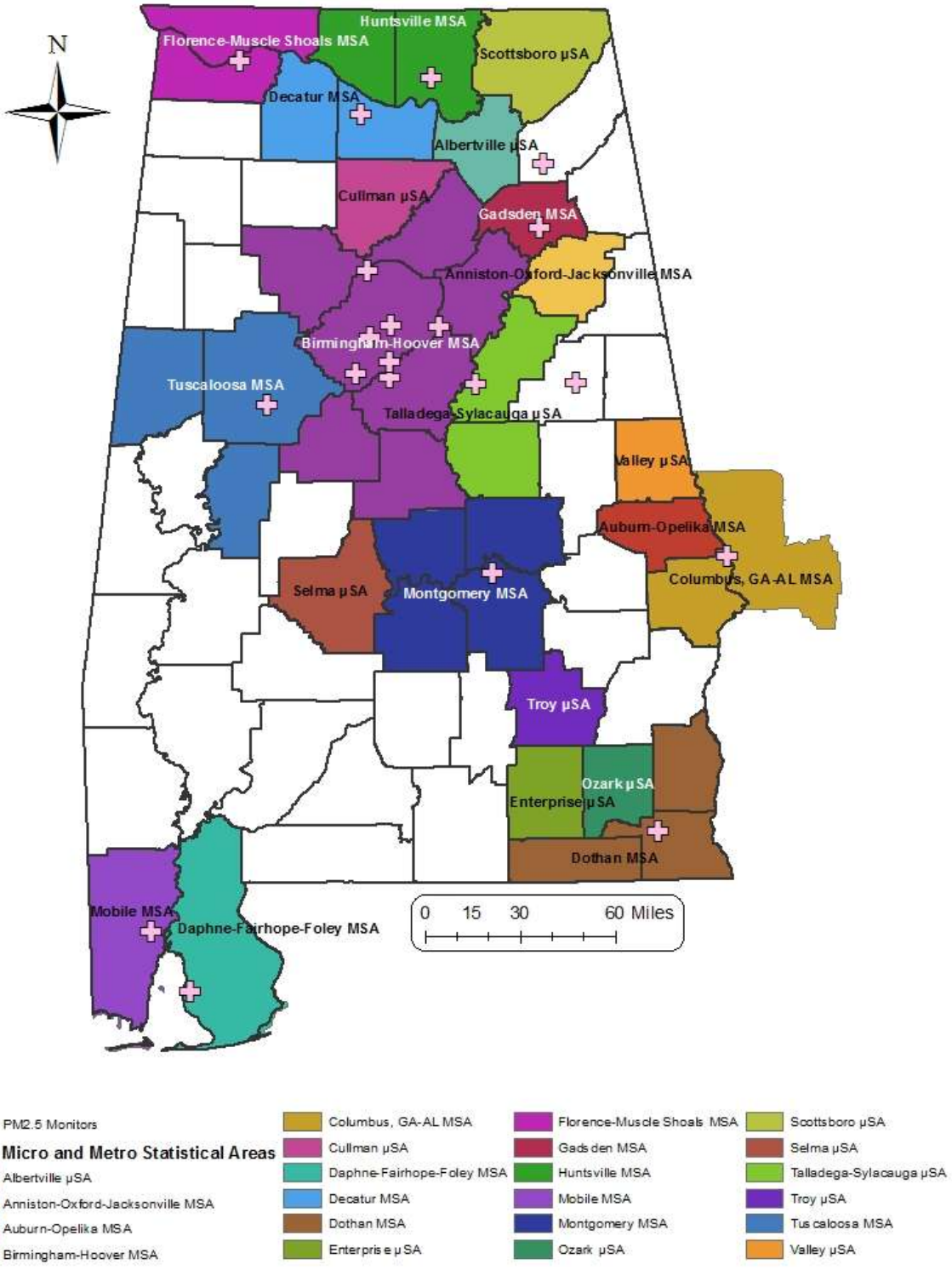


Figure 31 Metropolitan and Micropolitan Statistical Areas with PM $_{2.5}$ stations

Emissions

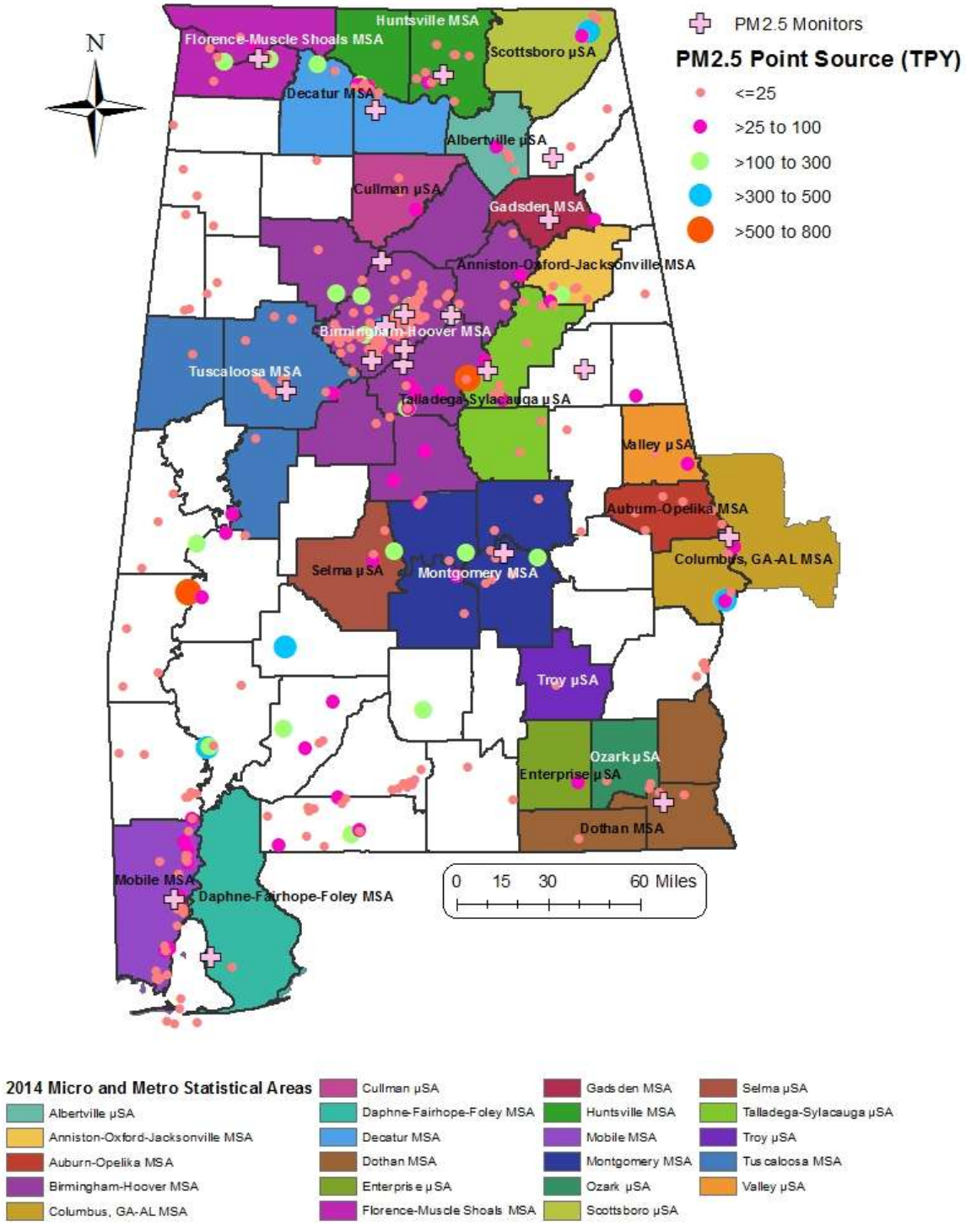


Figure 32 Statewide $PM_{2.5}$ Point Source Emissions

Site Correlation and Removal

Site Correlation

This tool was applied to the most densely monitored areas in the state: the Birmingham MSA and to the northern portion of the state.

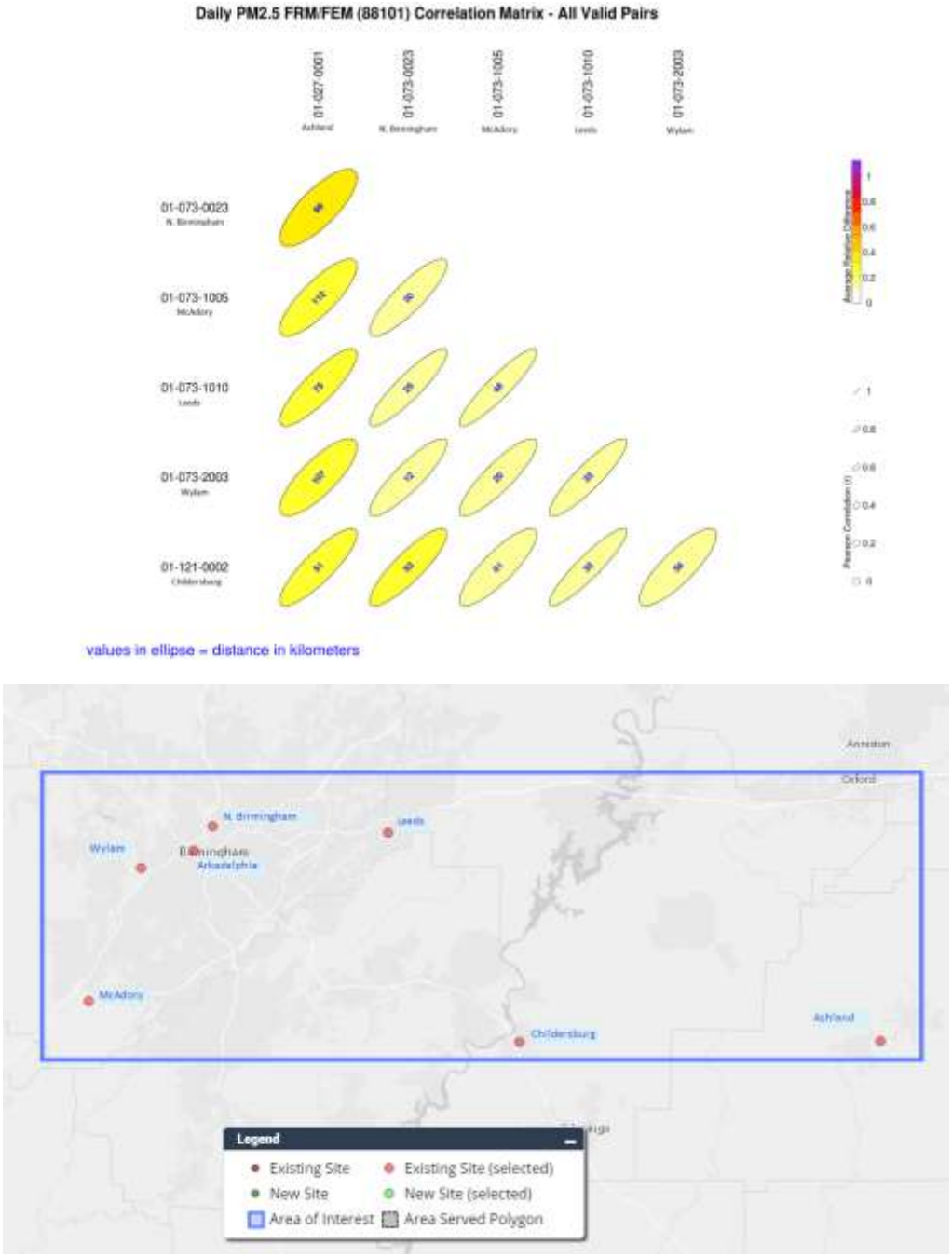


Figure 33 Birmingham MSA with Childersburg and Ashland

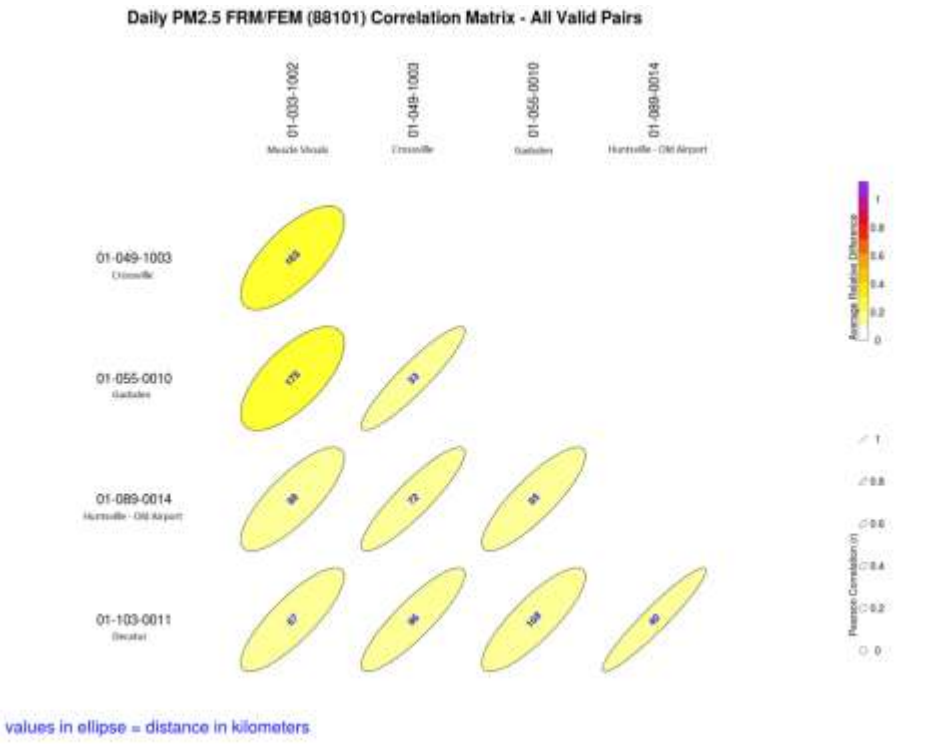


Figure 34 PM $_{2.5}$ Site Correlation Matrix North Alabama

These comparisons show there is not a strong correlation between the sites and there is a relatively large distance between the sites.

Site Removal Analysis

Since there was not a strong correlation between sites, no site pairs were singled out for removal analysis. The overall removal bias for the state and for the Columbus, GA-Phenix City MSA were calculated and are represented in the maps below.

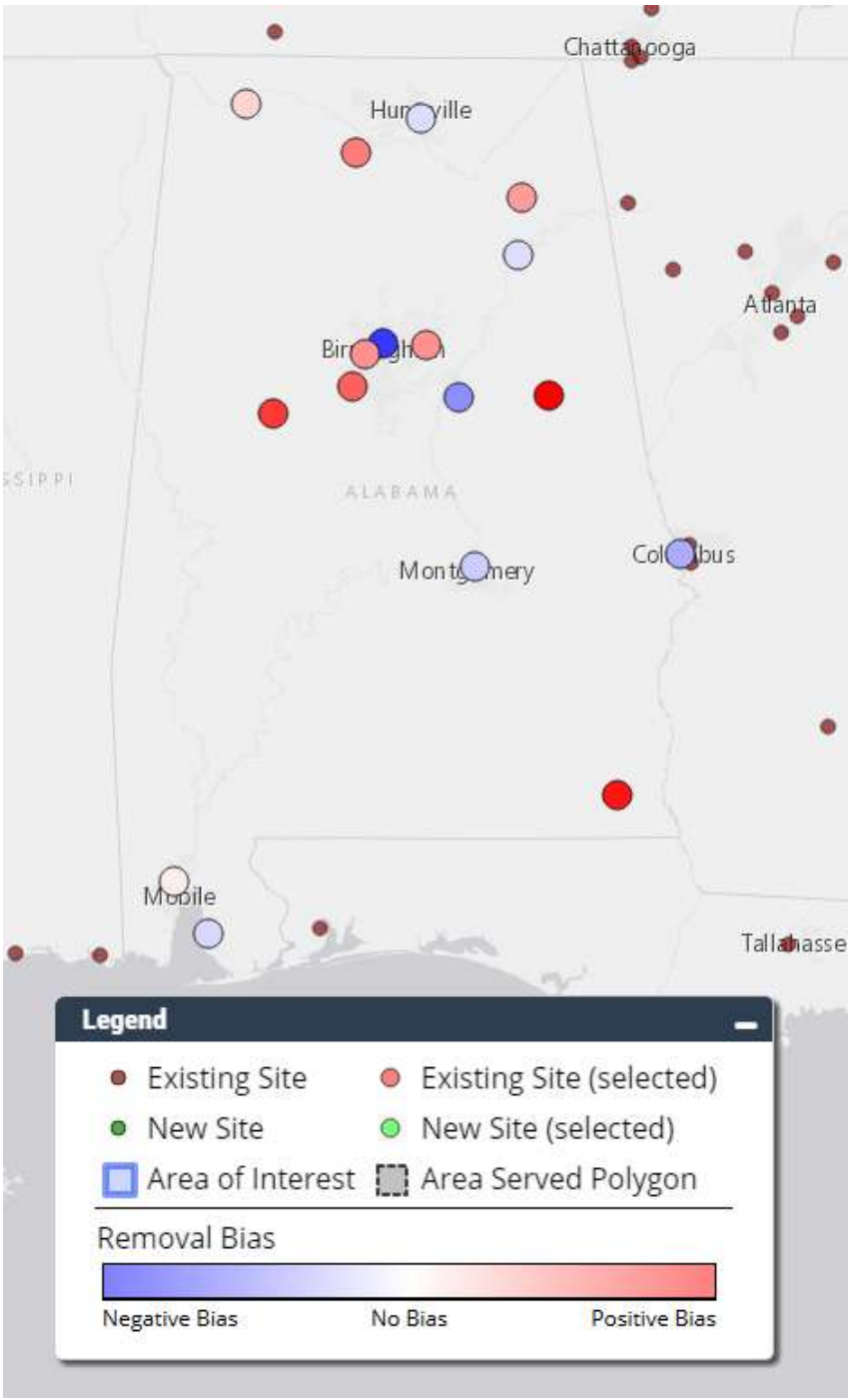


Figure 35 Removal Bias Estimate for Hoover and McAdory

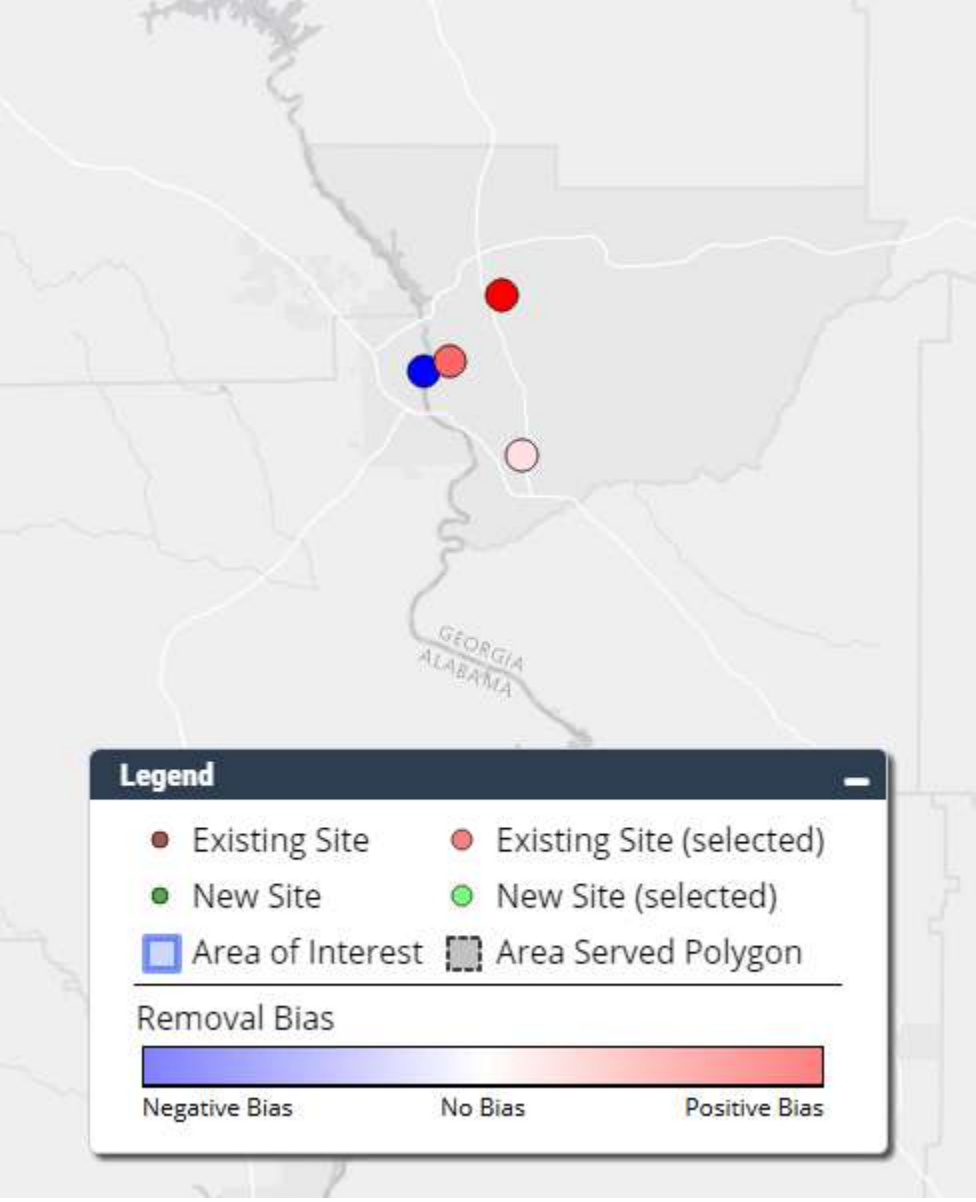


Figure 36 Removal Bias for Columbus, GA- Phenix City, AL MSA

These analyses indicate a substantial bias in the network if monitors were to be removed.

Additional Sites Analysis

At this time, Appendix D requirements are being met for the number of monitors in the state.
The current network provides broad coverage across Alabama and also provides more intensive monitoring in areas of higher population and emissions. There is a good network of continuous monitors to provide temporal coverage.

This analysis shows that no new sites are indicated in Alabama.

Summary of $PM_{2.5}$ Findings and Recommendations for Change to the $PM_{2.5}$ Network

Emission Densities, Population, Meteorology and Ambient Concentrations have been taken into account during the siting of the $PM_{2.5}$ monitors in Alabama's network. While the 2015 Ambient Air Quality Monitoring Plan shows several of the current monitors are no longer required by Appendix D due to a reduction in ambient concentrations in recent years, the site matrix analysis shows that most of the monitors are still important in the network. The current network provides broad coverage across Alabama and also provides more intensive monitoring in areas of higher population and emissions.

Possible changes to the network

For the reasons mentioned above, changes to the PM2.5 network are not foreseen at this time.

Particulate Matter Less Than 10 microns (PM 10)

All of the monitoring requirements of Appendix D are met for the MSAs in Alabama. These requirements are based on the design values and the population of the MSA. Maps showing the current PM 10 are found in Figure 37, Figure 38, Figure 39, and Figure 40.

The Huntsville MSA's PM_{10} concentrations are less than 80 percent of the PM_{10} NAAQS (National Ambient Air Quality Standards). Based on MSAs with populations between 250,000-500,000 and low concentrations (less than 80 percent of PM_{10} NAAQS), Huntsville is required to operate between 0 and 1 site. Huntsville operates 4 PM_{10} sites located south, central, and north within Huntsville. These monitors can be operated at very low cost and provide good spatial coverage within the city. Experience has shown that members of the public want ambient air monitoring to be performed in their part of the city, and the PM_{10} monitoring sites provide a monitoring presence at relatively low cost. Furthermore, the PM_{10} data provide an indirect indication of $PM_{2.5}$ spatial variability at a fraction of the cost of operating multiple $PM_{2.5}$ sites.

The Montgomery MSA has low concentrations and is required by Appendix D to have from 0 to 1 monitor. Montgomery has 1 manual method site.

Jefferson County's PM_{10} concentrations are greater than 80 percent of the PM_{10} National Ambient Air Quality Standards (NAAQS). Based on MSAs with populations greater than 1,000,000 and medium concentrations (greater than 80 percent of PM_{10} NAAQS), Jefferson County is required to operate between 4 and 8 sites. Jefferson County operates 4 Low-vol manual PM_{10} and 4 continuous PM_{10} sites located in the main industrial valley. These monitors can be operated at very low cost and provide good spatial coverage within the county. Three of the PM_{10} sites have continuous PM_{10} monitors and are collocated with manual PM_{10} monitors which run every six days for quality assurance purposes. JCDH uses the data from the Low-vol PM_{10} monitors along with $PM_{2.5}$ data to determine the course fraction of Particulate matter ($PM_{10-2.5}$).

Each agency also operates collocated monitors for quality assurance purposes.

Changes to the network since the 2010 Assessment

Due to the very low concentrations recorded and the aging equipment and infrastructure at the Mobile sites ADEM closed a continuous monitor in Chickasaw and a manual site at WKRG.

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JCDH has closed 3 manual PM10 monitors.

Possible changes to the network

There are no planned changes to the PM10 network at this time.

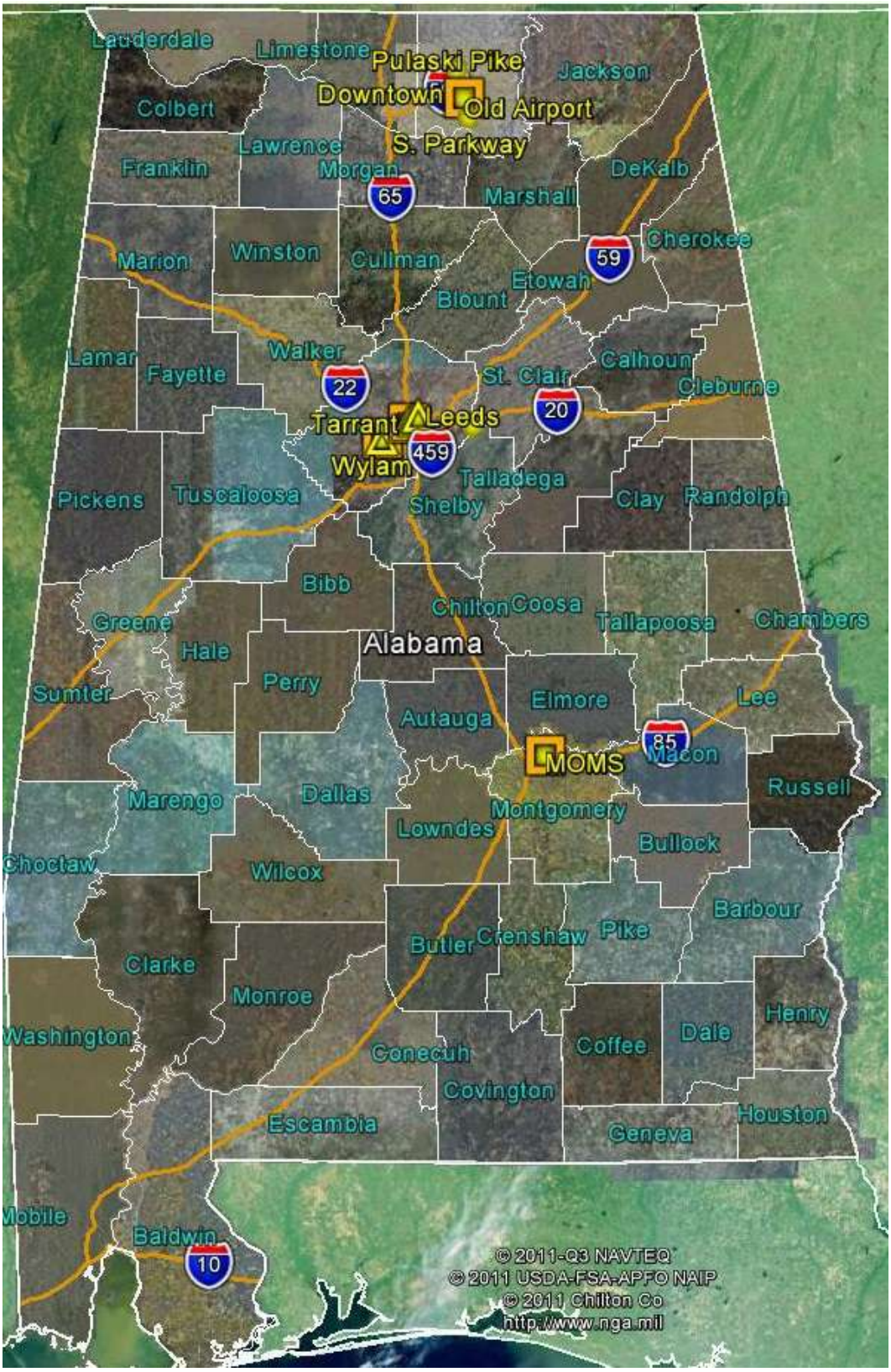

Figure 37 Alabama PM 10 Monitoring Network

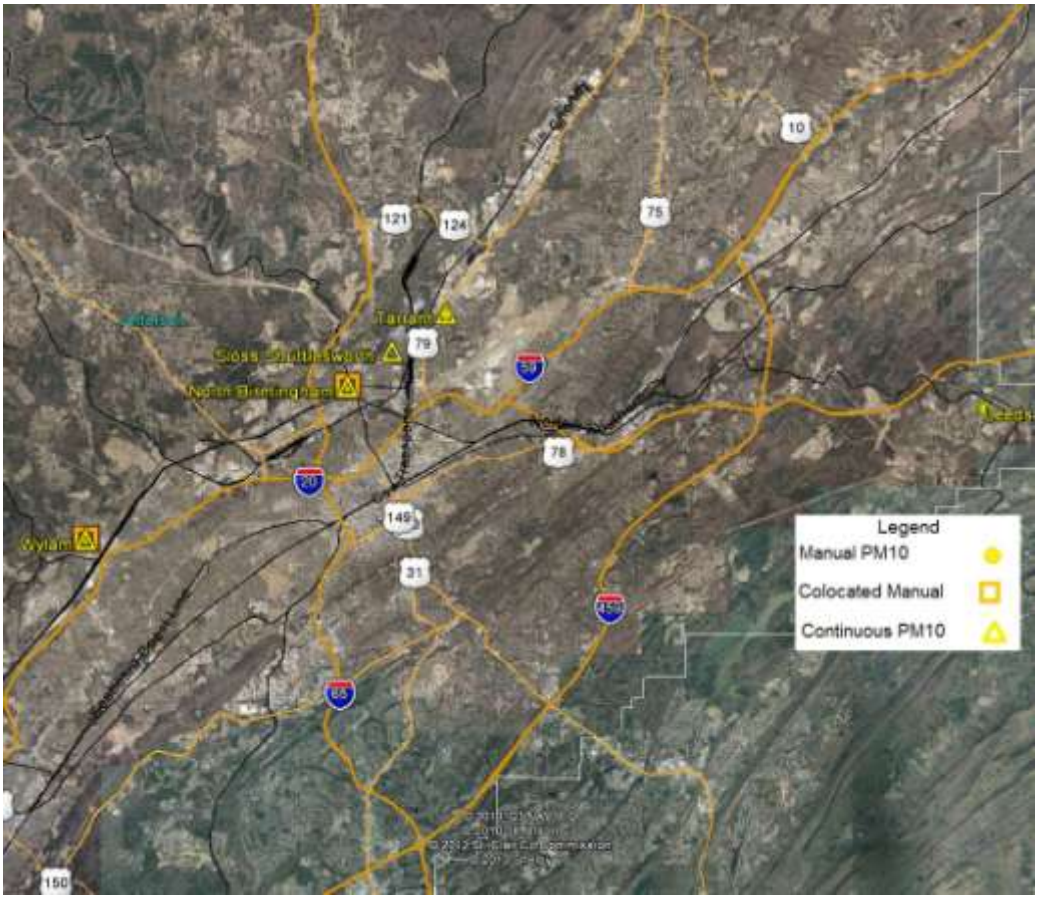

Figure 38 Birmingham Area PM_{10} Stations

Figure 39 Huntsville Area PM 10 Stations

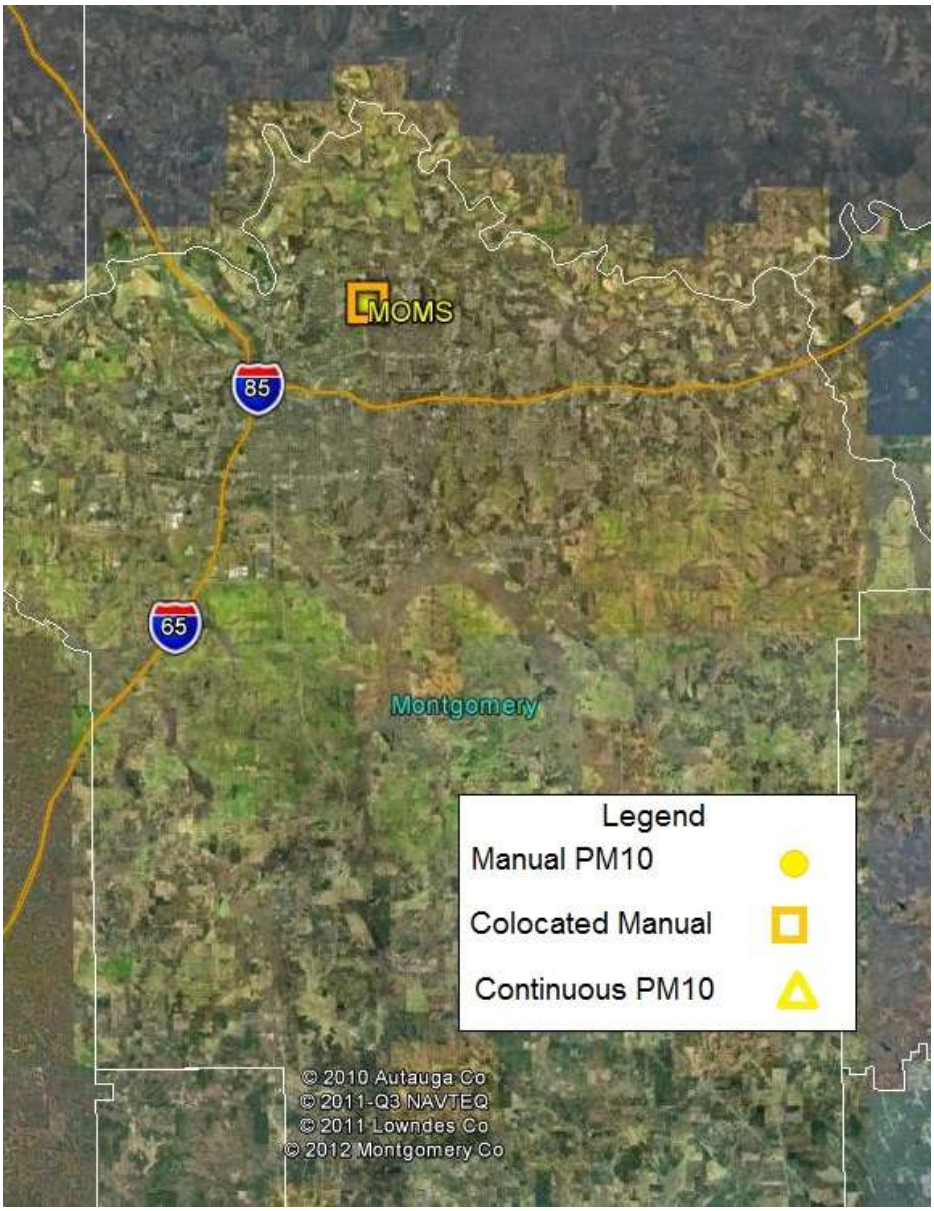

Figure 40 Montgomery Area PM 10 Station

Sulfur Dioxide (SO_2)

On June 2, 2010, EPA strengthened the primary National Ambient Air Quality Standard (NAAQS) for sulfur dioxide (SO_2). EPA is revising the primary SO_2 standard by establishing a new 1-hour standard at a level of 75 parts per billion (ppb).

Revising The SO_2 Monitoring Network

In the final rule, EPA is requiring fewer monitors than proposed, because the Agency plans to use a hybrid approach combining air quality modeling and monitoring to determine compliance with the new SO_2 health standard.

For a short-term 1-hour SO_2 standard, it is more technically appropriate, efficient, and effective to use modeling as the principal means of assessing compliance for medium to larger sources, and to rely more on monitoring for groups of smaller sources and sources not as conducive to modeling. Such an approach is consistent with EPA's historical approach and longstanding guidance for SO_2. EPA is setting specific minimum requirements that inform states on where they are required to place SO_2 monitors. The final monitoring regulations require monitors to be placed in Core Based Statistical Areas (CBSAs) based on a population weighted emissions index for the area. The final rule requires:

- 3 monitors in CBSAs with index values of 1,000,000 or more;
- 2 monitors in CBSAs with index values less than 1,000,000 but greater than 100,000; and
- 1 monitor in CBSAs with index values greater than 5,000.

All newly sited SO_2 monitors were operational by January 1, 2013.

Based on the PWEI calculations in Table 10 the Birmingham-Hoover CBSA requires 2 SO_2 monitors. JDCH has two sites at the North Birmingham NCore site (AQS ID 01-073-0023) and at Fairfield (AQS ID 01-073-1003) with SO_2 monitoring that fulfills the monitoring requirement.

The Huntsville CBSA has a PWEI less than 5,000 so no SO_2 monitor is required.

Based on the latest PWEI 1 SO_2 monitor is required in the Mobile, MSA. ADEM operates an SO_2 monitor at the Chickasaw site (AQS ID 01-097-0003) for the Mobile CBSA. This site became operational on January 1st, 2013

.

The current network and point source SO_2 emissions are represented in the map in Figure 41.

Potential Changes to the SO_2 network based on Regulatory Proposals

In 2010, EPA finalized the 1 hour SO_2 NAAQS. Since this time, EPA has finalized designations for portions of the nation, with the majority of areas deferred until the promulgation of the Data Requirements Rule (DRR). The DRR is intended to direct agencies to identify large sources of SO_2 and determine the impacts from these sources against the 1 hour NAAQS. This process began in May 2014 with a proposed DRR which was commented on and is still in development. This document has been delayed and is not expected to be released until late summer 2015.

One of the biggest concerns related to the delay in the Rule is that the timelines first established in 2010 may not be further revised in the final DRR. As a result of the delay in implementing the Rule, subject facilities may be required to provide, under an extremely short deadline, the expectation of whether modeling will be completed to show compliance with the NAAQS, or whether a monitoring strategy will be proposed to show compliance. The imminent date for making that decision will be January 15, 2016 under the proposed DRR. If the source chooses to propose a monitoring strategy, information will need to be provided to the State for inclusion in the Annual Monitoring Plan in July 2016.

CBSA's PWEI and number of monitors required

Population Weighted Emissions Index (PWEI) Calcuations

May 2015 - Using 2014 Census Estimates & 2011 NEI

CBSA Name	2011 NEI SO_2 (tpy)	Population (2013)	PWEI in Million persons-tpy	Required Monitors
Birmingham-Hoover, AL	119,145	1,263,739	150,568	2
Mobile, AL	20,673	415,123	8,582	1
Florence-Muscle Shoals, AL	19,441	147,639	2,870	0
Montgomery, AL	5,724	373,141	2,136	0
Columbus, GA-AL	3,787	314,005	1,189	0
Huntsville, AL	2,671	441,086	1,178	0
Decatur, AL	6,175	153,084	945	0
Tuscaloosa, AL	2,425	237,761	577	0
Talladega-Sylacauga, AL	6,154	92,208	567	0
Gadsden, AL	4,391	103,531	455	0
Scottsboro, AL	6,927	52,665	365	0
Troy, AL	8,211	33,389	274	0
Daphne-Fairhope-Foley, AL	627	200,111	125	0
Dothan, AL	777	148,095	115	0
Auburn-Opelika, AL	743	154,255	115	0
Anniston-Oxford, AL	848	115,916	98	0
Albertville, AL	1,015	94,636	96	0
Cullman, AL	590	81,289	48	0
Selma, AL	1,138	41,711	47	0
Enterprise-Ozark, AL	392	50,909	20	0
Ozark	168	49,484	8	0

Table 10 Population Weighted Emissions Index

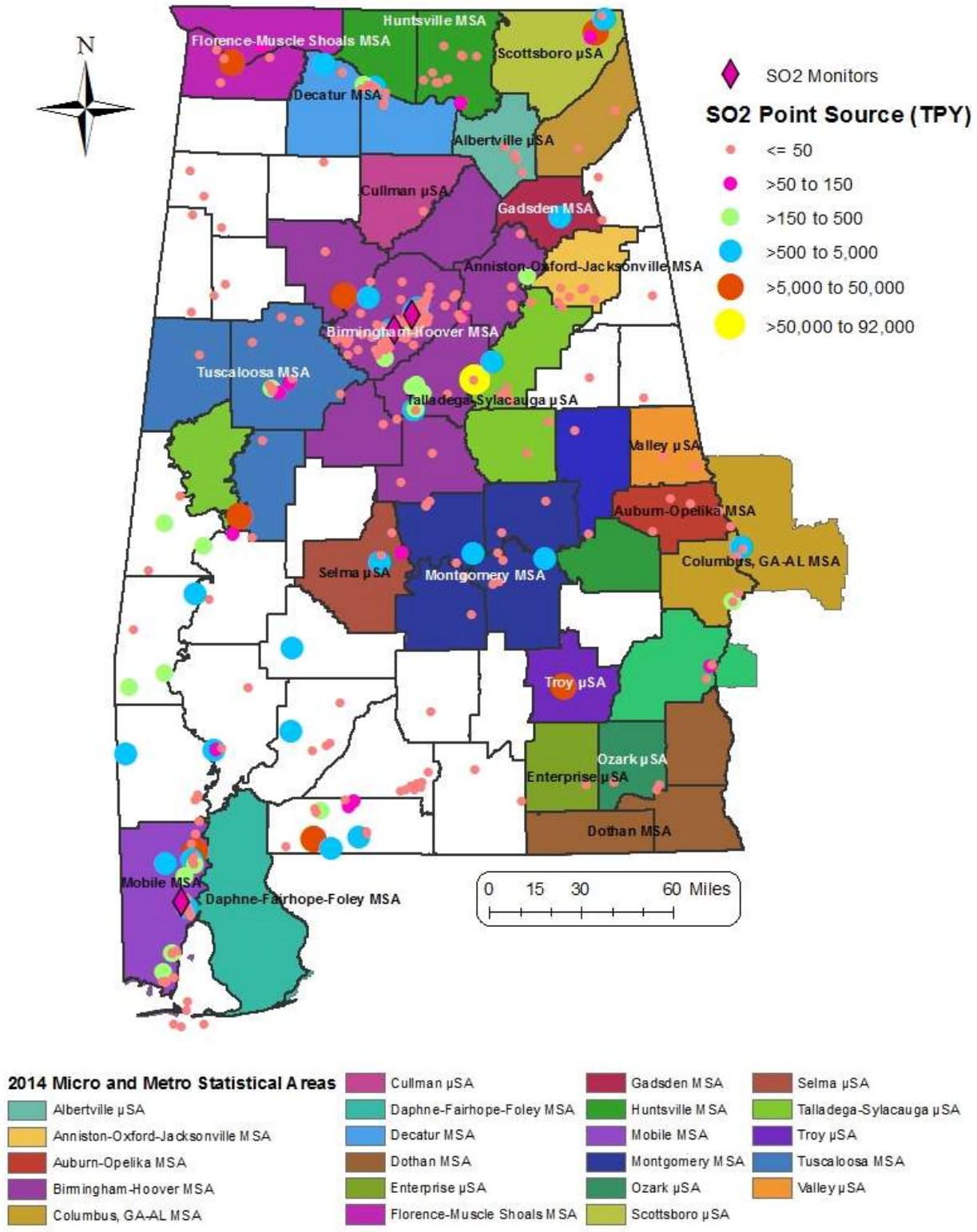

Figure 41 Sulfur Dioxide Emission with MSA Populations

Nitrogen Dioxide (NO_2)

On January 22, 2010, the US EPA finalized the monitoring rules for Nitrogen Dioxide. The new rules include new requirements for the placement of new NO_2 monitors in urban areas. These include:

Near Road Monitoring

• At least one monitor must be located near a major road in any urban area with a population greater than or equal to 500,000 people. A second monitor is required near another major road in areas with either:

(1) population greater than or equal to 2.5 million people, or
(2) one or more road segment with an annual average daily traffic (AADT) count greater than or equal to 250,000 vehicles.

These NO_2 monitors must be placed near those road segments ranked with the highest traffic levels by AADT, with consideration given to fleet mix, congestion patterns, terrain, geographic location, and meteorology in identifying locations where the peak concentrations of NO_2 are expected to occur. Monitors must be placed no more than 50 meters (about 164 feet) away from the edge of the nearest traffic lane.

Birmingham is the only MSA in Alabama with a population greater than 500,000, but the population is less than 2.5 million and there are no road segments with AADT greater than 250,000 vehicles. Funding was received and a turn-key near road site, which meets the design and siting criteria spelled out in 40 CFR Part 58, was purchased and installed in October 2013. The site became operational on January 1, 2014. The near-road site is the Arkadelphia Rd. site, AQS ID of 01-073-2059

Community Wide Monitoring

• A minimum of one monitor must be placed in any urban area with a population greater than or equal to 1 million people to assess community-wide concentrations.
• An additional 53 monitoring sites will be required to assess community-wide levels in urban areas.

The population of the Birmingham MSA is greater than 1 million so one NO_2 monitor was located at the NCore site and began operation in January 2014 for community wide monitoring.

A map of the current network is found in Figure 42.

Monitoring to Protect Susceptible and Vulnerable Populations

• Working with the states, EPA Regional Administrators will site at least 40 additional NO_2 monitors to help protect communities that are susceptible and vulnerable to NO_2-related health effects.

EPA has not identified a need for additional monitors in Alabama.

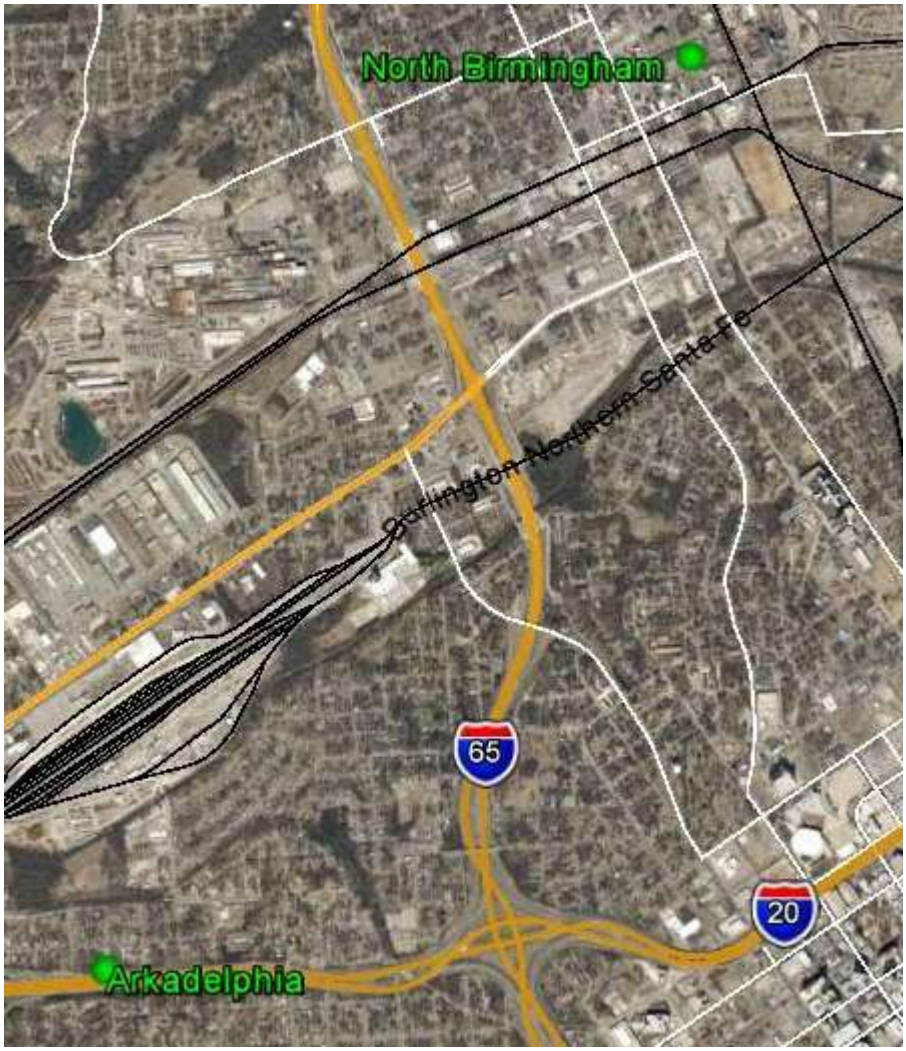

Figure 42 Near Road and Community Wide NO_2 Monitoring

Carbon Monoxide (CO)

Currently there are four monitors in the network operated by the Jefferson County Department of Health. See Table 11 for the site matrix analysis.

After changes to the monitoring rules at least two monitors in Jefferson County are required. This includes a requirement for CBSAs greater than one million in population and that are required to have a near-road NO_2 monitor to have a CO monitor located at the near-road site.

Currently there are four monitors in the Jefferson County network. (See Figure 43)

- The Fairfield monitor would serve as the site for monitoring the metropolitan area.
- The existing special purpose site will still be needed to monitor the emissions from Sloss Industries.
- The NCore site (North Birmingham) will serve to monitor trace levels of CO as stated in the NCore requirements.
- The Arkadelphia (Near Road) site will serve as the roadway site to monitor mobile source emissions.

There are no plans to modify the network at this time.

Figure 43 CO Monitor Locations

Table 11 Carbon Monoxide Site Matrix

Site Name	Site Id	POC	App D req	NCORE required	Located in complex terrain	Used for AQI	Used to fill spatial needs for Airnow reporting	Used in outside health studies	Located in unique areas	Bckg	Transport monitor	community concerns	Total
			10	10	1 to 5	3	3	5	5	5	5	10	20 or Greater
Fairfield	1003	1			5	3		5					13
North B'ham Sloss Ind.	6004	1			5	3		5	5			10	28
North B'ham (NCore)	0023	2		10	5	3		5					23
Arkadelphia (Near Road)	2059	1	10		5	3		5					23

Lead (Pb)

In 2008, the US EPA revised the National Ambient Air Quality Standard for lead. The lead standard was lowered from 1.5 ug/m3 for a quarterly average to 0.15 ug/m3 based on the highest rolling 3 month average over a 3 year period. EPA set minimum monitoring requirements for source and population oriented monitoring.

On December 27, 2010, EPA finalized revisions to the Lead Monitoring Rule requirements pertaining to where State and local monitoring agencies (‘‘monitoring agencies’’) would be required to conduct lead monitoring. [Revisions to the Lead Ambient Air Monitoring Requirements, FR/ Vol 75, No. 247 (PDF) (13pp, 199k)]

- EPA lowered the emission threshold from 1.0 tpy to 0.50 tpy for industrial sources of lead and required monitoring agencies to install and begin operation of source-oriented monitors near lead sources emitting 0.50 tpy or more but less than 1.0 tpy by December 27, 2011 (monitoring for 1.0 tpy and greater lead sources was required to begin in January 1, 2010, by the 2008 Lead Standard).
- EPA maintained the 1.0 tpy lead emission threshold for airports. However, EPA required monitoring agencies to conduct ambient air lead monitoring near 15 additional airports emitting 0.50 tpy or more but less than 1.0 tpy for a period of 12 consecutive months commencing no later than December 27, 2011.
- EPA required monitoring agencies to install and begin operation of non source- oriented monitors at NCore sites in Core-Based Statistical Areas (CBSAs) with a population of 500,000 people or more by December 27, 2011, and revoked the existing requirement for non source-oriented monitoring (40 CFR part 58, Appendix D, paragraph 4.5(b)).

Population Oriented Monitors

The Birmingham MSA is required to operate a population oriented monitor since the MSA population is greater than 500,000. This monitor is operated by the JCDH at the NCORE site (AQS ID 01-073-0023).

Source Oriented Monitors

After evaluating the most recent emissions information, the only source that exceeds the 0.5 ton per year threshold for Lead (Pb) is the Sanders Lead Company in Troy, Alabama. On November 12, 2012, ADEM submitted a revision to the State Implementation Plan for the purpose of providing for the attainment of the 2008 Lead (Pb) NAAQS for the Troy Lead Nonattainment Area. EPA proposed to approve the revision to the SIP on September 6, 2013 and the final rule was effective on February 27, 2014. ADEM has an existing monitor (AQS ID 01-109-0003) near that source. This monitor appears to be sited in the proper location and ADEM will continue to operate that monitor.

As a result, no additional monitoring provisions are required for lead sources in Alabama.

Pryor Field in Limestone County was identified in the Federal Register as one of fifteen airports in the nation which appeared to be emitting greater than 15 tpy of lead. ADEM established a lead monitoring site at that airport and monitored lead concentration for a one year (January through December of 2012). The results of that monitoring indicated that ambient concentrations were less

than 6 percent of the standard. ADEM requested in the 2013 Annual Air Monitoring Plan permanently discontinue monitoring at that location. The plan was approved by EPA.

Acknowledgement

The Site Correlation, Exeedance Probability maps, Area Served and Removal Bias tools were prepared by the Lake Michigan Air Directors Consortium (LADCO). Please visit their website to learn more about these tools.

http://ladco.github.io/NetAssessApp/