

2008-2009 Air Monitoring Network Plan

City of Philadelphia
Department of Public Health
Air Management Services

July 1, 2008

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) has regulations for 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: www.epa.gov/epahome/rules.html#codified.

Beginning July 1, 2007, and each year thereafter, AMS submits to EPA Region III, an Air Monitoring Network 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 eleven sections:

- **Announcement of Future Changes to the Network** – This section provides information on how the public is made aware of this 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 this Plan.
- **Review of Changes to the PM2.5 Monitoring Network** - Per 40 CFR part 58.10(c), this section documents changes to the PM2.5 monitoring network that impact the location of a violating PM2.5 monitor, including a description of the proposed use of spatial averaging for purposes of making comparisons to the annual PM2.5 NAAQS as set forth in appendix N to 40 CFR part 50.
- **Detailed Information on Each Site** - This is the largest section of the Plan. Each monitoring site is separately described in a table, map and pictures. 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 of the 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) a text description and graphs showing the concentration of the pollutant over a number of years.
- **Siting Criteria** - Appendix A summarizes the probe and monitoring path siting criteria.

AMS has provided a copy of the Air Monitoring Network Plan for public inspection on the City's Web site at: <http://www.phila.gov/health/units/ams/index.html>.

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

Mr. Henry Kim
 Chief of Program Services
 Air Management Services
 321 University Avenue, 2nd Floor
 Philadelphia, PA 19104
 Phone: 215-685-9437
 E-mail: henry.kim@phila.gov

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Announcement of Future Changes to the Network

Beginning July 1, 2007, and each year thereafter, AMS submits to EPA Region III, an Air Monitoring Network Plan which assures 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 will announce to the public the availability of the Air Monitoring Network Plan through notices published in the Philadelphia Daily News and the Pennsylvania Bulletin. Copies of the Plan will be available for public inspection on the City's Web site under the Department of Public Health, Air Management Services at: <http://www.phila.gov/health/units/ams/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 Air Monitoring Network 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 multipollutant monitoring stations. Monitors at these sites are required to measure particles (PM_{2.5}, speciated PM_{2.5}, PM_{10-2.5}), O₃, SO₂, CO, nitrogen oxides (NO/NO₂/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, 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.

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 the concentrations in air volumes associated with area dimensions ranging from several meters up to about 100 meters.
- **Middle scale** - defines the concentration typical of areas up to several city blocks in size with dimensions ranging from about 100 meters to 0.5 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.

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 10,000 population, 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 50,000 population or greater. 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 (O₃)**
 - **Sulfur Dioxide (SO₂)**
 - **Carbon Monoxide (CO)**
 - **Nitrogen Dioxide (NO₂)**
 - NO means nitrogen oxide.
 - NO_x means oxides of nitrogen and is defined as the sum of the concentrations of NO₂ and NO.
 - NO_y means the sum of all total reactive nitrogen oxides, including NO, NO₂, 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
 - **PM₁₀** -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 35 compounds, Carbonyls – 6 compounds, and metals - 6 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 ¹⁴C 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 PM₁₀ 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 PM₁₀ 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 Subambient 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 Chromatograph (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. NO₂ 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 SO₂ fluoresces giving off an amount of photons directly proportional to the concentration of sulfur dioxide in the air.
- **Ozone - Ultra Violet:** is 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°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 nitrogen and oxygen are collected in a vessel of known volume, the reference volume. From the pressure in the reference volume, the total volume of air which passed through the preconcentration system is known. This volume is used to calculate the

mixing ratio 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 °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 is a refrigerant used to obtain subambient temperatures in the VOC concentration and GC/MS. This analysis is used to determine the concentration of Benzene and other organic compounds and VOC in the atmosphere.

- **Multi-Detector GC:** Analysis of organic or VOC are conducted using a Gas Chromatograph (GC) with an attached detector such as a mass Spectrometer (MS), Flame Ionization Detector (FID), Photo Ionization Detector, or Electron Capture Detector.
- **Thin Layer Chromatography:** 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.

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 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 10 days or more, occurs infrequently: on the average, perhaps once in 10 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 7 mph for a period of 7 or more days occur seldomly. Stagnation lasting 4 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 10 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

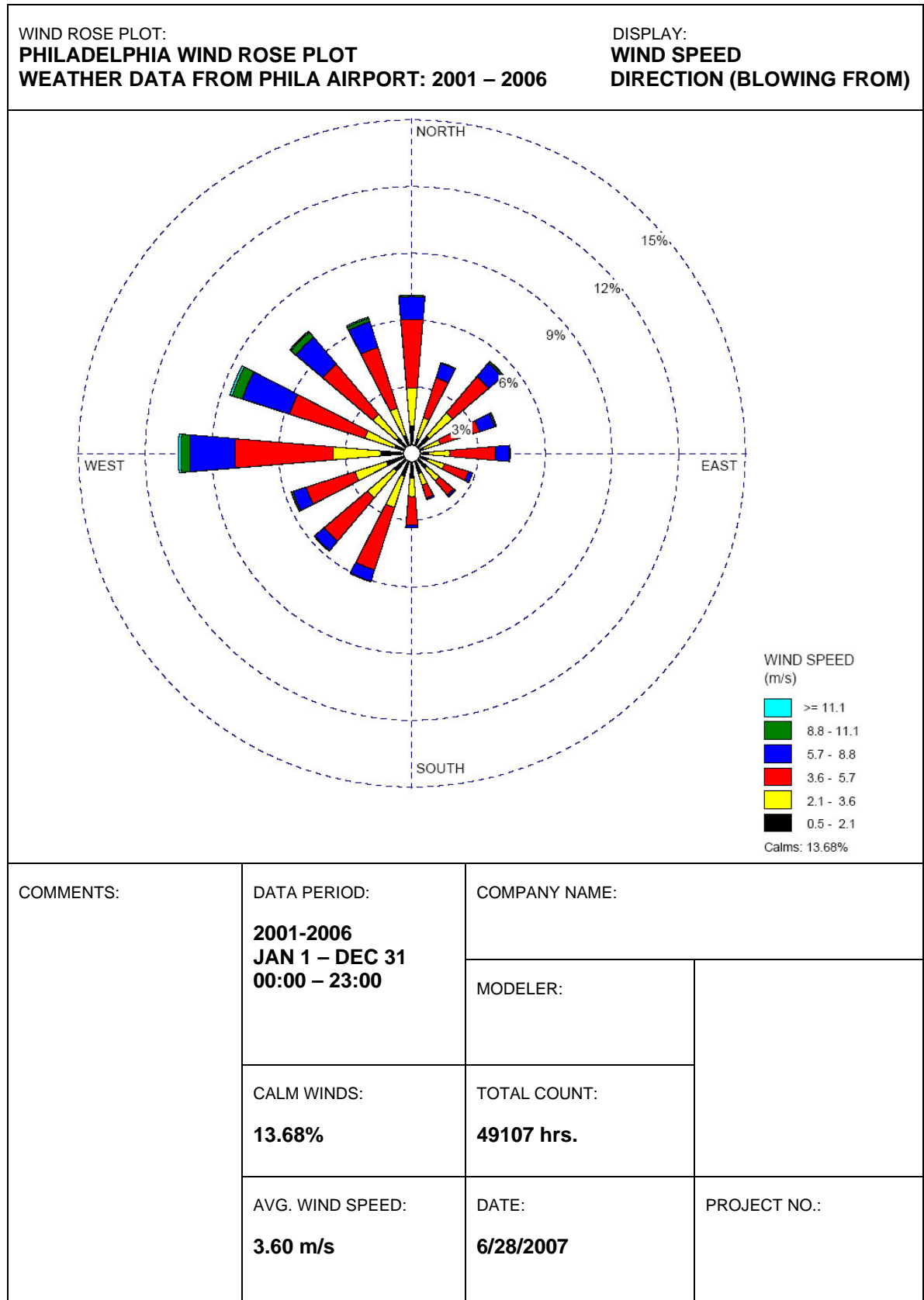
meteorological patterns which affect the city as a whole. They could, of course, contribute to increased air pollution problems in a small local area within the city under certain circumstances.

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)

The following figure **PHILADELPHIA WIND ROSE PLOT** provides information on the frequency and strength of wind in Philadelphia over a six 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.

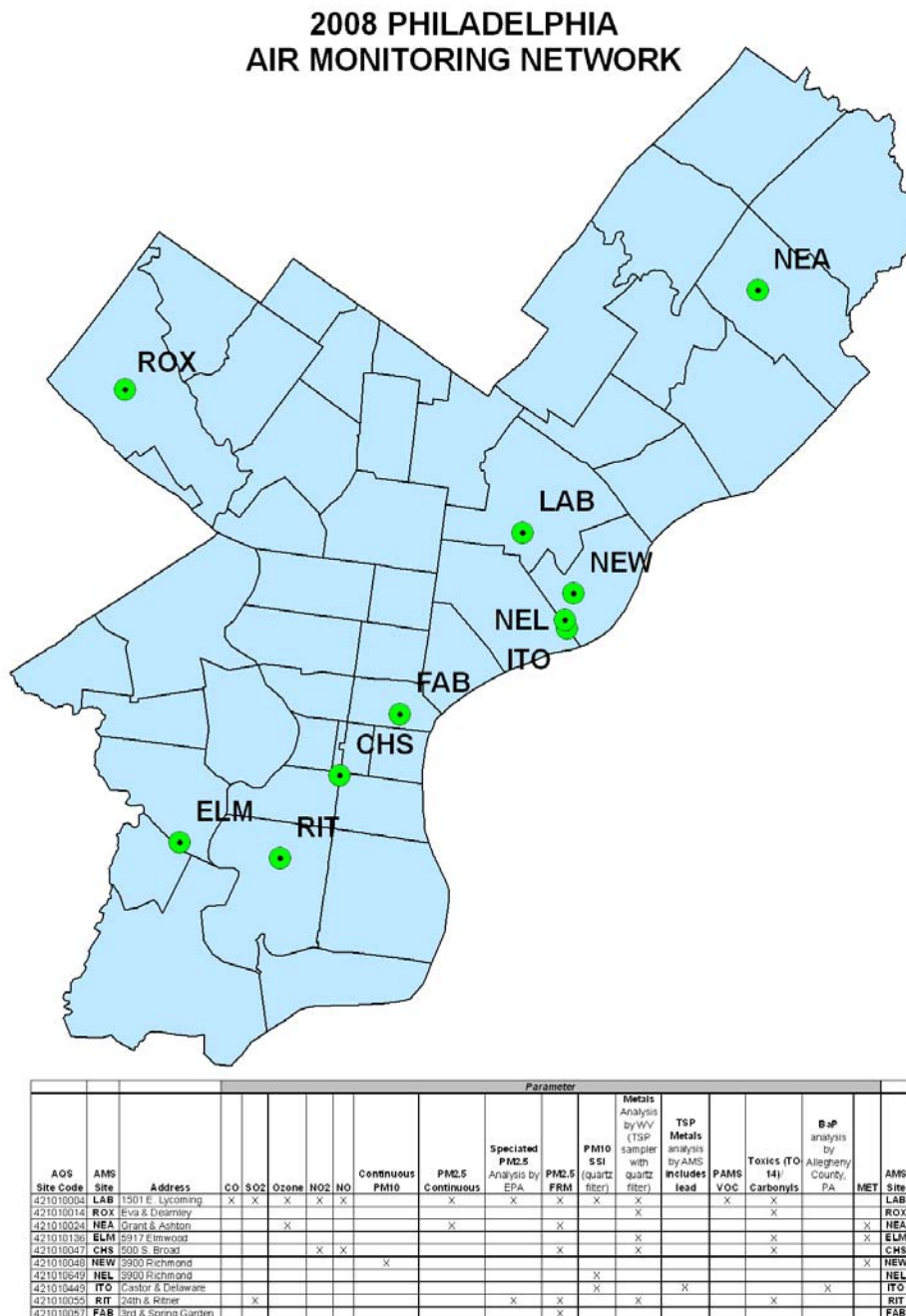
Figure 1 - Philadelphia Wind Rose Plot



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 (NO₂), sulfur dioxide (SO₂), particulate matter (PM₁₀ and PM_{2.5}), and lead. Five of the sites also measure toxics, such as benzene, acetaldehyde, and formaldehyde. The map on the next page shows the location of air monitors and the pollutants measured at each monitor location.

Figure 2 - 2008 Philadelphia Air Monitoring Network



Summary of the 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: 3,849,647

EPA Region: III, Philadelphia

Class 1 area: Brigantine Natural Wildlife Preserve near Atlantic City, NJ

City population: 1,500,000 as of 2000 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 High Ozone
42101 0024	NEA	Grant & Ashton	Periphery site High Ozone
42101 0136	ELM	5917 Elmwood	Periphery site High Ozone Selected as a replacement site for the S/E site located at Front Street & Packer Avenue which we were forced to close.
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. PM10 levels are continuously being monitored at this site which is used in reporting the Air Quality Index (AQI).
42101 0649	NEL	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. Monitoring of PM10 particulate continues at this site.
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 continues at this site.
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	3 rd & Spring Garden	This site was established to represent the highest levels of PM2.5 in the City based on EPA Region III's air quality modeling of air toxics in Philadelphia. It shows high levels of PM2.5 created by vehicle traffic.

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. Additional air monitoring for South Philadelphia is needed.

The agency will also be working to establish an NCore site within the city, one of 70 in the United States. NCore parameter requirements include measurements of PM_{2.5} FRM, speciation, and continuous mass, coarse particles (PM_{10-2.5}), O₃, trace levels of CO, SO₂, NO, and NO_y, and surface meteorology including wind speed and direction, temperature, and relative humidity.

Proposed Changes to the Network

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

- Closure of CHS site
 - The CHS site is expected to shutdown in 2009. Based on EPA Region III modeling results, FAB was established as an alternative site to CHS. Data from FAB and CHS are being compared until CHS is forced to shut down. AMS will obtain public comment on the impact of the loss of the data from the CHS station.
- Identify a location for the NCore station
 - A candidate NCore multi-parameter station, one of 70 in the national network, will be determined by July 15, 2008. An area northeast of center city at 5200 Pennypack St., Philadelphia, PA 19136 is being assessed for its suitability for establishing the site (BAX). SO₂ will be moved from LAB to BAX. “Trace” instruments for carbon monoxide, sulfur dioxide will be purchased and deployed at the NCore site.
- Philadelphia International Airport monitoring site
 - A monitor to measure PM_{2.5} and toxics will be placed to assess the airport (INT) by the 1st quarter of 2009. A location owned by the Health Department in South Philadelphia is near high levels of aldehydes shown by EPA Region III model analysis at 4600 Island Ave., Philadelphia, PA 19153.
- River Port monitoring site
 - A monitor to measure PM_{2.5} and toxics will be placed to assess the river port (PAC) by the 1st quarter of 2009. AMS is looking at the area in close proximity to Packer Avenue Terminal (near Packer Ave and S. Delaware Ave).
- Toxics monitors
 - The ELM toxics monitor will be moved to INT by the 1st quarter of 2009. The ROX or CHS toxics monitor will be moved to PAC by the 1st quarter of 2009. ELM will cease operation.

Review of Changes to the PM_{2.5} Monitoring Network

Per 40 CFR part 58.10(c), this annual monitoring network plan must document how AMS will provide for the review of changes to the PM_{2.5} monitoring network that impact the location of a violating PM_{2.5} monitor, 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.

The highest annual design value for PM_{2.5} is currently measured at CHS. With the expected closure of the CHS site in 2009, an alternative site was established at FAB. AMS will obtain public comment on the impact of the loss of the data from the CHS station. AMS has provided a copy of the Air Monitoring Network Plan for public inspection on the City's Web site at:

<http://www.phila.gov/health/units/ams/index.html>.

Results from an EPA modeling study in Philadelphia show the FAB site is located in the highest area of expected particulate levels in downtown Philadelphia, PA. Additional information gathered by Ted Erdman of EPA Region III supports this. His analysis resulted in the following conclusions:

- The Regional model, Community Multi-scale Air Quality (CMAQ) provided the regional background concentrations, and the local plume dispersion model, Industrial Source Complex Short-Term, version 3 (ISCST3) provided the concentrations from local emission sources.
- Maps show that FAB is in the area of highest traffic emissions in Philadelphia. Also the model output shows that CHS is not in an area of high impact from traffic emissions.
- FAB is also in a high population area. The general area around the station is expected to experience large increases in population and commercial activity.
- FAB is Neighborhood Scale per 40 CFR Part 58 Appendix D - Spacing from Roadways.
 - 6.3 Spacing for Particulate Matter (PM_{2.5}, PM₁₀, Pb) Inlets.
 - (a) Since emissions associated with the operation of motor vehicles contribute to urban area particulate matter ambient levels, spacing from roadway criteria are necessary for ensuring national consistency in PM sampler siting.
 - (b) The intent is to locate localized hot-spot sites in areas of highest concentrations whether it be from mobile or multiple stationary sources. If the area is primarily affected by mobile sources and the maximum concentration area(s) is judged to be a traffic corridor or street canyon location, then the monitors should be located near roadways with the highest traffic volume and at separation distances most likely to produce the highest concentrations. For the microscale traffic corridor site, the location must be between 5 and 15 meters from the major roadway. For the microscale street canyon site the location must be between 2 and 10 meters from the roadway. For the middle scale site, a range of acceptable distances from the roadway is shown in figure E-1 of Appendix B. This figure also includes separation distances between a roadway and neighborhood or larger scale sites by default. Any site, 2 to 15 meters high, and further back than the middle scale requirements will generally be neighborhood, urban or regional scale. For example, according to Figure E-1 of Appendix B, if a PM sampler is primarily influenced by roadway

emissions and that sampler is set back 10 meters from a 30,000 ADT (average daily traffic) road, the site should be classified as microscale, if the sampler height is between 2 and 7 meters. If the sampler height is between 7 and 15 meters, the site should be classified as middle scale. If the sample is 20 meters from the same road, it will be classified as middle scale; if 40 meters, neighborhood scale; and if 110 meters, an urban scale.

- Comparison of PM_{2.5} Data Collected at CHS vs. FAB during 4th Quarter 2007 shows good agreement:
 - The 4th quarter average of 91 values collected at CHS was 13.51 micrograms per cubic meter and for FAB was 13.26 micrograms per cubic meter. The goal was to demonstrate agreement between the quarterly average of 0.3 micrograms per meter which is the demonstrated agreement of collocated samplers at the same station at the 95 % confidence level.
 - On all days but one the agreement was within 2 micrograms per cubic meter. On 12/21, the CHS value was 14 and the FAB value was 21.
 - On three days the concentration was greater than 33 micrograms per cubic meter.

Additional information (maps, data, pictures) are provided in Appendix B - EPA PowerPoint Presentation – FAB PM_{2.5} Information.

Detailed Information on Each Site

LAB

Table 2 - Detailed LAB Information

Parameter	Samp Type	Op Schedule	Collection	Analysis	Comments	AQS Met	Spatial Scale	Monit. Obj.	Probe (m)	Begin
CO	NAMS	Hourly	Instrumental	Nondispersive infrared		54	Neighborhood	Population Exposure	7	2/1/1966
SO2	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
NO2	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									
PM2.5 Continuous	SPM	Continuous	BAM =Beta Attenuation Monitor Met One BAM - 1020			731				
PM2.5 Speciated	NAMS		Met One SASS	Energy Dispersive XRF	Analysis by EPA	811				
PM2.5 FRM	SLAMS	Daily	R&P PM2.5	Gravimetric		118	Neighborhood	Population Exposure		
PM10 SSI	NAMS	Daily	Hi-Vol-SA/GMW-321-B	Gravimetric	NAAQS Compliance Monitoring - Annual and 24 hr	92	Neighborhood	Population Exposure	7	1/1/1999
Metals	SPM		Hi-Vol	ICP-MS	Analysis by WV (TSP sampler with quartz), Not reported to AQS	107				

LAB
AQS Site
Identification

421010004

Street Address

1501 E. Lycoming Street, 19124

Geographical
Coordinates

Latitude:

40.008889

Longitude:

-75.09778

Lab information continued on next page –

Table 2 – Detailed Lab Information continued from previous page –

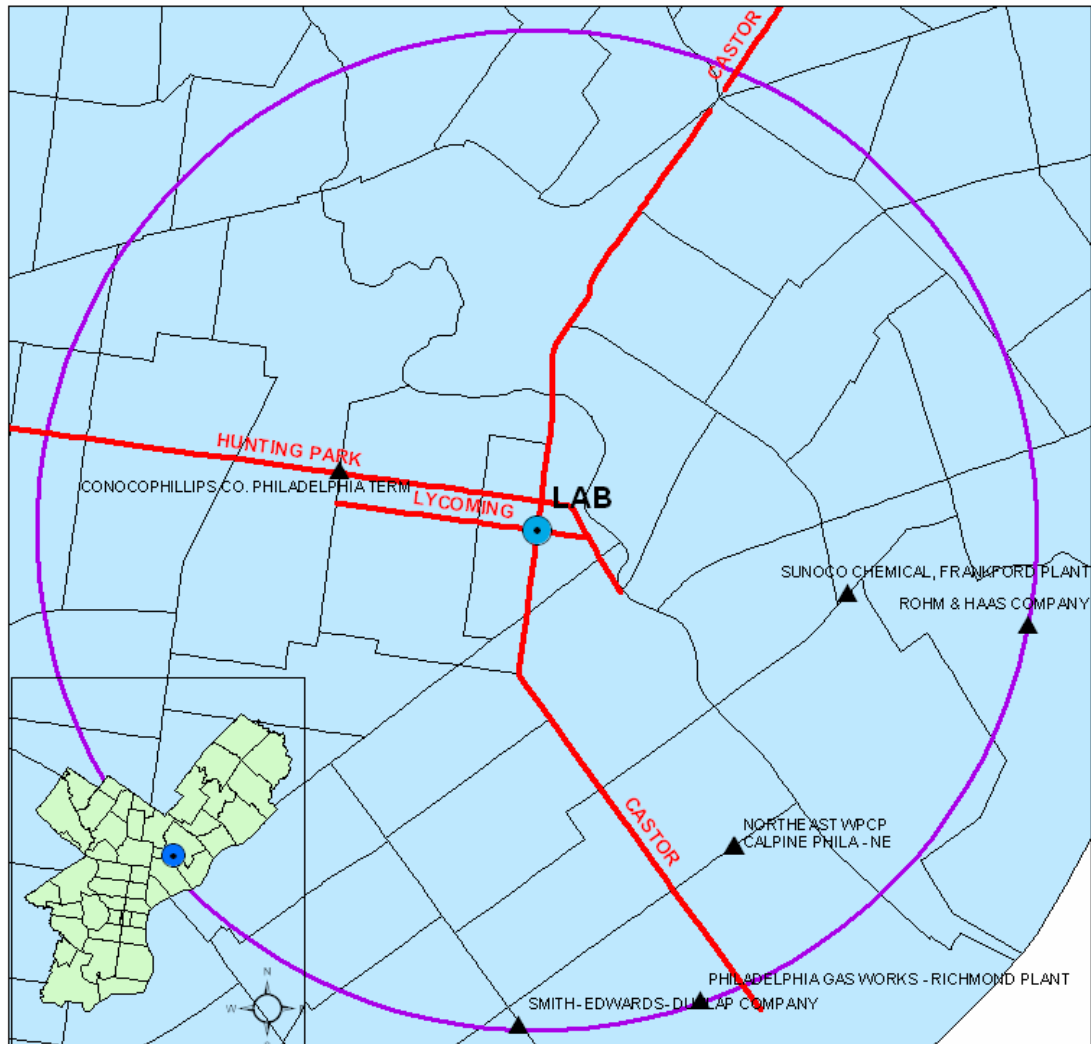
Parameter	Sampling Type	Operating Schedule	Collection Method	Analysis Method	Comments	AQS Method	Spatial Scale	Monitoring Objective	Probe Height (m)	Begin Date
PAMS VOC	PAMS	6th day	SS Canister Pressurized	Cryogenic Preconcentration GC/FID	continuous PAMS 3 hr, samples during summer	126				
Carbonyls	Urban Air Toxics	6th day	DNPH-Coated Cartridges		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				

Figure 3 - Ground Level LAB Monitoring Station Picture



Figure 4 - LAB Monitoring Site Map with Major Streets and Major Emission Sources

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



NAME	STREET	2005 EMISSIONS (in tons)							
		CO	NO2	PB	PM10	PM25	PT	SO2	VOC
CALPINE PHILA - NE	3900 RICHMOND STREET (NEWPCP)	5.47	3.54	0.00	0.07	0.00	0.07	3.16	0.76
CONOCOPHILLIPS CO. PHILADELPHIA TERM	4210 G ST	0.00	0.00	0.00	0.00	0.00	0.00	0.00	20.30
NORTHEAST WPCP	3899 RICHMOND ST	24.15	5.63	0.00	1.67	0.00	1.68	5.10	13.96
PHILADELPHIA GAS WORKS - RICHMOND PLANT	3100 EVENING ST	14.83	67.66	0.00	0.48	0.00	0.48	0.04	4.21
ROHM & HAAS COMPANY	5000 RICHMOND ST	1.47	9.26	0.00	0.50	0.00	0.64	1.40	9.71
SMITH- EDWARDS- DUNLAP COMPANY	2867 E ALLEGHENY AVE	0.07	0.32	0.00	0.01	0.00	0.03	0.32	3.84
SUNOCO CHEMICAL, FRANKFORD PLANT	4700 BERMUDA STREET	40.09	360.99	0.00	34.95	0.00	159.75	499.55	571.40
TOTAL		86.07	446.99	0.00	37.70	0.00	162.65	509.57	624.19



Figure 5 - LAB - North Aerial View

ROX

Table 3 - Detailed ROX Information

AMS Site

**ROX
AQS Site
Identification**

421010014

Street Address

Eva & Dearnley

**Geographical
Coordinates**

Latitude:

40.076389

Longitude:

-75.011944

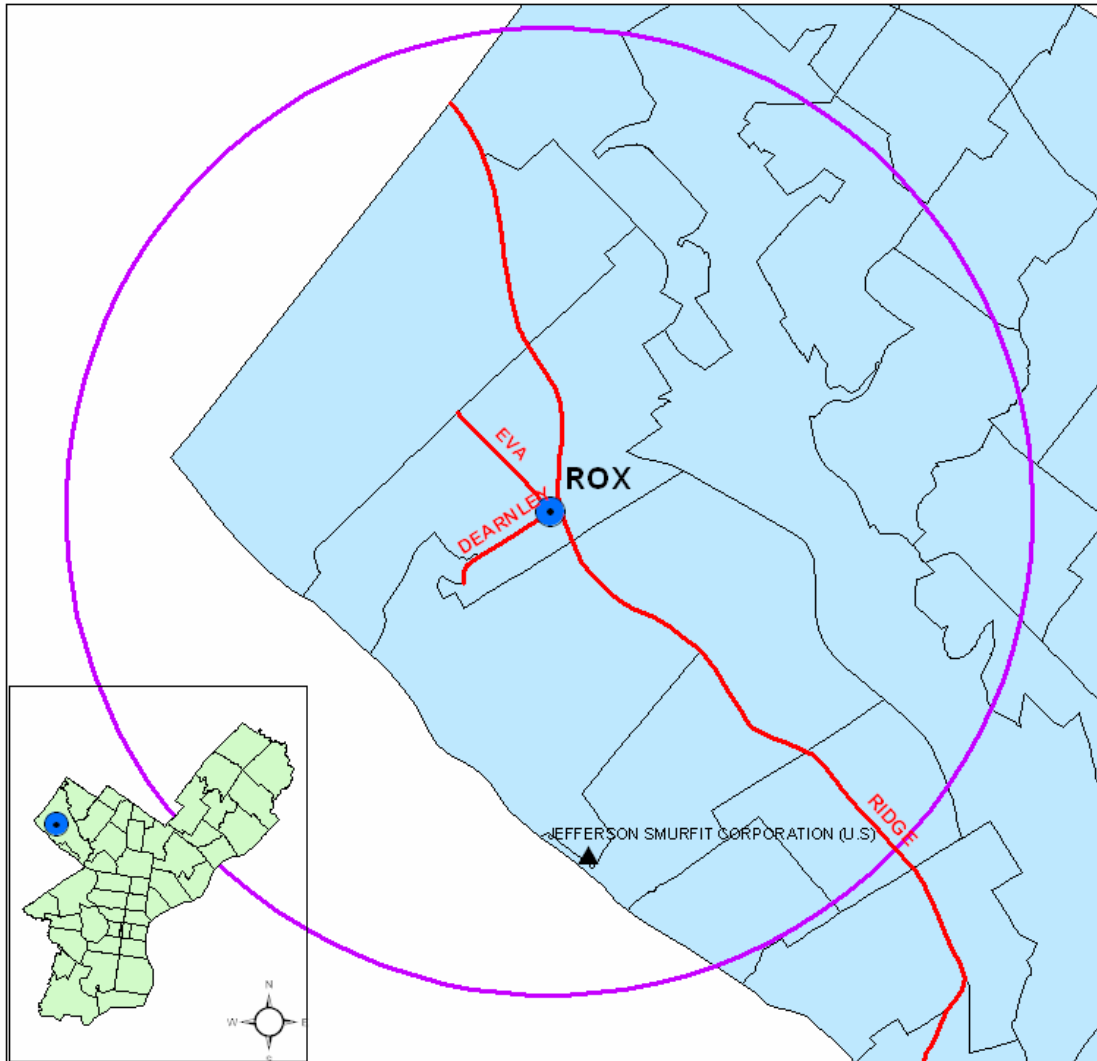
Parameter	Sampling Type	Operating Schedule	Collection Method	Analysis Method	Comments	AQS Method	Spatial Scale	Monitoring Objective	Probe Height (m)	Begin Date
Metals	SPM	6th day	Hi-Vol	ICP-MS	Analysis by WV (TSP sampler with quartz), Not reported to AQS	107				
Carbonyls	Urban Air Toxics	6th day	DNPH-Coated Cartridges			102				
Toxics	Urban Air Toxics	6th day	Canister Subambient Pressure	Multi-Detector GC		101				

Figure 5 - Ground Level ROX Monitoring Station Picture



Figure 6 - ROX Monitoring Site Map with Major Streets and Major Emission Sources

ROXBOROUGH - EVA & DEARNLEY STS. EPA AIRS CODE: 421010014



NAME	STREET	2005 EMISSIONS (in tons)							
		CO	NO2	PB	PM10	PM25	PT	SO2	VOC
BLUEGRASS CONTAINER COMPANY, LLC	5000 FLAT ROCK RD.	19.26	109.42	0.00	19.90	0.00	22.11	131.11	10.43
TOTAL		19.26	109.42	0.00	19.90	0.00	22.11	131.11	10.43

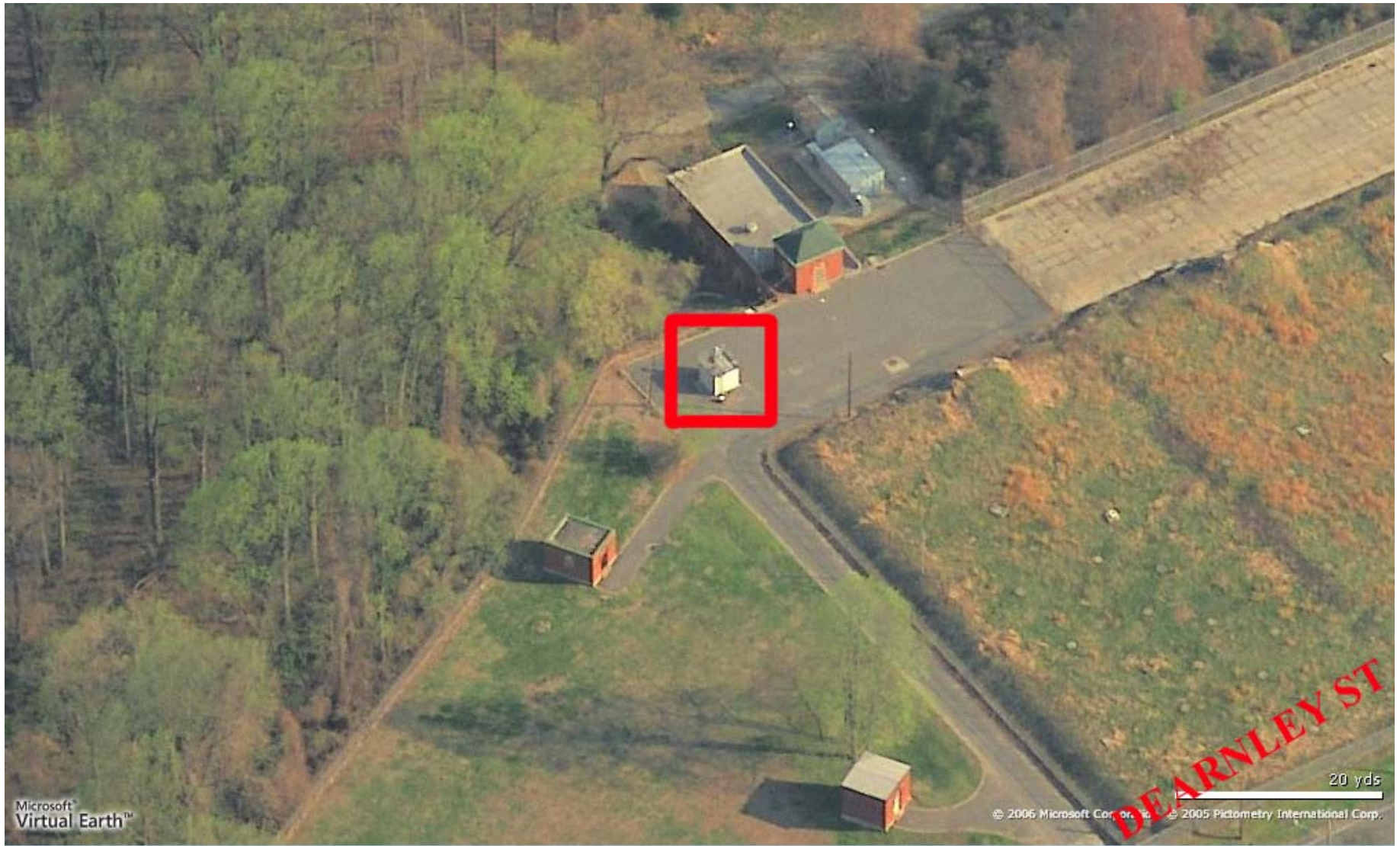


Figure 7 - ROX North Aerial View

NEA

Table 4 - Detailed NEA Information

AMS Site	Parameter	Sampling Type	Operating Schedule	Collection Method	Analysis Method	Comments	AQS Method	Spatial Scale	Monitoring Objective	Probe Height (m)
NEA	Ozone	NAMS	Hourly	Instrumental	Ultra Violet		47	Neighborhood	Population Exposure	6
AQS Site Identification	PM2.5 Continuous	SPM	Continuous	BAM =Beta Attenuation Monitor Met One BAM - 1020			731			
421010024	PM2.5 FRM	SLAMS	3rd day	R&P PM2.5	Gravimetric	NAAQS Compliance Monitoring - Annual and 24 hr	118	Neighborhood	Population Exposure	4
Street Address	MET	SLAMS								

Street Address

Grant & Ashton

Geographical Coordinates

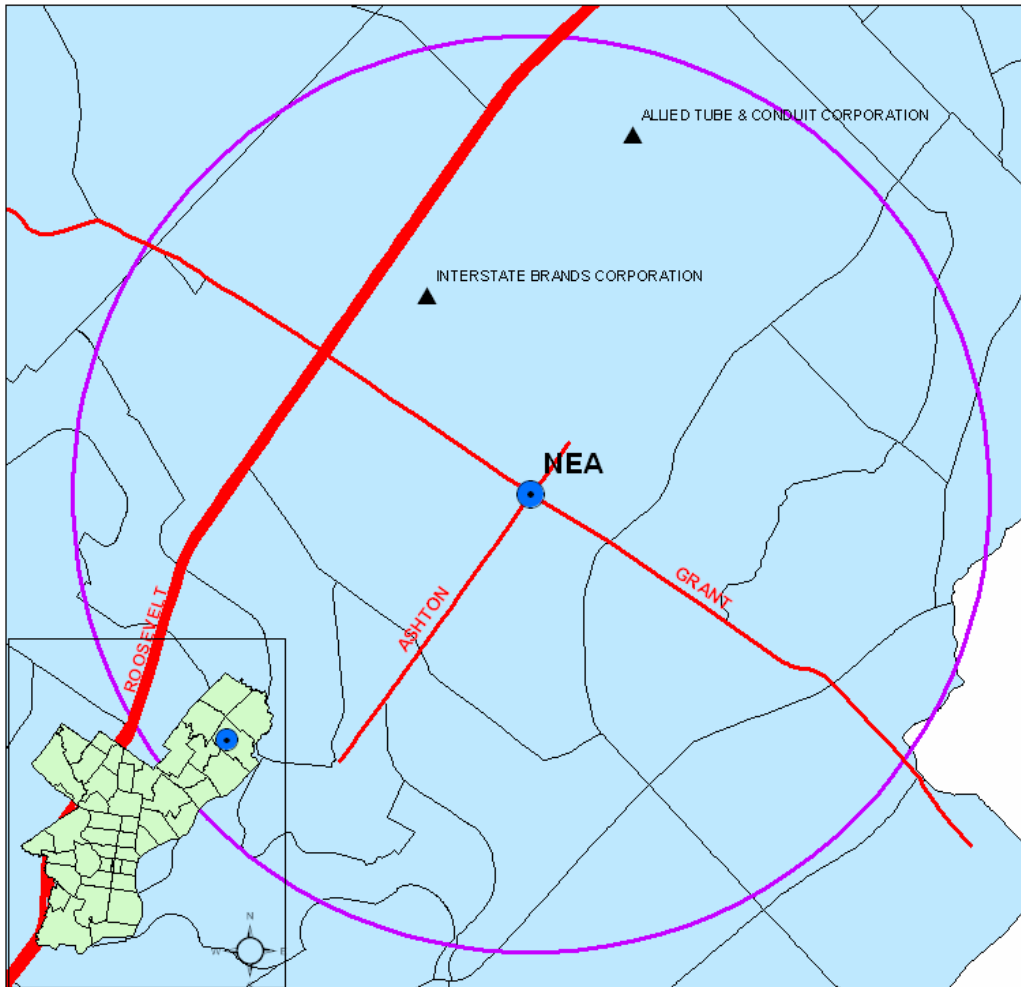
Latitude:
40.076389
Longitude:
-75.011944

Figure 8 - Ground Level NEA Monitoring Station Picture



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

NORTHEAST AIRPORT - GRANT & ASHTON AVES.
 EPA AIRS CODE: 421010024



NAME	STREET	2005 EMISSIONS (in tons)							
		CO	NO2	PB	PM10	PM25	PT	SO2	VOC
ALLIED TUBE & CONDUIT CORPORATION	11350 NORCOM RD	0.00	0.00	0.00	0.00	0.00	0.00	0.00	44.82
INTERSTATE BRANDS CORPORATION	9801 BLUE GRASS RD	6.23	25.29	0.00	0.79	0.00	1.06	9.09	40.00
TOTAL		6.23	25.29	0.00	0.79	0.00	1.06	9.09	84.82



Figure 10 - NEA North Aerial View

ELM

Table 5 - Detailed ELM Information

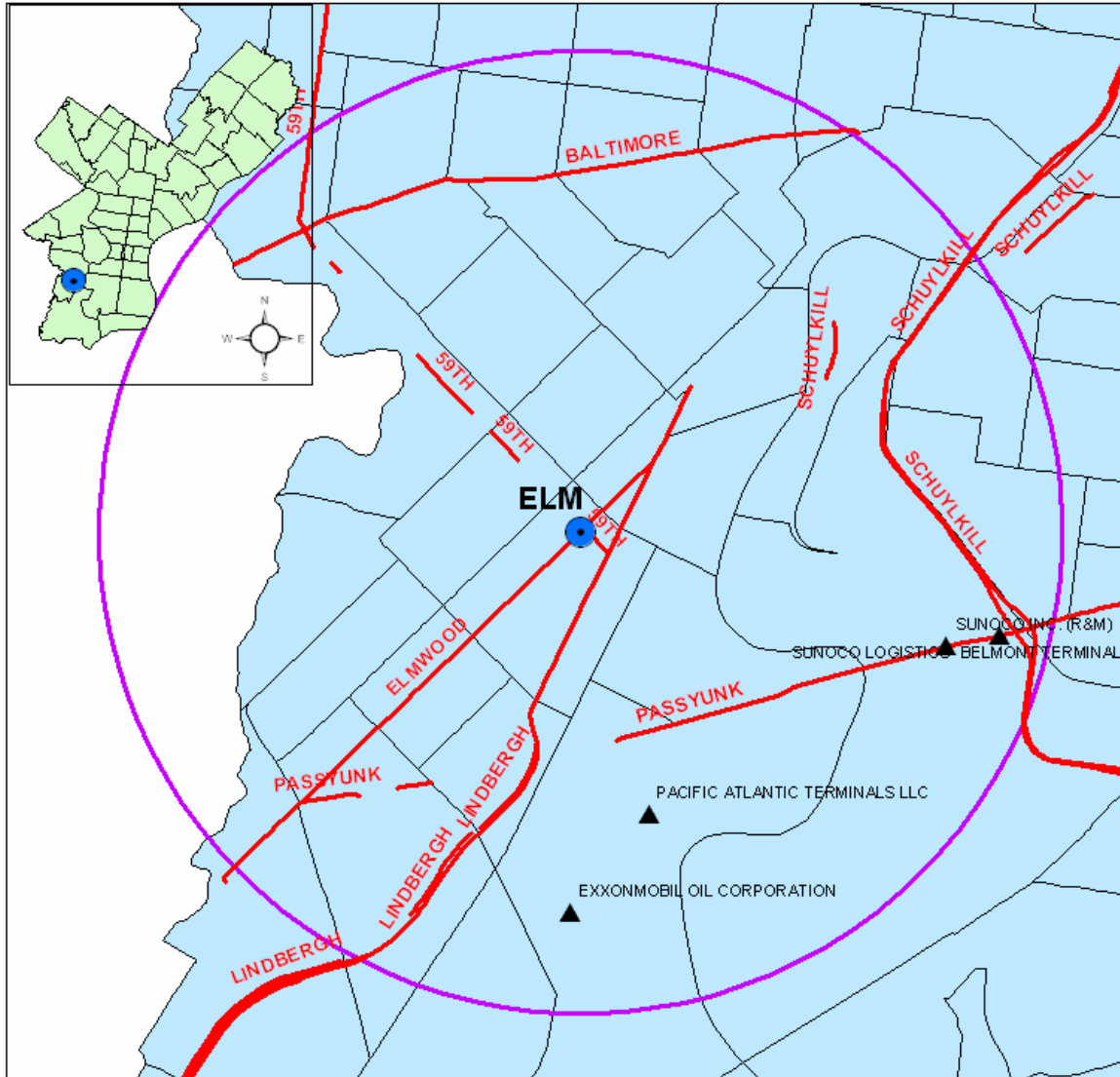
AMS Site	Parameter	Sampling Type	Operating Schedule	Collection Method	Analysis Method	Comments	AQS Method	Spatial Scale	Monitoring Objective	Probe Height (m)	Begin Date
ELM AQS Site Identification 421010136 Street Address 5917 Elmwood Geographical Coordinates Latitude: 39.9275 Longitude: -75.222778	Metals	SPM	6th day	Hi-Vol	ICP-MS	Analysis by WV (TSP sampler with quartz), Not reported to AQS	107				
	Carbonyls	Urban Air Toxics	6th day	DNPH-Coated Cartridges			102				
	Toxics	Urban Air Toxics	6th day	Canister Subambient Pressure	Multi-Detector GC		101				
	MET	SLAMS									6/1/1993

Figure 11 - Ground Level ELM Monitoring Station Picture



Figure 12 - ELM Monitoring Site Map with Major Streets and Major Emission Sources

ELMWOOD - 5917 ELMWOOD AVE
 EPA AIRS CODE: 421010136



NAME	STREET	2005 EMISSIONS (in tons)							
		CO	NO2	PB	PM10	PM25	PT	SO2	VOC
EXXONMOBIL OIL CORPORATION	6850 ESSINGTON AVE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	546.32
PACIFIC ATLANTIC TERMINALS LLC	3400 SOUTH 67TH STREET	1.56	2.46	0.00	0.08	0.00	0.19	2.38	1.09
SUNOCO INC. (R&M)	3144 PASSYUNK AVE	2006.00	3389.95	0.00	398.85	0.00	0.00	3353.02	901.04
SUNOCO LOGISTICS- BELMONT TERMINAL	2700 PASSYUNK AVE	15.14	6.05	0.00	0.12	0.00	0.00	6.91	91.17
TOTAL		2022.70	3398.46	0.00	399.05	0.00	0.19	3362.31	1539.61



Figure 13 - ELM North Aerial View

CHS

Table 6 - Detailed CHS Information

AMS Site	Parameter	Sampling Type	Operating Schedule	Collection Method	Analysis Method	Comments	AQS Method	Spatial Scale	Monitoring Objective	Probe Height (m)	Begin Date
CHS AQS Site Identification	NO2	SLAMS	Hourly	Instrumental	Chemiluminescence		74	Neighborhood	Population Exposure	11	1/1/1982
	NO	SPM									
	PM2.5 FRM	SLAMS	Daily	R&P PM2.5	Gravimetric	NAAQS Compliance Monitoring - Annual and 24 hr	118	Middle	Highest Concentration	4	1/1/1999
421010047	Metals	SPM	6th day	Hi-Vol	ICP-MS	Analysis by WV (TSP sampler with quartz), Not reported to AQS	107				
Street Address	Carbonyls	Urban Air Toxics	6th day	DNPH-Coated Cartridges			102				
500 S. Broad	Toxics	Urban Air Toxics	6th day	Canister Subambient Pressure	Multi-Detector GC		101				

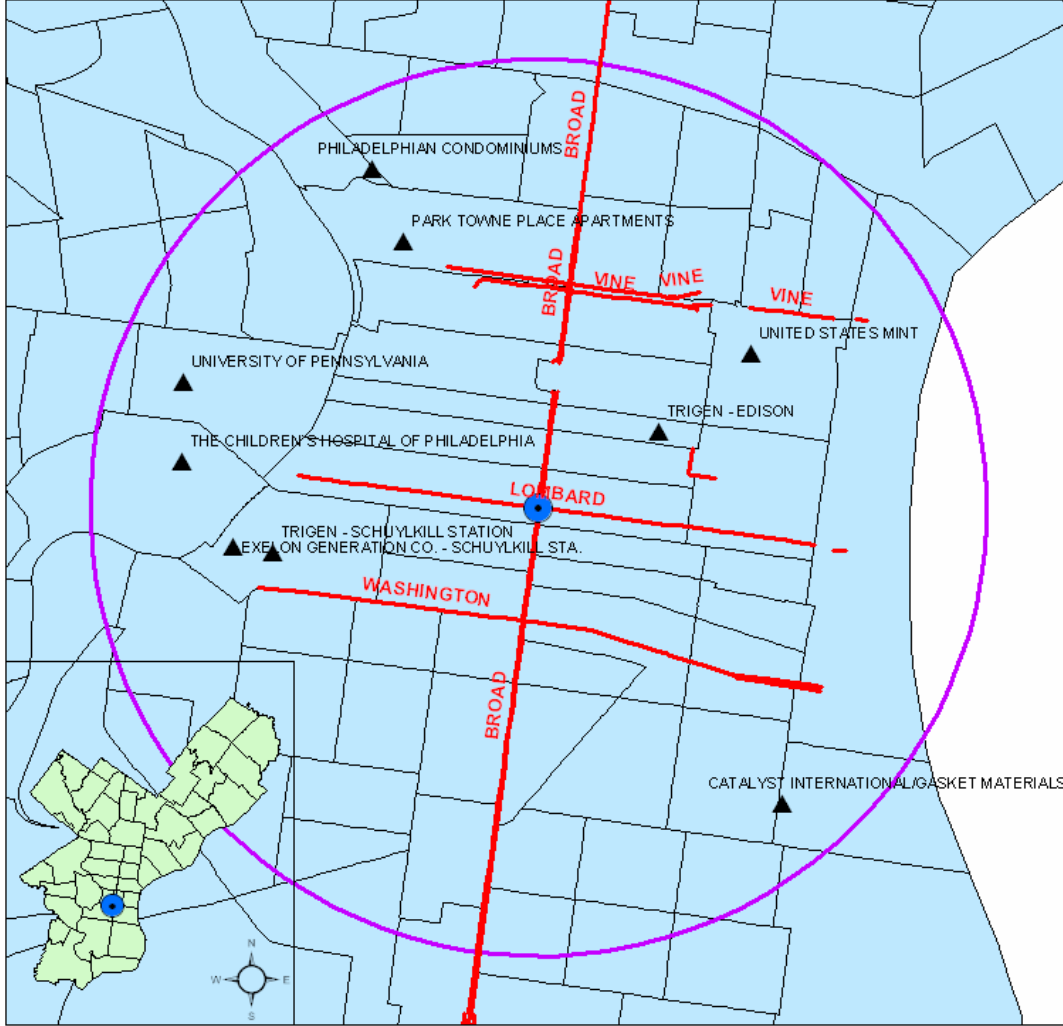
Geographical Coordinates
Latitude:
 39.944722
Longitude:
 -75.080833

Figure 14 - Ground Level CHS Monitoring Station Picture



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

COMMUNITY HEALTH CENTER #1 - 500 S. BROAD ST.
EPA AIRS CODE: 421010047



NAME	STREET	2005 EMISSIONS (in tons)							
		CO	NO2	PB	PM10	PM25	PT	SO2	VOC
CATALYST INTERNATIONAL/GASKET MATERIALS	80 E. MORRIS ST	0.03	0.14	0.00	0.00	0.00	0.00	0.00	4.88
EXELON GENERATION CO. - SCHUYLKILL STA.	2800 CHRISTIAN ST	27.82	185.27	0.00	27.88	0.00	39.51	371.71	4.21
PARK TOWNE PLACE APARTMENTS	2200 BEN FRANKLIN PKWY	1.95	2.46	0.00	0.11	0.00	0.24	0.46	0.13
PHILADELPHIAN COND OMINIUMS	2401 PENNSYLVANIA AVE.	50.79	45.24	0.00	3.40	0.00	3.64	4.79	9.74
THE CHILDREN'S HOSPITAL OF PHILADELPHIA	34TH AND CIVIC CENTER BLVD	12.06	13.25	0.00	0.75	0.00	1.32	0.42	1.14
TRIGEN - EDISON	900 SANSOM ST	15.67	122.30	0.00	6.08	0.00	6.76	223.37	0.88
TRIGEN - SCHUYLKILL STATION	2600 CHRISTIAN ST.	1.55	148.20	0.00	25.59	0.00	17.79	452.89	1.25
UNITED STATES MINT	151 N INDEPENDENCE MALL EAST	2.63	2.18	0.00	0.07	0.00	0.06	0.01	4.28
UNIVERSITY OF PENNSYLVANIA	3451 WALNUT ST	3.14	12.16	0.00	0.81	0.00	0.85	0.83	0.71
TOTAL		115.64	531.20	0.00	64.70	0.00	70.17	1054.49	27.22



Figure 16 - CHS North Aerial View

NEW

Table 7 - Detailed NEW Information

AMS Site	Parameter	Sampling Type	Operating Schedule	Collection Method	Analysis Method	Comments	AQS Method	Spatial Scale	Monitoring Objective	Probe Height (m)
NEW AQS Site Identification	PM10 Continuous	SPM	Continuous	BAM =Beta Attenuation Monitor Met One BAM -1020			731			
421010048	MET									

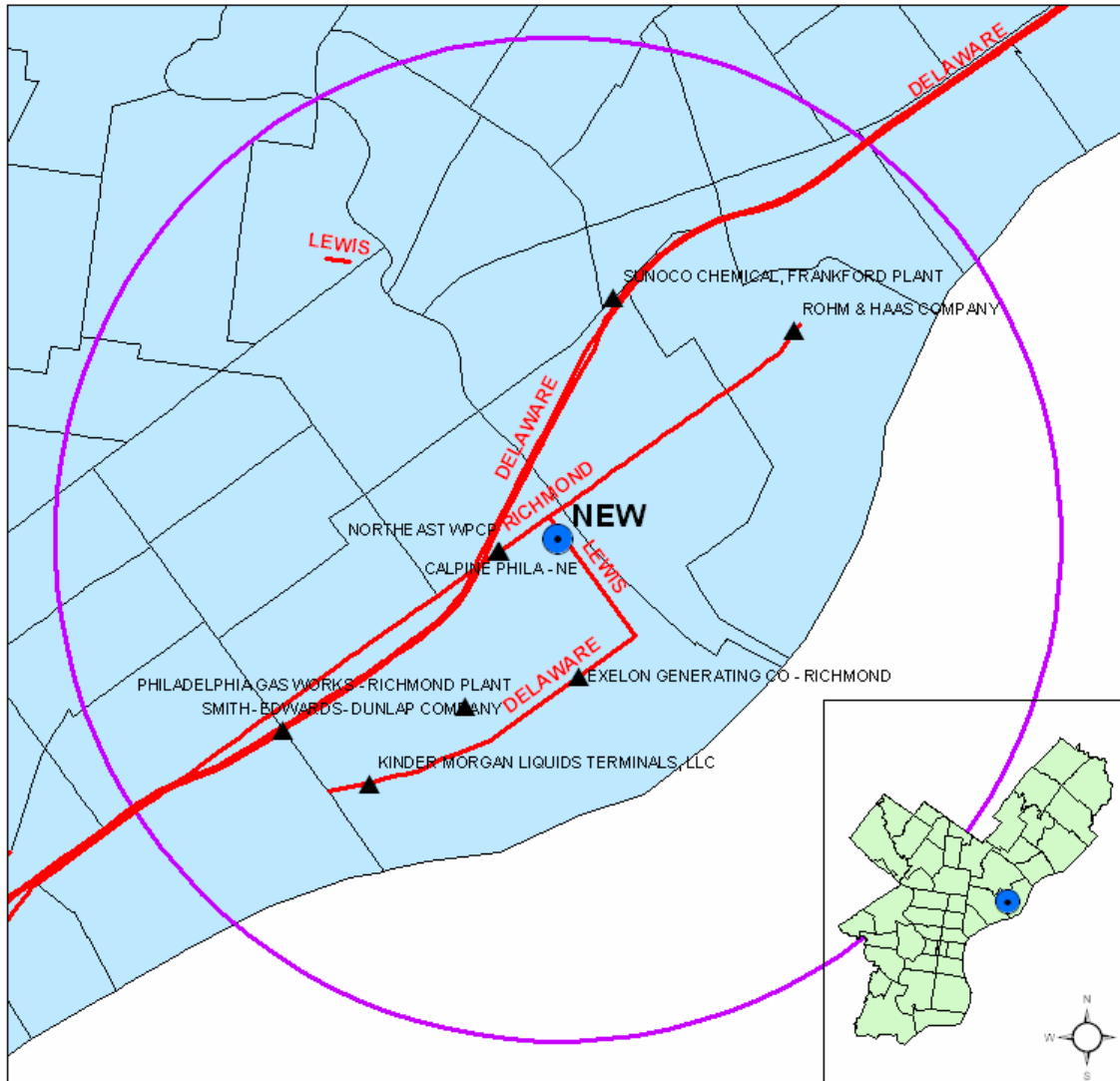
Street Address
 3900 Richmond
Geographical Coordinates
Latitude:
 39.991389
Longitude:
 -75.080833

Figure 17 - Ground Level NEW Monitoring Station Picture



Figure 18 - NEW Monitoring Site Map with Major Streets and Major Emission Sources

NORTHEAST WASTE - LEWIS & RICHMOND STS. EPA AIRS CODE: 421010048



NAME	STREET	2005 EMISSIONS (in tons)							
		CO	NO2	PB	PM10	PM25	PT	SO2	VOC
CALPINE PHILA - NE	3900 RICHMOND STREET (NEWPCP)	5.47	3.54	0.00	0.07	0.00	0.07	3.16	0.76
EXELON GENERATING CO - RICHMOND	3901 N DELAWARE AVE	0.17	35.09	0.00	3.06	0.00	3.06	6.21	0.02
KINDER MORGAN LIQUIDS TERMINALS, LLC	3300 N. DELAWARE AVENUE	0.71	2.83	0.00	0.28	0.00	0.28	4.08	32.10
NORTHEAST WPCP	3899 RICHMOND ST	24.15	5.63	0.00	1.67	0.00	1.68	5.10	13.98
PHILADELPHIA GAS WORKS - RICHMOND PLANT	3100 E VENANGO ST	14.83	67.66	0.00	0.48	0.00	0.48	0.04	4.21
ROHM & HAAS COMPANY	5000 RICHMOND ST	1.47	9.26	0.00	0.50	0.00	0.64	1.40	9.71
SMITH-EDWARDS-DUNLAP COMPANY	2867 E ALLEGHENY AVE	0.07	0.32	0.00	0.01	0.00	0.03	0.32	3.84
SUNOCO CHEMICAL, FRANKFORD PLANT	4700 BERMUDA STREET	40.09	360.59	0.00	34.96	0.00	159.75	499.55	571.40
TOTAL		86.94	484.91	0.00	41.04	0.00	165.99	519.86	636.00



Figure 19 - NEW North Aerial View

NEL

Table 8 - Detailed NEL Information

AMS Site

NEL

AQS Site

Identification

421010649

Street Address

3900 Richmond

**Geographical
Coordinates**

Latitude:

39.991389

Longitude:

-75.080833

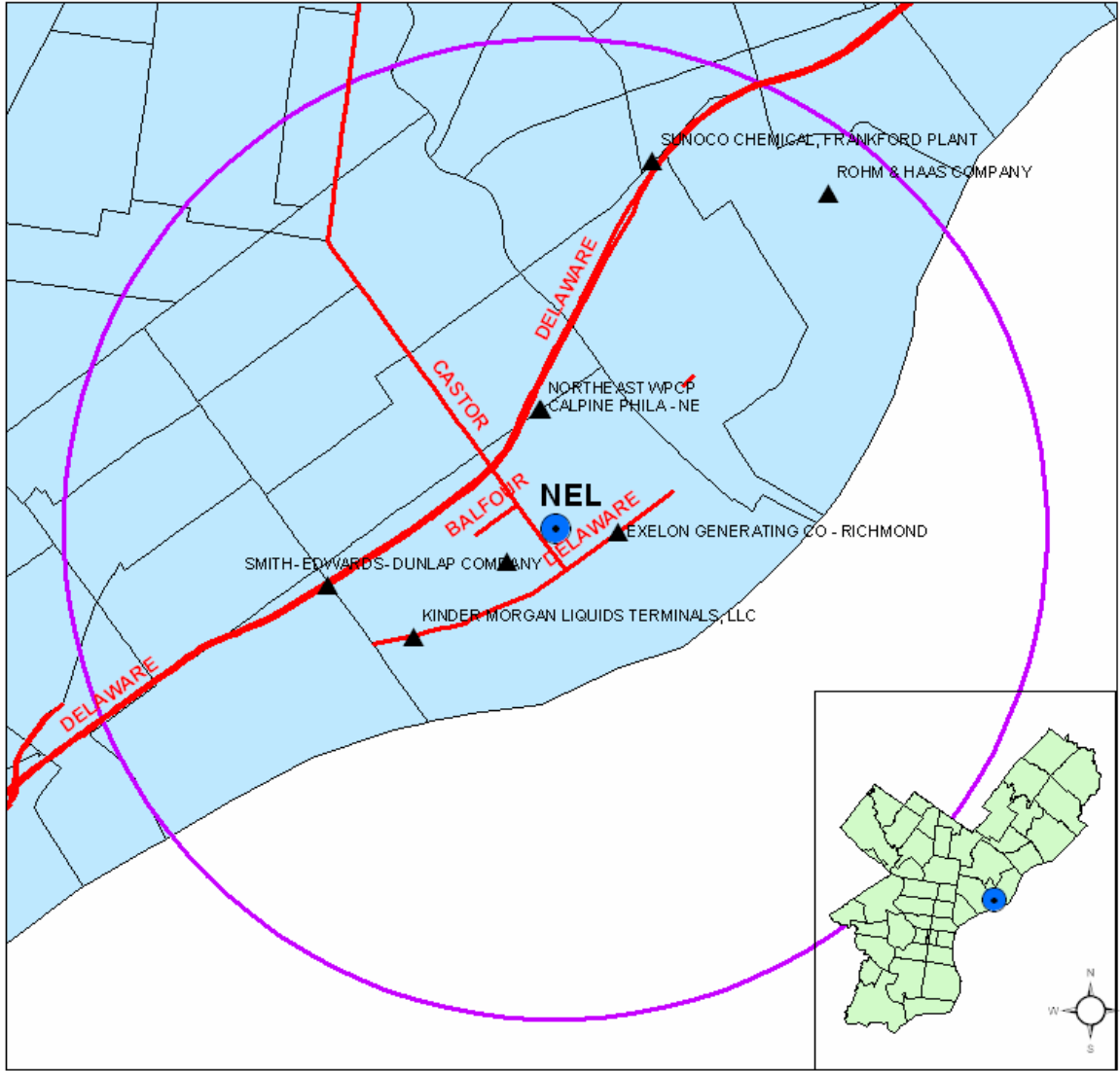
Parameter	Sampling Type	Operating Schedule	Collection Method	Analysis Method	Comments	AQS Method	Spatial Scale	Monitoring Objective
PM10 SSI	SLAMS	6th day	Hi-Vol-SA/GMW-321-B	Gravimetric	Quartz Filter co-located	64		

Figure 20 - Ground Level NEL Monitoring Station Picture



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

NORTHEAST - CASTOR AVE BETWEEN BALFOUR ST & DELAWARE AVE
EPA AIRS CODE: 421010649



NAME	STREET	2005 EMISSIONS (in tons)							
		CO	NO2	PR	PM10	PM25	PT	SO2	VOC
CALPINE PHILA - NE	3900 RICHMOND STREET (NEWPCP)	5.47	3.54	0.00	0.07	0.00	0.07	3.16	0.76
EXELON GENERATING CO - RICHMOND	3901 N DELAWARE AVE	0.17	35.09	0.00	3.06	0.00	3.06	6.21	0.02
KINDER MORGAN LIQUIDS TERMINALS, LLC	3300 N. DELAWARE AVENUE	0.71	2.83	0.00	0.28	0.00	0.28	4.08	32.10
NOR THEAST WPCP	3899 RICHMOND ST	24.15	5.63	0.00	1.67	0.00	1.68	5.10	13.96
PHILADELPHIA GAS WORKS - RICHMOND PLANT	3100 E VENANGO ST	14.83	67.66	0.00	0.48	0.00	0.48	0.04	4.21
ROHM & HAAS COMPANY	5000 RICHMOND ST	1.47	9.26	0.00	0.50	0.00	0.64	1.40	9.71
SMITH- EDWARDS- DUNLAP COMPANY	2867 E ALLEGHENY AVE	0.07	0.32	0.00	0.01	0.00	0.03	0.32	3.84
SUNOCO CHEMICAL, FRANKFORD PLANT	4700 BERMUDA STREET	40.09	360.59	0.00	34.96	0.00	159.75	499.55	571.40
TOTAL		86.94	484.91	0.00	41.04	0.00	165.99	519.86	636.00

Figure 22 - NEL North Aerial View



ITO

Table 9 - Detailed ITO Information

AMS Site
ITO
AQS Site Identification
421010449
Street Address
Castor & Delaware
Geographical Coordinates
Latitude:
-75.0838
Longitude:
39.9824

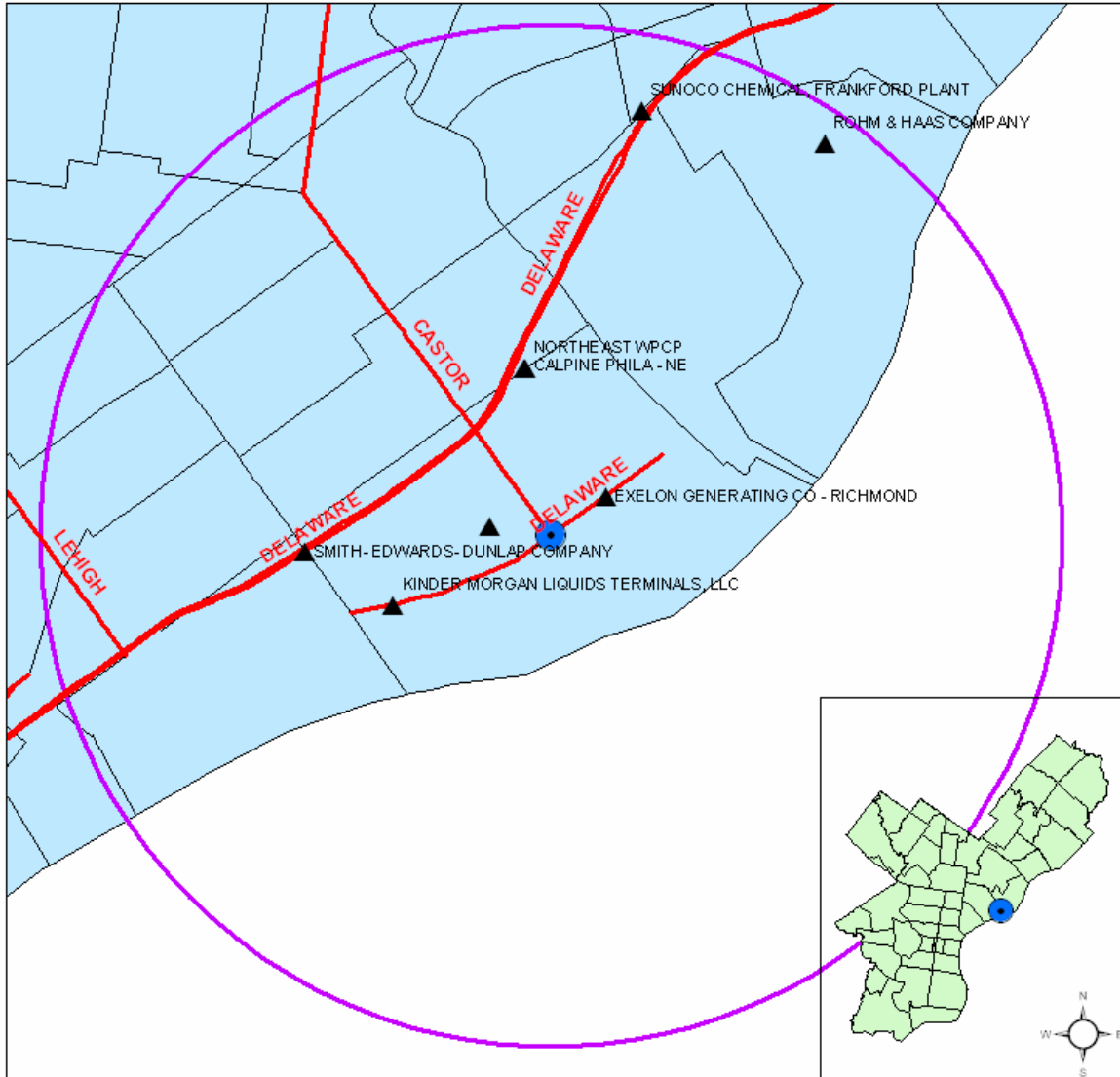
Parameter	Sampling Type	Operating Schedule	Collection Method	Analysis Method	Comments	AQS Method	Spatial Scale	Monitoring Objective	Probe Height (m)	Begin Date
PM10 SSI	SLAMS	6th day	Hi-Vol-SA/GMW-321-B	Gravimetric	Quartz Filter	64				
TSP Metals	SLAMS	6th day	Hi-Vol	Atomic Absorption	Analysis by AMS includes lead, co-located, lead is reported to AQS	92	Middle	Highest Concentration	2	1/1/1987
BaP	Urban Air Toxics	6th day	Hi-Vol	Thin Layer Chromatography	Analysis by Allegheny County, PA	91				

Figure 23 - Ground Level ITO Monitoring Station Picture



Figure 24 - ITO Monitoring Site Map with Major Streets and Major Emission Sources

ITO - CASTOR & DELAWARE AVES. EPA AIRS CODE: 421010449



NAME	STREET	2005 EMISSIONS (in tons)							
		CO	NO2	PB	PM10	PM25	PT	SO2	VOC
CALPINE PHILA - NE	3900 RICHMOND STREET (NEWPCP)	5.47	3.54	0.00	0.07	0.00	0.07	3.16	0.76
EXELON GENERATING CO - RICHMOND	3901 N DELAWARE AVE	0.17	35.09	0.00	3.06	0.00	3.06	6.21	0.02
KINDER MORGAN LIQUIDS TERMINALS, LLC	3300 N. DELAWARE AVENUE	0.71	2.83	0.00	0.28	0.00	0.28	4.08	32.10
NORTHEAST WPCP	3899 RICHMOND ST	24.15	5.63	0.00	1.67	0.00	1.68	5.10	13.96
PHILADELPHIA GAS WORKS - RICHMOND PLANT	3100 E VENANGO ST	14.83	67.66	0.00	0.48	0.00	0.48	0.04	4.21
ROHM & HAAS COMPANY	5000 RICHMOND ST	1.47	9.26	0.00	0.50	0.00	0.64	1.40	9.71
SMITH- EDWARDS- DUNLAP COMPANY	2867 E ALLEGHENY AVE	0.07	0.32	0.00	0.01	0.00	0.03	0.32	3.84
SUNOCO CHEMICAL, FRANKFORD PLANT	4700 BERMUDA STREET	40.09	360.59	0.00	34.96	0.00	159.75	499.55	571.40
TOTAL		86.94	484.91	0.00	41.04	0.00	165.99	519.86	636.00



Figure 25 - ITO North Aerial View

RIT

Table 10 - Detailed RIT Information

AMS Site	Parameter	Sampling Type	Operating Schedule	Collection Method	Analysis Method	Comments	AQS Method	Spatial Scale	Monitoring Objective	Probe Height (m)
RIT	SO2	NAMS	Hourly	Instrumental	Pulsed Fluorescent	very high levels momentarily exceeding 0.5 ppm, Expected to begin operation	60	Neighborhood	Population Exposure	4
AQS Site Identification	PM2.5 Speciated	NAMS		Met One SASS	Energy Dispersive XRF	Analysis by EPA	811			
421010055	PM2.5 FRM	SPM	3rd day	R&P PM2.5	Gravimetric	NAAQS Compliance - SPM Short duration	118	Neighborhood	Population Exposure	
Street Address	Metals	SPM	6th day	Hi-Vol	ICP-MS	Analysis by WV (TSP sampler with quartz), Not reported to AQS	107			
24th & Ritner	Carbonyls	Urban Air Toxics	6th day	DNPH-Coated Cartridges			102			
Geographical Coordinates	Toxics	Urban Air Toxics	6th day	Canister Subambient Pressure	Multi-Detector GC		101			

Street Address

24th & Ritner

Geographical Coordinates

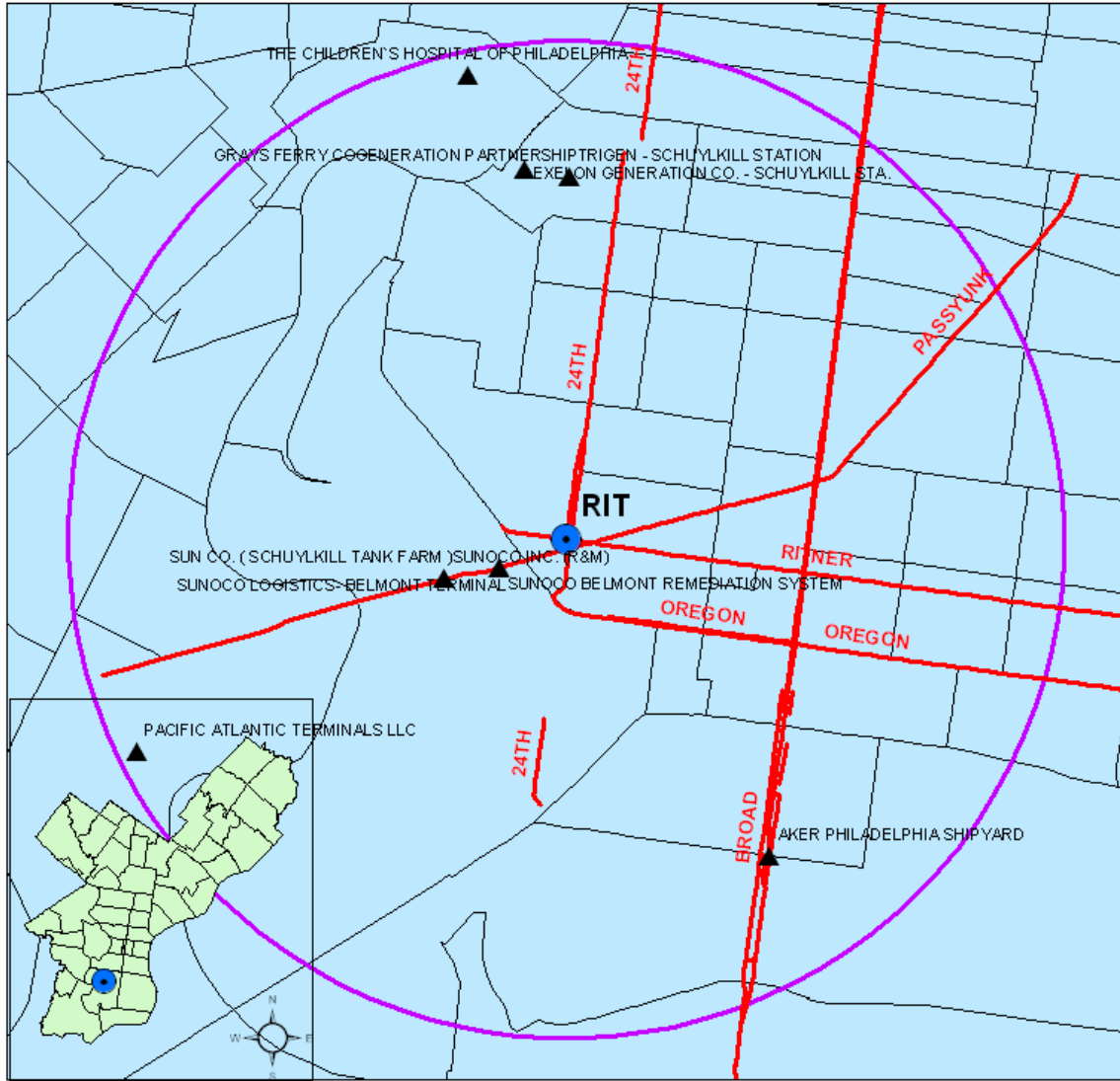
Latitude:
39.922517
Longitude:
-75.186783

Figure 26 - Ground Level RIT Monitoring Station Picture



Figure 27 - RIT Monitoring Site Map with Major Streets and Major Emission Sources

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



NAME	STREET	2005 EMISSIONS (in tons)							
		CO	NO2	PB	PM10	PM25	PT	SO2	VOC
AKER PHILADELPHIA SHIPYARD	PHILA. NAVAL BUS. CENTER	1.09	1.38	0.00	21.01	0.00	20.40	0.01	46.99
EXELON GENERATION CO. - SCHUYLKILL STA.	2800 CHRISTIAN ST	27.82	185.27	0.00	27.88	0.00	39.51	371.71	4.21
GRAYS FERRY COGENERATION PARTNERSHIP	2600 CHRISTIAN STREET	2.16	212.50	0.00	2.25	0.00	2.25	5.15	0.04
PACIFIC ATLANTIC TERMINALS LLC	3400 SOUTH 67TH STREET	1.56	2.46	0.00	0.08	0.00	0.19	2.38	1.09
SUN CO. (SCHUYLKILL TANK FARM)	3144 PASSYUNK AVE	8.65	1.59	0.00	0.00	0.00	0.00	0.00	361.44
SUNOCO BELMONT REMEDIATION SYSTEM	2700 W PASSYUNK AVE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	8.54
SUNOCO INC. (R&M)	3144 PASSYUNK AVE	2006.00	3389.95	0.00	398.85	0.00	0.00	3353.02	901.04
SUNOCO LOGISTICS - BELMONT TERMINAL	2700 PASSYUNK AVE	15.14	6.05	0.00	0.12	0.00	0.00	6.91	91.17
THE CHILDREN'S HOSPITAL OF PHILADELPHIA	34TH AND CIVIC CENTER BLVD	12.06	13.25	0.00	0.75	0.00	1.32	0.42	1.14
TRIGEN - SCHUYLKILL STATION	2600 CHRISTIAN ST.	1.55	148.20	0.00	25.59	0.00	17.79	462.89	1.25
TOTAL		2076.03	3960.65	0.00	476.63	0.00	81.45	4192.50	1415.90

Figure 28 - RIT North Aerial View



FAB

Table 11 - Detailed FAB Information

AMS Site – FAB

AQS Site Identification – 421010057

Street Address – 3rd and Spring Garden

Geographical Coordinates

Latitude: 39°57'36N

Longitude: 075°08'34W

Parameter – PM2.5 FRM

Sampling Type – SPM

Operating Schedule – 3rd Day

Collection Method – R&P PM2.5

Analysis Method – Gravimetric

Comments – NAAQS Compliance Monitoring – 24 hr

AQS Method – 118

Spatial Scale – Middle

Monitoring Objective – Population Exposure

Probe Height – 2m

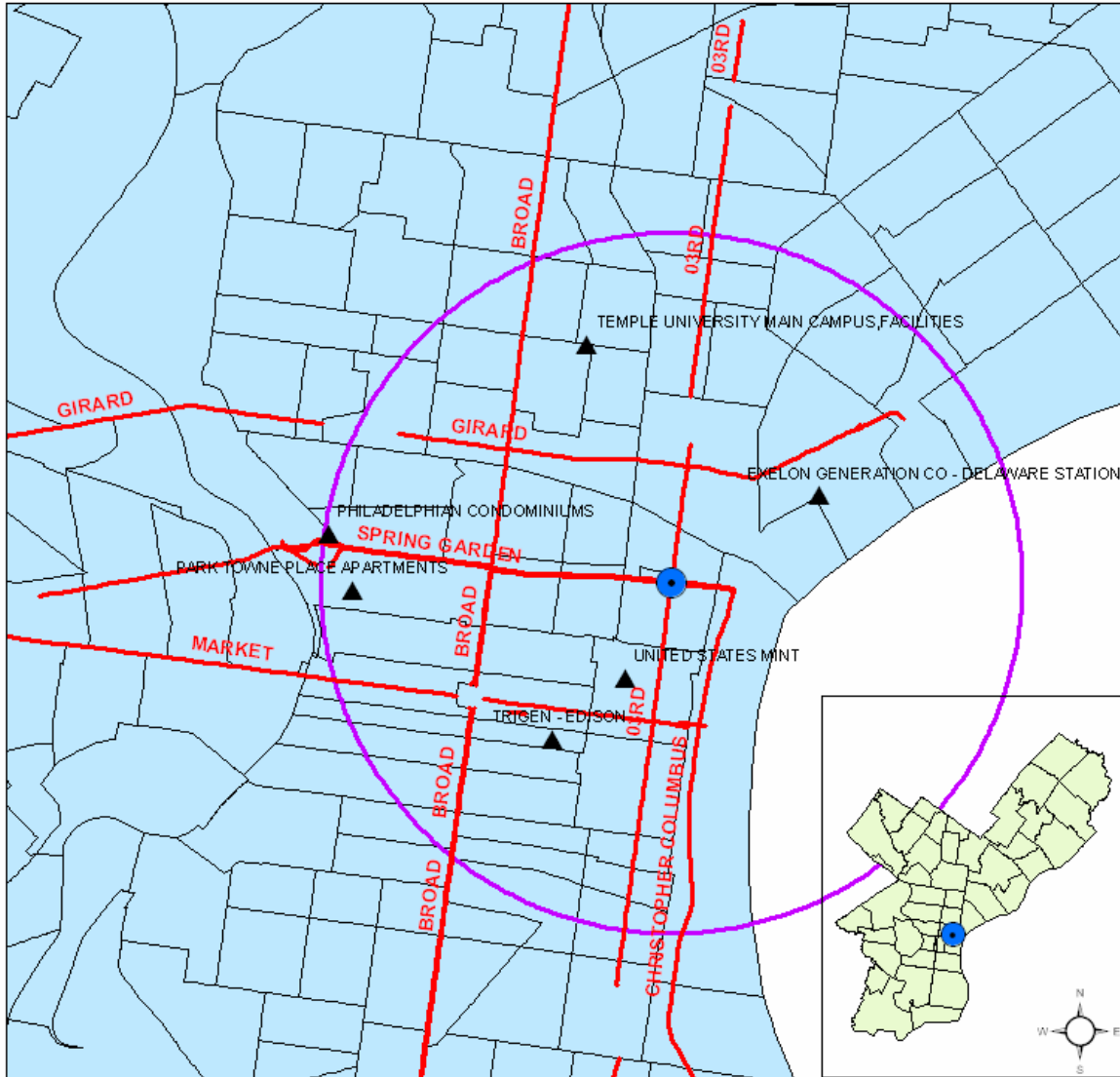
Begin Date – 9/2007 – Rooftop; 1/1/2008 – Ground Level

Figure 29 - Ground Level FAB Monitoring Station Picture



Figure 30 - FAB Monitoring Site Map with Major Streets and Major Emission Sources

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



NAME	STREET	2005 EMISSIONS (in tons)								
		CO	NO2	PB	PM10	PM2.5	PT	SO2	VOC	
EXELON GENERATION CO - DELAWARE STATION	1325 N BEACH STREET	0.10	17.21	0.00	1.56	0.00	1.56	3.31	0.01	
PARK TOWNE PLACE APARTMENTS	2200 BEN FRANKLIN PKWY	1.95	2.46	0.00	0.11	0.00	0.24	0.45	0.13	
PHILADELPHIAN CONDOMINIUMS	2401 PENNSYLVANIA AVE.	50.79	45.24	0.00	3.40	3.26	3.64	4.79	9.74	
TEMPLE UNIVERSITY MAIN CAMPUS FACILITIES	1009 W MONTGOMERY AVE	15.90	96.44	0.00	0.22	0.39	16.10	123.76	2.86	
TRIGEN - EDISON	900 SANSOM ST	15.67	122.30	0.01	6.08	0.00	6.76	223.37	0.88	
UNITED STATES MINT	151 N INDEPENDENCE MALL EAST	2.63	2.18	0.00	0.07	0.00	0.06	0.01	4.28	
TOTAL		87.05	285.83	0.01	11.44	3.65	28.36	355.70	17.89	

Figure 31 - FAB North Aerial View



Detailed Information by Pollutant

Ozone (O₃)

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 O₃ molecule.

NAAQS:

Highest 4th 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. NO_x are from burning of fuel in industry and motor vehicles. Ozone levels are consistently higher during the summer months.

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 (O₂) and nitrogen dioxide (NO₂). For this reason ozone levels are depressed in urban areas and increase downwind in more rural areas where there are emissions of NO. NEA, ROX, and ELM were placed to indicate O₃ levels coming into the City and leaving the City.

Unlike the oxygen that we breathe, which has only two atoms of oxygen (O₂), 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.

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.

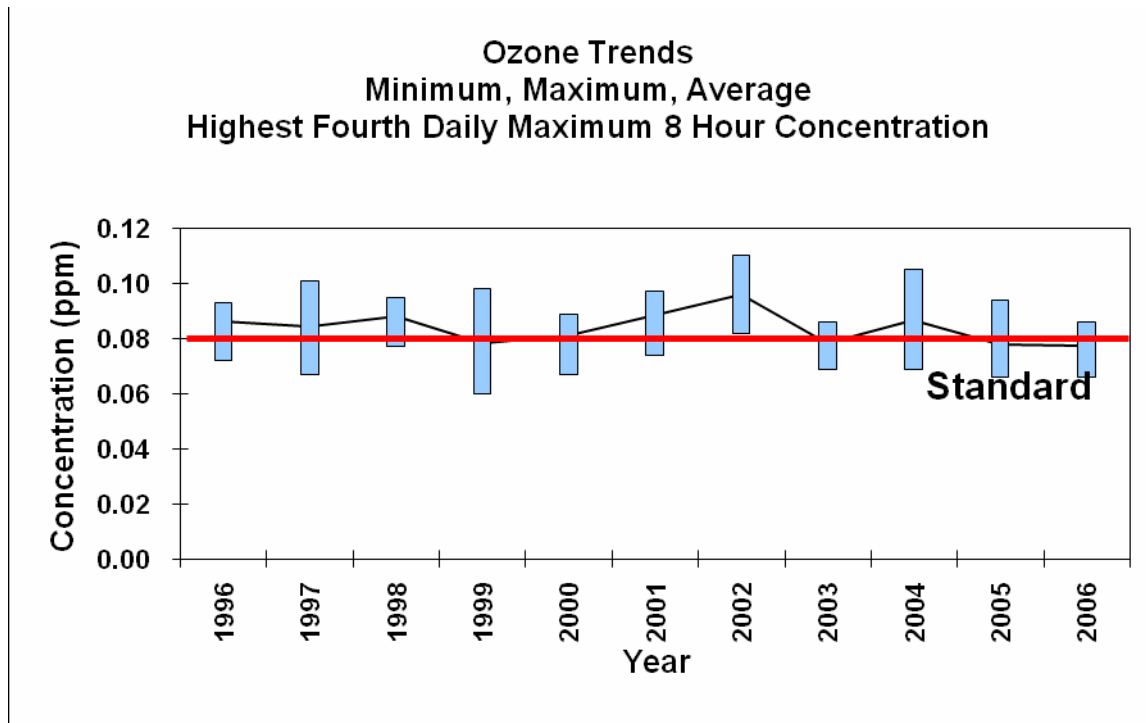
Some VOCs are considerably more reactive in the atmosphere than others, and the reactivity of a VOC influences how quickly ozone forms. A compound that reacts quickly to produce ozone will have a much greater impact near its source than one that reacts more slowly.

On July 18, 1997, the EPA promulgated a revision to the National Ambient Air Quality Standard for ozone which came into effect on July 1, 1999. Previously, the standard was based on the number of times that the daily maximum hourly ozone concentration was greater than 0.12 parts per million (PPM) over a 3 year period. The revised NAAQS is based on an 8-hour average ozone concentration. EPA revoked the 1-hour standard on June 15, 2005.

In 2007, Philadelphia and the surrounding counties were classified as nonattainment for the 8-hr ozone standard. This means that the standards set by the EPA for ozone have been exceeded. We're continuing our 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 following graph shows ozone trends just for Philadelphia.

On March 12, 2008, EPA revised the level of the primary and secondary 8-hour ozone standards to 0.075 ppm from 0.08 ppm.

Figure 32 - Ozone Trends



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.

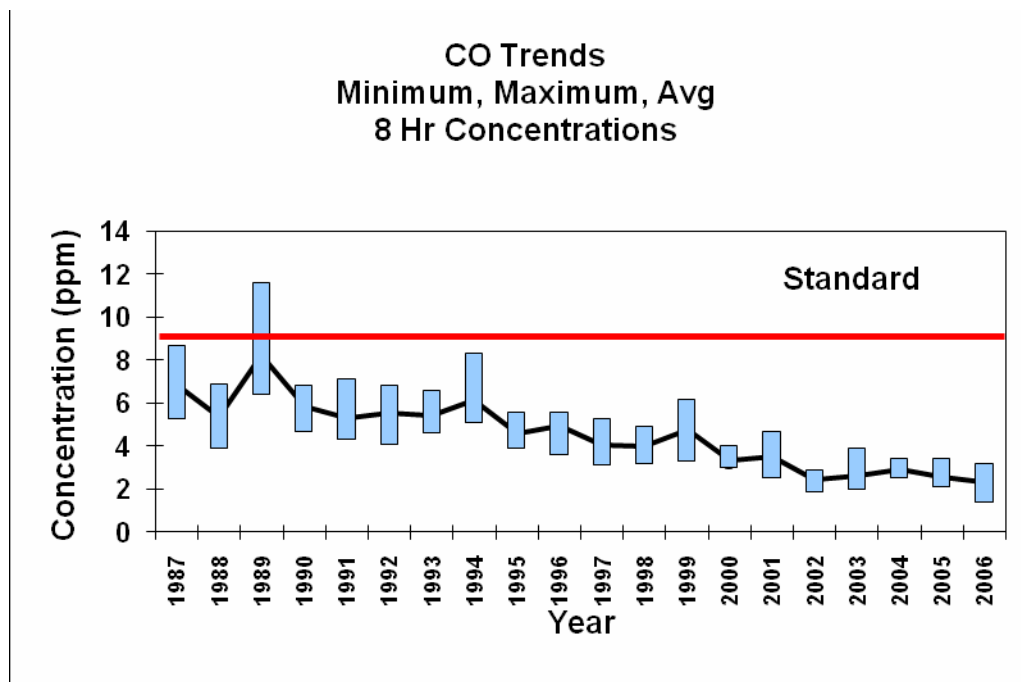
NAAQS:

Highest 2nd maximum 8 hour concentration = 9 ppm

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 monitors located at CHS, LAB, and NBR are located near roadways. Weather greatly affects CO levels, and peak CO concentrations typically occur during the colder months of the year.

Over the last decade, 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 33 - CO Trends



Nitrogen Dioxide (NO₂)

Principle of Operation

The concentration of nitric oxide [NO], total oxides of nitrogen [NO_x] and, by calculation, nitrogen dioxide [NO₂] is determined in a single instrument. The chemical reaction between nitric oxide [NO] and ozone [O₃] produces light (chemiluminescence). The concentration of nitric oxide is determined by the intensity of the light.

NAAQS:

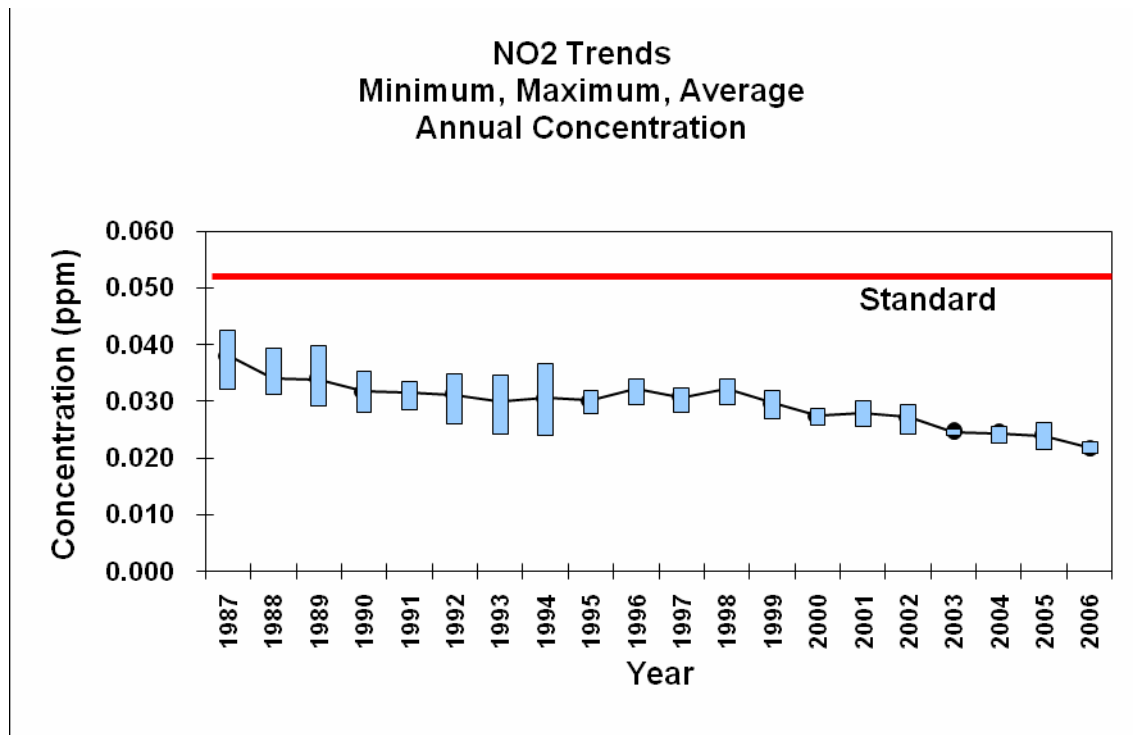
Highest Annual Arithmetic Mean concentration = 0.053 ppm

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.

Figure 34 - NO₂ Trends



Sulfur Dioxide (SO₂)

Principle of Operation

The concentration of SO₂ is based upon the measurement of fluorescence of SO₂ when it is exposed to Ultra Violet (UV) light (absorption of UV energy).

NAAQS:

Highest Annual Mean Concentration = 0.03 ppm

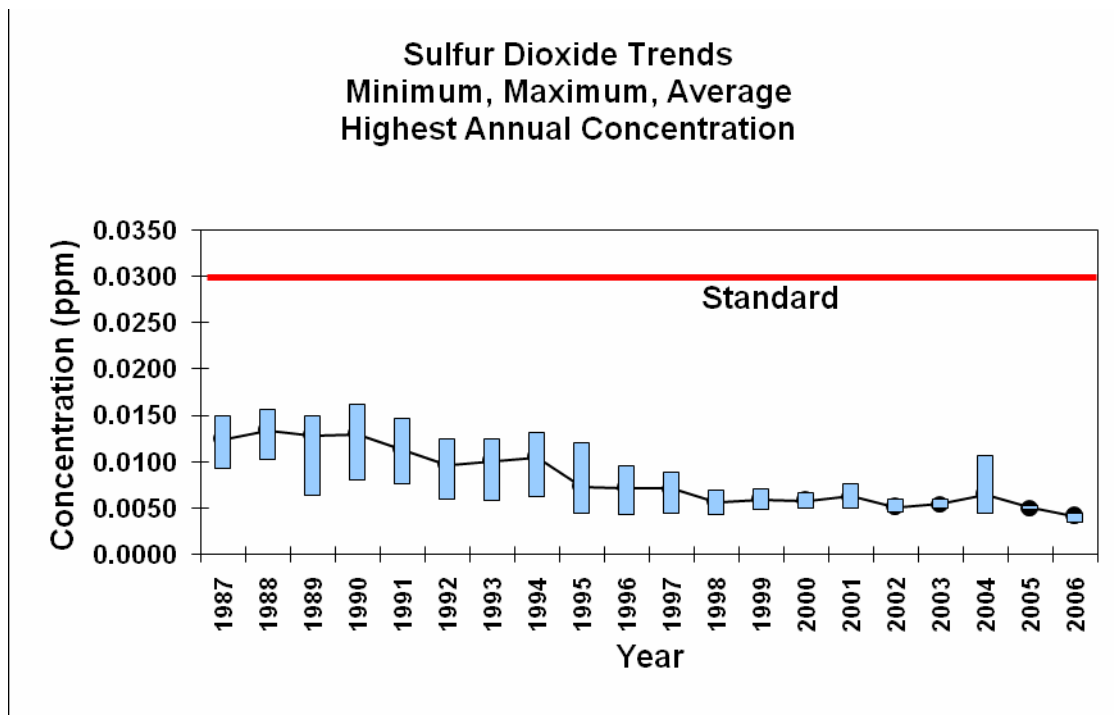
Highest Second Maximum 24 Hour Concentration = 0.14 ppm

SO₂ 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 SO₂ include effects on breathing, respiratory illness, alterations in the lungs' defenses, and aggravation of existing respiratory and cardiovascular disease. Together, SO₂ and NO_x are the major ingredients of acid rain. SO₂ 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 SO₂.

SO₂ 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.

Figure 35 - SO₂ Trends – Annual Concentration



Lead (Pb)

NAAQS:

Highest Quarterly Maximum Concentration = $1.5 \mu\text{g}/\text{m}^3$

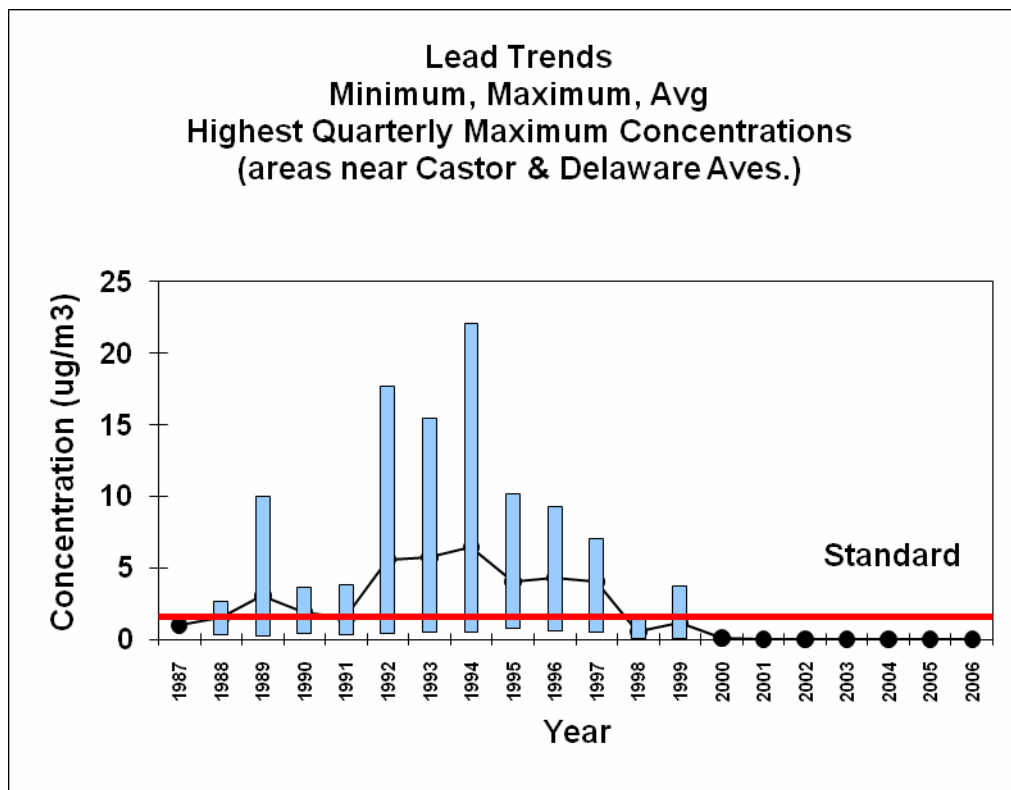
The processing of metals is the major source of lead emissions to the atmosphere. It does not travel over great distances in the air and so concentrations vary, with highest levels near particular industrial sites.

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 ITO location.

Figure 36 - Lead 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.

PM₁₀ 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 (PM₁₀)

PM₁₀

NAAQS:

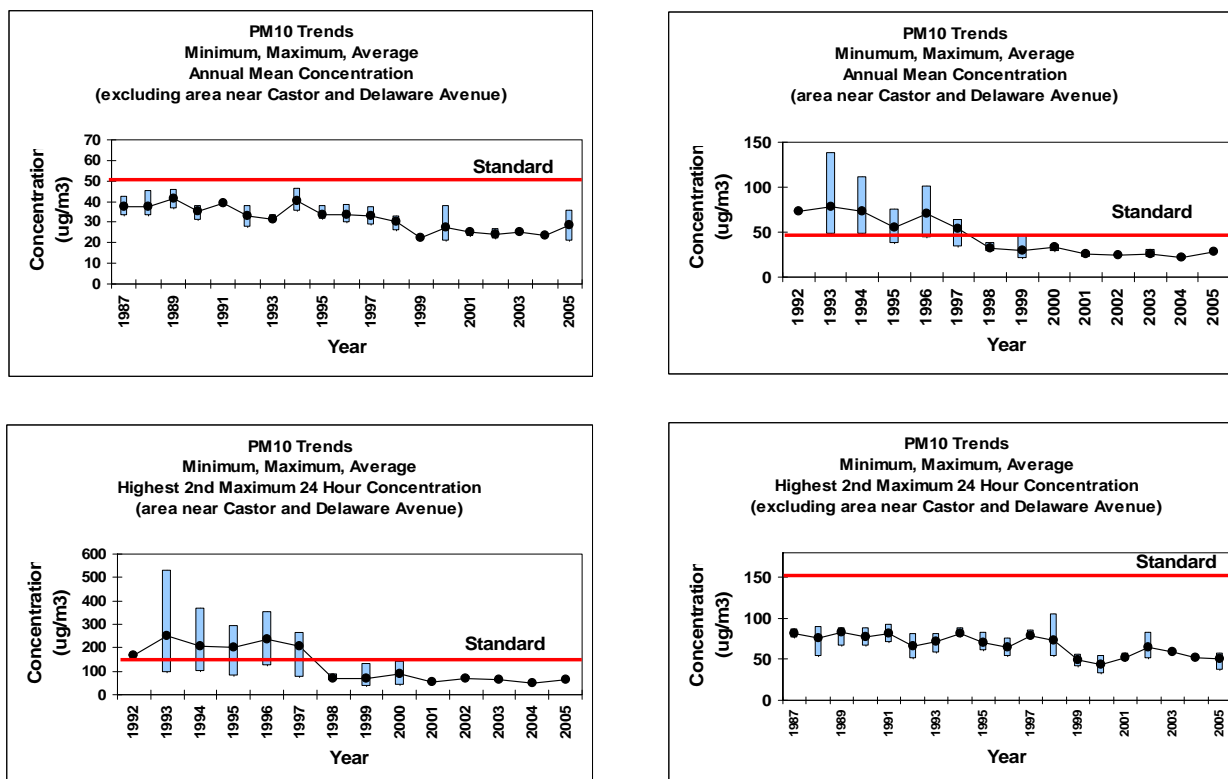
Highest Annual Mean Concentration = 50 µg/m³

Highest Second Maximum 24 Hour Concentration = 150 µg/m³

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 charts are 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 PM₁₀ data is used in the Air Quality Index. The graphs on the following page show PM₁₀ trends.

Figure 37 - PM10 Trends



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

NAAQS:

Highest Annual Mean Concentration = 15 µg/m³

Highest 98th Percentile 24 Hour Concentration = 35 µg/m³

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 SO₂, 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.

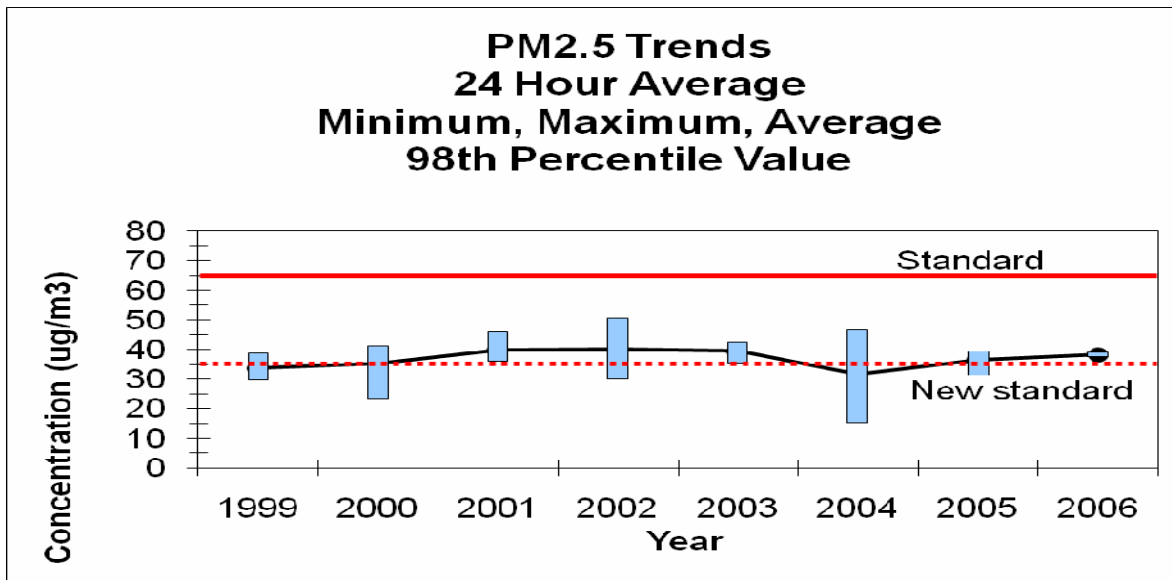
Revisions to the primary (health-based) NAAQS added the two new PM_{2.5} standards, set at 15 µg/m³ (annual standard) and 35 µg/m³ (daily standard). This was 65 µg/m³ until September 2006 when EPA strengthened the standard. Measuring PM_{2.5} requires highly sensitive equipment under tight temperature and humidity control. Figure 38 shows attainment for the 24 hour

standard. Figure 39 shows Philadelphia and the surrounding areas are in nonattainment for the annual PM_{2.5} standard.

Monitors are placed to assess public exposure high levels. Continuous PM_{2.5} data is used in the Air Quality Index.

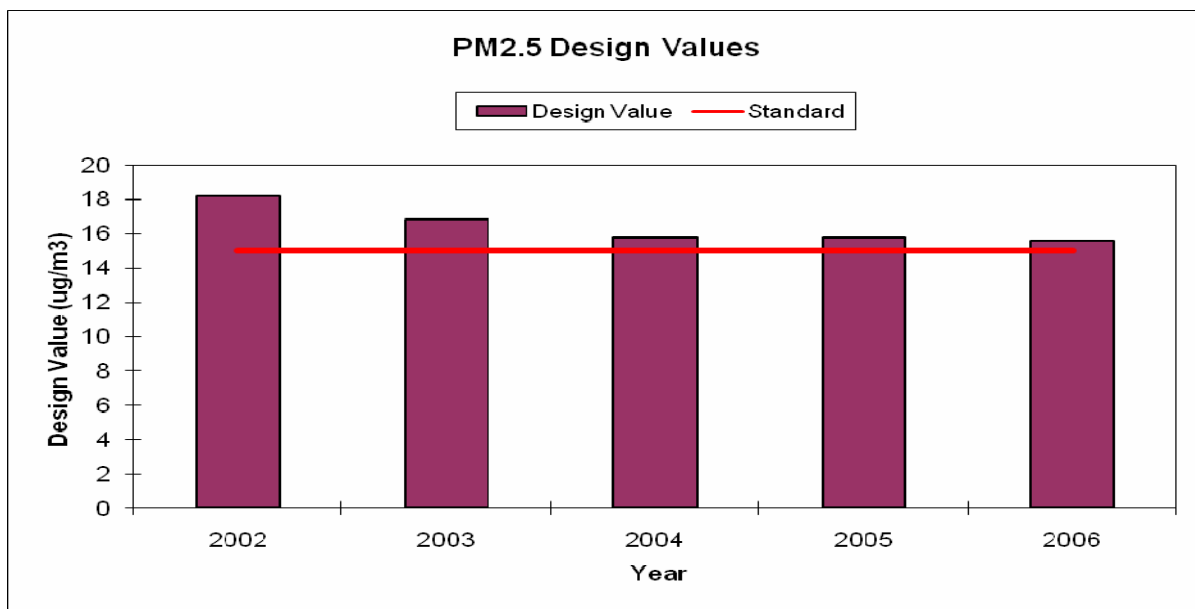
Speciation shows the make-up of PM_{2.5} in the City in general and the impact of large sources of emissions.

Figure 38 - PM_{2.5} Trends



Effective December 18, 2006, EPA strengthened the 24-hour PM_{2.5} standard from the 1997 level of 65 µg/m³ to 35 µg/m³.

Figure 39 - 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 www.cleanair.org/dieseldifference.

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

As part of EPA's National Air Toxics Assessment (NATA) activities, 177 air pollutants were assessed for either lifetime cancer risk or noncancer 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 that look at the year 1999.

- 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 noncancer effects.

The 1999 National Air Toxics Assessment (NATA) indicated high health risks in the City. Philadelphia ranked 55th 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:

1,1,2,2-tetrachloroethane (Cas RN 79-34-5) - It is a colorless or pale yellow liquid with a sickly sweet odor. It is used in making other chemicals, insecticides, paints, rust removers, varnishes, and as a solvent.

1,4-dichlorobenzene (Cas RN 106-46-7) - It is a colorless or white crystalline (sand-like) material with a mothball odor. It is used as a fumigant to control mildew and mold, and as an insecticide.

acetaldehyde (Cas RN 75-07-0) - It is a colorless liquid or gas with a fruity odor. It is used to manufacture many other chemicals.

benzene (Cas RN 71-43-2) - It is 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) - It is a colorless liquid with an ether-like odor. It is used as a solvent and in making fire extinguishers, refrigerants, and aerosols.

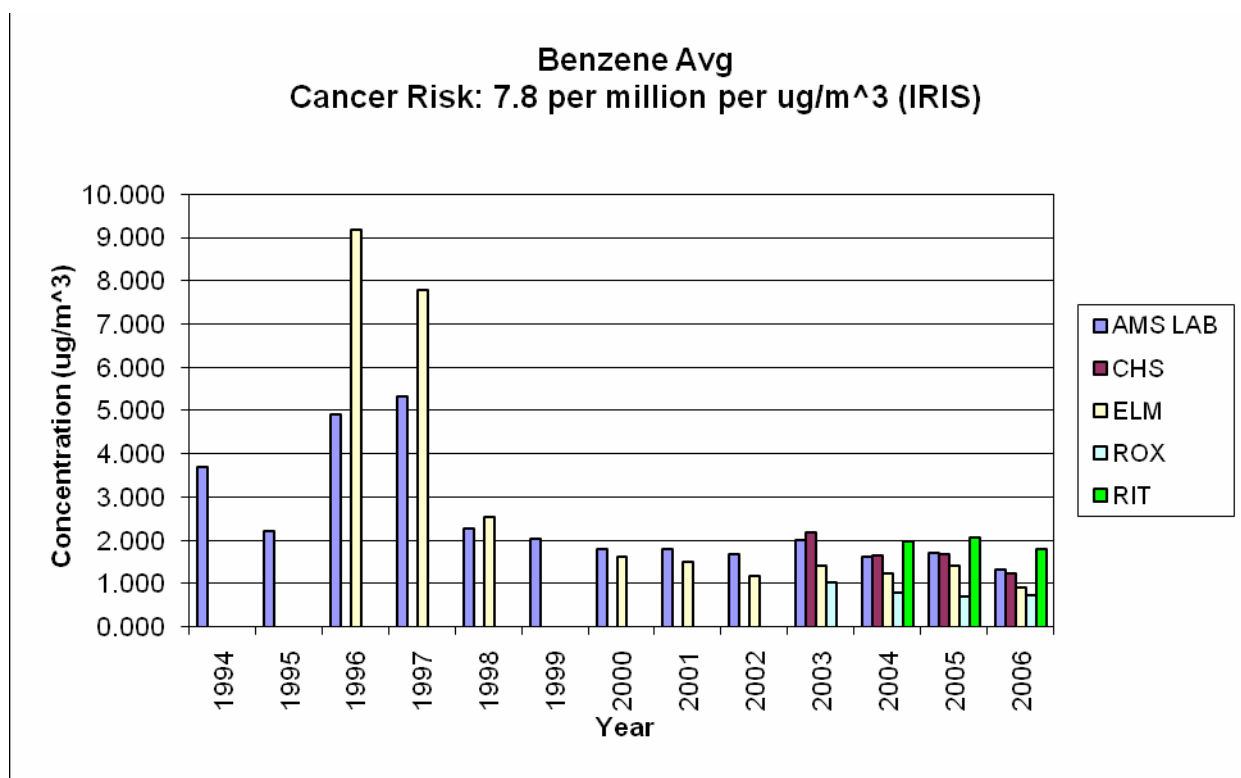
dichloromethane (Cas RN 75-09-2) - It is a colorless liquid with a pleasant chloroform-like odor. It is used in food, furniture and plastics processing, and as a paint remover. Its other common name is methylene dichloride.

ethylene dichloride (Cas RN 107-06-2) - It is a clear, colorless, oily liquid. It is used to make vinyl chloride, and as a solvent, fumigant, degreaser, and paint remover.

tetrachloroethylene (Cas RN 127-18-4) - It is a clear liquid with a sweet, chloroform-like odor. It is used in dry cleaning and metal degreasing. Its other common name is perchloroethylene.

Here is a graph of benzene trends over time.

Figure 40 - 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 12 - 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)
SO₂ 3 , 4 , 5 , 6	Middle (300 m) Neighborhood, Urban and Regional (1 km)	2-15	> 1	10	N/A
CO 4 , 5 , 7	Micro, middle (300 m) Neighborhood (1 km)	3 +/-\1/2\;2-15	> 1	10	Table E-2 of 40 CFR 58 Appendix E for middle and neighborhood scales
NO₂, O₃ 3 , 4 , 5	Middle (300 m) Neighborhood, Urban, and Regional (1 km)	2-15	> 1	10	Table E-1 of 40 CFR 58 Appendix E for all scales
O₃ precursors (for PAMS) 3 , 4 , 5	Neighborhood and Urban (1 km)	2-15	> 1	10	Table E-1 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), Figure E-1 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 and all applicable scales for monitoring SO₂, O₃, O₃ precursors, and NO₂.
- \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 dripline of tree(s) and must be 10 meters from the dripline 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.
- \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 13 - 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)
[1e]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.

Table 14 - 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, NO_x, NO_y)

Roadway average daily traffic, vehicles per day	Minimum distance \10\ (meters)	Minimum distance 10, 11 (meters)
[le]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 41 - Figure E-1, 40 Part 58 App. E – Distance of PM Samplers to Nearest Traffic Lane (meters)

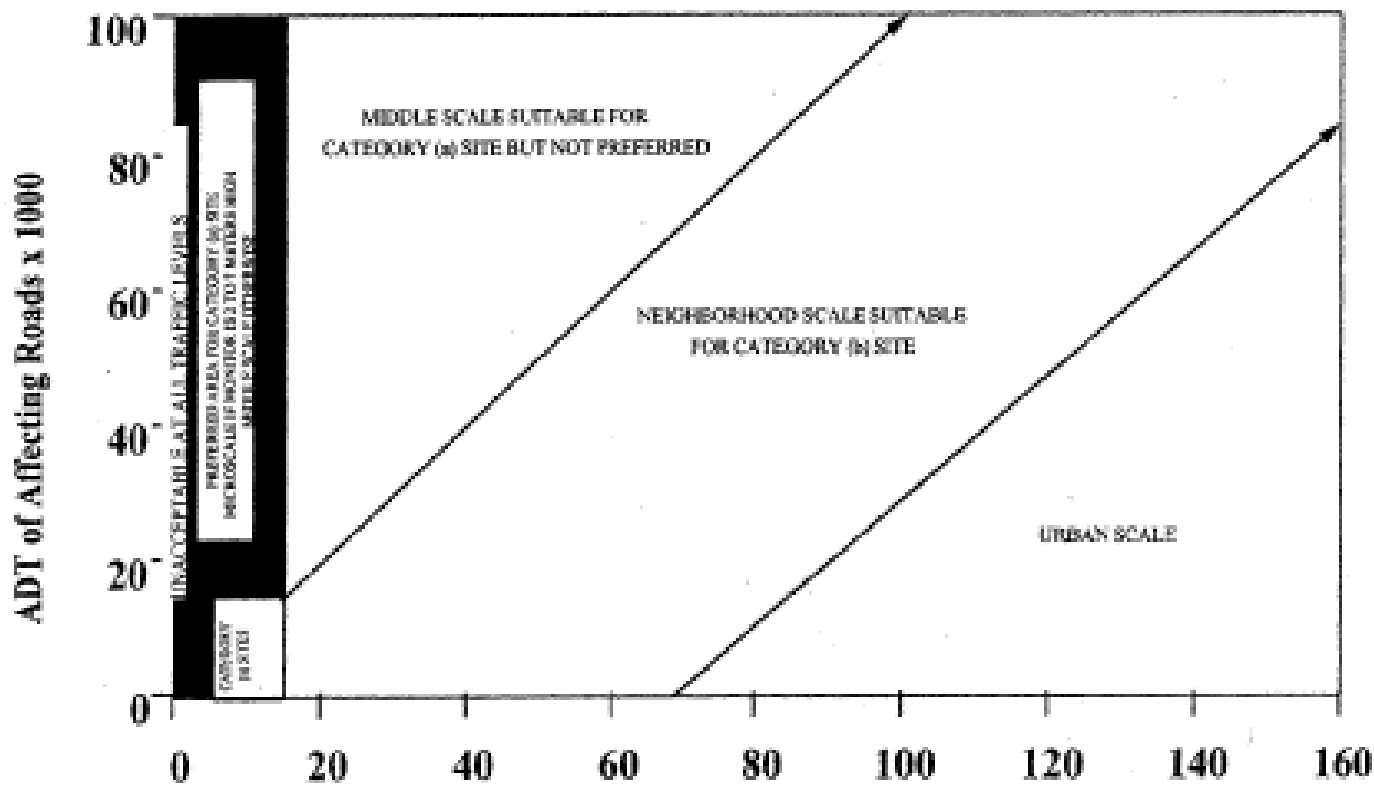


Figure E-1. Distance of PM samplers to nearest traffic lane (meters)

Appendix B: EPA PowerPoint Presentation – FAB PM2.5 Information

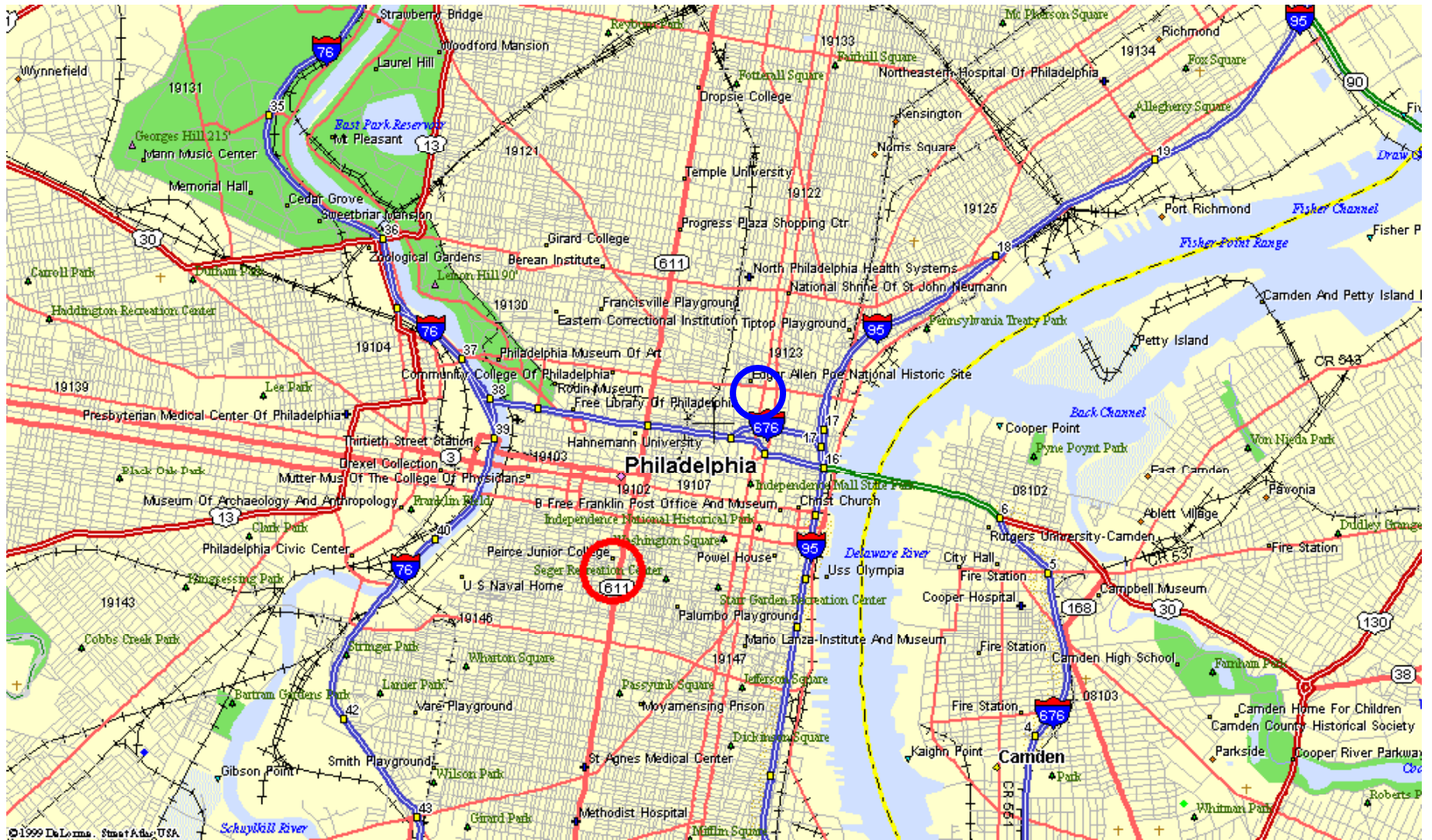
Information for Use in Demonstrating that the New
Fire Department Headquarters PM 2.5 Station
Monitors Highest Expect Particulate Levels in
Downtown Philadelphia, PA.

Information gathered by Ted Erdman 4/14/08

Philadelphia, PA Modeling of Diesel Emissions and Location of Downtown PM 2.5 FRM Stations

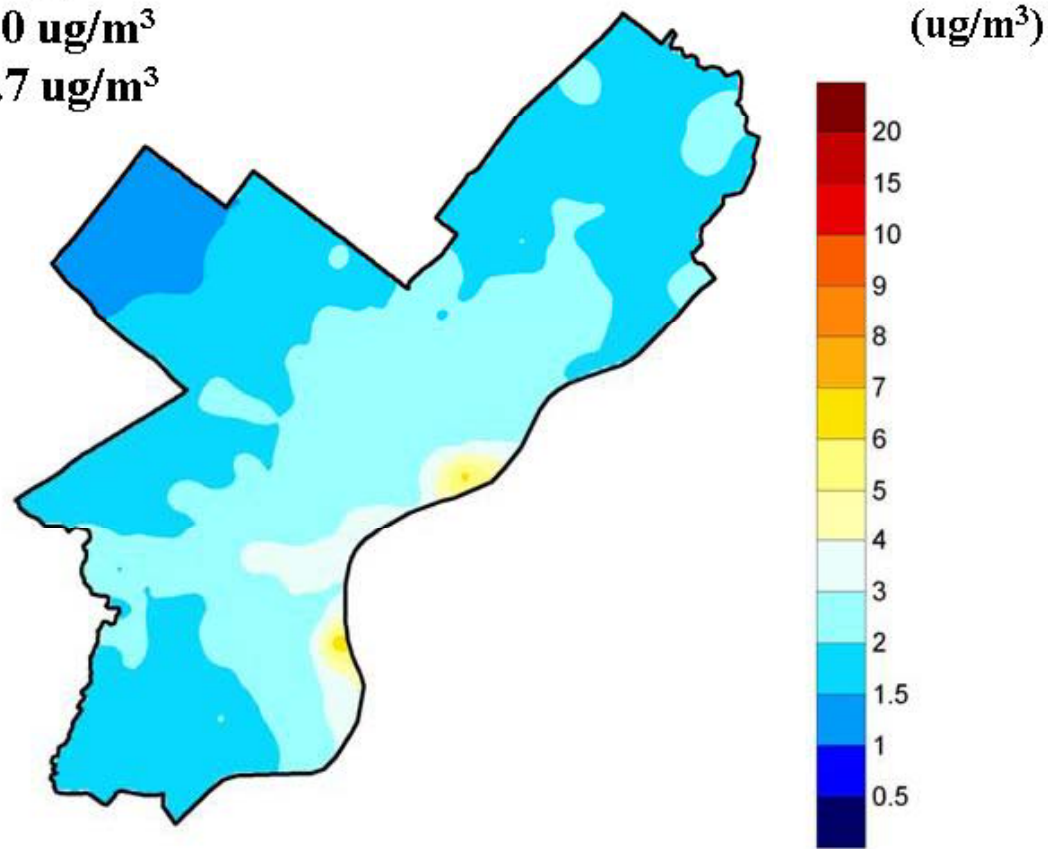
- The regional model – in this case the Community Multi-scale Air Quality (CMAQ) model - provides the regional background concentrations, and the local plume dispersion model – in this case Industrial Source Complex Short-Term, version 3 (ISCST3) model - provides the concentrations from local emission sources.
- The Mapping shows that the new Fire Department Headquarters Station is in the area of highest traffic emissions in Philadelphia. Also the model output shows that the old 500 S Broad Street station (421010047) is not in an area of high impact from traffic emissions.
- The modeling outputs are available. The modeling is used in a report, still in draft, that investigates toxic emissions in Philadelphia County.

Road Map Central Philadelphia showing Downtown PM 2.5 Station Location
AIRS # 421010047 (Red Circle)
and the Fire Department HQ Station (Blue Circle)



**Ambient Concentration
2001 Diesel PM (Revised Inventory):
Total Including Background**

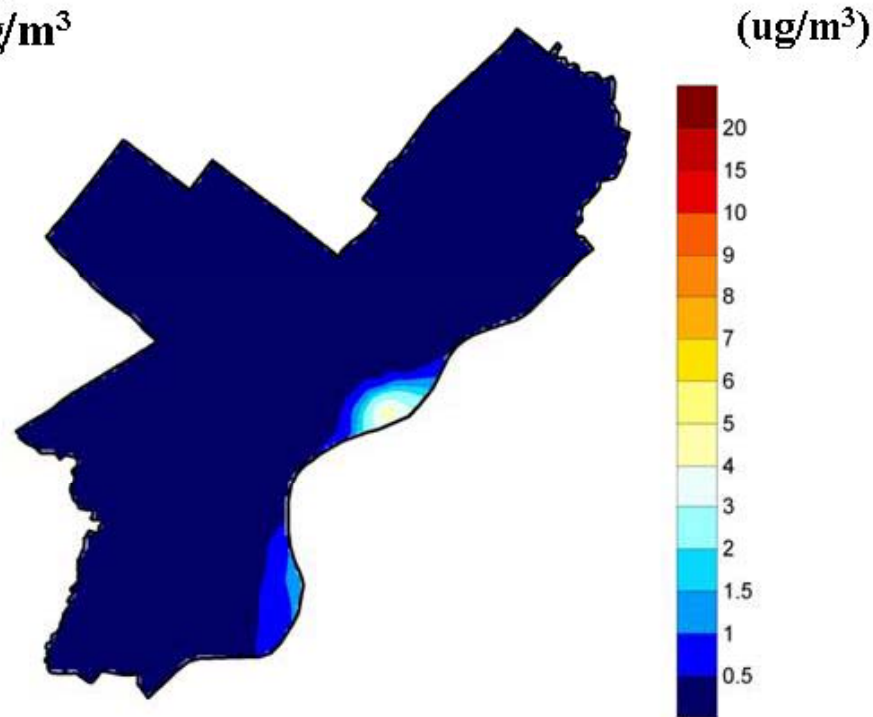
Maximum = 6.7 ug/m³
Mean = 2.0 ug/m³
Background = 0.7 ug/m³



Marine Diesel Emissions

**Ambient Concentration
2001 Diesel PM (Revised Inventory):
Marine Component**

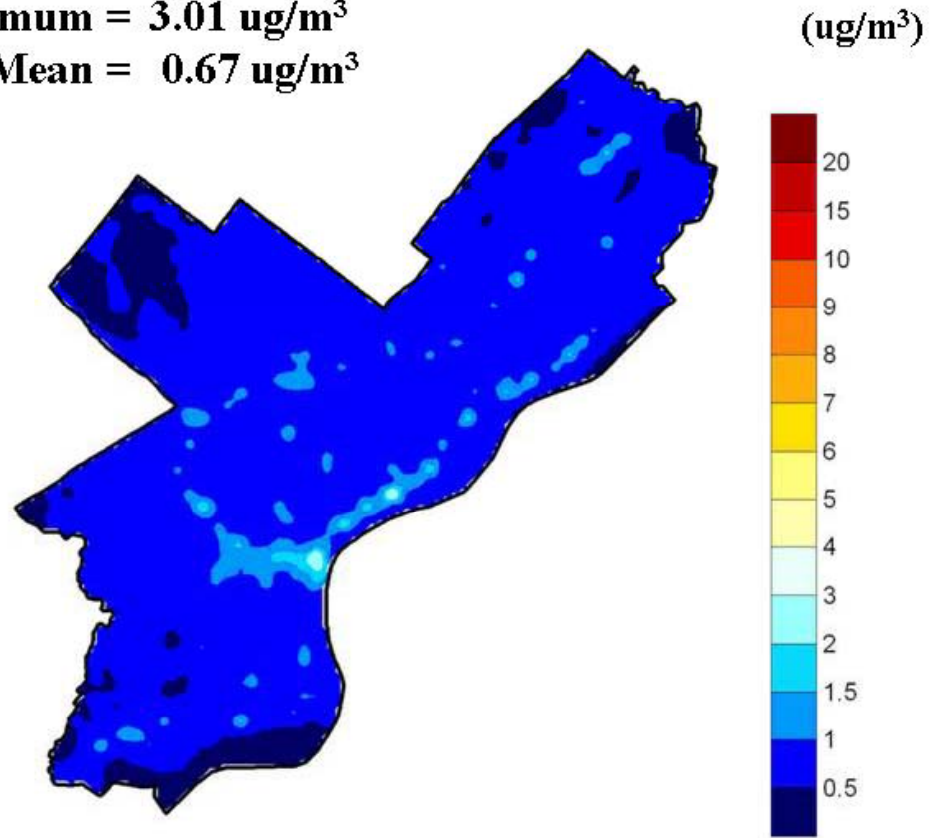
**Maximum = 4.42 ug/m³
Mean = 0.2 ug/m³**



On-Road Diesel Emissions

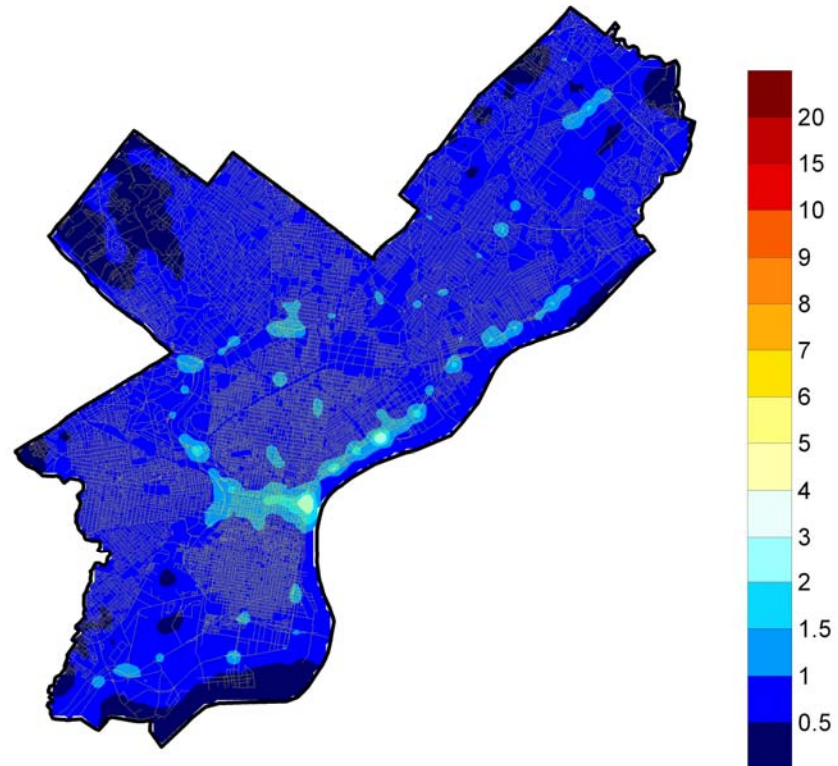
**Ambient Concentration
2001 Diesel PM (Revised Inventory):
On-Road**

**Maximum = 3.01 ug/m³
Mean = 0.67 ug/m³**

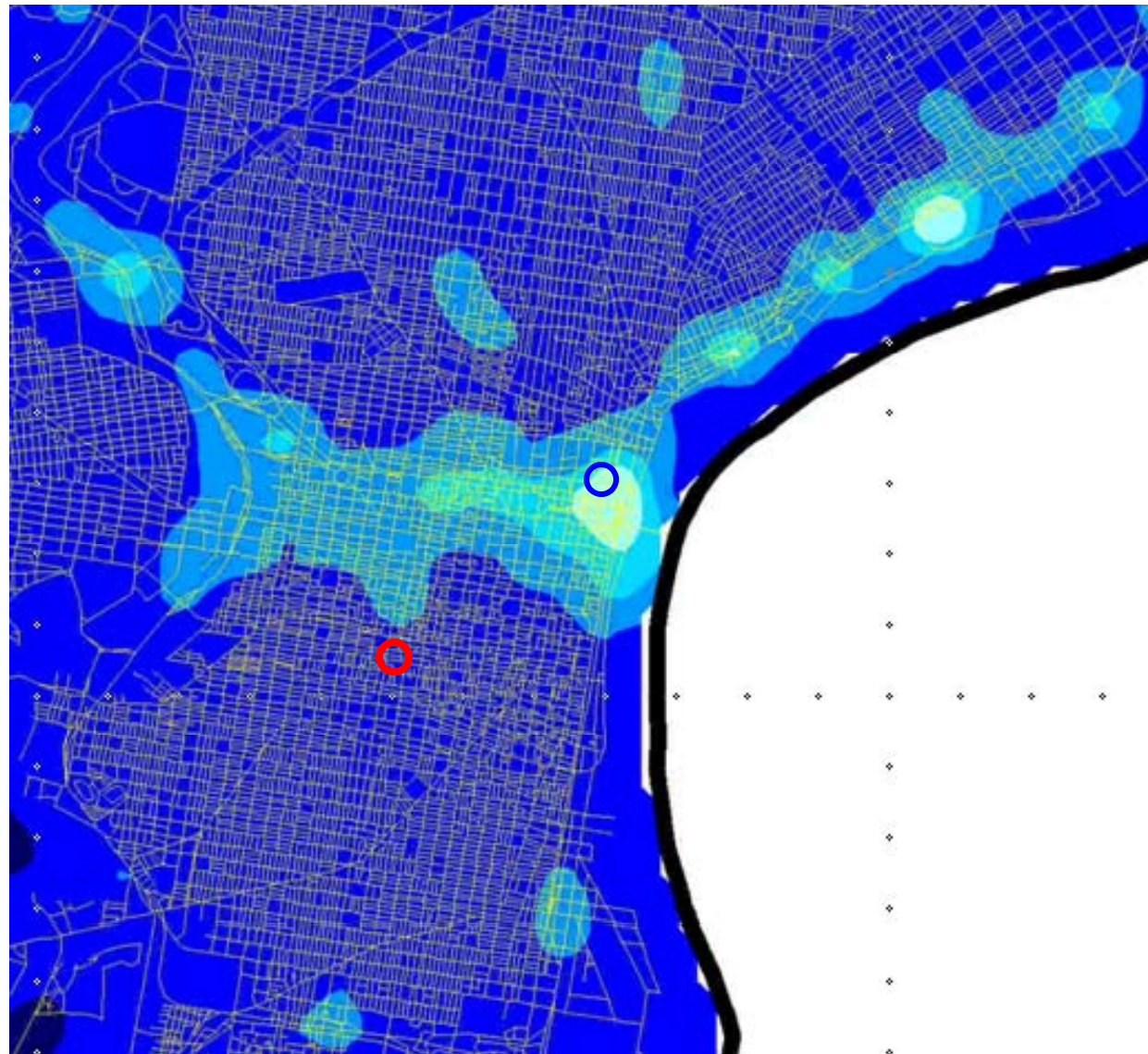


On-Road Diesel Emissions

Includes Roadways which are visible when the image is enlarged. See next slide.

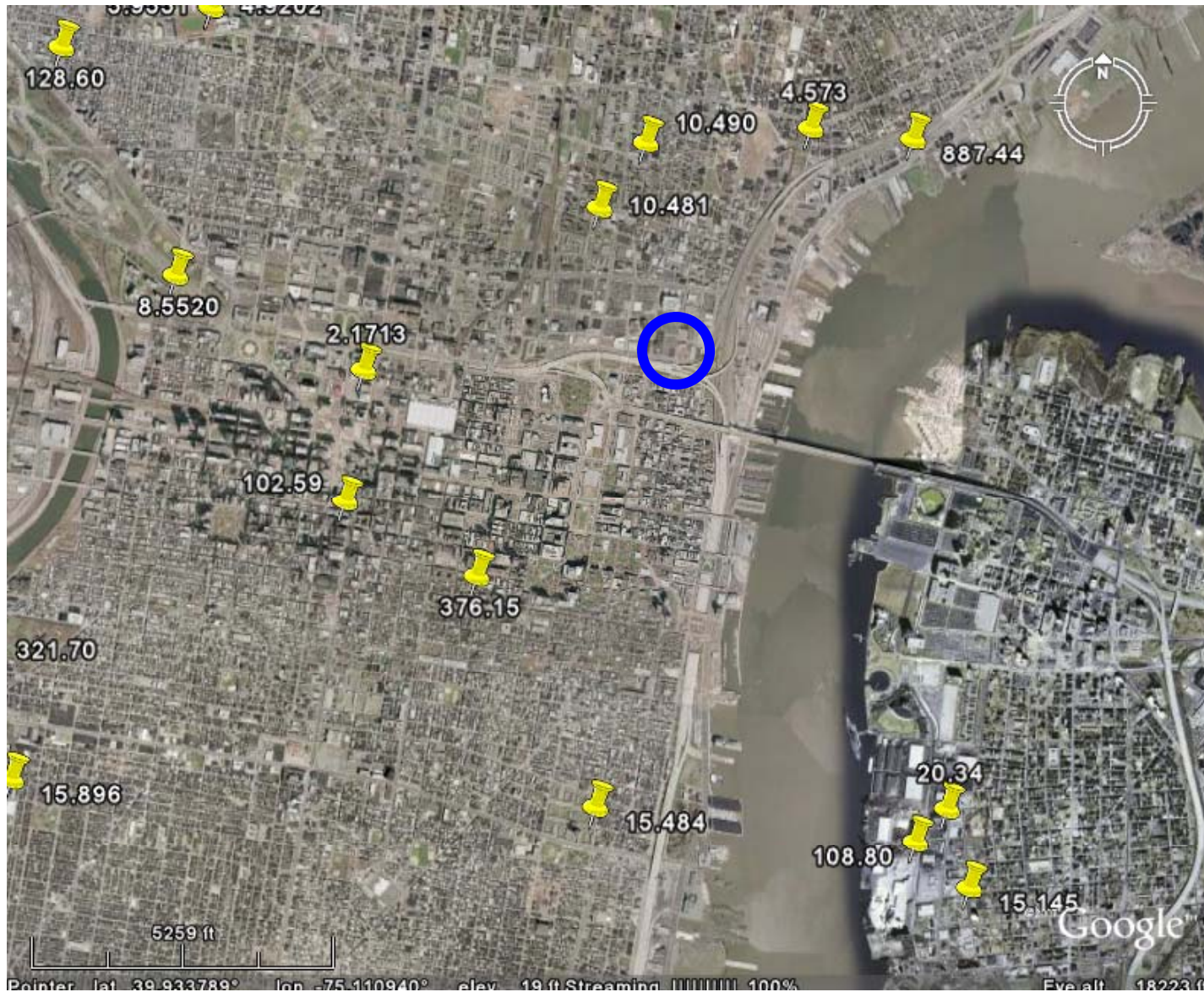


Model Output Central Philadelphia showing Downtown PM 2.5 Station Location, AIRS # 421010047
(Red Circle) and Fire Department Headquarters (Blue Circle)
On Road Diesel Emissions Isopleths



No Major Industrial Point Sources are adjacent to the Fire Department HQ station (blue circle).

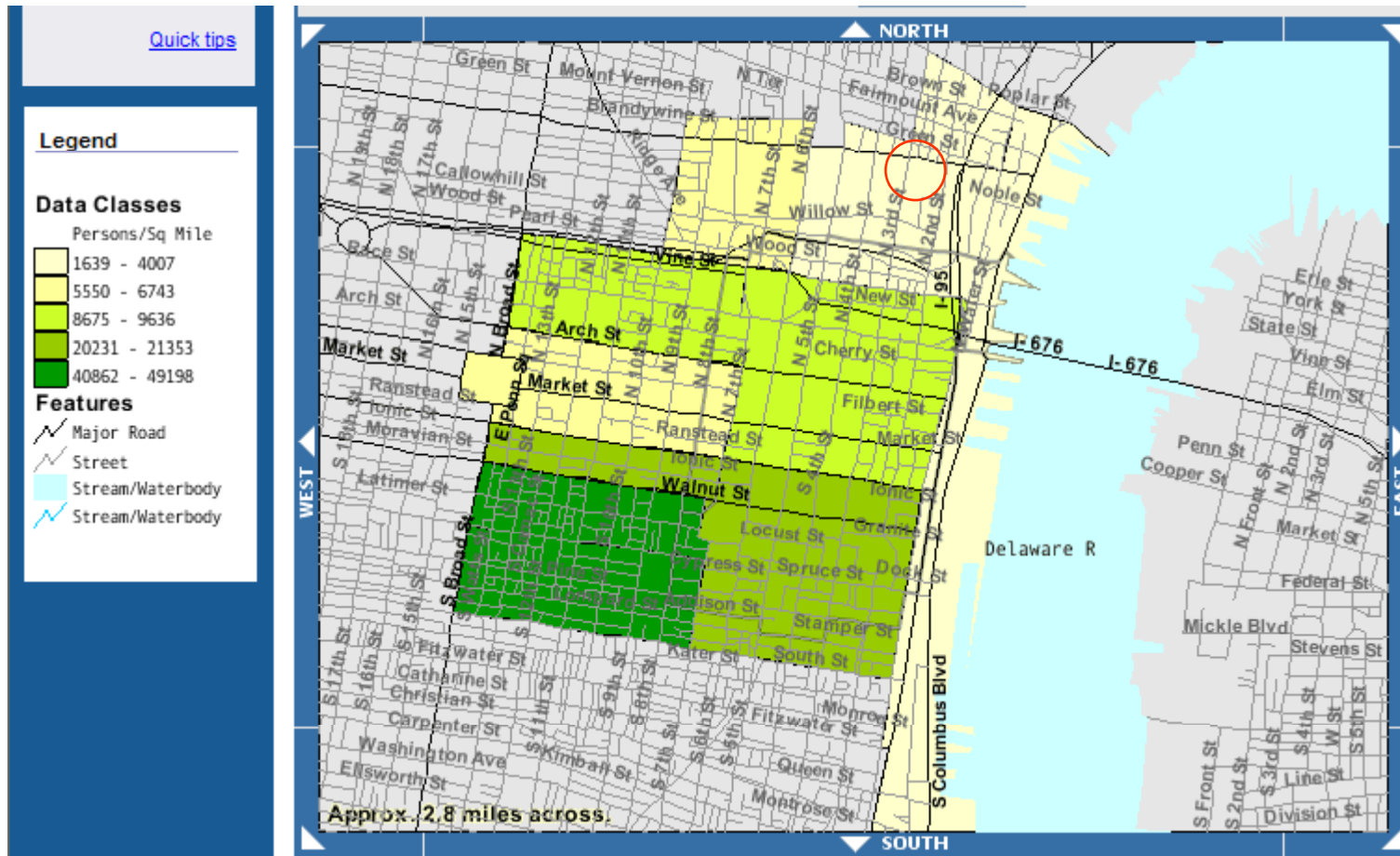
The yellow icons identify the NEI 2002 Inventory point sources in the immediate area. The icon label shows total emissions in tons.



The Fire Department Headquarters Station is in a high population area. The general area around the station is expected to experience large increases in population and commercial activity. See the two US Census maps on the following two slides.

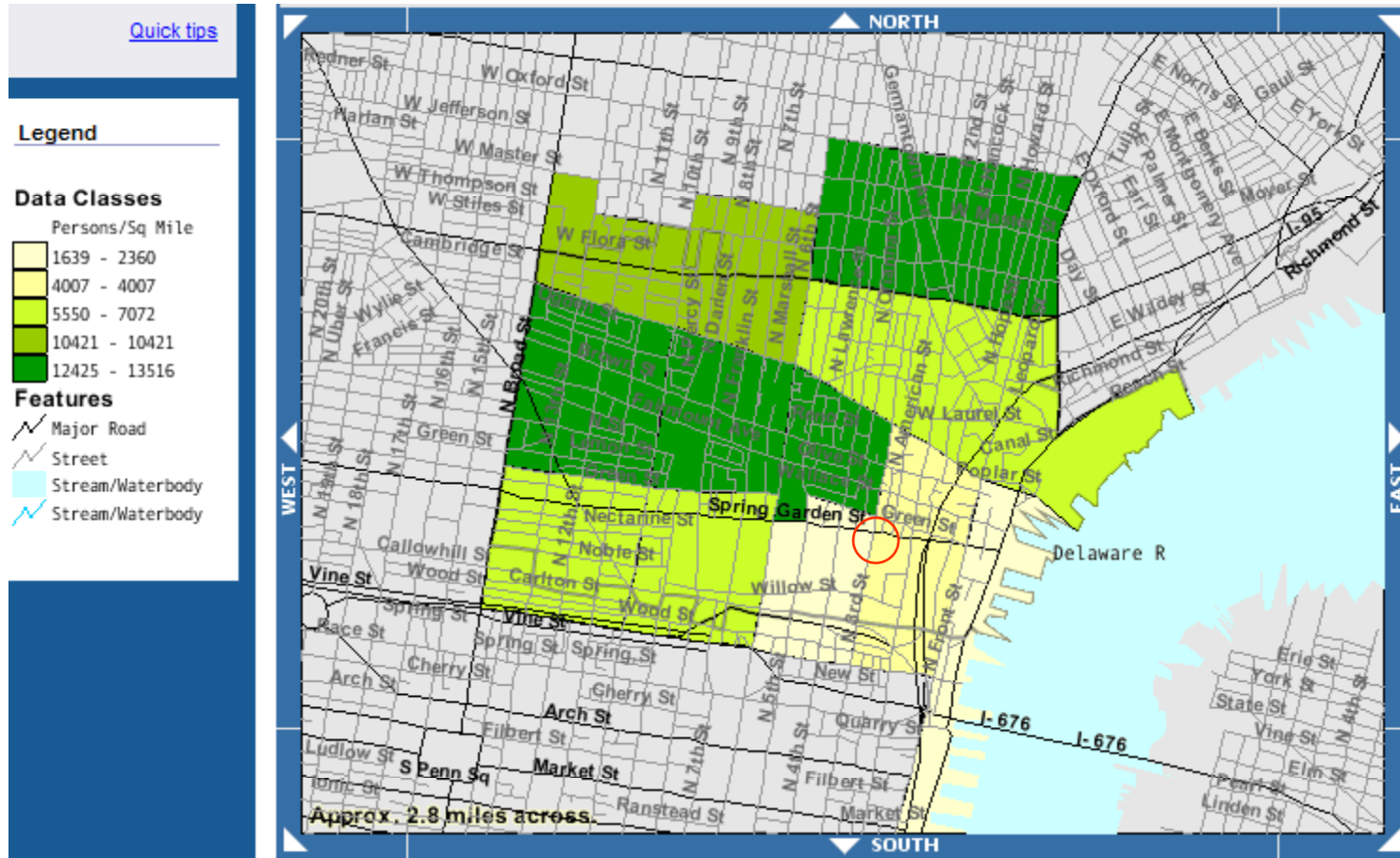
Residential Population Density Zip Code 19106

Fire Department HQ identified by red circle.



Residential Population Density Zip Code 19123

Fire Department HQ identified by red circle.



The new Fire Department Station PM 2.5 Station is Neighborhood Scale

per
40 CFR Part 58 Appendix D
Spacing from Roadways

6.3 Spacing for Particulate Matter (PM_{2.5}, PM₁₀, Pb) Inlets.

(a) Since emissions associated with the operation of motor vehicles contribute to urban area particulate matter ambient levels, spacing from roadway criteria are necessary for ensuring national consistency in PM sampler siting.

(b) The intent is to locate localized hot-spot sites in areas of highest concentrations whether it be from mobile or multiple stationary sources. If the area is primarily affected by mobile sources and the maximum concentration area(s) is judged to be a traffic corridor or street canyon location, then the monitors should be located near roadways with the highest traffic volume and at separation distances most likely to produce the highest concentrations. For the microscale traffic corridor site, the location must be between 5 and 15 meters from the major roadway. For the microscale street canyon site the location must be between 2 and 10 meters from the roadway. For the middle scale site, a range of acceptable distances from the roadway is shown in figure E-1 of this appendix. This figure also includes separation distances between a roadway and neighborhood or larger scale sites by default. Any site, 2 to 15 meters high, and further back than the middle scale requirements will generally be neighborhood, urban or regional scale. For example, according to Figure E-1 of this appendix, if a PM sampler is primarily influenced by roadway emissions and that sampler is set back 10 meters from a 30,000 ADT (average daily traffic) road, the site should be classified as microscale, if the sampler height is between 2 and 7 meters. If the sampler height is between 7 and 15 meters, the site should be classified as middle scale. If the sample is 20 meters from the same road, it will be classified as middle scale; if 40 meters, neighborhood scale; and if 110 meters, an urban scale.

FR 40 CFR Part 58 Appendix D Figure E-1
Distance of PM samplers to nearest traffic lane

61326 Federal Register / Vol. 71, No. 200 / Tuesday, October 17, 2006 / Rules and Regulations

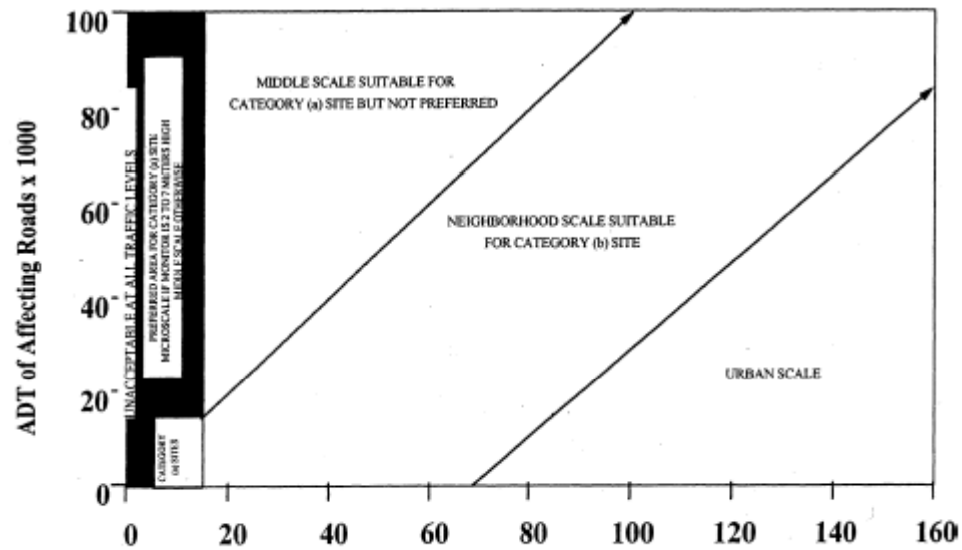
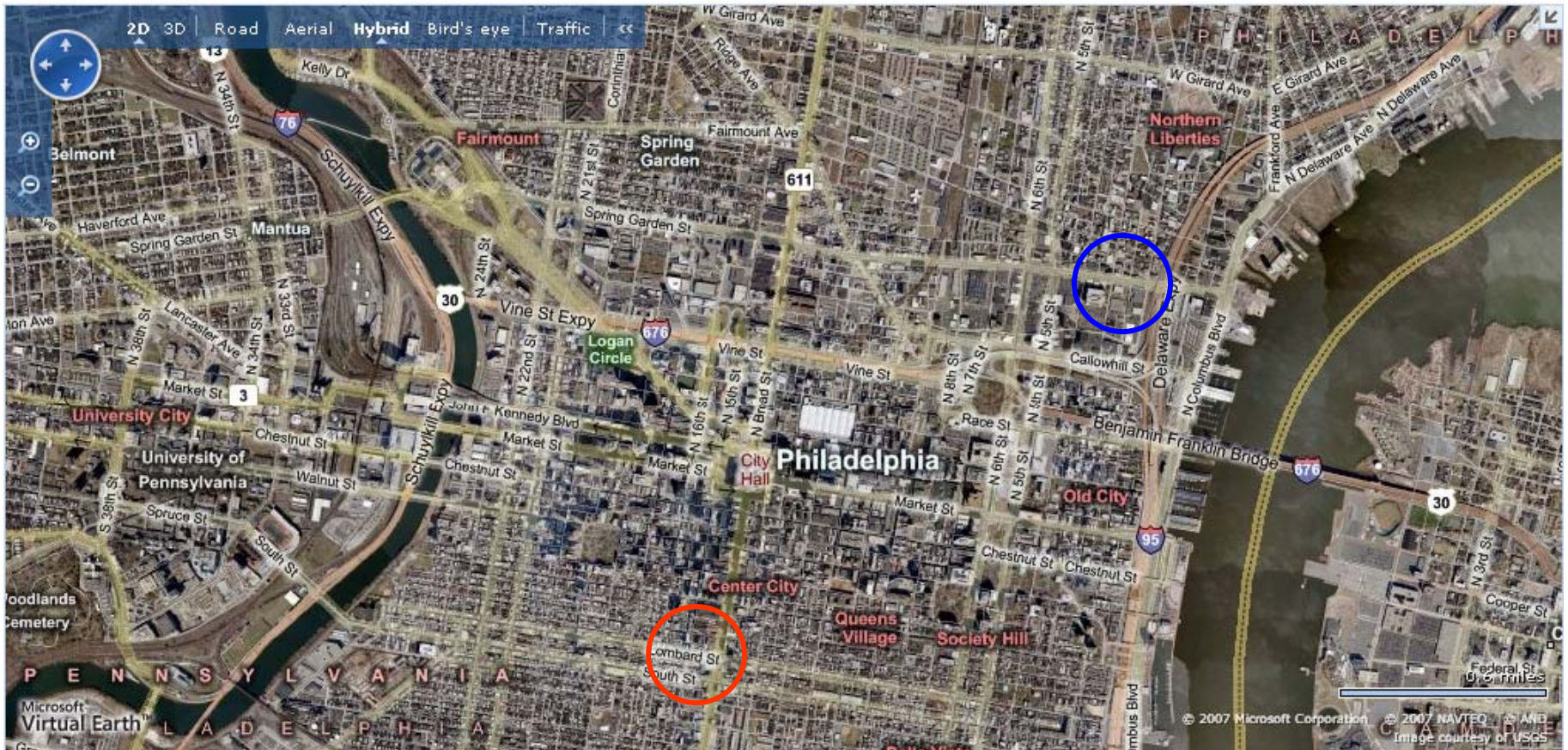
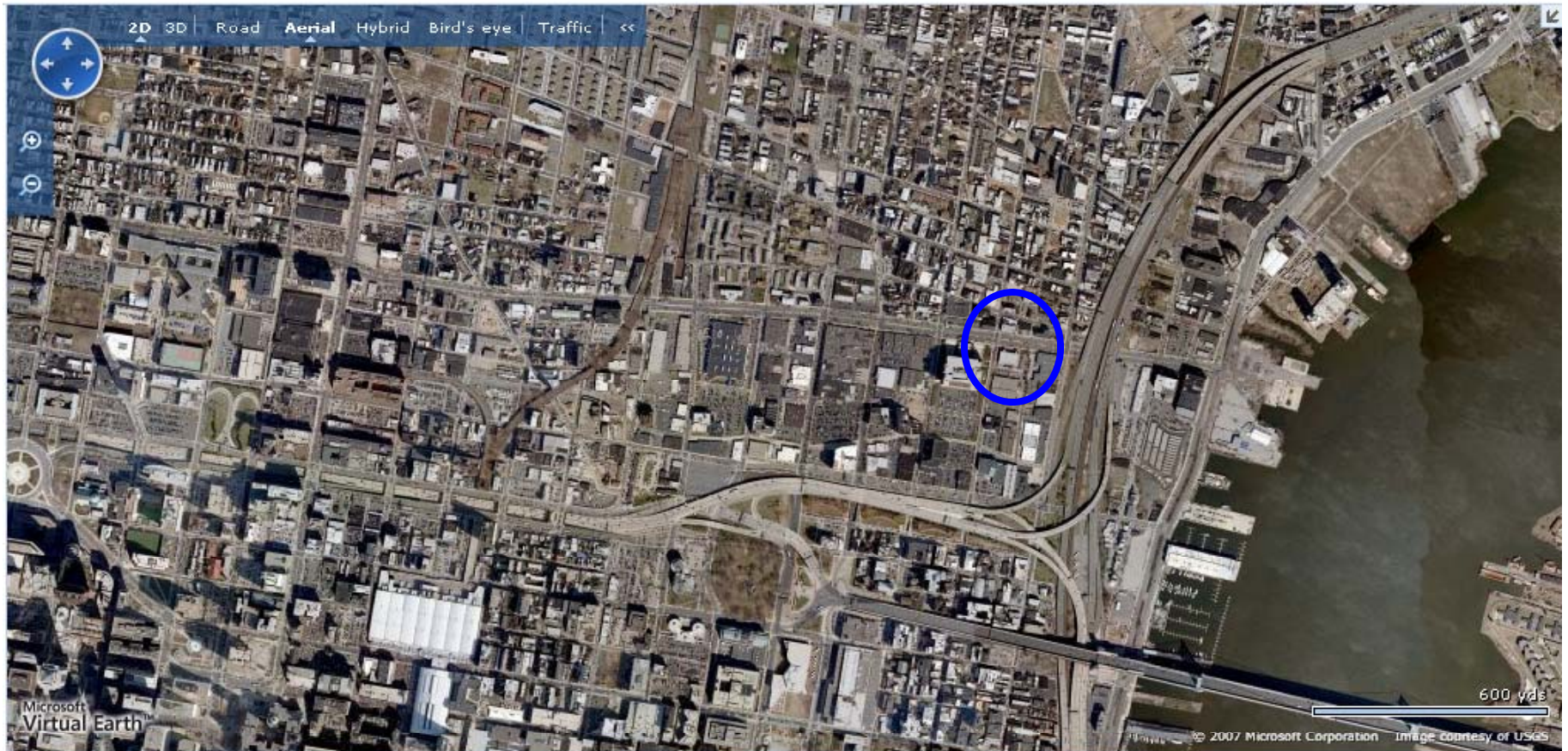


Figure E-1. Distance of PM samplers to nearest traffic lane (meters)

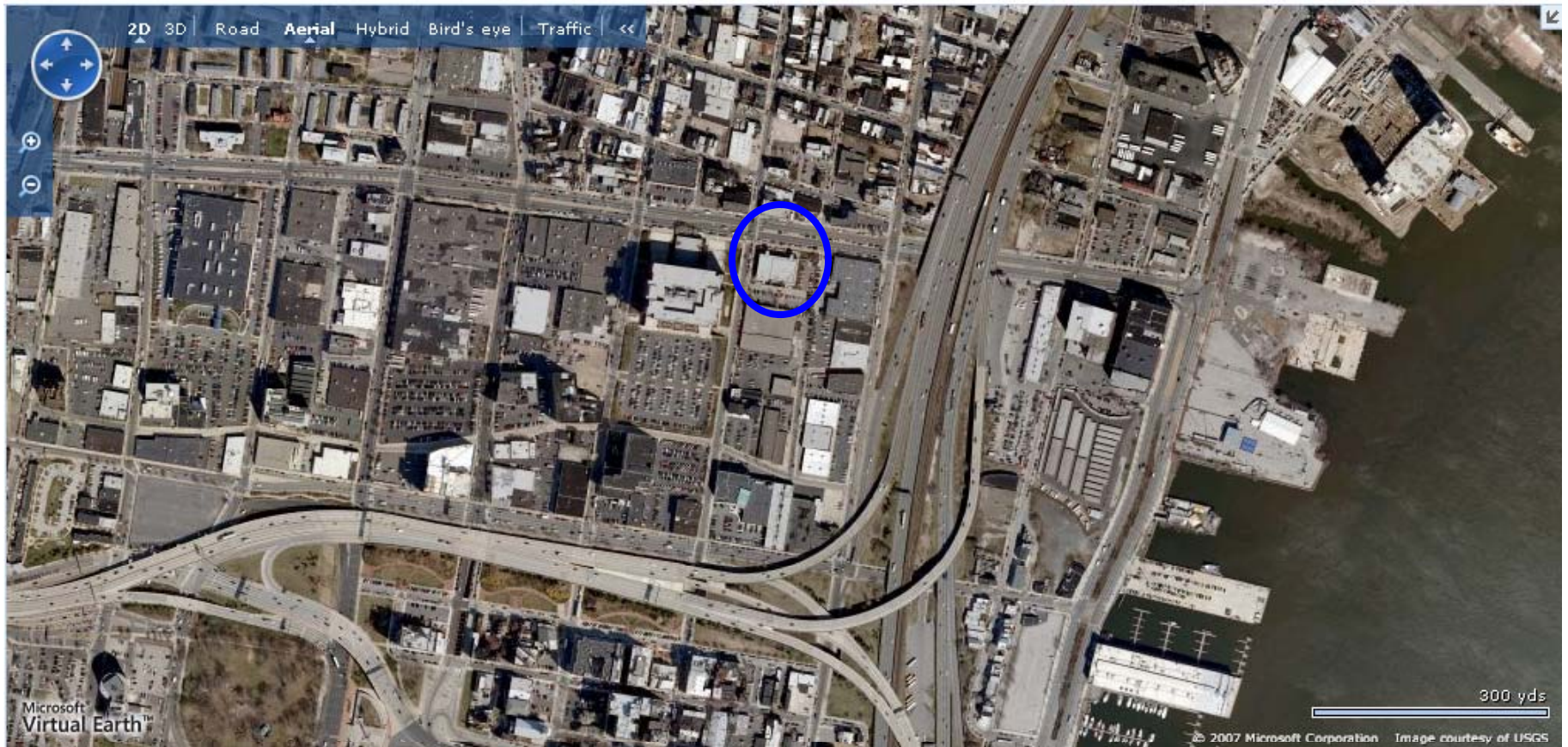
Aerial Hybrid Center City Philadelphia 0.6 Mile Scale
General Area of 421010047 Identified by Red Oval
General Area of Fire Department HQ Station Identified by Blue Oval



Aerial Photo Fire Department HQ
Scale 600 Yards
FDHQ Identified by Blue Oval



Aerial Photo Fire Department HQ
Scale 300 Yards
FDHQ Identified by Blue Oval



Aerial Photo Hybrid Philadelphia FDHQ
Scale 150 Yards



BirdsEye Aerial Photo Philadelphia Fire Department which is in the blue oval.

Looking North Scale 50 Yards

Pub is in the red oval. The Pub has cooking exhausts.

Parking in the lots appear to be usually for the duration of the work day.



BirdsEye Aerial Photo Philadelphia Fire Department looking South Scale 25 yards
Identifies PM 2.5 roof location by blue oval and alternate ground station location by yellow oval.

A tree now at the ground location.

Concerns on the roof are an oil fire furnace exhaust inside red oval. During the inspection, a brief, 10 second black smoke emission was observed. And two emergency generator exhaust pipes are in the green oval.

Surface photos are on the following slides.



Fire Dept HQ
PM 2.5 Sampler on roof.



Fire Dept. HQ
PM 2.5 Sampler on roof.



Fire Dept. HQ
PM 2.5 Sampler on roof.

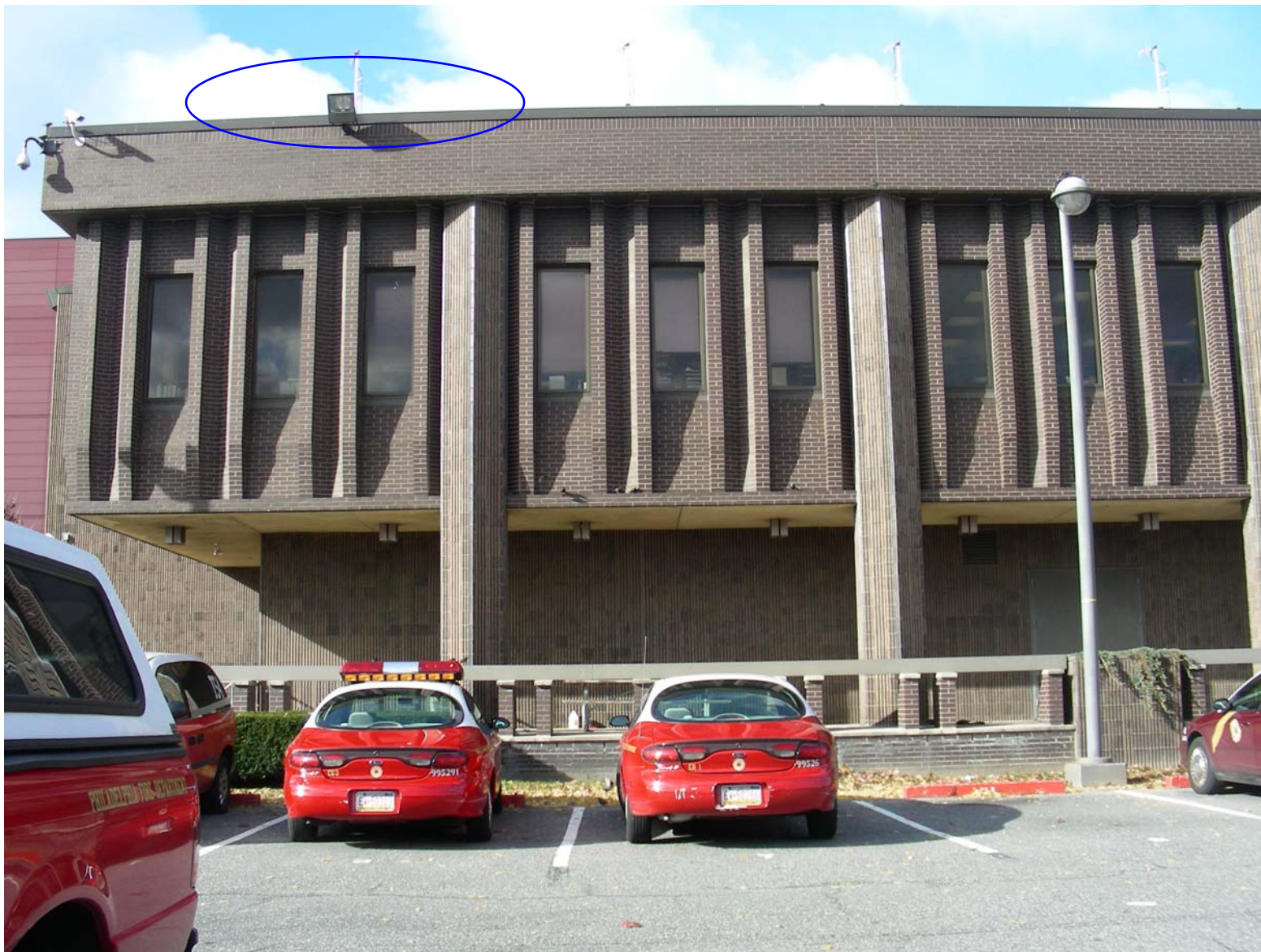


Fire Dept. HQ

From Ground showing location of the PM 2.5 Sampler on the Roof. Sampler is not visible.
This garage bay identified by red oval and others to the left (not visible) are too shallow for larger trucks



From Ground showing location of the PM 2.5 Sampler on the Roof. Sampler is not visible.



The two emergency diesel exhaust pipes are in the green oval. The oil furnace exhaust is in the red oval.
The oil furnace exhaust is about 30 meters from the PM 2.5 sampler.



View of oil furnace exhaust. The black on the lip of the stack is carbon.



View of oil furnace exhaust. The black on the lip of the stack is carbon.



View of two emergency diesel exhausts and the top of the mechanical area.



View of two emergency diesel exhausts and the mechanical area.



View of bottom of the mechanical area.



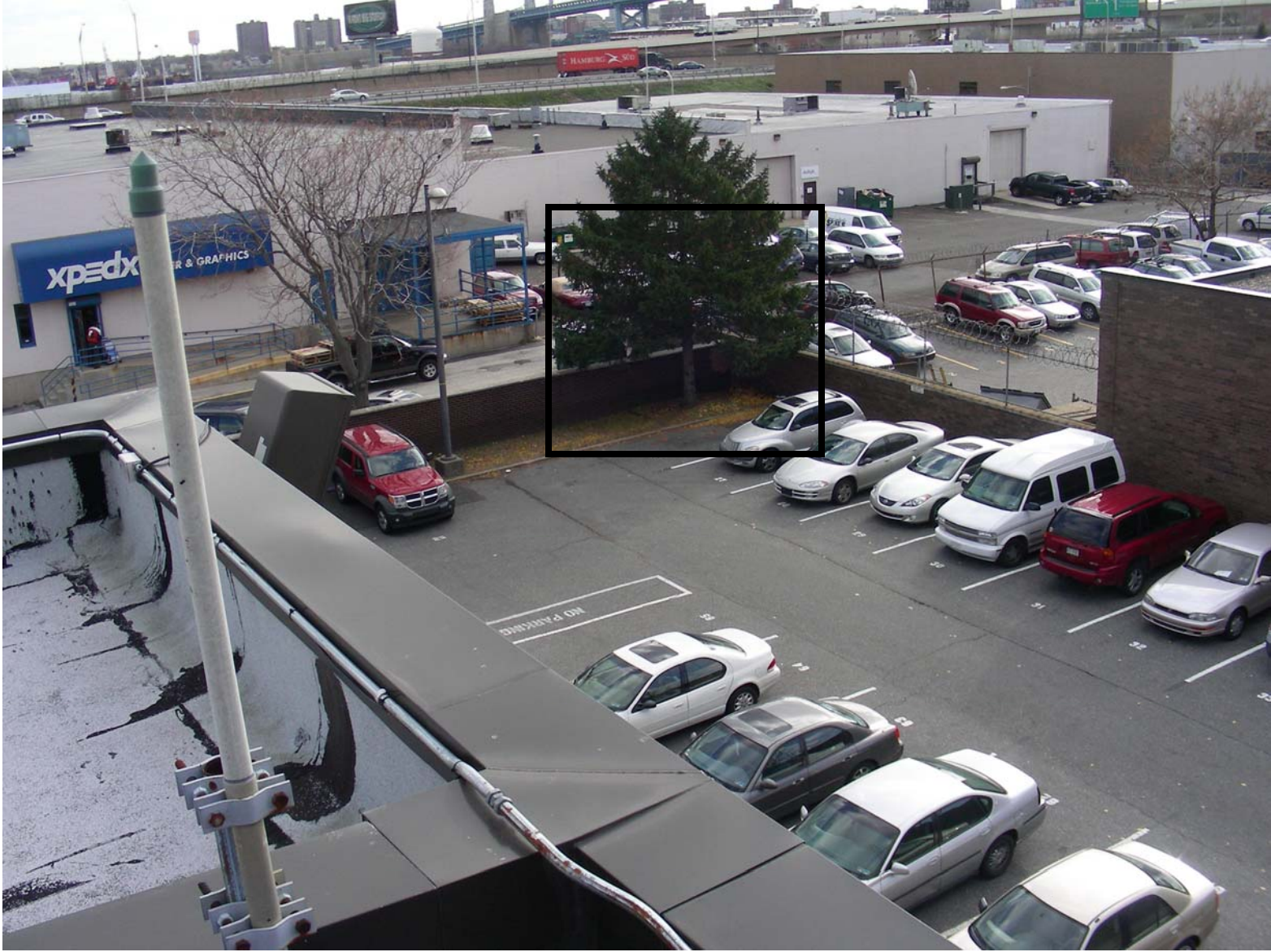
Pub



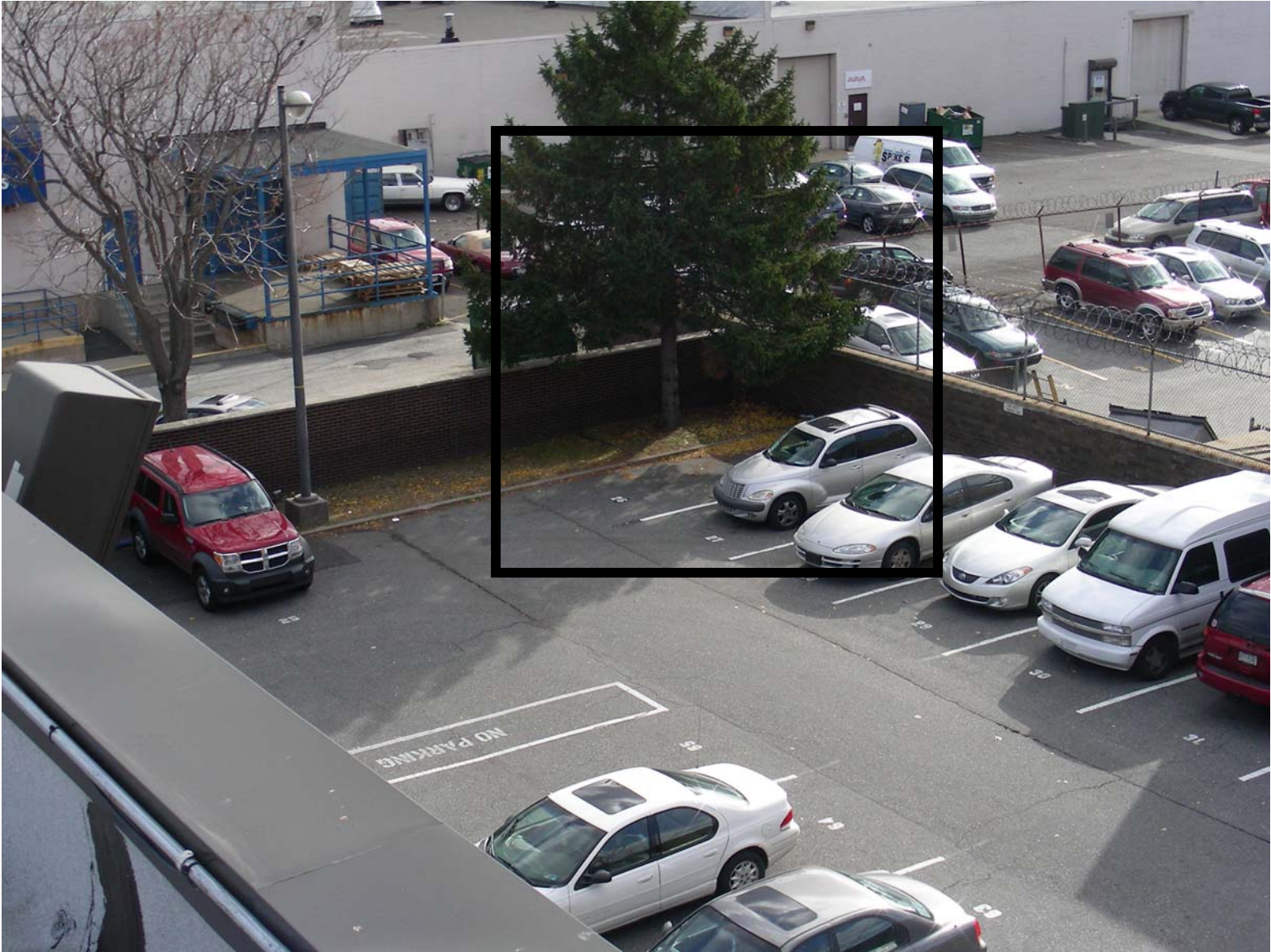
Pub Exhaust. May be for cooking.



View of Potential Ground Location for multi-monitor shelter.



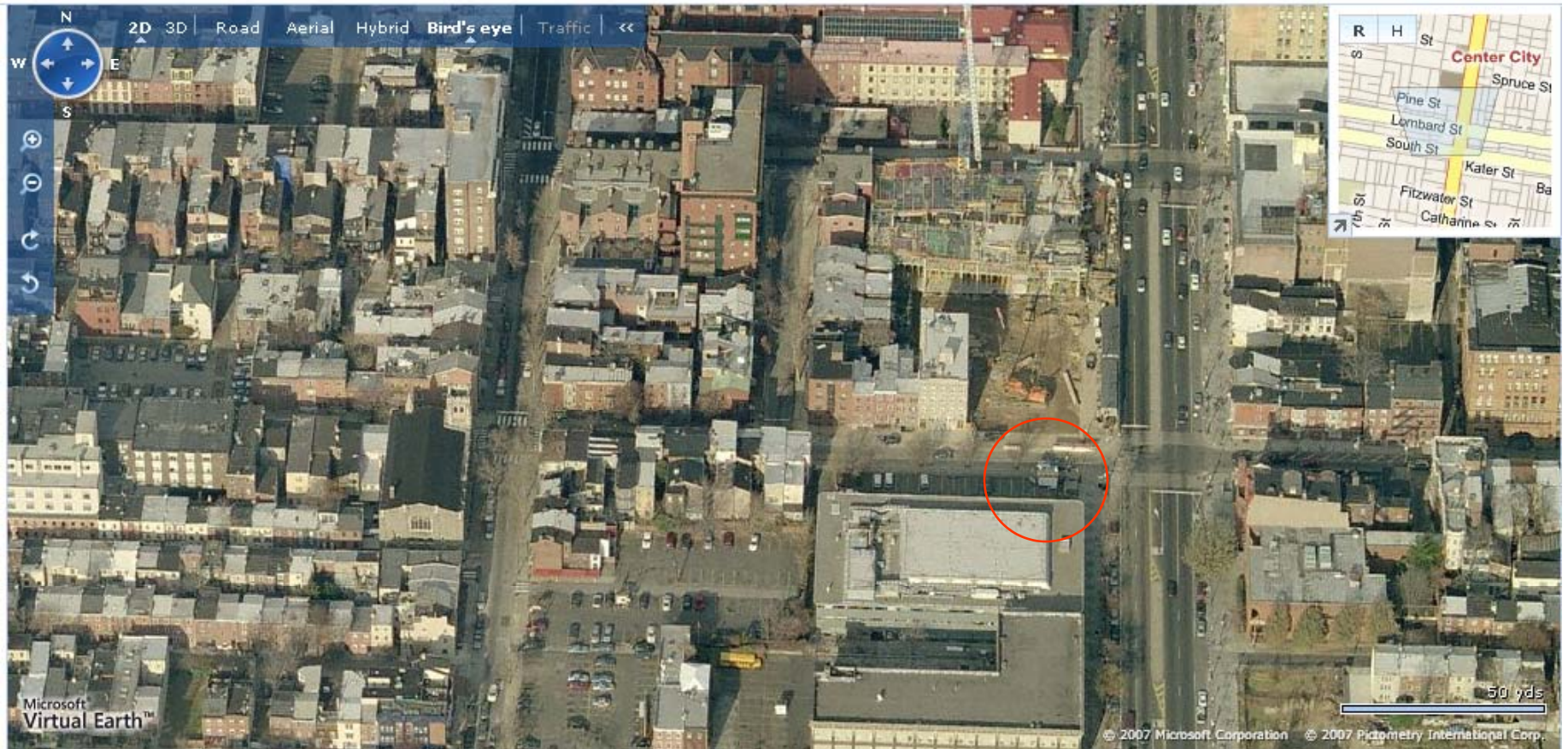
View of Potential Ground Location for multi-monitor shelter.



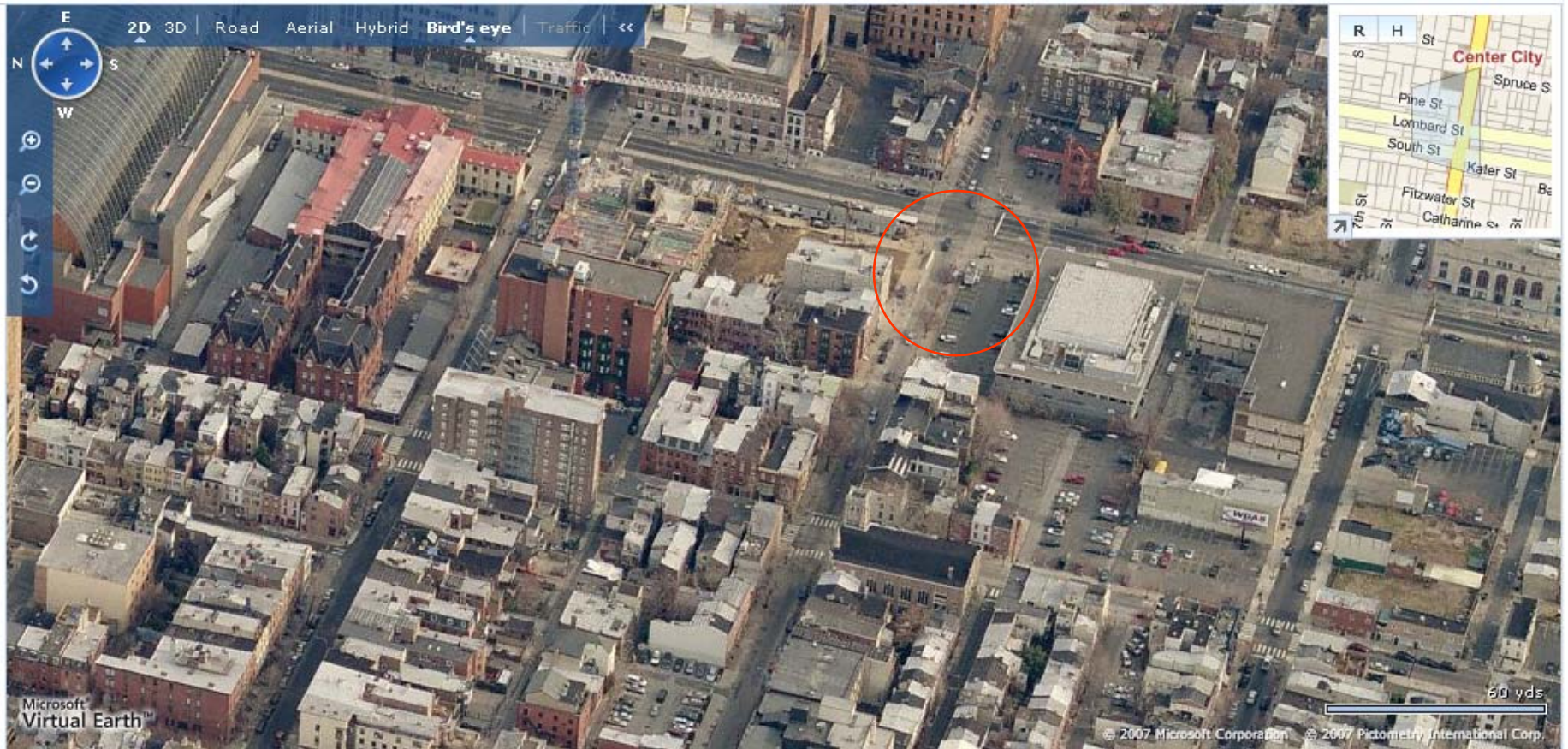
Surface close up view of the potential surface location.



BirdsEye
421010047
Looking North 50 Yards



BirdsEye
421010047
Looking West 60 Yards



421010047

Looking West 30 Yards
Station in red oval.

PM 2.5 Sampler in yellow oval used for comparison in fall and early winter 2006.



BirdsEye
421010047
Looking East 25 Yards



421010047 Picture of Corner showing sidewalks. Subway entrance identified by rectangle.



421010047 Picture of Corner Showing New Building Wall
Identified by Arrow and Hot Dog Stand in Circle



421010047 is on the corner of Broad Street and Lombard St in downtown Philadelphia, PA.
Provided below are three Quicktime video clips that show the traffic,
Thursday midday on 4/3/08.



Dscn2929.mov



Dscn2914.mov



Dscn2926.mov

Comparison of PM 2.5 Data Collected at 500 South Broad VS Fire Department HQ during 4th Quarter 2007

- The 4th quarter average of 91 values collected at 500 S. Broad was 13.51 micrograms per cubic meter and for Fire Dept. HQ was 13.26 micrograms per cubic meter. The goal was to demonstrate agreement between the quarterly average of 0.3 micrograms per meter which is the demonstrated agreement of collocated samplers at the same station at the 95 % confidence level.
- On all days but one the agreement was within 2 micrograms per cubic meter. On 12/21, the 500 S. Broad value was 14 and the Fire Dept. HQ value was 21.
- On three days the concentration were greater than 33 micrograms per cubic meter.
- An Excel spreadsheet that contains the data is provided below.



Microsoft Excel
Worksheet

Background Data

Google Earth link to PM 2.5 FRM station locations with 2003 thru 2006 summary data for Philadelphia Metro area. The new fire HQ station is not included, because it began operation in fall 2007.

Google Earth link to Philadelphia and Camden Counties NEI 2002 Plant Information and Emissions.

Google Earth internet connection required.

Must be in edit mode to activate. Will not activate in Slide Show mode.

Click on files below:



DE_NJ_PA_PM25_FRM.kml



PHILADELPHIA AND CAMDEN Plant Emissions.kml