



## Forsyth County Office of Environmental Assistance and Protection

---

June 15, 2015

Mr. Todd Rinck  
U.S. Environmental Protection Agency  
Region 4  
Atlanta Federal Building  
61 Forsyth Street  
Atlanta, GA 30303-8960

Dear Mr. Rinck:

This letter and accompanying Annual Network Plan report on the status of the **Ambient Air Monitoring** commitments for the FY-15 105 Grant Work plan for Forsyth County, North Carolina (Reporting Organization 37-067). The entire Plan follows the Executive Summary, complete with staff field reviews as well as a copy of the published public notice.

I certify the ambient concentration data and the quality assurance data are completely submitted to AQS and the ambient data are accurate to the best of my knowledge taking into consideration the quality assurance findings. If you need additional information concerning these matters, please contact me at (336) 703-2448.

Sincerely,

Jason R. Bodenhamer, Program Manager  
Analysis and Monitoring Division  
Forsyth County Office of Environmental Assistance and Protection

Enclosures

cc: Bob Ragland (FCEAP)  
Donnie Redmond (NCDENR)  
Joette Steger (NCDENR)  
Ryan Brown (EPA-Region IV)

This page intentionally left blank

## **Executive Summary**

---

### ***Submit by July 1, 2014 an evaluation to demonstrate the requirements of 40 CFR Part 58.10 (a)(1) (Annual Network Evaluation) have been met.***

This review was conducted and submitted by July 1, 2014.

### ***Quality Assurance Procedures.***

On February 5, 2013, this Office was notified that the submitted QMP was approved. This Office is currently updating all SOPs associated with our equipment used in our network and will submit each document to EPA for approval. We are also going to update our QAPP related to our network as well.

### ***Categorization of Ambient Monitors and Auxiliary Equipment.***

The evaluation was completed in January 2014. We currently have backup equipment for each monitoring device stored in our office in the case of equipment failure. The current emphasis remains maintenance of the monitoring buildings and consolidation of the network. Capital funds are available in limited quantity and are available for proper planning for future network needs.

### ***Notify EPA within 30 days after exceedances/violations of NAAQS.***

The Forsyth County Office of Environmental Assistance and Protection remained an active participant in the AirNow program. Part of that program ensures that all local and regional exceedances/violations of the NAAQS are submitted to EPA and all others affected in a timely fashion.

### ***Comply with Exceptional Events Policy.***

No situations requiring exceptional event flagging occurred since the last Annual Network Review period.

### ***Submit list of urban areas for which AQI is reported.***

Forsyth County reports the AQI for our part of the Greensboro-Winston-Salem-High Point MSA. AQI statistics are available in local newspapers, on the Department's web site at <http://www.forsyth.cc/EAP/>, and through the NC-DAQ's recorded 888-RU4NCAIR phone system. Real time data (updated hourly) are also available at: <http://www.forsyth.cc/EAP/airmonitoringdata.aspx>

### ***Attend Region 4 QA Meeting & AIRS Conference.***

Jason Bodenhamer, Cary Gentry, Jordan Payne, Lawrence Akoje, and Minor Barnette attended the National Ambient Air Monitoring Conference in August, 2014 in Atlanta, Georgia.

Jason Bodenhamer, Cary Gentry, and Lawrence Akoje attended the EPA Region 4 workshop meeting in Chattanooga, TN during March, 2015.

### ***Submit air quality forecasts for MSA's >500,000 population to EPA AIRNOW.***

Forsyth County has been a leader in this area and submits air quality forecasts for multiple pollutants to AIRNOW on a year-round basis. Several presentations on this program have been given at recent EPA National Forecasting and Outreach Conferences.

### ***Changes in the SLAMS/NAMS Network***

No changes in the network over the past year.

### ***Data Submittal Criteria***

All SLAMS data were submitted to AQS within 90 days of the end of each quarter. PARS data was submitted following a Technical Systems Audit in January 2015, which pointed out gaps in the QC data submittal due to management turnover. All data was certified by May 1, 2015.

### ***National Performance Audit Program***

An NPAP audit was conducted at the Shiloh Church site (37-067-0028) on July 2, 2014. An NPAP audit was conducted at the Clemmons Middle School site (37-067-0030) on July 1, 2014. An NPAP audit was conducted at the Peter's Creek site (37-067-0023) on July 1, 2014.

### ***Continued-Annual Network Evaluation***

Forsyth County has realigned the local monitoring network in recent years to account for changes in population, land use, and traffic patterns.

#### **OZONE**

The Shiloh Church site (37-067-0028) was established in 1996 to serve as the primary direction urban fringe monitor but design values continue to be 5-6 ppb lower than the other three sites in Forsyth County. We would like to shut this site down at the end of the ozone season, Nov. 1, 2015. Past data shows closing down this site would not affect the highest design value listed for Forsyth County. The maximum impact downwind site is operated by the State program in Rockingham County (Bethany School, 37-157-0099). The secondary wind direction is measured by the Union Cross site (37-067-1008). In addition, the Clemmons Middle site (37-067-0030), established in 2005, monitors the southwest sector of Forsyth County. Another ozone monitor at Hattie Avenue (37-067-0022) has operated since 1993.

#### **CARBON MONOXIDE**

The microscale Peters Creek site (37-067-0023) has served as the maximum impact site for Forsyth County since 1988. We would like to shut this site down at the end of the calendar year 2015. The CO maintenance era expires in November, 2015 and maximum CO levels continue to run at less than 10% of the NAAQS standard.

#### **SULFUR DIOXIDE/NITROGEN OXIDES**

Sulfur dioxide levels have been measured at the Hattie Avenue site (37-067-0022) since 1983. Readings are considered to be characteristic of background levels in Forsyth County. On occasion, the site is impacted by plume touchdowns from the Duke Energy Belews Creek Generating Station located approximately 20 miles to the northeast in Stokes County. In compliance with the most recent monitoring data requirements, 5-minute SO<sub>2</sub> averaged data from this site is reported along with 1-hour data.

Nitrogen oxide levels have been measured at the Hattie Avenue site (37-067-0022) since 1984. Readings represent the neighborhood impact of major transportation related emissions from inter-city and intra-city traffic on Business I-40 and U.S. 52 bisecting Winston-Salem. Both monitors satisfy the most recent monitoring criteria related to the 1-hour SO<sub>2</sub> and NO<sub>2</sub> standards.

## PARTICULATE

Continuous PM10 (TEOM) concentrations continue to be recorded at the Hattie Avenue site (37-067-0022). These readings are representative of a maximum impact particulate site influenced by background emissions and locally generated transportation emissions.

### FRM STATUS

CORE PM2.5 sites have been established at Hattie Avenue (37-067-0022; 1/1 frequency) and Clemmons Middle (37-067-0030; 1/3 frequency + 1/6 collocated) as part of North Carolina's EPA approved PM2.5 monitoring plan. Data collection has been quite successful and validated concentration and QA information has been reported to AQS through December 2014. Due to pressures from the state to reduce NCDAQ lab workload we would like to shutdown the 3 day and 6 day samplers at Clemmons Middle (37-067-0030) on Dec. 31, 2015. This would also reduce staff time in the field and allow that time to be spent working on the more robust QA review process that was implemented March, 2015. Our co-location requirement would force us to startup a 6 day sampler at the Hattie Avenue site (37-067-0022) Dec 31, 2015.

### CONTINUOUS STATUS

A continuous PM2.5 (TEOM) was installed at the Hattie Avenue site in June 1999 and it was joined by an additional PM10 TEOM in October 1999. The data set continues to indicate excellent agreement between the FRM PM2.5 data and 24-hour averages obtained from the TEOM. An additional PM2.5 TEOM was established in the Clemmons area of Forsyth County in the spring of 2005.

### SPECIATION STATUS

A speciated PM2.5 monitor (1/6 frequency) began operation on September 22, 2001 and a carbon speciated PM2.5 monitor (1/6 frequency) began operation on February 28, 2007 at Hattie Avenue. Validated data sets have been received from RTI through December 2014.

## AIR TOXICS

A (1/6) day air toxic sampler operated in conjunction with the NCDAQ has been resident at the Hattie Avenue site since 2000. Air toxic data remains under NCDAQ control. This Office does not review or upload this data to AQS.

## LEAD

No lead monitors are currently in place at any sites within Forsyth County. Based on the interpretation of the lead monitoring requirements, recent population data, and recent source emission inventory data, there are no sources that emit more than 700 lbs of lead per year. Therefore, there are no immediate plans for lead monitoring in the County.

## VISIBILITY PROGRAM

With financial assistance from Region 4 and the NCDAQ, a visibility camera system was established for the Triad area during 2002. The associated web site combines pictures of two mountain scenes with hourly updated ozone and PM2.5 AQI statistics. A nephelometer was installed in 2004 to provide visual range data. The information is available at: <http://www.forsyth.cc/EAP/hazecam.aspx>. Replacement cameras are needed to address focus and communication problems experienced over the last 4 months of 2014.

# 2015 Annual Monitoring Network Plan

## Forsyth County

### Office of Environmental Assistance and Protection

---



© Forsyth County Office of Environmental Assistance and Protection  
201 North Chestnut Street, 5<sup>th</sup> Floor  
Winston-Salem, NC 27101  
Phone 336-703-2440 • Fax 336-727-2777  
June 19, 2015

**CERTIFICATION**

By the signatures below, the Forsyth County Office of Environmental Assistance and Protection (FCEAP) certifies that the information contained in the 2014 Annual Monitoring Network Plan is complete and accurate at the time of submittal to EPA Region 4. However, due to circumstances that may arise during the sampling year, some network information may change. A notification of change and a request for approval will be submitted to EPA Region 4 at that time.

Print Name: Jason R. Bodenhamer Signature: \_\_\_\_\_ Date: \_\_\_\_\_  
Program Manager, Analysis and Monitoring Division, FCEAP

Print Name: W. Minor Barnette Signature: \_\_\_\_\_ Date: \_\_\_\_\_  
Director, FCEAP

# 2015 ANNUAL MONITORING NETWORK PLAN

## TABLE OF CONTENTS

<b>EXECUTIVE SUMMARY .....</b>	<b>3</b>
INTRODUCTION .....	9
SITE DESCRIPTION BACKGROUND INFORMATION AND DEFINITIONS .....	10
1. Site Description .....	10
2. Date Established .....	10
3. Site Approval Status .....	10
4. Monitoring Objectives .....	10
5. Monitoring Stations' Designations .....	10
SLAMS .....	11
NAMS .....	11
SPM .....	11
NCORE .....	11
6. Monitoring Methods .....	11
Particulate Matter 10 microns in size (PM <sub>10</sub> ) .....	11
Particulate Matter 2.5 microns in size (PM <sub>2.5</sub> ) .....	12
PM <sub>2.5</sub> Speciation sampling and analysis .....	12
Sulfur Dioxide .....	12
Carbon Monoxide .....	12
Ozone .....	13
Nitrogen Dioxide .....	13
Air Toxics .....	13
7. Quality Assurance Status .....	13
8. Scale of Representativeness .....	13
9. Data Processing and Reporting .....	14
<i>Network Summary .....</i>	<i>15</i>
1. Site Table and Criteria Pollutants Monitored .....	15
2. Site Map .....	16
3. Monitoring Methods .....	17
<i>Air Monitoring Station Descriptions .....</i>	<i>18</i>
1. Clemmons Middle School .....	18
(a) Site Table .....	18
(b) Site Description and Statement of Purpose .....	18
(c) Site Photographs .....	20
2. Hattie Avenue "A" .....	21
(a) Site Table .....	21
(b) Description and Statement of Purpose .....	21
(c) Site Photographs .....	23
3. Hattie Avenue "B" .....	24
(a) Site Table .....	24
(b) Description and Statement of Purpose .....	24
(c) Site Photographs .....	28
4. Peter's Creek .....	29
(a) Site Table .....	29
(b) Site Description and Statement of Purpose .....	29
(c) Site Photographs .....	31
5. Shiloh Church .....	32
(a) Site Table .....	32
(b) Site Description and Statement of Purpose .....	32
(c) Site Photographs .....	34
6. Union Cross .....	35
(a) Site Table .....	35
(b) Site Description and Statement of Purpose .....	35
(c) Site Photographs .....	37
REFERENCES .....	38

## ***Introduction***

The Forsyth County Office of Environmental Assistance and Protection's (FCEAP) monitoring program provides air quality monitoring services in Forsyth County, NC. FCEAP is a state "certified local air pollution program" whose purpose(s) are to improve and maintain ambient air quality and reduce exposure to unhealthful air pollutants.

FCEAP has operated an air quality monitoring program since the early 1970's. The air monitoring services provided by the program are conducted to measure concentrations of criteria air pollutants (CO, NO<sub>2</sub>, SO<sub>2</sub>, PM, and O<sub>3</sub>) in accordance with USEPA regulatory requirements. Measurements are used to assess compliance with National Ambient Air Quality Standards (NAAQS). The NAAQS define air pollutant concentration level thresholds judged necessary to protect the public health and welfare.

The FCEAP air monitoring program operates a network of state and local air monitoring stations (SLAMS) in Forsyth County. The current network configuration consists of seven monitoring stations that measure concentrations of criteria air pollutants. In addition to the SLAMS network the county network also includes monitoring for meteorological parameters and visibility conditions.

The annual monitoring network plan, as provided for in 40 CFR Part 58.10, *Annual Monitoring Network Plan and Periodic Network Assessment* must contain the following information for each monitoring station in the network:

1. The Air Quality System (AQS) site identification number for existing stations.
2. The location, including the street address and geographical coordinates, for each monitoring station.
3. The sampling and analysis method used for each measured parameter.
4. The operating schedule for each monitor.
5. Any proposal to remove or move a monitoring station within a period of eighteen months following the plan submittal.
6. The monitoring objective and spatial scale of representativeness for each monitor.
7. The identification of any sites that are suitable and sites that are not suitable for comparison against the annual PM<sub>2.5</sub> NAAQS.
8. The Metropolitan Statistical Area (MSA), Core-Based Statistical Area (CBSA), Combined Statistical Area (CSA) or other area represented by the monitor.

The following information below replicates the Forsyth County Air Quality ambient air monitoring network plan and continues in the following sections outlined below:

**II. Site Description Background Information and Definitions:** An outline of the designations, parameters, monitoring methods, and the basis for site selection.

**III. Network Summary:** This section presents an overview of the total number of sites and monitors in Forsyth County. Also included is a listing of all proposed changes to the current network.

**IV. Air Monitoring Station Description:** Each air monitoring station is described in detail as per the outline in (II.) above. Modification to the network as determined by an annual review process will be made each year to maintain a current up-to-date network description document.

## **Site Description Background Information and Definitions**

### **1. Site Description**

Specific information is provided to show the location of the monitoring equipment at the site, if the site is located in a CSA/MSA, the AQS identification number, the GPS coordinates, and evidence that monitors and monitor probes conform to the siting criteria.

### **2. Date Established**

The date when each existing monitoring station was established is shown in the description. For those stations, which are proposed, a date is provided when it is expected for the station to be in operation.

### **3. Site Approval Status**

Each monitoring station in the existing network has been reviewed with the purpose of determining whether it meets all design criteria for inclusion in the SLAMS network. Stations that do not meet the criteria will either be relocated in a nearby area or, when possible, re-sited at the present location.

### **4. Monitoring Objectives**

Per 40 CFR 58 Appendix D, Section 1.1:

*“The ambient air monitoring networks must be designed to meet three basic monitoring objectives. These basic objectives are listed below. The appearance of any one objective in the order of this list is not based upon a prioritized scheme. Each objective is important and must be considered individually.”*

The objectives are summarized below:

- (a) Provide air pollution data to the general public in a timely manner.
- (b) Support compliance with ambient air quality standards and emissions strategy development. Data from FRM (Federal Reference Method), FEM (Federal Equivalent Method), and ARM (Approved Regional Method) monitors for NAAQS pollutants will be used for comparing an area’s air pollution levels against the NAAQS.
- (c) Support for air pollution research studies.

### **5. Monitoring Stations’ Designations**

Most stations described in the air quality surveillance network are designated as State and Local Air Monitoring Stations (SLAMS). In addition, some of these stations fulfill other requirements, which must be identified. In this description of the network, designations are also made for National Air Monitoring Stations (NAMS), Special Purpose Monitors (SPM), and National Core (community oriented) stations (NCore). The following is the criteria used for each of these designations.

## ***SLAMS***

Requirements for air quality surveillance systems provide for the establishment of a network of monitoring stations designated as State and Local Air Monitoring Stations (SLAMS) that measure ambient air concentrations of those pollutants for which standards have been established. These stations must meet requirements that relate to four major areas: quality assurance, monitoring methodology, sampling interval and siting of instruments and instrument probes.

## ***NAMS***

Within the SLAMS network certain monitors are selected to provide the USEPA with timely data for use in national trends analysis. These NAMS monitors are identified in the summary of network stations.

## ***SPM***

Not all monitors and monitoring stations in the air quality surveillance network are included in the SLAMS network. In order to allow the capability of providing monitoring for various reasons such as: special studies, modeling verification and compliance status, and other objectives; certain monitors are designated as Special Purpose Monitors (SPM). These monitors are not committed to any one location or for any specified time period. They may be located as separate monitoring stations or be included at SLAMS locations. Monitoring data may be reported, provided that the monitors and stations conform to all requirements of the SLAMS network.

## ***NCORE***

National Core (community-oriented) multi-pollutant monitoring station data will be used to evaluate the regional air quality models used in developing emission strategies, and to track trends in air pollution abatement control measures' impact on improving air quality.

## ***6. Monitoring Methods***

Sampling and analytical procedures for criteria air pollutant monitoring performed in the FCEAP ambient air monitoring network are conducted in accordance with applicable USEPA Designated Federal Reference (FRM) or Equivalent (FEM) Methods unless otherwise noted. Analytical techniques for non-criteria air pollutant monitoring (methods employed that are not USEPA Designated Federal Reference (FRM) or Equivalent (FEM) Methods) are documented in the applicable FCEAP Quality Assurance Project Plans (QAPP), FCEAP Standard Operating Procedures (SOP), or the appropriate North Carolina Division of Air Quality (NCDAQ) QAPP or SOP. Methods used by FCEAP for criteria pollutant monitoring are listed below:

### ***Particulate Matter 10 microns in size (PM<sub>10</sub>)***

All PM<sub>10</sub> samplers operated by FCEAP are operated as federal reference method (FRM) or equivalent samplers and are operated according to the

requirements set forth in 40 CFR 50 and 40 CFR 53. Listed below is the USEPA Designated Reference or Equivalent Method used in the FCEAP monitoring network:

Method	Designation Number	Method Code
R&P TEOM Series 1400a	EQPM-1090-079	079

***Particulate Matter 2.5 microns in size (PM<sub>2.5</sub>)***

With the exception of continuous samplers and speciation samplers all PM<sub>2.5</sub> samplers operated by FCEAP are either FRM or FEM samplers. Listed below is the USEPA Designated Reference or Equivalent Method used in the FCEAP monitoring network:

Method	Designation Number	Method Code
R & P Partisol-Plus 2025 PM-2.5 Seq.	RFPS-0498-118	118
R & P Partisol-Plus 2025i PM-2.5 Seq.	EQPM-0202-145	145

***PM<sub>2.5</sub> Speciation sampling and analysis***

In addition to operating PM<sub>2.5</sub> samplers that determine only PM<sub>2.5</sub> mass values, FCEAP also operates PM<sub>2.5</sub> speciation samplers that collect samples that are analyzed to determine the chemical makeup of PM<sub>2.5</sub>. Data collected using this method cannot be compared to the NAAQS. Listed below is the method used in the FCEAP monitoring network:

Method	Designation Number	Method Code
MetOne SASS	NA	NA
URG	NA	NA

***Sulfur Dioxide***

Instruments used to continuously monitor sulfur dioxide levels in the atmosphere employ the pulsed UV fluorescence method. Listed below is the USEPA Designated Reference or Equivalent Method used in the FCEAP monitoring network:

Method	Designation Number	Method Code
Thermo Electron 43A, 43C-TLE, 43i	EQSA-0486-060	100

***Carbon Monoxide***

Continuous monitoring for carbon monoxide is performed by use of the non-dispersive infrared (gas filter correlation) method. Listed below is the USEPA Designated Reference or Equivalent Method used in the FCEAP monitoring network:

Method	Designation Number	Method Code
Thermo Electron or Thermo Environmental Instruments 48, 48C, 48i	RFCA-0981-054	054

### **Ozone**

Ozone is monitored using the UV photometry method. Listed below is the USEPA Designated Reference or Equivalent Method used in the FCEAP monitoring network:

Method	Designation Number	Method Code
Teledyne – Advanced Pollution Instrumentation, Inc. Model 400E	EQOA-0992-087	087

### **Nitrogen Dioxide**

The chemiluminescence method is used in monitoring the nitrogen dioxide level in the ambient air. Listed below is the USEPA Designated Reference or Equivalent Method used in the FCEAP monitoring network:

Method	Designation Number	Method Code
Teledyne – Advanced Pollution Instrumentation, Inc Model 200A, 200AU, 200E, 200EU	RFNA-1194-099	099

### **Air Toxics**

Air toxics sampling is conducted in Forsyth County using equipment on loan from the State of North Carolina, Division of Air Quality. Listed below is the USEPA Designated Reference or Equivalent Method used in the FCEAP monitoring network:

Method	Designation Number	Method Code
Compendium Method for Toxic Organics	Compendium Method TO-15	150

## **7. Quality Assurance Status**

FCEAP has recently implemented a more extensive quality assurance procedure to ensure that all air monitoring data collected meets established criteria for precision and accuracy. FCEAP operates according to EPA approved Quality Assurance Project Plans (QAPP) and Standard Operating Procedures and will be updating and seeking EPA approval of the updated documents by the end of 2015. Staff members audit instrumentation on a scheduled basis to ensure that each instrument is calibrated and operating properly. Data validation is performed monthly to ensure data reported by each instrument is recorded accurately in the air quality monitoring database.

## **8. Scale of Representativeness**

Each station in the monitoring network must be described in terms of the physical dimensions of the air parcel nearest the monitoring station throughout which actual pollutant concentrations are reasonably similar. Area dimensions or scales of representativeness used in the network description are:

- (a) Microscale - defines the concentration in air volumes associated with area dimensions ranging from several meters up to about 100 meters.
- (b) Middle scale - defines the concentration typical of areas up to several city blocks in size with dimensions ranging from about 100 meters to 0.5 kilometers.

- (c) Neighborhood scale – defines concentrations within an extended area of a city that has relatively uniform land use with dimensions ranging from about 0.5 to 4.0 kilometers.
- (d) Urban scale - defines an overall citywide condition with dimensions on the order of 4 to 50 kilometers.
- (e) Regional Scale - defines air quality levels over areas having dimensions of 50 to hundreds of kilometers.

Closely associated with the area around the monitoring station where pollutant concentrations are reasonably similar are the basic monitoring exposures of the station. There are six basic exposures:

- (a) Sites located to determine the highest concentrations expected to occur in the area covered by the network.
- (b) Sites located to determine representative concentrations in areas of high population density.
- (c) Sites located to determine the impact on ambient pollution levels of significant sources or source categories.
- (d) Sites located to determine general background concentration levels.
- (e) Sites located to determine the extent of regional pollutant transport among populated areas; and in support of secondary standards.
- (f) Sites located to measure air pollution impacts on visibility, vegetation damage, or other welfare-based impacts.

The design intent in siting stations is to correctly match the area dimensions represented by the sample of monitored air with the area dimensions most appropriate for the monitoring objective of the station. The following relationship of the six basic objectives and the scales of representativeness are appropriate when siting monitoring stations:

<b>Site Type</b>	<b>Appropriate Siting Scales</b>
1. Highest concentration	Micro, middle, neighborhood (sometimes urban or regional for secondarily formed pollutants).
2. Population oriented	Neighborhood, urban.
3. Source impact	Micro, middle, neighborhood.
4. General/background & regional transport	Urban, regional.
5. Welfare-related impacts	Urban, regional.

**Table 1 - Siting Objectives and Scales**

### **9. Data Processing and Reporting**

All ambient air quality data are stored in the Environmental Data Acquisition System (EDAS) database located on the 5th floor of the Forsyth County Government Center, FCEAP, 201 N. Chestnut Street, Winston-Salem, North Carolina. On a daily basis the EDAS data are backed up and maintained at an off-site location. After all monthly data validation procedures are successfully completed, data is transmitted to the USEPA’s national Air Quality System (AQS) database. The AQS database is maintained by EPA as the official repository of the fully quality assured ambient air quality dataset.

## Network Summary

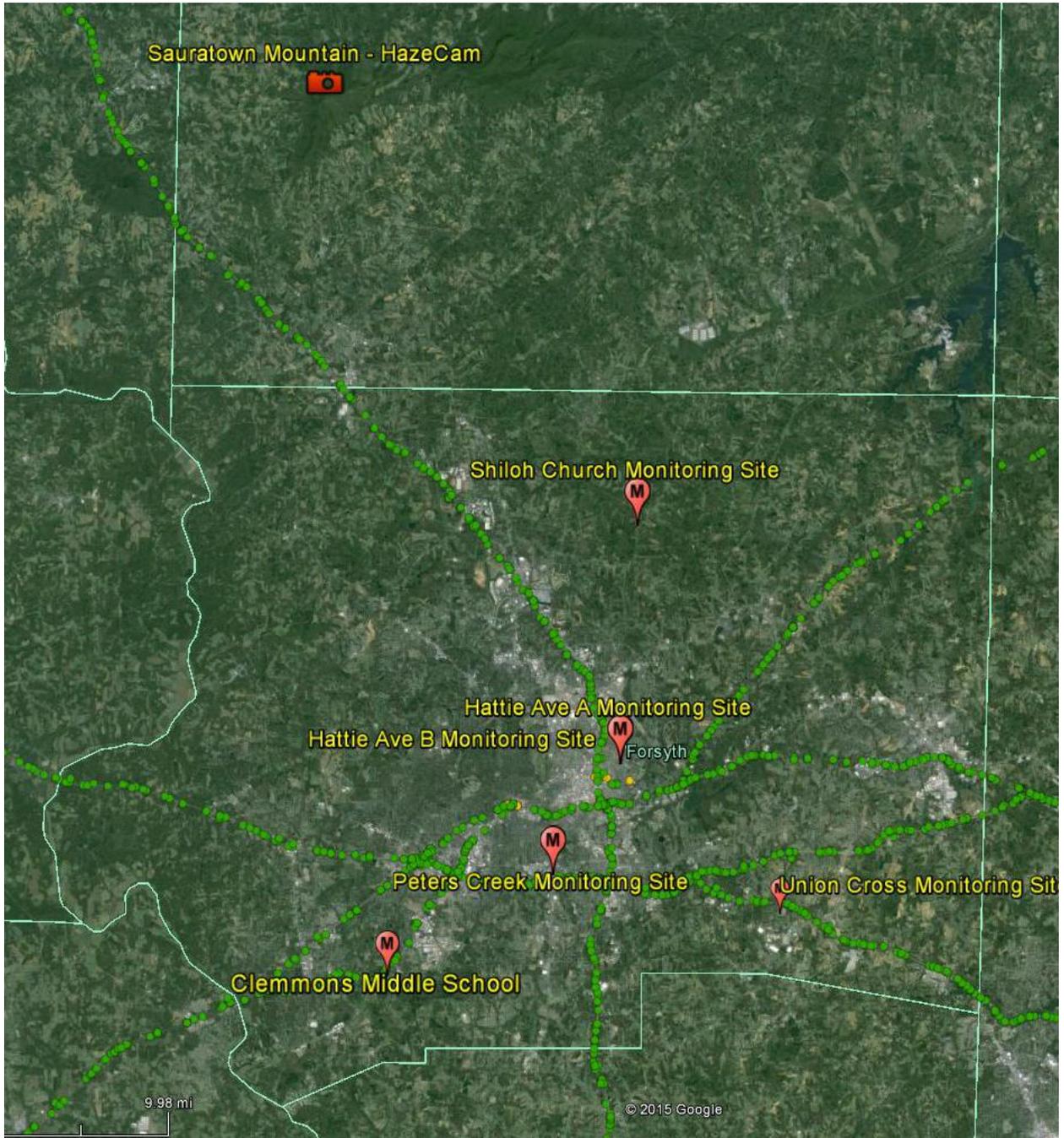
### 1. Site Table and Criteria Pollutants Monitored

Site	AQS ID #	CO	NO <sub>2</sub>	O <sub>3</sub>	Pb	PM <sub>2.5</sub>	PM <sub>10</sub>	SO <sub>2</sub>	Air Toxics
Clemmons Middle School	37-067-0030			X		X			
Hattie Avenue "A"	37-067-0022		X	X				X	
Hattie Avenue "B"	37-067-0022					X	X		X
Peter's Creek	37-067-0023	X							
Shiloh Church	37-067-0028			X					
Union Cross	37-067-1008			X					

Table 2 - Forsyth County Monitoring Sites

2. Site Map

AIR QUALITY MONITORING STATIONS  
FORSYTH COUNTY, NC 2015



### 3. Monitoring Methods

Site	Parameter	Instrument / Method	Method Number	Parameter Number	Monitor Type <sup>†</sup>	Serial Number	Purchase Date	Replace Date	Condition
37-067-0022	Ozone	UV Photometric	087	44201	SLAMS	2621	2009	2019	Good
37-067-0022	SO2	Pulsed UV Fluorescent	100	42401	SLAMS	819230552	2008	2018	Good
37-067-0022	NO	Chemi-luminescence	099	42601	SLAMS	200EU-133	2007	2017	Good
37-067-0022	NO <sub>2</sub>	Chemi-luminescence	099	42602	SLAMS	200EU-133	2007	2017	Good
37-067-0022	NO <sub>x</sub>	Chemi-luminescence	099	42603	SLAMS	200EU-133	2007	2017	Good
37-067-0022	Air Toxic	Compendium Method for Toxic Organics (TO) 15	150	Multiple	NON	4518 3603	NCDENR Owned Equipment		
37-067-0022	PM2.5	FRM	145	88101	SLAMS	2025A202849805	2014	2020	New
37-067-0022	PM2.5	Speciation	118	Multiple	SLAMS	A2591	2001	2018	Fair
37-067-0022	PM2.5	TEOM	701	88501	SLAMS	140AB223509812	2000	2017	Fair
37-067-0022	PM2.5	TEOM	702	88502	SLAMS	140AB223509812	2000	2017	Fair
37-067-0022	PM2.5	Carbon Speciation	118	88101	SLAMS	3NB0191	2007	2018	Good
37-067-0022	PM10	TEOM	079	81102	SLAMS	140AB226379906	2000	2017	Fair
37-067-0023	CO	Gas Filter Correlation	054	42101	SLAMS	819230553	2008	2019	Good
37-067-0028	Ozone	UV Photometric	087	44201	SLAMS	2217	2009	2019	Good
37-067-0030	Ozone	UV Photometric	087	44201	SLAMS	2218	2009	2019	Good
37-067-0030	PM2.5	TEOM	701	88501	SLAMS	140AB252230406	2000	2017	Fair
37-067-0030	PM2.5	TEOM	702	88502	SLAMS	140AB252230406	2000	2017	Fair
37-067-0030	PM2.5	FRM	116	88101	SLAMS	2025A205999808	1999	2019	Fair
37-067-0030	PM2.5	FRM	118	88101	SLAMS	2025B217080407	2004	2019	Fair
37-067-1008	Ozone	UV Photometric	087	44201	SLAMS	2219	2009	2019	New
37-067-1008	Temp	R. M. Young	020	61101	SLAMS				Fair
37-067-1008	Humidity	R. M. Young	020	61103	SLAMS				Fair
37-067-1008	WD	Climatronics	020	61104	SLAMS	102779	2008	2015	Poor
37-067-1008	WS	Climatronics	020	61103	SLAMS	102779	2008	2015	Poor
37-067-1008	Pressure	R. M. Young	011	64101	SLAMS				Fair

Table 3 - Forsyth County Monitoring Methods

<sup>†</sup> - Monitor Type:

SLAMS- State and Local Air Monitoring Station

SPM- Special Purpose

NON- Non-regulatory

TRENDS- Trends Speciation

## Air Monitoring Station Descriptions

### 1. Clemmons Middle School

#### (a) Site Table

Site Name: Clemmons Middle School  
AQS Site Identification Number: 37-067-0030  
Location: Fraternity Church Road  
Winston-Salem, NC  
Latitude: N36.025931°  
Longitude: W80.342257°  
Elevation: 245 meters  
Date Monitor Established: Ozone April 27, 2005  
Date Monitor Established: PM2.5 TEOM April 27, 2005  
Date Monitor Established: PM2.5 FRM April 27, 2005  
Nearest Road: Fraternity Church Road Distance to Road: 40 meters  
Traffic Count<sup>3</sup>: 4100 Year of Count: 2013  
MSA<sup>4</sup>: Winston-Salem, NC Metropolitan Statistical Area (2006) MSA #: 49180

Parameter	Method	Method Number	Sampling Schedule
Ozone	UV Photometric	087	April 1 – Oct. 31, Continuous
PM2.5	TEOM	701	Continuous
PM2.5	Gravimetric	116	1 in 3 day
PM2.5	Gravimetric	118	1 in 6 day

Table 4 - Clemmons Middle School Monitoring Station Summary

#### (b) Site Description and Statement of Purpose

An ozone monitor, PM<sub>2.5</sub> TEOM, and PM<sub>2.5</sub> FRM have been located at a manufactured structure since April 27, 2005. A collocated PM<sub>2.5</sub> FRM sampler has been located less than 3m N of the reporting sampler since the same date. The site is located in a mixed use environment at latitude N36.025931° and longitude W80.342257°. The site elevation is 245 meters above sea level. The nearest road is Fraternity Church Road with an annual traffic volume of 4100 vehicles (2013) at a distance of 40 meters from the sample inlet. This site combined the PM<sub>2.5</sub> equipment from site 37-067-0024 and the ozone equipment from site 37-067-0027 when these sites were forced to relocate.

The inlet of the samplers is approximately 4 meters above ground level and 1 meter above roof level. There is a tree drip-line nearing the minimum distance from the inlet but we plan to remove these trees this summer (2015). The area is a

transition zone of business (~50%) to residential (~50%) within a 1 km radius. The samplers are SLAMS.

The sampling frequencies for PM<sub>2.5</sub> are 1 in 3 and 1 in 6 day sampling. The sampling interval is 24 hours, from midnight to midnight. The ozone instrument is operated during the North Carolina ozone monitoring season which begins April 1 and ends October 31 (beginning 2016, March 1- October 31). The ozone instrument operates continuously during this period.

The site complies with the siting requirements of 40CFR58 for criteria air pollutants but based on historical data for the FRM 2.5, both 3 and 6 day samplers, and lab staffing limitations at the state of NC, our agency would like to cease operation of both samplers on December 31, 2015. The co-location requirement of 40CFR58 would then have to be satisfied by adding a co-located 6 day sampler at the Hattie Ave. location.

### **OBJECTIVE AND SPATIAL SCALE**

The monitoring objectives of the instruments are to measure: 1) upwind background ambient concentrations and 2) population exposure.

The site is a neighborhood spatial scale for ozone and PM<sub>2.5</sub>. Data from this site is used to assess compliance with the NAAQS for ozone and PM<sub>2.5</sub>.

The site is located in the Winston-Salem, NC Metropolitan Statistical Area<sup>4</sup>. The principal cities and counties in the MSA are Winston-Salem, Davie County, Forsyth County, Stokes County, and Yadkin County, NC.

***(c) Site Photographs***



NORTH



EAST



SOUTH



WEST

## 2. Hattie Avenue "A"

### (a) Site Table

Site Name: Hattie Avenue "A"  
 AQS Site Identification Number: 37-067-0022  
 Location: 1300 Hattie Avenue  
 Winston-Salem, NC  
 Latitude: N36.110941°  
 Longitude: W80.224423°  
 Elevation: 284 meters  
 Date Monitor Established: Ozone May 21, 1993  
 Date Monitor Established: NO<sub>2</sub> January 1, 1984  
 Date Monitor Established: SO<sub>2</sub> January 1, 1983  
 Date Monitor Established: Air Toxics January 1, 2000  
 Nearest Road: Hattie Avenue Distance to Road: 27 meters  
 Traffic Count<sup>3</sup>: 6000 Year of Count: 2013  
 MSA<sup>4</sup>: Winston-Salem, NC Metropolitan Statistical Area (2006) MSA #: 49180

Parameter	Method	Method Number	Sampling Schedule
Ozone	UV Photometric	087	Continuous
NO <sub>2</sub>	Chemiluminescence	099	Continuous
SO <sub>2</sub>	UV Pulsed Fluorescence	100	Continuous

Table 5 - Hattie Avenue "A" Monitoring Station Summary

### (b) Description and Statement of Purpose

The Hattie Avenue A site monitors ozone, sulfur dioxide, and oxides of nitrogen. The site is located in the 1300 block of Hattie Avenue in downtown Winston-Salem. The site is located approximately 2.2 km NE of downtown, 1.1 km E of US52 and approximately 1.8 km NNW of Interstate 40 Business in a residential district at latitude N36.110941° and longitude W80.224423°. The site elevation is 284 meters. The nearest road, Hattie Avenue, is 27 meters from the inlets and has a daily traffic flow of 6000 vehicles (2003). The nearest tallest building is St. Benedict's Church (approximately 10 meters). The inlets are approximately 43 meters from the shopping center. The inlets are approximately 4 meters above the ground and 1 meter above the roof of the monitoring station. The area is residential. The ozone, sulfur dioxide, and NO<sub>2</sub> monitors are all SLAMS.

The ozone instrument is operated during the North Carolina ozone monitoring season which begins April 1 and ends October 31. The ozone instrument operates continuously during this period.

The SO<sub>2</sub> and NO<sub>2</sub> instruments operate continuously.

The site complies with the siting requirements of 40CFR58 for criteria air pollutants. There is a tree drip-line nearing the minimum distance from the inlet

but we plan to remove these trees this summer (2015). . It is recommended that the current site status be maintained.

### **OBJECTIVE AND SPATIAL SCALE**

The monitoring objectives of the instruments are to measure: 1) background ambient concentrations and 2) population exposure.

The site is a neighborhood spatial scale. Data from this site is used to assess compliance with the NAAQS for ozone, sulfur dioxide, and nitrogen dioxide.

The site is located in the Winston-Salem, NC Metropolitan Statistical Area<sup>4</sup>. The principal cities and counties in the MSA are Winston-Salem, Davie County, Forsyth County, Stokes County, and Yadkin County, NC.

**(c) Site Photographs**



NORTH



EAST



SOUTH



WEST

### 3. Hattie Avenue "B"

#### (a) Site Table

Site Name: Hattie Avenue "B"  
 AQS Site Identification Number: 37-067-0022  
 Location: 1300 Hattie Avenue  
 Winston-Salem, NC  
 Latitude: N36.110892°  
 Longitude: W80.224432°  
 Elevation: 284 meters  
 Date Monitor Established: PM<sub>2.5</sub> - FRM January 1, 1999  
 Date Monitor Established: PM<sub>2.5</sub> - Speciation January 1, 1999  
 Date Monitor Established: PM<sub>2.5</sub> - TEOM June 16, 1999  
 Date Monitor Established: PM<sub>10</sub> - TEOM October 18, 1999  
 Nearest Road: Hattie Avenue Distance to Road: 27 meters  
 Traffic Count<sup>3</sup>: 6000 Year of Count: 2013  
 MSA<sup>4</sup>: Winston-Salem, NC Metropolitan Statistical Area (2006) MSA #: 49180

Parameter	Method	Method Number	Sampling Schedule
PM <sub>2.5</sub>	FRM Gravimetric	118	1 in 1 day
PM <sub>2.5</sub>	MetOne, Speciation	701	1 in 6 day
PM <sub>2.5</sub>	TEOM, Continuous	701, 702	Continuous
PM <sub>10</sub>	TEOM, Continuous	079	Continuous
Air Toxics	Compendium Method for Toxic Organics (TO) 15	150	1 in 6 day

Table 6 - Hattie Avenue "B" Monitoring Station Summary

#### (b) Description and Statement of Purpose

This Hattie Avenue site monitors PM<sub>2.5</sub> and PM<sub>10</sub>. The site is located in the 1300 block of Hattie Avenue in Winston-Salem. The site is located approximately 2.2 km NE of downtown, 1.1 km E of US52 and approximately 1.8 km NNW of Interstate 40 Business in a residential district at latitude N36.110892° and longitude W80.224432°. The site elevation is 284 meters. The nearest road, Hattie Avenue, is 27 meters from the inlets and has a daily traffic flow of 6000 vehicles (2013). The nearest tallest building is St. Benedict's Church (approximately 10 meters). The inlets are approximately 43 meters from the shopping center. The inlets are approximately 4 meters above the ground and 1 meter above the roof of the monitoring station. The area is residential. The monitors are SLAMS.

The PM<sub>2.5</sub> FRM sampling frequency is every day. The sampling interval is 24 hours, from midnight to midnight every day.

The PM<sub>2.5</sub> Speciation sampling frequency is 1 in 6 days. The sampling interval is 24 hours, from midnight to midnight every six days.

The PM<sub>2.5</sub> and PM<sub>10</sub> TEOM instruments operate continuously.

Monitoring for Urban Air Toxics (UAT) is currently conducted at this site by the North Carolina Division of Air Quality (NC-DAQ), Toxics Protection Branch (TPB). Currently, the NC-DAQ TPB collects whole air samples in stainless steel 6 liter- pressurized canisters. The samples are then analyzed using cryogenic preconcentration gas chromatography with mass spectrometric detection (GC/MS) via the Compendium Method for Toxic Organics (TO) 15 for the list of 68 compounds (below).

- Propene
- Freon 12
- Freon 22
- Freon 114
- Chloro Methane
- (Methylchloride)
- Isobutene
- Vinyl chloride
- 1,3-Butadiene
- Bromomethane
- Chloroethane
- Freon 11
- Pentane
- Ethanol
- Isoprene
- Acrolein
- 1,1-Dichloroethene
- (Vinylidene chloride)
- Freon 113
- Methyl Iodide
- Isopropyl Alcohol
- Carbon Disulfide
- Acetonitrile
- Methylene chloride
- Cyclopentane
- MTBE
- Hexane
- Methacrolein
- Vinyl Acetate
- 1,1-Dichloroethane
- Methyl Vinyl Ketone
- Methyl Ethyl Ketone
- 1,2 Dichloroethene
- Chloroform
- 1,1,1-Trichloroethane
- (Methyl chloroform)
- Cyclohexane
- Carbon Tetrachloride
- Benzene
- 1,2-Dichloroethane
- (ethylene dichloride)
- 1-Butanol
- Trichloroethylene
- 2-Pentanone
- 3-Pentanone
- 1,2-Dichloropropane
- 1,4-Dioxane
- Bromodichloromethane
- trans-1,3  
Dichloropropene
- Methyl Isobutyl Ketone
- Toluene
- cis-1,3  
Dichloropropene
- 1,1,2-Trichloroethane  
(vinyl trichloride)
- Ethylpropylketone
- Tetrachloroethylene
- (perchloroethylene)
- Methyl Butyl Ketone
- Dibromoethane
- Chlorobenzene
- (phenylchloride)
- Ethylbenzene
- m- & p-Xylene
- o-Xylene
- Styrene
- Bromoform
- 1,1,2,2-  
Tetrachloroethane
- 1,3,5-Trimethylbenzene
- (mesitylene)
- 1,2,4-Trimethylbenzene
- (pseudocumene)
- m-Dichlorobenzene
- 1,2,3-Trimethylbenzene
- p-Dichlorobenzene
- Benzylchloride
- o-Dichlorobenzene
- 1,2,4-Trichlorobenzene

The site complies with the siting requirements of 40CFR58 for criteria air pollutants. There are no proposed changes for this site. It is recommended that the current site status be maintained.

### **OBJECTIVE AND SPATIAL SCALE**

The monitoring objective of the instruments is to measure population exposure.

The site is a neighborhood spatial scale. Data from this site is used to assess compliance with the NAAQS for PM<sub>2.5</sub> and PM<sub>10</sub>.

The site is located in the Winston-Salem, NC Metropolitan Statistical Area<sup>4</sup>. The principal cities and counties in the MSA are Winston-Salem, Davie County, Forsyth County, Stokes County, and Yadkin County, NC.

**(c) Site Photographs**



**NORTH**



**EAST**



**SOUTH**



**WEST**

#### 4. Peter's Creek

##### (a) Site Table

Site Name: Peter's Creek  
AQS Site Identification Number: 37-067-0023  
Location: 1401 Corporation Parkway  
Winston-Salem, NC  
Latitude: N36.066479°  
Longitude: W80.258455°  
Elevation: 233 meters  
Date Monitor Established: CO November 14, 1988  
Nearest Road: Peter's Creek Parkway Distance to Road: 6 meters  
Traffic Count<sup>3</sup>: 25000 Year of Count: 2013  
MSA<sup>4</sup>: Winston-Salem, NC Metropolitan Statistical Area (2006) MSA #: 49180

Parameter	Method	Method Number	Sampling Schedule
CO	Gas Filter Correlation	554	Continuous

Table 7 - Peter's Creek Monitoring Station Summary

##### (b) Site Description and Statement of Purpose

A CO sampler was located at the Peter's Creek station on November 14, 1998. A PM<sub>10</sub> sampler was located at 1401 Corporation Parkway but removed in 2014. The site is located approximately 4 kilometers SW of the central business district at latitude N36.066504° and longitude W80.258445°. The site elevation above sea level is 233 meters. The nearest road is Peter's Creek Parkway at a distance of approximately 6 meters. The estimated daily traffic flow is 25,000 vehicles (2013). The inlet is approximately 4 meters above the ground and 1 meter from the roof. These trees grew from an abandoned garden used by the school adjacent to the site. The area is commercial with several residential areas near the sampler. The CO sampler is SLAMS.

The sampling frequency for CO is continuous.

The site complies with the siting requirements of 40CFR58 for criteria air pollutants. We would like to shut this site down since the maintenance period for CO will expire November 7, 2015 and historical data shows CO levels well below the standard. Ideally, we would cease operation of this site December 31, 2015.

## **OBJECTIVE AND SPATIAL SCALE**

The monitoring objective of the Peter's Creek site is population exposure. The site is a micro spatial scale. Data is used to assess trends and compliance to the NAAQS.

The site is located in the Winston-Salem, NC Metropolitan Statistical Area<sup>4</sup>. The principal cities and counties in the MSA are Winston-Salem, Davie County, Forsyth County, Stokes County, and Yadkin County, NC.

**(c) Site Photographs**



NORTH



EAST



SOUTH



WEST

## 5. Shiloh Church

### (a) Site Table

Site Name: Shiloh Church  
AQS Site Identification Number: 37-067-0028  
Location: 6496 Baux Mountain Road  
Winston-Salem, NC  
Latitude: N36.205789°  
Longitude: W80.215774°  
Elevation: 294 meters  
Date Monitor Established: Ozone April 1, 1996  
Nearest Road: Baux Mountain Rd Distance to Road: 20 meters  
Traffic Count<sup>3</sup>: 2600 Year of Count: 2013  
MSA<sup>4</sup>: Winston-Salem, NC Metropolitan Statistical Area MSA #: 49180  
(2006)

Parameter	Method	Method Number	Sampling Schedule
Ozone	UV Photometry	087	Continuous

Table 8 - Shiloh Church Monitoring Station Summary

### (b) Site Description and Statement of Purpose

An ozone monitor has been located at this site since April 1, 1996. The site is located approximately 12 km NNE of the central business district at latitude 36.205789° and longitude -80.215774°. The site elevation is 294 meters above sea level. The nearest road is Baux Mountain Road with an annual traffic volume of 2600 vehicles (2013) at a distance of 20 meters from the sample inlet.

The inlet is approximately 4 meters above the ground and 1 meter from the roof. The area is residential. The ozone sampler is SLAMS.

The ozone instrument is operated during the North Carolina ozone monitoring season which begins April 1 and ends October 31. The ozone instrument operates continuously during this period.

The site complies with the siting requirements of 40CFR58 for criteria air pollutants. We are planning on shutting down this site at the end of the ozone season (October 31, 2015). There is no reason for us to be running four ozone sites within our county and this site's design value has consistently been several ppb less than the other three sites.

#### OBJECTIVE AND SPATIAL SCALE

The monitoring objective of the instrument is to measure population exposure.

The site is a neighborhood spatial scale for ozone. Data from this site is used to assess compliance with the NAAQS for ozone.

The site is located in the Winston-Salem, NC Metropolitan Statistical Area<sup>4</sup>. The principal cities and counties in the MSA are Winston-Salem, Davie County, Forsyth County, Stokes County, and Yadkin County, NC.



***(c) Site Photographs***



NORTH



EAST



SOUTH



WEST

## 6. Union Cross

### (a) Site Table

Site Name: Union Cross  
AQS Site Identification Number: 37-067-1008  
Location: 3656 Piedmont Memorial Drive  
Winston-Salem, NC  
Latitude: N36.050746°  
Longitude: W80.143826°  
Elevation: 285 meters  
Date Monitor Established: Ozone April 1, 1998  
Nearest Road: Piedmont Memorial Dr. Distance to Road: 55 meters  
Traffic Count<sup>3</sup>: 650 Year of Count: 2011  
MSA<sup>4</sup>: Winston-Salem, NC Metropolitan Statistical Area (2006) MSA #: 49180

Parameter	Method	Method Number	Sampling Schedule
Ozone	UV Photometry	087	Continuous
Wind Speed	Climatronics	020	Continuous
Wind Direction	Climatronics	020	Continuous
Pressure	R. M. Young	011	Continuous
Outdoor Temperature	R. M. Young	020	Continuous
Relative Humidity	R. M. Young	020	Continuous

Table 9 - Union Cross Monitoring Station Summary

### (b) Site Description and Statement of Purpose

An ozone monitor has been located at this site since April 1, 1998 along with a meteorological tower since 1997. The site is located approximately 10 km SE of the central business district at latitude 36.050746° and longitude -80.143826°. The site elevation is 285 meters above sea level. The nearest road is Piedmont Memorial Drive with an annual traffic volume of 650 vehicles (2011) at a distance of 55 meters from the sample inlet.

The inlet is approximately 4 meters above the ground and 1 meter from the roof. There is a tree drip-line nearing the minimum distance from the inlet but we plan to remove these trees this summer (2015). The area is residential. The ozone sampler is SLAMS.

The ozone instrument is operated during the North Carolina ozone monitoring season which begins April 1 and ends October 31. The ozone instrument operates continuously during this period.

The site complies with the siting requirements of 40CFR58 for criteria air pollutants. There are no proposed changes for this site. It is recommended that the current site status be maintained.

## **OBJECTIVE AND SPATIAL SCALE**

The monitoring objective of the instrument is to measure population exposure.

The site is a neighborhood spatial scale for ozone. Data from this site is used to assess compliance with the NAAQS for ozone.

The site is located in the Winston-Salem, NC Metropolitan Statistical Area<sup>4</sup>. The principal cities and counties in the MSA are Winston-Salem, Davie County, Forsyth County, Stokes County, and Yadkin County, NC.

**(c) Site Photographs**



**NORTH**

**EAST**



**SOUTH**

**WEST**

## **References**

1. [Title 40 Code of Federal Regulations Part 58, Ambient Air Quality Surveillance](#). Part 58 and Part 58 Amended: Federal Register/Vol. 71 No. 200/Tuesday, October 17, 2006/Rules and Regulations.
2. Watson, John G., Chow, Judith C., DuBois, David, Green, Mark, Frank, Neil, Pitchford, Marc. [Guidance for Network Design and Optimum Site Exposure for PM2.5 and PM10](#). Office of Air Quality Planning and Standards, U. S. Environmental Protection Agency, Research Triangle Park, NC 27711. December 15, 1997.
3. Winston-Salem Department of Transportation. [Current Traffic Counts](#)  
Note: Traffic Count taken from nearest road providing most impact to site
4. US Census Bureau. Current Lists of Metropolitan and Micropolitan Statistical Areas and Definitions. <http://www.census.gov/population/metro/data/index.html> . (301) 763-2419. 2006.

---

# 2014 Annual Monitoring Network Plan

## Appendix A

No comments were received.

# 2013 Annual Monitoring Network Plan

## Appendix B

---

No comments were received.