

# Delaware Ambient Air Monitoring Network Description for Criteria Pollutants



Air Quality Management Section  
Division of Air and Waste Management  
Department of Natural Resources and Environmental Control

715 Grantham Lane  
New Castle, DE 19720  
(302) 323-4542

And

156 South State Street  
Dover, DE 19901  
(302) 739-9402

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## List of Acronyms

AQS – Air Quality System

CAA – Clean Air Act

CFR – Code of Federal Regulations

CO – carbon monoxide

CSA – combined statistical area

DNREC – Department of Natural Resources and Environmental Control

EPA – Environmental Protection Agency

FEM – Federal Equivalent Method

FRM – Federal Reference Method

MSA – metropolitan statistical area

NAAQS – National Ambient Air Quality Standards

NO – nitric oxide

NO<sub>2</sub> – nitrogen dioxide

NO<sub>x</sub> – nitrogen oxides

O<sub>3</sub> – ozone

Pb - lead

PM<sub>2.5</sub> – fine particulate matter (2.5 microns)

PM<sub>10</sub> – respirable particulate matter (10 microns)

PM<sub>10-2.5</sub> – coarse particulate matter (PM<sub>10</sub> – PM<sub>2.5</sub>)

SLAMS – state and local monitoring stations

SO<sub>2</sub> – sulfur dioxide

WS/WD – wind speed/wind direction

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## Introduction

In 1970, Congress passed the Clean Air Act that authorized the Environmental Protection Agency (EPA) to establish National Ambient Air Quality Standards (NAAQS) for pollutants shown to threaten human health and welfare. Primary standards were set according to criteria designed to protect public health, including an adequate margin of safety to protect sensitive populations such as children and asthmatics. Secondary standards were set according to criteria designed to protect public welfare (decreased visibility, damage to crops, vegetation, and buildings, etc.).

Seven pollutants currently have NAAQS: ozone (O<sub>3</sub>), carbon monoxide (CO), sulfur dioxide (SO<sub>2</sub>), nitrogen dioxide (NO<sub>2</sub>), particulate matter less than 10 microns (PM<sub>10</sub>), particulate matter less than 2.5 microns (PM<sub>2.5</sub>) and lead (Pb). These are commonly called the "criteria" pollutants. When air quality does not meet the NAAQS, the area is said to be in "nonattainment" with the NAAQS.

## Requirements for Monitoring Network Descriptions

In October 2006, the EPA issued final regulations concerning state and local agency ambient air monitoring networks. These regulations require periodic assessments of the monitoring networks including the information described below.

§58.10 Annual monitoring network plan and periodic network assessment.

Section §58.10 (a) requires for each existing and proposed monitoring site:

- 1) A statement of purpose for each monitor.
- 2) Evidence that siting and operation of each monitor meets the requirements of appendices A, C, D, and E of 40 CFR Part 58, where applicable.
- 3) Proposals for any State and Local Air Monitoring station (SLAMS) network modifications.

(b) The annual monitoring network plan must contain the following information for each existing and proposed site:

- 1) The Air Quality System (AQS) site identification number.
- 2) The location, including street address and geographical coordinates.
- 3) The sampling and analysis method(s) for each measured parameter.
- 4) The operating schedules for each monitor.
- 5) Any proposals to remove or move a monitoring station within a period of 18 months following plan submittal.
- 6) The monitoring objective and spatial scale of representativeness for each monitor.
- 7) The identification of any sites that are suitable and sites that are not suitable for comparison against the annual PM<sub>2.5</sub> NAAQS as described in §58.30.
- 8) The Metropolitan Statistical Area (MSA), Core Based Statistical Area (CBSA), Combined Statistical Area (CSA) or other area represented by the monitor.

## **Delaware Air Monitoring Network**

### **History of air monitoring in Delaware**

Air pollution monitoring in Delaware began in the 1950s, prior to the establishment of the US EPA. The first monitors were simple mechanisms or passive collectors such as dust-fall buckets and tape samplers. These were followed in the 1960s by wet-chemistry instruments, which were soon replaced by more advanced electronic instruments. The addition of computer technology in operating monitoring systems and air pollution data collection in the late 1970s and early 1980s was critical to the development of the core monitoring network that exists today.

The earliest monitors were placed near pollution sources to measure direct impact of pollution emissions. As ambient air pollution standards became established and monitoring methods standardized, the monitoring network expanded to include monitors in both urban and suburban areas. Monitoring goals shifted to include measuring high pollution concentrations in population centers, detecting trends, and determining compliance with the new national and state air quality standards, as well as establishing background levels and measuring pollution transported from areas outside of Delaware.

With the passage of the Clean Air Act in 1970, and the Clean Air Act Amendments in 1990, various control measures implemented by the federal and state governments resulted in major improvements in air quality, particularly regarding major industrial sources. Pollutants of concern today come from a variety of sources including mobile (both on road and off road vehicles) sources, large industrial facilities, and smaller industries and business. Delaware continues to use its ambient monitoring network to track changes in air quality across the state and evaluate compliance with ambient air quality standards.

### **Network Overview**

The State of Delaware has established an air monitoring network to determine the ambient levels of the pollutants for which NAAQS have been established. The Delaware Air Monitoring Network consists of the sites and monitors listed in this document. Although monitoring takes place statewide, most of the stations are concentrated in the northern urban/industrial areas, which have the highest population and number of pollutant sources. This network is maintained and operated by the Air Surveillance Branch of the Air Quality Management Section, Division of Air and Waste Management, DNREC.

### **National Core Monitoring Strategy – NCore**

In October 2006 the United States Environmental Protection Agency (EPA) issued final amendments to the ambient air monitoring regulations for criteria pollutants. These amendments are codified in 40 CFR parts 53 and 58. The purpose of the amendments was to enhance ambient air quality monitoring to better serve current and future air quality needs. One of the most significant changes in the regulations was the requirement to establish National Core (NCore)

multi-pollutant monitoring stations. These stations will provide data on several pollutants at lower detection limits and replace the National Air Monitoring Station (NAMS) networks that have existed for several years. The final network plan must be submitted to EPA by July 1, 2009 and the stations must be operational by January 1, 2011.

The NCore Network addresses the following monitoring objectives:

- timely reporting of data to the public through AIRNow, air quality forecasting, and other public reporting mechanisms
- support development of emission strategies through air quality model evaluation and other observational methods
- accountability of emission strategy progress through tracking long-term trends of criteria and non-criteria pollutants and their precursors
- support long-term health assessments that contribute to ongoing reviews of the National Ambient Air Quality Standards (NAAQS)
- compliance through establishing nonattainment/attainment areas by comparison with the NAAQS
- support multiple disciplines of scientific research, including; public health, atmospheric and ecological

The NCore sites must measure, at a minimum, PM<sub>2.5</sub> particle mass using continuous and integrated/filter-based samplers, speciated PM<sub>2.5</sub>, PM<sub>10-2.5</sub> particle mass, speciated PM<sub>10-2.5</sub>, O<sub>3</sub>, SO<sub>2</sub>, CO, NO/NO<sub>y</sub>, wind speed, wind direction, relative humidity, and ambient temperature.

Each State is required to operate at least one NCore site. The objective is to locate sites in broadly representative urban (about 50 sites) and rural or regional (about 20 sites) locations throughout the country to help characterize urban- and regional-scale patterns of air pollution. Monitoring agencies are encouraged by EPA to collocate NCore sites with existing sites already measuring ozone precursors, air toxics, or PM<sub>2.5</sub> speciation components. By combining these monitoring programs at a single location, stakeholders can maximize the multi-pollutant information available. This approach not only leverages existing resources but notably enhances the foundation for future health studies and NAAQS revisions.

In 2009, EPA provided funding to begin the process of establishing an NCore station in Delaware. After evaluating the existing network, historical data, census data, meteorology, and topography, Delaware is proposing the existing MLK monitoring site as Delaware's NCore site. The documents contained specific information associated with this proposal are included as Appendix A to this annual network plan. Delaware is also requesting a waiver for NO<sub>y</sub> monitoring; documents for this waiver are included as Appendix B to this plan.

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## Lead Monitoring

In November 2008 EPA promulgated a new lead National Ambient Air Quality Standard (NAAQS). As part of that process, EPA redesigned the lead monitoring network to assess compliance with the revised lead standards by requiring two types of monitoring:

- EPA will require state and local monitoring agencies to conduct monitoring taking into account lead sources that are expected to, or have been shown to, exceed the standards. At a minimum, monitors must be placed in areas with sources of lead emissions greater than or equal to one ton or more per year, to measure the maximum concentration.
- EPA also will require a monitor to be operated in each CBSA with populations greater than 500,000 to gather information on the general population's exposure to lead in air and ensure protection against sources of airborne dust containing lead.

EPA has also required a plan for establishing lead monitoring sites in accordance with the requirements of 40 CFR Part 58 Appendix D be submitted to the EPA Regional Administrator no later than July 1, 2009 as part of the annual network plan. The plan shall provide for the required source-oriented lead monitoring sites to be operational by January 1, 2010, and for all required non-source-oriented lead monitoring sites to be operational by January 1, 2011. Specific site locations for the sites to be operational by January 1, 2011 are not required as part of the July 1, 2009 annual network plan, but shall be included in the annual network plan due to be submitted to the EPA Regional Administrator on July 1, 2010.

In accordance with guidance and regulations published by EPA, Delaware has reviewed all emissions data concerning lead sources and has determined that there are no single sources (or cluster of sources) in Delaware with emissions greater than or equal to 1 ton per year. This means that no lead monitoring will be required in Delaware by January 2010.

Delaware's largest population center is Wilmington, which is part of the greater Philadelphia CBSA as defined by the U.S. Census bureau. Preliminary discussions with EPA Region 3 in Philadelphia indicated that Wilmington will not be considered a separate area from Philadelphia. The selection of a lead monitoring site for the Philadelphia CBSA will be included in the monitoring network plan for 2011.

Delaware notes that preliminary computer modeling (CMAQ) conducted as part of a larger air toxics study indicates that the highest lead concentrations in the Philadelphia CBSA are predicted to occur in the Wilmington area. Delaware plans to investigate this issue in more detail over the next year, including reviews of emissions data and ambient lead monitoring data resulting from the air toxics study as well as any other relevant special studies. Delaware also requests that EPA Region 3 allow Delaware to participate in any discussions concerning the location of a population-oriented lead monitor in the Philadelphia CBSA that will include and apply to Wilmington.

In addition, Delaware will continue to monitor lead in TSP as part of the EPA Region 3 air toxics monitoring project. Data from this project, although not collected with federal reference or equivalent methods or analyses, will be helpful in assessing ambient lead concentrations in the Wilmington area.

### Monitoring Site Network Map

Below is the Delaware ambient air monitoring site network map as of April 2009.



Below is a summary table with additional information on every SLAMS site in Delaware. Information includes site name, active site monitors, when each monitor began collecting information, the scale of representativeness for each monitor, the monitoring objective, and any other comments relating to the site or monitor.

Site Name & AQS ID	Parameter	Start Date	Scale of Rep	Objective	Comments
Killens Pond 10-001-0002	Ozone - seasonal	4/1/1995	Neighborhood	General/Background	Rural site
	PM2.5	1/1/1999	Neighborhood	General/Background	
	WS/WD	4/1/1995	N/A		
Dover 10-001-0003	PM2.5	1/1/1999	Neighborhood	Population Exposure	
	PM2.5 speciation	6/1/2001	N/A		
Brandywine 10-003-1010	Ozone - seasonal	7/1/1994	Neighborhood	Population Exposure	Secondary downwind of Wilm.
Bellefonte2 10-003-1013	Ozone	4/1/2001	Neighborhood	Population Exposure	Primary downwind of Wilm.
	SO2	3/1/2003	Neighborhood		
Bellefonte 10-003-1003	PM2.5	1/1/1999	Neighborhood	Population Exposure	
MLK 10-003-2004	SO2	1/1/1999	Neighborhood		Urban site
	CO	1/1/1999	Middle	Maximum concentration	
	NO2	1/1/2001	Neighborhood	Maximum concentration	
	PM10	1/1/2000	Neighborhood	Maximum concentration	
	PM2.5	1/1/1999	Neighborhood	Maximum concentration	
	PM2.5 speciation	6/1/2001	N/A		
	BC	1/1/2001	N/A		
	VOCs	1/1/1999	N/A		
	Carbonyls	1/1/2003	N/A		
	Metals	1/1/2003	N/A		
WS/WD	6/1/2000	N/A			
Newark 10-003-1012	PM2.5	12/15/1999	Neighborhood	Population Exposure	
Lums Pond 10-003-1007	Ozone	1/1/1992	Neighborhood	Upwind/Background	Rural/suburban
	PM2.5	1/1/1999	Neighborhood	Transport/Background	

Site Name & AQS ID	Parameter	Start Date	Scale of Rep	Objective	Comments
Delaware City 10-003-1008	SO2	2/1/1992	Neighborhood		Point source dominated site
	CO	1/1/1994	Middle		
	VOCs	1/1/2001	N/A		
	WS/WD		N/A		
Seaford 10-005-1002	Ozone - seasonal	3/1/1990	Neighborhood	Population Exposure	
	PM2.5	1/1/1999	Neighborhood	Population Exposure	
	WS/WD		N/A		
Lewes 10-005-1003	Ozone - seasonal	5/1/1997	Neighborhood	Population Exposure	Coastal site
	WS/WD	6/1/1997	N/A		

N/A – not applicable

**Criteria Pollutant Network Description by Parameter**

**Ozone (O<sub>3</sub>)**

Ozone is measured by ultraviolet absorption photometry. Air is drawn through a sample cell where ultraviolet light (254 nm wavelength) passes through it. Light not absorbed by the ozone is converted into an electrical signal proportional to the ozone concentration.

**Monitoring Requirements**

Within an O<sub>3</sub> network, at least one O<sub>3</sub> site for each MSA, or CSA if multiple MSAs are involved, must be designed to record the maximum concentration for that particular metropolitan area. More than one maximum concentration site may be necessary in some areas. Other types of monitoring sites are needed to determine maximum population exposure, background concentrations, and concentrations being transported into an area (boundary conditions). The appropriate spatial scales for O<sub>3</sub> sites are neighborhood, urban, and regional. Since O<sub>3</sub> requires appreciable formation time, the mixing of reactants and products occurs over large volumes of air, and this reduces the importance of monitoring small scale spatial variability.

The prospective maximum concentration monitor site should be selected in a direction from the city that is most likely to observe the highest O<sub>3</sub> concentrations, more specifically, downwind during periods of photochemical activity. Since O<sub>3</sub> levels decrease significantly in the colder parts of the year in many areas, O<sub>3</sub> is required to be monitored only during the “ozone season” as designated in the 40 CFR Part 58 Appendix D, which in Delaware is April 1 through October 31.



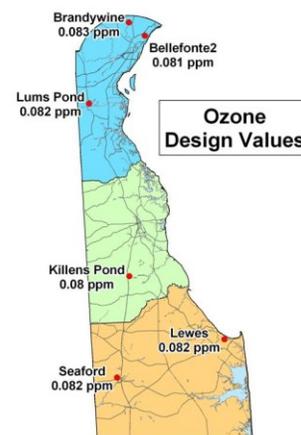
Delaware operates six ozone monitoring sites, including sites for maximum downwind concentrations, background concentrations, and transport conditions. The monitors at Bellefonte

and Lums Pond operate year-round, while the remaining sites operate during the ozone season (April through October). Hourly data is sent to the AirNow website to generate the daily Air Quality Index and to be used in mapping ozone concentrations throughout the region.

### Ozone Design Values

The table below shows the most recent (2006 – 2008) design values for ozone monitors in Delaware. Ozone design values are calculated by taking the 3-year average of the annual 4th maximum daily maximum 8-hr ozone averages. The current 8-hr ozone standard is 0.08 ppm. Because the current standard is written to two decimal places, design values of 0.085 or higher are non-attainment. Although the most recent Delaware design values are below the standard, New Castle and Kent Counties are classified as non-attainment based on being part of or upwind adjacent to the Philadelphia non-attainment area.

Site	Design Value
Brandywine	0.083
Bellefonte2	0.078
Lums Pond	0.080
Killens Pond	0.081
Seaford	0.081
Lewes	0.079



### Sulfur Dioxide (SO<sub>2</sub>)

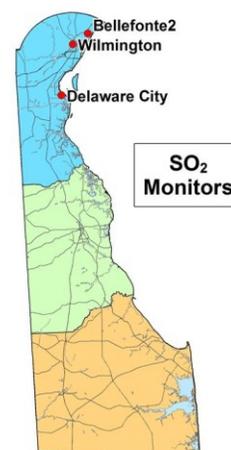
Sulfur dioxide is measured with a fluorescence analyzer. Air is drawn through a sample cell where it is subjected to high intensity ultraviolet light. This causes the sulfur dioxide molecules in the air to fluoresce and release light. The fluorescence is detected with a photo multiplier tube and converted to an electrical signal proportional to the SO<sub>2</sub> concentration.

### Monitoring Requirements

There are no minimum requirements for the number of SO<sub>2</sub> monitoring sites. Continued operation of existing SO<sub>2</sub> sites is required until discontinuation is approved by the EPA Regional Administrator. Where SO<sub>2</sub> monitoring is ongoing, at least one of the SO<sub>2</sub> sites must be a maximum concentration site for that specific area.

The appropriate spatial scales for SO<sub>2</sub> monitoring are the microscale, middle, and possibly neighborhood scales.

Delaware operates three SO<sub>2</sub> monitoring sites, all in New Castle County. All sites operate year-round. Please see the section on “Changes from 2007” for more information on SO<sub>2</sub> sites.



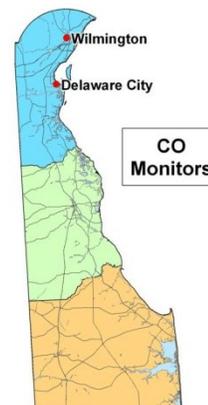
### Carbon Monoxide (CO)

Carbon monoxide is measured by infrared absorption photometry. Air is drawn continuously through a sample cell where infrared light passes through it. Carbon monoxide molecules in the air absorb part of the infrared light, reducing the intensity of the light reaching a light sensor. The light is converted into an electrical signal related to the concentration of carbon monoxide in the sample cell.

#### *Monitoring Requirements*

There are no minimum requirements for the number of CO monitoring sites. Continued operation of existing CO sites is required until discontinuation is approved by the EPA Regional Administrator. Where CO monitoring is ongoing, at least one site must be a maximum concentration site for that area under investigation.

Delaware operates two CO monitoring sites; monitors operate year-round.



### Nitrogen Dioxide (NO<sub>2</sub>)

Nitrogen oxides are measured using the chemiluminescence reaction of nitric oxide (NO) with ozone (O<sub>3</sub>). Air is drawn into a reaction chamber where it is mixed with a high concentration of ozone from an internal ozone generator. Any NO in the air reacts with the ozone to produce NO<sub>2</sub>. Light emitted from this reaction is detected with a photo multiplier tube and converted to an electrical signal proportional to the NO concentration. NO<sub>2</sub> must be measured indirectly. NO<sub>x</sub> is measured by passing the air through a converter where any NO<sub>2</sub> in the air is reduced to NO before the air is passed to the reaction chamber. By alternately passing the air directly to the reaction chamber, and through the converter before the reaction chamber, the analyzer alternately measures NO and NO<sub>x</sub>. The NO<sub>2</sub> concentration is equal to the difference between NO and NO<sub>x</sub>.

#### *Monitoring Requirements*

There are no minimum requirements for the number of NO<sub>2</sub> monitoring sites. Continued operation of existing NO<sub>2</sub> sites is required until discontinuation is approved by the EPA Regional Administrator. Where NO<sub>2</sub> monitoring is ongoing, at least one NO<sub>2</sub> site in the area must be located to measure the maximum concentration of NO<sub>2</sub>.

Delaware operates one NO<sub>2</sub> site at MLK in Wilmington.



### **Particulate Matter - Fine (PM<sub>2.5</sub>)**

The federal reference method (FRM) monitors for PM<sub>2.5</sub> operate by drawing air through a specially designed inlet that excludes particles larger than 2.5 microns in diameter. The particles are collected on a Teflon<sup>®</sup> microfiber filter that is weighed to determine the particulate mass.

Delaware operates PM<sub>2.5</sub> monitors at seven sites throughout the state. All monitors operate year-round. There is one collocated site at MLK in Wilmington. The normal sampling schedule is 24 hours every third day, however, at MLK samples are collected every day.

### **Monitoring Requirements**

State agencies must operate at least the minimum number of required PM<sub>2.5</sub> sites listed in 40 CFR Part 58 Appendix D Table D-5. These required monitoring stations or sites must be sited to represent community-wide air quality. In addition, the following specific criteria apply:

- (1) At least one monitoring station is to be sited in a population-oriented area of expected maximum concentration.
- (2) For areas with more than one required station, a monitoring station is to be sited in an area of poor air quality.
- (3) Each State shall install and operate at least one PM<sub>2.5</sub> site to monitor for regional background and at least one PM<sub>2.5</sub> site to monitor regional transport.



### **PM<sub>2.5</sub> Speciation**

Chemical speciation is encouraged at sites where the chemically resolved data would be useful in developing State implementation plans and supporting atmospheric or health effects related studies. These sites in Delaware are MLK in Wilmington and Dover in Kent County. The PM<sub>2.5</sub> chemical speciation sites include analysis for elements, selected anions and cations, and carbon.

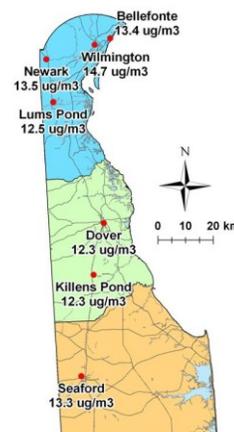
### **Continuous PM<sub>2.5</sub>**

Delaware operates a continuous PM<sub>2.5</sub> monitor that generates FRM-like hourly and 24-hour data at the MLK site. This monitor operates year-round, and is collocated with an FRM PM<sub>2.5</sub> monitor. Continuous PM<sub>2.5</sub> data had formerly been collected at Newark, Killens Pond, and Seaford using different monitoring methodology. The data collected with that instrumentation did not consistently compare well with the FRM data. Consequently, operation of these monitors has been temporarily suspended to work with the manufacture on improving performance.

**PM<sub>2.5</sub> Annual Design Values (2006 – 2008)**

Below are the current annual design values for PM<sub>2.5</sub> using 2006 through 2008 data. PM<sub>2.5</sub> annual design values are calculated using the 3-year average of the respective annual averages. The current annual PM<sub>2.5</sub> standard is 15 µg/m<sup>3</sup>.

Site	Design Value
Bellefonte	12.9
MLK – Wilmington	14.2
Newark	12.9
Lums Pond	11.8
Dover	11.7
Killens Pond	11.8
Seaford	12.7

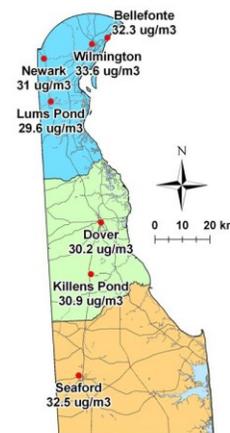


**PM<sub>2.5</sub> Daily Design Values (2006 - 2008)**

Below are the current daily design values for PM<sub>2.5</sub> using 2006 through 2008 data. PM<sub>2.5</sub> daily design values are calculated using the 3-year average of the annual 98th percentile values. As of 2006, the new, more stringent daily PM<sub>2.5</sub> standard is 35 µg/m<sup>3</sup>. The previous daily standard was 65 µg/m<sup>3</sup>. Final designations relative to the new standard will be required by December 2009 (becoming effective in April 2010), based upon measured data from 2006 through 2008.

Currently, under the 1997 PM<sub>2.5</sub> NAAQS, all Delaware monitors are measuring attainment for both the annual and daily PM<sub>2.5</sub> standards. However, New Castle County is currently designated nonattainment for the annual standard as part of the Philadelphia nonattainment area.

Site	Design Value
Bellefonte	31
MLK – Wilmington	36
Newark	30
Lums Pond	29
Dover	30
Killens Pond	30
Seaford	31



**Particulate Matter (PM<sub>10</sub>)**

PM<sub>10</sub> is sampled continuously using a tapered element oscillating microbalance (TEOM). Air is drawn through a specially designed inlet that excludes particles larger than 10 microns in diameter. Particle accumulation causes changes in the microbalance oscillation which are recorded by the instrument.

**Monitoring Requirements**

State, and where applicable local, agencies must operate the minimum number of required PM<sub>10</sub> monitoring sites listed in Table D-4 of 40 CFR Part 58 Appendix D. For Delaware this requires at least one site in the urban Wilmington area.

Although microscale monitoring may be appropriate in some circumstances, the most important spatial scales to effectively characterize the emissions of PM<sub>10</sub> from both mobile and stationary sources are the middle scales and neighborhood scales.

Delaware operates one PM<sub>10</sub> monitor at MLK in Wilmington.

**Changes from 2007**

SO<sub>2</sub> monitoring at Lums Pond was ended in 2008 due to continuing problems with monitor operation. The age of the monitor and high cost of replacement resulted in the suspension of SO<sub>2</sub> monitoring at that site. If resources become available in the future, monitoring can resume.

**Changes anticipated for 2009**

No changes are anticipated for 2009.

**Individual Monitoring Site Information**

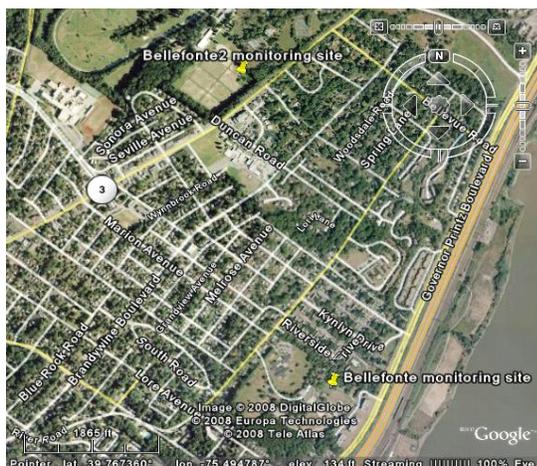
The following pages contain additional site specific information on all active SLAMS monitoring sites in Delaware. Sites are shown in alphabetical order for New Castle, Kent, and Sussex Counties.

**Site: Bellefonte and Bellefonte2**

County:	New Castle	Latitude:	Bellefonte 39.7611 Bellefonte2 39.7739
Address:	Bellefonte: River Road Park Bellefonte2: Bellevue State Park	Longitude:	Bellefonte -75.4919 Bellefonte2 - 75.4964
AQS site ID:	Bellefonte: 10-003-1003 Bellefonte2: 10-003-1013	Year Established:	Bellefonte 1969 Bellefonte2 2001
Spatial Scale:	Neighborhood	Area Represented:	Wilmington area



Bellefonte and Bellefonte2 locations



Bellefonte2



**Monitored Parameters**

	Ozone	SO <sub>2</sub>	CO	NO <sub>2</sub>	PM <sub>2.5</sub>	PM <sub>2.5</sub> speciation	PM <sub>2.5</sub> continuous	PM <sub>10</sub>	Wind Speed	Wind Direction
Bellefonte					X					
Bellefonte2	X	X								

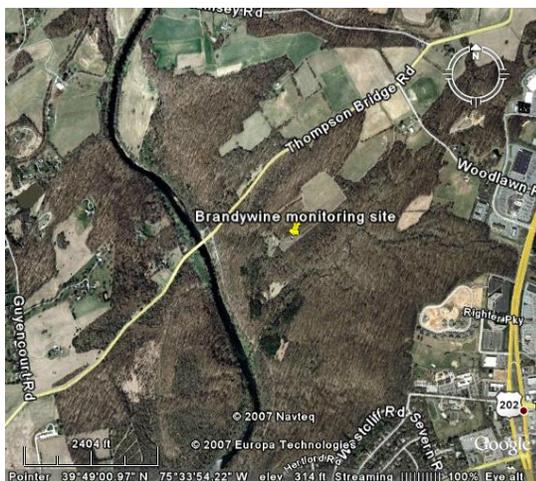
**Site Description:** Bellefonte was originally established in 1969 to monitor O<sub>3</sub> and SO<sub>2</sub>. PM<sub>2.5</sub> was added in 1999. When changing site characteristics began to interfere with ozone monitoring, a new site (Bellefonte2) was established in 2001, less than a mile to the north. The O<sub>3</sub> and SO<sub>2</sub> monitors were relocated to the new site, while the PM<sub>2.5</sub> monitor remained at the original site to provide data continuity. Both sites meet all EPA siting criteria.

**Monitoring Objectives:** Both monitoring sites are neighborhood scale, and collect data to determine compliance with the NAAQS, to determine population exposures, and to track trends. Bellefonte2 is the O<sub>3</sub> maximum downwind concentration site for Wilmington. The SO<sub>2</sub> monitor is sited for general population exposure and trends, with major point sources located to the northeast in Marcus Hook, PA and to the south in Edgemoor.

**Planned Changes through 2009:** No changes planned.

**Site: Brandywine**

County:	New Castle	Latitude:	39.8172
Address:	Brandywine Creek State Park	Longitude:	-75.5639
AQS site ID:	10-003-1010	Year Established:	1994
Spatial Scale:	Neighborhood	Area Represented:	Wilmington area



**Station Photo Not Available**

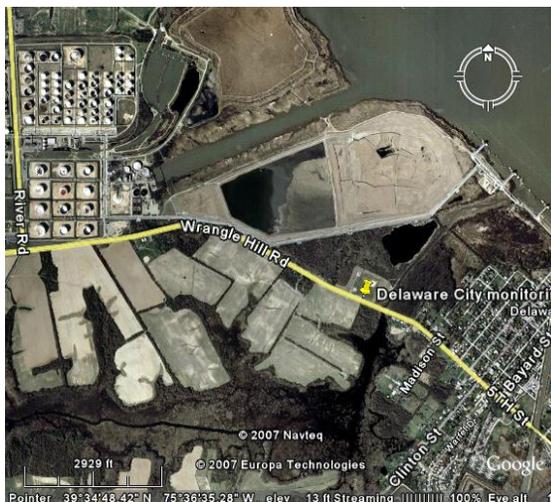
**Monitored Parameters**

Ozone	SO <sub>2</sub>	CO	NO <sub>2</sub>	PM <sub>2.5</sub>	PM <sub>2.5</sub> speciation	PM <sub>2.5</sub> continuous	PM <sub>10</sub>	Wind Speed	Wind Direction
X									

<p><b>Site Description:</b> The Brandywine site is located in Brandywine Creek State Park. This is a neighborhood scale site for O<sub>3</sub> monitoring. The site meets all EPA siting requirements.</p>
<p><b>Monitoring Objectives:</b> The Brandywine site is in the secondary downwind direction from Wilmington. The objectives are compliance with the O<sub>3</sub> NAAQS, population exposure, and trends.</p>
<p><b>Planned Changes through 2009:</b> No changes are planned.</p>

**Site: Delaware City**

County:	New Castle	Latitude:	39.5778
Address:	Route 9, Delaware City	Longitude:	-75.6111
AQS site ID:	10-003-1008	Year Established:	1992
Spatial Scale:	Neighborhood	Area Represented:	Delaware City



**Monitored Parameters**

Ozone	SO <sub>2</sub>	CO	NO <sub>2</sub>	PM <sub>2.5</sub>	PM <sub>2.5</sub> speciation	PM <sub>2.5</sub> continuous	PM <sub>10</sub>	Wind Speed	Wind Direction
	X	X						X	X

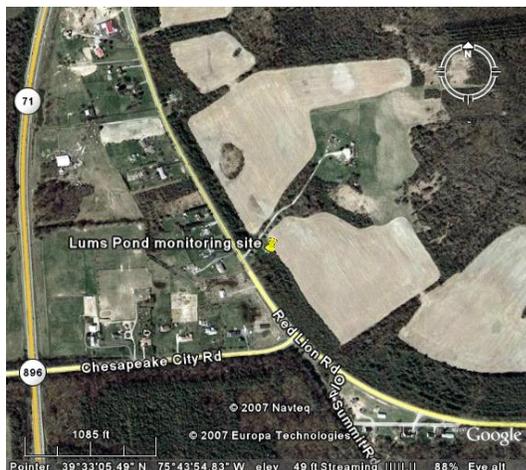
**Site Description:** The Delaware City site was established at a location along Route 9 that is between the Delaware City industrial complex and the nearest populated area (Delaware City) in the predominant downwind direction. This site meets all EPA siting criteria.

**Monitoring Objectives:** This monitoring site is a stationary source-impacted site for SO<sub>2</sub>. The monitoring objectives are compliance with the NAAQS, population exposure, and trends.

**Planned Changes through 2009:** No changes planned.

**Site: Lums Pond**

County:	New Castle	Latitude:	39.5511
Address:	Lums Pond State Park	Longitude:	-75.7308
AQS site ID:	10-003-1007	Year Established:	1999
Spatial Scale:	Neighborhood	Area Represented:	Wilmington area



**Monitored Parameters**

Ozone	SO <sub>2</sub>	CO	NO <sub>2</sub>	PM <sub>2.5</sub>	PM <sub>2.5</sub> speciation	PM <sub>2.5</sub> continuous	PM <sub>10</sub>	Wind Speed	Wind Direction
X				X					

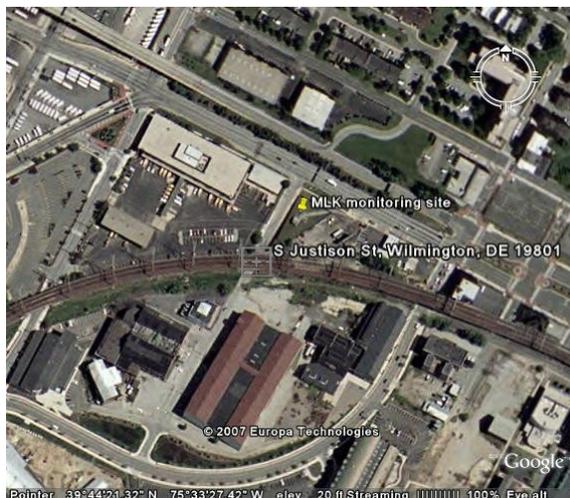
**Site Description:** The Lums Pond site is a neighborhood scale site located in a general upwind direction from Wilmington. The immediate area is rural. The site meets all EPA siting criteria.

**Monitoring Objectives:** The site objectives for O<sub>3</sub> are NAAQS compliance, regional transport, population exposure, and trends. This site was originally planned to monitor O<sub>3</sub> transported into Delaware from the Baltimore/Washington area, and continues to serve this purpose. The SO<sub>2</sub> monitor was added 2000 to detect impacts from major point sources directly to the east. PM<sub>2.5</sub> monitoring began in 1999 as both a transport and general population exposure site, as well as for NAAQS compliance. All parameters are neighborhood scale.

**Planned Changes through 2009:** SO<sub>2</sub> monitoring has been suspended for 2009 due to lack of resources to repair/replace the monitor.

**Site: MLK**

County:	New Castle	Latitude:	39.7394
Address:	Justison St. and MLK Blvd	Longitude:	-75.5581
AQS site ID:	10-003-2004	Year Established:	1999
Spatial Scale:	Neighborhood	Area Represented:	Wilmington



**Monitored Parameters**

Ozone	SO <sub>2</sub>	CO	NO <sub>2</sub>	PM <sub>2.5</sub>	PM <sub>2.5</sub> speciation	PM <sub>2.5</sub> continuous	PM <sub>10</sub>	Wind Speed	Wind Direction
	X	X	X	X	X	X	X	X	X

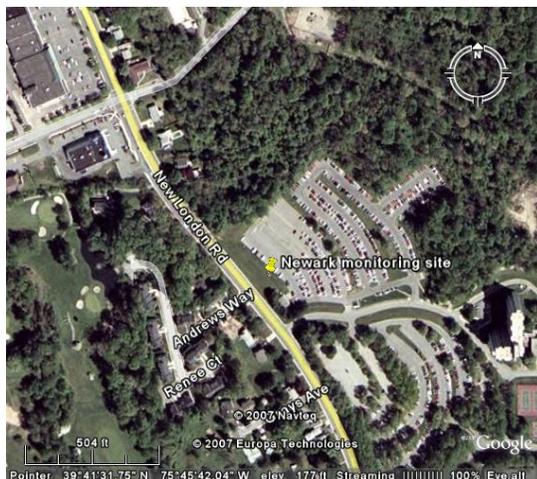
**Site Description:** The MLK site is located in Wilmington at the intersection of Justison St. and MLK Blvd. It replaced another urban site at 12<sup>th</sup> and King Streets that had operated at that location for over 20 years. The MLK site represents urban population exposure to multiple pollution sources. The site meets all EPA siting criteria.

**Monitoring Objectives:** Monitoring objectives are compliance with the NAAQS, maximum population exposure, and trends.

**Planned Changes through 2009:** No changes planned.

**Site: Newark**

County:	New Castle	Latitude:	39.6919
Address:	University of Delaware North Campus	Longitude:	-75.7617
AQS site ID:	10-003-1012	Year Established:	1999
Spatial Scale:	Neighborhood	Area Represented:	Newark



**Monitored Parameters**

Ozone	SO <sub>2</sub>	CO	NO <sub>2</sub>	PM <sub>2.5</sub>	PM <sub>2.5</sub> speciation	PM <sub>2.5</sub> continuous	PM <sub>10</sub>	Wind Speed	Wind Direction
				X					

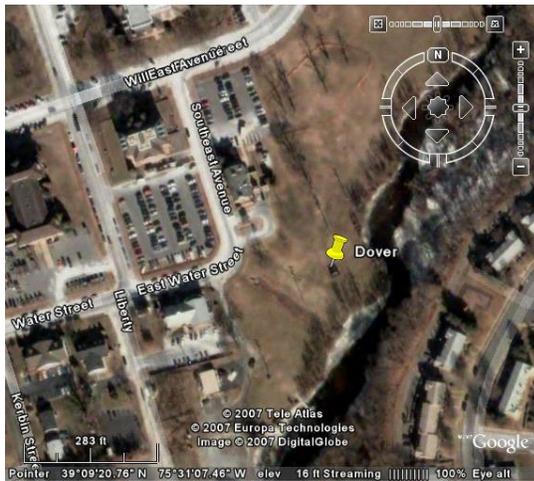
**Site Description:** The Newark site is a platform only. It is a PM<sub>2.5</sub> neighborhood scale site. The location is suburban and generally impacted by mobile sources and regional transport. The site meets all EPA siting criteria.

**Monitoring Objectives:** The objectives are NAAQS compliance, regional transport, population exposure, and trends.

**Planned Changes through 2009:** No changes planned.

**Site: Dover**

County:	Kent	Latitude:	39.155
Address:	Water St.	Longitude:	-75.5181
AQS site ID:	10-001-0003	Year Established:	1999
Spatial Scale:	Neighborhood	Area Represented:	Dover



**Monitored Parameters**

Ozone	SO <sub>2</sub>	CO	NO <sub>2</sub>	PM <sub>2.5</sub>	PM <sub>2.5</sub> speciation	PM <sub>2.5</sub> continuous	PM <sub>10</sub>	Wind Speed	Wind Direction
				X	X				

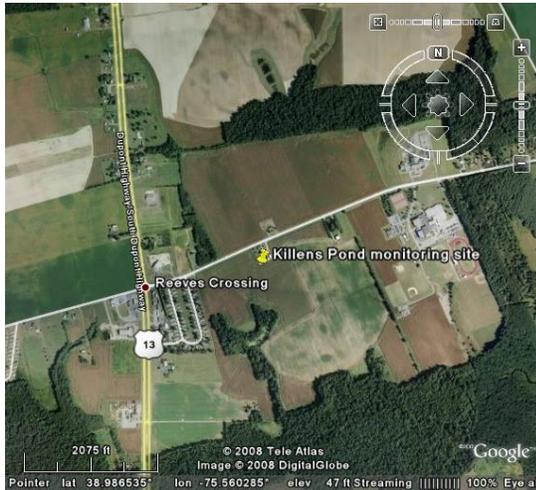
**Site Description:** The Dover site is a platform only. It is a neighborhood scale site representative of the Dover area, and is impacted by a combination of source types including mobile, large and small point sources. The site meets all EPA siting criteria.

**Monitoring Objectives:** The monitoring objectives are NAAQS compliance, population exposure, and trends.

**Planned Changes through 2009:** No changes planned.

**Site: Killens Pond**

County:	Kent	Latitude:	38.9847
Address:	Killens Pond Rd.	Longitude:	-75.5555
AQS site ID:	10-001-0002	Year Established:	1995
Spatial Scale:	Neighborhood	Area Represented:	Not in an urban area



**Monitored Parameters**

Ozone	SO <sub>2</sub>	CO	NO <sub>2</sub>	PM <sub>2.5</sub>	PM <sub>2.5</sub> speciation	PM <sub>2.5</sub> continuous	PM <sub>10</sub>	Wind Speed	Wind Direction
X				X				X	X

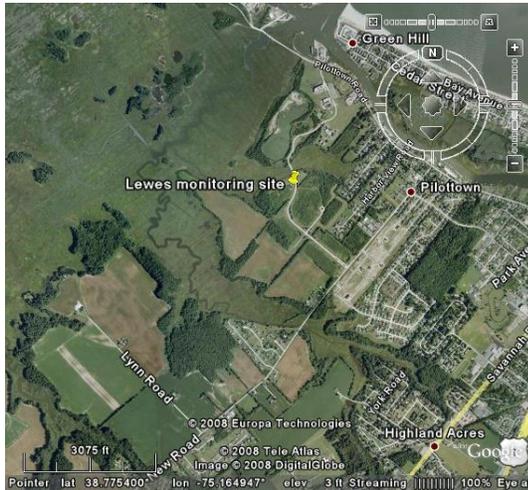
**Site Description:** The Killens Pond site is located in a rural area that is part of Killens Pond State Park. The site meets all EPA siting criteria.

**Monitoring Objectives:** The objectives for this site are background concentrations, NAAQS compliance, and trends.

**Planned Changes through 2009:** No changes planned.

**Site: Lewes**

County:	Sussex	Latitude:	38.7792
Address:	University of Delaware College of Marine Studies	Longitude:	-75.1631
AQS site ID:	10-005-1003	Year Established:	1997
Spatial Scale:	Neighborhood	Area Represented:	Lewes



**Monitored Parameters**

Ozone	SO <sub>2</sub>	CO	NO <sub>2</sub>	PM <sub>2.5</sub>	PM <sub>2.5</sub> speciation	PM <sub>2.5</sub> continuous	PM <sub>10</sub>	Wind Speed	Wind Direction
X								X	X

**Site Description:** The Lewes site is neighborhood scale. It is near the University of Delaware College of Marine Studies campus in Lewes, and is representative of the coastal Sussex County area. The site meets all EPA siting criteria.

**Monitoring Objectives:** The objectives include NAAQS compliance, population exposure, and trends.

**Planned Changes through 2009:** No changes planned.

**Site: Seaford**

County:	Sussex	Latitude:	38.6444
Address:	350 Virginia Ave.	Longitude:	-75.6131
AQS site ID:	10-005-1002	Year Established:	1990
Spatial Scale:	Neighborhood	Area Represented:	Seaford



**Monitored Parameters**

Ozone									
SO <sub>2</sub>									
CO									
NO <sub>2</sub>									
PM <sub>2.5</sub>	X								
PM <sub>2.5</sub> speciation									
PM <sub>2.5</sub> continuous									
PM <sub>10</sub>									
Wind Speed							X		
Wind Direction								X	

**Site Description:** The Seaford site was originally located further south, near the Seaford water tower. It was relocated to the present location in 1990 due to deteriorating conditions at the original site. The current site is neighborhood scale and is suburban. The site is impacted by local point sources, mobile sources, and regional transport. The site meets all EPA siting criteria.

**Monitoring Objectives:** The site objectives are NAAQS compliance, population exposure, and trends.

**Planned Changes through 2009:** No changes planned.

### Monitoring method information

Monitoring methods and associated AQS codes used in the Delaware ambient air monitoring network:

Parameter	AQS Method Code	Method Description
O <sub>3</sub>	047, 091	UV Absorption
SO <sub>2</sub>	092	UV Fluorescence
CO	054	Non-dispersive Infrared
NO <sub>2</sub>	074	Chemiluminescence
PM <sub>2.5</sub>	155	Gravimetric
PM <sub>10</sub>	079	TEOM Gravimetric
WS/WD	050	Ultrasonic

#### Ozone (O<sub>3</sub>)

Ozone is measured by ultraviolet absorption photometry. Air is drawn through a sample cell where ultraviolet light (254 nm wavelength) passes through it. Light not absorbed by the ozone is converted into an electrical signal proportional to the ozone concentration.

#### Sulfur Dioxide (SO<sub>2</sub>)

Sulfur dioxide is measured with a fluorescence analyzer. Air is drawn through a sample cell where it is subjected to high intensity ultraviolet light. This causes the sulfur dioxide molecules in the air to fluoresce and release light. The fluorescence is detected with a photo multiplier tube and converted to an electrical signal proportional to the SO<sub>2</sub> concentration.

#### Carbon Monoxide (CO)

Carbon monoxide is measured by infrared absorption photometry. Air is drawn continuously through a sample cell where infrared light passes through it. Carbon monoxide molecules in the air absorb part of the infrared light, reducing the intensity of the light reaching a light sensor. The light is converted into an electrical signal related to the concentration of carbon monoxide in the sample cell.

#### Nitrogen Dioxide (NO<sub>2</sub>)

Nitrogen oxides are measured using the chemiluminescence reaction of NO with O<sub>3</sub>. Air is drawn into a reaction chamber where it is mixed with a high concentration of ozone from an internal ozone generator. Any NO in the air reacts with the ozone to produce NO<sub>2</sub>. Light emitted from this reaction is detected with a photo multiplier tube and converted to an electrical signal proportional to the NO concentration. NO<sub>2</sub> must be measured indirectly. NO<sub>x</sub> are measured by passing the air through a converter where any NO<sub>2</sub> in the air is reduced to NO before the air is passed to the reaction chamber. By alternately passing the air directly to the

reaction chamber, and through the converter before the reaction chamber, the analyzer alternately measures NO and NO<sub>x</sub>. The NO<sub>2</sub> concentration is equal to the difference between NO and NO<sub>x</sub>.

**Particulate Matter - Fine (PM<sub>2.5</sub>)**

PM<sub>2.5</sub> is sampled by drawing air through a specially designed inlet that excludes particles larger than 2.5 microns in diameter. The particles are collected on a Teflon<sup>7</sup> microfiber filter that is weighed to determine the particulate mass. The normal sampling schedule is 24 hours every third day, however, at one site (Wilmington-MLK) samples are collected for 24 hours every day.

**Particulate Matter (PM<sub>10</sub>)**

PM<sub>10</sub> is sampled continuously using a tapered element oscillating microbalance (TEOM). Air is drawn through a specially designed inlet that excludes particles larger than 10 microns in diameter. Particle accumulation causes changes in the microbalance oscillation which are recorded by the instrument.

# Appendix A

# **Ambient Air Monitoring Proposal For National Core (NCore) Monitoring Station**



## **State of Delaware**

**Air Quality Management Section  
Division of Air and Waste Management  
Department of Natural Resources and Environmental  
Control**

715 Grantham Lane  
New Castle, DE 19720  
(302) 323-4542

And

156 South State Street  
Dover, DE 19901  
(302) 739-9402

April 30, 2009

## **National Core (NCore) Multi-pollutant Monitoring Stations:**

In October 2006 the United States Environmental Protection Agency (EPA) issued final amendments to the ambient air monitoring regulations for criteria pollutants. These amendments are codified in 40 CFR parts 53 and 58. The purpose of the amendments was to enhance ambient air quality monitoring to better serve current and future air quality needs. One of the most significant changes in the regulations was the requirement to establish National Core (NCore) multi-pollutant monitoring stations. These stations will provide data on several pollutants at lower detection limits and replace the National Air Monitoring Station (NAMS) networks that have existed for several years. The final network plan must be submitted to EPA by July 1, 2009 and the stations must be operational by January 1, 2011.

The NCore Network addresses the following monitoring objectives:

- timely reporting of data to the public through AIRNow, air quality forecasting, and other public reporting mechanisms
- support development of emission strategies through air quality model evaluation and other observational methods
- accountability of emission strategy progress through tracking long-term trends of criteria and non-criteria pollutants and their precursors
- support long-term health assessments that contribute to ongoing reviews of the National Ambient Air Quality Standards (NAAQS)
- compliance through establishing nonattainment/attainment areas by comparison with the NAAQS
- support multiple disciplines of scientific research, including; public health, atmospheric and ecological

The NCore sites must measure, at a minimum, PM<sub>2.5</sub> particle mass using continuous and integrated/filter-based samplers, speciated PM<sub>2.5</sub>, PM<sub>10-2.5</sub> particle mass, speciated PM<sub>10-2.5</sub>, O<sub>3</sub>, SO<sub>2</sub>, CO, NO/NO<sub>y</sub>, wind speed, wind direction, relative humidity, and ambient temperature.

Each State is required to operate at least one NCore site. The objective is to locate sites in broadly representative urban (about 50 sites) and rural or regional (about 20 sites) locations throughout the country to help characterize urban- and regional-scale patterns of air pollution. Monitoring agencies are encouraged by EPA to collocate NCore sites with existing sites already measuring ozone precursors, air toxics, or PM<sub>2.5</sub> speciation components. By combining these monitoring programs at a single location, stakeholders can maximize the multi-pollutant information available. This approach not only leverages existing resources but notably enhances the foundation for future health studies and NAAQS revisions.

**Recommendation:** After evaluating the existing network, historical data, census data, meteorology, and topography, Delaware is proposing the existing MLK monitoring site as Delaware's NCore site. Locating the NCore site at the MLK site allows Delaware to leverage the existing infrastructure and monitoring network (including PM<sub>2.5</sub> speciation and air toxics), provides logistical practicality, allows for historic continuity, and provides the most relevant information to assess local source control strategy effectiveness. This site also offers potential information for long-term health impact assessments for the largest population concentration in the state.

**Monitoring Objectives:**

Determine compliance with NAAQS; observe pollution trends for national data analysis, provide pollution levels for daily index reporting; and provide data for scientific studies.

**Table 1 Monitors:**

Monitor Type	Designation	Analysis Method	Frequency of Sampling
Carbon Monoxide (CO)	NCore	Federal Reference Method utilizing trace level non-dispersive infrared analysis.	Continuously
*Nitrogen Oxide (NO <sub>x</sub> )	NCore	*Federal Reference Method utilizing high sensitivity chemiluminescence analysis.	Continuously
*Ozone (O <sub>3</sub> )	NCore	*Federal Equivalent Method utilizing UV photometry analysis.	Continuously
*Sulfur Dioxide (SO <sub>2</sub> )	NCore	*Federal Equivalent Method utilizing trace level UV fluorescence analysis	Continuously
PM <sub>2.5</sub>	NCore/ SLAMS	Federal Reference Method utilizing gravimetric analysis.	Daily
PM <sub>2.5</sub> SHARP	NCore		Continuously
* PM <sub>coarse</sub>	NCore	* Federal Reference Method PM <sub>10</sub> utilizing differential gravimetric analysis.	1/6 days
PM <sub>2.5</sub> Speciation	NCore	Multi-species manual collection method utilizing thermal optical, ion chromatography, gravimetric, and X-ray fluorescence analyses.	1/6 days
*Meteorological	NCore	Air quality measurements approved instrumentation for wind speed, wind direction, *humidity, *barometric pressure *temperature, rainfall, and *solar radiation	Continuously

\* Pending

**Quality Assurance Status:**

All Quality Assurance procedures shall be implemented in accordance with 40 CFR 58, Appendix A. Current Quality Assurance Project Plans(QAPPs) and Standard Operating Procedures (SOPs) cover PM<sub>2.5</sub>, Ozone, and PM<sub>2.5</sub> Speciation. For the remaining monitors, QAPPs and associated SOPs will be developed and submitted prior to submittal of any validated data to the national AQS data system. Data generated prior to official QAPP and SOP submittals will be for internal use only.

**Area of Representativeness:**

40 CFR Part 58 Appendix D provides design criteria for ambient air monitoring. The monitoring objective for the NCore site is to produce data that represents a fairly large area and therefore the spatial scale of the site is important. The spatial scale defines the physical dimensions of the air parcel nearest to a monitoring site throughout which actual pollutant concentrations are reasonably similar. It is determined by the characteristics of the area surrounding the air monitoring site and the site's distance from nearby air pollution sources such as roadways, factories, etc. In the case of urban NCore the spatial scales to be used are neighborhood and urban. Table 2 shows the area of representativeness for each pollutant for the MLK site.

**Table 2: Spatial Scales for Each Pollutant**

<b>Pollutant</b>	<b>Spatial Scale</b>
Ozone	Neighborhood Scale
NO <sub>x</sub>	Neighborhood Scale
Carbon Monoxide	Neighborhood Scale
SO <sub>2</sub>	Neighborhood Scale
PM <sub>10</sub> /PM <sub>2.5</sub>	Neighborhood Scale

**Monitoring Site Description:**

The existing MLK monitoring site is located at the southeast corner of the intersection of MLK Blvd and Justison Street (see figures 1 and 2). Monitoring objectives are compliance with the NAAQS, maximum population exposure, and trends.

This site is representative of the urban Wilmington area, which is the largest population concentration in Delaware. A mix of point, small area, and mobile sources, characteristic of the Wilmington area as a whole, impact this site, as well as regional transport. Locally, there are several major roadways nearby, along with residential and central business areas. There are no large unique point sources within 4 km of the site; however several larger point sources are located over 4 km from the site. These larger point sources also impact the greater Wilmington and nearby New Castle County areas, so the MLK site is still considered representative on a neighborhood scale.

The MLK site currently contains a significant number of continuous and manual monitors (including PM<sub>2.5</sub> mass and speciation, NO/NO<sub>2</sub>/NO<sub>x</sub>, CO, SO<sub>2</sub>, black carbon, VOCs, carbonyls, and metals) so the infrastructure is already in place to support multiple long-term monitoring efforts. The site also includes a research monitoring trailer operated by the University of Delaware for various special studies, emphasizing aerosol and ultra-fine particle research.

Figure 1. Aerial view

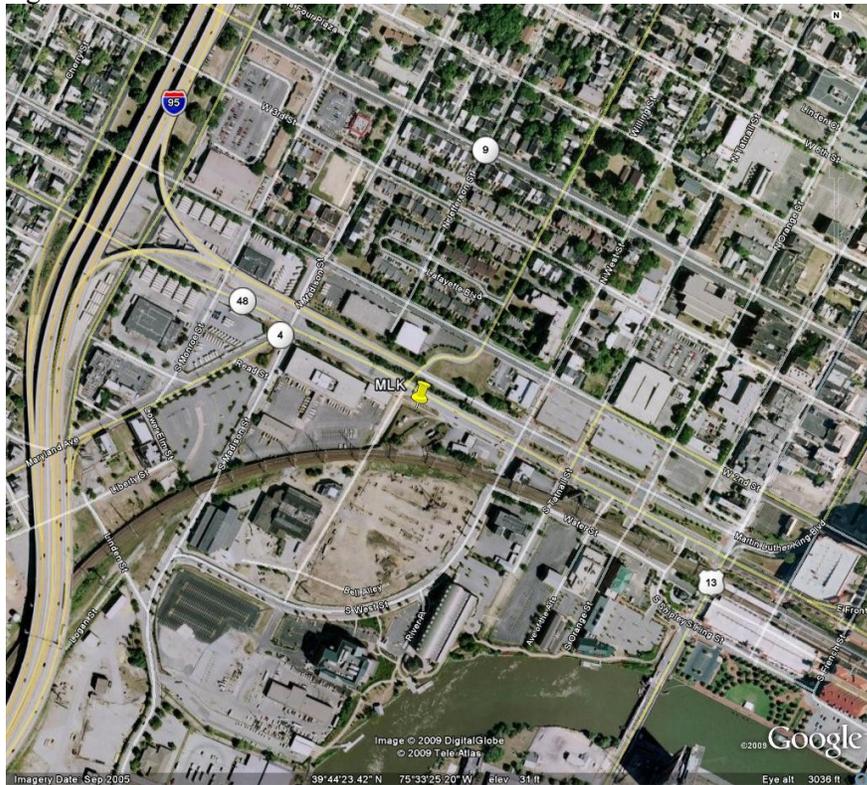
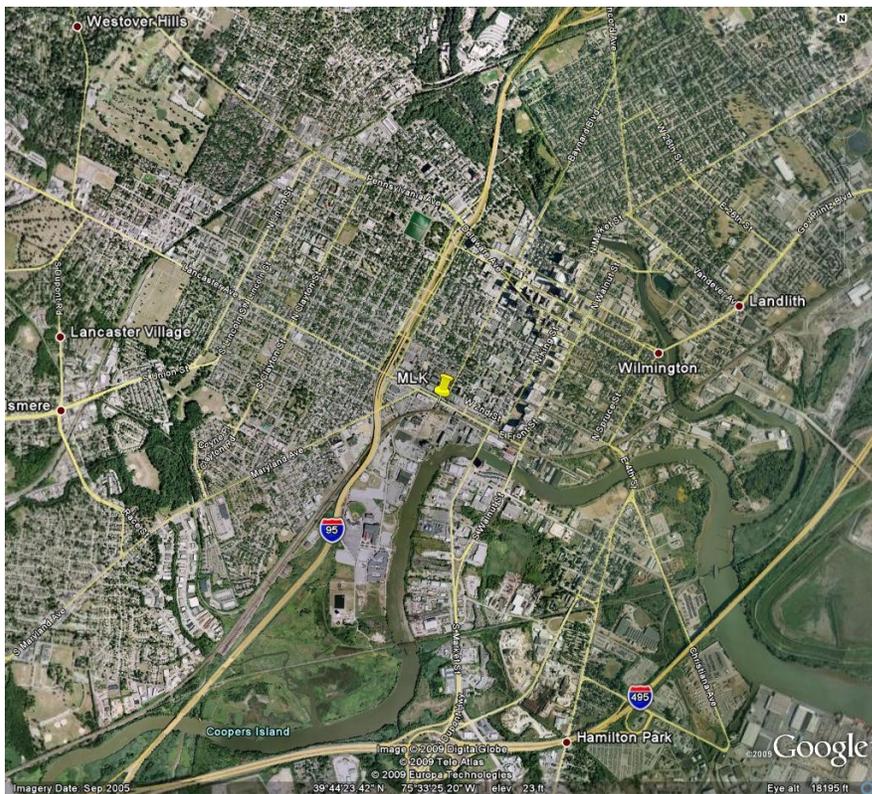
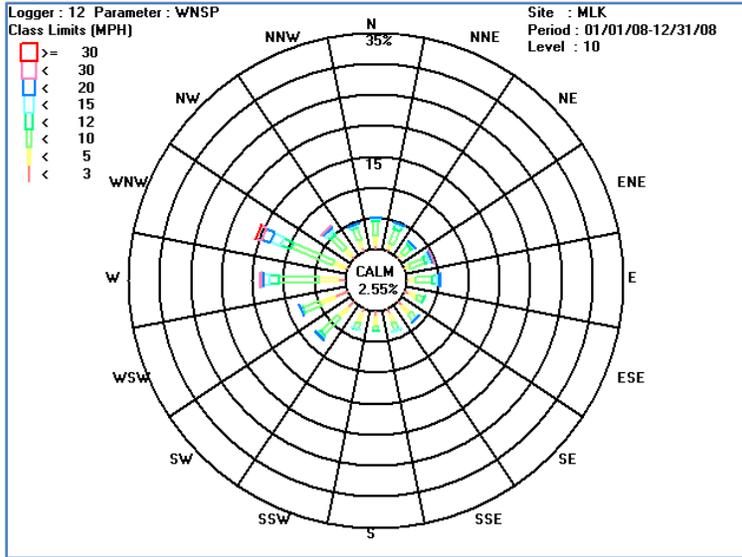


Figure 2. Aerial view larger urban area.



The 2008 wind rose indicates the prevailing wind directions.

Figure 3. 2008 wind rose.



**Site Description and Spacing:**

<b>County:</b>	New Castle	<b>Latitude:</b>	39.7394
<b>Address:</b>	Justison St. and MLK Blvd	<b>Longitude:</b>	-75.5581
<b>AQS site ID:</b>	10-003-2004	<b>Year Established:</b>	1999
<b>Spatial Scale:</b>	Neighborhood		
<b>Area Represented:</b>	Wilmington Metro Division (Code 48864 ) of the Philadelphia CBSA (Code 37980)		



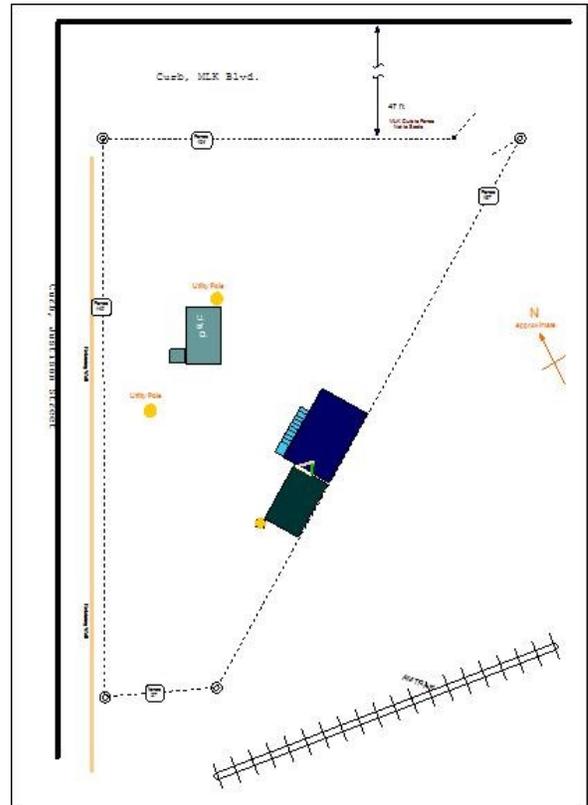
**Inspection Date:**  
**Inspection By:**  
**Site Approval Status:** Pending

CBSA Code	Metro Division Code	Geographic area
		<b>Metropolitan statistical areas</b> (Titles of metropolitan divisions are indented.)
37980		Philadelphia-Camden-Wilmington, PA-NJ-DE-MD
37980	15804	Camden, NJ
37980	37964	Philadelphia, PA
37980	48864	Wilmington, DE-MD-NJ

Figure 3. MLK Site close aerial view.



Figure 4. MLK Site diagram



Note: Due to construction on Justison Street, in 2008 the DNREC trailer and sampling platform were relocated to the east along the property line, to comply with Appendix E siting guidelines (distance to nearest traffic lane). The site diagram shows the new shelter location.

## NCore and PM<sub>2.5</sub> SLAMS Siting Criteria

Appendix E to 40 CFR Part 58-*Probe and Monitoring Path Siting Criteria for Ambient Air Quality Monitoring* contains specific location criteria applicable to NCore and SLAMS siting. The following measurements and data were obtained for evaluation of compliance with the criteria.

### 1. **Horizontal Placement of Sampling Probes:**

The gaseous instruments are located in a 10'w x 14' l x 8'h air monitoring shelter with the sample probe inlets being approximately 4 meters above the ground. A 10 meter "nested" meteorological tower will be placed next to the air monitoring shelter to allow for extension of the sampling inlet for the NO<sub>y</sub> monitor to reach up to 10 meters.

The manual particulate samplers are located on a wooden deck adjoining the sampling shelter. The height of the inlets of the particulate samplers is approximately 3-4 meters. The inlets for the continuous particulate samplers are on the roof of the air monitoring shelter with the sample inlets being 2 meters above the roof (4 meters above ground). The control units are located inside the temperature controlled shelter.

### 2. **Spacing from Roadways:**

Tables E-1, E-2, and Figure E-1 of 40 CFR Part 58 Appendix E list the minimum distances from roadways a monitoring probe needs to be based on the average daily traffic (ADT) counts. Table 3 summarizes the findings and includes the minimum separation distance from roadways for each pollutant. ADT counts were obtained from a traffic count map generated from the Delaware Department of Transportation's website.

**Table 3**  
Spacing from Roadways Analysis

Roadway	ADT (year)	Distance from site (meters)	Minimum Distance Required (meters)			
			Ozone Table E-1	NO/NO <sub>y</sub> Table E-1	CO Table E-2	PM Figure E-1
MLK Blvd	6784 (2001)	34	20	20	10	20
Justison St.	No count	15.5				
I-95	80,039 (2005)	420	100	100	150	160

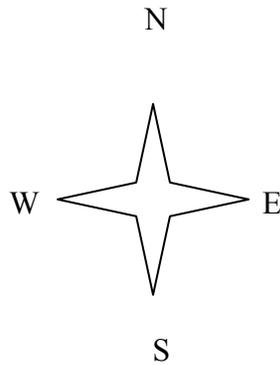
### 3. **Spacing from Minor Sources:**

The closest source to the site is the DART bus depot to the northwest. There is also a gas station to the east, and AMTRAK/freight rail lines to the south.

DART bus depot – 213 meters

Gas station – 71 meters

AMTRAK line – 31 meters (passenger trains are electric, some diesel freight)



Direction	Description	Approx. Dist. To nearest point
North	(foreground: Univ. of Delaware trailer) Intersection MLK and Justison St.	~ 40 m
North East	MLK Blvd entrance to monitoring site	~ 40 m
East	MLK Blvd, Amtrak lot (vacant), gas station	30 – 70 m
South East	Back of Amtrak lot, Amtrak rail line	20 – 40 m
South	Amtrak rail line, parking garage	30 – 70 m
South west	Amtrak rail line, residential/office building under construction	50 – 100 m
West	Justison St., Delmarva Power office building/parking lot	30 – 40 m
North West	Justison St., Delmarva Power office building/parking lot	30 – 40 m



**Site Details:**

The pictures above show the monitoring station and the sampling platform which is 10'w x 14'1 and 8'h. The sample inlets are just over 2 meters above the ground. The platform supports the PM<sub>2.5</sub> FRM, the PM<sub>10</sub>, PM<sub>2.5</sub> Speciation, URG Carbon, and the RadNet sampler. It also has room for future hi-volume lead sampling if needed and room for the PEP audit equipment. Electrical service to the platform is 100 amps with 5 (20 amp GFCI) outlets strategically placed on the platform to provide power to the instruments.

# Appendix B

# **NO<sub>y</sub> waiver request**

**State of Delaware  
Air Quality Management Section  
Division of Air and Waste Management  
Department of Natural Resources and Environmental Control**

April 30, 2009

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## **Summary**

Considering the characteristics of the urban MLK site, the existing monitoring data, the importance of local mobile source emissions, and the presence of fresh NO/NO<sub>x</sub> emissions, Delaware expects there to be negligible difference between NO<sub>y</sub> and NO<sub>x</sub> concentrations. Delaware therefore requests a waiver to substitute high sensitivity NO<sub>x</sub> for NO<sub>y</sub> monitoring at the proposed NCore site in Wilmington.

## **Background**

The NCore sites must measure, at a minimum, PM<sub>2.5</sub> particle mass using continuous and integrated/filter-based samplers, speciated PM<sub>2.5</sub>, PM<sub>10-2.5</sub> particle mass, speciated PM<sub>10-2.5</sub>, O<sub>3</sub>, SO<sub>2</sub>, CO, NO/NO<sub>y</sub>, wind speed, wind direction, relative humidity, and ambient temperature. The objective is to locate sites in broadly representative urban (about 50 sites) and rural or regional (about 20 sites) locations throughout the country to help characterize urban- and regional-scale patterns of air pollution.

## **Delaware's proposed NCore site**

In accordance with EPA regulations and guidance, and after evaluating the existing network, historical data, census data, meteorology, and topography, Delaware is proposing the existing MLK monitoring site as Delaware's NCore site. Locating the NCore site at the MLK site allows Delaware to leverage the existing infrastructure and monitoring network (including PM<sub>2.5</sub> speciation and air toxics), provides logistical practicality, allows for historic continuity, and provides the most relevant information to assess local source control strategy effectiveness. This site also offers potential information for long-term health impact assessments for the largest population concentration in the state.

The MLK site is representative of the urban Wilmington area, which is the largest population concentration in Delaware. A mix of point, small area, and mobile sources, characteristic of the Wilmington area as a whole, impact this site, as well as regional transport. Locally, there are several major roadways nearby, along with residential and central business areas.

## **Issues relating to NO<sub>y</sub> versus NO<sub>x</sub> monitoring**

According to 40 CFR Part 58, Appendix D Section 3.a.(1): "Although the measurement of NO<sub>y</sub> is required in support of a number of monitoring objectives, available commercial instruments may indicate little difference in their measurement of NO<sub>y</sub> compared to the conventional measurement

of NOX, particularly in areas with relatively fresh sources of nitrogen emissions. Therefore, in areas with negligible expected difference between NOy and NOX measured concentrations, the Administrator may allow for waivers that permit NOX monitoring to be substituted for the required NOy monitoring at applicable NCore sites.”

**NOx Emissions**

The MLK monitoring site is representative of the general Wilmington urban area, and as such is strongly influenced by mobile source emissions, as well as a mix of local area sources and distant point sources. The presence of major roadways nearby such as I-95, as well as more distant large point sources of NOX, indicates that there are significant fresh NO/NOx emissions in the area.

Figure \_\_\_ and Table \_\_\_ represent emissions information from the 2002 statewide ozone emissions inventory. The importance of mobile NOx emissions is clear inventory table.

Figure 1. NOx Point Source Emissions

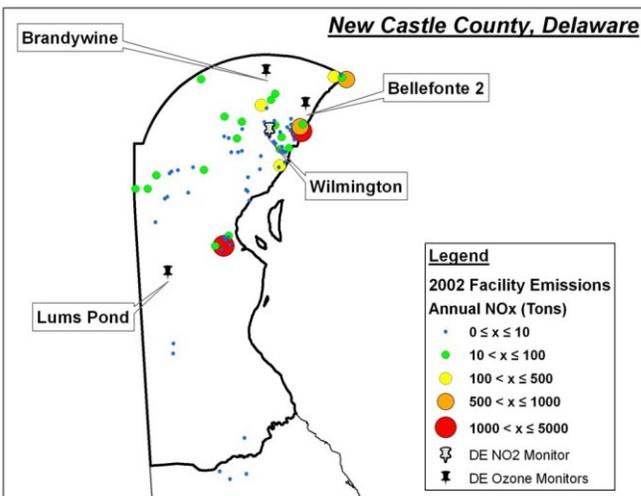


Table 1. 2002 Ozone Season Emissions

2002 Statewide Peak Ozone Season Daily Emissions		
Source Category	Pollutant Emissions (TPD)	
	VOC	NO <sub>x</sub>
Point	23.3	74.1
Non-point	33.0	3.2
Mobile on-road	32.4	69.0
Mobile off-road	26.8	52.8
Natural	173.9	3.9

**Ambient data**

The impact of fresh NOx emissions is also supported by the existing NO/NO2/NOx data from the MLK site (as shown in Table 2). In 2008 there were 35 days with a daily 1-hour NO maximum greater than 0.10 ppm, and 5 days with a daily 1-hour maximum greater than 0.20 ppm.

Table 2. MLK NO/NO<sub>x</sub> Monitoring Data 2006 - 2008

NO/NO <sub>x</sub> 1-hour data in ppm						
Pollutant	Year	1 <sup>st</sup> max	2 <sup>nd</sup> max	3 <sup>rd</sup> max	4 <sup>th</sup> max	Ann Mean
NO	2006	0.466	0.397	0.396	0.370	0.018
	2007	0.353	0.343	0.327	0.314	0.020
	2008	0.446	0.337	0.253	0.247	0.012
NO <sub>x</sub>	2006	0.490	0.449	0.439	0.325	0.033
	2007	0.392	0.372	0.363	0.349	0.035
	2008	0.472	0.363	0.287	0.285	0.026

### Conclusion

Considering the characteristics of the urban MLK site, the existing monitoring data, and the presence of fresh NO/NO<sub>x</sub> emissions, Delaware expects there to be negligible difference between NO<sub>y</sub> and NO<sub>x</sub> concentrations. Delaware therefore requests a waiver to substitute high sensitivity NO<sub>x</sub> for NO<sub>y</sub> monitoring at the proposed NCore site in Wilmington. A high sensitivity NO<sub>x</sub> monitor could be converted to NO<sub>y</sub> monitoring at a future time if monitoring technology improvements or if significant emissions changes take place.