2012-2013
Air Monitoring Network Plan

City of Philadelphia
Department of Public Health
Air Management Services

July 1, 2012

Executive Summary

Philadelphia has an air monitoring network of ten air monitoring stations that house instruments that measure ambient levels of gaseous, solid and liquid aerosol pollutants. It is operated by the City of Philadelphia's Department of Public Health, Air Management Services (AMS), the local air pollution control agency for the City of Philadelphia. This network is part of a broader network of air monitoring operated by our local states of Pennsylvania, New Jersey, Delaware and Maryland that make up the Philadelphia-Wilmington-Atlantic City, PA-NJ-DE-MD Metropolitan Statistical Area (MSA).

The United States Environmental Protection Agency (US EPA) created regulations on how the air monitoring network is to be set up. These regulations can be found in Title 40 - Protection of Environment in the Code of Federal Regulations (CFR) Part 58 – Ambient Air Quality Surveillance, located online at: http://www.epa.gov/ttnamti1/40cfr53.html.

Beginning July 1, 2007, and each year thereafter, AMS has submitted to EPA Region III, an Air Monitoring Network Plan (Plan) which assures that the network stations continue to meet the criteria established by federal regulations.

Air monitoring provides critical information on the quality of air in Philadelphia. The objective for much of our network is to measure pollutants in areas that represent high levels of contaminants and high population exposure. Some monitoring is also done to determine the difference in pollutant levels in various parts of the City, provide long term trends, help bring facilities into compliance, provide real-time monitoring and provide the public with information on air quality.

The proper siting of a monitor requires the specification of the monitoring objective, the types of sites necessary to meet the objective, and the desired spatial scale of representativeness. These are discussed in the section entitled "Definitions".

This Plan is composed of twelve sections plus Appendices A - E:

- **Announcement of Future Changes to the Network -** This section provides information on how the public is made aware of the Plan and where it is available for review.

- **Definitions -** This section describes the terms used for air monitoring programs, measurement methods, monitoring objectives, spatial scales, air monitoring areas, pollutants, collection methods, and analysis methods.

- **Philadelphia's Meteorology and Topography -** This section describes the general meteorology relative to wind and air stagnation and the impact of topography on Philadelphia's meteorology

- **Current Network at a Glance** - This section shows the location of the monitoring sites and the pollutants measured at each site.

- **Current Sites Summary** - This section provides information applicable to our overall network such as population. It also provides a brief overall purpose for each monitoring site.

- **Direction of Future Air Monitoring** - This section gives a perspective of the major areas and initiatives AMS will be considering during the next few years.

- **Potential Changes to the Network** - This section describes changes that may occur within the next 18 months that would modify the network from how it is currently described in the Plan.

- **NO_2 Monitoring Network -** Per 40 CFR Part 58.10(a)(5), this section documents how AMS will establish NO_2 monitoring sites in response to the new 1-hour standard.

- **CO Monitoring Network –** Per 40 CFR Part 58 Appendix D 4.2.1, this section documents the minimum requirements for CO monitors.

- **Changes to a Violating $PM_{2.5}$ Monitor** - Per 40 CFR Part 58.10(c), this section documents changes to the $PM_{2.5}$ monitoring network that impact the location of a violating $PM_{2.5}$ monitor.

- **Detailed Information on Each Site -** This is the largest section of the Plan. Each monitoring site is separately described in a table, complete with pictures and maps. The material is presented as:
    - A table providing information on the pollutants measured, sampling type, operating schedule, collection method, analysis method, spatial scale, monitoring objective, probe height, and begin date of each monitor;
    - Pictures taken at ground level of the monitoring station;
    - A map of the monitoring site complete with major cross streets and major air emission sources within 3000 meters (almost 2 miles); and
    - An aerial picture providing a north view of the site.

- **Detailed Information by Pollutant -** The report is completed with detailed information for each the following pollutants: Ozone, Carbon Monoxide, Nitrogen Dioxide, Sulfur Dioxide, Lead, Particulate Matter, and Toxics. The monitoring of each pollutant is described by a map showing where the pollutant is monitored, National Ambient Air Quality Standard (if there is one) and a text description and trend graphs showing the concentration of the pollutant over a number of years.

- **Siting Criteria -** Appendix A summarizes the probe and monitoring path siting criteria.

- **Port Monitoring Site -** Appendix B provides detailed information on the proposed site (PAC).

- **NEL Shutdown** - Appendix C includes correspondence from and to EPA regarding the closure of the NEL monitoring site.

- **Near-road NO_2 monitoring site** - Appendix D provides information regarding the near-road NO_2 monitor.

- **Open Path Monitoring in South Philadelphia** - Appendix E provides information regarding continuous air toxics monitoring in South Philadelphia.

AMS has provided a copy of the Plan for public inspection on the City's website at: http://www.phila.gov/health/airmanagement/index.html.

Comments or questions concerning the air monitoring network or this Plan can be directed to:

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Announcement of Future Changes to the Network

Beginning July 1, 2007, and each year thereafter, AMS has submitted to EPA Region III, a Plan assuring that the network stations continue to meet the criteria established by federal regulations. At least 30 days prior to July 1 of each year, AMS announces to the public the availability of the Plan through notices published in the *Philadelphia Daily News* and the *Pennsylvania Bulletin*. Copies of the Plan are available for public inspection on the City's website under the Department of Public Health, Air Management Services at:
http://www.phila.gov/health/airmanagement/index.html and at the AMS office:

Air Management Services
321 University Avenue, 2nd Floor
Philadelphia, PA 19104
Phone – 215-685-7586

Provisions will be made to accommodate comments and questions concerning the air monitoring network or the Plan. If comments are received, they will be considered for incorporation into the Plan.

Definitions

Air Monitoring Programs

EPA has established various air monitoring programs for the measurement of pollutants. Some of these are briefly described below. Later in this Plan, air monitoring sites and monitoring equipment are specifically identified relative to these air monitoring programs:

- **NAMS** - National Air Monitoring Stations. This network provides ambient levels of criteria air pollutants (carbon monoxide, sulfur dioxide, nitrogen dioxide, ozone, particulate and lead). These sites are established with the intent that they will operate over many years and provide both current and historical information.
- **NATTS** - National Air Toxics Trends Stations. This network provides ambient levels of hazardous air pollutants. These sites are established with the intent that they will operate over many years and provide both current and historical information.
- **NCore** - National Core multi-pollutant monitoring stations. Monitors at these sites are required to measure particles ($PM_{2.5}$, speciated $PM_{2.5}$, $PM_{10-2.5}$), O_3, SO_2, CO, nitrogen oxides ($NO/NO_2/NO_y$), Pb, and basic meteorology. They principally support research in air pollution control.
- **SLAMS** - State or Local Air Monitoring Stations. The SLAMS make up the ambient air quality monitoring sites that are primarily needed for NAAQS comparisons, but may serve other data purposes. SLAMS exclude special purpose monitor (SPM) stations and include NCore, PAMS, Near-road NO_2/CO and all other State or locally operated stations that have not been designated as SPM stations.
- **PAMS** - Photochemical Assessment Monitoring Stations.
- **STN -** A $PM_{2.5}$ speciation station designated to be part of the Speciation Trends Network. This network provides chemical species data of fine particulate. These sites are established with the intent that they will operate over many years and provide both current and historical information.
- **State speciation site -** A supplemental $PM_{2.5}$ speciation station that is not part of the speciation trends network.
- **SPM** - Special Purpose Monitor. As the name implies these monitors are placed for purposes of interest to the city of Philadelphia. Often this monitoring is performed over a limited amount of time. Data is reported to the federal Air Quality System (AQS) and is not counted when showing compliance with the minimum requirements of the air monitoring regulations for the number and siting of monitors of various types. The agency may designate a monitor as an SPM after January 1, 2007 only if it is a new monitor or for a monitor included in the monitoring plan prior to January 1, 2007, if the Regional Administrator has approved the discontinuation of the monitor as a SLAMS site.

Measurement Methods

- **Approved Regional Method (ARM)** - A continuous $PM_{2.5}$ method that has been approved specifically within a State or Local air monitoring network for purposes of comparison to the NAAQS and to meet other monitoring objectives.
- **Federal Equivalent Method (FEM)** - A method for measuring the concentration of an air pollutant in the ambient air that has been designated as an equivalent method in accordance with 40 CFR Part 53; it does not include a method for which an equivalent

method designation has been canceled in accordance with 40 CFR Part 53.11 or 40 CFR Part 53.16.

- **Federal Reference Method (FRM)** - A method of sampling and analyzing the ambient air for an air pollutant that is specified as a reference method in an appendix to 40 CFR Part 50, or a method that has been designated as a reference method in accordance with this part; it does not include a method for which a reference method designation has been canceled in accordance with 40 CFR Part 53.11 or 40 CFR Part 53.16.

Monitoring Objectives

The ambient air monitoring networks must be designed to meet three basic monitoring objectives:

- Provide air pollution data to the general public in a timely manner.
- Support compliance with ambient air quality standards and emissions strategy development.
- Assist in the evaluation of regional air quality models used in developing emission strategies, and to track trends in air pollution abatement control measures' impact on improving air quality.

In order to support the air quality management work indicated in the three basic air monitoring objectives, a network must be designed with a variety of different monitoring sites. Monitoring sites must be capable of informing managers about many things including the peak air pollution levels, typical levels in populated areas, air pollution transported into and outside of a city or region, and air pollution levels near specific sources.

Spatial Scales

The physical siting of the air monitoring station must be consistent with the objectives, site type and the physical location of a particular monitor.

The goal in locating monitors is to correctly match the spatial scale represented by the sample of monitored air with the spatial scale most appropriate for the monitoring site type, air pollutant to be measured, and the monitoring objective.

The spatial scale results from the physical location of the site with respect to the pollutant sources and categories. It estimates the size of the area surrounding the monitoring site that experiences uniform pollutant concentrations. The categories of spatial scale are:

- **Microscale** - Defines concentrations in air volumes associated with area dimensions ranging from several meters up to about 100 meters.
- **Middle scale** - Defines concentration typical of areas up to several city blocks in size with dimensions ranging from about 100 meters to 0.5 kilometer.
- **Neighborhood scale** - Defines concentrations within some extended area of the city that has relatively uniform land use with dimensions in the 0.5 to 4.0 kilometers range. The neighborhood and urban scales listed below have the potential to overlap in applications that concern secondarily formed or homogeneously distributed air pollutants.
- **Urban scale** - Defines concentrations within an area of city-like dimensions, on the order of 4 to 50 kilometers. Within a city, the geographic placement of sources may result in there being no single site that can be said to represent air quality on an urban scale.
- **Regional scale –** Defines usually a rural area of reasonably homogeneous geography without large sources, and extends from tens to hundreds of kilometers.

- **National and global scales –** These measurement scales represent concentrations characterizing the nation and the globe as a whole.

Air Monitoring Area

- **Core-Based Statistical Area (CBSA)** - Defined by the U.S. Office of Management and Budget, as a statistical geographic entity consisting of the county or counties associated with at least one urbanized area/urban cluster of at least a population of 10,000 people, plus adjacent counties having a high degree of social and economic integration.
- **Metropolitan Statistical Area (MSA)** - A Core-Based Statistical Area (CBSA) associated with at least one urbanized area of a population of 50,000 people or more. The central county plus adjacent counties with a high degree of integration comprise the area.

Pollutants

Air Management Services monitors for a wide range of air pollutants:

- **Criteria Pollutants** are measured to assess if and how well we are meeting the National Ambient Air Quality Standards (NAAQS) that have been set for each of these pollutants. These standards are set to protect the public's health and welfare.
  - **Ozone (O_3)**
  - **Sulfur Dioxide (SO_2)**
  - **Carbon Monoxide (CO)**
  - **Nitrogen Dioxide (NO_2)**
    - NO means nitrogen oxide.
    - NO_X means oxides of nitrogen and is defined as the sum of the concentrations of NO_2 and NO.
    - NO_y means the sum of all total *reactive* nitrogen oxides, including NO, NO_2, and other nitrogen oxides referred to as NO_Z.
  - **Particulate**
    - $PM_{2.5}$ means particulate matter with an aerodynamic diameter less than or equal to a nominal 2.5 micrometers.
    - PM_{10} means particulate matter with an aerodynamic diameter less than or equal to a nominal 10 micrometers.
  - **Lead (Pb)**
- **Volatile Organic Compounds** (VOC) - Approximately 56 of these compounds are monitored to assist in understanding the formation of ozone and how to control this pollutant.
- **Toxics** - Approximately 44 compounds, Carbonyls – 7 compounds, and metals - 7 elements are toxic and are measured to assess the risk of cancer and non cancer caused by these pollutants.
- **Speciated $PM_{2.5}$** - $PM_{2.5}$ particles are analyzed to identify their makeup (60 components including elements, radicals, elemental carbon, and organic carbon) and help assess the level of health risk and identify sources that are contributing to the levels of $PM_{2.5}$ being measured.

Collection Methods

Particulate samples

- **BAM-Beta Attenuation Monitor Met One BAM-1020** - This instrument provides concentration values of particulate each hour. The BAM -1020 uses the principle of beta ray attenuation to provide a simple determination of mass concentration. Beta ray attenuation: A small ^{14}C element emits a constant source of high-energy electrons, also known as beta particles. These beta particles are efficiently detected by an ultra-sensitive scintillation counter placed nearby. An external pump pulls a measured amount of air through a filter tape. Filter tape, impregnated with ambient dust is placed between the source and the detector thereby causing the attenuation of the measured beta-particle signal. The degree of attenuation of the beta-particle signal may be used to determine the mass concentration of particulate matter on the filter tape and hence the volumetric concentration of particulate matter in ambient air.

The following instruments provide concentration values of particulate over a 24-hour period. Laboratory analysis is required before the concentration of particulate can be determined.

- **Hi-Vol -** High-Volume Air Samplers (HVAS) are used to determine the concentration of particulate matter in the air. Without a size-selective inlet (SSI), all collected material is defined as total suspended (in the air) particulates (TSP), including lead (Pb) and other metals. A size-selective inlet is added for PM_{10} measurement. A Hi-Volume sampler consists of two basic components: a motor similar to those used in vacuum cleaners and an air flow control system.
- **Hi-Vol-SA/GMW-321-B -** High Volume Sierra Anderson or General Metal Works (GMW) model 321-B PM_{10} is a high volume air sampler system which has a selective inlet 203 cm x 254 cm filter.
- **Met One SASS -** Filters used to collect PM measurement of total mass by gravimetry, elements by x-ray fluorescence.
- **R & P $PM_{2.5}$** - Rupprecht & Potashnick $PM_{2.5}$ monitors an air sample drawn through a Teflon filter for 24 hours.

Gaseous / criteria pollutants

- **Instrumental - Data from these instruments is telemetered to a central computer system and values are available in near "real time".** An analyzer used to measure pollutants such as: carbon monoxide, sulfur dioxide, nitrogen oxides and ozone.

Toxic and organic (VOC) pollutants

- **SS Canister Pressurized -** Ambient air is collected in stainless-steel canisters, cryogenically concentrated using liquid nitrogen and analyzed for target VOCs and other organic components by GC-FID.
- **Canister Sub Ambient Pressure -** Collection of ambient air into an evacuated canister with a final canister pressure below atmospheric pressure.
- **DNPH-Coated Cartridges -** Cartridges are coated with 2,4-dinitrophenylhydrazine (DNPH). This is used for carbonyl determination in ambient air. High Performance Liquid Chromatography (HPLC) measures the carbonyl.

Analysis Methods

Particulate concentration

- **Gravimetric -** The determination of the quantities of the constituents of a compound, describes a set of methods for the quantitative determination of an analyte based on the weight of a solid. Laboratory analysis is needed.
- **BAM-Beta Attenuation -** The principle of beta ray attenuation to provide a simple determination of mass concentration. Instrumental – data is available in near real time.

Composition/make-up of particulates

- **Atomic Absorption -** This analysis measures the intensity of radiation of a specific wavelength that is absorbed by an atomic vapor.

- **Energy Dispersive XRF -** Energy dispersive x-Ray Fluorescence Spectrometer for the determination of metals including Lead concentration in ambient particulate matter. The method is collected on $PM_{2.5}$ filter samples.

Gaseous / criteria pollutants

- **Nitrogen Oxides – Chemiluminescence -** Emission of light as a result of a chemical reaction at environmental temperatures. This analysis is used for NO, NO_x, and NO_y. NO_2 is calculated as NO_x- NO.
- **Carbon monoxide - Nondispersive infrared -** A nondispersive infrared (NDIR) gas analyzer is an instrument that measures air samples for CO content.
- **Sulfur dioxide - Pulsed Fluorescent -** Pulsed fluorescence sulfur dioxide monitor where air is drawn from the outside and passes through the analysis cell, and a high intensity burst of UV light is emitted. The sulfur dioxide responds to the specific UV wavelength generated by absorbing the energy. When the flash lamp shuts off (in a fraction of a second) the SO_2 fluoresces giving off an amount of photons directly proportional to the concentration of sulfur dioxide in the air.
- **Ozone - Ultra Violet -** A light, which supplies energy to a molecule being analyzed. Ozone is analyzed with UV.

Toxic and Volatile Organic pollutants

- **Cryogenic Preconcentration GC/FID -** Cryogenic Preconcentration Gas Chromatograph/Flame Ionization Detector - air injection volume for capillary GC combined with low concentrations of analyte require that samples be preconcentrated prior to GC analysis. Sample preconcentration is accomplished by passing a known volume of the air sample through a trap filled with fine glass beads that is cooled to -180^{o}C. With this technique, the volatile hydrocarbons of interest are quantitatively retained in the trap, whereas the bulk constituents of air (nitrogen, oxygen, etc.) are not. The air sample is collected in a vessel of known volume. A portion of this volume is analyzed and used to calculate concentration of each compound in the original air sample after Gas Chromatographic (Flame Ionization Detector, GC-FID) analysis. The sample trapped cryogenically on the glass beads is thermally desorbed into a stream of ultra-pure helium and re-trapped on the surface of a fine stainless steel capillary cooled to -180 ^{o}C. This second cryogenic trapping stage "focuses" the sample into a small linear section of tubing. The cold stainless steel capillary is ballistically heated (by electrical resistance) and the focused sample quickly desorbs into the helium stream and is transferred to the chromatographic column. Cryogen (liquid nitrogen, LN_2) is used to obtain sub ambient temperatures in the VOC concentration and GC. This analysis is used to determine the concentration of Benzene and other organic compounds and VOC in the atmosphere.
- **GC/MS -** Gas Chromatograph/Mass Spectrometer**.** Analysis of organic or VOC are conducted using a gas chromatograph (GC) with a mass spectrometer (MS) attached as the detector. Cryogenic preconcentration with liquid nitrogen (LN_2) is also used to trap and concentrate sample components.
- **Thin Layer Chromatography (TLC) -** TLC is a widely used chromatography technique used to separate chemical compounds. It involves a stationary phase consisting of a thin layer of adsorbent material, usually silica gel, aluminum oxide, or cellulose immobilized onto a flat, inert carrier sheet.
- **High Pressure Liquid Chromatography (HPLC)**. The analytical method used to analyze carbonyl compounds such as acetaldehyde and formaldehyde. Carbonyl compounds are collected on the sampling media as their 2,4-dinitrohydrazine derivatives. The derivatives are separated by liquid chromatography (LC) on a packed column by

means of a solvent mixture under high pressure (HPLC) followed by UV detection of each carbonyl derivative.

Philadelphia's Meteorology and Topography

Although Philadelphia is located less than 100 miles from the Atlantic Ocean, its climate is predominantly influenced by air masses and prevailing winds from an inland direction. The weather is highly variable, characterized by a succession of alternate high and low pressure systems moving, in general, from west to east with average velocities of 30 to 35 miles per hour (mph) in winter and 20 to 25 mph in summer.

The normal paths of practically all low pressure systems affecting weather in the United States are toward the northeast corner of the nation. About 40 percent of the low centers pass very close to Philadelphia and most of the others approach closely enough to exert some influence on Philadelphia weather, resulting in a regular change in weather patterns without any consistent periods of stagnation. The movement of high pressure centers is slowest in summer and early fall and, because the lower edge of the prevailing westerlies aloft is farthest north at the same time, high pressure centers sometimes become stationary for periods of several days near the Philadelphia area. The result is increasing atmospheric stability at such times. This condition is frequently broken up diurnally in the summer because of the length and intensity of the sun's heating during the day, but strongly stable conditions may persist for a number of successive days in almost any month. Persistent stability, lasting ten days or more, occurs infrequently: on the average, perhaps once in ten years, but it may possibly happen in successive years or more than once in the same year.

Stagnating high pressure systems which result in winds of less than seven mph for a period of seven or more days occur seldomly. Stagnation lasting four or more days occurred much more frequently and reached a maximum in fall.

During the spring, fall and winter, the weather is dominated by cold air masses of the continental Arctic or continental polar types. These air masses are extremely stable at their source, but are subjected to heating from below as they move across the land, thus generally becoming unstable in the lower few thousand feet by the time they reach Philadelphia. In the summer, the maritime tropical air mass plays as great a part in the weather as the continental air masses. Nocturnal cooling from below produces a high frequency of temperature inversions during the summer, but these are most often broken up or weakened by heating during the day, with ensuing turbulence and mixing at the atmosphere.

Philadelphia is located on the Atlantic Coastal Plain, some 50 miles or more from the nearest mountains (Appalachian) and large bodies of water (Atlantic Ocean and Delaware Bay). The land and sea breeze effect is practically never felt at Philadelphia and the mountain-valley circulation is non-existent.

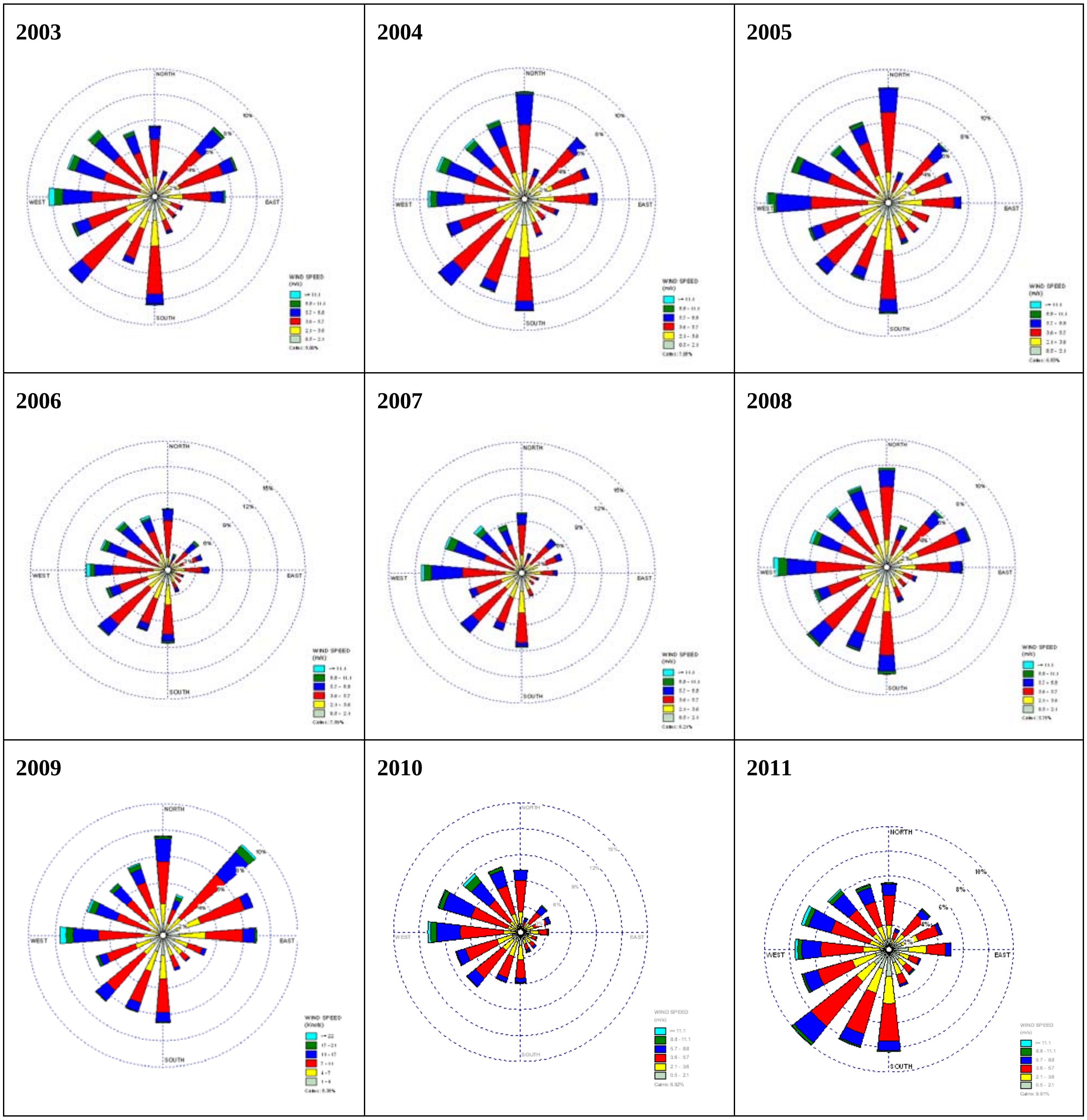
Within the City itself there are very few marked extremes in topography. Elevations range from sea level at the southern and southwestern extremities of the City to 400 to 450 feet above sea level in the northwestern section (Chestnut Hill), about ten miles away. The Wissahickon Creek and the Schuylkill River flow through the northwestern part of the City, however, and along these two streams there are some rather sharp rises in elevation, as much as 100 to 200 feet in a horizontal distance of 500 feet. Such extremes are quite limited and would not influence the meteorological patterns which affect the City as a whole. They could, of course, contribute to increased air pollution problems in a small local area within the City under certain circumstances.

In general, the topography of the City and the immediate surrounding area is such that it would make no significant contribution to increased air stagnation and stability over and above that produced by the meteorological pattern.

(Taken from “The Atmosphere over Philadelphia, Its Behavior and Its Contamination” by Francis K. Davis Jr. Ph.D., Professor of Physics, Drexel Institute of Technology October, 1960)

Figure 1 on the next page - Philadelphia Wind Rose Plots (2003 – 2011) provides information on the frequency and strength of wind in Philadelphia over a nine year period. The “rays” that make up the graph point to the direction the wind comes from. For example, wind blows most often from West to East and least often from the Southeast.

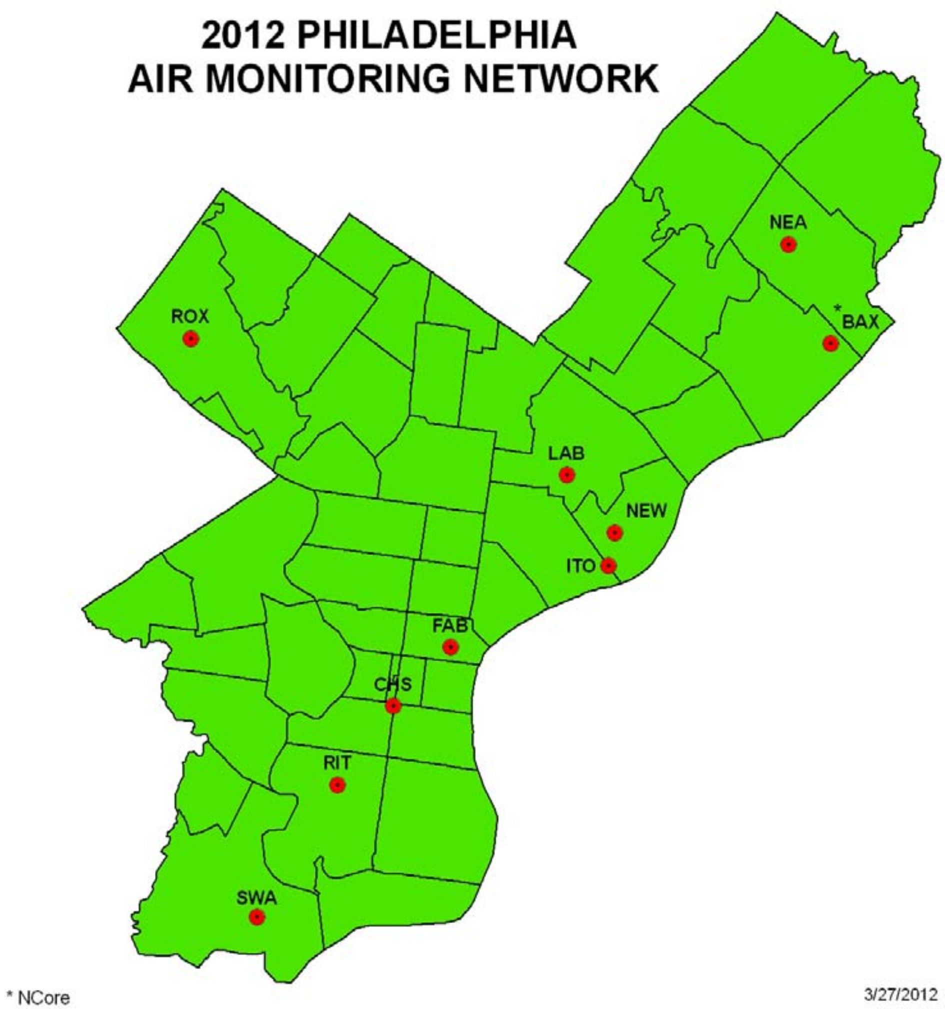
Figure 1 - Philadelphia Wind Rose Plots (2003-2011)



Current Network at a Glance

The City of Philadelphia is served by a network of ten (10) air monitoring sites located throughout the City that measure the criteria pollutants: ozone, carbon monoxide (CO), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), particulate matter (PM_{10} and $PM_{2.5}$), and lead (Pb). Five of the sites also measure toxics, such as benzene, acetaldehyde, and formaldehyde. The map below shows the location of air monitors and the pollutants measured at each monitor location.

Figure 2 - 2012 Philadelphia Air Monitoring Network as of March 27, 2012



			Parameter																			
AQS Site Code	AMS Site	Address	CO	SO_2	Ozone	NO_2	NO	PM_{10} FEM	$PM_{2.5}$ FEM	Speciated $PM_{2.5}$ Analysis by EPA	$PM_{2.5}$ FRM	PM_{10} SSI (quartz filter)	PM Coarse	Metals Analysis by WV (TSP sampler with quartz filter)	TSP Lead	PAMS VOC	Carbonyls	Toxics TO14	BaP analysis by Allegheny County, PA	MET	AMS Site
421010004	LAB	1501 E. Lycoming	X	X	X	X	X		X			X		X		X	X	X			LAB
421010014	ROX	Eva & Dearnley												X			X	X			ROX
421010024	NEA	Grant & Ashton			X															X	NEA
421010047	CHS	500 S. Broad				X	X				X			X			X	X			CHS
421010048	NEW	3900 Richmond						X												X	NEW
421010449	ITO	Castor & Delaware										X							X		ITO
421010055	RIT	24th & Ritner		X						X	X			X			X	X		X	RIT
421010057	FAB	3rd & Spring Garden									X										FAB
421010063	SWA	8200 Enterprise												X			X	X			SWA
421011002	*BAX	5200 Pennypack	X	X	X		X		X	X			X		X					X	BAX

Summary of Current Sites

All of our ten monitoring sites are located in Philadelphia, PA:

State: Pennsylvania
City: Philadelphia
County: Philadelphia
Metropolitan Statistical Area (MSA): Philadelphia-Wilmington-Atlantic City, PA-NJ-DE-MD-
MSA number: 6160
Population: 4,012,573 as of 2009 annual estimate
EPA Region: III, Philadelphia
Class 1 area: Brigantine Natural Wildlife Preserve near Atlantic City, NJ
City population: 1,526,006 as of 2010 census
Time zone: EST
UTM zone: 18

Table 1 - Site Summary Table

AQS Site Code	AMS Site	Address	Statement of Purpose
42101 0004	**LAB**	1501 E. Lycoming	Built in 1964, a good site for the assessment of the City's impact on precursors to the formation of ozone and is a designated PAMS site. It is a good site to test new or complex monitoring methods as laboratory staff are readily available.
42101 0014	**ROX**	Eva & Dearnley	Periphery site
42101 0024	**NEA**	Grant & Ashton	Periphery site High Ozone
42101 0047	**CHS**	500 S. Broad	Traffic related, a site that indicates the impact of street traffic and pollutants that are transported into Center City
42101 0048	**NEW**	3900 Richmond	This site was located to measure the impact of the facilities Franklin Smelting and Refining and MDC, which are now closed and the waste water treatment plant. PM_{10} levels are continuously being monitored at this site which is used in reporting the Air Quality Index (AQI).
42101 0449	**ITO**	Castor & Delaware	This site was located to measure the impact of the facilities Franklin Smelting and Refining and MDC, which are now closed. Monitoring of lead has been discontinued at this site while PM_{10} FRM and BaP are still being monitored.
42101 0055	**RIT**	24th & Ritner	This site was selected to help assess the impact of the petroleum refinery on the local community. The area was identified by air quality modeling.
42101 0057	**FAB**	3rd & Spring Garden	This site was established to represent the highest levels of $PM_{2.5}$ in the City based on EPA Region III's air quality modeling of air toxics in Philadelphia. It shows high levels of $PM_{2.5}$ created by vehicle traffic.
42101 0063	**SWA**	8200 Enterprise	This site was established to measure toxics, carbonyls, and metals. EPA Region III modeling analysis showed areas near the airport to have high levels of aldehydes.
42101 1002	**BAX**	5200 Pennypack	This site was established as the NCore multi-pollutant station, one of 70 in the national network. NCore parameter requirements include measurements of $PM_{2.5}$ FRM, speciation, and continuous mass, coarse particles ($PM_{10-2.5}$), O_3, trace levels of CO, SO_2, NO, and NO_y, and surface meteorology including wind speed and direction, temperature, and relative humidity.

Direction of Future Air Monitoring

The agency will study and assess the overall monitoring program within the City to determine the course of future changes to the air monitoring network.

The agency will focus on improving the understanding of particulate and air toxic pollutants in Philadelphia. Model results from the EPA Region III Philadelphia Air Toxics Project were provided to AMS. The Philadelphia river ports and International Airport were identified as potential major contributors to health risk associated with air toxic emissions.

The agency will review the NO_2 network for the addition of near-roadway monitoring and maintenance of area-wide monitoring, in addition to the SO_2 and CO networks.

The agency will continue to utilize $PM_{2.5}$ FEMs as replacements for FRMs.

The agency will review O_3 data at BAX and NEA for comparison.

The agency will utilize the funds received from EPA for its Community Scale Air Toxics Monitoring grant to purchase two analyzers which will enable the agency to continuously monitor air toxic pollutants such as benzene and hydrogen fluoride (HF) in the South Philadelphia community. This 3-year project will help the agency to take appropriate actions in protecting the community and to evaluate the open path monitoring method.

Proposed Changes to the Network

Below are changes that are anticipated to occur over the next 18 months to the existing air monitoring network:

- Calendar Year 2011
  - On September 1, 2011, the PM_{10} monitor at NEL was discontinued. The NEL site was also shut down. See Appendix C for additional information.
- Calendar Year 2012 – June 2013
  - On January 1, 2012, the LAB $PM_{2.5}$ Speciation monitor was discontinued.
  - AMS plans to utilize $PM_{2.5}$ FEMs as replacements for FRMs by deploying them alongside existing FRMs as co-located units.
    - RIT: $PM_{2.5}$ FEM monitor installed on June 1, 2011. The projected date for designating the FEM as the primary monitor is January 1, 2013.
    - CHS: $PM_{2.5}$ FEM monitor installed on September 4, 2011. The projected date for designating the FEM as the primary monitor is January 1, 2013.
    - The projected start date for FAB has not been established.
  - AMS will establish and operate one Near-road NO_2 monitor by January 1, 2013. See Appendix D for additional information.
    - A CO monitor will also be established at the same location by January 1, 2013.
  - PAC monitoring site to be established near Washington Ave & S. Columbus Blvd (behind Steel Worker's Union building) or an alternative location (parking lot of Walmart at Pier 70 Blvd).
    - A monitor to measure $PM_{2.5}$, PM_{10}, toxics, BaP, carbonyls, and metals will be placed to assess the river port.
    - When the PAC site is established:
      - Toxics, carbonyls, and metals will no longer be monitored at ROX and will be moved to PAC.
        - The ROX site will be temporarily shut down.
      - PM_{10} and BaP will no longer be monitored at ITO and will be moved to PAC.
        - The ITO site will be shut down.
  - AMS plans to install 2 open path monitors in South Philadelphia to continuously monitor selected air toxics at or near the Sunoco Refinery. See Appendix E for additional information.
  - Ozone may also be discontinued at NEA based on data comparison with BAX. The BAX site is located approximately 2.8 miles south of NEA.
  - CHS may shut down. Based on EPA Region III modeling results, FAB was established as an alternative site to CHS.
    - If CHS is shut down, NO_2 and NO will be moved to RIT.

NO_2 Monitoring Network

Per 40 CFR Part 58.10(a)(5), the Plan must document how AMS will establish NO_2 monitoring sites in accordance with the requirements of 40 CFR Part 58 Appendix D by July 1, 2012.

On January 22, 2010, EPA strengthened the health-based National Ambient Air Quality Standard (NAAQS) for nitrogen dioxide (NO_2) by setting a new 1-hour NO_2 standard at the level of 100 parts per billion (ppb). EPA is also retaining, with no change, the current annual average NO_2 standard of 53 ppb.

EPA also set new requirements for the placement of new NO_2 monitors in urban areas. The requirements are codified in 40 CFR Part 58 Appendix D 4.3.2. The final rule requires:

- 1 microscale near-road NO_2 monitoring station in CBSAs with population of 500,000 persons or more
- 2 microscale near-road NO_2 monitoring stations in CBSAs with population of 2,500,000 persons or more, or in any CBSA with a population of 500,000 or more persons and one or more road segments with 250,000 or greater AADT counts
- 1 NO_2 monitoring station in each CBSA with a population of 1,000,000 or more persons to assess community-wide concentrations.
- Monitors must be operational by January 1, 2013.

Based on the final rule, the Philadelphia-Camden-Wilmington, PA-NJ-DE-MD CBSA is required to have 2 near-road NO_2 monitoring stations. Due to funding issues, only 1 near-road NO_2 monitor will be installed and operational by January 1, 2013 (see Appendix D for additional information). AMS currently operates an NO_2 monitor that meets the area-wide monitoring requirements.

CO Monitoring Network

On August 12, 2011, EPA issued a decision to retain the existing National Ambient Air Quality Standards (NAAQS) for carbon monoxide (CO). The existing primary standards are 9 parts per million (ppm) measured over 8 hours, and 35 ppm measured over 1 hour.

EPA is revising minimum requirements for CO monitoring by requiring CO monitors to be sited near roads in certain urban areas. The requirements are codified in 40 CFR Part 58 Appendix D 4.2.1. In summary, EPA is requiring one CO monitor to be collocated with a near-road NO_2 monitor in CBSAs having populations of 1 million or more. EPA is specifying that monitors required in CBSAs of 2.5 million or more persons are to be operational by January 1, 2015. Other CO monitors required in CBSAs having 1 million or more persons are required to be operational by January 1, 2017. The Philadelphia-Camden-Wilmington, PA-NJ-DE-MD CBSA will have a CO monitor collocated with the near-road NO_2 monitor and be operational by January 1, 2013.

Changes to a Violating $PM_{2.5}$ Monitor

Per 40 CFR Part 58.10(c), the Plan must document how AMS will provide for the review of changes to a $PM_{2.5}$ monitoring network that impact the location of a violating $PM_{2.5}$ monitor or the creation/change to a community monitoring zone, including a description of the proposed use of spatial averaging for purposes of making comparisons to the annual $PM_{2.5}$ NAAQS as set forth in appendix N to 40 CFR Part 50. AMS must document the process for obtaining public comment and include any comments received through the public notification process within their submitted Plan.

On May 31, 2008, a network plan was made available for public inspection and was also posted on the City of Philadelphia website. The 2008 plan documented changes to the $PM_{2.5}$ monitoring network that impacted the location of a violating $PM_{2.5}$ monitor at 500 S. Broad Street (CHS). FAB was established as an alternative to CHS, but CHS was not shutdown.

AMS plans to replace all primary $PM_{2.5}$ FRMs with $PM_{2.5}$ FEMs, starting with RIT, CHS, and FAB. RIT and CHS $PM_{2.5}$ FEM monitors will be operational by January 1, 2013 and FAB $PM_{2.5}$ FEM starting date has not been established yet.

CHS may shut down by the end of calendar year 2012.

Detailed Information on Each Site

LAB

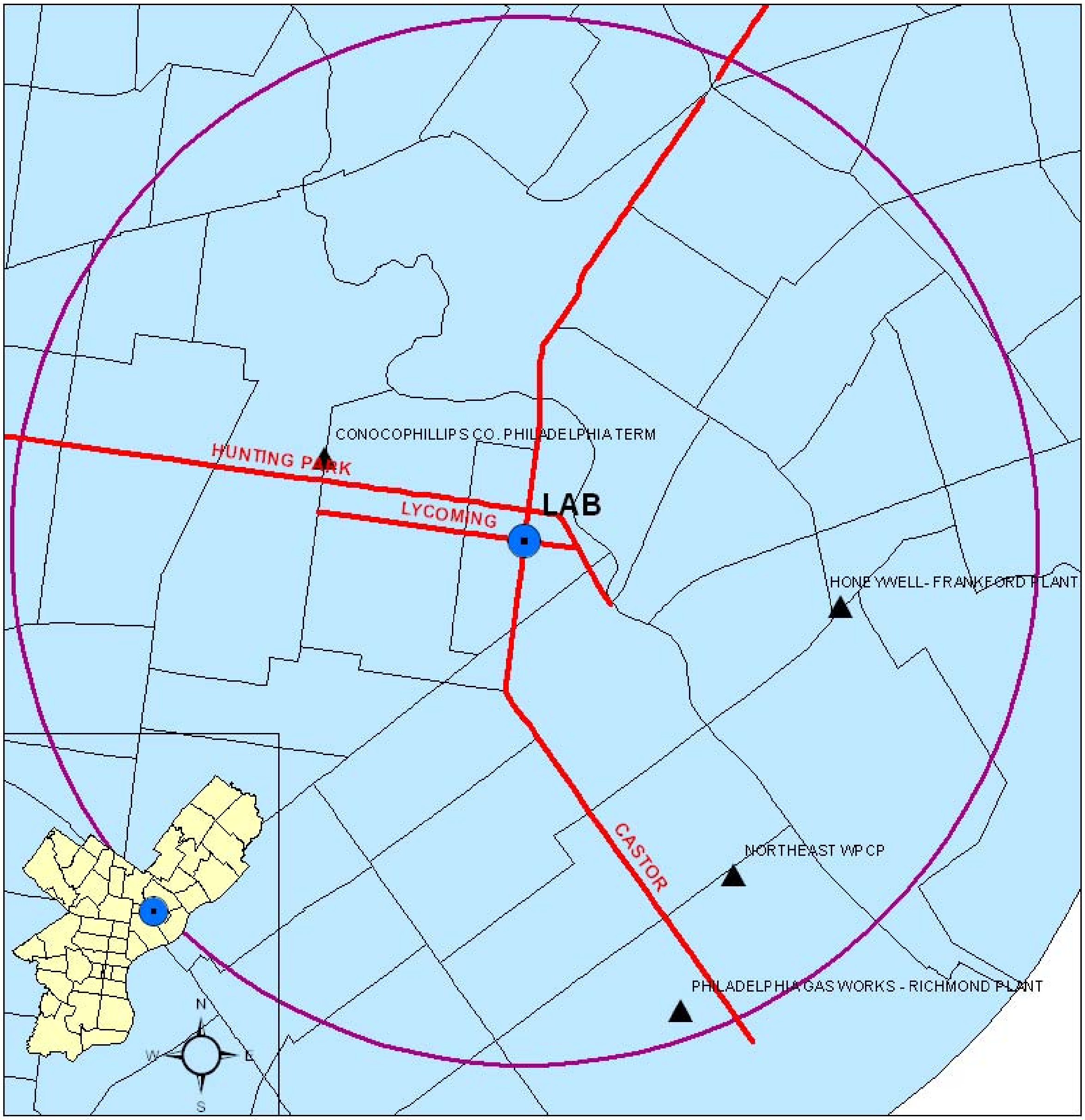
Table 2 - Detailed LAB Information with Monitoring Station Picture

AMS SITE ID: LAB
AQS Site ID: 421010004
Street Address: 1501 E. Lycoming Street, 19124
Geographical Coordinates
Latitude: 40.008889
Longitude: -75.09778

Parameter	Sampling Type	Operating Schedule	Collection Method	Analysis Method	Comments	AQS Method	Spatial Scale	Monitoring Objective	Probe Height (m)	Begin Date
CO	NAMS	Hourly	Instrumental	Nondispersive infrared		54	Neighborhood	Population Exposure	7	2/1/1966
SO_2	NAMS	Hourly	Instrumental	Pulsed Fluorescent		60	Neighborhood	Population Exposure	7	2/1/1966
Ozone	PAMS	Hourly	Instrumental	Ultra Violet		47	Neighborhood	Population Exposure	7	1/1/1974
NO_2	NAMS, PAMS	Hourly	Instrumental	Chemiluminescence		74	Urban	Population Exposure	7	1/1/1977
NOx	SLAMS		Instrumental	Chemiluminescence		74	Urban	Population Exposure	7	1/1/1977
NOy	SLAMS		Low Level Nox Instrumental	TECO 42S Chemiluminescence		75				
NO	PAMS									
$PM_{2.5}$ Continuous	SPM	Continuous		BAM =Beta Attenuation Monitor Met One BAM -1020		731				
$PM_{2.5}$ FRM	Co-located	Daily	R&P $PM_{2.5}$	Gravimetric	Sixth day	118				
PM_{10} SSI	NAMS	Daily	Hi-Vol-SA/ GMW-321-B	Gravimetric	Analysis by EPA	92	Neighborhood	Population Exposure	7	1/1/1999
Metals	SPM		Hi-Vol	Atomic Absorption	Core	107				
PAMS VOC	PAMS	6th day	SS Canister Pressurized	Cryogenic Preconcentration GC/FID	Continuous PAMS 3 hr, samples during summer	126				
Carbonyls	Urban Air Toxics	6th day	DNPH-Coated Cartridges	HPLC	Sampled for four 3-hour periods every 3rd day during PAMS season	102				
Toxics	Urban Air Toxics	6th day	Canister Subambient Pressure	Multi-Detector GC		101				
BaP	Urban Air Toxics	6th day	Hi-Vol	Thin Layer Chromatography		91				

Figure 3 - LAB Monitoring Site Map with Major Streets and Major Emission Sources

AMS LABORATORY - 1501 E. LYCOMING ST.
EPA AIRS CODE: 421010004



			2010 EMISSIONS (IN TONS/YR)							
PLID	NAME	STREET	CO	NO_2	PB	PM_{10}	$PM_{2.5}$	PT	SO_2	VOC
1551	HONEYWELL- FRANKFORD PLANT	4700 BERMUDA ST	62.54	227.38	0.00	73.06	56.46	73.07	110.94	119.92
4922	PHILADELPHIA GAS WORKS - RICHMOND PLANT	3100 E VENANGO ST	0.96	3.92	0.00	0.10	0.10	0.10	0.01	0.15
5004	CONOCOPHILLIPS CO. PHILADELPHIA TERM	4210 G ST	0.00	0.00	0.00	0.00	0.00	0.00	0.00	20.22
9513	NORTHEAST WPCP	3899 RICHMOND ST	29.01	5.84	0.00	1.69	1.69	1.70	6.01	13.36
		TOTAL	92.51	237.14	0.00	74.85	58.25	74.87	116.97	153.64

Figure 4- LAB North Aerial View

ROX

Table 3 – Detailed ROX Information with Monitoring Station Picture

AMS SITE ID: ROX

AQS Site ID: 421010014

Street Address: Eva & Dearnley Streets

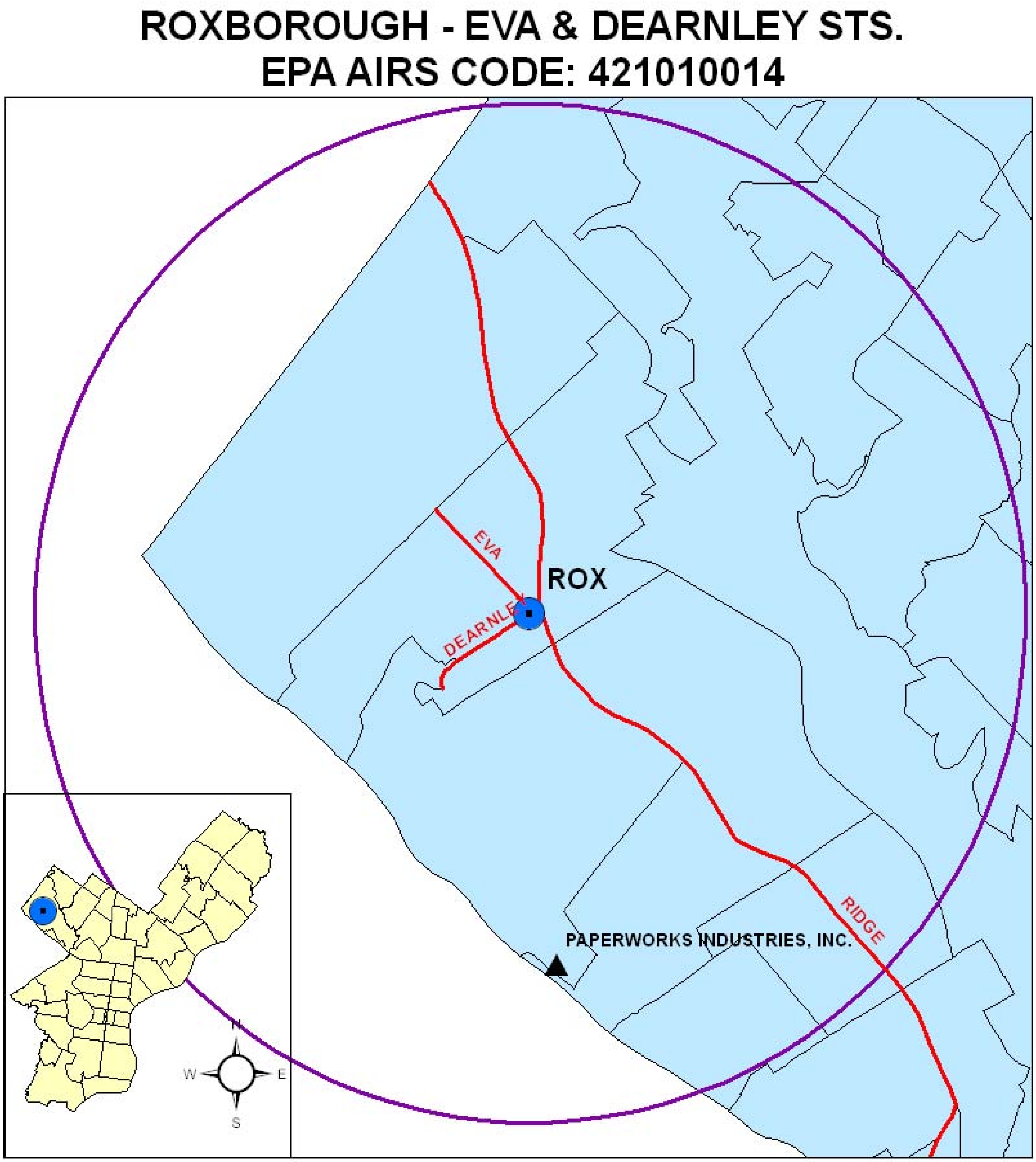
Geographical Coordinates

Latitude: 40.050000

Longitude: -75.240556

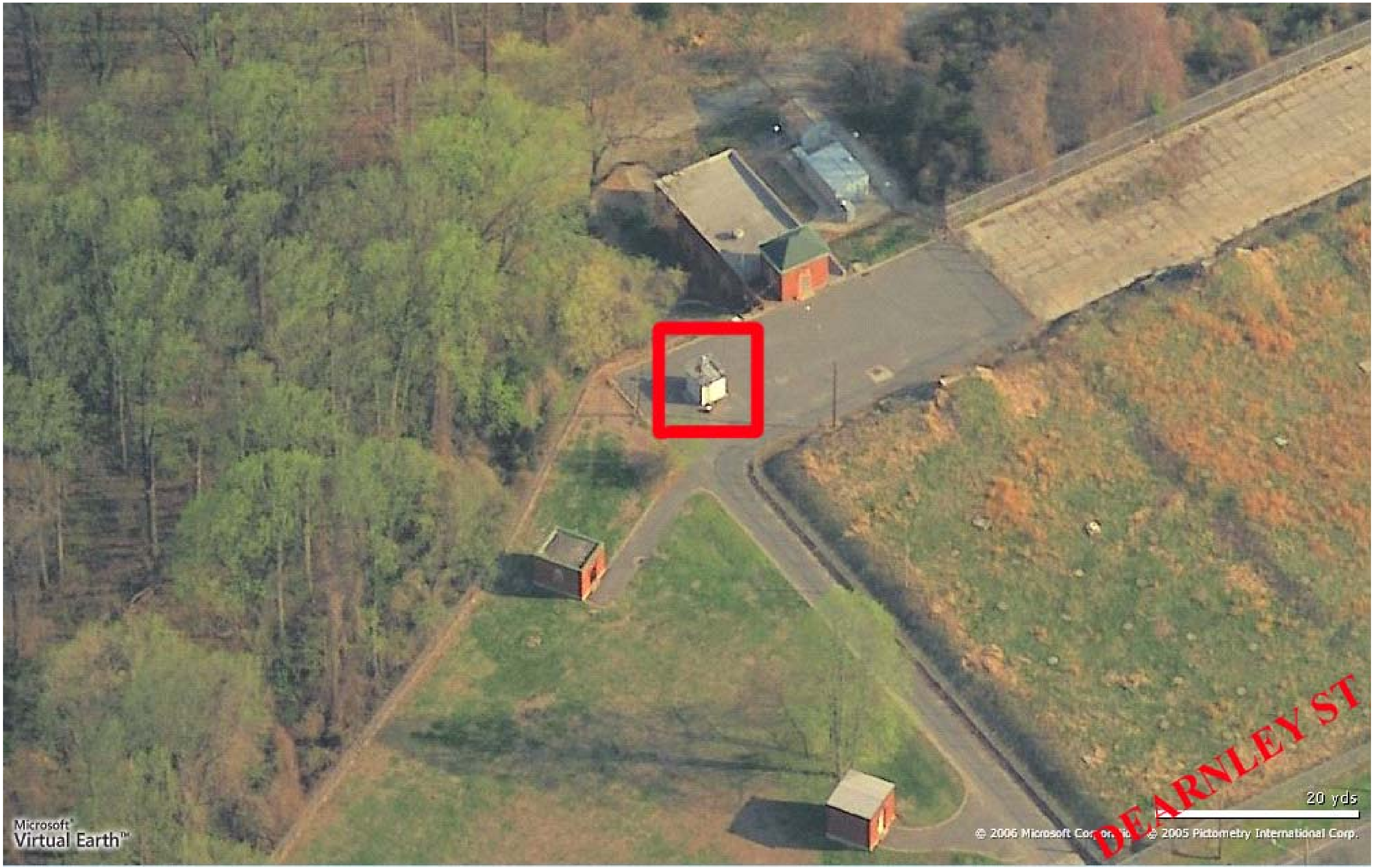
Parameter	Sampling Type	Operating Schedule	Collection Method	Analysis Method	Comments	AQS Method	Spatial Scale	Monitoring Objective	Probe Height (m)	Begin Date
Metals	SPM	6th day	Hi-Vol	Atomic Absorption	Analysis by WV (TSP sampler with quartz)	107				
Carbonyls	Urban Air Toxics	6th day	DNPH-Coated Cartridges			102				
Toxics	Urban Air Toxics	6th day	Canister Subambient Pressure	Multi-Detector GC		101				

Figure 5 - ROX Monitoring Site Map with Major Streets and Major Emission Sources



			2010 EMISSIONS (IN TONS/YR)							
PLID	NAME	STREET	CO	NO_2	PB	PM_{10}	$PM_{2.5}$	PT	SO_2	VOC
1566	PAPERWORKS INDUSTRIES, INC.	5000 FLAT ROCK RD	42.89	139.08	0.00	1.53	1.53	3.88	0.30	24.54

Figure 6 - ROX North Aerial View



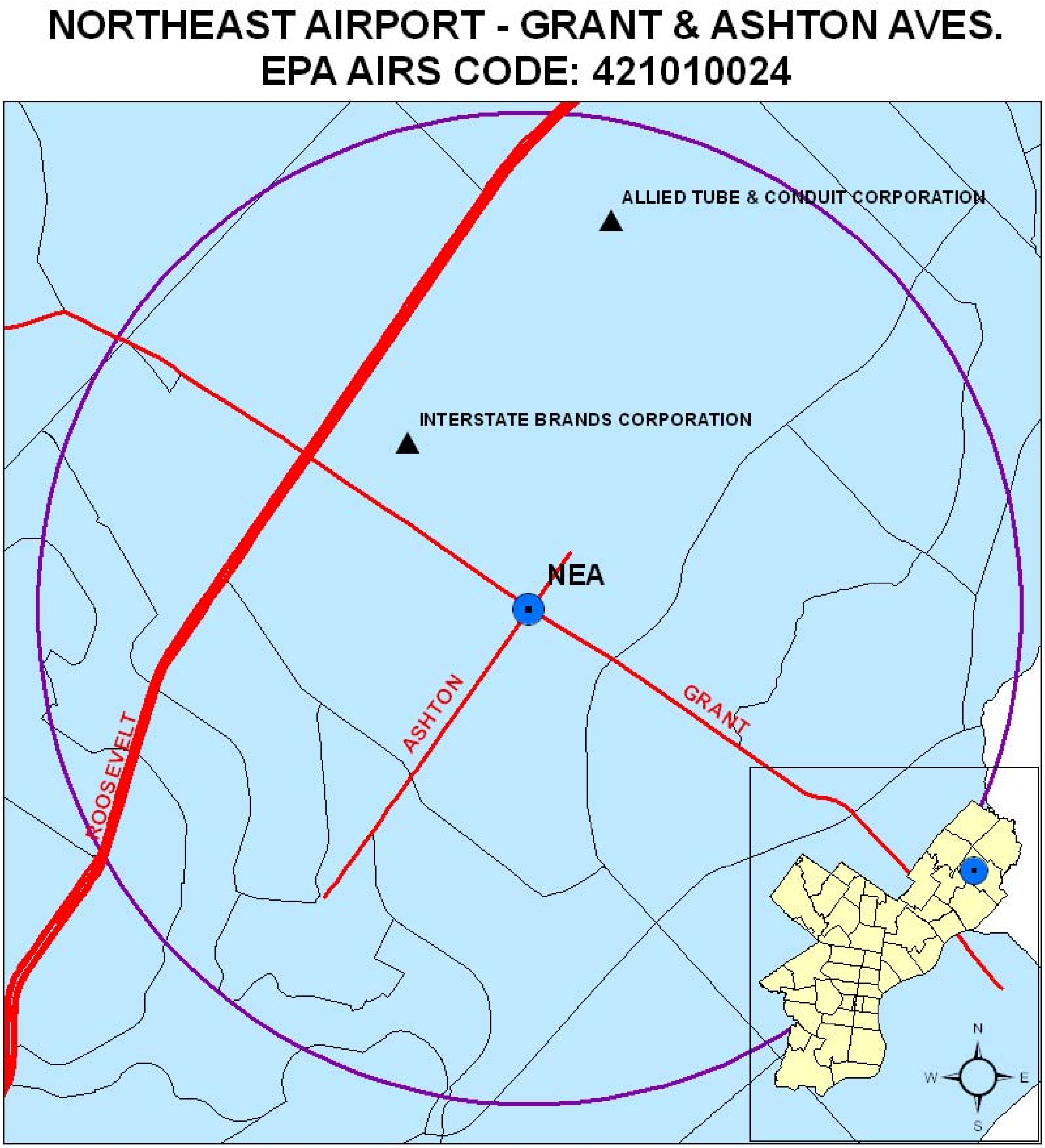
NEA

Table 4 – Detailed NEA Information with Monitoring Station Picture

AMS SITE ID: NEA
AQS Site ID: 421010024
Street Address: Grant & Ashton Roads Phila NE Airport
Geographical Coordinates
Latitude: 40.076389
Longitude: -75.011944

Parameter	Sampling Type	Operating Schedule	Collection Method	Analysis Method	Comments	AQS Method	Spatial Scale	Monitoring Objective	Probe Height (m)	Begin Date
Ozone	NAMS	Hourly	Instrumental	Ultra Violet		47	Neighborhood	Population Exposure	6	1/1/1974
Meteorological (MET)	SLAMS									

Figure 7 - NEA Monitoring Site Map with Major Streets and Major Emission Sources



			2010 EMISSIONS (IN TONS/YR)							
PLID	NAME	STREET	CO	NO_2	PB	PM_{10}	$PM_{2.5}$	PT	SO_2	VOC
3363	ALLIED TUBE & CONDUIT CORPORATION	11350 NORCOM RD	0.12	0.15	0.00	0.00	0.00	0.01	0.00	48.44
5811	INTERSTATE BRANDS CORPORATION	9801 BLUE GRASS RD	5.19	7.74	0.00	0.23	0.22	0.52	0.19	18.09
		TOTAL	5.32	7.89	0.00	0.23	0.22	0.53	0.20	66.53

Figure 8 - NEA North Aerial View

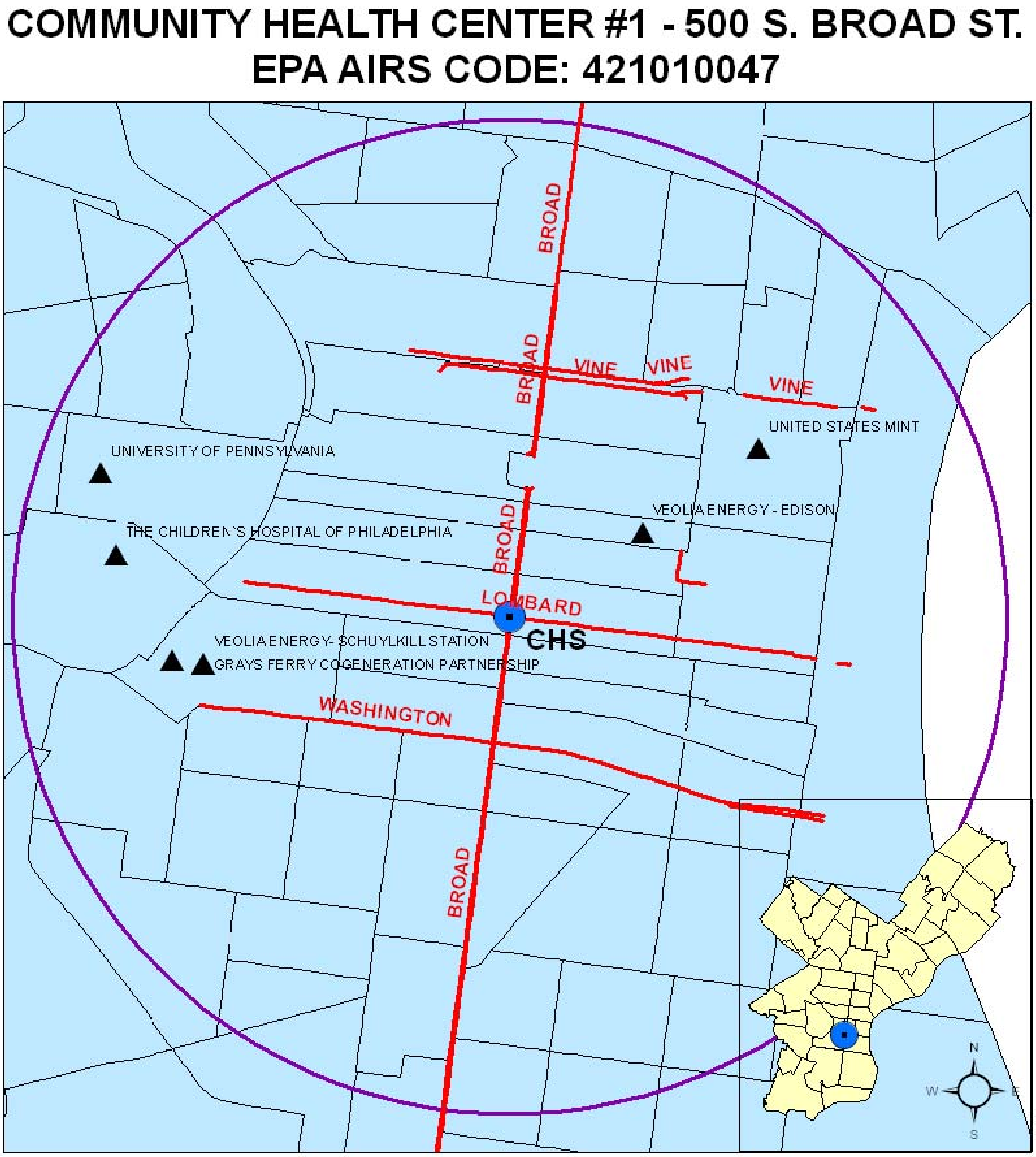
CHS

Table 5 - Detailed CHS Information with Monitoring Station Picture

AMS SITE ID: CHS
AQS Site ID: 421010047
Street Address: 500 S. Broad St
Geographical Coordinates
Latitude: 39.944722
Longitude: -75.166111

Parameter	Sampling Type	Operating Schedule	Collection Method	Analysis Method	Comments	AQS Method	Spatial Scale	Monitoring Objective	Probe Height (m)	Begin Date
NO_2	SLAMS	Hourly	Instrumental	Chemiluminescence		74	Neighborhood	Population Exposure	11	1/1/1982
NO	SPM									
$PM_{2.5}$ FRM	SPM	Daily	R&P PM2.5	Gravimetric	Core	118	Middle	Highest Concentration	4	1/1/1999
$PM_{2.5}$ Continuous	SPM	Continuous		BAM =Beta Attenuation Monitor Met One BAM -1020		731				
Metals	SPM	6th day	Hi-Vol	Atomic Absorption	Analysis by WV (TSP sampler with quartz)	107				
Carbonyls	Urban Air Toxics	6th day	DNPH-Coated Cartridges			102				
Toxics	Urban Air Toxics	6th day	Canister Subambient Pressure	Multi-Detector GC		101				

Figure 9 - CHS Monitoring Site Map with Major Streets and Major Emission Sources



			2010 EMISSIONS (IN TONS/YR)							
PLID	NAME	STREET	CO	NO_2	PB	PM_{10}	$PM_{2.5}$	PT	SO_2	VOC
4902	VEOLIA ENERGY - EDISON	908 SANSOM ST	5.20	37.82	0.00	2.02	1.31	2.25	74.21	0.29
4904	EXELON GENERATION CO. - SCHUYLKILL STA.	2800 CHRISTIAN ST	3.49	38.13	0.00	3.42	2.45	4.87	44.26	0.49
4942	VEOLIA ENERGY - SCHUYLKILL STATION	2600 CHRISTIAN ST.	8.67	120.80	0.00	56.28	42.48	56.28	173.24	8.31
4944	GRAYS FERRY COGENERATION PARTNERSHIP	2600 CHRISTIAN STREET	9.98	274.40	0.00	20.14	20.14	20.14	10.72	5.19
8069	THE CHILDREN'S HOSPITAL OF PHILADELPHIA	34TH AND CIVIC CENTER BLVD	23.97	28.21	0.00	2.76	2.76	2.76	0.96	2.10
8912	UNIVERSITY OF PENNSYLVANIA	3451 WALNUT ST	1.82	7.13	0.00	0.48	0.47	0.50	0.44	0.38
9703	UNITED STATES MINT	151 N INDEPENDENCE MALL EAST	1.76	0.85	0.00	0.06	0.05	0.06	0.02	0.69
		TOTAL	54.89	507.34	0.01	85.18	69.67	86.87	303.85	17.45

Figure 10 - CHS North Aerial View

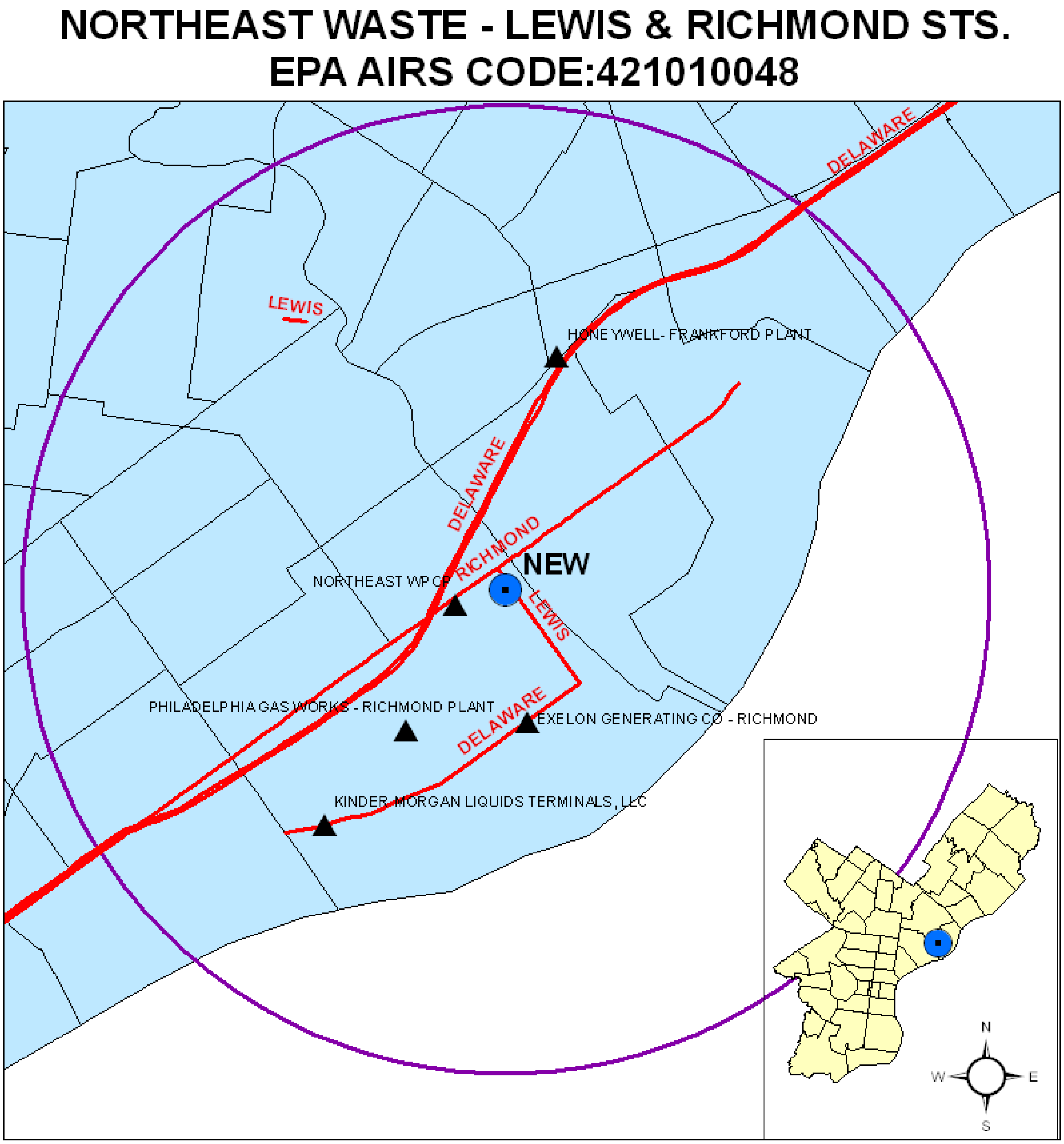
NEW

Table 6 - Detailed NEW Information with Monitoring Station Picture

AMS SITE ID: NEW
AQS Site ID: 421010048
Street Address: 3900 Richmond Street
Geographical Coordinates
Latitude: 39.991389
Longitude: -75.080833

Parameter	Sampling Type	Operating Schedule	Collection Method	Analysis Method	Comments	AQS Method	Spatial Scale	Monitoring Objective	Probe Height (m)	Begin Date
PM_{10} Continuous	SPM	Continuous		BAM =Beta Attenuation Monitor Met One BAM -1020		731				2/20/2007
Meteorological (MET)										

Figure 11 - NEW Monitoring Site Map with Major Streets and Major Emission Sources



PLID	NAME	STREET	2010 EMISSIONS (IN TONS/YR) CO	NO_2	PB	PM_{10}	$PM_{2.5}$	PT	SO_2	VOC
1551	HONEYWELL - FRANKFORD PLANT	4700 BERMUDA ST	62.54	227.38	0.00	73.06	56.46	73.07	110.94	119.92
4903	EXELON GENERATING CO - RICHMOND	3901 N DELAWARE AVE	0.10	17.61	0.00	0.36	0.36	0.83	5.00	0.01
4922	PHILADELPHIA GAS WORKS - RICHMOND PLANT	3100 E VENANGO ST	0.96	3.92	0.00	0.10	0.10	0.10	0.01	0.15
5003	KINDER MORGAN LIQUIDS TERMINALS, LLC	3300 N DELAWARE AVE	1.31	5.18	0.00	0.26	0.07	0.52	7.31	55.67
9513	NORTHEAST WPCP	3899 RICHMOND ST	29.01	5.84	0.00	1.69	1.69	1.70	6.01	13.36
		TOTAL	93.92	259.93	0.00	75.47	58.67	76.22	129.27	189.11

Figure 12 - NEW North Aerial View

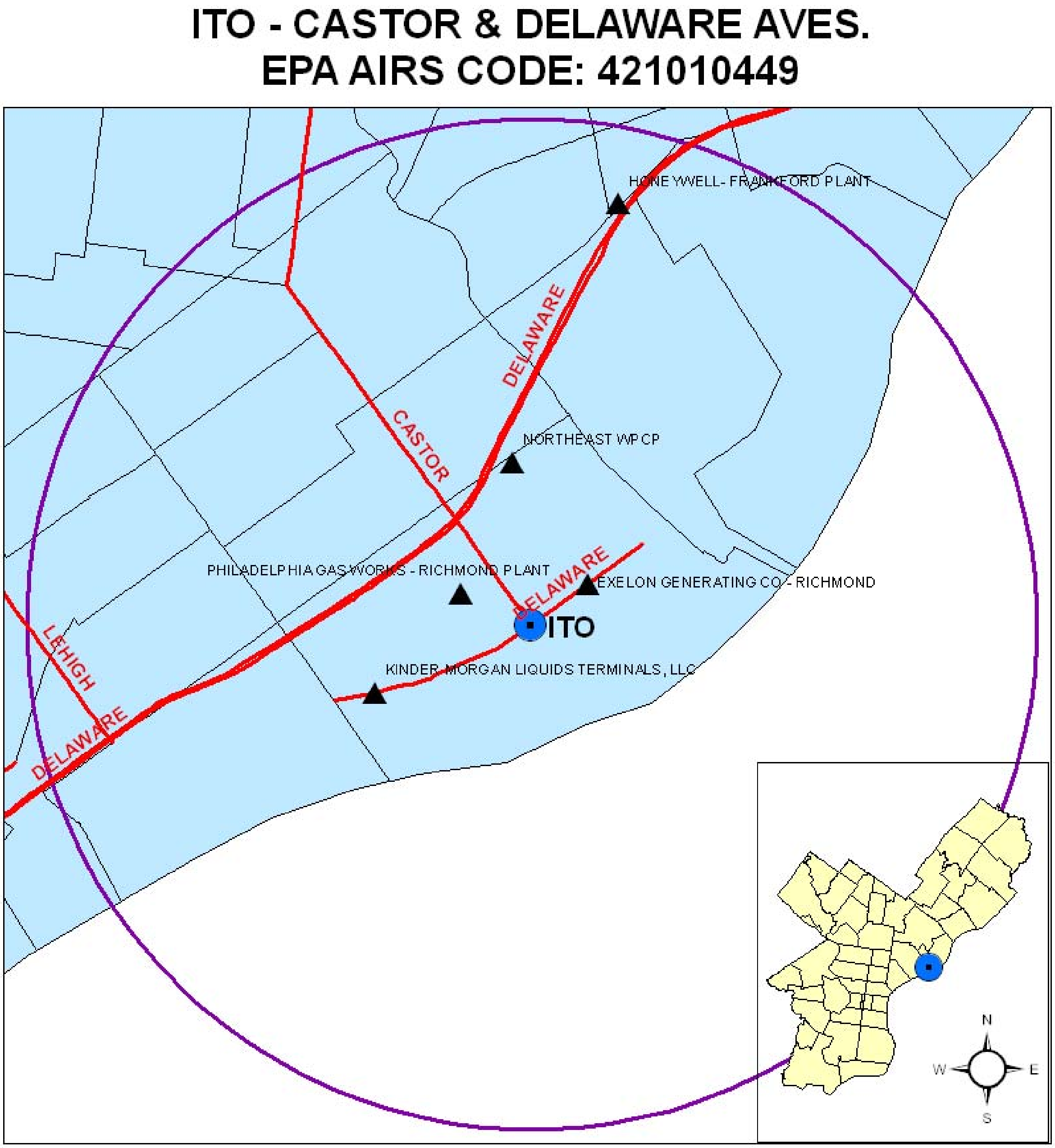
ITO

Table 7 - Detailed ITO Information with Monitoring Station Picture

AMS SITE ID: ITO
AQS Site ID: 421010449
Street Address: Castor & Delaware Avenues
Geographical Coordinates
Latitude: 39.982500
Longitude: -75.083056

Parameter	Sampling Type	Operating Schedule	Collection Method	Analysis Method	Comments	AQS Method	Spatial Scale	Monitoring Objective	Probe Height (m)	Begin Date
PM_{10} SSI	SLAMS	6th day	Hi-Vol-SA/GMW-321-B	Gravimetric	Quartz Filter	64				
BaP	Urban Air Toxics	6th day	Hi-Vol	Thin Layer Chromatography	Analysis by Allegheny County, PA	91				

Figure 13 - ITO Monitoring Site Map with Major Streets and Major Emission Sources



			2010 EMISSIONS (IN TONS/YR)							
PLID	NAME	STREET	CO	NO_2	PB	PM_{10}	$PM_{2.5}$	PT	SO_2	VOC
1551	HONEYWELL - FRANKFORD PLANT	4700 BERMUDA ST	62.54	227.38	0.00	73.06	56.46	73.07	110.94	119.92
4903	EXELON GENERATING CO - RICHMOND	3901 N DELAWARE AVE	0.10	17.61	0.00	0.36	0.36	0.83	5.00	0.01
4922	PHILADELPHIA GAS WORKS - RICHMOND PLANT	3100 E VENANGO ST	0.96	3.92	0.00	0.10	0.10	0.10	0.01	0.15
5003	KINDER MORGAN LIQUIDS TERMINALS, LLC	3300 N DELAWARE AVE	1.31	5.18	0.00	0.26	0.07	0.52	7.31	55.67
9513	NORTHEAST WPCP	3899 RICHMOND ST	29.01	5.84	0.00	1.69	1.69	1.70	6.01	13.36
		TOTAL	93.92	259.93	0.00	75.47	58.67	76.22	129.27	189.11

Figure 14 - ITO North Aerial View

RIT

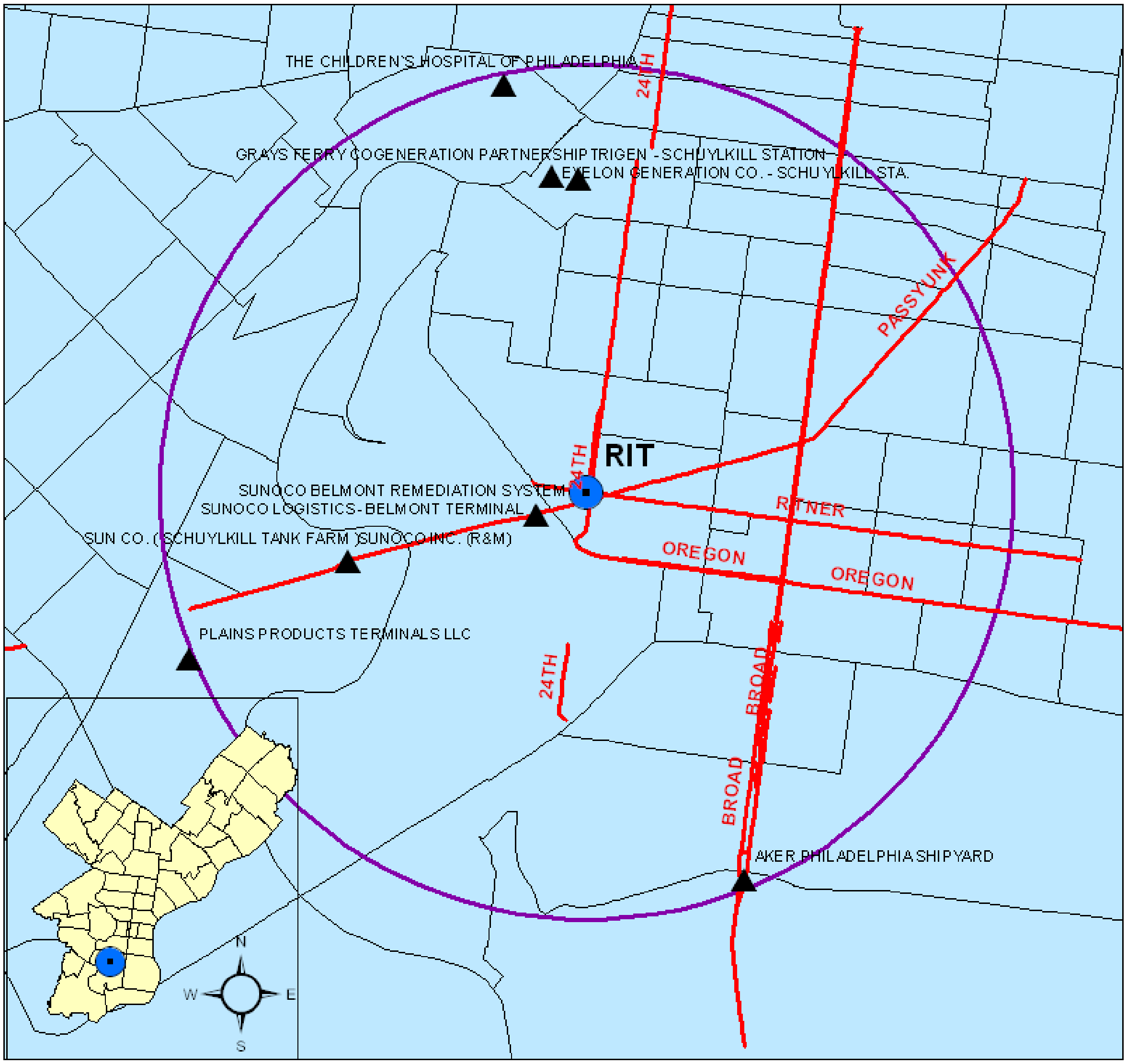
Table 8 - Detailed RIT Information with Monitoring Station Picture

AMS SITE ID: RIT
AQS Site ID: 421010055
Street Address: 24th & Ritner Streets
Geographical Coordinates
Latitude: 39.922517
Longitude: -75.186783

Parameter	Sampling Type	Operating Schedule	Collection Method	Analysis Method	Comments	AQS Method	Spatial Scale	Monitoring Objective	Probe Height (m)	Begin Date
SO_2	NAMS	Hourly	Instrumental	Pulsed Fluorescent	Very high levels momentarily exceeding 0.5 ppm, Expected to begin operation	60	Neighborhood	Population Exposure	4	11/9/2004
$PM_{2.5}$ Speciated	NAMS		Met One SASS Teflon	Energy Dispersive XRF	Analysis by EPA	811				
$PM_{2.5}$ FRM	Rover	Daily	R&P PM2.5	Gravimetric		118				
$PM_{2.5}$ Continuous	SPM	Continuous		BAM =Beta Attenuation Monitor Met One BAM -1020		731				
Metals	SPM	6th day	Hi-Vol	Atomic Absorption	Analysis by WV (TSP sampler with quartz)	107				
Carbonyls	Urban Air Toxics	6th day	DNPH-Coated Cartridges			102				
Toxics	Urban Air Toxics	6th day	Canister Subambient Pressure	Multi-Detector GC		101				

Figure 15 - RIT Monitoring Site Map with Major Streets and Major Emission Sources

RITNER - 24TH & RITNER STS.
EPA AIRS CODE: 421010055



			2010 EMISSIONS (IN TONS/YR)							
PLID	NAME	STREET	CO	NO_2	PB	PM_{10}	$PM_{2.5}$	PT	SO_2	VOC
1501	SUNOCO INC. (R&M)	3144 PASSYUNK AVE	1713.10	1642.48	0.00	549.67	549.67	549.67	561.46	689.07
1507	SUNOCO LOGISTICS - BELMONT TERMINAL	2700 PASSYUNK AVE	19.67	8.00	0.00	0.25	0.02	0.01	0.09	31.90
1508	SUNOCO BELMONT REMEDIATION SYSTEM	2700 W PASSYUNK AVE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.33
1517	SUN CO. (SCHUYLKILL TANK FARM)	3144 PASSYUNK AVE	2.30	0.59	0.00	0.00	0.00	0.00	0.00	85.20
1569	AKER PHILADELPHIA SHIPYARD	PHILA. NAVAL BUS. CENTER	1.53	0.00	0.00	33.79	33.50	34.82	0.01	130.18
4904	EXELON GENERATION CO. - SCHUYLKILL STA	2800 CHRISTIAN ST	3.49	38.13	0.00	3.42	2.45	4.87	44.26	0.49
4942	VEOLIA ENERGY- SCHUYLKILL STATION	2600 CHRISTIAN ST.	8.67	120.80	0.00	56.28	42.48	56.28	173.24	8.31
4944	GRAYS FERRY COGENERATION PARTNERSHIP	2600 CHRISTIAN STREET	9.98	274.40	0.00	20.14	20.14	20.14	10.72	5.19
5013	PLAINS PRODUCTS TERMINALS LLC	3400 SOUTH 67TH STREET	0.48	0.58	0.00	0.01	0.00	0.04	0.00	41.62
8069	THE CHILDREN'S HOSPITAL OF PHILADELPHIA	34TH AND CIVIC CENTER BLVD	23.97	28.21	0.00	2.76	2.76	2.76	0.96	2.10
		TOTAL	1783.20	2113.19	0.00	666.33	651.03	668.60	790.74	995.38

Figure 16 - RIT North Aerial View

FAB

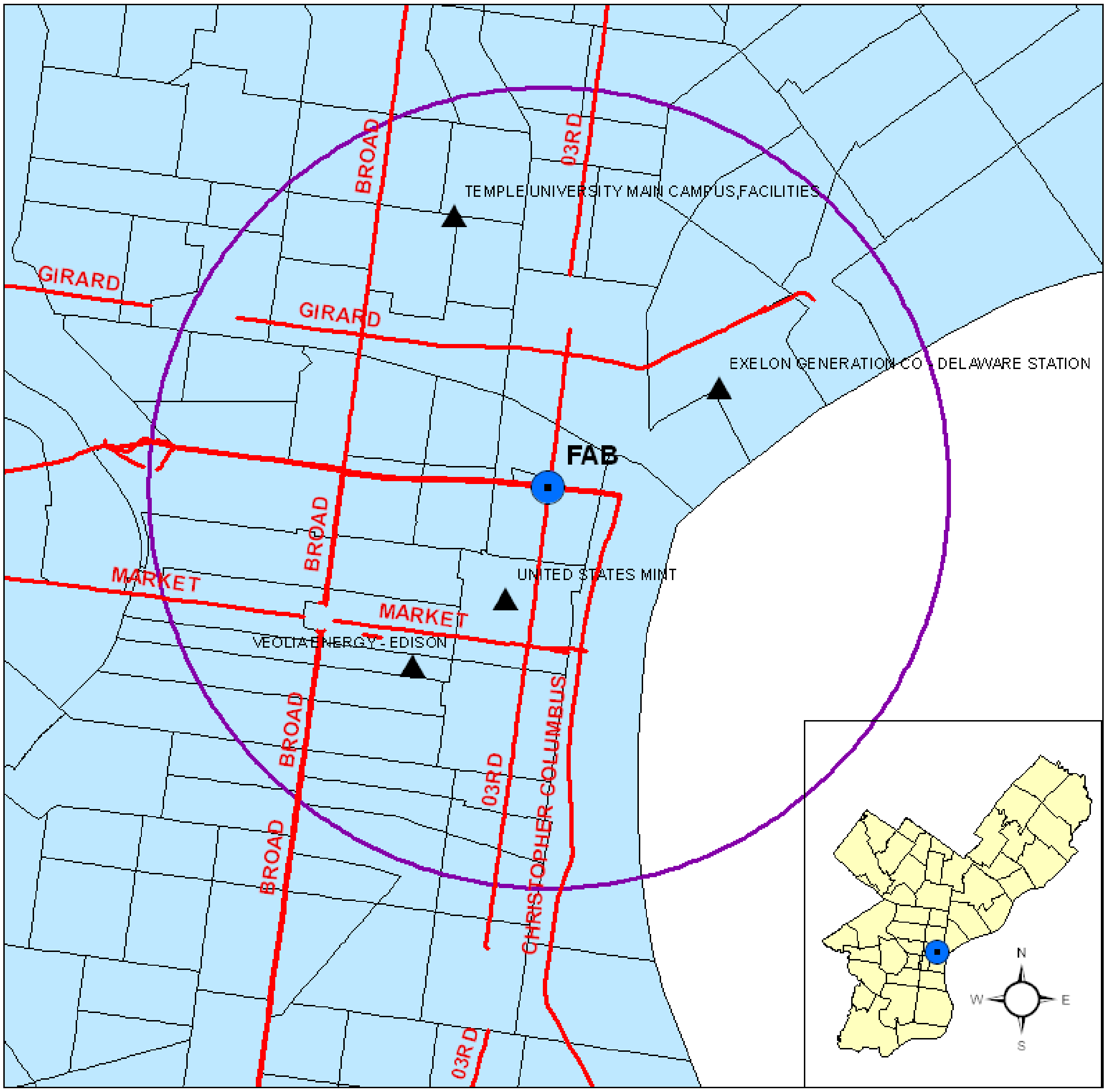
Table 9 - Detailed FAB Information with Monitoring Station Picture

AMS SITE ID: FAB
AQS Site ID: 421010057
Street Address: 240 Spring Garden Street, 19123
Geographical Coordinates
Latitude: 39.960291
Longitude: -75.142388

Parameter	Sampling Type	Operating Schedule	Collection Method	Analysis Method	Comments	AQS Method	Spatial Scale	Monitoring Objective	Probe Height (m)	Begin Date
$PM_{2.5}$ FRM	SPM	Daily	R&P PM2.5	Gravimetric	NAAQS Compliance Monitoring - 24 hr	118	Middle	Population Exposure	2	9/2007 - Rooftop 1/1/2008 - Ground Level

Figure 17 - FAB Monitoring Site Map with Major Streets and Major Emission Sources

FIRESTATION (FAB) - 3RD & SPRING GARDEN STS.
EPA AIRS CODE: 421010057



			2010 EMISSIONS (IN TONS/YR)							
PLID	NAME	STREET	CO	NO_2	PB	PM_{10}	$PM_{2.5}$	PT	SO_2	VOC
4901	EXELON GENERATION CO - DELAWARE STATION	1325 N BEACH ST	0.98	6.98	0.00	0.39	0.00	0.64	1.73	0.03
4902	VEOLIA ENERGY - EDISON	908 SANSOM ST	5.20	37.82	0.00	2.02	1.31	2.25	74.21	0.29
8905	TEMPLE UNIVERSITY MAIN CAMPUS FACILITIES	1009 W MONTGOMERY AVE	30.06	38.94	0.00	1.24	1.24	2.72	0.79	4.23
9703	UNITED STATES MINT	151 N INDEPENDENCE MALL EAST	1.76	0.85	0.00	0.06	0.05	0.06	0.02	0.69
		TOTAL	38.00	84.59	0.00	3.72	2.60	5.67	76.76	5.25

Figure 18 - FAB North Aerial View

SWA

Table 10 - Detailed SWA Information with Monitoring Station Picture

AMS SITE ID: SWA

AQS Site ID: 421010063

Street Address: 8200 Enterprise Avenue, 19153

Geographical Coordinates

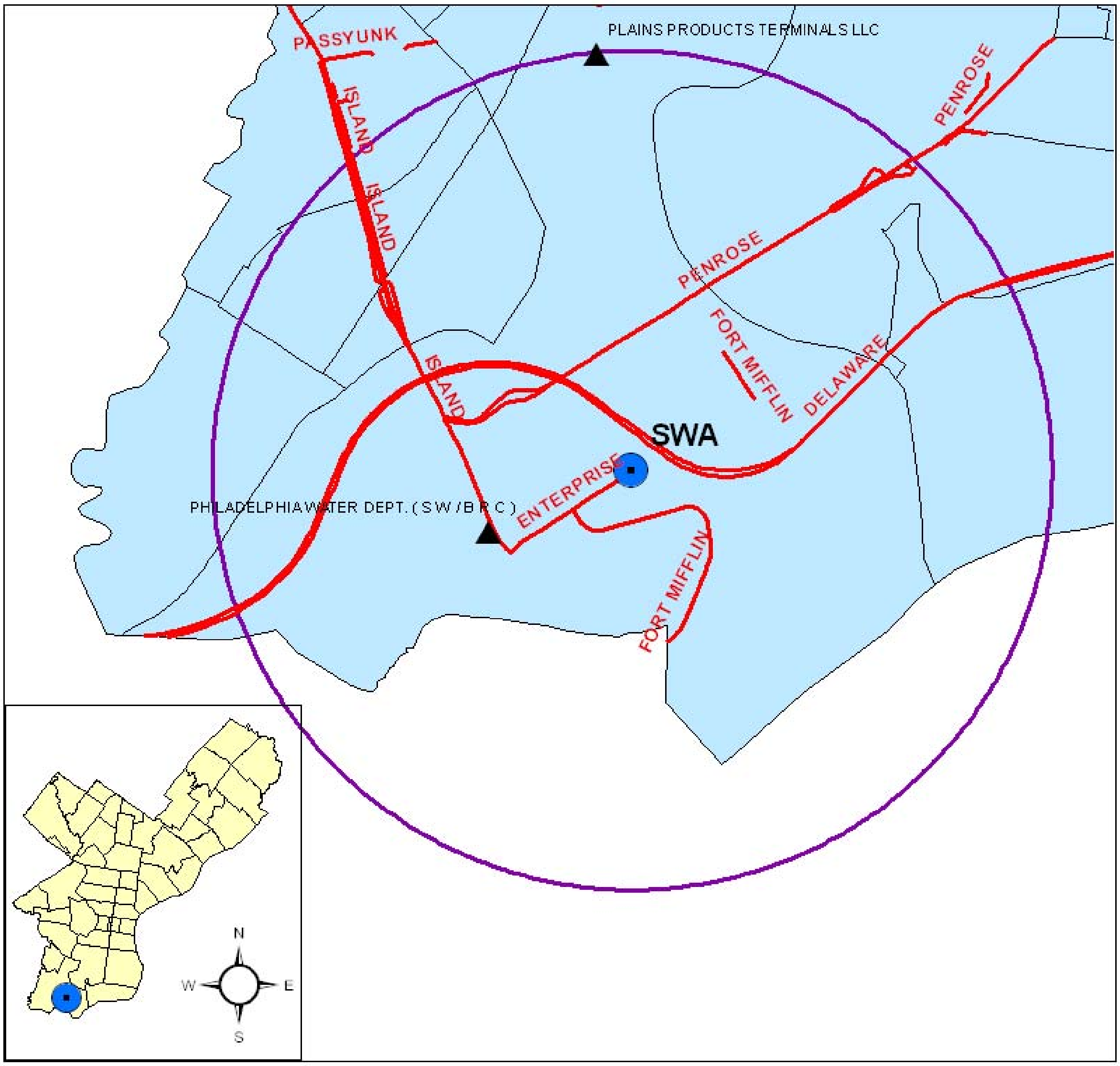
Latitude: 39.880115

Longitude: -75.222784

Parameter	Sampling Type	Operating Schedule	Collection Method	Analysis Method	Comments	AQS Method	Spatial Scale	Monitoring Objective	Probe Height (m)	Begin Date
Metals	SPM	6th day	Hi-Vol	ICP-MS	Analysis by WV (TSP sampler with quartz)	107				9/10/2009
Carbonyls	Urban Air Toxics	6th day	DNPH-Coated Cartridges			102				9/10/2009
Toxics	Urban Air Toxics	6th day	Canister Subambient Pressure	Multi-Detector GC		101				9/10/2009

Figure 19 - SWA Monitoring Site Map with Major Streets and Major Emission Sources

PHILADELPHIA AIRPORT - 8200 ENTERPRISE AVE
EPA AIRS CODE: 421010063



PLID	NAME	STREET	2010 EMISSIONS (IN TONS/YR)							
			CO	NO_2	PB	PM_{10}	$PM_{2.5}$	PT	SO_2	VOC
5013	PLAINS PRODUCTS TERMINALS LLC	3400 S 67TH ST	0.48	0.58	0.00	0.01	0.00	0.04	0.00	41.62
9515	PHILADELPHIA WATER DEPT. (S W / B R C)	8200 ENTERPRISE/7800 PENROSE	42.38	10.39	0.00	3.11	3.11	3.14	8.67	23.53
		TOTAL	42.86	10.97	0.00	3.12	3.11	3.18	8.67	65.15

Figure 20 - SWA Aerial View

BAX

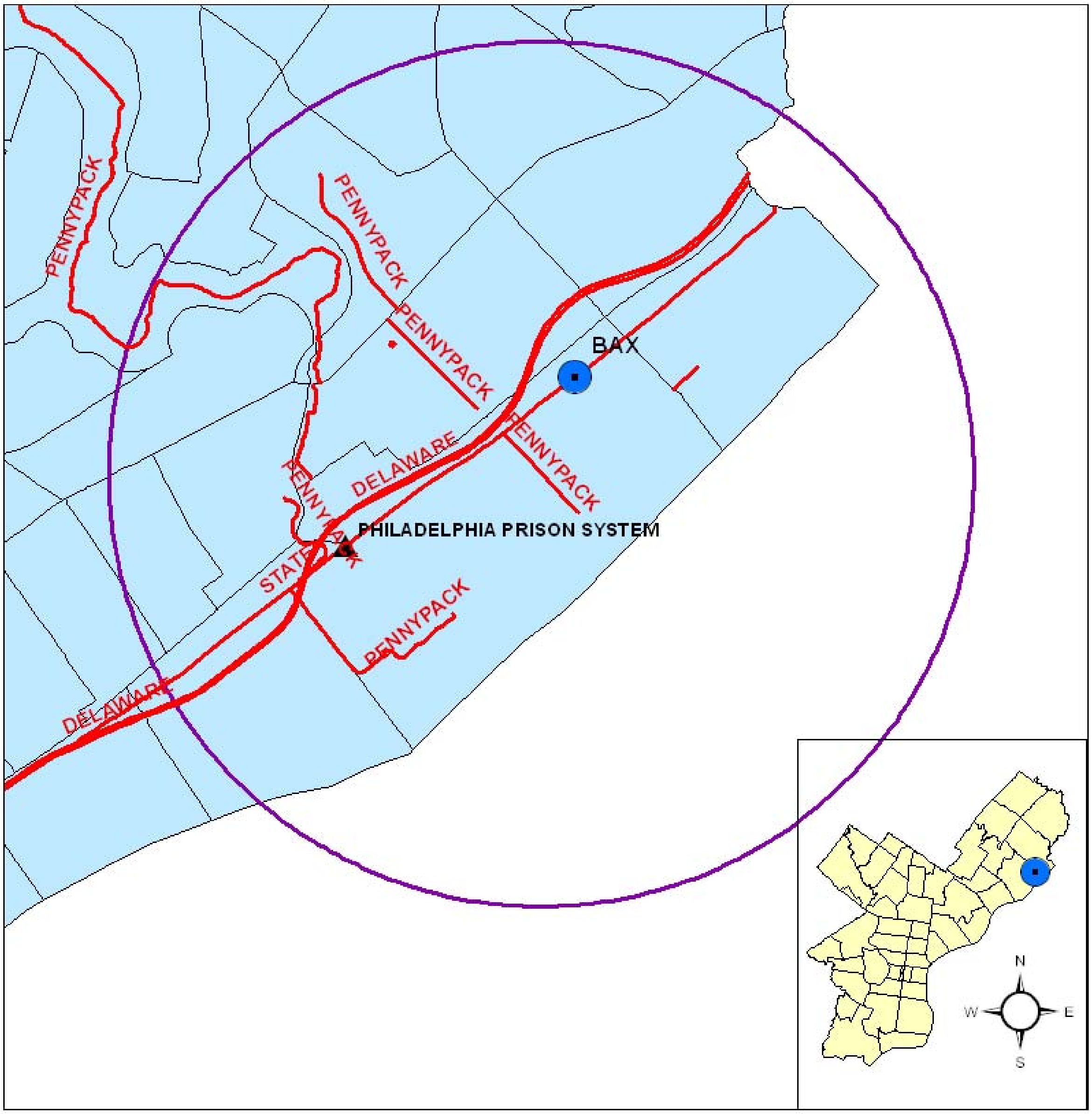
Table 11 - Detailed BAX Information with Monitoring Station Picture

AMS SITE ID: BAX
AQS Site ID: 421011002
Street Address: 5200 Pennypack Park, 19136
Geographical Coordinates
Latitude: 40.035985
Longitude: -75.002405

Parameter	Sampling Type	Operating Schedule	Collection Method	Analysis Method	Comments	AQS Method	Spatial Scale	Monitoring Objective	Probe Height (m)	Begin Date
CO (trace)	Ncore	Continuous	Instrumental	ARM utilizing trace level Non-dispersive infrared	High sensitivity	54				
SO_2 (trace)	NCore	Continuous	Instrumental	ARM utilizing trace level UV Flurorescence	High sensitivity	60				
Ozone	Ncore/AQI	Continuous	Instrumental	ARM utilizing Ultra Violet photomentry	Year-round operation	47				
NO (trace)	Ncore									
NOy (trace)	Ncore	Continuous	Instrumental	ARM utilizng chemiluminescence	High sensitivity external converter mounted at 10m	75				
$PM_{2.5}$ Continuous	Ncore/AQI	Continuous	BAM =Beta Attenuation Monitor Met One BAM -1020		FEM	731				
$PM_{2.5}$ Speciated	Ncore	1/3 days	Met One SASS	Energy Dispersive XRF	Analysis by EPA	811				
$PM_{2.5}$ FRM	Ncore	1/3 days	R&P $PM_{2.5}$	Gravimetric		118				
PM Coarse	Ncore	1/6 days	Hi-Vol-SA/GMW-321-B	Gravimetric	Integrated samplers	92				
TSP Metals	Ncore	6th day	Hi-Vol	Atomic Absorption	Analysis by InterMountain Laboratory (IML)	92				
Meteorological (MET)	Ncore	Continuous		Air quality measurements approved instrumentation for wind speed, wind direction, humidity, barometric pressure,rainfall and solar radiation						

Figure 21 - BAX Monitoring Site Map with Major Streets and Major Emission Sources

BAXTER - 5200 PENNYPACK ST.
EPA AIRS CODE: 421011002



			2010 EMISSIONS (IN TONS/YR)							
PLID	NAME	STREET	CO	NO_2	PB	PM_{10}	$PM_{2.5}$	PT	SO_2	VOC
9519	PHILADELPHIA PRISON SYSTEM	8001 STATE RD	7.91	10.31	0.00	0.35	0.27	0.78	0.15	0.56

Figure 22 - BAX Aerial View

Detailed Information by Pollutant

Ozone (O_3)

Principle of Operation
The detection of ozone molecules is based on absorption of 254 nm UV light due to an internal electronic resonance of the O_3 molecule.

NAAQS:
Highest 4^{th} daily maximum 8-Hour Concentration = 0.075 ppm

Ground level ozone (the primary constituent of smog) is the pollutant most often responsible for unhealthy air quality in the Philadelphia region. Ozone is not emitted into the atmosphere directly but is formed by reactions of other pollutants. Volatile Organic Compounds (VOCs) and Nitrogen Oxides (NO_x) react to create ozone in the presence of heat and sunlight.

Unlike the oxygen that we breathe, which has only two atoms of oxygen (O_2), ozone has an additional oxygen atom, making it very reactive. This is why ozone is said to burn or irritate the lungs. People who are very young or very old, or who have chronic lung problems such as asthma are particularly sensitive to ground level ozone.

In any discussion of ozone, it is important to distinguish between the effects of ozone at the ground and ozone high in the atmosphere, several miles above our heads. An advertisement might use the slogan "good up high, bad nearby," to describe ozone. Regardless of where it is, no one would want to breathe it. However, up high in what's called the ozone layer, ozone is essential to the health of nearly every living thing, since it protects the Earth from harmful ultraviolet (UV) light. If not for this natural layer, UV light would sterilize the Earth's surface, and life as we know it would cease to exist. Near the ground, ozone reacts with buildings, plants, animals, and people, and is one of the most irritating, harmful components of smog. Smog refers to the whole mixture of air pollution in an area, and may include ozone, a whole host of other gases, and fine particles and the hazy conditions they cause. Ozone levels are consistently higher during the summer months.

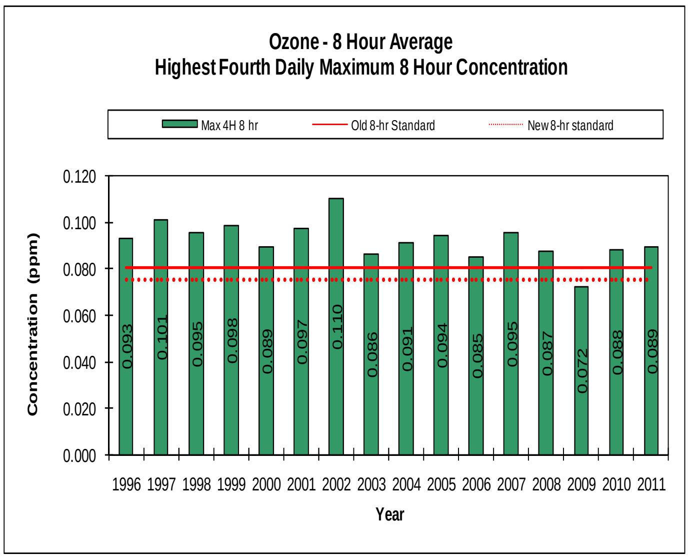
NO_x are from burning of fuel in industry and motor vehicles. A significant amount of NO_x that are emitted during fossil fuel combustion is Nitrogen Oxide (NO). NO reacts quickly with ozone to form oxygen (O_2) and nitrogen dioxide (NO_2). For this reason ozone levels are depressed in urban areas and increase downwind in more rural areas where there are emissions of NO. NEA was placed to indicate O_3 levels coming into the City and leaving the City.

VOCs are organic compounds that evaporate readily, such as gasoline vapors and paint fumes. VOCs that come from human activities are called anthropogenic VOCs. Some anthropogenic VOCs, such as benzene, are themselves toxic and may increase risks of cancer or lead to other adverse health effects in addition to helping form ozone. Some VOCs are considerably more reactive in the atmosphere than others, and the reactivity of a VOC influences how quickly ozone forms. A compound that reacts quickly to produce ozone will have a much greater impact near its source than one that reacts more slowly.

Philadelphia is in attainment for the 1997 8-hr ozone standard, but is in nonattainment for the 2008 8-hr standard. This means that the standards set by the EPA for ozone are being exceeded. AMS continues efforts with surrounding agencies to get into compliance for ozone. A State Implementation Plan (SIP) is a plan which identifies how a State will attain the standard. Each State is required to have a SIP which contains control measures and strategies which demonstrate how each area will attain and maintain the NAAQS. These plans are developed through a public process, formally adopted by the State, and submitted by the Governor's designee to EPA. The graph below shows ozone trends just for Philadelphia.

On March 12, 2008, EPA revised the level of the primary and secondary 8-hour ozone standards from 0.08 ppm to 0.075 ppm. EPA is reconsidering the level as the NAAQS is not as protective as recommended by EPA's panel of science advisers, the Clean Air Scientific Advisory Committee, CASAC. In the NAAQS final rule, EPA committed to issue a separate rule to address monitoring requirements necessary to implement the new standards. On September 2, 2011, President Obama requested the Administrator Jackson to withdraw the draft Ozone NAAQS and did not support asking state and local governments to begin implementing a new standard that will soon be reconsidered since the work to revise the standard in 2013 has been underway. Presently, states are required to operate a minimum numbers of EPA-approved ozone monitors based on the population of each of their MSA and the most recently measured ozone levels for each area. States also operate additional ozone monitors to meet objectives including assessment of compliance with the NAAQS, investigation of ozone transport issues, calculations of the Air Quality Index, verification of photochemical modeling efforts, and assessment of ozone-related effects on ecosystems with natural plants sensitive to air pollution damage. EPA is lengthening the required ozone monitoring season in many states to account for the tightened level of the revised NAAQS and require ozone monitors operated as part of a new multi-pollutant network to operate on a year-round schedule when the network is fully operational in 2011. This does not affect Philadelphia because our ozone monitors run all year long.

Figure 23 - O_3 Trends



In 2011, Philadelphia and the surrounding counties were in nonattainment for the 8-hour ozone standard. This means that the standard set by the EPA for ozone was exceeded. This standard was exceeded 12 times in 2011. AMS, along with other local and regional air quality agencies, continues to work towards compliance with ozone standards.

Carbon Monoxide (CO)

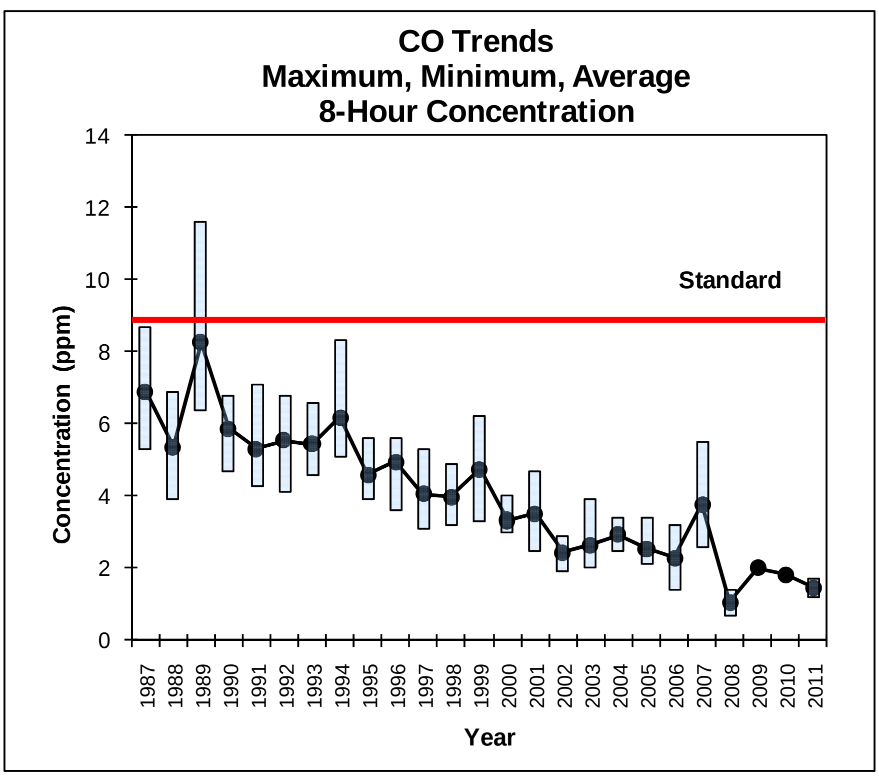
Principle of Operation
The basic principle by which the analyzer works is called Beer's Law. It defines the concentration of carbon monoxide by the amount of light of a specific wavelength that is absorbed by the carbon monoxide molecules over a fixed distance.

NAAQS:
Highest 2nd maximum 8-Hour Concentration = 9 ppm
Highest 2nd maximum 1-Hour Concentration = 35 ppm

Carbon monoxide (CO) is colorless, odorless, and at high concentrations is a poisonous gas. It is formed when carbon in fuels are not burned completely. By far the largest source of CO is motor vehicle emissions. It is for this reason that a monitor located at LAB is near roadways and there will be a near-road station for NO_2 monitoring which is also used to monitor CO. The monitor is required to be operating by January 1, 2015 for CBSAs with 2.5 millions and greater population or January 1, 2017 for CBSAs with population of 1 million and greater. Weather greatly affects CO levels, and peak CO concentrations typically occur during the colder months of the year.

Over the last two decades, there has been a continued reduction in carbon monoxide levels. This is mainly the result of federal requirements for cleaner automobiles and fuel and state inspection/maintenance programs.

Figure 24 - CO Trends



Nitrogen Dioxide (NO_2)

Principle of Operation
The concentration of nitric oxide [NO], total oxides of nitrogen [NO_X] and, by calculation, nitrogen dioxide [NO_2] is determined in a single instrument. The chemical reaction between nitric oxide [NO] and ozone [O_3] produces light (chemiluminescence). The concentration of nitric oxide is determined by the intensity of the light.

NAAQS:
Highest Annual Arithmetic Mean Concentration = 0.053 ppm
Highest 98^{th} percentile daily 1-Hour Concentration = 100 ppb

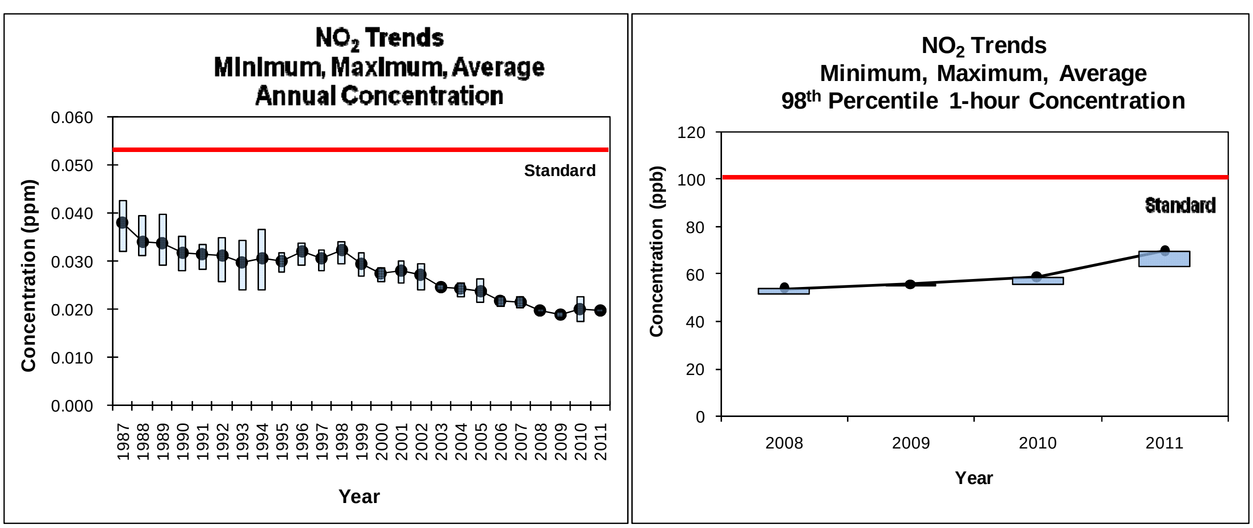
Nitrogen dioxide is a light brown gas that is an important component of urban haze. The compound is created primarily from fuel combustion in motor vehicles, utilities, and industrial sources.

Nitrogen dioxide can irritate the lungs and lower resistance to respiratory infections such as influenza. Nitrogen oxides (NO_X) are an important precursor to both ozone and acid rain and can affect both land and water ecosystems. They contribute to the formation of fine particulate matter, haze and reductions in visibility.

Ambient levels of nitrogen dioxide in Philadelphia are better than the NAAQS, showing a sustained downward trend over time for the annual standard.

On January 25, 2010, EPA added the primary 1-hour NO_2 standard of 100 ppb, to protect against short-term exposures, typically near major roads. Trends are shown for Philadelphia over the last few years. Any new near-road monitors must be in operation by January 1, 2013. AMS is in the process of finding the proper location for the monitor. There are three prospective sites in which AMS will be looking further for its availability. More information about near-road monitors can be found on the Appendix D of this Plan.

Figure 25 - NO_2 Trends



Sulfur Dioxide (SO_2)

Principle of Operation
The concentration of SO_2 is based upon the measurement of fluorescence of SO_2 when it is exposed to Ultra Violet (UV) light (absorption of UV energy).

NAAQS:
Highest Annual Mean Concentration = 0.03 ppm
Highest Second Maximum 24-Hour Concentration = 0.14 ppm
Highest 99^{th} percentile daily 1-hour Concentration = 75 ppb

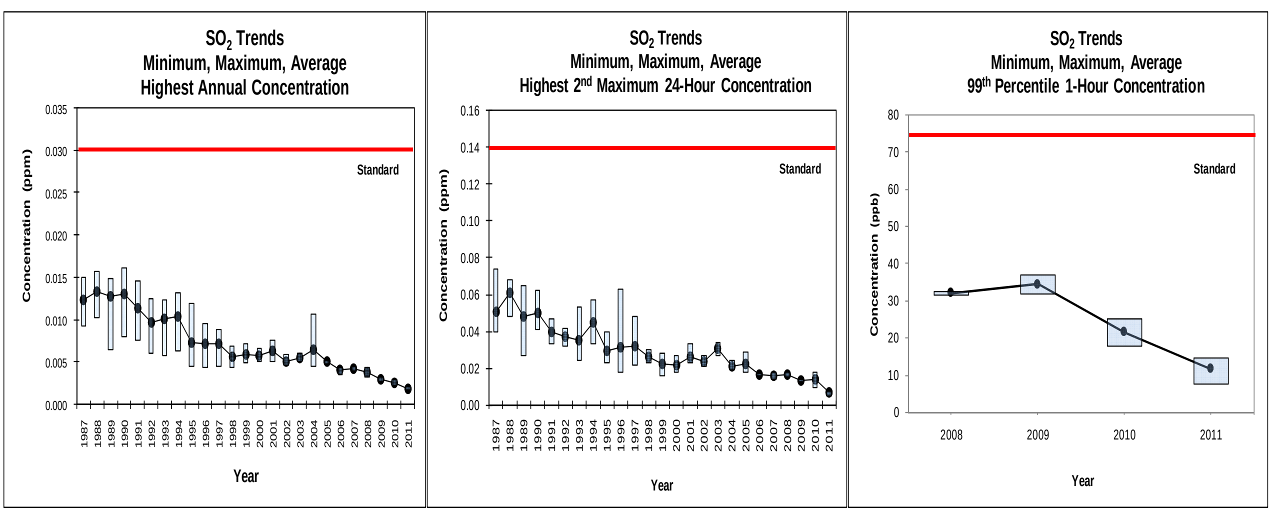
SO_2 is emitted from the burning of fuels that contain sulfur. Industrial grade fuel oils are the primary source in Philadelphia.

The major health concerns associated with exposure to high concentrations of SO_2 include effects on breathing, respiratory illness, alterations in the lungs' defenses, and aggravation of existing respiratory and cardiovascular disease. Together, SO_2 and NO_X are the major ingredients of acid rain. SO_2 also plays a significant role in the formation of fine particulate matter. Monitors are placed to better understand the impact of the City's major emitters of SO_2.

SO_2 levels are well within air quality standards and show a slow, continued improvement over time. This is mainly due to industry, businesses, and homes changing to fuels with lower sulfur content such as natural gas. In October 2006, ultra low sulfur diesel (ULSD) came on line for on-road vehicles producers were required to begin producing ultra ULSD to comply with new requirements that 80% of diesel fuel used for on-road vehicles must be ULSD.

On June 2, 2010, EPA revoked the primary annual and 24-hour SO_2 standards from 30 ppb and 140 ppb, respectively, to a 1-hour standard of 75 ppb. Any new monitors must be in operation by January 1, 2013.

Figure 26 - SO_2 Trends



Lead (Pb)

NAAQS:
Highest 3-Month Rolling Average Concentration = 0.15 µg/m^3

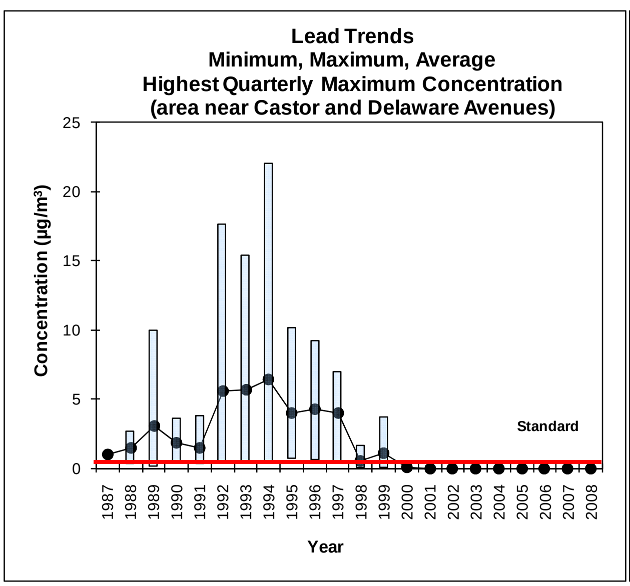
The processing of metals is the major source of lead emissions to the atmosphere. It does not travel over great distances in the air and so concentrations vary, with highest levels near particular industrial sites.

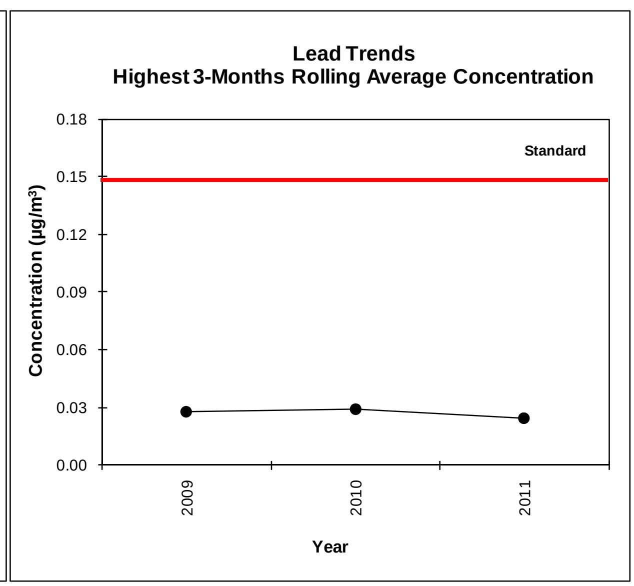
Lead is a metal that is highly toxic when inhaled or ingested. Lead accumulates in the blood, bone, and soft tissue and may affect the kidneys, liver, nervous system and other organs. It also can cause learning difficulties in children.

Ambient lead levels decreased significantly throughout the City due to the use of unleaded gasoline and greater control of emissions from companies that produce or process lead compounds. Lead levels in certain parts of the City were extremely high in the 1980's and 1990's due to the concentration of particular industries in the area. This is reflected in the previously high readings for monitors near Castor and Delaware Avenues. The levels of lead in these areas have drastically improved, and are now comparable to the rest of the City. Currently, AMS measures for ambient lead only at the BAX location.

On November 12, 2008, EPA strengthened the lead NAAQS standard from 1.5 µg/m^3 to 0.15 µg/m^3, measured as total suspended particles (TSP). AMS meets the new standard. EPA requires monitoring near lead sources with emissions of 0.5 to 1.0 tons per year. Philadelphia has no sources that emit 0.5 or more tons of Pb per year.

Figure 27 - Lead (Pb) Trends





Particulate Matter

Particulate matter is the general term used for a mixture of solid particles and liquid droplets found in the air. These particles come in a wide range of sizes and originate from stationary, mobile, and natural sources.

PM_{10} and $PM_{2.5}$ are small particulate matter that measure less than 10 micrometers (0.00001 meters) and 2.5 micrometers (0.0000025 meters) respectively (1/30 thickness of human hair). These small particles penetrate deeply into the respiratory system and can have adverse health effects. In addition to health problems, particulate matter can cause reduced visibility, soiling, and damage to materials.

In 1997, the EPA revised the National Ambient Air Quality Standards to include fine particulate. Fine particles are made up of both primary (combustion) and secondary (formed in the air) sources. Particles remain airborne for long periods of time and disperse in uniform concentrations across wide areas, crossing geographic boundaries.

Fine particles are treated as though they are a single pollutant, but fine particles come from many different sources and are composed of thousands of different compounds. Fortunately, these compounds fall into a few dominant categories: sulfates, nitrates, ammonium compounds, soil, organic carbon compounds, and elemental carbon. Soot, also referred to as black carbon or elemental carbon, is emitted directly by diesel engines and forest fires, among other sources. Most individual particles are likely mixtures of different substances, the products of growing by collisions with other particles and by taking on gases.

Particulate Matter of less than 10 microns (PM_{10})

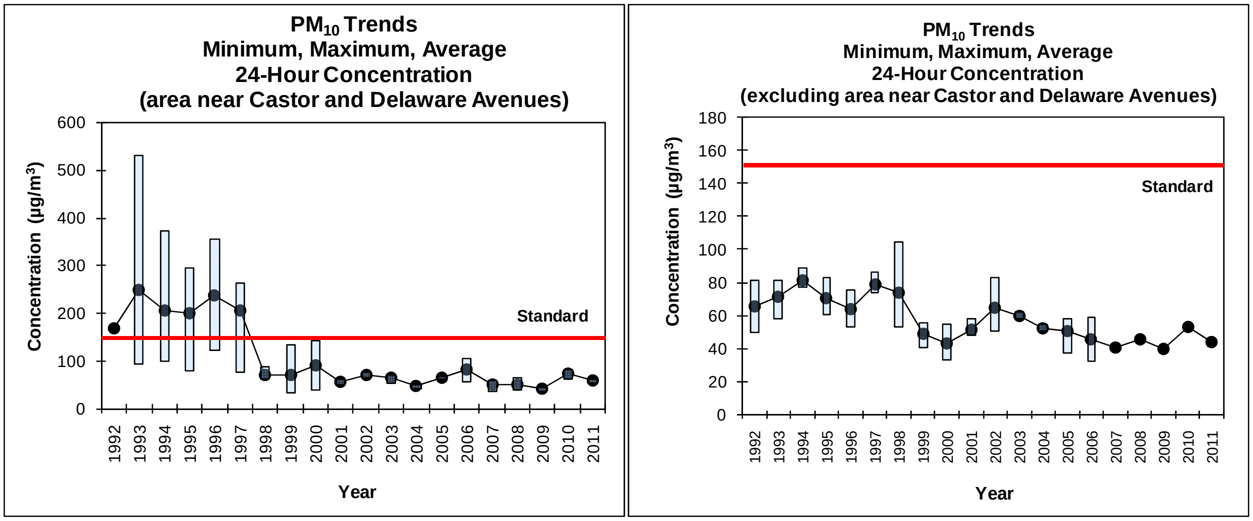
PM_{10}

NAAQS:
Highest Second Maximum 24-Hour Concentration = 150 $\mu g/m^3$

Particulate matter levels have been decreasing due to regulations limiting the amount of emissions allowed and the change to cleaner fuels such as natural gas by industry, businesses and homes.

There are two sets of trend charts shown for this pollutant. During the mid 1990s, particulate emissions from several sources in the area of Castor and Delaware Avenues caused extremely high localized measurements. In fact, the levels were many times higher than those measured at other City locations. Because the impact was not widespread, the additional chart is presented to highlight that fact. Specific action to abate these sources have resulted in air quality that now meets the national standards and are now comparable to levels in the rest of the City. Continuous PM_{10} data is used in the Air Quality Index. The graphs on the following page show PM_{10} trends.

Figure 28 - PM_{10} Trends



Particulate Matter of less than 2.5 microns ($PM_{2.5}$)

$PM_{2.5}$

NAAQS:
Highest Annual Mean Concentration = 15 $\mu g/m^3$
Highest 98th Percentile 24-Hour Concentration = 35 $\mu g/m^3$

$PM_{2.5}$ consists of those particles that are less than 2.5 micrometers in diameter. They are also referred to as "fine" particles. Fine particles result from fuel combustion from motor vehicles, power generation, and industrial facilities, as well as from residential fireplaces and wood stoves. A significant amount of fine particles are also formed in the atmosphere by the transformation of gaseous emissions such as SO_2, NO_X, VOCs, and ammonia.

Fine particles can accumulate in the respiratory system and are associated with numerous health effects such as premature death, increased respiratory symptoms and disease, and decreased lung functions. Sensitive groups that appear to be at the greatest risk for such effects include the elderly, children, and individuals with cardiopulmonary disease or respiratory ailments such as asthma.

Revisions to the primary (health-based) NAAQS added the two new $PM_{2.5}$ standards, set at 15 $\mu g/m^3$ (annual standard) and 35 $\mu g/m^3$ (24-hour standard). Effective December 18, 2006, EPA strengthened the 24-hour $PM_{2.5}$ standard, from 65 $\mu g/m^3$ to 35 $\mu g/m^3$.

Measuring $PM_{2.5}$ requires highly sensitive equipment under tight temperature and humidity control. Philadelphia was in nonattainment for the 24-hour $PM_{2.5}$ standard, but is now in attainment for both annual and 24-hour $PM_{2.5}$ standards.

Monitors are placed to assess public exposure high levels. Continuous $PM_{2.5}$ data is used in the Air Quality Index. Speciation shows the make-up of $PM_{2.5}$ in the City in general and the impact of large sources of emissions.

Figure 37 shows that Philadelphia has met the $PM_{2.5}$ 24-hour standard since 2008. The Design Value of the 24-hour standard which is used to demonstrate attainment, is based on a 3-year average of annual 98th percentile values. Figure 38 shows Philadelphia based on the site 421010047 (CHS) met the annual $PM_{2.5}$ standard for design value period of 2009 - 2011. CHS is one of five $PM_{2.5}$ monitoring sites that historically has experienced the highest $PM_{2.5}$ concentration. The Design Value is based on a 3-year average of annual averages.

Figure 29 - $PM_{2.5}$ Trends

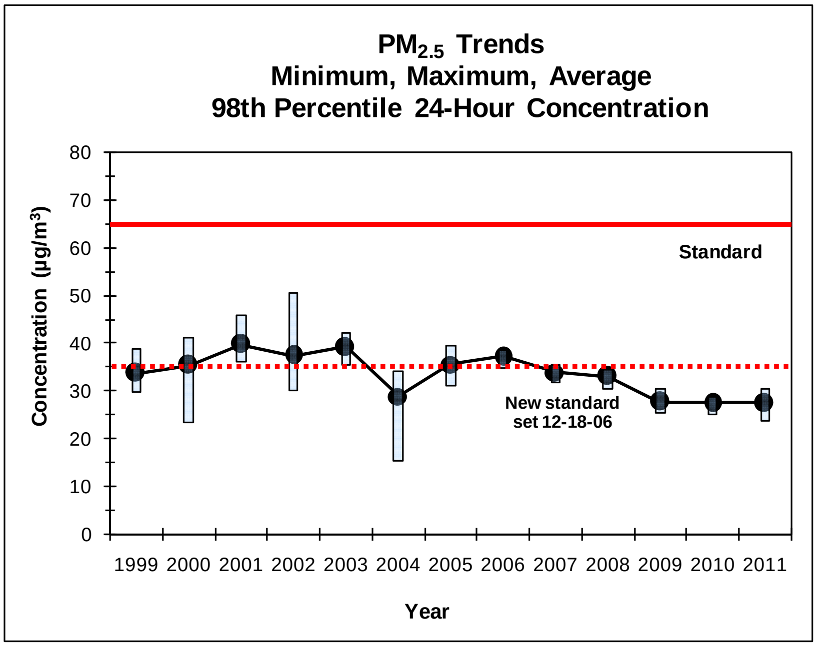
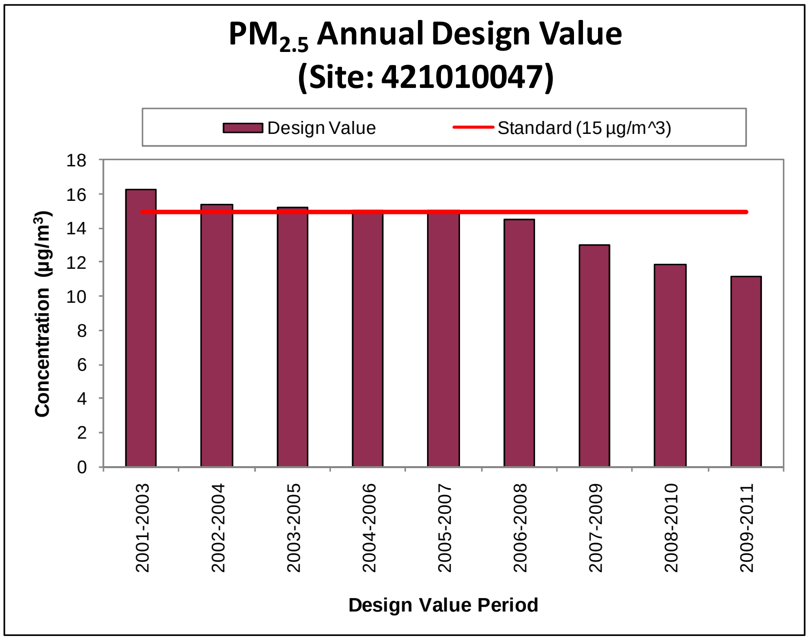


Figure 30 - $PM_{2.5}$ Design Values



Toxics

Air toxics, also referred to as toxic air pollutants or hazardous air pollutants (HAPs), are substances that cause adverse health effects or environmental damage. The Federal Clean Air Act Amendments (CAAA) of 1990 lists 187 pollutants or chemical groups as HAPs. Examples of air toxics include heavy metals (such as beryllium), organic chemicals (such as formaldehyde), polycyclic organic matter (POM, which are formed primarily by combustion), benzene (which is found in gasoline), and pesticides, fine mineral fibers, and asbestos. HAPs are emitted from stationary sources (large industrial facilities), area sources (dry cleaners and household uses), as well as mobile sources (trucks and buses).

The mix of monitor locations provides information on public exposure from major industry, road traffic, and background.

There is less information known about the health impact from the 187 HAPs than there are for criteria pollutants, and no national standards exist for them. However, a number of these pollutants are known or suspected to be carcinogenic, and there is no known "safe concentration." The danger posed by toxics is often referred to in terms of risk. Risk is defined as the likelihood of a negative outcome from a certain level of a specific chemical, or the measure of a chance that health problems will occur. For example, many toxics cause cancer, while others cause respiratory problems, birth defects, neurological or, immune response problems, and other health concerns. Toxics have varying degrees of danger, and some will cause harm with a very small amount of the substance while others require large amounts to have a negative effect. Risk is often expressed as the additional number of deaths that would occur over 70 years (a lifetime) than would have occurred without that ambient concentration of that pollutant. For example, one in a million implies that one person out of every million people would live longer without that amount of that pollutant in the air.

AMS is helping to reduce HAPs in Philadelphia by enforcing Federal, State, and locally mandated programs that limit emissions from stationary and area sources. Many toxic emissions have been reduced by regulations designed to bring Philadelphia into compliance with the NAAQS for Ozone. In addition, Philadelphia enforces the National Emission Standards for Hazardous Air Pollutants (NESHAP), a program to reduce emissions from existing major and area sources, as well as New Source Performance Standards (NSPS), which limit toxic emissions from new sources.

Since diesel emissions are a significant, but not quantified, contributing factor to health risks from toxic emissions, AMS continues working to promote voluntary emissions reductions from diesel vehicles and to bring clean diesel technology to the Philadelphia area. The Philadelphia Diesel Difference Working Group, a coalition of diverse stakeholders whose primary purpose is to reduce the air pollutants associated with diesel-powered engines in the greater Philadelphia area, meets on a monthly basis. The group is currently compiling lists of diesel fleets interested in initiating retrofit or clean fuel projects. The list may help position the Philadelphia area for anticipated Federal funding. More information on this program can be found at http://www.cleanair.org/program/transportation/diesel_campaign.

AMS has historically measured toxic pollutants at the Laboratory (LAB) and more recently at the Community Health Services (CHS), Roxborough (ROX), Ritner (RIT) and PHL Airport (SWA) monitoring sites.

As part of EPA's National Air Toxics Assessment (NATA) activities, the latest, the 2005 NATA, was made available to the public in March 11, 2011. 180 of the 187 Clean Air Act air toxics plus diesel particulate matter were assessed for either lifetime cancer risk or non-cancer hazard due to inhalation. NATA is EPA's ongoing comprehensive evaluation of air toxics in the U.S. These activities include expansion of air toxics monitoring, improving and periodically updating emission inventories, improving national- and local-scale modeling, continued research on health effects and exposures to both ambient and indoor air, and improvement of assessment tools. The goal of NATA is to identify those air toxics which are of greatest potential concern, in terms of contribution to population risk. The results will be used to establish strategies to reduce emissions and these set priorities or programs and the collection of additional air toxics data.

The assessment includes four steps:

- Compiling a national emissions inventory of air toxics emissions from outdoor sources.
- Estimating ambient concentrations of air toxics across the contiguous United States.
- Estimating population exposures across the contiguous United States.
- Characterizing potential public health risk due to inhalation of air toxics including both cancer and non-cancer effects.

The 2005 NATA indicated high health risks in the City. Philadelphia ranked 87th in the country based on average risk. To better understand the air toxic problem and promote actions to reduce the risks caused by these pollutants, the Philadelphia Air Toxic Project was initiated by EPA Region III and Air Management Services to develop a more accurate emission inventory, develop modeling systems, identify sources, identify stakeholders and gather background information so a process can be developed to reduce emissions. Activities associated with the river ports and the airport appear to be a significant source of diesel particulate.

AMS has determined health risks associated with the concentrations of air toxics measured at the City’s air toxic monitoring sites. Annual averages for each of the compounds at each monitoring site were calculated and used to estimate the risk from inhalation exposure to ambient air for cancer and non-cancer health effects.

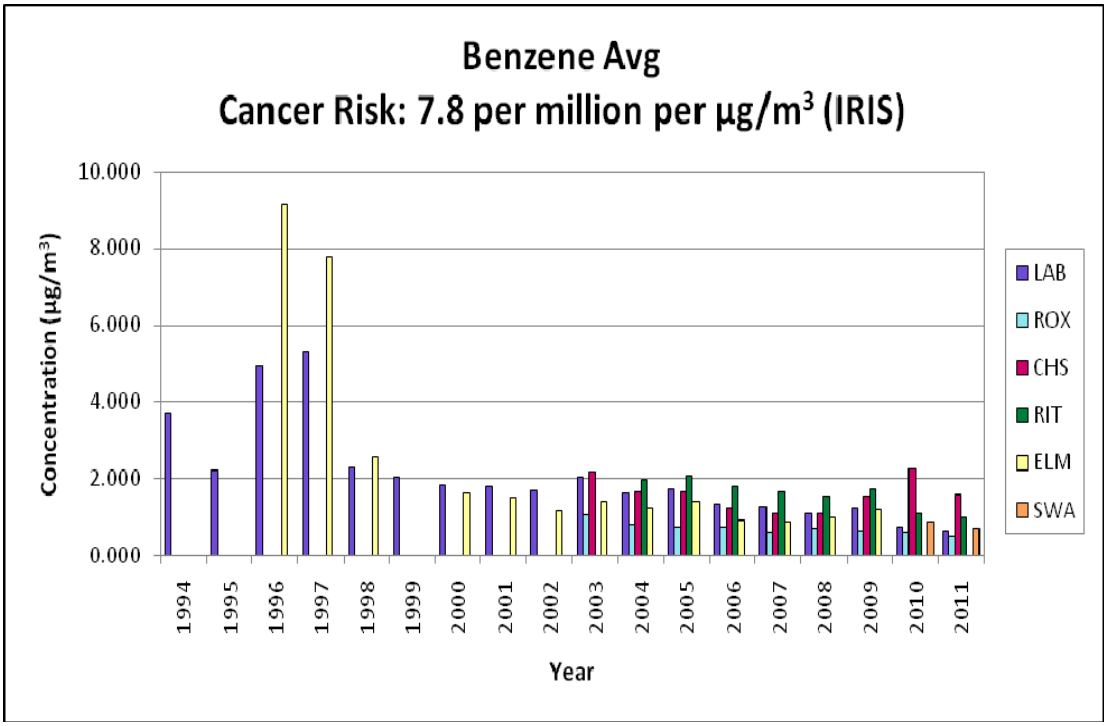
The risk calculation is based upon the standard methodology used by EPA. The excess lifetime cancer risk for each of the chemical compounds was calculated using unit risk factors (URFs). The URF is the measure of the probability of developing cancer from exposure over a lifetime to a specified concentration of a given chemical. Air toxics that are being measured in Philadelphia that show an excess lifetime cancer risk of 1 or more out of a million are:

1,3-butadiene (Cas RN 106-99-0) - A colorless, non-corrosive gas with a mild aromatic or gasoline-like odor, used primarily as a monomer to manufacture many different types of polymers and copolymers.
acetaldehyde (Cas RN 75-07-0) - A colorless liquid or gas with a fruity odor. It is used to manufacture many other chemicals.
benzene (Cas RN 71-43-2) - A colorless liquid with a pleasant odor. It is used mainly in making other chemicals and plastics, as a solvent, and is found in trace amounts of gasoline.

carbon tetrachloride (Cas RN 56-23-5) - A colorless liquid with an ether-like odor. It is used as a solvent and in making fire extinguishers, refrigerants, and aerosols.
formaldehyde (Cas RN 50-00-0) - a colorless, flammable gas that has a distinct, pungent smell. It is used in the production of fertilizer, paper, plywood and urea-formaldehyde resins.
tetrachloroethylene (Cas RN 127-18-4) - A clear liquid with a sweet, chloroform-like odor. It is used in dry cleaning and metal degreasing. Its other common name is perchloroethylene.

Below is a graph of benzene trends over time.

Figure 31 - Benzene Trends



Appendix A: Probe and Monitoring Path Siting Criteria

Below is a summary of the general requirements for probe and monitoring path siting criteria.

Table A.1 - Table E-4 of Appendix E to 40 CFR Part 58 - Summary of Probe and Monitoring Path Siting Criteria

Pollutant	**Scale (maximum monitoring path length, meters**	**Height from ground to probe, inlet or 80% of monitoring path \1**	**Horizontal and vertical distance from supporting structures \2\ to probe, inlet or 90% of monitoring path \1\ (meters)**	**Distance from trees to probe, inlet or 90% of monitoring path \1\ meters**	**Distance from roadways to probe, inlet or monitoring path \1\ (meters)**
SO_2 \3\,\4\,\5\,\6\	Middle (300 m) Neighborhood, Urban and Regional (1 km)	2-15	> 1	> 10	N/A
CO \4\,\5\,\7\	Micro (downtown or street canyon sites, near-road), middle (300 m) Neighborhood (1 km)	2.5-3.5; 2-7; 2-15	> 1	> 10	2-10; downtown areas or street canyon microscale; 50 for near-road microscale; See Table E-2 of 40 CFR 58 Appendix E for middle and neighborhood scales
O_3 \3\,\4\,\5\	Middle (300 m) Neighborhood, Urban, and Regional (1 km)	2-15	> 1	> 10	See Table E-1 of 40 CFR 58 Appendix E for all scales
NO_2 \3\,\4\,\5	Micro (Near-road [50-300]) Middle (300 m) Neighborhood, Urban, and Regional (1 km)	2-7 (micro); 2-15 (all other scales)	> 1	> 10	50 meters for near-road microscale; See Table E-1 of 40 CFR 58 Appendix E for all other scales
O_3 precursors (for PAMS) \3\,\4\,\5\	Neighborhood and Urban (1 km)	2-15	> 1	> 10	See Table E-4 of 40 CFR 58 Appendix E for all scales
PM, Pb \3\,\4\,\5\,\6\,\8\	Micro: Middle, Neighborhood, Urban and Regional	2-7 (micro); 2-7 (middle $PM_{10-2.5}$); 2-15 (all other scales)	> 2 (all scales, horizontal distance only)	> 10 (all scales)	2-10 (micro); See Figure E-1 of 40 CFR 58 for all other scales

N/A_Not applicable.
\1\ Monitoring path for open path analyzers is applicable only to middle or neighborhood scale CO monitoring, middle, neighborhood, urban, and regional scale NO_2 monitoring, and all applicable scales for monitoring SO_2,O_3, and O_3 precursors.
\2\ When probe is located on a rooftop, this separation distance is in reference to walls, parapets, or penthouses located on roof.
\3\ Should be >20 meters from the drip-line of tree(s) and must be 10 meters from the drip-line when the tree(s) act as an obstruction.
\4\ Distance from sampler, probe, or 90% of monitoring path to obstacle, such as a building, must be at least twice the height the obstacle protrudes above the sampler, probe, or monitoring path. Sites not meeting this criterion may be classified as middle scale (see text).
\5\ Must have unrestricted airflow 270 degrees around the probe or sampler; 180 degrees if the probe is on the side of a building or a wall.
\6\ The probe, sampler, or monitoring path should be away from minor sources, such as furnace or incineration flues. The separation distance is dependent on the height of the minor source's emission point (such as a flue), the type of fuel or waste burned, and the quality of the fuel (sulfur, ash, or lead content). This criterion is designed to avoid undue influences from minor sources.
\7\ For microscale CO monitoring sites, the probe must be >10 meters from a street intersection and preferably at a midblock location.
\8\ Collocated monitors must be within 4 meters of each other and at least 2 meters apart for flow rates greater than 200 liters/min or at least 1 meter apart for samplers having flow rates less than 200 liters/min to preclude airflow interference.

Table A.2 - Table E-2 to Appendix E of Part 58. Minimum Separation Distance Between Roadways and Probes or Monitoring Paths for Monitoring Neighborhood Scale Carbon Monoxide

Roadway average daily traffic, vehicles per day	Minimum distance \9\ (meters)
≤10,000	10
15,000	25
20,000	45
30,000	80
40,000	115
50,000	135
≥60,000	150

\9\ Distance from the edge of the nearest traffic lane. The distance for intermediate traffic counts should be interpolated from the table values based on the actual traffic count.

Table A.3 - Table E-1 to Appendix E of Part 58. Minimum Separation Distance Between Roadways and Probes or Monitoring Paths for Monitoring Neighborhood and Urban Scale Ozone (O3) and Oxides of Nitrogen (NO, NO2, NOx, NOy)

Roadway average daily traffic, vehicles per day	Minimum distance \10\ (meters)	Minimum distance \10\,\11 (meters)
≤1,000	10	10
10,000	10	20
15,000	20	30
20,000	30	40
40,000	50	60
70,000	100	100
≥110,000	250	250

\10\ Distance from the edge of the nearest traffic lane. The distance for intermediate traffic counts should be interpolated from the table values based on the actual traffic count.
\11\ Applicable for ozone monitors whose placement has not already been approved as of December 18, 2006.

Values based on the actual traffic count.

Figure A.1 – Figure E-1, 40 Part 58 Appendix E – Distance of PM Samplers to Nearest Traffic Lane (meters)

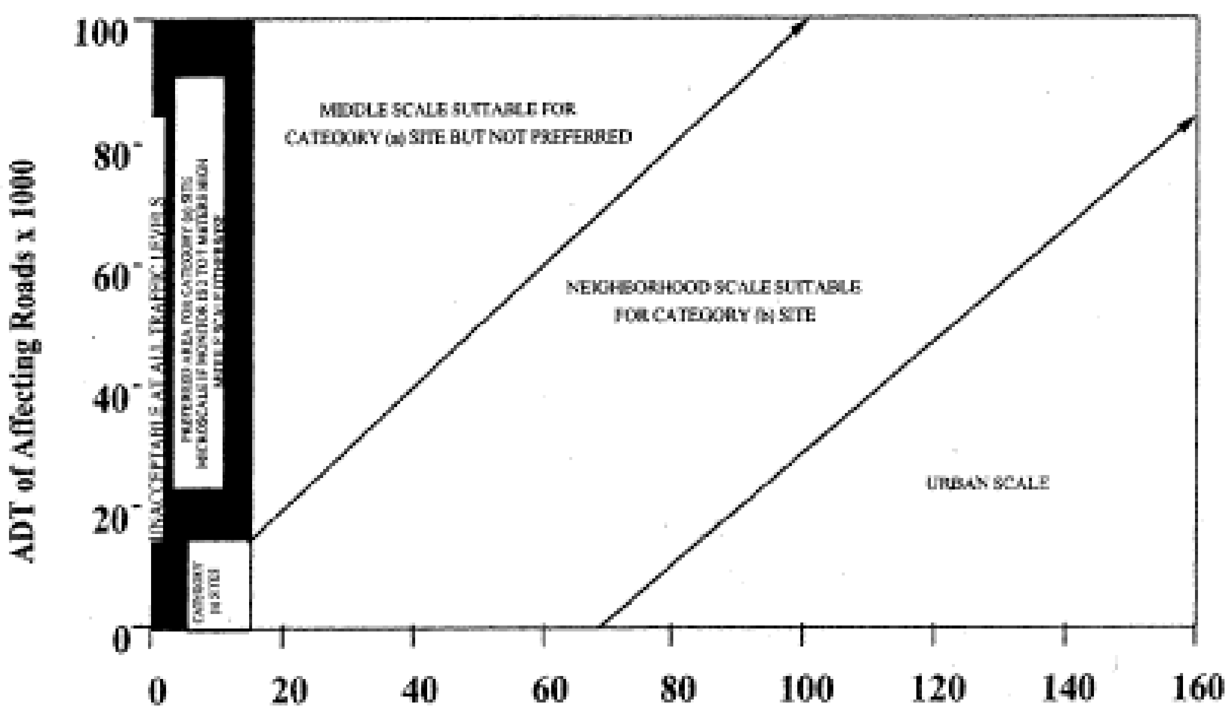


Figure E-1. Distance of PM samplers to nearest traffic lane (meters)

Appendix B: PAC Proposed Site

Table B.1 - Detailed PAC Information

AMS Site

PAC

AQS Site Identification

421010065

Street Address

Washington Ave & S. Columbus Blvd

Geographical Coordinates

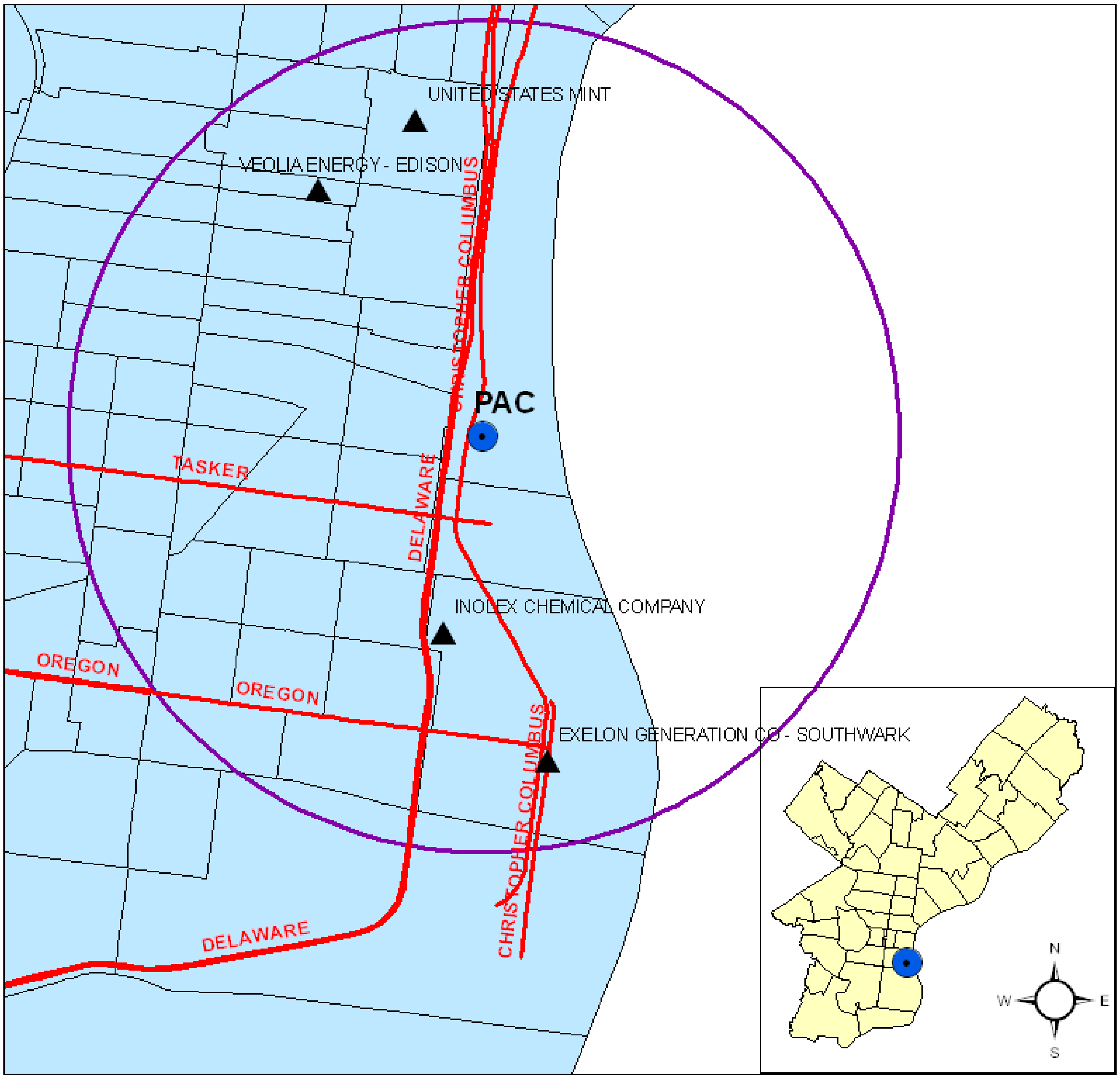
Latitude:
39.93273

Longitude:
-75.142445

Parameter	Sampling Type	Operating Schedule	Collection Method	Analysis Method	Comments	AQS Method	Spatial Scale	Monitoring Objective	Probe Height (m)	Begin Date
PM2.5 FRM	SLAMS	3rd day	R&P PM2.5	Gravimetric	NAAQS Compliance	118	Neighborhood	Population Exposure		
TSP Metals	SLAMS	6th day	Hi-Vol	Atomic Absorption	Analysis by AMS inludes lead, co-located, lead is reported to AQS	92				
Carbonyls	Urban Air Toxics	6th day	DNPH-Coated Cartridges			102				
Toxics	Urban Air Toxics	6th day	Canister Subambient Pressure	Multi-Detector GC		101				
PM10 SSI	SLAMS	6th day	Hi-Vol-SA/GMW-321-B	Gravimetric	Quartz Filter	64				
BaP	Urban Air Toxics	6th day	Hi-Vol	Thin Layer Chromatography	Analysis by Allegheny County, PA	91				

Figure B.1 - PAC Monitoring Site Map with Major Streets and Major Emission Sources

PACKER AVE SITE - WASHINGTON AVE & S. COLUMBUS BLVD
EPA AIRS CODE:421010065



			2010 EMISSIONS (IN TONS/YR)							
PLID	NAME	STREET	CO	NO_2	PB	PM_{10}	$PM_{2.5}$	PT	SO_2	VOC
2059	INOLEX CHEMICAL COMPANY	JACKSON AND SWANSON STS	12.38	14.74	0.00	1.38	0.91	2.15	0.09	6.72
4902	VEOLIA ENERGY - EDISON	908 SANSOM ST	5.20	37.82	0.00	2.02	1.31	2.25	74.21	0.29
4905	EXELON GENERATION CO - SOUTHWARK	2501 S DELAWARE AVE	0.74	5.27	0.00	0.89	0.00	0.89	1.45	0.03
9703	UNITED STATES MINT	151 N INDEPENDENCE MALL EAST	1.76	0.85	0.00	0.06	0.05	0.06	0.02	0.69
		TOTAL	20.09	58.68	0.00	4.35	2.27	5.36	75.77	7.73

Figure B.2 - PAC Aerial View

Appendix C: NEL Shutdown

CITY OF PHILADELPHIA

DEPARTMENT OF PUBLIC HEALTH
Donald F. Schwarz, MD, MPH
Deputy Mayor for Health & Opportunity
Health Commissioner

Nan Feyler, JD, MPH
Chief of Staff

Air Management Services
Thomas Huynh
Director

321 University Avenue, 2nd Floor
Philadelphia, PA 19104

Telephone (215) 685-7584
Fax (215) 685-9451

November 18, 2011

Shawn M. Garvin
Regional Administrator
United States Environmental Protection Agency
Region III
Mail Code 3RA00
1650 Arch Street
Philadelphia, PA 19103-2029

Dear Mr. Garvin:

The City of Philadelphia, Department of Public Health, Air Management Services (AMS) is submitting a request to discontinue the PM_{10} monitor (NEL), with AQS ID 421010649, as of September 1, 2011. The site owner is constructing a 5.5 megawatt co-generation facility that has disrupted the power supply to NEL.

The requirements to discontinue monitoring are documented in 40 CFR Part 58.14(c). NEL meets the criteria established in 40 CFR Part 58.14(c)(1):

> *(1) Any $PM_{2.5}$, O_3, CO, PM_{10}, SO_2, Pb, or NO_2 SLAMS monitor which has shown attainment during the previous five years, that has a probability of less than 10 percent of exceeding 80 percent of the applicable NAAQS during the next three years based on the levels, trends, and variability observed in the past, and which is not specifically required by an attainment plan or maintenance plan. In a nonattainment or maintenance area, if the most recent attainment or maintenance plan adopted by the State and approved by EPA contains a contingency measure to be triggered by an air quality concentration and the monitor to be discontinued is the only SLAMS monitor operating in the nonattainment or maintenance area, the monitor may not be discontinued.*

Table 1 shows NEL is in attainment of the PM_{10} standard for the previous five years and has a probability of less than 10 percent of exceeding 80 percent of the applicable NAAQS. Additionally, AMS has determined that there are no State Implementation Plan related or maintenance plan commitments to run this monitor.

Table 1: NEL summary from 2006 – 2010
(data downloaded from AQS on 11/7/2011)

Site ID	POC	YEAR	Ann Avg (μg/m³)	Sample Count	# days > 120 μg/m³ (80% of standard)	% days > 120 μg/m³ (80% of standard)	#days > 150 μg/m³	Max Daily Value (μg/m³)
0649	1	2006	35.90	41	1	2%	1	162.1
0649	1	2007	26.81	51	0	0%	0	61.4
0649	1	2008	26.62	49	0	0%	0	64.9
0649	1	2009	19.35	57	0	0%	0	80.6
0649	1	2010	25.65	55	1	2%	1	218.7

AMS has contacted Andrew Hass of EPA Region III regarding issues with the NEL monitor. AMS believes that loss of site access/power coupled with a low value monitor that does not affect planning decisions is sufficient for approval for final shut down.

If you have any questions, please contact Thomas Huynh at 215-685-7584 or thomas.huynh@phila.gov.

Sincerely,

Donald Schwarz, MD, MPH,
Health Commissioner

Enclosure

cc: Pauline DeVose, EPA Region III
David Lutz, Data Certification Contact, US EP (D304-06)
Walter Wilkie, EPA Region III
Thomas Huynh, Director, Air Management Services
Ed Braun, Regulatory Services Manager, Air Management Services
Henry Kim, Chief, Program Services, Air Management Services
Kirit Dalal, PADEP Division of Air Quality Monitoring
Arleen Shuman, PADEP Division of Resources Management

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION III
1650 Arch Street
Philadelphia, Pennsylvania 19103-2029

Mr. Thomas Huynh, Director
Air Management Services
321 University Avenue, 2nd Floor
Philadelphia, PA 19104

December 9, 2011

Dear Mr. Huynh,

By letter dated November 18, 2011, the City of Philadelphia, Department of Public Health, Air Management Services (AMS), submitted to the U.S. Environmental Protection Agency – Region III (EPA) a request to discontinue the PM_{10} monitor (NEL) AQS ID# 421010649, as of September 1, 2011.

Certain requirements detailed in the CFR, if met, allow for discontinuation of a monitor. AMS submitted to EPA information showing that the NEL PM_{10} met requirements detailed in 40 CFR Pt. 58, Sec. 58.14(c)(1).

40 CFR Pt. 58, Sec. 58.14(c)(1) states:

(1) Any $PM_{2.5}$, O_3, CO, PM_{10}, SO_2, Pb, or NO_2SLAMS monitor which has shown attainment during the previous five years, that has a probability of less than 10 percent of exceeding 80 percent of the applicable NAAQS during the next three years based on the levels, trends, and variability observed in the past, and which is not specifically required by an attainment plan or maintenance plan. In a nonattainment or maintenance area, if the most recent attainment or maintenance plan adopted by the State and approved by EPA contains a contingency measure to be triggered by an air quality concentration and the monitor to be discontinued is the only SLAMS monitor operating in the nonattainment or maintenance area, the monitor may not be discontinued.

Based on the data presented by AMS, the NEL PM_{10} site meets the requirements of 40 CFR Pt. 58 Sec. 58.14 (c)(1) for discontinuation of a SLAMS monitor. EPA, therefore, approves the discontinuation of the NEL PM_{10} site as requested in the letter dated November 18, 2011.

If you have any questions regarding this approval action, please feel free to contact Mrs. Loretta Hyden, of my air monitoring staff, at 215-814-2113.

Sincerely,

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AIR MANAGEMENT SERVICES
DIRECTOR'S OFFICE

Andrew Hass, Acting Associate Director
Office of Air Monitoring and Analysis

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Appendix D: NO2 Near-Road Monitor

<u>Near-Road NO_2 Monitoring Grant Application</u>
<u>RFP Number:</u>
<u>CDFA Number:</u>

Project Title: Near-Road NO_2 Monitoring
Organization: Air Management Services
Address: 321 University Avenue, 2nd Floor, Philadelphia, PA 19104
Contact: Thomas Huynh
Phone: 215-685-7585
Fax: 215-685-7451
Email: Thomas.Huynh@phila.gov
Total Project Cost: $200,000
Project Period (dates): 3/1/2012 – 2/28/2014
DUNS Number: 834466463

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1. Background

EPA recognized that the combination of increased vehicle-miles-traveled (VMT), which correspond to on-road mobile source emissions, with higher urban population densities can result in an increased potential for exposure and associated risks to human health and welfare. As a result, on February 9, 2010, EPA promulgated (75 FR 6474) new minimum monitoring requirements for the nitrogen dioxide (NO_2) monitoring network in support of a newly revised 1-hour NO_2 National Ambient Air Quality Standard (NAAQS). In this rule, EPA required changes to the monitoring network. State and local air monitoring agencies are required to install near-road NO_2 monitoring stations in larger urban areas where hourly NO_2 concentrations in the near-road environment are believed to be the highest in that urban area. The monitoring network will focus monitoring resources to capture short-term NO_2 concentrations near heavily trafficked roads, to assess area-wide (or community-wide) NO_2 concentrations, and to assess NO_2 concentrations for vulnerable and susceptible populations. State and local air agencies are required to consider traffic volumes, fleet mix, roadway design, traffic congestion patterns, local terrain or topography, and meteorology in the implementation process of any required near-road NO_2 monitor. Monitoring requirements are based upon population levels and a specific traffic metric within Core Based Statistical Areas (CBSAs). State and local ambient air monitoring agencies are required (per 40 CFR Part 58 Appendix D, Section 4.3.2.a) to use the latest available census figures (e.g., census counts and/or estimates) and available traffic data in assessing what may be required of them under this new rule. The NO_2 NAAQS was revised to include a 1-hour standard with a 98th percentile form and a level of 100 ppb, reflecting the maximum allowable NO_2 concentration anywhere in an area, while retaining the annual standard of 53 ppb.

The CBSA in which Philadelphia County is located is the "Philadelphia" CBSA which is comprised of five counties in PA: Philadelphia, Bucks, Chester, Delaware, and Montgomery, four counties in NJ: Burlington, Camden, Gloucester and Salem, one county in DE: New Castle, and one county in MD: Cecil. The Philadelphia CBSA has a population of 5,965,343. The Pennsylvania Department of Environmental Protection serves as the air agency for all counties in PA, except Allegheny County which is served by the Allegheny County Health Department and

Philadelphia, the most populous county in Pennsylvania, which is served by the Philadelphia Department of Public Health, Air Management Services (AMS). AMS is the local air pollution control agency for the City of Philadelphia. AMS is responsible for the prevention, abatement, and control of air pollution and air pollution nuisances, achieving and maintaining federal NAAQS in Philadelphia, and protecting the health and quality of life of the Philadelphia community from the adverse effects of air contaminants and noise. AMS analyzed Annual Average Daily Traffic (AADT) for roadway segments in the entire Philadelphia CBSA, and the highest traffic counts occurred predominantly on roadway segments located in the City of Philadelphia, thus the near-road NO_2 monitor for the Philadelphia CBSA will be located in Philadelphia and will be installed and operated by AMS.

Due to the complexities associated with the implementation of the near-road monitoring component of the recently revised minimum monitoring requirements, the EPA created the Technical Assistance Document (TAD). The TAD has been drafted in a collaborative effort among local, state, and federal air monitoring and transportation agencies to provide a set of recommendations by which required near-road NO_2 stations would be deployed.

2. Scope of Work

In 2010, EPA strengthened the health-based NAAQS for NO_2 by adding a new 1-hour standard. NO_2 is the component of greatest interest and the indicator for the larger group of NO_x, a group of highly reactive gasses. NO_2 forms quickly from emissions from cars, trucks and buses, power plants, and off-road equipment. In addition to contributing to the formation of ground-level ozone, and fine particle pollution, NO_2 is linked to a number of adverse effects on the respiratory system.The new NO_2 standard protects public health by limiting short-term exposures to NO_2 concentrations that could worsen the control of asthma and that have been linked to hospital admissions and emergency room visits for respiratory illnesses, particularly in at-risk populations such as children, the elderly, and asthmatics. The revised NAAQS defines the maximum allowable NO_2 concentration anywhere in an area. Specifically, monitoring studies and modeling efforts indicate that NO_2 concentrations in heavy traffic or near major roadways can be twice as high as concentrations measured away from such roads. With the elevated NO_2 concentrations near major roads and the potential for peak human exposures to occur on or near such roads, and given that the public health protection envisioned under the revised NO_2 NAAQS depends on States monitoring peak 1-hour NO_2 concentrations, the final NO_2 NAAQS requires monitors near major roadways in large urban areas and Philadelphia CBSA is one of them.

The Philadelphia CBSA is the second most populous CBSA following the New York CBSA in Mid-Atlantic Regional States. As an urban area, Philadelphia faces many of the same pollution challenges as other densely populated areas, such as emissions from vehicles and industries. More than 70% of Nitrogen Oxides (NO_x) Emissions in Philadelphia come from mobile sources[1]. Two busy major roadways run through the City: Interstates 76 and 95. There are also several smaller roadways that connect center city and Philadelphia's suburbs, such as US 1, Route 30, Route 63 and Route 73.

[1] http://www.epa.gov/cgi-bin/broker?_service=data&_debug=0&_program=dataprog.state_1.sas&pol=NOX&stfips=42

The first step in deciding on candidate near-road NO_2 monitoring locations as stated in the EPA TAD is to identify the extent to which monitoring requirements apply. In 40 CFR Part 58 Appendix D, the EPA requires state and local air agencies to operate one near-road NO_2 monitor in each CBSA with a population of 500,000 or more persons. CBSAs with 2,500,000 or more persons, or those CBSAs with one or more roadway segments carrying traffic volumes of 250,000 or more vehicles (as measured by AADT counts), shall have two near-road NO_2 monitors within that CBSA. State and local ambient air monitoring agencies are required to use the most up-to-date census information and traffic data in assessing what may be required of them under this rule, per 40 CFR Part 58 Appendix D, Section 4.3.2.a. AMS used the U.S. Census Bureau as the source of its population estimate. Philadelphia's population was 1,526,006[2] based on the 2010 Census data. Based only on population, at least one monitor is required to be installed in Philadelphia County.

The next step in identifying candidate NO_2 near-road monitoring sites is collecting and analyzing traffic data. AMS used the latest traffic data from Pennsylvania Department of Transportation's (PennDOT) Internet Traffic Monitoring System (ITMS) to identify road segments and their traffic volumes in Philadelphia County. Over a two week period, several potential sites were evaluated based on satellite imagery through Google Earth and through site visits. Ten candidate sites are listed on Table 2.1.

Table 2.1 – Ten Candidate Sites

SITE	TRAF. RT. NO	STREET NAME	LOCATION	FE AADT
A	I-95	Delaware Ex	Between Exit 25 (Allegheny Ave/Castor Ave) & I-95 North – Trenton	348412
B	I-95	Delaware Ex	Between Exit 22 (I-676/US 30 - Central Phila/Callowhill St) & Exit 25 (Allegheny Ave/Castor Ave)	296176
C	I-95	Delaware Ex	Between Boundary with Delco & Exit 12 (PA 291 - Cargo City)	257934
D	I-95	Delaware Ex	Between Exit 32 (Academy Rd/ Linden Ave) & Exit 33 (Grant Ave - Boundary with Bucks Co.)	257460
E	I-95	Delaware Ex	Between Exit 17 (PA 611 N.Broad St/Pattison Ave) & Exit 19 (I-76 E - Walt Whitman Br/Packer Ave)	248661
F	I-95	Delaware Ex	Between I-95 North - Trenton & Exit 30 (Cottman Ave/Rhawn St)	231251
G	I-95	Schuylkill Ex	Between Exit 340A (Lincoln Dr/Kelly Dr) & Exit 341 (Montgomery Dr/West River Dr)	225529
H	I-95	Schuylkill Ex	Between Exit 343 (Spring Garden St/Harverford Ave) & Exit 346A (South St)	224503
I	I-95	Delaware Ex	Between Exit 30 (Cottman Ave/Rhawn St) & Exit 32 (Academy Rd/ Linden Ave)	223959
J	I-95	Delaware Ex	Between Exit 13 (to I-76 W/PA 291-Valley Forge/Island Ave) & W. Fort Mifflin Rd	221037

Prior to site visits, ten possible sites were identified, based on Fleet Equivalent (FE) AADT rankings, which accounts for traffic volume and fleet mix. Possible locations were chosen based on the criteria in section 6 of EPA's Near-Road NO_2 Monitoring TAD dealing with physical

[2] http://www.census.gov/popest/metro/metro.html

considerations as shown in Table 2.2. Since there are no road segments that have AADT greater than 250,000, Philadelphia only needs one near-road NO_2 monitor.

Table 2.2 – Physical Considerations for Near-road Candidate Sites

Physical Site Component	Impact on Site Selection	Desirable Attributes	Less Desirable Attributes	Potential Information Source
Roadway design or configuration	Feasibility of monitor placements; affects pollutant transport and dispersion	Near ramps, intersections, lane merge locations/interchanges; at grade with surrounding terrain	Cut-section/below grade; above grade (bridge)	Field reconnaissance; satellite imagery
Roadside Structures	Feasibility of monitor placement; affects pollutant transport and dispersion	No barriers present besides low (<2 min height) safety features such as guardrails	Presence of sound walls, high vegetation, obstructive buildings	Field reconnaissance; satellite imagery
Terrain	Affect pollutant dispersion, local atmospheric stability	Flat or gentle terrain, within a valley, or along road grade	Along mountain ridges or peaks, hillsides, or other naturally windswept areas	Field reconnaissance; digital elevation models and vegetation files; satellite imagery
Meteorology	Affects pollutant transport and dispersion	Relative downwind locations – winds from roads to monitor	Strongly predominant upwind positions	Local data; NOAA/NWS; AQS

Furthermore, sampling network design and monitoring site selection must comply with:

- 40 CFR Part 58, Appendix A - Quality Assurance Requirements for State and Local Air Monitoring Stations (SLAMS)
- 40 CFR Part 58, Appendix D - Network Design for State and Local Air Monitoring Stations (SLAMS) and National Air Monitoring Stations (NAMS), and Photochemical Assessment Monitoring Stations (PAMS)
- 40 CFR Part 58, Appendix E - Probe and Monitoring Path Siting Criteria for Ambient Air Quality Monitoring.

Near-road NO_2 monitoring is classified under the SLAMS network.

After different locations were identified, site visits were conducted to assess each site's potential, advantages and disadvantages. Seven prospective sites were removed due to logistical issues, e.g. safety issues, unavailability of a power source, locations of the sites that are further than required (greater than 20 meters from the outside nearest edge of the roads) and roadside structures. The top three sites that will need to be reviewed further by AMS are located along Interstate I-95 North. They are the PennDot Road Salt Storage Facility (Site A), the Torresdale Train Station (Grant Ave & James St, Site D) and the International Longshoremen Association Memorial Hall (Near I-95 and Packer Ave).

Equipment, supplies, and related services recommended for a permanent near-road monitoring station by EPA and AMS are in Table 2.3 and the budget detail is in Table 2.4.

Table 2.3 – Equipment, Supplies and Related Services (EPA Recommendations and AMS Comments)

	EPA Recommendations	AMS Comments
Air Monitoring Shelter	• Shelter should be large enough for multi-pollutant monitoring • Consider potential future needs for roof-top sampling	• 12' x 114' Shelter-One Mobile Shelter with Air Condition • Including roof railing and vertical steps
Air Sampling Instrumentation	• Federal Reference or Equivalent NO_2 analyzer • Trace-level CO analyzer	• Teledyne NO_2 analyzer model T200 • Teledyne Trace-level CO analyzer model 300E
Meteorological Instrumentation	• 2-D or 3-D Sonic Anemometer (at 10 meters, possibly at 2 meters as well) • Temperature • Relative Humidity	• MET Tower & MET System, Met One Instrument Inc., Model 970895
Data logging hardware, software and supporting documentation	• These items should match up or improve upon a State or locals' existing data acquisition infrastructure	• Computer includes software, data acquisition and wireless modem
Communication equipment and supplies	• Such as broadband or wireless internet access, routers, etc.	• Is included on wireless modem on data logging hardware, software and supporting documentation item
Gas calibration standards	• Such as high-end zero gas generators, calibration systems and plumbing, and gas cylinders	• Calibration Equipment (Calibrator and zero air Generator)
Utility connections	• Including power, telecom, etc	
Safety and Security Equipment	• Such as fencing around site • Possible installation of protective traffic guard rail or barrier	

Table 2.4 – The Budget Detail for Near-Road Monitoring

EQUIPMENT		
NO_2 Analyzer		$11,150
CO Analyzer		$10,200
MET Tower & MET System		$15,200
Manifold, Pump,connectors		$15,000
Calibration Equipment (Calibrator & Zero air generator)		$16,500
Computer Includes software, data acquisition, and wireless modem		$12,000
Racks & Storage		$6,000
Total Equipment		**$86,050**
SUPPLIES		
Shelter, air conditioner		$28,000
Contractor for level the site, construction materials,fencing surround the sites,securing the site		$60,000
Calibration gas for 1 years		$2,000
Replacement Parts/ consumables for 1 years		$3,000
Electrical Supplies, Electrician's tools, Hardware, Screws, Electronic Components		$3,000
Precision Equipment - Handheld Multimeters, Temperature Probes, Pressure Calibrator, etc.		$1,950
Flow calibrator, Temperature calibrator		$3,000
Total Supplies		**$100,950**
CONTRACTUAL		
Annual instrument service and maintenance for 1 year		$3,000
Electrical Service for 1 years		$2,000
Wireless Plan for 1 years		$2,000
Initial Installation		$1,000
Total Contractual		**$8,000**
OTHER		
Total Other		**$5,000**
GRAND TOTAL		**$200,000**

3. Data Analysis

Real time continuous analyzers will be used to collect NO_2 measurements from the near-road monitoring site in accordance with Federal Reference Methods (FRM) or Federal Equivalent Methods (FEM). No physical collection of samples for analytical analysis will be collected for this project. Review of the continuous data will be conducted by the quality assurance (QA) Engineer or QA Staff.

The data compiled is a combination of meteorological and criteria pollutant data. The pollutant concentrations to be measured are CO and NO_2, NO_x, and NO. The meteorological data to be measured are wind speed, wind direction, relativity humidity and ambient temperature. The measurement of the untreated sample provides an NO concentration, while the measurement of the converted sample provides a measurement of the NO_x concentration. Subtracting the NO concentration from the NO_x concentration yields the NO concentration. Periodically, a background measurement is taken to correct the zero offset of the instrument to maintain zero stability.

Data reduction activities aggregate raw data into averages that are required to compare against the NAAQS criteria pollutant limits. These values obtained from reducing these data sets establish whether or not the NAAQS have been exceeded. AMS' field and laboratory personnel and QA engineer, are provided the raw data sets from the instrument download for each monitoring site. These data sets are verified, corrected, and flagged by the appropriate AMS Lab personnel and returned to the data management personnel for updating and archiving.

The appropriate field and/or laboratory personnel or QA engineer monitors and reviews the data sets for invalid flags. If the data are deemed invalid, they are disqualified from the data set, and consequently, not used. Criteria for the quantity of valid data points required within a data set are defined in 40 CFR Part 50, Appendix S. These criteria are adhered to when performing the data reduction operations. The network-provided raw data sets are reduced, yielding the appropriate averaging period values. These results are compared to the NAAQS for the specific criteria pollutants under consideration. Acceptable values are those that do not exceed the established NAAQS values.

Each quarter, AMS will report to AQS the results of all precision, bias, and accuracy tests it has carried out during the previous quarter. The quarterly reports will be submitted consistent with the data reporting requirements specified for air quality data as set forth in 40 CFR Part 58, Appendix A, Section 4. The data reporting requirements of 40 CFR Section 58.16 apply to those stations designated SLAMS or NAMS. Required accuracy and precision data are to be reported on the same schedule as quarterly monitoring data submittals.

The minimum number of samples required for appropriate summary statistics should be taken. At least 75% of the total possible observations must be present before summary statistics are calculated. Tables 3.1 and 3.2 list the monitoring requirements for calculating summary statistics and the monitoring frequency.

Table 3.1: Roadside Monitoring Requirements for Calculating Summary Statistics

Pollutant	Completeness Requirement	Time Frame
CO	75%	Per quarter
NO_2, NO, NOx	75%	Per quarter

Table 3.2: Roadside Monitoring Frequency

Pollutant	Time Frame	Frequency	Monitor Type
CO	Midnight to Midnight	24/7	Continuous
NO_2, NO, NOx	Midnight to Midnight	24/7	Continuous
Wind Speed	Midnight to Midnight	24/7	Continuous
Wind Direction	Midnight to Midnight	24/7	Continuous
Ambient Temperature	Midnight to Midnight	24/7	Continuous
Relative Humidity	Midnight to Midnight	24/7	Continuous

This data will be used to:

- Evaluate compliance with the NAAQS;
- Establish a historical baseline concentration of natural and anthropogenic air pollutants;
- Monitor the current dynamic concentrations of these pollutants;
- Monitor progress made toward meeting national ambient air quality standards;
- Activate emergency control procedures that prevent or alleviate air pollution episodes;
- Provide data, upon which long-term control strategies can be reliably developed;
- Observe pollution trends throughout the region; and
- Provide a database for researching and evaluating effects.

Quality Assurance:

A data quality assessment (DQA) is the statistical analysis of environmental data to determine whether the data meet the assumptions that the Data Quality Objectives (DQOs) and data collection design were developed under and whether the total error in the data is tolerable. Calculations for DQA activities shall follow the requirements and equations identified in 40 CFR Part 58, Appendix A, Section 5. The DQA process is described in detail in the Guidance for the Data Quality Assessment Process, EPA QA/G-9.

<u>Five Steps of the Data Quality Assessment Process</u>

Step 1. Review Data Quality Objectives (DQOs) and Sampling Design - The Data and Modeling Analyst shall review the project's sampling design Data Quality Indicators (DQIs), i.e., precision, bias, comparability, representativeness and completeness, and DQOs to verify that they are still applicable.

Step 2. Conduct Preliminary Data Review - The Data and Modeling Analyst and the Data Management Supervisor shall review the various submitted QA reports to identify any corresponding anomalous conditions. The first phase of the preliminary data review is to review the QA reports. The second phase of the preliminary data review is to calculate basic summary statistics (number of samples, median concentration, standard deviations, maximum concentration, minimum concentration, inter-quartile range), generate graphical presentations of the data and review these summary statistics and graphs.

Additionally, basic histograms or other appropriate graphs such as box plots or CDF plots may be created for each of the primary and QA samplers and for the percent difference at the collocated sites. These graphs will be useful in identifying anomalies and evaluating the normality assumption in the measurement errors.

Step 3. Select the Statistical Test - The Data and Modeling Analyst will determine whether the primary objective of Philadelphia's Ambient Air Quality Monitoring Network, which is compliance with the NAAQS established by the EPA for criteria pollutant concentrations, has been attained for the prior monitoring period

Step 4. Verify the Assumptions of the Statistical Test - The Data and Modeling Analyst, QA Staff, and/or AMS manager shall evaluate the assumptions upon which the DQOs, and the bias and precision (measurement error) assumptions are based.

Steps 5. Draw Conclusions from the Data - Perform the calculations required for the statistical test and document the Inferences drawn as a result of these calculations. If the design is to be used again, evaluate the performance of the sampling design.

Each year, a thorough DQA process will be conducted. For this section, the AMS Lab Administrative Engineer or appropriate AMS Lab (AMSL) Supervisor assumes that the assumptions for developing the DQOs have been met. If not, the AMSL Supervisor must first revisit the impact of the violation on the bias and precision limits determined by the DQO process.

If the conclusion from the DQA process is that each of the ambient air monitors is operating with less than 10% bias and precision, then the field supervisor/ QA Staff may pursue action to reduce the QA/QC burden associated with the monitor. Possible courses of action may include the following:

- **Modifying the QA Monitoring Network** - 40 CFR Part 58 requires that each QA monitor be the same designation as the primary monitor. Once it is demonstrated that the data collected from the network are within tolerable levels of errors, the Administrative Engineer or Administrative Scientist may request that it be allowed to modify these requirements.
- **Data from a collocated network** (Local Program, nearby reporting organizations, national),
- **Data from performance audits** (contracted or NPAP), and QC trails.

Some particular courses of action include:

- **Determining the level of aggregation at which DQOs are violated** - The DQA process tells which monitors are having problems, since the DQOs were developed at the monitor level. Examination of these reports may assist in determining the level at which the DQOs are being violated.
- **Communicating with EPA Region III** - If a violation of the bias and precision DQIs are found, AMS will remain in close contact with EPA for both assistance and for communication.
- **Extensively reviewing quarterly data until DQOs are achieved** - The Administrative Engineer or Administrative Scientist will continue to extensively review the quarterly QA reports and the QC summaries until the bias and precision tolerable limits are attained.

Corrective action measures in the near-road NO_2 monitoring will be taken to ensure the data quality objectives are attained. There is the potential for many types of sampling and measurement system corrective actions. Each approved standard operating procedure details some expected problems and corrective actions needed for a well-run monitoring network.

The data obtained from the electronic evaluation of criteria pollutant concentrations shall be validated and verified utilizing both manual and electronic methods. Specific criteria are employed that identify the range of acceptable data, the minimum and maximum acceptable values, the rate of change of specific values, and other criteria that are indicative of valid qualifying data.

4. Timeline

Projected Timeline for Installation and Operation of the Near Roadway Monitoring Station

Milestones	**Date**
Identify location of monitoring site, considering the required factors prescribed in 40 CFR Part 58 Appendix D, along with the logistics and availability of space at candidate sites – estimated timeframe 1 - 2 months.	2/1/12 – 4/1/12
Complete EPA S103 application for Near Roadway NO2 Monitoring Station.	3/1/12
If necessary, obtain permissions/permits from respective transportation authorities.	5/1/12
Survey site with *Construction Management and General Contractor – estimated timeframe* 1 month.	6/1/12
Purchase equipment for monitoring station – estimated timeframe 1 month from receipt of grant award.	7/1/12
Site prep—installation of building, foundation, fencing, barriers, met tower, utility and phone lines. Installation and conditioning of equipment—estimate 2 weeks from site prep completion.	9/1/12
Official start-up date—estimate one week from installation and conditioning of equipment.	1/1/13

5. EPA Strategic Plan Linkage and Anticipated Outcomes, Outputs and Performance Measures

Pursuant to Section 6(a) of EPA Order 5700.7, "Environmental Results under EPA Assistance Agreements," EPA must link proposed assistance agreements to the Agency's Strategic Plan. EPA also requires that grant applicants and recipients adequately describe environmental outputs and outcomes to be achieved under assistance agreements (see EPA Order 5700.7, Environmental Results under Assistance Agreements, http://www.epa.gov/ogd/grants/award/5700.7.pdf

Linkage to EPA Strategic Plan

This proposal supports Goal 1: Taking Action on Climate Change, and Improving Air Quality; Objective 1.2: Improve Air Quality, of EPA's 2011-2015 Strategic Plan.

Specifically, the proposed activities will protect human health and the environment by focusing on monitoring resources to capture short-term NO_2 concentrations near heavily trafficked roads, to assess area-wide (or community-wide) NO_2 concentrations, and to assess NO_2 concentrations for vulnerable and susceptible populations.

Environmental Results: Anticipated Outcomes, Outputs and Performance Measures:

Outcomes from this project include:

Short-term Outcomes	Long-term Outcomes
• Improved procedures and expertise at AMS in operating monitoring equipment. • Relocated existing NO_2 monitors to other areas in need of study, discontinued redundant NO_2 monitors to save time and money.	• Provides the appropriate public health protection by limiting the higher short-term peak exposure concentrations expected to occur on and near major roadways, as well as the lower short-term exposure concentrations expected to occur away from those roadways. • Provides data that can be used for comparison to the NAAQS and to assess population exposures to those who live, work, play, go to school, or commute within the near-roadway environment. • Provides a clear means to determine whether or not the NAAQS is being met within the near-road environment throughout a particular urban area.

Outputs from this project include:

- Collection of data necessary for determining compliance with the standards as well as to protect public health and the environment.

- Focus of monitoring resources to capture short-term NO_2 concentrations near heavily trafficked roads, to assess area-wide (or community-wide) NO_2 concentrations, and to assess NO_2 concentrations in low-income or minority at-risk communities.

- Gathering of sufficient information from these monitors based on which the Grantee would consider options including proposing changes to the required near-road network as part of the continuing air pollution control program or reconsider the near-road population threshold requirement in a future rulemaking.

- Quarterly progress reports and a Final Report.

Performance Measures

NO_2 sampling is continuous. The data are measured and collected in a real-time manner. The revised NAAQS defines the maximum allowable NO_2 concentration anywhere in an area. Based on the results of this enhanced monitoring, AMS may make recommendations or conduct other interventions to reduce NO_2 emissions from heavy duty vehicle specifically and all motor vehicles generally to promote healthier and cleaner air outdoors.

Programmatic Capability and Past Performance

AMS is responsible for enforcement of the Philadelphia Air Management Code, the Regulations of the Air Pollution Control Board, the Noise and Excessive Vibration Code, and Regulations of the Board of Health. AMS also has authority through EPA and Pennsylvania DEP to enforce state & federal regulations controlling air pollution. In addition to providing engineering, enforcement and laboratory services, AMS also operates a citywide air sampling network to continuously monitor Philadelphia's air for comparison with Federal air quality standards. AMS has more than 70 staff members who are charged with monitoring air quality in the City of Philadelphia and ensuring compliance with the Philadelphia Air Code as well as State and Federal regulations. The agency maintains 11 air monitoring stations across the city, responds to citizen complaints about pollution, noise and odors, and handles permitting and inspection of industrial and residential facilities where pollution may arise.

Since the City of Philadelphia first established air pollution control measures in 1948, there has been significant progress toward improving the quality of air in the City. AMS has been an important part of that effort by enforcing local, state and federal regulations, by monitoring and analyzing levels of air pollution, and by collaborating with its partners on compulsory and voluntary measures across the region. Our staff members possess extensive technical expertise in fields related to air quality tracking, analysis and modeling. For more information on AMS, please visit our website at: http://www.phila.gov/health/airmanagement/.

Grants Received from EPA by AMS:

Grants received from EPA by AMS have successfully generated significant benefits during the past three years. Outcomes include increased compliance with air quality regulations and public health benefits. Outputs include the following:

In Fiscal Year 2010, 375,932 air samples were taken, 45 violations were issued to major facilities, 2,358 asbestos inspections were conducted, and 1,480 citizen complaints were serviced.

In Fiscal Year 2009, 360,658 air samples were taken, 58 violations were issued to major facilities, 2,956 asbestos inspections were conducted, and 1,234 citizen complaints were serviced.

In Fiscal Year 2008, 408,501 air samples were taken, 51 violations were issued to major facilities, 3,365 asbestos inspections were conducted, and 1,222 citizen complaints were serviced.

As part of AMS Section 103 and 105 commitments, the AMS Voluntary Programs Coordinator also sends quarterly reports to EPA on the number and status of known diesel retrofit projects, both public and private, within the City of Philadelphia. Reports include the number of vehicles retrofitted, the type of technology used, and an estimate of emissions reduces by the retrofits based on vehicle miles traveled. This reporting mechanism was initiated in fall of 2005 and the first report was submitted by the reporting deadline of December 31, 2005. Subsequent reports have been submitted on time. Reporting is now done on a semiannual basis. AMS is currently in good standing with all grant commitments, including those to EPA. Grants from EPA that were managed during the period January 2008 – December 2011 include:

Project Title: Air Pollution Control Program
Received by AMS: 2008-2012 (Most recent: Oct. 1, 2010 – Sept. 30, 2012)
Funding Agency: EPA, Agreement # A-00304511
Reporting frequency: Various reports are sent on a monthly, quarterly, and semiannual basis
CDFA number: 66.001 (Section 105 of the Clean Air Act)

AMS receives Air Pollution Control Program funding to support several major goals: Achieving attainment and maintenance with NAAQS for the six criteria pollutants (ozone, particulate matter, carbon monoxide, lead, sulfur dioxide and nitrogen dioxide), meeting visibility goals, reducing or eliminating risks to human health from toxic air contaminants, and mitigating the effects of air pollution on the environment, particularly to the City's land, buildings and waterways which can be damaged by acid rain. AMS activities funded by this grant include monitoring, data analysis, attainment plan development, and other functions that address multiple pollutant, cross-media, interstate, trans-boundary as well as traditional local air quality concerns.

AMS tracks the six criteria pollutants as well as approximately 51 air toxics and a number of other pollutants. There are numerous outputs and activities generated by this grant. Reports are

submitted that track the city's outreach and inter-agency collaboration, progress on regulatory and attainment-related measures such as State Implementation Plan revision, and voluntary programs such as those that reduce diesel emissions. Air monitoring and analysis activities are also supported by this grant, and data and planning documents are submitted to EPA and PADEP periodically. These include emissions inventories for criteria pollutants and air toxics. AMS participates in a number of workshops and training events related to these activities each year. Finally, AMS reports to EPA's central databases on permitting, compliance and enforcement activities for emissions sources as well as air monitoring within the City of Philadelphia as part of this grant.
All reports for this Section 105 grant have been submitted in a timely fashion and AMS is meeting guidelines established by EPA for carrying out grant functions.

Project Title: National Air Toxics Trend Site Grant (NATTS)
Received by AMS: 2008-2012 (Most recently Jul. 1, 2011 – Jun. 30, 2012)
Funding Agency: EPA, Agreement # XA-97333003
Reporting frequency: Quarterly
CDFA number: 66.034 (Section 103 of the Clean Air Act)

The NATTS laboratory network is a system designed to help EPA track and evaluate trends in high-risk air contaminants, particularly six priority pollutants: formaldehyde, arsenic, hexavalent chromium, benzene, 1,3 butadiene, and acrolein. Light absorbing carbon is also tracked at these sites. Air Management Services supports the network by conducting laboratory analysis that assists in examining health effects on the public. NATTS is funded under Section 103 of the Clean Air Act.

AMS is up to date in its submission of reports related to the NATTS grant.

Project Title: $PM_{2.5}$ Ambient Air Monitoring Program
Received by AMS: 2009-2012 (Most recent Apr. 1, 2011 – March 31, 2012)
Funding Agency: EPA, Agreement #PM-97311802
Reporting frequency: Data is updated periodically and email confirmations are sent to EPA central database system accordingly.
CDFA number: 66.034 (Section 103 of the Clean Air Act)

The $PM_{2.5}$ Ambient Air Monitoring Program is intended to track the region's progress toward achieving attainment with Clean Air Act standards for fine particulates. National Ambient Air Quality Standards for $PM_{2.5}$ were enacted in 1997 to help reduce human exposure to fine particulates, which can be inhaled deep into the lungs and can exacerbate health problems such as asthma. Funds have been used to upgrade and maintain the City's monitoring system for particulate matter. Notably, the grant has helped to purchase continuous monitors and to replace non-continuous ones. EPA has also provided in-kind contributions under this grant in the form of supplies (e.g. filters) and laboratory services. AMS submits data generated by this monitoring system periodically, and is up to date on all submissions. The $PM_{2.5}$ Ambient Air Monitoring Program falls under Section 103 of the Clean Air Act.

AMS is up to date in its submission of reports related to the $PM_{2.5}$ grant.

Staff Expertise/Qualifications

Staff members involved in this project have extensive experience in installing and maintaining sophisticated air pollution monitoring equipment as well as quality assuring the data produced. Lab Engineering Supervisor Paresh Mehta and Administrative Chemist Philipose Cheriyan will be responsible for the installation and maintenance of the equipment, as well as data collection activities. Program Services Chief Henry Kim will coordinate the data analysis and will compile reports to EPA to track progress in implementation of the project. Air Director Thomas Huynh will oversee all activities to ensure that all project milestones are achieved. Mr. Huynh has successfully managed numerous projects related to air programs for many years and frequently communicates with community members regarding the quality of Philadelphia's air.

Quality Assurance Project Plan (QAPP)

City of Philadelphia Air Management Services (AMS) - South Philadelphia Community Continuous Air Toxics (SPCCAT) Monitoring Project

Open Path Analyzers for Air Toxics and Hydrogen Fluoride

February 22, 2012

Prepared for: Kia Hence,
United States (US) Environmental Protection Agency (EPA) Region III

Submitted by: Dennis Sosna, Administrative Scientist
Paresh Mehta, Administrative Engineer

Prepared by: Maryjoy Ulatowski, Environmental Engineer

City of Philadelphia
Department of Public Health
Air Management Services Laboratory (AMSL)
1501 E. Lycoming St.
Philadelphia, PA 19124

ACRONYMS AND ABBREVIATIONS

ATMP	Air Toxics Monitoring Program
AMS	City of Philadelphia Air Management Services
AMSL	City of Philadelphia Air Management Services Laboratory
CAA	Clean Air Act
CFR	Code of Federal Regulations
CHS	Community Health Services, AMS Monitoring Site
DQA	Data Quality Assessment
DQOs	Data Quality Objectives
EDO	Environmental Data Operation
EPA	Environmental Protection Agency
GC/MS	Gas Chromatography/Mass Spectrometry
HAP(s)	Hazardous Air Pollutant(s)
HF	Hydrogen Fluoride
LAB	Laboratory, AMS Monitoring Site
MDL	Method Detection Limit
MQO	Measurement Quality Objectives
MSR	Management Systems Review
NAAQS	National Ambient Air Quality Standards
NATA	National Air Toxics Assessment
NATTS	National Air Toxics Trends Station
OAQPS	Office of Air Quality Planning and Standards
ppbv	Parts Per Billion Volume
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QC	Quality Control
RIT	Ritner, AMS Monitoring Site
ROX	Roxborough, AMS Monitoring Site
SIP	State Implementation Plan
SLAMS	State and Local Air Monitoring Stations
SPCCAT	South Philadelphia Community Continuous Air Monitoring Project
SOP	Standard Operating Procedures
SWA	Southwest Airport (Philadelphia), AMS Monitoring Site
TDLAS	Tuneable Diode Laser Absorption Spectroscopy
UATS	Urban Air Toxics Strategy
UV-DOAS	Ultraviolet Differential Optical absorption Spectroscopy
VOC	Volatile Organic Compound

A1. QAPP Identification and Approval

Title: ***South Philadelphia Community Continuous Air Toxics Monitoring Project, Open Path Analyzers for Toxics and Hydrogen Fluoride***

The attached QAPP for the South Philadelphia Continuous Open Path Air Monitoring Project is recommended for approval and binds the City of Philadelphia Air Management Services (AMS) to the following specifics described within:

City of Philadelphia Air Management Services (AMS)

Signature: ______________________ Date: 2/21/2012
AMS Program Director

Signature: ______________________ Date: 2/21/2012
AMS EPA Grant Administrator

Signature: ______________________ Date: 2/1/2012
AMSL Administrative Scientist

Signature: ______________________ Date: 2/1/2012
AMSL Administrative Engineer

Signature: ______________________ Date: 2/1/2012
AMSL Quality Assurance Engineer

EPA Region III

Signature: ______________________ Date ____________
Grants Manager

Signature: ______________________ Date ____________
QA Officer - Air Monitoring Branch

Signature: ______________________ Date: ____________
Technical Lead - Air Monitoring Branch

A2. Table of Contents

A2.1 LIST OF TABLES and FIGURES

A3. Distribution List

A hardcopy or an electronic copy of this QAPP has been distributed to the individuals in Table A3.0-1. For AMSL personnel, this QAPP can be located at I:\QA\QAPPs.

TABLE A3.0-1: DISTRIBUTION LIST

Name	Title	Division /Branch	Contact Information Phone No. And Email
Philadelphia Air Management Services (AMS)			
Thomas Huynh	Program Director	AMS-Administration	Phone: 215-685-7584 Email: Thomas.Huynh@phila.gov
Dennis Sosna	Administrative Scientist	AMSL	Phone: 215-685-1051 Email: Dennis.Sosna @phila.gov
Henry Kim	Administrative Engineer	AMS-Program Services	Phone: 215-685-9439 Email: Henry.Kim@phila.gov
Paresh Mehta	Administrative Engineer	AMSL	Phone: 215-685-1052 Email: Paresh.Mehta@phila.gov
Philipose Cheriyan	Analytical Chemist / Calibration Supervisor	AMSL	Phone: 215-685-1053 Email: Philipose.Cheriyan@phila.gov
Hallie Weiss	Engineering Supervisor	AMS-Program Services	Phone: 215-685-9436 Email: Hallie.Weiss@phila.gov
Maryjoy Ulatowski	Quality Assurance Engineer	AMSL	Phone: 215-685-1067 Email: Maryjoy.Ulatowski@phila.gov
Environmental Protection Agency (EPA) Region III			
Andrew Hass	EPA Region III Project Manager	Air	Email: Hass.Andrew@epa.gov
Kia Hence	EPA Region III Quality Assurance	Air/QA	Email: Hence.Kia@epa.gov
Jim Afghani	EPA Region III		Email: Afghani.James@epa.gov

A4. Project / Task Description

A4.1 Roles and Responsibilities

In Spring 2011, EPA announced the availability of funds and solicited applications for projects designed to assist state, local and tribal communities in the following:

(1) Identifying and profiling air toxic sources;
(2) Characterizing the degree and extent of local-scale air toxics problems;
(3) Tracking progress of air reduction activities; and
(4) Assessing emerging measurements methods.

The grant announcement can be found on EPA's website at http://www.epa.gov/air/grants/rfp-epa-oar-oaqps-11-05.pdf. In May 2011, Philadelphia AMS submitted a grant proposal titled *South Philadelphia Continuous Air Toxics (SPCCAT) Monitoring Project* to EPA. This QAPP is developed for the SPCCAT Monitoring Project and for clarification purposes it is hereby termed the "Project" for the remainder of this QAPP. This section will detail each Project member's roles and responsibilities.

4A.1.a Office of Air Quality Planning and Standards (OAQPS)

The OAQPS is the organization charged under the authority of the Clean Air Act (CAA) to protect and enhance the quality of the nation's air resources. The OAQPS sets standards for pollutants considered harmful to public health or welfare in cooperation with EPA's Regional Offices and the States. The OAQPS enforces compliance with the standards through state implementation plans (SIPs) and regulations controlling emissions from stationary sources. The OAQPS evaluates the need to regulate potential air pollutants, and develops national standards; works with State, Local and Tribal (S/L/T) agencies to develop plans for meeting these standards. The OAQPS will provide the funding for this Project.

A4.1.b EPA Region III Office

EPA Regional Offices have been developed to address environmental issues related to the states within their jurisdiction and to administer and oversee regulatory and congressionally mandated programs. The major quality assurance responsibilities of EPA's Region III, in regards to this Project will be coordination of quality assurance matters with AMS. The main duties of EPA Region III for this Project will be reviewing and approving the Project QAPP submitted by AMS.

A4.1.c City of Philadelphia Air Management Services

The City of Philadelphia, Department of Public Health, Air Management Services (AMS) is the local air pollution control agency in Philadelphia. AMS monitors air pollutants and enforces city, state and federal air quality standards. AMS is organized into seven (7) units; (1) Administration; (2) Asbestos Control; (3) Facility Compliance and Enforcement; (4) Grants and Voluntary Programs; (5) Source Registration; (6) Program Services; and (7) Air Management Services Laboratory (AMSL). Table 4.1-1 lists a brief description of the responsibilities of each unit within AMS. The AMSL is the unit mainly responsible for the Ambient Air Monitoring Program in Philadelphia.

TABLE A4.1-1: AMS–UNITS DESCRIPTION

AMS Unit	Unit Description
Administration	The Administration Unit provides centralized administrative and organizational support related to the development, allocation and management of agency funding, personnel, and other program resources.
Asbestos Control	The Asbestos Control Unit is responsible for enforcing the federal, state and local laws and regulations, which control emissions of asbestos and regulate the asbestos abatement industry.
Facility Compliance and Enforcement	The Facility Compliance and Enforcement (FC&E) Unit is responsible for assuring compliance with local, state and federal air pollution laws and regulations, and the local noise and vibration code and regulations.
Grants and Voluntary Programs	The Grants and Voluntary Programs Unit oversees non-regulatory programs related to air quality and sustainability.
Source Registration	The Source Registration Unit is responsible for issuing construction and operating permits as well as operating licenses to install or operate equipment that emits or controls air pollution.
Program Services	The Program Services Unit provides coordination of projects and the emissions inventory process. Staffs provide modeling analyses to assist with permit application evaluations and develop database reports, as needed, using Crystal Reports and Microsoft Excel.
Laboratory	The Laboratory Unit, AMSL, is responsible for monitoring the Philadelphia's ambient air quality. AMSL analyzes samples for pollutants of concern under city, state, and federal air regulations. AMSL has been in operation since 1964.

The major responsibility of the AMSL is the implementation of a satisfactory monitoring program, for the Project. The monitoring will include implementation of proper quality assurance tasks as well as reporting data. AMS will implement quality assurance programs in all phases of the environmental data operation (EDO), including field and laboratory operations used to obtain the data. An EDO is defined as work performed to obtain, use, or report information pertaining to environmental processes or conditions.

Figure A4.1-1 represents the organizational task structure for the Project. Table A4.1-2 represents the duties and responsibilities of each AMS Personnel involved in the project.

FIGURE A4.1-1: SPCCAT OPEN PATH MONITORING PROJECT ORGANIZATIONAL TASK STRUCTURE

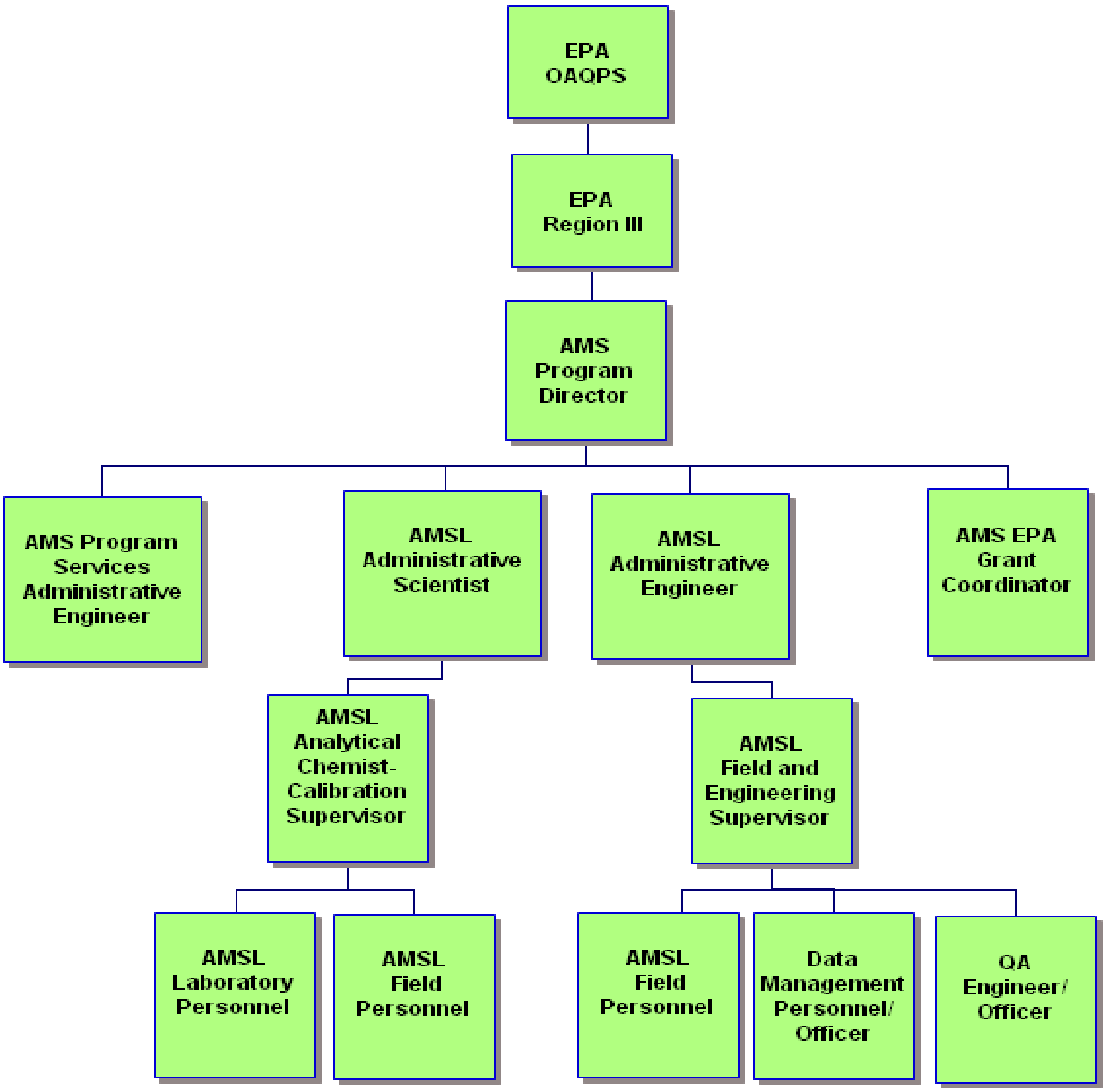


TABLE A4.1-2: AMS–PROJECT ROLES AND RESPONSIBILITIES

Position	Main Duties and Responsibilities:
AMS Program Director	• Oversees all activities to ensure that all Project milestones are achieved; • Reviews and approves QAPP prior to submission to EPA.
AMS EPA Grant Administrator	• Oversees and approves the grant budget; • Reviews and Approves the QAPP.
AMSL Administrative Scientist	• Reviews and approves QAPP prior to submission to EPA; • Maintains an active line of communication with AMS Program Director and AMSL.
AMSL Administrative Engineer	• Manages the installation of the monitoring equipment; • Approves the project budget and planning process; • Reviews and approves the QAPP for project; • Maintains an active line of communication with the QA and Analytical Chemist-Calibration Supervisor or AMS Laboratory Administrative Scientist; • Certifies the data collected and submitted to EPA conforms to all QA policies.
Data Management Officer or Personnel	• Ensures that project data and information collected are properly captured, stored, transmitted and validated for use by program participants; • Develops and implements local data and management standard operating procedures (SOPs); • Ensures that data activities are completed within established time frames; • Follows good automated data processes; • Coordinates the development of the data management system with data users; • Ensures the adherence to the QAPP where applicable; • Ensures access to data for timely reporting and interpretation processes; • Reviews data and status information to determine data validity using established procedures.

TABLE A4.1-2: AMS–PROJECT ROLES AND RESPONSIBILITIES (CONTINUED)

Position	Main Duties and Responsibilities:
AMS Program Services Administrative Engineer	• Coordinates the data analysis; • Compiles reports to EPA to track progress in implementation of the project.
QA Staff - Quality Assurance Engineer and/or Supervisor	• Ensures the QA of the project; • Understands EPA monitoring and QA regulations and guidance, and ensures that lab personnel understand and follow these regulations and guidance; • Writes, develops, and implementing the Project QAPP; • Writes and modifies Standard Operating Procedures (SOPs); • Ensures that technical personnel follow the project QAPP; • Verifies that all required QA activities are performed and that measurement quality standards are met as required in the QAPP; • Updates the Project QAPP, as necessary, to keep it current.
AMSL Field and Engineering Supervisor	• Participates in the development and implementation of the QAPP; • Manages the installation of the monitoring equipment; • Ensures that technical personnel follow the project QAPP and appropriate SOPs; • Ensures timely follow-up and corrective actions resulting from evaluation activities; • Assures that AMSL develops and maintains a current quality system; • Assures AMSL develops and maintains a current QAPP and ensures adherence to the document by AMSL personnel.
Analytical Chemist-Calibration Supervisor	• Participates in the development and implementation of the QAPP; • Oversees all analytical laboratory activities associated with the project; • Writes and modifies the Standard Operating Procedures (SOPs); • Reports all problems to the QA Officer/Engineer; • Ensures all laboratory personnel follow the analytical portion of the QAPP and related SOP's; • Ensures timely follow-up and corrective actions resulting from evaluation activities.
Laboratory and Field Personnel	• Participates in training and certification activities; • Performs and documents preventive maintenance; • Documents deviations from established procedures and methods; • Documents deviations from established procedures and methods; • Reports all problems and corrective actions to the unit supervisor; • Assesses and reports data quality; • Flags suspect data; • Maintains chain-of-custody records in the field; • Maintains logbooks of the QA/QC activities and equipment preventive maintenance logs.

A5. Problem Definition / Background

A5.1 Problem Statement and Purpose

The goals for this Project are to:

(1) Profile the air toxics listed in Table A5.3 from a site in the vicinity of major refinery and/or industrial area using two continuous open path analyzers;
(2) Assess the degree and extent to which air toxics impact the immediate community and in assess human exposure to air toxics;
(3) Assess the effectiveness of the CEREX-UV DOAS Analyzer as a continuous monitor for air toxics;
(4) Assess the effectiveness of the SPECTRA-1 DTL Analyzer as a continuous monitor for Hydrogen Fluoride (HF).

This Project will help AMS assess the degree and extent to which air toxics from a major oil refinery and other manufacturing activities impact the immediate community. While the NATTS program is intended to gather and assess priority HAPs on a national scale, this project will help AMS assess HAPs in a local community with the highest air toxic risks.

Currently, AMS measures air toxics pollutant in the proximity of the refinery at 24^{th} and Ritner (RIT) by based on a 6^{th} day collection operation scheduled by Canister Subambient Pressure (EPA Method TO-15). One disadvantage of the canister sampling is the amount of time to obtain the results and limited sample holding times. Canister sampling does not allow for real time data measurement. The neighborhood at 24^{th} and Passyunk is located near a refinery and in 2010; the refinery has experienced various operational issues such as fires and other accidental releases of chemicals. One main concern in the community is the potential release of HF gas from the refinery. As part of this project, AMS will continuously monitor HF. Currently AMS does not continuously monitor HF. By continuously monitoring HF, AMS will be in a position to quickly take appropriate actions to protect the community in an event there is a release of the HF from the refinery. In a community close to a major refinery source, where the potential release of air toxics is the highest, continuous monitoring equipment that will allow AMS to help assess human exposure to air toxic quickly would be helpful.

With the funds received, AMS would like to purchase the Cerex Ultraviolet Differential Optical Absorption Spectroscopy (UV DOAS) and Cerex SPECTRA-1 DTL Analyzer. The two open path monitors will allow AMS to continuously monitor toxic air pollutants such as benzene and HF and AMS would be in a better position to quickly take the appropriate actions to protect the community.

During the course of this project, AMS will also look to improve measurement techniques and identify any localized air toxics problems. The Project will also help AMS evaluate the open path monitoring method.

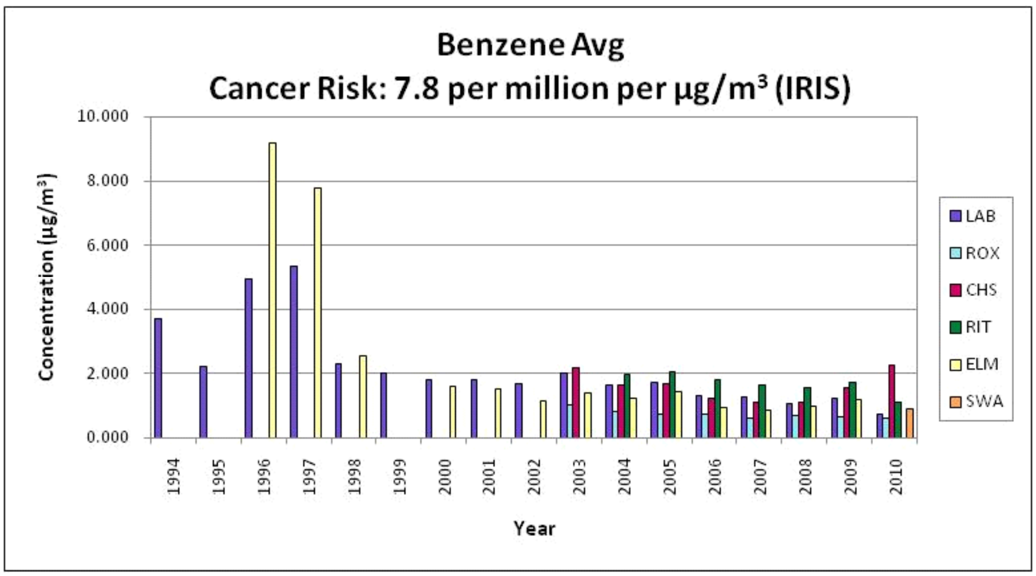
A5.2 Background

The community surrounding the Sunoco Oil Refinery, located at 3144 Passyunk Avenue in Philadelphia, PA (19145), has long been concerned about the possible impacts of exposure to air toxics. AMS has ongoing concerns about the environmental justice implications of the heavy industrial activities that may be impacting the community because this neighborhood has high poverty rates, lower-than average education levels, and a large at-risk population. Philadelphia was rated the second worst City in the U.S. for Asthma in 2007 by the Asthma and Allergy Foundation of America, and asthma impacts more than one in five children in Philadelphia.[1]

The 2005 National Air Toxic Assessment (NATA) indicated high health risks in Philadelphia. Air toxics in Philadelphia that show an excess lifetime cancer risk of greater than one in a million are: formaldehyde, benzene, acetaldehyde, 1,3-butadiene, carbon tetrachloride, naphthalene, chromium compounds, arsenic compounds, Polycyclic Aromatic Hydrocarbons/ Polycyclic Organic Matter (PAH/POM), perchloroethylene, and ethylene oxide. Philadelphia shows a total cancer risk of 58 in a million and is ranked 87th out of 3222 counties in the nation.

As show in the Figure A5.2-1 below, AMS's Ritner Monitoring Site (RIT) has been reading high levels of benzene since 2004. Benzene is a known carcinogen.

FIGURE A5.2-1: AVERAGE BENZENE CONCENTRATIONS IN PHILADELPHIA



These compounds measured by the AMSL showed an excess lifetime cancer risk of greater than one in a million in 2010 at RIT: 1,1,2,2-Tetrachloroethane, 1,2-Dibromoethane, 1,2-Dichloroethane, 1,3-Butadiene, 1,4-Dichlorobenzene, Acrylonitrile, Benzene, Carbon tetrachloride, Chloroform, Chloromethane, and Tetrachloroethylene.

[1] http://www.pediatricasthma.org/community_coalitions/philadelphia

The oil refinery is one (1) of approximately fifty (50) in the United States that uses hydrofluoric acid as a catalyst in making gasoline. Hydrofluoric acid, if released to the atmosphere, becomes HF gas. HF gas is of great concern to the surrounding community due to its highly toxic characteristics.

Currently, AMS measures toxic pollutants at five monitoring sites:
(1) AMS Laboratory (LAB);
(2) Community Health Services (CHS);
(3) Roxborough (ROX);
(4) Ritner (RIT); and
(5) Philadelphia International Airport /Southwest Airport (SWA).

The closest site to the refinery that measures air toxics is the RIT Site located at 24th and Ritner, (Latitude: 39.922517, Longitude: -75.186783); however, the air toxics operating sample schedule currently is every 6th day collected by Canister Subambient Pressure and analyzed by Multi-Detector GC. RIT is the only AMS monitor in zip code 19145. AMS does not currently have a monitor to measure air toxics continuously.

AMS needs to determine if there is indeed a need for concern from the immediate community and be able to take corrective action and communicate to citizens. In order to do this, AMS would like to purchase the Cerex UV Sentry DOAS air monitoring system and the Cerex SPECTRA-1 TDL, both of which are designed for continuous operation. The monitors will provide the capability to measure in real-time process releases and other temporal events that can be communicated to the community and industry.

As part of this project, AMS will try to correlate the continuous data with the 24-hr batch sampling that is currently being done on a once every 6th day schedule at the RIT site. The results of this study could lead to the continuous method of measurement being more widely utilized and the possible replacement of the batch sampling method.

A5.3 List of Pollutants

Table A5.3-1 is a list of the pollutants of interest

TABLE A5.3-1: LIST OF POLLUTANTS

Pollutant
1,3 Butadiene (C_4H_6)
Acetaldehyde (C_2H_4O)
Benzene (C_6H_6)
Ethyl Benzene (C_8H_{10})
Formaldehyde (CH_20)
Hydrogen Fluoride (HF)
Styrene (C_8H_8)
Trimethylbenzene (C_9H_{12})
Toluene ($C_6H_5CH_3$)
o-Xylene, m-Xylene, p-Xylene (C_8H_{10})

A5.4 Location of Interest

The monitoring equipment purchased under this project will be installed in South Philadelphia near a heavily industrial area, home to a major oil refinery as well as other manufacturing facilities. In site selection, the following criteria are to be considered:

(1) Known pollutant emission category and sources (area and point) impacts on the local air quality;
(2) Population density and environmental justice impacts;
(3) Economics, security, safety, and logistics;
(4) Atmospheric considerations and topography.

The site selection criteria are discussed in details in Section B1.4.b. Taking the site selection criteria into consideration as mention above; AMS has identified the following potential site to conduct the open path monitoring:

Philadelphia Housing Authority
3100 Penrose Ferry Rd.
Philadelphia, PA 19145

An alternative site in the vicinity may be chosen if for any reason AMS is not able to secure the site for sampling. From the selected site, AMS will be able to effectively monitor ambient concentrations of HAPs from industrial sources near neighboring residences.

A6. Project Task Description and Schedule

A6.1 Description of the Work to be performed

The measurement goal of the Project is to estimate the concentration, in units of parts per billion by volume (ppbv), of the air toxic compounds listed in Table A3.1 with a continuous open path analyzer.

Funding will be used to purchase the Cerex UV Sentry DOAS air monitoring system and Cerex SPECTRA-1 TDL gas analyzer. The two (2) year project will involve intensive sampling at the proposed site. The continuous data and trends obtained from the continuous analyzers will then be reported and public health risk will be analyzed to determine human exposure and health risks to air toxics. The continuous data and trends obtained from the continuous analyzers will also be compared will be made to RIT and NATA data.

The concentrations for each air toxic will be characterized in term of its median, mean and max values. The values will be used to estimate cancer risks. Cancer estimates will be based on standard exposure and inhalation rate assumptions, along with cancer unit risk estimates for each toxic in the inhalation pathway. The airborne concentrations measured in and risks estimated will be benchmarked against those determined in other recent air toxics studies. AMS will compare the continuous data from these instruments with the data collected from 24-hour batch sampling at the RIT Site using statistical methods to determine the correlation between the two**.**

The QA Engineer will make several plots of the concentration data. The first will be a set of plots of target gas concentration versus time. These plots will be examined for any expected trends in time. The concentration values should not go negative to any great extent; although around zero concentration the values may go slightly negative, the average value over time should be zero. Suppression of negative values should never be done in the analysis because then a zero average can never be achieved. If values go negative with time in a regular fashion, then something is amiss with the data. The most likely case is that there is a small remaining absorbance due to the target gas in the water vapor reference spectrum. If the concentration values are much higher than the anticipated values, there may also be a problem with the water vapor reference spectrum. In this case there may have been too much of the target gas absorbance subtracted from the water vapor reference. If that is so, the water vapor reference should be fixed and then the data reanalyzed.

Plots will be made of the target gas concentration versus the water vapor. If the variability of the target gas and the water vapor are correlated and this is not expected, the water vapor reference spectrum must, in most cases, be corrected. The next step is to plot the concentration values of those gases whose concentrations are expected to be correlated. This includes any gases that are derived from the same source. If the variability of these gases is not correlated, the data must be carefully examined for the cause. There are no good guidelines to judge what is causing that problem, but a nonlinear response of the instrument for one of the gases is a possibility. If that is suspected, the QA Officer must carefully examine the QA data for possible clues.

The following sections will describe the measurements required for the routine field and laboratory activities for this Project.

A6.2 Field Activities

AMS Personnel will perform field activities that support the successful operation of the Project. Field Personnel will perform field activities that include, but are not limited to conducting periodic preventive maintenance, calibrations, and servicing the project's equipment. Tables A6.2-1 and A6.2-2 summarize critical performance requirements for the open path monitors.

TABLE A6.2-1: DESIGN/PERFORMANCE SPECIFICATIONS – UVDOAS-CEREX OPEN PATH MONITOR

Specifications:	
Substances, (mdl ppbv)*	1,3 Butadiene (To Be Determined, (TBD)) Acetaldehyde (TBD), Benzene (TBD), Ethyl Benzene (TBD) Formaldehyde (TBD), Styrene (TBD) Toluene (TBD) TrimethylbenzeneC (TBD) O-Xylene, M-Xylene, P-Xylene (TBD)
Measurement range	Varies per pollutant
Measurement Time	Data Set Every 5 minutes
Path Length	Approx 200-300 meters

* Minimum detection limits (mdl) vary with light intensity and path length. The final path length selected will determine the mdl for each pollutant. The final path length to be selected is estimated to be between 200-300 meters.

TABLE A6.2-2: DESIGN/PERFORMANCE SPECIFICATIONS –TDLAS-CEREX OPEN PATH MONITOR

Specifications:	
Substances, (mdl ppbv)*	Hydrogen Fluoride (TBD)
Measurement range	TBD
Measurement Time	Data Set every 5 Minutes
Path Length	TBD

*Minimum detection limits (mdl) vary with light intensity and path length. The final path length selected will determine the mdl for the pollutant. The final path length to be selected is estimated to be between 200-300 meters.

A6.3 Laboratory Activities

The AMSL will conduct TO-15 analysis on the canister samples collected at the RIT site in accordance with the AMSL's TO-15 QAPP submitted and approved by EPA on October 2004.

Laboratory personnel will be responsible to preparing consumables for field use. This may include, but not be limited to, performing assays on materials prior to and after exposure to the ambient atmosphere, preparing and analyzing control samples, maintaining consumable inventories, shipping and receiving activities, and performing instrument audits.

A6.4 Project Assessment Techniques

An assessment is an evaluation process used to measure the performance or effectiveness of a system and its elements. As used here "assessment" is an all-inclusive term used to denote any of the following: audit, performance evaluation, management systems review (MSR), peer review, inspection, or surveillance. Section C.1 will discuss the details of assessments.

Table A6.4-1 will provide information on the parties implementing assessments and their frequency.

TABLE A6.4-1: ASSESSMENT SCHEDULE

Assessment type	Assessment Agency	Frequency
Data Analysis/Assessment	AMSL	Quarterly from Winter 2013 to Summer 2013
Preliminary Assessment Report	AMSL, EPA Region III	Quarterly from Winter 2013 to Summer 2013
Standard Operating Procedures Reviews	AMSL	Annually during the term of the Project
Final Report	AMSL, EPA Region III	End of Project, Summer 2013

A6.5 Schedule of Activities

Table A6.5-1 is a list of the critical activities required to plan, implement and assess the Project:

TABLE A6.5-1: SCHEDULE OF CRITICAL PROJECT ACTIVITIES

Activity	Due Date	Comments
QAPP Development	Fall 2011- Winter 2012	
Secure Site(s) Location	Winter 2012	Coordinate with site operator where location of the monitoring equipment.
QAPP submittal	Winter 2012	QAPP submittal to EPA
QAPP Approval	Winter 2012	Approval by EPA
Project Fund Distribution	Winter 2012- Spring 2012	AMS receives Project funding.
*Secure equipment purchase, sampler order	Winter 2012- Spring 2012	Ordered all equipment for the field portion of the project.
*Samplers arrive	Spring 2012	Received by AMSL Personnel
*Demonstration of UV Sentry DOAS and Spectra-1 TDL by Cerex at Philadelphia	Spring 2012	Personnel that will be working on the project should attend the demonstration.
*Field/Laboratory Personnel Training	Spring 2012	
*Site setup	Spring 2012	Set up site and monitoring network. Set up shelter, tripod, and wireless network
* SOP development	Spring 2012	Once the equipment has been ordered and received, AMS will develop the appropriate SOP.
*Routine Sampling Begins	Spring 2012- Summer 2012	Routine activities must start.
Sampling Extensive	Spring 2012 thru Summer 2013	Routine sampling.
Data Analysis and Assessment	Winter 2013 Spring 2013 Summer 2013	
Preliminary Assessment Report	Winter 2013 Spring 2013 Summer 2013	AMS to submit assessment reports each quarter listed.

* May be delayed based of date funding is received.

A7. Data Quality Objectives (DQO) for Measurement Data

This section provides a description of the DQO for the AMS SPCCAT Project. DQO are qualitative and quantitative statements that: (1) Clarify the intended use of the data; (2) Define the type of data needed; (3) Specify the tolerable limits of the probability of the decision error due to uncertainty in the data.

A7.1 Data Quality Objectives (DQO)

In general the goal of this project is to:

- Determine the highest concentrations expected to occur in the community near a refinery or industrial area;
- Determine representative concentrations in areas of high population density;
- Determine the impact on ambient pollution levels of significant sources or source categories.
- Characterize the degree and extent of local air toxics problems;
- Analyze cancer risk in the community;
- Evaluate the open path monitoring technique for air toxics.

A7.1.a Background and Purpose

This project is intended to assist AMS in assessing the degree and extent to which air toxics from a major oil refinery and other manufacturing activities impact the immediate community.

A7.1.b Intended Use of Data

The data obtained from the project will be used to estimate air toxics concentration in a community and analyze the population health risk. The data is obtained is intended to help AMS set policies to help reduce human exposure to HAPs. Table A7-1 lists the intended use of the data on a term basis.

TABLE A7-1: INTENDED USE OF DATA

Term	Intended Data Use
Short-term	• Profile air toxic sources in community near a refinery and/or industrial area; • Evaluate new and emerging measurement techniques for air toxics, open path method.
Mid-term	• Characterize the degree and extent of local air toxics problems; • Analyze cancer risk in the community; • Possible deployment of new measurement technique.
Long-term	• Set local policy actions to help reduce human exposure to HAPs; • Set local policy actions to help reduce adverse health effects from HAPs.

A7.1.c Type of Data Needed

The type of data needed will be the concentration of air toxics. The specific type of data needed is listed in Section A7.4. Specific information on the sampling design, including how to identify the monitoring location is presented in Section B1.

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A7.1.d Study Boundaries

Each monitor operated in Philadelphia is assigned a scale of representative-ness based on the definitions of 40 CFR Part 58, Appendix D.

- **Micro Scale** - describes air volumes associated with area dimensions ranging from several meters up to about 100 meters (m).
- **Middle Scale** - describes air volumes associated with area dimensions up to several city blocks in size with dimensions ranging from about 100-500 m (0.1- 0.5 kilometer (km)).
- **Neighborhood Scale** - describes air volumes associated with en area of a city that has relatively uniform land use with dimensions in the 500- 4,000 m (0.5 -4 km) range.
- **Urban Scale** - describes air volumes within cities with dimensions on the order of 4,000 m to 50,000 m (4-50 km).
- **Regional Scale** - describes air volumes associated with rural areas of reasonably homogeneous geography that extends for tens to hundreds of kilometers.

For the Project, the UV and laser open path monitors will be assigned the neighborhood scale.

A7.1.e Decision Rules

Table A7.1-1 list the principal study questions of the project and decision rules.

TABLE A7.1-1: DECISION RULES

Principal Study Questions	Alternative Actions
What are the concentrations of air toxics in the community?	N/A
Is the community at risk for a specific air toxic community?	Yes - AMS need to set policy actions to help reduce air toxic risk No - No actions required
Are the open path monitors a reliable method for measuring air toxics?	Yes - AMS to explore possible long term use of the measurement technique in air monitoring. No - Discontinued use of the sampler

A7.1.f Tolerable Error Limits

Tolerable Error Limits for this Project has not been developed, but will be developed in accordance with EPA's Guidance on Systematic Planning Using the Data Quality Objective Process (EPA QA/G4) and other EPA Guidance Documents. Performance and acceptable criteria are often expressed in terms of data quality indicators (DQI). See Table A7.1-2 for summary of DQI. An acceptable range for several of the DQI listed below will be established for the project once the analyzers have been ordered and the monitoring site set up.

TABLE A7.1-2: DATA QUALITY INDICATORS PER EPA QA/Q5 –GUIDANCE FOR QUALITY ASSURANCE PROJECT

DQI	Definition	Examples Determination Methodologies
Precision	The measure of agreement among repeated measurements of the same property under identical, or substantially similar conditions; calculated as either the range or as the standard deviation. May also be expressed as a percentage of the mean of the measurements, such as relative range or relative standard deviation (coefficient of variation).	Use the same analytical instrument to make repeated analyses on the same sample. Use the same method to make repeated measurements of the same sample within a single laboratory or have two or more laboratories analyze identical samples with the same method. Split a sample in the field and submit both for sample handling, preservation and storage, and analytical measurements. Collect, process, and analyze collocated samples for information on sample acquisition, handling, shipping, storage, preparation, and analytical processes and measurements.
Bias	The systematic or persistent distortion of a measurement process that causes errors in one direction.	Use reference materials or analyze spiked matrix samples.
Accuracy	A measure of the overall agreement of a measurement to a known value; includes a combination of random error (precision) and systematic error (bias) components of both sampling and analytical operations.	Analyze a reference material or reanalyze a sample to which a material of known concentration or amount of pollutant has been added; usually expressed either as percent recovery or as a percent bias.
Representativeness	A qualitative term that expresses "the degree to which data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition." (ANSI/ASQC 1995)	Evaluate whether measurements are made and physical samples collected in such a manner that the resulting data appropriately reflect the environment or condition being measured or studied
Comparability	A qualitative term that expresses the measure of confidence that one data set can be compared to another and can be combined for the decision(s) to be made.	Compare sample collection and handling methods, sample preparation and analytical procedures, holding times, stability issues, and QA protocols.
Completeness	A measure of the amount of valid data needed to be obtained from a measurement system.	Compare the number of valid measurements completed (samples collected or samples analyzed) with those established by the project's

		quality criteria (Data Quality Objectives or performance/acceptance criteria).
Sensitivity	The capability of a method or instrument to discriminate between measurement responses representing different levels of the variable of interest.	Determine the minimum concentration or attribute that can be measured by a method (method detection limit), by an instrument (instrument detection limit), or by a laboratory (quantitation limit).

A7.2 Measurement Quality Objectives (MQO)

To obtain good data quality, the data must be evaluated and controlled. MQOs are designed to evaluate and control various phases (sampling, preparation, and analysis) of the measurement process to ensure that total measurement uncertainty is within acceptable ranges. MQOs can be defined in terms of the data quality indicators listed in Table A7.1-2. MQOs for the open path analyzers will be develop after the analyzers have been ordered and set up. The open path analyzers are new to AMSL and time will be required for the agency to familiar with the operation of the analyzers.

A7.3 General Data Quality Objectives

- All data should be traceable to a National Institute of Science and Technology (NIST) primary standard.
- All data shall be of a known and documented quality. The level of quality required for each specific monitoring project shall be established during the initial planning stages of the project and will depend upon the data's intended use. Two major measurements used to define quality are precision and bias. Refer to Section A7.2 for definitions of the metrics precision and bias.
- All data shall be comparable. This means all data shall be produced in a similar and scientific manner. The use of the standard methodologies for sampling, calibration, audition, etc found in the QAPP should achieve this goal.
- All data shall be representative of the parameters being measured with respect to time, location, and the conditions from which the data are obtained. The use of the standard methodologies contained in the QAPP should ensure that the data generated are representative. Ideally, a 95% confidence of both precision and bias should be maintained with a ±15% difference or better between the actual amount of an introduced parameter (to a measurement system) and the indicated response of the measurement system.
- The QAPP must be dynamic to continue to achieve its stated goals as techniques, systems, concepts, and project goals change.

A7.4 Specific Data Quality Objectives

The specific data quality objectives for this Project are to determine the 24-hour average ambient concentration (in ppb) for the following pollutants:

- 1,3-butadiene.
- acetaldehyde.
- benzene.
- ethylbenzene.

- formaldehyde.
- styrene.
- toluene.
- trimethylbenzene.
- combined xylenes (o-Xylene, m-Xylene, and p-Xylene).
- hydrogen fluoride

A8. Training and Certification Requirements

A8.1 Purpose/Background

Personnel assigned to the Project will meet the educational, work experience, responsibility, personal attributes, and training requirements for their positions. Records on personnel qualifications and training will be maintained in personnel files and will be accessible for review during audit activities.

A8.2 Training

The AMSL requires that all personnel involved in the Project must conform to the job specifications for the position being held. Training is aimed at increasing the effectiveness of employees and is integral to any monitoring program that strives for reliable and comparable data.

Air monitoring personnel training consists of required reading prior to implementing the requirements of this QAPP. Documents required to be read shall include Project QAPP and SOP's that are specific to the equipment to the equipment personnel will be working with and servicing. All employees are actively encouraged to pursue training opportunities whenever possible and as needed. AMSL will coordinate and encourage vender based training for personnel when new equipment is obtained. Additionally, personnel are encouraged to periodically identify, request, and added pertinent courses and seminars. These courses and seminars may be provided as videotapes, closed circuit transmission, web-based real-time interactive formats, and /or live instruction. Air monitoring personnel will have sufficient training to currently perform necessary functions at an acceptable level.

A9. Documentation and Records

A9.1 Documents and Records

AMSL will establish and maintain procedures for the timely preparation, review, approval, control, and maintenance of documents and records. It is important that throughout areas of the Project, AMSL needs to keep a complete record of all-important information. Table A9.1-1 lists all the documents that will be required in order to maintain the required data for the Project.

TABLE A9.1-1: PROJECT DOCUMENTATION

Categories	Record/Document Type	File Locations
Management and Organization	State Implementation Plan Reporting Agency Information Organizational Structure Personnel Qualification and Training Training Certification Quality Management Plan Document control Plan EPA Directives Grant Allocations Support Contracts	Air Management Services – Central Office/ Laboratory
Site Information	Network Descriptions Site Files; Site Maps Site Pictures	Air Management Services – Central Office/ Laboratory
Environmental Data Operations	Quality Assurance Project Plans Standard Operating Procedures Field and Laboratory Notebooks Sample Handling/Custody Records Inspection/Maintenance Records	Air Management Services – Central Office/ Laboratory
Raw Data	Any Original Data (routine and quality control) Including Data Entry Forms	Air Management Services – Laboratory
Data Reporting	Air Quality Index Reports Annual SLAMS Reports Data/Summary Reports Journal/Articles/Papers/Presentations	Air Management Services – Central Office/ Laboratory
Data Management	Data Algorithms Data Management Plans/Flowcharts Data Management Systems Pollutant Data Meteorological Data	Air Management Services – Central Office/ Laboratory
Quality Assurance	Network Reviews Control Charts Data Quality Assessments Quality Assurance Reports Technical System Audits Response/Corrective Action Reports Site Audits	Air Management Services – Central Office/ Laboratory

A9.2 Quarterly Data Analysis and Assessment Submittal to EPA

AMS shall submit quarterly data to EPA, either directly via AQS data entry or through the Region III office. The quarterly data submittal shall contain the following summary data:

- The city name (if applicable), county name, location street address of the project site;
- The measurement scale associated with the parameter of occurrence (POC),
- The results of all valid precision, bias, and accuracy tests performed during the quarter;
- The location, date, pollution source, and duration of incidents of ambient level exceedances.

A9.3 Quarterly Report (Preliminary Report) and Final Report

AMS shall submit preliminary reports to EPA on a quarterly basis. A final report will be submitted at end of the Project.

A9.4 Data Reporting Package Formal and Documentation Control.

Table A9-1 lists the documents and records that must be included in the reporting package. The details of these various documents and records will be discussed in the appropriate sections of this document. All raw data required for calculations, the submissions to the AQS database, and QA/QC data shall be collected electronically or on data forms. All hardcopy information shall be filled out in indelible ink. Corrections shall be made by inserting one line through the incorrect entry, initialing and dating this correction. and placing the correct entry alongside the incorrect entry, if this can be accomplished legibly, or by providing the information on a new line if the above is not possible.

A9.4.a Data Reporting Package Formal and Documentation Control.

Each field and laboratory technician will be responsible for obtaining appropriate field logbooks. These logbooks will be uniquely numbered and associated with the individual and/or a specific program or monitor. The logbooks will be used to record information about the site and laboratory operations, as well as document routine operations. Completion of data entry forms, associated with all routine environmental data operations, are required even when the field logbooks contain all appropriate and associated information required for the routine operation being performed.

- **Field Logbooks** - A combination of bound paper and/or electronic logbooks will be used for record keeping for each sampling site, sampling instrument, specific program, or individual. Each notebook should be hardbound and paginated. Appropriate data entry forms may be used instead of logbooks; however these forms are not required for routine operations, inspection and maintenance operations, or SOP activities as long as the information is contained in a notebook.
- **Lab Logbooks** - A combination of paper data sheets, bound paper logbooks, electronic databases, and electronic logbooks exist in which the state laboratory retains all records pertaining to equipment calibrations and materials tracking, preparation, storage, and disposal, as well as general comments and notations and

other pertinent information required for support of the Ambient Air Quality Network Data integrity activities.

A9.4.b Electronic Data Collection

Certain instruments can provide an automated means for collecting information that would otherwise be recorded on data entry forms. Information on these systems is detailed in Section B8. In order to reduce the potential for data entry errors, automated systems will be utilized where appropriate and will record the same information that would be recorded on data entry forms in order to provide a backup, electronic copies of the automated data collection information (daily poll) will be stored for an appropriate time frame by the appropriate AMS personnel on their computers. Electronic backup copies of automated data collection information will also be stored on the site computers, in the regional offices and m the central office.

A9.5 Data Reporting Package Archiving and Retrieval

All the information listed in Table A9.1-1 will be retained for three years from the date of collection. If any litigation, claim, negotiation, audit, or other action involving the records has been started before the expiration of the three-year period, the records will be retained until completion of the action and resolution of all issues that arise from it, or until the end of the regular three year period, whichever is later.

SECTION B. MEASUREMENT / DATA ACQUISITION

B1. Sampling Design

This section will discuss the operation and installation of the UV and HF open path analyzer.

B1.1 Scheduled Project Activities, Including Measurement Activities

Open path monitors will be situated so as to best access community exposure with close attention being given to wind direction, clear light paths, local interfering small emission sources and firm mounting surfaces for the transmitter and receiver telescopes.

AMS will be monitoring the air toxics at the proposed location and comparing the results obtained to the RIT monitoring Site and NATA Sites. Table B1.1-1 represents the activities represents the activities associated with ordering and deployment of the open path analyzers.

TABLE B1.1-1: SCHEDULE OF AIR TOXICS SAMPLING RELATED ACTIVITIES

Activity	Due Date	Comments
*Secure equipment purchase. Order UV Sentry DOAS and Spectra-1 TDL monitors	Winter 2012-Spring 2012	Ordered all equipment for the field portion of the project.
*Samplers arrive	Spring 2012	Received by AMSL Personnel
*Demonstration of UV Sentry DOAS and Spectra-1 TDL by Cerex at Philadelphia	Spring 2012	Personnel that will be working on the project should attend the demonstration.
*Field/Laboratory Personnel Training	Spring 2012	
*Site setup	Spring 2012	Set up site and monitoring network. Set up shelter, tripod, and wireless network
* SOP development	Spring 2012	Once the equipment has been ordered and received, AMS will develop the appropriate SOP.
*Routine Sampling Begins	Spring 2012-Summer 2012	Routine activities must start.
Sampling Extensives	Spring 2012 thru Summer 2013	Routine sampling.
*Routine Sampling Begins	Spring 2012-Summer 2012	Routine activities must start.
Sampling Extensives	Spring 2012 thru Summer 2013	Routine sampling.

* May be delayed based of date funding is received.

B1.2 Rationale for Design

B1.2.a Equipment Selection

The open path monitoring offers many benefits that are unique to the method:

- **There are no analytical costs associated with the data**. The open path UV and HF analyzer system can continuously measure light beam from the UV source or laser source and store data electronically. This is extremely important as it eliminates any bias that can be introduced into the sample via improper storage and handling. It also eliminates the cost of expensive sample analysis and well as costs related to the storage of gas samples.
- **Raw data can be stored and reviewed at a later date for unknown gases in the air (UV open path only)**. Raw data in its basic form as data table of wavelength and signal strength. This provide the capability to re-analyze the data at a point in the future to look for the presence of gases that were the not part of the original sample goal.
- **The presence of gases can be easily verified and presented to the end-users.** The software automatically processes, in real time, the data from the spectrometer and creates a file that lists the time and concentration of the detections.
- **Overtime the system can increase their accuracy while continuing to provide real time-results.** If operated for over time, a sample matrix unique to the site will become know, allowing optimizations to be performed with the analytical software. The software automatically processes, in real time, the data from the spectrometer and creates a file that lists the time and concentration of the detections.

B1.3 Design Assumptions

Data obtained from the open path analyzers will be compared to the VOC Toxics data obtained at the AMS RIT Site. The AMS RIT site is not an appropriate site for the open path monitor Project for logistic purposes, space, safety and security. It is assumed that the RIT site and the proposed open path site would expect similar concentrations of toxic VOC's since both sites are at the vicinity of the refinery.

B1.4 Procedure for Locating and Selecting Environmental Samples

B1.4.a Sample Design

The design of the SPCCAT Project is to achieve the following monitoring objectives:

- Determine the annual average ambient concentration for the target pollutant listed in Table A3-1 with an open path monitor;
- Determine the 24hour average ambient concentration expected to occur in the community with an open path monitor.
- Compare the air toxics concentrations obtained with the open path analyzer with AMS RIT VOC toxics canister sampling data.

B1.4.b Site Selection

The monitoring equipment purchased under this project will be installed in South Philadelphia near a heavily industrial area, home to a major oil refinery as well as other manufacturing facilities. The criteria that are to be considered when evaluating the potential site are as follows:

1. Impacts of known pollutant emission category and sources (area and point) on the local air quality;
2. Population Density and Environmental Justice Impacts;
3. Economics;
4. Safety and Security;
5. Logistics;
6. Atmospheric Considerations and Topography.

Impacts of known pollutant emission category and sources (area and point) on the local air quality - The community selected is in a highly industrial area and in the vicinity of a refinery.

Population Density and Environmental Justice Impacts - According to the 2000 Census[2] (2010 data is not yet available), zip code 19145 is home to more than 45,000 residents, including more than 11,000 (>25%) living below the federal poverty level. Median family income in 1999 dollars was roughly $33,000, well below the national average of $50,046. The area is also home to many children (11,705 under the age of 18 in 2000) and seniors (7,860 or 7.2% in 2000, above the national average of 12.4% seniors). The neighborhood is also very diverse, with a population that is 51% White, 37.2% Black or African American, 0.2% American Indian/Alaska Native, 8.9% Asian, 1.7% Hispanic or Latino, and 2.3% Other. Only 9.7% of the neighborhood's population possesses a Bachelor's degree, well below the national average. Selection according to these criteria requires detailed information concerning the location of sources, geographic variability of ambient pollutant concentrations meteorological conditions, and population density. Selection of the number, geographic locations, and types of sampling stations is, therefore, a complex process.

Economics - The quantity of resources required to accomplish all data collection activities, including instrumentation, installation, maintenance, data retrieval, data analysis, QA, and data interpretation, must be established.

Safety and Security - In some cases, a preferred location may have associated problems that compromise the security of monitoring equipment (i.e., high risk of theft, vandalism, safety and liability issues etc.). If such problems cannot be remedied through the use of standard measures such as additional lighting, fencing, etc., then an attempt to locate the site as near to the preferred location as possible shall be made.

Logistics - This process includes procurement, maintenance, and transportation of material and personnel for the monitoring operation. The logistics process requires full knowledge of all aspects of the data collection operation: planning reconnaissance, training, scheduling, safety, staffing, procuring goods and services, communications, and inventory management.

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[2] Source: U.S. Census Bureau, Summary File 1 (SF 1) and Summary File 3 (SF 3), 2000 Census

Atmospheric Considerations - These considerations may include spatial and temporal variability of pollutants and their transport. Effects of buildings, terrain, and heat sources or sinks on sir trajectories can produce localized anomalies of pollutant concentrations. Meteorology must be considered in determining the geographic location of a site as well as the height, direction, and extension of sampling probes. Evaluation of a local wind rose is essential to property locate many monitoring sites (e.g., siting either to detect or avoid emissions from specific sources).

Topography - Evaluation of the local topography based upon land use maps, U.S Geological Survey topographic maps, and other available resources must be completed Minor and major topological features that impact both the transport and diffusion of air pollutants must be identified and evaluated. Minor features may include an adjacent tree lined stream or tall structures either upwind or downwind of a point source, each of which may exert small influences on pollutant dispersion patterns. Major features include river canyons or deep valleys, mountain ranges, and large lakes Major features significantly impact the prevailing wind patterns or create their men local weather such as katabatic or anabatic winds.

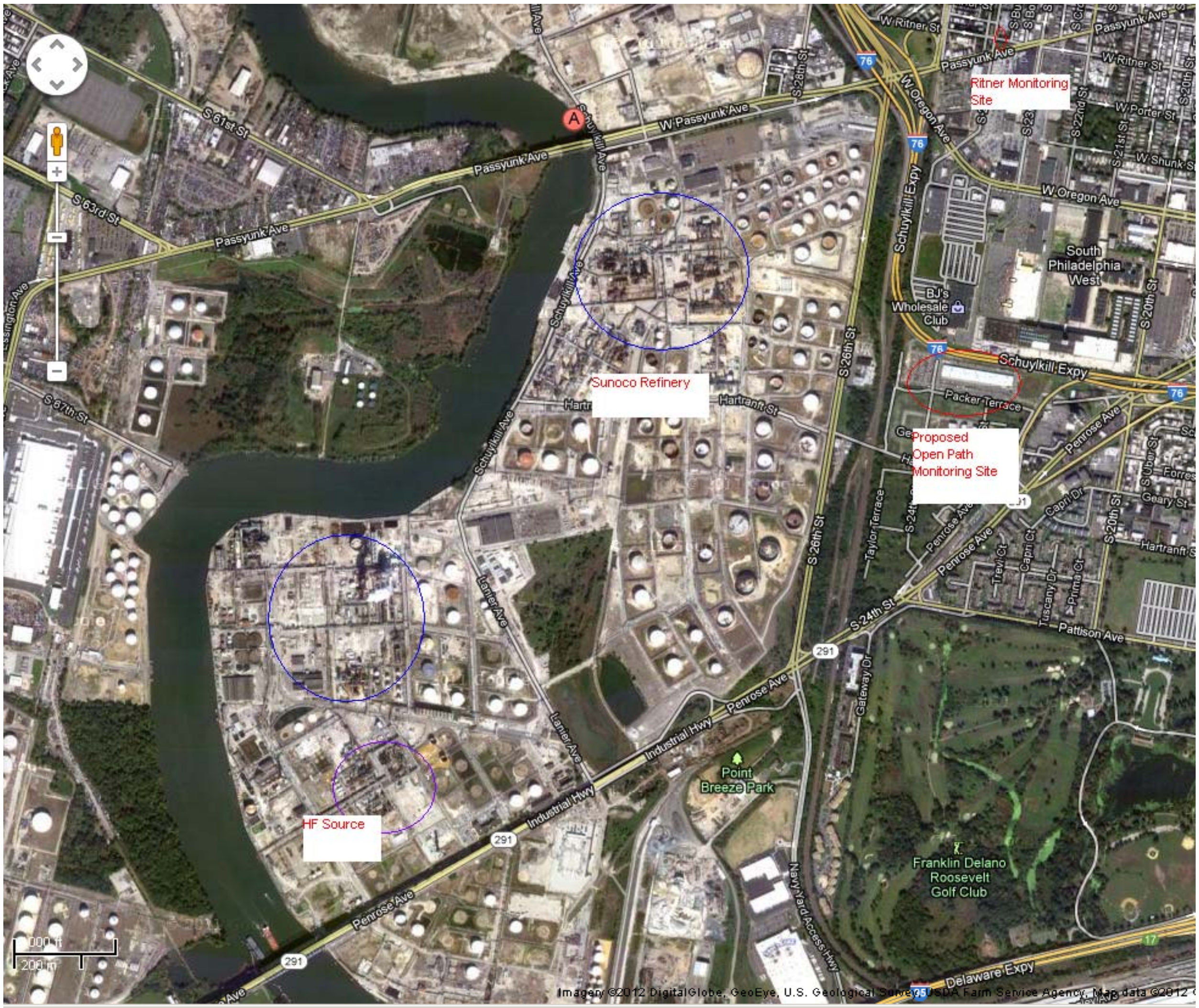
Interdependence exists between all of the factors listed above. Consequently, an iterative procedure must be employed in order to successfully select an appropriate project site that can provide the data necessary to accomplish the project's stated objectives. In situations where the sites do not specifically meet the requirements necessary to obtain the project objectives, reevaluation of the project operation of air qualify measurement systems estimates of air quality, field, and theoretical studies of air diffusion; and considerations of atmospheric chemistry and air pollution effects make up the required expertise needed to select the optimum sapling site for obtaining data necessary to fulfill the monitoring objectives.

Taking the criteria mentioned above, AMS has identified following site as an ideal location for the project.

Philadelphia Housing Authority
3100 Penrose Ferry Rd.
Philadelphia, PA 19145

Figure B1.4-1 is a map of the proposed site for the project. The figure shows the proposed open path-monitoring site, AMS Ritner Monitoring Site, and Sunoco Refinery just west of the proposed open path-monitoring site. Three areas at the refinery have been circled to indicate the HF source and main sources of air toxics.

FIGURE B1.4-1: MAP OF PROPOSED SITE (B) FOR COMMUNITY AIR TOXIC PROJECT



B1.4.c Monitor Placement

AMS proposes to place the monitor on the rooftop of a one-story building (20-25 feet in height). The placement of each monitor is generally determined by the defined monitoring objective. Monitors are thus usually placed according to potential exposure to pollution. Due to the various factors discussed above, tradeoffs are often necessary to locate a site for collection of optimally representative data. Final placement of a particular monitor at a selected site is dependent on physical obstructions and activities in the immediate area. Monitors must be placed away from obstructions such as trees and fences in order to avoid their effects on airflow. To prevent sampling bias, airflow around monitor sampling probes must be representative of the general airflow in the area. In addition, the availability of utilities (i.e., electricity and telephone services) is critical.

AMS will comply with the monitoring path length requirements of 40 CFR 58 Appendix E, Section 8. Section 8 indicates that the monitoring path length must not exceed 1 kilometer for open path analyzers in neighborhood, urban, or regional scale. For middle scale monitoring sites, the monitoring path length must not exceed 300 meters. In areas subject to frequent periods of dust, fog, rain, or snow, consideration should be given to a shortened monitoring path length to minimize loss of monitoring data due to these temporary optical obstructions. For certain ambient air monitoring scenarios using open path analyzers, shorter path lengths may be needed in order to ensure that the monitoring site meets the objectives and spatial scales defined in 40 CFR 58, Appendix D.

B1.5 Classification of Measurement as Critical / Non Critical.

Ambient concentrations and site location obtained by the open path analyzers will be provided to AQS. When routine sampling has begun, AMS will determine which parameters will be critical and non-critical.

B1.6 Validation of Any Non-Standard Measurements

At this time there are no NAAQS for air toxics compounds, except for lead. AMS will deploy and operate instruments according to descriptions in the applicable EPA guidance documents.

B2. Sampling Method Requirements

B2.1 Purpose

The methods designed here will provide measurement of the relative concentration of HAPs in ambient air for a 24-hour sampling period.

The purpose of this section is to:

- Identity the sampling methods;
- Identify the procedures for collecting the required environmental samples;
- Describe the:
  - Equipment used in the data collection network.
  - Necessary support facilities.
  - Implementation requirements.
  - Required materials.

- Identity the:
  - Corrective actions necessary to reestablish network data integrity.
  - Responsible parties to implement the corrective actions.
- Describe methods required to verify corrective action effectiveness

B2.2 Monitoring Technology/Methodology

B2.2.a UV Absorbent Air Toxics- Cerex UV Sentry DOAS

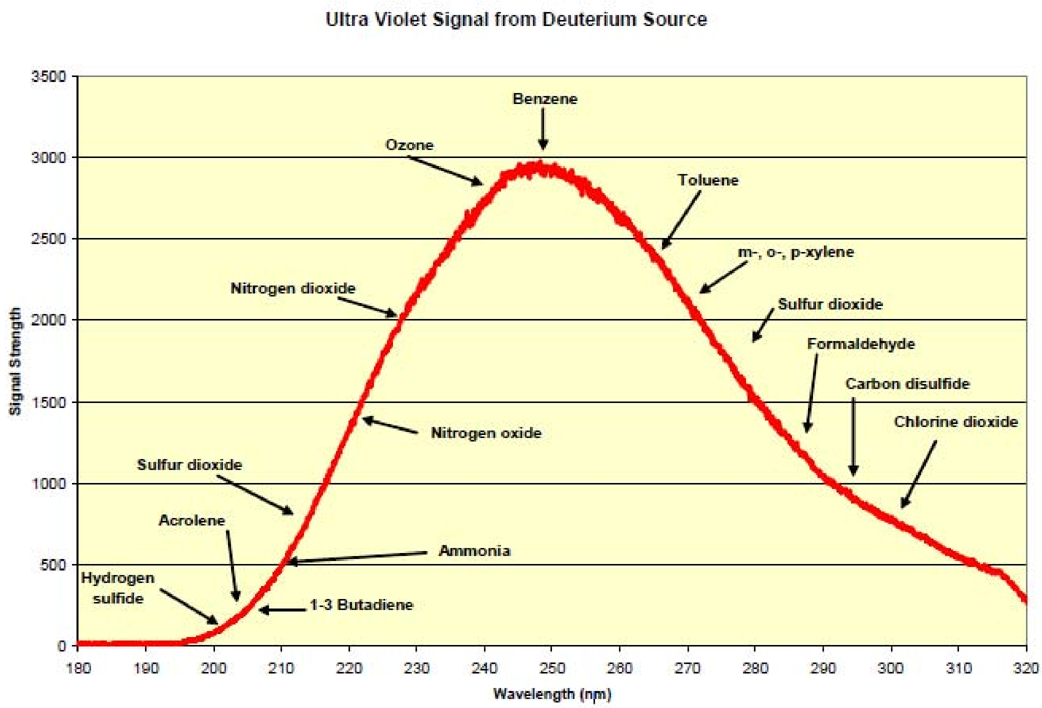
The Cerex UV Sentry DOAS is a multi-gas open-path air-monitoring system that uses ultraviolet differential optical absorption spectroscopy (UV-DOAS) with a CCD-array (charged-couple device) detector to analyze ambient air for hazardous pollutants and VOC toxics. The Cerex UV Sentry air monitoring system uses the optical principle that when exposed to light, numerous chemicals will absorb various wavelengths of the light at levels that are proportional to amount of gas in the light beam. This method of gas measurement is generically known as Ultra-Violet Differential Optical Absorption Broadband (UVDOAS) spectroscopy and refers to the measurement of spectral regions that include a large portion of electromagnetic energy.

The fundamentals of the system's operation are as follows:
(1) A Xenon or Deuterium lamp produces an ultra-violet beam;
(2) Specially designed optics focuses the beam and projects it through the air;
(3) At the opposing end a receiver collects the light and focuses it into a spectrometer;
(4) The spectrometer analyzes the wavelengths and magnitudes of received light and determines the presence and concentration of interfering gases.

The Cerex UV produces an ultraviolet light beam from a light source, either xenon or deuterium. The light beam is collected and concentrated using standard telescope optics. The concentrated light then passes through an input lens into the spectrometer via a fiber optic coupling. Once through a holographic grating, the light then hits the CCD array which in turn charges the capacitor. The capacitors are discharged at a sample rate set by the user and the light signal at each light frequency is proportional to the total charge of each capacitor. Finally, a graphical representation of the UV spectra is produced by measuring the electrical charge of each capacitor at each given wavelength (signal intensity vs. wavelength). The data is collected using an integrated controller or a laptop computer using a USB and can be interfaced with most data acquisition systems.

Figure B2.2-1 shows the typical output spectra of a UV Sentry system that uses a deuterium light source. The x-axis (the horizontal axis on the bottom) records the wavelength of light measured in nanometers (one billionth of a meter). The y-axis (the vertical axis at left) records the amount of light at each wavelength. The graph also shows the approximate locations where various gases absorb light. Some gases, such as sulfur dioxide, absorb in multiple areas due to their molecular configuration.

FIGURE B2.2-1: ULATRA VIOLET SIGNAL FROM DETERIUM SOURCE, FROM CEREX- SHELL DEER PARK STUDY, 2004



B2.2.b Analysis by the UV Sentry Software Package

With the two spectra (resultant and reference) it is now possible to quantitatively determine the concentration of the gas. The standard Cerex UV Sentry quantitative software contains a library of the unique spectral features of various gases. With each spectral feature, a linear regression is then performed on the absorbance spectrum. An output file is created that records the concentration value of the chemical, the standard error, and the correlation coefficient associated with the linear regression process for each chemical. The correlation coefficient denoted by the formula name "R^2" is often used as a key determinant of whether or not the chemical was actual present (versus a falsely positive detection due to some other gas or particulate absorbing UV light).

The correlation coefficient, R^2, has no units associated with it and ranges between 0 and 1. The closer it is to 1, the greater the confidence in the accuracy of the detected compound concentrations. Table B2.2-1 presents a rough guide for interpreting the values of R^2.

TABLE B2.2-1: EXPLANATION OF R^2 VALUES

R^2 Value	Explanation of Confidence
0.75 – 1.00	The chemical is present
0.50 – 0.75	It is very likely the chemical is there.
0.20 – 0.50	The chemical may be there, but it could also be a false positive.
0.00 – 0.20	The chemical is not present.

Some chemicals have features that are "sharp" and easily identified and quantified by the software, e.g., Benzene, whereas others have more broad and sloping features that are less easily detected, e.g., 1,3-Butadiene.

B2.2.c Hydrogen Fluoride, Cerex SPECTRA-1

The Cerex SPECTRA-1 gas detection monitor will be used to detect hydrogen fluoride (HF). The monitor is based on tuneable diode laser absorption spectroscopy (TDLAS). The identification of gas species by absorption spectroscopy is well established. A molecule can be identified by its characteristic absorption spectra. If the frequency (or wavelength) of the infrared (IR) light source matches the vibrational frequency of the molecule, then light will be absorbed. The Beer-Lambert law is the linear relationship used to calculate molecule concentration (ppm) from the characteristic absorption a molecule exhibits. One of these absorption features is chosen that does not coincide with any other molecule absorption spectra. The wavelength of the tuneable laser is set very close to the absorption feature to be measured. A laser is ideally suited for this, as the light output is monochromatic. The laser wavelength is then scanned back and forth over this absorption feature. The resulting change in laser intensity when scanned over the absorption feature provides the information required to calculate the molecule concentration.

B2.3 Support Facilities for Sampling Methods

B2.3.a Monitoring Station Design

The monitoring station design must encompass the operational needs of the equipment and provide an environment that supports sample integrity, and allow the operator to safely and easily service and maintain the equipment. Winter weather conditions must be considered during site selection in order to meet the station safety and serviceability requirements.

Cumulative Interferences on a Monitoring Path - To control the sum effect on a path measurement from all the possible interferences which exist around the path, the cumulative length or portion of a monitoring path that is affected by obstructions, trees, or roadways must not exceed 10 percent of the total monitoring path length. This limit for cumulative interferences on the monitoring path controls the total amount of interference from minor sources, obstructions, roadways, and other factors that might unduly influence the open path monitoring data.

Monitoring Path Length - The monitoring path length must not exceed 1 kilometer for analyzers in neighborhood, urban, or regional scales, or 300 meters for middle scale monitoring sites. These path limitations are necessary in order to produce a path concentration representative of the measurement scale and to limit the averaging of peak concentration values. In addition, the selected path length should be long enough to encompass plume meander and expected plume width during periods when high concentrations are expected. In areas subject to frequent periods of rain, snow, fog, or dust, a shortened monitoring path length should be considered to minimize the loss of monitoring data due to these temporary optical obstructions.

Mounting of Components and Optical Path - Alignment: Since movements or instability can misalign the optical path, causing a loss of light and less accurate measurements or poor readings, highly stable optical platforms are critical. Steel buildings and wooden platforms should be avoided, as they tend to move more than brick buildings when wind and temperature conditions vary. Metal roofing will, for example, expand when heated by the sun in the summer. A concrete pillar with a wide base, placed upon a stable base material, has been found to work well in field studies.

B2.3.b Shelter Requirements

The shelter must protect the instrumentation from any environmental stress such as vibration, corrosive chemicals, intense light, or radiation. The shelter selected shall allow for each open path analyzer to be operated at the required operating temperature as recommended by the manufacturer.

B2.4 Sampling Equipment Requirements

This section details sampling equipments requirements.

TABLE B2.4-1: SAMPLING EQUIPMENT REQUIREMENTS

Sampler	Parameter	Comments
CEREX UV open-path	Ambient Operating Temperature	-10 to 40 Celsius
	Power requirement (Spectrometer)	110/240 volts self switching
	Path Length (light source)	20-300 meters (Deuterium)
	Measurement Range	0 to 500 ppb
	Measurement Time	Continuous/ Instantaneous
	Path Requirements	Open path between telescopes, no physical obstructions
	Mounting Surface	Tripod or permanent mounts. Good alignment with the receiver and transmitter is required for proper operation of the system.
	Light Source Replacement	Average UV Source life is 4000 hours
	Shelter	Recommended
	Calibration Gas Standards	Sealed Cell Gas System
Cerex SPECTRA-1	Ambient Operating Temperature	
	Power requirement	Connect supplied power cable to Spectra-1, and to a +12VDC source. A 12 volt battery pack may be used, or a 12 volt DC power supply capable of > 3 Amps.
	Measurement Time	Continuous/ Instantaneous
	Path Requirements	A clear line of sight between Spectra-1 and the retro-reflector is required. Open path between telescopes, no physical obstructions
	Mounting Surface	Tripod or permanent mounts. Good alignment with the receiver and transmitter is required for proper operation of the system.
	Light Source Replacement	Laser lifetime is very long and replacement is not required
	Shelter	Recommended

B3. Quality Control (QC) Requirements

B3.1 QC Procedures

To assure the quality of data from air monitoring measurements, two district and important Interrelated functions must be performed. One function is the control of the measurement process through broad QA activities, such as establishing policies aid procedures, developing DQOs, assigning roles and responsibilities, conducting oversight and reviews, and implementing corrective actions. The other function is the control of the measurement process through the implementation of specific quality control procedures, such as audits calibrations, checks, replicates, routine self -assessments, etc.

Quality control is the overall system of technical activities that measure the attributes and performance of a process, item, or service against defined standards to verity that they meet the stated requirements established by the customer. In the case of this Project, QC activities are used to ensure that measurement uncertainty, as discussed in Section A7, is maintained within acceptance criteria for the attainment of the DQOs. Lists of pertinent QC checks are provided is the standard operating procedures and instrument manuals. Quality control is achieved through periodic maintenance, calibrations, and other methods. Table B3.1-1 represent a number of QC activities that help to evaluate and control data quality for the program.

TABLE B3.1-1: QC ACTIVITIES

Sampler	Parameter	Comments
CEREX UV open-path	Signal Strength	Low signal strength could indicate physical obstruction of the beam, accidental misalignment through outside disturbance or a power failure. If signal strength drops below a preset level, the system would notify the appropriate personnel of the change in signal strength and appropriate diagnostics steps need to be taken.
	Calibration Gas Standards	Are the calibration results acceptable? If the calibrations results are not acceptable, the system needs to be trouble shoot.
	Accuracy	The open path Analyzers method is new to AMS. Procedures on accuracy to be developed after the open analyzers arrive.
	Precision	The open path Analyzers method is new to AMS. Procedures on accuracy to be developed after the open analyzers arrive.
	R^2 Values, correlation coefficient	The correlation coefficient, $\mathbf{R^2}$, has no units associated with it and ranges between 0 and 1. The closer it is to 1, the greater the confidence in the accuracy of the detected compound concentrations. Table B2.2-1 presents a rough guide for interpreting the values of R^2.
Cerex SPECTRA-1	Signal Strength	Signal Level (LVL) should fall between 10% and 75% for best operation.
	Measurement Range	TBD
	Calibration Gas Standards	None. Manufacturer Calibration Required
	Accuracy	The open path analyzers method is new to AMS. Procedures on accuracy to be developed after the open analyzers arrive.
	Precision	The open path Analyzers method is new to AMS. Procedures on accuracy to be developed after the open analyzers arrive.

B3.1 Calibrations

Calibration is the comparison of a measurement standard or instrument with another standard or instrument to report, or eliminate by adjustment, any variation (deviation) in the accuracy of the item being compared. The purpose of calibration is to minimize bias. Calibration activities for the UV open path air toxics samplers follow a two-step process:

1. Certifying the calibration standard and/or transfer standard against an authoritative standard, and;
2. Comparing the calibration standard and or transfer standard against the routine sampling/analytical instruments.

If significant deviations exist between the instruments measurements and the calibration/transfer standards measurements, corrective action is implemented to rectify the analytical instrument's measurements. Calibration requirements for the critical field and laboratory equipment are found in the SOP's and in the specific instruments' operations manuals.

B3.2 Precision Checks

Precision is the measure of mutual agreement among individual measurements of the same property, usually under prescribed similar conditions. In order to meet the data quality objectives for precision, AMS must ensure the entire measurement process is within statistical control. For this Project, AMS will develop precision measurements. Various tools will be employed in evaluating and monitoring precision measurements. Periodically employing collocated monitoring, and monitoring data integrity with will provide evidence of deviations from the required precision measurement.

Precision of a Single Sampler - Quarterly Basis. For particulate sampler *i*, the individual 95% confidence limit, produced during the calendar year are pooled using the following equations: where the number of checks made during the calendar quarter and Si is the standard error calculated for each quarterly set. Each individual compound must have the precision data generated.

Upper 95% Percent Limit

$$Limit = d_i + 1.96 * S_i \tilde{} / 2$$

Lower 95% Percent Limit

$$Limit = d_i - 1.96 * S_{i/} \tilde{} / 2$$

Corrective Action: Quarter - Usually, corrective action will be initiated and imprecision rectified before a quarters worth of data fail to meet 15% Confidence Limits (CL). However in the case were the quarters CL is greater than 20%, the routine data for that monitor for that quarter will be flagged.

B3.3 Accuracy Checks

Accuracy is defined as the degree of agreement between an observed value and an accepted reference value and includes a combination of random error (precision). The following check(s) will be implemented in the open path Project:

- Cylinder gas audits (UV-DOAS)

Sealed cylinder gas of known concentration of analyte(s) will be utilized to audit the UV open path monitor.

B4. Instrument / Equipment Testing, Inspection, and Maintenance

B4.1 Purpose/Background

The purpose of this section is to discuss the procedures used to verify that all the instruments and equipment are maintained in sound operating condition and capable of operating at acceptable performance levels.

B4.1.a Testing

The analyzers will be similar to the instruments described in EPA's Compendium Method TO-16. Prior to field installation, AMSL will assemble and test the analyzers at the laboratory to assure it is function properly. If the analyzers are not working, then AMS will contact the vendor and try to resolve the problem. The analyzers and data acquisition system will be tested initially to ensure the system is working properly before any routing sampling begins.

B4.1.b Inspection

Inspection of project equipment and components are provided in Table B4.1-1.

TABLE B4.1-1: INSPECTIONS REQUIRED

Item	Inspection Parameter	Inspection Frequency	Action if Item Fails Inspection	Documentation Requirements
Cerex UV Open Path Analyzer	Stable Mounting	TBD, As required	Possible Realignment Required	Field/Equipment Log
	Low Signal Strength	As required	Realignment Required	Field/Equipment Log
Cerex SPECTRA-1	Stable Mounting	TBD, As required	Possible Realignment Required	Field/Equipment Log
	Low Signal Strength		Possible Realignment Required	Field/Equipment Log

B4.1.c Maintenance

Items that need maintenance are provided in Table B4.1-2.

TABLE B4.1-2: PREVENTIVE MAINTENANCE OF FIELD INSTRUMENTS

Instrument	Item	Maintenance Frequency	Responsible Party
Cerex UV Analyzer	Clean Mirrors	As recommended by the manufacturer or as required.	Field Personnel
	Clean Lenses	As recommended by the manufacturer or as required.	Field Personnel
	Replace Filter	As recommended by the manufacturer	Field Personnel
	Inspect Filter Screen (For deposits that might clog the filter)	As recommended by the manufacturer or as required.	Field Personnel
	Inspection Light Source	As recommended by the manufacturer or as required.	Field Personnel
Cerex SPECTRA	Clean Mirrors	As recommended by the manufacturer or as required.	Field Personnel
	Clean Lenses	As recommended by the manufacturer or as required.	Field Personnel
	Inspection Light Source	None. The laser light is expected to last lifetime.	

B5. Instrument Calibration and Frequency

Table B5-1 lists a summary of the specific standard materials and apparatus used in calibrating measurement systems.

TABLE B5-1: STANDARD MATERIALS AND/OR APPARATUS FOR AIR TOXICS CALIBRATION

Parameter	Std. Material	Std. Apparatus	Mfr. Name	Model #	Frequency of Calibration
UV-DOAS Concentration	Sealed Calibration Gases				As required
TDLAS Concentration	None				Manufacturer

B6. Inspection / Acceptable Requirements for Supplies and Consumables

B6.1 Purpose

The purpose of this section is to establish and document a system for inspecting and accepting supplies and consumables that may directly affect the quality o f the Project. By having documented inspection and acceptance criteria consistency of supplies can be assured. This section details the supplies and/consumables, their acceptable criteria, and required documentation for tracking purposes.

B6.2 Critical Supplies and Consumables.

Table B6.2-1 details the various components for the field operations.

TABLE B6.2-1: CRITICAL FIELD SUPPLIES AND CONSUMABLES

Area	Item	Description	Vendor	Model Number
Cerex UV Analyzer	Light Source			
	Cleaning Wipes			
	UV Glasses			
Cerex SPECTRA-1 Analyzer	Cleaning Wipes			

B6.3 Tracking and Quality Verification of Supplies and Consumables

The following procedure outline the proper tracking and documentation procedures to follow:

- Receiving personnel will perform a rudimentary inspection of the packages as they are received from the courier or shipping company. Note any obvious problems with a receiving shipment such as crushed box or wet cardboard.
- The package will be opened, inspected and contents compared against the packing slip.
- If there is a problem with the equipment/supply, note it on the packing list, notify appropriate AMSL personnel and immediately call the vendor.
- If the equipment/supplies appear to be complete and in good condition, sign and date the packing list. This receipt is then given to the front desk for filing.
- Notify appropriate personnel that equipment/supplies are available.
- Stock equipment/supplies in appropriate pre-determined area.
- For supplies, consumables, and equipment used throughout the program, document when these items are changed out. A sign-in/sign-out sheet is placed outside of the stockroom. All personnel must sign-out for any consumables removed or added to the stock room. A lab technician then enters this data into the equipment-tracking database.

B7. Data Acquisition Requirements

This section addresses data not obtained by direct measurement from the Project. This includes both outside data and historical monitoring data. Non-monitoring data and historical monitoring data are used by the Project in a variety of ways. Use of information that fails to meet the necessary DQOs for the ATMP leads to erroneous trend reports and regulatory decision errors. The policies and procedures described in this section apply both to data acquired through the Project and to information previously acquired and/or acquired from outside sources.

B7.1 Acquisition of Non-Direct Measurement Data

The Project relies on data that are generated through field and laboratory operations; however, other significant data are obtained from sources outside the Project or from historical records. This section lists this data and addresses quality issues related to the Project.

B7.1.a Chemical and Physical Properties Data

Physical and chemical properties data and conversion constants are often required in the processing of raw data into reporting units. This type of information that has not already been specified in the monitoring regulations will be obtained from nationally and internationally recognized sources. Other data sources may be used with approval of the Air Division QA Officer.

- National Institute of Standards and Technology;
- ISO, IUPAC, ANSI, and other widely-recognized national and international standards organizations;
- U.S. EPA;
- The current edition of certain standard handbooks may be used without prior approval of the AMS QA Supervisor or QA Engineer. Two that are relevant to the fine particulate

monitoring program are CRC Press' *Handbook of Chemistry and Physics*, and *Merck Manual.*

B7.1.b Sampler Operation and Manufacturers' Literature

Another important source of information needed for sampler operation is manufacturers' literature. Operations manuals and users' manuals frequently provide numerical information and equations pertaining to specific equipment. AMSL personnel are cautioned that such information is sometimes in error, and appropriate crosschecks will be made to verify the reasonableness of information contained in manuals. Whenever possible, the field operators will compare physical and chemical constants in the operators manuals to those given in the sources listed above. If discrepancies are found, determine the correct value by contacting the manufacturer. The following types of errors are commonly found in such manuals:

- Insufficient precision;
- Outdated values for physical constants;
- Typographical errors;
- Incorrectly specified units;
- Inconsistent values within a manual, and
- Use of different reference conditions than those called for in EPA regulations.

B7.1.c Geographic Location

Another type of data that will commonly be used in conjunction with the Project is geographic information. For the current and proposed sites, AMS will locate these sites using global positioning systems (GPS) that meet EPA Locational Data Policy of 25 meters accuracy. USGS maps were used as the primary means for locating and sitting stations in the existing network.

B8. Data Management

B8.1 Background and Overview

This section will identify the processes and procedures that are followed to acquire, transmit, reduce, analyze, store, and retrieve data. These processes and procedures will maintain assure and maintain data integrity and validity.

B8.2 Data Recording

The majority of the data recorded for the Project will be recorded electronically into a computer with the Sentry Continuous Monitoring Software (CMS). With the CMS is capable of monitoring gases in the software's spectral library. The output of the system is both raw spectroscopic and also computer-aided analysis (concentration value) data. AMS will develop a database or upgrade an existing database to allow data to be recorded and saved from the project.

B8.3 Data Validation

During the time UV light passed through the atmosphere, there may be gases present in the beampath. If the gases are UV-compatible, a portion of the ration is absorbed. It is the loss of light due to absorption that is collected into the spectrometer for analysis. It is know that every gas a unique spectral fingerprint. When the gas becomes present in the beampath, the spectral fingerprints are compared to the stored library references using a pattern-matching classical least square regression analysis. The results are presented to the user as real-time concentration numbers. In addition, there is a goodness of fit qualifiers, coefficient of correlation, that are also presented so the quality of the data can be assed in each measurement.

B8.4 Data Transformation

As mentioned in Section B8.3, the raw spectral fingerprints are compared to the stored library references using a pattern-matching classical least square regression analysis. Using the pattern matching classical least square regression analysis, the monitoring software automatically transforms the raw spectral data into real-time concentration numbers.

B8.5 Data Transmittal

Data transmittal for the Project will be accomplished using a wireless modem or standard telephone lines to access the sites' modems, which are linked to a computer

B8.6 Data Reduction

Data reduction processes involve aggregating and summarizing results so that they can be understood and interpreted in different ways. Since air toxics have no regulatory requirements, such as those with the NAAQS, monitoring regulations are not required to be reported regularly to EPA. Examples of data summaries include:

- Average concentration for a station or set of stations for a specific time period;
- Accuracy, and precision statistics;
- Data completeness reports based on numbers of valid samples collected during a specified period.

The audit trail is another important concept associated with data transformations and reductions. An audit trail is a data structure that provides documentation for changes made to a data set during processing. Typical reasons for data changes that would be recorded include the following:

- Corrections of data input due to human error;
- Application of revised calibration factors;
- Addition of new or supplementary data;
- Flagging of data as invalid or suspect;
- Logging of the date and times when automated data validation programs are run.

Retaining copies of all data sets electronically recorded provides a data audit trail. These data sets will be archived on backup systems in addition to being retained on computers.

B8.7 Data Summary /Data Tracking

For this Project AMS will track data completeness quarterly.

B8.8 Data Storage and Retrieval

The storage and retrieval of the air quality monitoring data is possible through AMS's archiving system. The data is stored for a minimum period of three years, unless any litigation, claim, negotiation, audit, or other action involving the records has been started before the expiration of the three-year period. When the type of situation occurs, the records will be retained until completion of the action and resolution of all issues that arise from it, or until the end of the regular three-year period, whichever is later. The data shall be stored on electronic media (such as Write-Once, Read-Many [WORM] CDs or magnetic tapes) or in hard copy, whichever format proves most advantageous. After the storage period has passed, the storage media may be disposed of or recycled.

SECTION C. ASSESMENT / OVERSIGHT

C1. Assessments and Response Actions

An assessment is defined as an evaluation process used to measure the performance or effectiveness of the quality system or the establishment of the monitoring network and sites and various measurement phases of the data operation.

The results of Quality Assurance assessments indicate whether the quality control efforts are adequate or need to be improved.

Some (routine) Assessment of QA Procedures is performed by Laboratory Management and AMS QA Section if data quality issues develop. External assessment is primarily performed by EPA or its designee and may consist of Network review, Technical Systems Audit and Performance Evaluation Audit.

C1.1 Management Systems Review

A Management Systems Review (MSR) is a qualitative assessment of a data collection operation or organization. A MSR is employed to establish whether the prevailing quality management structure, policies, practices, and procedures are adequate to ensure data obtained are of the necessary type and quality to support the decision process. The MSR will use appropriate federal regulations and the QAPP to determine the adequate operation of the air monitoring program and its related quality system. The EPA will report its findings to senior management. The report will be filed appropriately. The Air Quality Monitoring Coordinator or a duty appointed representative would regularly monitor progress on corrective action(s).

C1.2 Network Review/Assessment

The network review is used to determine if a particular air-monitoring network is collecting adequate, representative, and useful data in pursuit of its air monitoring objectives. Additionally, the network review may identify possible network modifications to enhance the system or coned deficiencies in attaining network objectives.

Prior to implementing a network review, significant data and information pertaining to the network will be compiled and evaluated. Such information might include:

- Network files (including updated site information and site photographs);
- AQS reports;
- Network monitors' five year at quality summaries;
- Major metropolitan area emissions trends reports;
- Emissions information, such as a monitor's emission density maps and maps delineating an area's major emissions sources; and
- National Weather Service summaries for the monitoring network area.

Upon receiving the information it will be checked to ensure it is current. Discrepancies will be noted and resolved during the review. Files and/or photographs that need to be updated will also be identified during the review. The following categories will be emphasized during network reviews:

Adequacy of the network will be determined using the following information:

- Maps of historical monitoring data;
- Maps of emission densities;
- Dispersion modeling;
- Special studies/saturation sampling;
- Best professional judgment;
- State Implementation Plan requirements, and
- Revised monitoring strategies (a g., lead strategy. reengineering air monitoring network).

Monitor Locations - Adequacy if the location of monitors is determined on a case-by-case basis to meet the monitoring objectives specified in 40 CFR Part 58, Appendix D. Suitable monitor locations can only be determined on the basis of slated objectives. Maps, graphical overlays, and GIS-based information will be helpful in visualizing or assessing the adequacy of monitor locations. Plots of potential emissions, historical monitoring data, and/or saturation study findings versus monitor locations will also be used.

During the network review, the stated objective for each monitoring site will be reconfirmed and the location's spatial scale will be re-verified. If the site location does not support the stated objectives, or the designated spatial scale, changes will be proposed to rectify the discrepancy.

Probe Siting Requirements - Applicable siting criteria for SLAMS and NAMS are specified in 40 CFR Part 58, Appendix E. The on-site visit will consist of physical measurements and observations to determine compliance with the 40 CFR Part 58, Appendix E requirements, such as height above ground level, distance from frees, appropriate ground cover, etc. This check at each site is performed every year. The annual network review and probe sale check will also:

- Review the most recent hard copy of site description (including any photographs) for any updates needed for headquarters;
- Report on any new industries in the area and review their emission impacts based on the site of the facility and predominant wind directions; and
- Determine conformance with 40 CFR Part 58 Appendix E.

A checklist will be used to determine conformance with 40 CFR Part 58, Appendix E. In addition to the items on the checklist, the reviewer will also perform the following tasks:

- Perform annual site safety check, including checking equipment for missing pans, frayed cords, damage etc;
- Record findings on the sate safety audit form and the annual network review checklist, as appropriate, to be turned in to headquarters;
- Take photographs/videotape in the eight directions (E, SE. S. SW. W, NW, N. and NE) when significant changes are observed in vegetation, trees, or roadways; and
- Document any significant changes in site conditions on the network review checklist.

In addition to the items included in the checklists, other subjects for discussion as part of the network review and overall adequacy of the monitoring program will include:

- Installation of new monitors,
- Relocation of eating monitors,
- Siting criteria problems and suggested solutions,
- Problems with data submittals and data completeness,
- Maintenance and replacement of existing monitors and related equipment,
- Quality assurance problems,
- Air quality studies and special monitoring programs, and
- Other issues such as proposed regulations and funding.

The network review will be documented in a report within two months of completion. The report will be distributed to the appropriate senior staff, and EPA.

C1.2.a Technical System Audits

A technical systems audit (TSA) is a thorough and systematic qualitative audit, where facilities, equipment, personnel, training procedures, protocols, and record keeping are examined for conformance with the QAPP. A TSA will be performed on-site during the catty stage of the project, and anytime senior staff feels 'it is appropriate, to assist in identifying deficiencies and providing timely corrective actions. Annual TSA's will take place at the conclusion of each calendar year's collection of data to maintain high quality data collection and reporting.

A TSA team or an individual TSA auditor may segregate TSA activities into three categories. The categories may be audited independently or they may be combined. The TSA categories are:

- Field activities - Handling, sampling, and shipping;
- Laboratory activities - Pre-sampling weighing, shipping, receiving post- sampling weighing, archiving, and associated QA/QC activities;
- Data management activities - Collecting, flagging, editing, and uploading data, providing data security.

Key personnel to be interviewed during the audit are those individuals with responsibilities for planning, field operations, laboratory operations, QA/QC, data management and reporting. The audit team will prepare a brief written report summarizing the findings. The following areas may be included but all reports will include items d, e, and f:

a. Planning,
b. Field operations,
c. Laboratory operations,
d. QA/QC;
e. Data management, and
f. Reporting.

Problems with specific areas will be documented, and corrective actions will be implemented.

C1.2.b Post-Audits Activities

The major post-audit activity is the preparation of the systems audit report. The report will include:

- Audit title identification leader, date of report, and any other identifying information;
- Audit team leaders, audit team participants, and audited participants,
- Background information about the project purpose of the audit, dates of the audit, particular measurement phase or parameters met were audited, and a brief description of the audit process;
- Summary and conclusions of the audit and corrective action required; and
- Attachments or appendices that include al audit evaluations and audit finding forms.

To prepare the report, the audit team will meet and compare observations with collected documents and results of interviews with key personnel. Expected QAPP implementation is compared with observed accomplishments and deficiencies. The audit findings are reviewed in detail, and, within 30 calendar days of the completion of the audit, a comprehensive audit report will be generated and distributed to senior staff for comment.

If the affected parties have written comments or questions concerning the audit report, the audit team will review and incorporate them as appropriate. Subsequently, a modified report will be prepared and resubmitted in final form within 30 days of receipt of the written comments. The report will include an agreed-upon schedule for corrective action implementation.

C1.2.c Follow-up and Corrective Action Requirements

As part of corrective action and follow-up, an audit finding response form will be generated by the audited organization for each finding in the TSA report. The audit finding response form is signed by the respective Regional air quality manager(s) and sent to the TSA team, which reviews, and accepts or rejects the corrective action. The audit response form will be completed within 30 days of acceptance of the audit report.

C1.2.d Performance Evaluation

Performance evaluation activities are addressed by Air Management Services participating in the EPA's National Performance Audit Program (NPAP). Only, qualified and authorized personnel execute performance audits.

C1.2.e Audit of Data Quality

An audit of data quality (ADQ) reveals how data are handled, what judgments were made, and whether uncorrected mistakes were made. An ADQ can often identify the means to correct systematic data reduction errors. An ADQ shall be included as part of the annual systems audit. Sufficient beta and effort en be devoted to this activity so that the auditors have a clear understanding and complete documentation of data flow.

Pertinent ADQ questions appear on the TSA check sheets, which shall be used in executing an ADQ. The TSA check sheets shall be used to ensure that the data collection and handling integrity is maintained. The ADQ will serve as an effective framework for organizing the extensive amount of information gathered during the audit of laboratory, field monitoring, and support functions within the agency.

C1.2.e Data Assessment

A data quality assessment (DQA) is the statistical analysis of environmental data to determine whether the data meet the assumptions that the DQOs and data collection design were developed under and whether the total error in the data is tolerable. Calculations for DQA activities shall follow the requirements and equations identified in 40 CFR Part 58, Appendix A, Section 5, and reiterated in Section B3 of this QAPP. The DQA process is described in detail in the Guidance for the Data Quality Assessment Process, EPA QA/G-9.

Measurement uncertainty will be estimated for both automated and manual data recording methods. Terminology associated with measurement uncertainty is found within 40 CFR Part 58 Appendix A. Estimates of the data quay will be calculated on the basis of single monitors and aggregated to alt monitors. The individual results of these tests for each method or analyzer shall be reported to EPA. Data quality assessment findings will be included in AMS's QA annual report.

C1.3 Assessment Documentation

C1.3.a Number, Frequency and Type of Assessments

Audits shall be executed during the course of this project at the frequency and quantity indicated. Network Reviews shall be conducted every year that the Ambient Air Quality Monitoring Network operational Management systems reviews shall be conducted. Once during every three-year period that the Ambient Air Quality Monitoring Network collects data verifying compliance with the NAAQS. TSAs shall be performed once during every three-year period that the Ambient Air Quality Monitoring Network collects data verifying compliance with the NAAQS. Application of additional TSAs shall be at the discretion of the AMS Quality Director Performance evaluation audits shall be performed in accordance with the schedule established by EPA's NPAP. An ADQ shall be performed every year that the Ambient Air Quality Monitoring Network is operational.

C1.3.b Assessment Personnel

Table C.1.3-1 list the assessment personnel and the responsibilities of each personnel within the monitoring organization. These individuals are responsive for executing audits, assessing findings, developing and implementing necessary corrective actions, preparing QA reports, evaluating their impact, and implementing follow-up actions.

TABLE C1.3-1: ASSESMENT PERSONNEL

Position	Main Duties and Responsibilities:
AMSL Administrative Scientist	The AMSL Administrative Scientist and maintains overall responsibility for management and administrative aspects of the QA program.
AMS Laboratory Administrative Engineer	The AMS Administrative Engineer is responsible for assessing audit findings, issuing appropriate response/corrective actions, and assigning response/corrective actions to specific personnel and assuring the completeness and efficacy of the work. AMSL Supervisors are also responsible for assuring that the at laboratory and field personnel maintain their documentation as defined in the network design (40 CFR Part 58, Appendix D) and for disseminating information appearing in audit reports and other quality-related documents to operations personnel.
Data Management Officer or Data Management Supervisor	The data management officer is responsible for coordinating the information management activities for SLAMS/NAMS data entry. Specific activities related to audit execution include ensuring access to data for DQA and ADQ activities.
AMSL Supervisors (Laboratory, Field and Quality Assurance)	The AMSL supervisors are responsible for identifying problems, overseeing the corrective action, and assuring that the appropriate documentation is generated, distributed, and filed. The AMSL supervisors are also responsible for reviewing field and laboratory QC data and assuring that equipment repairs and preventive maintenance are completed. AMSL supervisors assuring that personnel under their supervision maintain their documentation files as defined in the relevant SOPs. The AMSL Supervisors will assist the QA Engineer, field personnel, and laboratory personnel in preparing QA reports and summaries.
QA Engineer, Field Personnel, and Laboratory Personnel	These personnel are responsible for implementing day-to-day QA activities for the Project. These personnel assist with data quality assessments and other internal audits, and calculating and/or reviewing precision and bias data. These personnel are also responsible for documenting the response to required corrective actions in response/corrective action reports (see section C1.3.c).

C1.3.c Reporting and Resolution of Issues

In order to address the findings from audits, peer reviews and other assessments, the following structure arid associated protocols shall be employed to identify and implement corrective actions.

Any participant in the collection, analysis, audit/assessment, and report generating activities affiliated with the Ambient Air Quality Monitoring Network is responsible for identifying the need for corrective actions. Identifying the need for corrective actions can occur during site visits, audits, data analysis operations, or other monitoring network activities. This shared responsibility, coupled with diligent attention to detail and accuracy, will assure that the Ambient Air Quality

Monitoring Network consistently collects quality data, and that this data is reduced, analyzed, and presented in an accurate and representative manner. Any participant that perceives a need for corrective action(s) shall present the situation to their supervisor and the appropriate AMS manager within 30 days of perceiving the need.

The AMSL Supervisors will assess the need for a corrective action. If one is deemed necessary, a suitable corrective action will be selected and disseminated to the air quality science officer(s) and the originator within 60 days.

The Quality Assurance Supervisor and/or Quality Engineer are responsible for implementing corrective actions. An implementation notice will be supplied to the AMS manager upon completion of the corrective action. The corrective action must be implemented within 30 days notwithstanding extenuating circumstances.

Following implementation of a corrective action, the quality director may, at his or her discretion, require a TSA to verity the efficacy of the corrective action. Both the action of implementing the corrective action and the influence of the corrective action on the operations of the Ambient Air Quality Monitoring Network must be appraised. Any deficiencies in the correction must be noted and the procedure updated to completely correct the discrepancy.

C2. Reports to Management

C2.1 Purpose/Background

This section describes the quality related reports and communication to management necessary to support air toxics network operations and the associated data acquisition, validation, assessment and reporting.

Important benefits of regular QA reports to management include the opportunity to alert the management of data quality problems, to propose viable solutions to problems, and to procure necessary additional resources. Management should not rely entirely upon the MSRs for their assessment of the data. The MSR only occur once every three years. Quality assessment, including the evaluation of the technical systems, the measurement of performance, and the assessment of data, is conducted to help insure that measurement results meet program objectives and to insure that necessary corrective actions are taken early, when they will be most effective.

Effective communication among all personnel is an integral part of a quality system. Regular, planned quality reporting provides a means for tracking the following:

- Adherence to scheduled delivery of data and reports,
- Documentation of deviations from approved QA and test plans, and the impact of these deviations on data quality;
- Analysis of the potential uncertainties in decisions based on the data.

C2.2 Frequency, Content, and distribution of Reports

Reports to management required for monitoring in general are discussed in various sections of 40 CFR Parts 50, 53, and 58. Guidance for management report format and content is provided in reports developed by EPA's Quality Assurance Division and Office of Air Quality Planning and Standards. These reports are described in the following subsections.

C2.2.a QA Annual Report

Periodic assessments of air toxic data quality are to be reported to EPA Regional Offices under the grant requirements. AMS's QA annual report is issued to meet this requirement. This document describes the quality objectives for measurement data and how those objectives have been met.

C2.2.b Technical System Audit Reports

External TSAs are conducted at least once every three years by EPA Regional Offices or EPA's Contractor as required by 40 CFR Part 58. These reports are issued by the Air Quality Division Office and are reviewed by the regional air quality managers. These reports will be filed and made available to EPA personnel during their technical systems audits.

C2.2.c Response/Corrective Action Reports

The response/corrective action report procedure will be followed whenever a problem is found such as a safety defect, an operational problem or a failure to comply with procedures. A separate report will be required for each problem identified. The response/corrective action report is one of the moat important ongoing reports to management because it documents primary QA activities and provides valuable records of QA activities that can be used m preparing other summary reports. Copies of response/corrective action reports will be distributed twice first when the problem has been identified and the action has been scheduled, and second when the correction has been completed. The air quality analyst, air quality technician, or air quality science officer assigned ad generate the response/corrective action reports. The report will be distributed to the regional air quality manager and the monitoring and emissions inventory coordinator.

C3. Data Review

C3.1 Data Review Design

The primary purpose of this section is to describe the data validation procedures, which are used to process air toxics data. Data validation refers to those activities performed after the fact, that is, after the data have been collected. The difference between data validation and quality control techniques is that the quality control techniques attempt to minimize the amount of bad data being collected, while data validation seeks to prevent any bad data from getting through the data collections and storage systems.

It is preferable that data review be performed as soon as possible after the data collection, so that the questionable data can be checked by recalling information on unusual events and on meteorological conditions, which can aid in the validation. Also, timely corrective actions should be taken when indicated to minimize further generation of questionable data. The data review group will attempt to review the data within 1 month after the end of the quarter of sampling. This will also help with getting the data loaded onto AQS in a timely manner.

C3.2 Data Review Testing

C3.2.a Data Identification Checks

Data with improper identification codes are useless. Three equally important identification fields, which must be correct are time, location, and parameter and sample ID.

C3.2.b Unusual Event Review

Extrinsic events (e.g., construction activity, dust storms, unusual traffic volume, and traffic jams) can explain unusual data. This information could also be used to explain why no data are reported for a specified time interval, or it could be the basis for deleting data from a file for specific analytical purposes.

C3.2.c. Relationship Checks

Toxics data sets contain many physically or chemically related parameters. These relations can be routinely checked to ensure that the measured values on an individual parameter do not exceed the corresponding measured values of an aggregate parameter, which includes the individual parameter.

C3.3 Procedures

These tests check values in a data set, which appear atypical when compared to the whole data set. Common anomalies of this type include unusually high or low values (outliers) and large differences in adjacent values. These tests will not detect errors, which alter all values of the data set by either an additive or multiplicative factors. The following test for internal consistency are used:

- Data Plots
- Ratio Test
- Students “t-test”

C3.3.a Tests for Historical and Temporal Consistency

These tests check the consistency of the data set with respect to similar data recorded in the past. In particular, these procedures will detect changes where each item is increased by a constant or by a multiplicative factor. Gross limit checks are useful in detecting data values that are either highly unlikely or considered impossible. The use of upper and lower 95% confidence limits is very useful in identifying outliers.

C3.3.b Pattern and Successive Difference Tests

These tests check data for pollutant behavior, which has never or very rarely occurred in the past. Values representing pollutants outside of these predetermined limits are then flagged for further investigation. Pattern tests place upper limits on:

- The individual concentration value (Maximum –hour test);
- The difference in adjacent concentration values (Adjacent hour test);
- The difference or percentage difference between a value and both of its adjacent values (Spike test); and
- The average of three or more consecutive values (consecutive value test).

C3.3.c Parameter Relationship Tests

Parameter relationship tests can be divided into deterministic tests involving the theoretical relationships between parameters (e.g., ratios between benzene and toluene) or empirical tests which determine whether or not a parameter is behaving normally in relation to the observed behavior of one or more parameters. Determining the “normal” behavior of related parameters requires the detailed review of historical data.

SECTION D. DATA VALIDATION AND USEABILITY

D1. Data Validation and Verification and Analysis Methods

The purpose of this element is to identity the procedure, and responsible parties who will perform data validation and verification. Data verification is the process of evaluating the completeness, correctness, and conformance/compliance of a specific data set against the method, procedural, or contractual requirements. Data validation is an analyze and sample-specific process that extends the evaluation of data beyond method, procedural, or contractual compliance (i.e. data verification) to determine the analytical quality of a specific data set.

Many of the processes for verifying and validating the measurement phases of the data collection operation have been discussed in Section C3. If these process as written in the QAPP are followed, and the sites are representative of the boundary conditions for which they were selected, one would expect to achieve the DQOs. However, exceptional field events may occur and field activities may negatively impact the integrity of the samples. In addition, it is expected that some of the QC checks will fail to meet the acceptable criteria. This section will outline how AMS will take the data to a higher level of analysis. This will be accomplished by performing software test, plotting, and other methods of analysis.

D1.1 Process for Validating and Verifying Data

D1.1.a Verification of Samples

After data is collected, a thorough review of the data will be conducted for completeness and data entry accuracy. The data will be reviewed for routine data outliers and conformance to acceptance criteria. Unacceptable or questionable data will be flagged appropriately.

D1.1.b Validation

Validation of measurement data requires two stages, one at the measurement value level and another at the batch level. Records of all invalid samples shall be retained in the appropriate database. Information shall include a brief summary of why the sample was invalidated along with the associated flags. Logbook notes and field data sheets shall have more detailed information regarding the reason a sample was flagged. These documents shall remain with the field operators and/or at the monitoring site.

D2. Data Analysis

D2.1 Analytical Tests

AMS will employ several software programs towards analyzing the data. These are listed below with a short explanation of each.

Spreadsheet - The District will perform a rudimentary analysis on the data sets using EXCEL™ spreadsheets. Spreadsheets allow the user to input data and statistically analyze, plot and graph linear data. This type of analysis will allow the user to see if there are any variations in the data sets. In addition, various statistical tests such as tests for linearity, slope, intercept or correlation coefficient can be generated between two strings of data. Box and Whisker, Scatter and other plots can be employed. Time series plots can help identify the following trends:(1) Large jumps or dips in concentrations; (2) periodicity of peaks within a month or quarter; (3) Expected or un-expected relationships among species.

GIS - GIS program that allows the user the ability to overlay concentration data on geographic data. By creating "views", the user can overlay temporally changing data into a spatial analysis too. Plots of concentrations of data can be temporal/spatially displaced.

D3. Reconciling with DQOs (Data Quality Objectives)

The purposes of Section D3 are to identify the acceptable methods for evaluating the project results, and provide an outline for the report required to document the findings.
The DQOs for the Ambient Air Quality Monitoring Network were established in Section A7 of this QAPP. The resulting DQOs are for sampling or monitoring precision and relative bias. Section C1 discusses assessment and response actions. This section of the QAPP will outline the procedures that will follow to determine whether the monitors and laboratory analyses are producing data that comply with the DQOs, what actions will be taken as a result of the assessment process, who will perform, review, and approve this assessment, and who will generate the report that documents the findings.

D3.1 Reconciling Results with Data Quality Objectives

This element includes scientific and statistical evaluations of data to determine if the data are of the right type, quantity, and quality to support their intended use. The EPA document Guidance for Data Quality Assessment (EPA QA/G-9) focuses on evaluating data for fitness in decision-making and also provides many graphical and statistical tools. As described in Guidance for Data Quality Assessment, the DQA process is comprised of four steps. The steps are outlined below. Refer to Guidance for Data Quality Assessment for a detailed description of each step.

<u>Five Steps of the Data Quality Assessment Process</u>

As described in Guidance for Data Qualify Assessment (EPA QA/G-9), the DQA process is comprised of five steps. The steps are outlined below. Refer to Guidance for Data Quality Assessment for a detailed description of each step.

Step 1. Review Data Quality Objectives and Sampling Design. Data and modeling analysis, and the Administrative Engineer and/or QA Staff shall review the project's sampling design DQIs (precision, bias, comparability, representativeness. and completeness), and DQOs to verify that they are still applicable; Section A7 of this QAPP contained details for DQO development. Additional information contained in Section A7 includes methods for:

- Defining the primary objectives of the Project.
- Translating the objectives into a outcomes
- Developing limits on decision errors

Section B1 of this QAPP contains the details of the Sample Design, including the rationale for the design the design assumptions, and the sampling locations and frequency. If any deviations from the sampling design have occurred, these shall be documented for the DQA, and their potential effect carefully considered throughout the entire DQA.

Step 2. Conduct Preliminary Data Review. Date and modeling analysts and the Data management supervisor shall the various submitted QA reports to identify any corresponding anomalous conditions. The first phase of the preliminary data review is to review the QA reports. The second phase of the preliminary data review is to calculate basic summary statistics, generate graphical presentations of the data and review these summary statistics and graphs.

- **Review Quality Assurance Reports** – Data Management Staff or QA Staff will write all QA reports that describe the data collection and reporting process. Particular attention will be directed to looking for anomalies in recorded data, missing values, and any deviations from SOPs. This is a quality review. Any concerns will be further investigated in the next two steps.

- **Calculate Summary Statistics and Generate Graphical Presentations** – Data management staff will generate summary statistics (via AQS) for cacti of its primary and QA samplers. The summary statistics will be calculated at the quarterly, annual, and three-year levels and will include only valid samples. Standard summary statistics include:
  - Effective number of samples
  - Median concentrations
  - Standard deviations
  - Maximum concentrations
  - Minimum concentrations
  - Inter-quartile range

These statistics will also be calculated for percent differences at collocated sites. The results will be summarized in a table. Particular attention will be given to the impact on the statistics caused by abnormalities noted in the QA review.

Additionally, basic histograms or other appropriate graphs such as box plots or CDF plots, may be created for each of the primary and QA samplers and for the percent difference at the collocated sites. These graphs will be useful in identifying anomalies and evaluating the normality assumption in the measurement errors.

Step 3. Select the Statistical Test. The data analyst will determine whether the primary objective of Project has been attained for the prior monitoring period. This goal will be accomplished by employing statistical testing to validate the data.

Step 4. Verify the Assumptions of the Statistical Test. There are no NAAQS to compare with air toxics; therefore, verification of the data must be done against estimated values, such as models. Before verification, the distribution, test for trends, test for outliers must be examined.

Normal Distribution for Measurement Error Assumptions. It is commonly assumed that measurement errors are distributed normally in environmental monitoring. EPA QA/G-9: Data Qualify Evaluation Statistical Tools (DataQUEST) provides statistical tools for creating normal probability plots. If a plot indicates possible violations of normality, the data analyst may need to determine the sensitivity of the DQOs to departures in normality.

Trends Analysis. It is recommended that a simple linear regression test be performed to observe the temporal variations in the data sets.

Measurement precisions. For each sampling system, AMSL will review the 95% confidence limits. If any exceed AMS may need to determine the sensitivity of the DQOs to larger levels of measurement imprecision. AMS will develop confidence intervals for the precision estimates.

The limits on precision and bias are based on the smallest number of required sample values in a one-or three-year period. In developing DQOs, the smallest number of required samples is used. This is to ensure that the confidence is sufficient in the minimal case. If more samples are collected, then the confidence in the resulting decision will be even higher. Data completeness evaluations will be performed each quarter to ensure that this DQO requirement is upheld.

Measurement imprecision is established at 10% coefficient of variation. For each monitor, the QA Staff or Data management staff will review the coefficients of variation. If any exceed 10%, QA Staff or data anlayst may need to determine the sensitivity of the DQOs to larger levels of imprecision.

Before determining whether the monitored data indicate compliance with a NAAQS, it must first be determined if any of the assumptions upon which the statistical test is based are violated. If any of the assumptions have been violated, then the level of confidence associated with the test is suspect and must be investigated further.

Steps 5. Draw Conclusions from the Data. Perform the calculations required for the statistical test and document the Inferences drawn as a result of these calculations. If the design is to be used again, evaluate the performance of the sampling design.

D3.2 Data Quality Assessment Report

A summary report, documenting the findings from the five Maps associated with the DQA, shall be compiled, reviewed, approved, and distributed. The composition of this report shall parallel the DQA's five steps.

This report shall document any deviations experienced from the sampling plan for each criteria pollutant, on a site-by-site bias. The basic summary statistics, representative of the raw data sets, shall be calculated and presented along with the graphical presentation of the raw data. The report shall provide observations of the data patterns, structures, and relationships. Careful attention must be provided to identity, and document potential anomalous data.

Based upon the evaluation of the raw data and Insight mined from each DQI's condition the data analyst shall select the most appropriate procedure for summarizing and analyzing the data. The report shall present these selected methods, along with the key underlying assumptions supporting valid statistical conclusions associated with these procedures, i.e. state the null and alternative hypotheses. A check will be performed of the selected analysis methodology, verifying that the underlying assumptions are valid or whether departures are acceptable. The actual data, and resulting raw statistics, along with the QA reported information would provide the foundation for this evaluation.

Apply the selected statistical tests on each data set's basic summary statistics. Evaluate, and draw inferences from the results. Document the projects findings, and provide conclusions and observations that may assist the project correct deficiencies for the next data collection period.

D3.3 Action Plan Based on Conclusions from Data Quality Assessments

Each year, a thorough DQA process will be conducted. For this section, the laboratory manager assumes that the assumptions for developing the DQOs have been met. If not, the AMS Engineering supervisor must first revisit the impact of the violation on the bias and precision limits determined by the DQO process.

If the conclusion from the DQA process is that each of the ambient air monitors is operating with less than 10% bias and precision, then the laboratory manager may pursue action to reduce the QA/QC burden associated with the monitor. Possible courses of action may include the following:

- **Modifying the QA Monitoring Network** - 40 CFR Part 58 requires that each QA monitor be the same designation as the primary monitor. Once it is demonstrated that the data collected from the network are within tolerable levels of errors, the Administrative Engineer or Administrative Scientist may request that it be allowed to modify these requirements.

If and when the data from at least one of the monitors or sites violates the DQI bias and/or precision units, the Administrative Scientist or Administrative Engineer or manager will conduct an investigation to uncover the cause of the violation. If all of the monitors/samplers in the network of a similar type or pollutant violate the DQI, the cause may be at the agency level (operator training) or higher (laboratory QC, problems with method designation). If only one monitor/sampler or site violates the DQI, the cause is more likely specific to the site (particular operator, problem with the site). Tools for determining the cause include reviewing:

- Data from a collocated network (Local Program, nearby reporting organizations, national);
- Data from performance audits (contracted or NPAP), and QC trails.

Some particular courses of action include:

- **Determining the level of aggregation at winch DQOs are violated** - The DQA process tells which monitors are having problems, since the DQOs were developed at the monitor level. To determine the level at which corrective action to be taken, it must be determined whether the violations of the DQOs are unique to one site, multiple sates, or a network of similar monitors, or are caused by a broader problem. An example of a broader problem may be e particular sampler demonstrating poor QA on a national level. The AQS generates QA reports summarizing bias and precision statistics at the national and reporting organization levels by method designation. Examination of these reports may assist in determining the level at which the DQOs are being violated.
- **Communicating with EPA Region III** - It a violation of the bias and precision DQIs are found, AMS will remain in close contact with EPA for both assistance and for communication.
- **Extensively reviewing quarterly date until DQOs are achieved** - The Administrative Engineer or Administrative Scientist will continue to extensively review the quarterly QA reports end the QC summaries until the bias and precision lends are attained.

APPENDICES

APPENDIX 1. TERMS AND DEFINITIONS

Note: This section contains a portion of the glossary of terms from the guidance document (1) for remote sensing that is applicable to Compendium Method TO-16. When possible, definitions of terms have been drawn from authoritative texts or manuscripts in the fields of remote sensing, air pollution monitoring, spectroscopy, optics, and analytical chemistry. In some cases, general definitions have been augmented or streamlined to be more specific to long-path, open-path monitoring applications and to Compendium Method TO-16

Absorbance—the negative logarithm of the transmission. A = -ln(I/I), where I is the transmitted intensity of the light and I is the incident intensity. Generally, the logarithm to the base 10 is used, although the quantity I really diminishes exponentially with A.

Apodization—a mathematical transformation carried out on data received from an interferometer to alter the instrument's response function. There are various types of transformation; the most common are boxcar, triangular, Happ-Genzel, and Beer-Norton functions.

Background Spectrum—1. With all other conditions being equal, that spectrum taken in the absence of the particular absorbing species of interest. 2. Strictly, that radiant intensity incident on the front plane of the absorbing medium. 3. A spectrum obtained from the ambient black body radiation entering the system. This background must be considered in FT-IR systems, in which the IR beam is not modulated before it is transmitted along the path. For FT-IR systems that do not use a separate source of infrared energy, the background is the source of infrared energy.

Beer's Law—Beer's law states that the intensity of a monochromatic plane wave incident on an absorbing medium of constant thickness diminishes exponentially with the number of absorbers in the beam. Strictly speaking, Beer's law holds only if the following conditions are met: perfectly monochromatic radiation, no scattering, a beam that is strictly collimated, negligible pressure-broadening effects (2,3).

Bistatic System—a system in which the receiver is some distance from the transmitter. This term is actually taken from the field of radar technology. For remote sensing, this implies that the light source and the detector are separated and are at the ends of the monitoring path.

Fourier Transform—a mathematical transform that allows an aperiodic function to be expressed as an integral sum over a continuous range of frequencies (4). The Fourier transform of the interferogram produced by the Michelson interferometer in an FT-IR is the intensity as a function of frequency.

FT-IR—an abbreviation for "Fourier transform infrared." A spectroscopic instrument using the infrared portion of the electromagnetic spectrum. The working component of this system is a Michelson interferometer. To obtain the absorption spectrum as a function of frequency, a Fourier transform of the output of the interferometer must be performed. A brief overview of the FT-IR is provided in FT-IR Theory (5). An in-depth description of the FT-IR can be found in Fourier Transform Infrared Spectrometry (6).

Intensity—the radiant power per unit solid angle. When the term "spectral intensity" is used, the units are watts per steradian per nanometer. In most spectroscopic literature, the term "intensity" is used to describe the power in a collimated beam of light in terms of power per unit area per unit wavelength.

Interference—the physical effects of superimposing two or more light waves. The principle of superposition states that the total amplitude of the electromagnetic disturbance at a point is the vector sum of the individual electromagnetic components incident there. For a two-component system of collinear beams of the same amplitude, the mathematical description of the result of addition is given by $I(p) = 2I\,(1 + \cos[A])$, where 0 I is the intensity of either beam, and A is the phase difference of the two components. The cosine term is called 0 the "interference term" (7,8). See also "Spectral Interference."

Interferogram—the effects of interference that are detected and recorded by an interferometer; the output of an FT-IR and the primary data that is collected and stored (6,8).

Interferometer—any of several kinds of instruments used to produce interference effects. The Michelson interferometer used in FT-IR instruments is the most famous of a class of interferometers that produce interference by the division of an amplitude (9).

Light—strictly, light is defined as that portion of the electromagnetic spectrum that causes the sensation of vision. It extends from about 25,000 cm-1 to about 14,300 cm-1 (4).

Minimum Detection Limit—the minimum concentration of a compound that can be detected by an instrument with a given statistical probability. Usually the detection limit is given as 3 times the standard deviation of the noise in the system. In this case, the minimum concentration can be detected with a probability of 99.7% (10,11).

Monitoring path—the actual path in space over which the pollutant concentration is measured and averaged.

Monostatic System—a system with the source and the receiver at the same end of the path. For FT-IR systems, the beam is generally returned by a retroreflector.

Reference Spectra—spectra of the absorbance versus wave number for a pure sample of a set of gases. The spectra are obtained under controlled conditions of pressure and temperature and with known concentrations. For most instruments, the pure sample is pressure-broadened with nitrogen so that the spectra are representative of atmospherically broadened lines. These spectra are used for obtaining the unknown concentrations of gases in ambient air samples.

Relative Absorption Strength—a term used exclusively in Compendium Method TO-16 to describe the relation of absorption due to interfering species to the absorption of the target gas.

Resolution—the minimum separation that two spectral features can have and still, in some manner, be distinguished from one another. A commonly used requirement for two spectral features to be considered just resolved is the Raleigh criterion. This states that two features are just resolved when the maximum intensity of one falls at the first minimum of the other (5,6). This definition of resolution and the Raleigh criterion are also valid for the FT-IR, although there is another definition in common use for this technique. This definition states that the minimum separation in wave numbers of two spectral features that can be resolved is the reciprocal of the maximum optical path difference (in centimeters) of the two interferometer mirrors employed.

Retroreflector—the CIE (Commission Internationale de l'Eclairage) defines retroreflection as "radiation returned in directions close to the direction from which it came, this property being maintained over wide variations of the direction of the incident radiation." Retroreflector devices come in a variety of forms and have many uses. The one commonly described by workers in remote sensing uses total internal reflection from three mutually perpendicular surfaces. This kind of retroreflector is usually called a corner cube or prismatic retroreflector (12).

RMS Noise—this quantity is actually the statistical quantity rms deviation. In Compendium Method TO-16 the rms noise (deviation) is calculated by using a least squares fit to the baseline. Because of this calculation, the rms noise in Compendium Method TO-16 uses the quantity N-2 in the denominator rather than N-1 as normally described.

Single Beam Spectrum—that spectrum which results from performing the Fourier transform on the interferogram. It is not a transmission spectrum. The term “single beam” is a holdover from older instruments that were double beam instruments.

Source—the device that supplies the electromagnetic energy for the various instruments used to measure atmospheric gases. These generally are a Nernst glower or globar for the infrared region or a xenon arc lamp for the ultraviolet region.

Spectral Interference—when the absorbance features from two or more gases cover the same wave number regions, the gases are said to exhibit spectral interference. Water vapor produces the strongest spectral interference for infrared spectroscopic instruments that take atmospheric data.

Synthetic Background—a spectrum that is made from a field spectrum by choosing points along the baseline and connecting them with a high-order polynomial or short, straight lines. The synthetic background is then used to find the absorbance spectrum.

Wave Number—the number of waves per centimeter. This term has units of reciprocal centimeters (cm-1).

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APPENDIX 2. QAPP REVISION HISTORY

Date	Revision No.	Sections Revised	Prepared / Revised By: Title	Date Submitted to EPA	Date of EPA Approval
October 2011	0	Initial QAPP Submitted for EPA Approval	Paresh Mehta, Administrative Engineer	October 2011	
February 22, 2012	1	All Sections	Maryjoy Ulatowski, Environmental Engineer	February 22, 2012	