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November 21, 2013

Mr. Shawn Garvin (3RA00),
Regional Administrator, Region III
U. S. Environmental Protection Agency
1650 Arch Street
Philadelphia, PA, 19103-2029

Dear Mr. Garvin:

On December 14, 2012 the U.S. Environmental Protection Agency (EPA) strengthened the National Ambient Air Quality Standards (NAAQS) for fine particulate matter ($PM_{2.5}$) by lowering the annual primary standard from 15 micrograms per cubic meter ($\mu g/m^3$) to12 $\mu g/m^3$. Section 107(d) of the Clean Air Act (CAA) requires the Governor of each State to submit to the EPA a list of all areas (or portions thereof) in the State, designating each as nonattainment, attainment, or unclassifiable. This letter fulfills Delaware's obligations under Section 107(d) of the CAA.

Area Description and Monitoring Data

Delaware is composed of three counties, namely New Castle, Kent and Sussex, laying from north to south. The northern portion of New Castle County lies above the Chesapeake and Delaware Canal, a waterway that connects the Chesapeake Bay with the Delaware Bay. This part of New Castle County is more metropolitan and industrialized than the remainder of Delaware. The remainder of Delaware lies south of the Chesapeake and Delaware Canal, and comprises the southern portion of New Castle County, and all of Kent and Sussex Counties.

Delaware currently monitors $PM_{2.5}$ at seven locations throughout the State. The design values based upon 2010 through 2012 complete and certified monitoring data are 10.4 $\mu g/m^3$, 9.0$\mu g/m^3$ and 8.9 $\mu g/m^3$ for New Castle, Kent and Sussex County, respectively. This monitoring data indicates that $PM_{2.5}$ concentrations in Delaware's air are well below the 12 $\mu g/m^3$ NAAQS throughout the State.

Attainment/Nonattainment Recommendation

Section 107(d) of the CAA requires the EPA to designate an area "nonattainment" if it is violating the NAAQS, or if it is contributing to a nearby area where a violation of the NAAQS occurs.

Delaware has controlled every non-trivial source of $PM_{2.5}$ and its precursors, and all Delaware emission sources are now well controlled. This is demonstrated by our emissions inventory – between 2002 and 2012 Delaware implemented control strategies that reduced its overall emissions of direct $PM_{2.5}$ by 46%, and precursor's sulfur dioxide by 95%, nitrogen oxides by 47%, volatile organic compounds by 42% and ammonia by 52%. Monitoring data confirms the effectiveness of these control strategies – in 2002 the $PM_{2.5}$ design value in New Castle County was 16.2 $\mu g/m^3$, and the emission reductions between 2002 and 2012 have reduced the design value to 10.4 $\mu g/m^3$.

Because $PM_{2.5}$ concentrations throughout Delaware are well below the 2012 $PM_{2.5}$ NAAQS, and because every non-trivial source of $PM_{2.5}$ and its precursors are well controlled, emissions from Delaware do not contribute to the nonattainment of the $PM_{2.5}$ NAAQS in any area. Given this, each of Delaware's three counties should be designated as attainment for the annual $PM_{2.5}$ NAAQS. Additional documentation and analysis to support a designation of attainment is provided in the enclosed technical support document which address each of the five factors that the EPA has suggested in guidance (i.e., air quality data, emissions and emissions-related data, meteorology, geography/topography, and jurisdictional boundaries).

Thank you for your consideration of these recommendations. If you have any questions concerning this submittal or would like to discuss it further, please contact Mr. Ali Mirzakhalili, Director of the Division of Air Quality at (302) 739-9402.

Sincerely,

Jack Markell

Jack A. Markell
Governor

Enclosure

cc: Collin P. O'Mara, DNREC
Dave Small, DNREC
Ali Mirzakhalili, DNREC
Diana Esher, EPA, Region III

State of Delaware
Department of Natural Resources and Environmental Control

Division of Air Quality

Technical Support Document to Support a Designation of Attainment of the 2012 Fine Particle ($PM_{2.5}$) NAAQS

November 21, 2013

Table of Contents

List of Figures

List of Tables

1 INTRODUCTION

On December 14, 2012 the U.S. Environmental Protection Agency (EPA) strengthened the National Ambient Air Quality Standards (NAAQS) for fine particulate matter ($PM_{2.5}$) by lowering the annual primary standard from 15 micrograms per cubic meter ($\mu g/m^3$) to 12 $\mu g/m^3$. Section 107(d) of the Clean Air Act (CAA) requires *"… not later than 1 year after promulgation of a new or revised national ambient air quality standard … the Governor of each State shall … submit to the Administrator a list of all areas (or portions thereof) in the State, designating as— (i) nonattainment, any area that does not meet (or that contributes to ambient air quality in a nearby area that does not meet) the national primary or secondary ambient air quality standard for the pollutant…"*

The CAA uses the nonattainment designation to establish the area where CAA control requirements are applied. Both areas that do not meet a NAAQS, and areas that contribute to air quality in a nearby area that does not meet a NAAQS are required to apply the CAA control requirements. The CAA clearly and completely sets a path that leads to attainment -- requiring controls, in both the area with bad air quality and the nearby areas that are causing the bad air quality, will lead to clean air; while controlling only one area but not the other may not.

Regarding air quality in Delaware, Delaware currently monitors $PM_{2.5}$ at seven locations throughout the State. The design values based upon 2010 through 2012 complete and certified monitoring data are 10.4 $\mu g/m^3$, 9.0 $\mu g/m^3$ and 8.9 $\mu g/m^3$ for New Castle, Kent and Sussex County, respectively. This monitoring data indicates that $PM_{2.5}$ concentrations in Delaware's air are well below the 12 $\mu g/m^3$ NAAQS throughout the State.

Regarding Delaware's contribution to air quality in any nearby area, the word "contributes" in context of CAA 107 does not necessarily mean "any contribution," but rather a degree of contribution sufficient to deem an area nonattainment. Given that the purpose of a nonattainment designation is to establish the area where the CAA control requirements are to be applied, it is reasonable to conclude that an area contributes if the application of CAA control requirements in that area would result in emission reductions that will help the nearby area meet a NAAQS. Conversely, if the application of CAA control requirements will not result in emission reductions in the area, then that area does not contribute to the air quality and would not be designated nonattainment.

This document presents Delaware data and analysis relevant to five factors EPA outlines in their April 2013 guidance[1] which they believe are appropriate to consider when making nonattainment boundary recommendations (i.e., air quality data, emissions and emissions-related data, meteorology, geography/topography, and jurisdictional boundaries). This technical analysis focuses on the Philadelphia-Camden-Wilmington, PA-NJ-DE-MD Combined Statistical Area (CBSA) area and a ring of counties surrounding that area (hereafter referred to as the "CBSA+"). The data and analysis in this document indicate that Delaware does contribute a small amount to air quality in nearby areas that do not meet the $PM_{2.5}$ NAAQS, and that 1) the air quality in those areas is impacted by a different set of sources, and is otherwise different than the air quality in Delaware, and 2) Delaware $PM_{2.5}$ and $PM_{2.5}$ precursor emission sources are currently well controlled, and the application of CAA control requirements in Delaware would result in no additional emission reductions. Delaware concludes based on this data and analysis that Delaware emissions do not contribute a sufficient amount to any area to deem any part of Delaware nonattainment for $PM_{2.5}$.

[1] "Designations for the Fine Particle National Ambient Air Quality Standards," April 2013

2 AIR QUALITY DATA IN THE REGION

EPA recommends that states consider the air quality in areas included versus excluded from the nonattainment area as one of the factors in determining appropriate nonattainment area boundaries. Given that monitoring data indicates all areas of Delaware are attaining the $PM_{2.5}$ standard, this analysis focuses on how the air quality in Delaware compares to the air quality in any nearby area that the EPA may associate with Delaware. In this Section Delaware evaluates the air quality within the Philadelphia CBSA and CBSA+, and demonstrates that the New Castle County attainment area is separate and distinct from any nonattainment problems in the CBSA.

2.1 Delaware $PM_{2.5}$ Monitoring Network and Data

Delaware began official $PM_{2.5}$ monitoring in 1999. Delaware's $PM_{2.5}$ network consists of seven (7) monitoring sites. There are four (4) sites in New Castle County, two (2) in Kent County and one (1) in Sussex County.

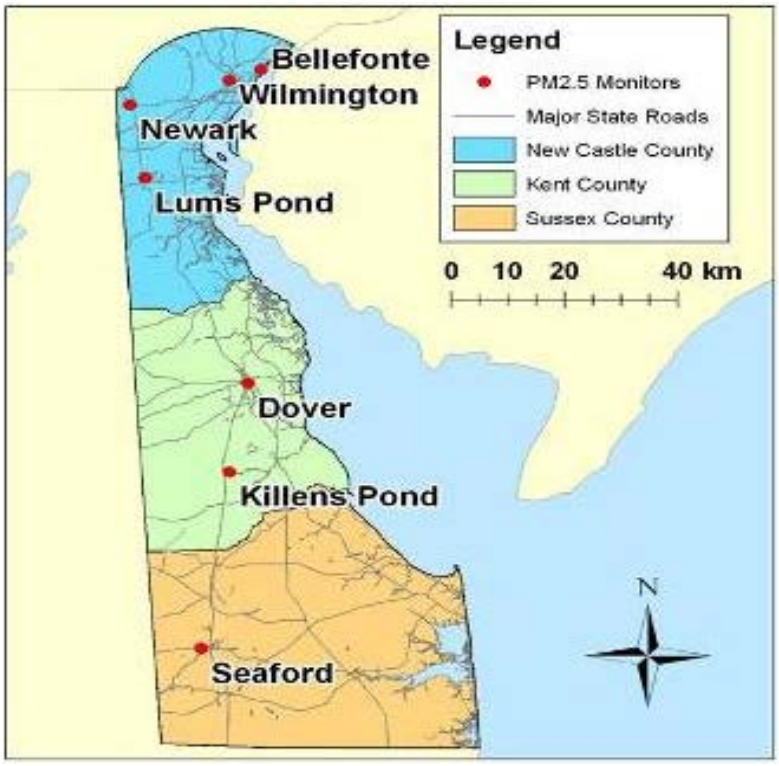
The primary goal of the $PM_{2.5}$ monitoring network in Delaware is to determine the status of the ambient air with respect to the 24-hour and annual average $PM_{2.5}$ NAAQS. In accordance with federal regulations, state agencies must operate at least the minimum number of required $PM_{2.5}$ sites 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 also 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 $PM_{2.5}$ site to monitor for regional background and at least one $PM_{2.5}$ site to monitor regional transport.

Figure 2.1 shows the locations of Delaware's $PM_{2.5}$ monitors. All data from these monitors are measured using EPA approved federal reference methods (FRM). All $PM_{2.5}$ monitoring sites are located appropriately and are eligible for comparison to the annual and daily $PM_{2.5}$ NAAQS. The standard monitoring schedule is one in three days, with one site, Martin Luther King (MLK) in Wilmington, monitoring every day. MLK is also designated a collocated site, with the collocated monitor designated as MLK-b operating on a one in six day schedule. All data are submitted to EPA's Air Quality System (AQS) in a timely manner in accordance with the schedule prescribed by EPA.

Chemical speciation is encouraged at sites where the chemically resolved data would be useful in developing SIPs and supporting atmospheric or health effects related studies. Chemical speciation is conducted at MLK in Wilmington and Dover in Kent County. The $PM_{2.5}$ chemical speciation sites include analysis for elements, selected anions and cations, and carbon.

Figure 2.1: Delaware $PM_{2.5}$ Air Monitoring Locations



Delaware's original $PM_{2.5}$ monitoring network design and monitor siting were completed in accordance with EPA requirements and guidance as stated in 40 CFR Part 58 Appendices D and E, and the EPA Office of Air Quality Planning & Standards (OAQPS) document "*Guidance for Network Design and Optimum Site Exposure for $PM_{2.5}$ and PM_{10}*" (EPA 1997a). Final network documents were submitted to EPA Region 3 in June 1998, and EPA approved Delaware's $PM_{2.5}$ monitoring network.

Delaware Annual Ambient Air Monitoring Network Reviews, including $PM_{2.5}$, have been completed each year in accordance with 40 CFR Part 58 Appendix D and subsequently submitted to EPA Region 3 for approval.

In fulfillment of the federal CAA 103 grant requirements, Delaware submits annual *Delaware Data Quality Assessments* for $PM_{2.5}$ speciation data and $PM_{2.5}$ FRM data to EPA Region 3. All data complies with appropriate federal and state requirements, including 40 CFR Part 50 Appendices L and N, and 40 CFR Part 58 Appendix A.

In fulfillment of the federal CAA 103 grant requirements, Delaware also submits annual $PM_{2.5}$ Speciation Monitoring Network Review and Monitoring Strategy reports to EPA Region 3. The $PM_{2.5}$ speciation network design and monitor siting follows EPA requirements and guidance as stated in 40 CFR Part 58 Appendices D and E, and the documents "*Guidance for Network Design and Optimum Site Exposure for $PM_{2.5}$ and PM_{10}*" (EPA 1997a), "*Particulate Matter ($PM_{2.5}$) Speciation Guidance*" (EPA 1999), and "*Guideline on Speciated Particulate Monitoring*" (EPA 1999a).

Delaware has quality assured all data in accordance with 40 CFR 58.10 and all other federal requirements. Delaware has recorded the data in the AQS database and, therefore, the data are available to the public.

The Delaware-monitored annual mean $PM_{2.5}$ concentrations and site information for 2010-2012 are provided in Table 2.1, and show that all sites are monitoring $PM_{2.5}$ concentrations that are well below the 2012 $PM_{2.5}$ NAAQS.

Table 2.1: Delaware $PM_{2.5}$ Annual Mean Concentrations; NAAQS = 12 µg/m^3, 3-year average

County	Site Name and ID Number	2010	2011	2012	3-year Average
New Castle	Bellefonte 10-003-1003	10.2	9.4	9.3	**9.6**
	MLK 10-003-2004	10.6	10.3	10.3	**10.4**
	Newark 10-003-1012	10.4	10.4	9.4	**10.1**
	Lums Pond 10-003-1007	10.0	8.8	8.5	**9.1**
Kent	Dover 10-001-0003	9.7	9.1	8.1	**9.0**
	Killens Pond 10-001-0002	9.3	8.6	8.1	**8.7**
Sussex	Seaford 10-005-1002	9.9	8.7	8.2	**8.9**

2.2 Delaware, Maryland, New Jersey and Pennsylvania Annual $PM_{2.5}$ Design Values

Table 2.2 shows the 2010-2012 annual $PM_{2.5}$ design values (DV) and rankings for counties within the CBSA+.

Table 2.2: 2010-2012 DV for the Philadelphia CBSA+

State	County**	CBSA	Site	2010-2012 Annual DV (µg/m3)	Rank
PA	**Philadelphia**	**Philadelphia-Camden-Wilmington, PA-NJ-DE-MD**	**421010004**	**13.5**	NA [1.]
PA	Northampton	Allentown-Bethlehem-Easton, PA-NJ	420950025	13.2	1
PA	**Delaware**	**Philadelphia-Camden-Wilmington, PA-NJ-DE-MD**	**420450002**	**13.1**	**2**
PA	**Chester**	**Philadelphia-Camden-Wilmington, PA-NJ-DE-MD**	**420290100**	**12.3**	**3**
PA	Lancaster	Lancaster, PA	420710007	12.1	4
PA	York	York-Hanover, PA	421330008	11.7	5
PA	**Philadelphia**	**Philadelphia-Camden-Wilmington, PA-NJ-DE-MD**	**421010055**	**11.0**	**6**
PA	Berks	Reading, PA	420110011	10.9	7
PA	**Bucks**	**Philadelphia-Camden-Wilmington, PA-NJ-DE-MD**	**420170012**	**10.9**	**8**
PA	**Philadelphia**	**Philadelphia-Camden-Wilmington, PA-NJ-DE-MD**	**421010047**	**10.9**	**8**
PA	**Philadelphia**	**Philadelphia-Camden-Wilmington, PA-NJ-DE-MD**	**421010057**	**10.8**	**9**

State	County**	CBSA	Site	2010-2012 Annual DV (µg/m3)	Rank
MD	**Cecil**	**Philadelphia-Camden-Wilmington, PA-NJ-DE-MD**	**240150003**	**10.4**	**10**
DE	**New Castle**	**Philadelphia-Camden-Wilmington, PA-NJ-DE-MD**	**100032004**	**10.4**	**10**
MD	Kent	Not Applicable	240290002	10.3	11
DE	**New Castle**	**Philadelphia-Camden-Wilmington, PA-NJ-DE-MD**	**100031012**	**10.1**	**12**
PA	**Montgomery**	**Philadelphia-Camden-Wilmington, PA-NJ-DE-MD**	**420910013**	**9.8**	**13**
NJ	**Camden**	**Philadelphia-Camden-Wilmington, PA-NJ-DE-MD**	**340070002**	**9.7**	**14**
DE	**New Castle**	**Philadelphia-Camden-Wilmington, PA-NJ-DE-MD**	**100031003**	**9.6**	**15**
PA	**Philadelphia**	**Philadelphia-Camden-Wilmington, PA-NJ-DE-MD**	**421010024**	**9.6**	**15**
PA	**Philadelphia**	**Philadelphia-Camden-Wilmington, PA-NJ-DE-MD**	**421011002**	**9.6**	**15**
NJ	**Camden**	**Philadelphia-Camden-Wilmington, PA-NJ-DE-MD**	**340071007**	**9.5**	**16**
NJ	Mercer	Trenton, NJ	340210008	9.5	17
NJ	Warren	Allentown-Bethlehem-Easton, PA-NJ	340410006	9.4	18
NJ	**Gloucester**	**Philadelphia-Camden-Wilmington, PA-NJ-DE-MD**	**340150004**	**9.3**	**19**
DE	**New Castle**	**Philadelphia-Camden-Wilmington, PA-NJ-DE-MD**	**100031007**	**9.1**	**20**
DE	Kent	Dover, DE	100010003	9.0	21
NJ	Atlantic	Atlantic City-Hammonton, NJ	340011006	8.9	22
DE	Kent	Felton, DE	100010002	8.7	23
NJ	Warren	Allentown-Bethlehem-Easton, PA-NJ	340410007	8.6	24
NJ	Ocean	New York-Newark-Jersey City, NY-NJ-PA	340292002	8.5	25
NJ	Atlantic	Atlantic City-Hammonton, NJ	340010006	8.2	26
NJ	Mercer	Trenton, NJ	340218001	8.2	26
NJ	Middlesex	New York-Newark-Jersey City, NY-NJ-PA	340230006	8.0	27

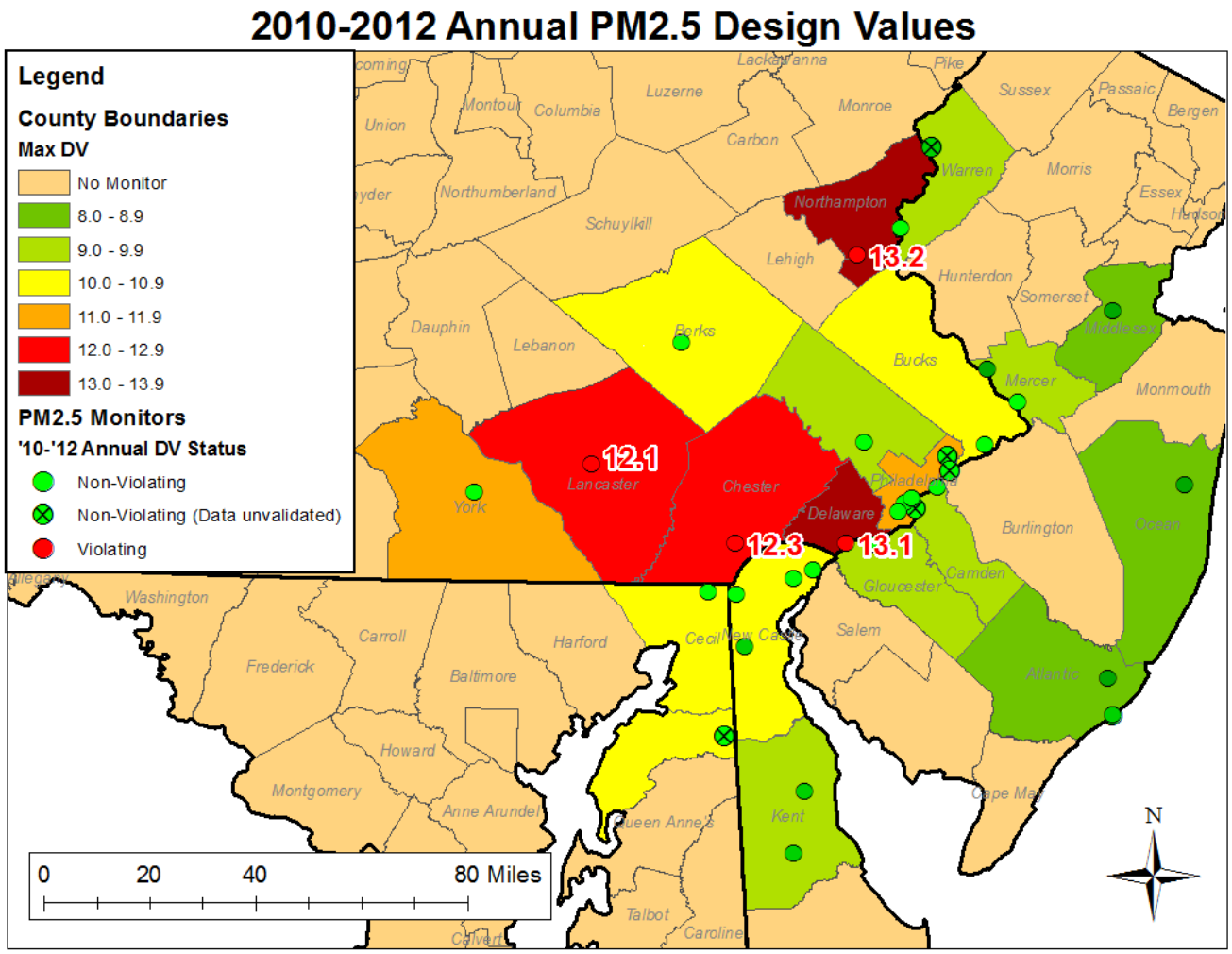
** Counties within the Philadelphia CBSA are in bold font
NA = Not applicable
1. Philadelphia monitor ID 421010024 (LAB) is only included in this table for completeness (i.e., to show all monitors in the CBSA+). Delaware agrees with the City of Philadelphia that this monitor is not appropriate for comparison to the 2012 $PM_{2.5}$ NAAQS designations, for reasons discussed in Section 2.3.

As can be seen in Table 2.2, four counties in the CBSA+, all in Pennsylvania, have 2010-2012 DV's that exceed the NAAQS, and design values outside of these four counties are well in compliance with the NAAQS. The highest monitor in Delaware's New Castle County (i.e., the MLK monitor in downtown Wilmington) ranks 10th out of the 33 monitors in the CBSA+ (tied with the rural Cecil County, MD

monitor), and the lowest monitor in New Castle County ranks 20th. These data indicate that the air quality in the CBSA+ is well below the NAAQS except for the four, non-contiguous Pennsylvania counties.

Figure 2.2 illustrates the color-coded DVs in one µg/m3 increments using 2010-2012 $PM_{2.5}$ data for each county in the CBSA+.[2] The map also shows the violating monitors/DVs in southeast PA, and also demonstrates the relatively low DVs for those counties encircling the violating monitors.

Figure 2.2: CBSA+ Violating Counties and Color-Coded Design Values per County



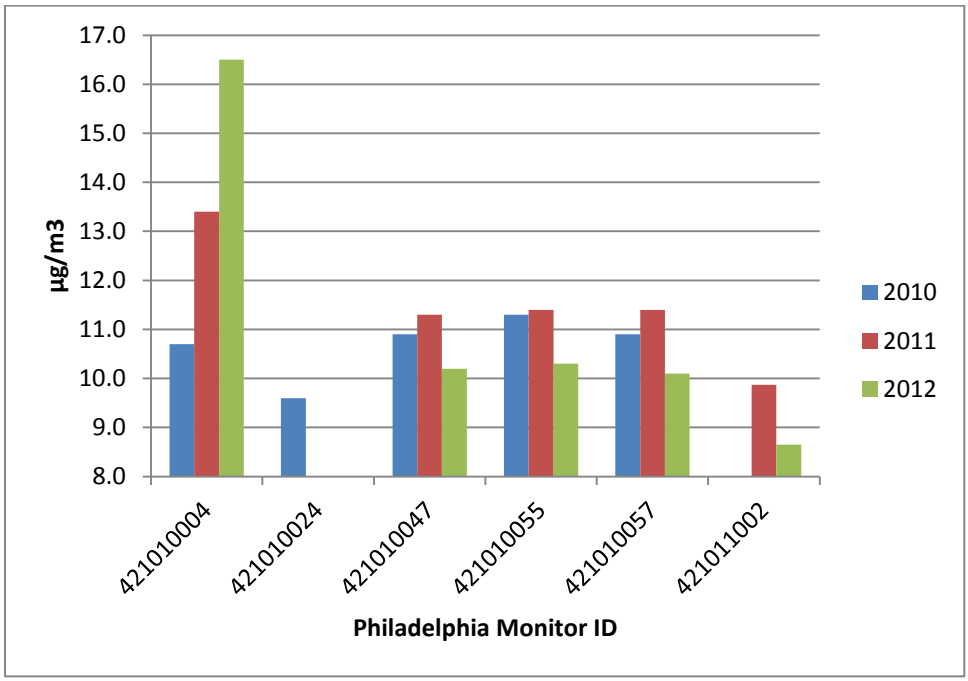
2.3 Philadelphia County Monitoring Data for the "LAB" (ID 421010004)

In accordance with the $PM_{2.5}$ NAAQS rule published on January 15th, 2013 (78 FR 3086), and specific to the provisions detailed in §58.10 (b)(13) and §58.11(e), the City of Philadelphia Air Management Services (AMS) requested EPA not use the Federal Equivalent Method (FEM) data from the "LAB" (ID

[2] See map legend for description of the incremental maximum (Max) DV.

421010004) for NAAQS designation purposes for the years 2011 – 2013, Quarter 1.[3] In 2011 this monitor was switched from Federal Reference Method (FRM) to FEM. Delaware agrees with Philadelphia's rationale for this request. Figure 2.3 provides annual means for 2010, 2011 and 2012 and demonstrates how the other Philadelphia county monitors are trending downward, while the LAB's $PM_{2.5}$ values show an unusually sharp rise beginning in 2011 with the installation of the FEM monitor.[4] The LAB FEM monitor annual mean is ≥ 60% higher than the other monitors in the same county.

Figure 2.3: Philadelphia County 2010-2012 $PM_{2.5}$ annual averages



Delaware does not consider the Philadelphia LAB station to be reflective of the $PM_{2.5}$ NAAQS regional contributions, and does not consider it suitable for comparison to the NAAQS. Delaware will not include this monitor further in this document.

2.4 Air Quality Rankings in the Philadelphia CBSA and Surrounding Counties (CBSA+)

Table 2.3 shows the 2010-2012 monitoring data for all of the monitors in the Philadelphia CBSA.

[3] 40 CFR Part 58.11(e) documents the process for excluding $PM_{2.5}$ FEM data from comparison to the NAAQS and/or AQI if the performance criteria described in Table C-4 of Subpart C are not met when assessed with a collocated FRM monitor. In their 2013-2014 Air Monitoring Network Plan, the City of Philadelphia AMS requested $PM_{2.5}$ FEM data from 2011 through the first quarter of 2013 at the LAB monitoring site (AQS ID 421010004) be excluded from comparison to the NAAQS and Air Quality Index. The request to exclude data and the assessment generated to determine FEM incomparability to a collocated Federal Reference Method is located in Appendix B of their report located at:
http://www.phila.gov/health/pdfs/2013_14AMNPFinalwAppendices__20130628.pdf

[4] 421010024 was shutdown in 2011 and 421011002 begin operations in 2011.

Table 2.3: Philadelphia CBSA Monitors: annual $PM_{2.5}$ mean and 2010-2012 DVs

State	County	Site ID	2010	2011	2012	2010-2012 DV	*Rank*
PA	Delaware	420450002	13.5	12.9	12.8	13.1	1
PA	Chester	420290100	13.8	13.3	9.8	12.3	2
PA	Philadelphia	421010055	11.3	11.4	10.3	11.0	3
PA	Bucks	420170012	10.5	11.5	10.7	10.9	4
PA	Philadelphia	421010047	10.9	11.3	10.2	10.8	5
PA	Philadelphia	421010057	10.9	11.4	10.1	10.8	6
MD	Cecil	240150003	11	10.9	9.3	10.4	7
DE	**New Castle**	**100032004**	**10.6**	**10.3**	**10.3**	**10.4**	**7**
DE	**New Castle**	**100031012**	**10.4**	**10.4**	**9.4**	**10.1**	**8**
PA	Montgomery	420910013	9.5	10.3	9.7	9.8	9
NJ	Camden	340070002	*	*	9.7	9.7	10
PA	Philadelphia	421011002	*	9	10.3	9.7	10
DE	**New Castle**	**100031003**	**10.2**	**9.4**	**9.3**	**9.6**	**11**
PA	Philadelphia	421010024	9.6	*	*	9.6	11
NJ	Camden	340071007	9.5	10.1	9	9.5	12
NJ	Gloucester	340150004	9.1	9.4	9.4	9.3	13
DE	**New Castle**	**100031007**	**10**	**8.8**	**8.5**	**9.1**	**14**

Table 2.3 shows that the air quality in two Pennsylvania CBSA counties exceed the NAAQS, and that the air quality in New Castle County is significantly better. The air quality in New Castle County ranks 7th (tied with Cecil County, MD) at its worst monitor, and has the best air quality in the entire CBSA at its lowest monitor.[5]

In order to better illustrate county-wide air quality Delaware incorporated spatial averaging for those Philadelphia CBSA counties that have more than one monitoring site. Table 2.4 presents the resultant DVs.

Table 2.4: Philadelphia 2010-2012 DVs (Spatial Averaging)

State	County	Site ID	2010-2012 AVG.	*Rank*
PA	Delaware	420450002	13.1	1
PA	Chester	420290100	12.3	2
PA	Bucks	420170012	10.9	3
MD	Cecil	240150003	10.4	4
PA	Philadelphia	***AVERAGE***	10.4	5
PA	Montgomery	420910013	9.8	6
DE	New Castle	***AVERAGE***	9.8	6
NJ	Camden	***AVERAGE***	9.6	7
NJ	Gloucester	340150004	9.3	8

[5] Note that New Castle County ranked 2nd highest DV in the Philadelphia CBSA under the previous 1997 annual NAAQS, which shows that Delaware's $PM_{2.5}$ control strategies have been effective. This is discussed in detail in Section 4.4 of this document.

Note that only two counties in Pennsylvania exceed the NAAQS, and that the air quality in the other CBSA counties is significantly cleaner. Of the 8 CBSA counties New Castle County is tied at 6th place with Montgomery County at 9.8 µg/m^3.[6]

Relative to New Castle County, Delaware there are five CBSA counties in four states which encircle and are adjacent to New Castle County, Delaware. The 2010-2012 DVs for each of these counties, and the percentage the DV is above or below the NAAQS, is shown in Table 2.5.

Table 2.5: New Castle and Adjacent Counties' 2010-2012 Design Values (ranked low-to-high)

County/State	Site Name and ID Number	2010-2012 Design Value	Percent Below/Above NAAQS
Gloucester, NJ	Gibbstown Municipal Bldg. 34-015-5001	9.7	-19%
New Castle, DE	**MLK (highest of 4 monitors in New Castle County), 10-003-2004**	**10.4**	**-13%**
Cecil, MD	Fair Hill 24-015-0003	10.4	-13%
Philadelphia, PA	RIT (24th and Ratner) 42-101-0055	11.0	-8%
Chester, PA	New Garden Airport 42-029-0100	**12.3**	**+2%**
Delaware, PA	Front St & Norris St 42-045-0002	**13.1**	**+8%**

Table 2.5 shows there are two violations of the 2012 $PM_{2.5}$ NAAQS which are occurring solely in the Pennsylvania Counties (assuming EPA will exclude the Philadelphia "LAB" for designation purposes). Based on the data in Table 2.4 and Table 2.5 it is evident that; 1) Delaware county is significantly above the NAAQS, 2) Chester county is slightly above the NAAQS, 3) New Castle County is significantly below the NAAQS, and 4) New Castle County's *highest* DV (of 4 monitors) is **21% lower than the Chester monitor DV**.

[6] Note that the average of New Castle County's four monitors is below that of Cecil County MD, which EPA excluded from the Philadelphia based non-attainment boundaries under the 1997 and 2006 $PM_{2.5}$ NAAQS due to low DVs, and because it was not as "industrialized" as the rest of the CBSA. Delaware believes this low New Castle County averaged DV is a direct result of Delaware's control strategies implemented under the last two rounds of $PM_{2.5}$ standards.

2.5 Philadelphia CBSA Trends, Seasonal and Wind Patterns

Air quality in the Philadelphia CBSA has shown significant improvement in relation to $PM_{2.5}$ concentrations. Trends in annual average design values are shown in Figure 2.4, which for clarity includes only those sites in the CBSA with data through 2012. The dashed line indicates the $PM_{2.5}$ national ambient air quality standard for the annual average. Only two sites in New Castle County (the highest concentration site at MLK in downtown Wilmington and the Bellefonte site located between MLK and the Delaware County, PA monitoring site in Chester) are shown.

Figure 2.4: Trends in annual average design values

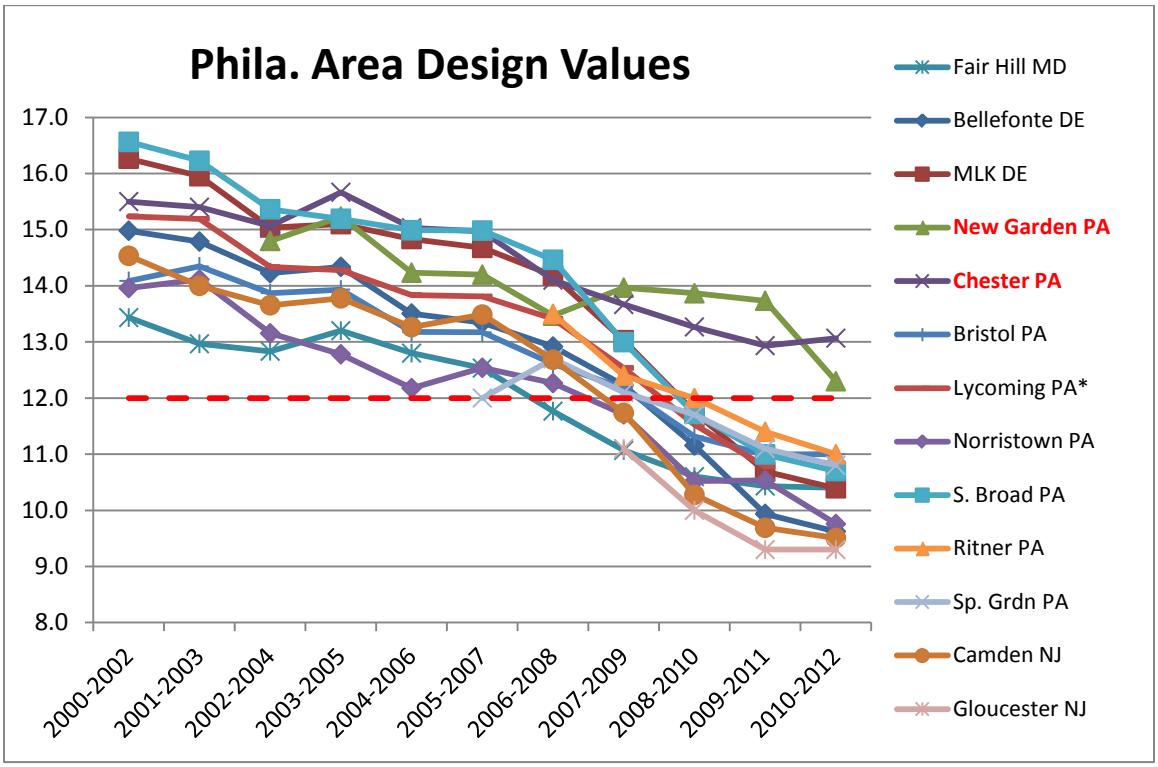


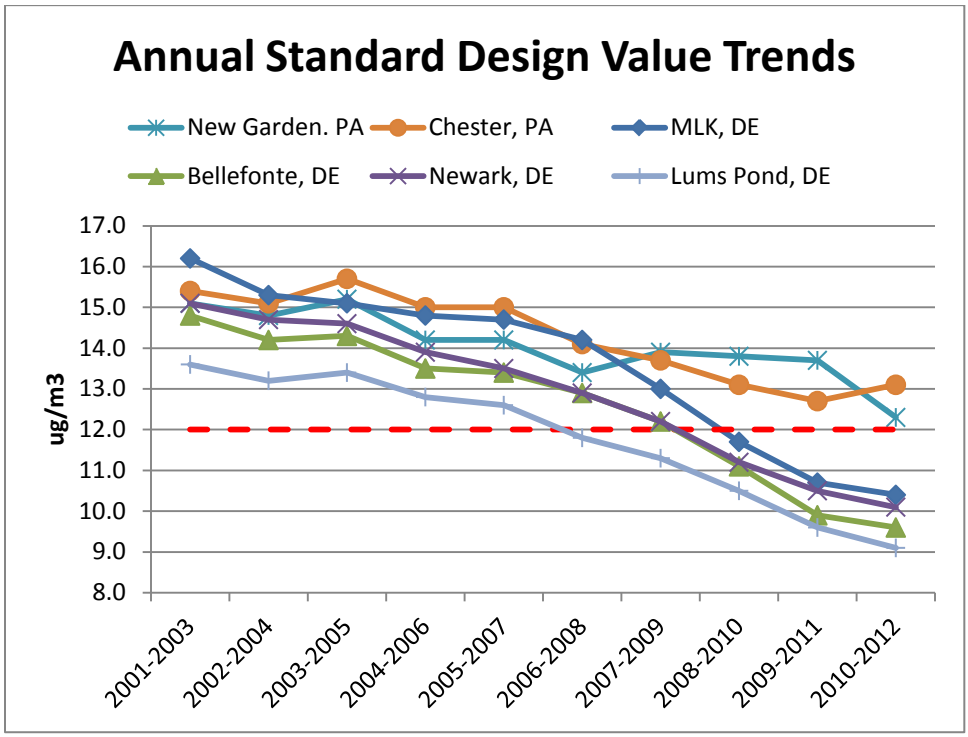
Figure 2.4 demonstrates the continued improvement in air quality as shown by the decreasing trends in annual average design values. It should be noted that in the 2007 – 2009 time frame two sites began to show somewhat different trends –New Garden in Chester County PA and Chester in Delaware County PA which are the only two sites in the CBSA that are currently monitoring nonattainment for the 2012 NAAQS. The New Garden site changed methods from FRM to FEM in 2009, which has a possible high bias in comparison to the FRM. According to data submitted to EPA AQS, the FRM resumed sampling at New Garden in 2012, and there was a corresponding drop in design value (see Table 2.3, Site ID 420290100); which is more in line with other regional sites. It is likely that considering the past trend when the FRM monitor was in use at this site, in the future when additional years of data from the FRM monitor are incorporated we will see that $PM_{2.5}$ concentrations do actually trend with the other CBSA sites, and that the design value at New Garden will be below the annual NAAQS.

The Chester site in Delaware County PA showed a slower rate of improvement beginning in 2007-2009, and slightly increased in annual average design value concentrations in the most recent three year period (2010-2012). As trends in other regional monitors indicate, as regional $PM_{2.5}$ ambient concentrations and transport levels continue to improve, nearby local sources may become relatively more significant. It is

likely that local sources have a significant influence on the Chester PA monitor and that local sources are the reason the Chester PA monitor does not follow the trend of the other CBSA monitors. The siting of the Chester monitor is discussed in detail in section 2.7 of this document.

Figure 2.5 shows annual average design value trends for $PM_{2.5}$ sites in New Castle County DE along with the New Garden and Chester monitors in the adjoining PA counties (Chester and Delaware Counties, respectively). The same trends discussed above are more clearly seen in this chart with the PA monitors showing clear differences compared to the New Castle County DE monitors.

Figure 2.5: Average DV Trends for New Castle, Chester and Delaware Counties

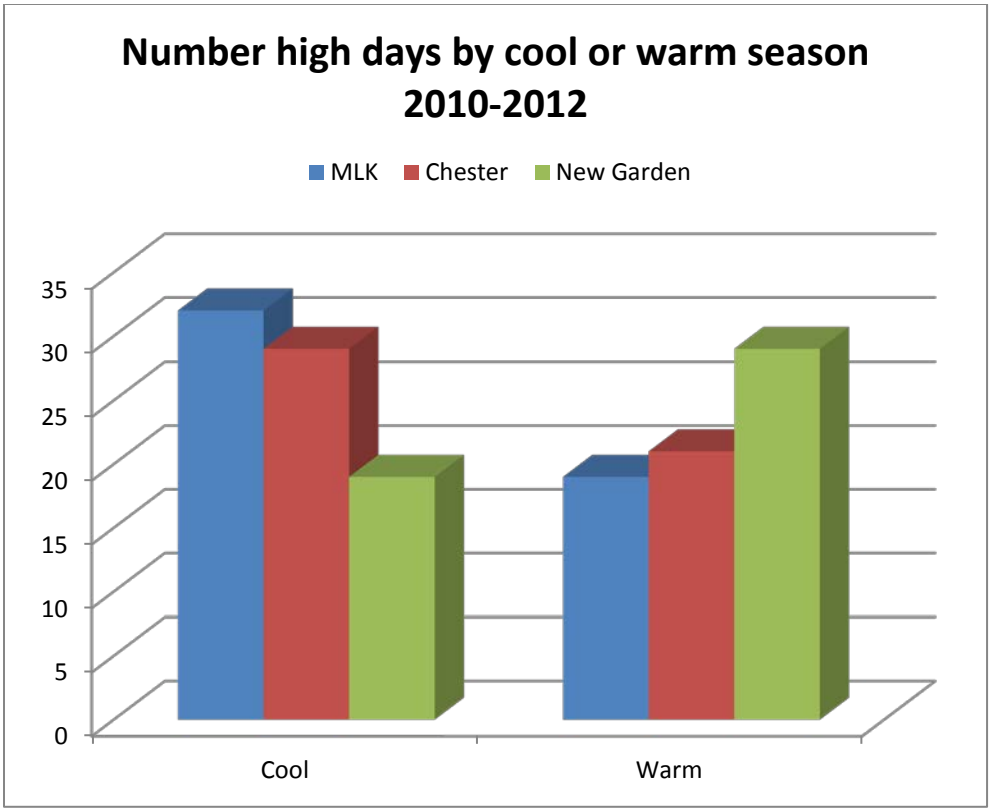


To further examine similarities and differences in the $PM_{2.5}$ concentrations and trends among the sites, the highest concentration monitoring site in New Castle County (MLK in Wilmington) DE was compared to the New Garden PA (Chester County) and Chester PA (Delaware County) monitoring sites. Following EPA guidance as contained in the April 13, 2013 $PM_{2.5}$ Designation Guidance Memo to EPA Regional Administrators, high concentration days were identified and assessed for each monitoring site by occurrences in warm or cool season as well as by month.

For each site, the 95th percentile was calculated for the three year period of 2010-2012 as per EPA guidance, and high concentration days were defined as exceeding that concentration. Cool and warm seasons were defined as per EPA guidance as cool season equal to October through December and January through April, and warm season as May through September for each calendar year.

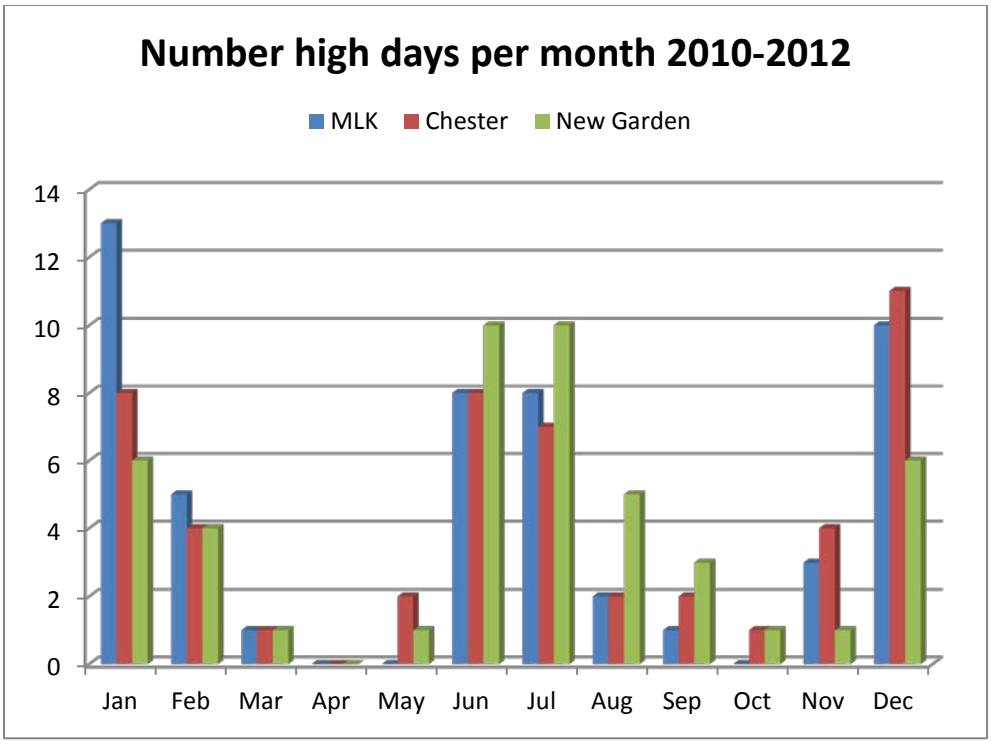
Figure 2.6 shows that both MLK in DE and Chester in PA have more high concentration days in the cool season while New Garden has more high concentration days in the warm season.

Figure 2.6: MLK, Chester and New Garden Cool vs. Warm Season



Further breakdown of high concentration days by month in Figure 2.7 confirms this pattern.

Figure 2.7: MLK, Chester and New Garden No. of High Days



In the warm season, sulfates dominate the composition of $PM_{2.5}$ and are generally an indication of regional transport; high concentrations in the cool season are dominated by shorter range components and are generally more indicative of local source impacts. More information on $PM_{2.5}$ composition is presented in section 2.6.

The seasonal breakdown and design value trends indicate that the New Garden monitor in Chester County, PA is not representative of $PM_{2.5}$ concentrations or trends in the New Castle County, DE or Delaware County, PA areas. Since the ambient data from the New Garden site is only slightly above the annual average NAAQS and shows decreasing concentrations, and given the likely problem with the FEM monitor discussed above, further detailed analysis of the data from this site is not included in the following analyses which focus on identifying characteristics of the $PM_{2.5}$ data from the highest Philadelphia CBSA design value site at Chester (Delaware County, PA) and the MLK site which is the highest concentration monitor in New Castle County, DE.

Because the Chester PA site is similar in seasonal pattern to the MLK DE site, same day high concentrations for both sites were compared and the difference in concentration plotted as time series graphs as seen in Figure 2.8 and Figure 2.9.

Figure 2.8: MLK/Chester High Concentration Days

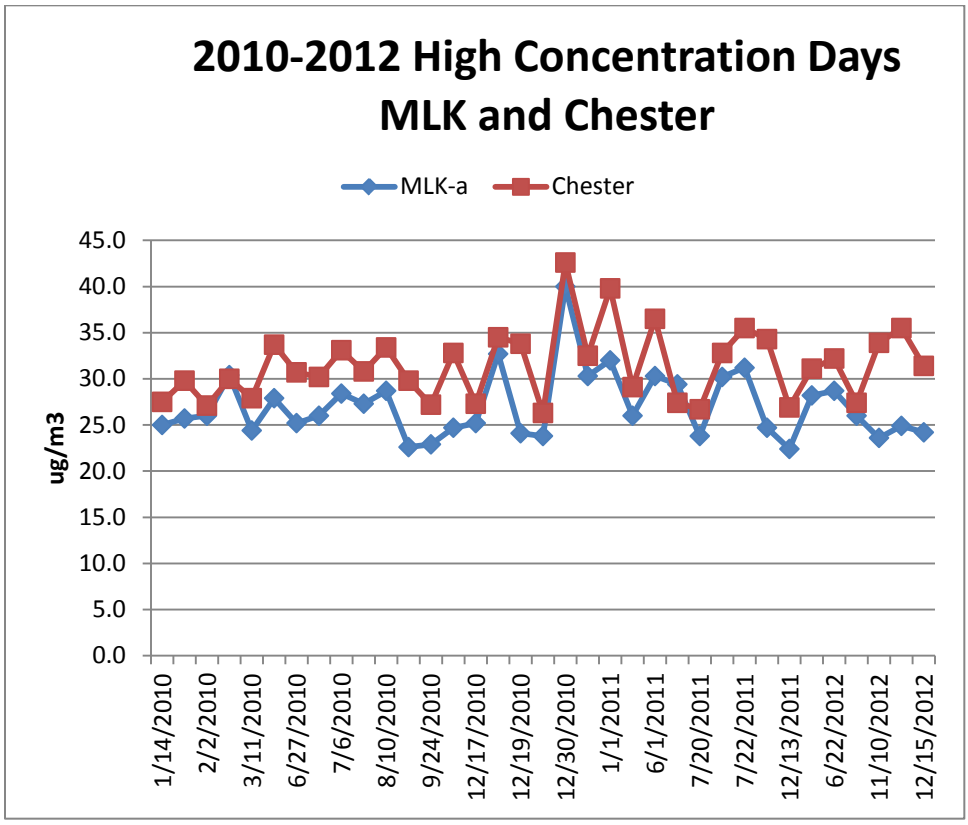


Figure 2.9: MLK/Chester High Day Difference

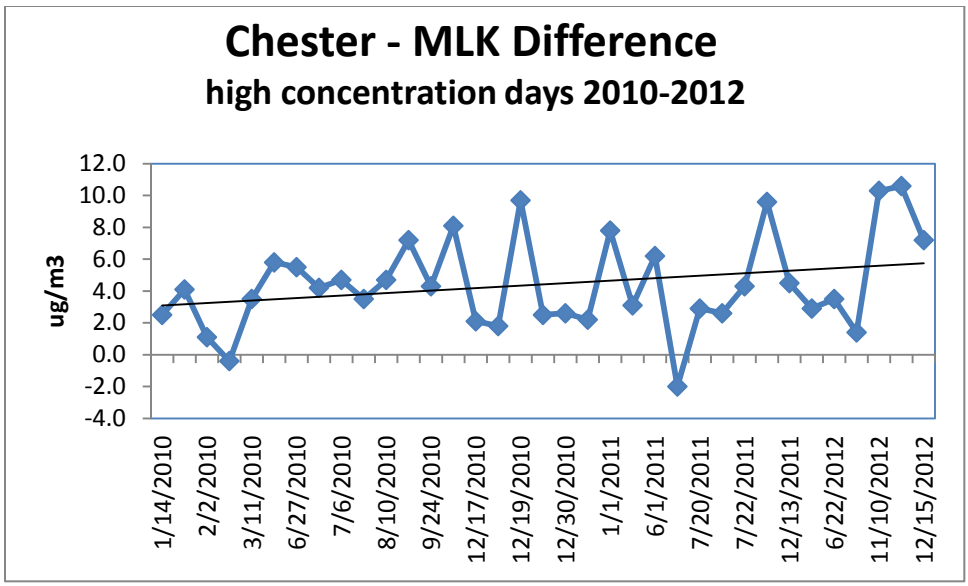


Figure 2.9 shows an increasing difference with time between concentrations at MLK and Chester, which is in agreement with the decreasing trend in average concentrations at MLK and a flat or slightly increasing trend at Chester. All other monitoring sites in the Philadelphia CBSA also show the decreasing trend similar to MLK (Figure 2.5). This data supports the interpretation that as regional transport $PM_{2.5}$ contributions decrease, local sources are becoming more significant at the Chester PA site. As the Chester site is becoming dominated by local source influences, it can therefore no longer be considered as representative of the wider Philadelphia CBSA

To further examine local versus regional influences on $PM_{2.5}$ concentrations, analysis of wind directions associated with $PM_{2.5}$ concentrations is useful. Both MLK and Chester have continuous $PM_{2.5}$ FEM monitor data, which is more meaningful for comparison with wind direction data than 24-hour average $PM_{2.5}$ data. The hourly $PM_{2.5}$ FEM concentrations at MLK DE and Chester PA for 2010 through 2012 were plotted by hourly average wind direction as shown in the following figures. Both radar plots and bar charts are shown as different ways to visualize the same data.

The Chester site shows higher average concentrations when winds are from the Northeast (40 to 80 degrees) and Southwest (200 to 280 degrees) as shown in Figure 2.10 and Figure 2.11, while the MLK DE site shows a less pronounced broader range of high concentrations associated with winds from Southeast through Southwest (100 degrees to 240 degrees), as shown in Figure 2.12 and Figure 2.13.

Figure 2.10: Chester $PM_{2.5}$ Concentrations by Wind Direction (WD) Radar Plot

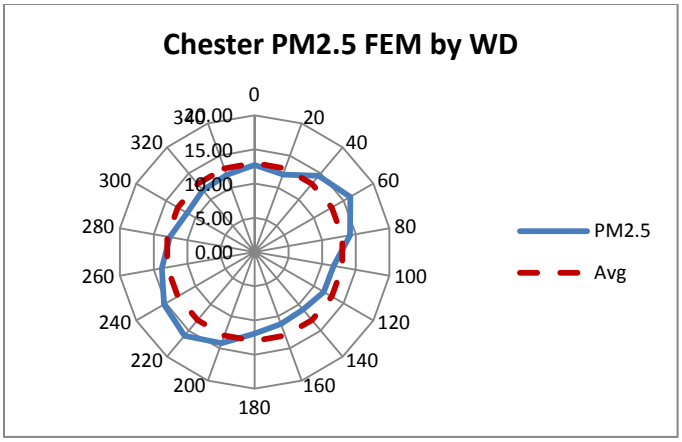


Figure 2.11: Chester $PM_{2.5}$ Concentrations by Wind Direction Bar Chart

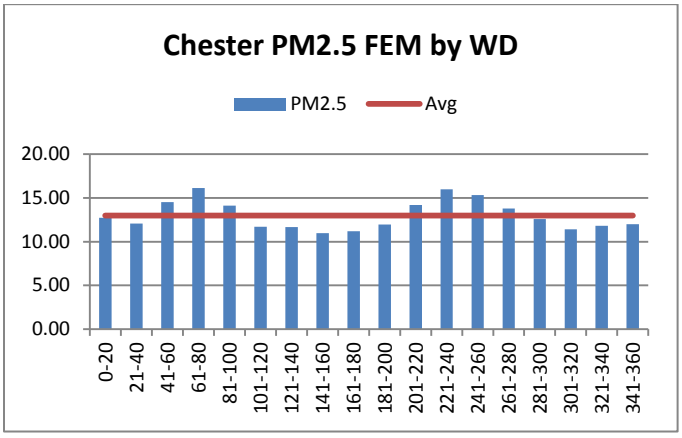


Figure 2.12: MLK $PM_{2.5}$ Concentrations by Wind Direction (WD) Radar Plot

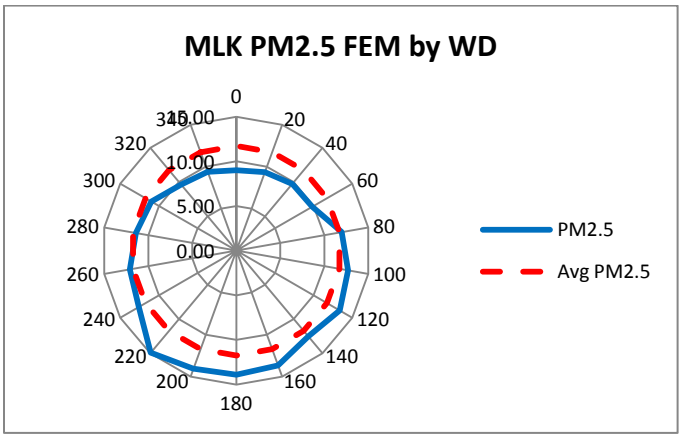
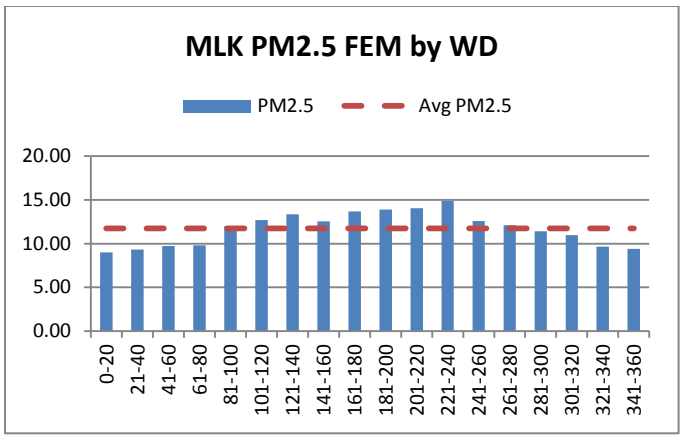


Figure 2.13: MLK $PM_{2.5}$ Concentrations by Wind Direction (WD) Bar Chart



This supports the interpretation that while both MLK and Chester are impacted by regional transport (southwest), Chester also shows significant impact from the northeast, probably reflecting local sources. Further examination of transport and trajectories are discussed in section 3.

2.6 Speciation and "SANDWICH" Analysis

EPA guidance also discusses the use of $PM_{2.5}$ compositional analysis through use of speciated data from the chemical speciation network (CSN) and Improve networks. While MLK has CSN speciation data from 2002 through 2012, the Chester PA CSN speciation monitoring ended after 2009. Therefore, only 2009 speciated data was used to examine similarities and differences between the two sites as well as a regional background at Brigantine NJ's IMPROVE site (Interagency Monitoring of Protected Visual Environments). The EPA also recommends the use of the SANDWICH method to compare CSN and IMPROVE data.

Table 2.6 shows the 2009 speciated SANDWICH (Sulfate, Adjusted Nitrate, Derived Water, Inferred Carbon Hybrid) data for each site as average µg/m3 mass concentrations.

Table 2.6: 2009 Speciated SANDWICH Data

Year	Site Name	SANDWICH Sulfate	SANDWICH Nitrate	SANDWICH Organic Carbon	SANDWICH Elemental Carbon	SANDWICH Crustal
2009	Chester	3.3	2.2	2.6	0.9	0.4
2009	MLK	5.4	1.4	2.9	0.7	0.5
2009	Brigantine	3.8	0.4	1.7	0.3	0.5

Figure 2.14, Figure 2.15, and Figure 2.16 are pie charts with the data in Table 2.6 shown as percentages of total $PM_{2.5}$ mass. The rural Brigantine background site is dominated by transport as shown by the high percentage of sulfates. The MLK site shows a combination of transport and local sources as shown by the slightly lower percentage of sulfates and higher percentage of nitrates and organic carbon, while the Chester site shows even stronger local source impact as seen by the lower sulfate and higher nitrate, organic carbon and elemental carbon components.

Figure 2.14: Brigantine Speciated SANDWICH

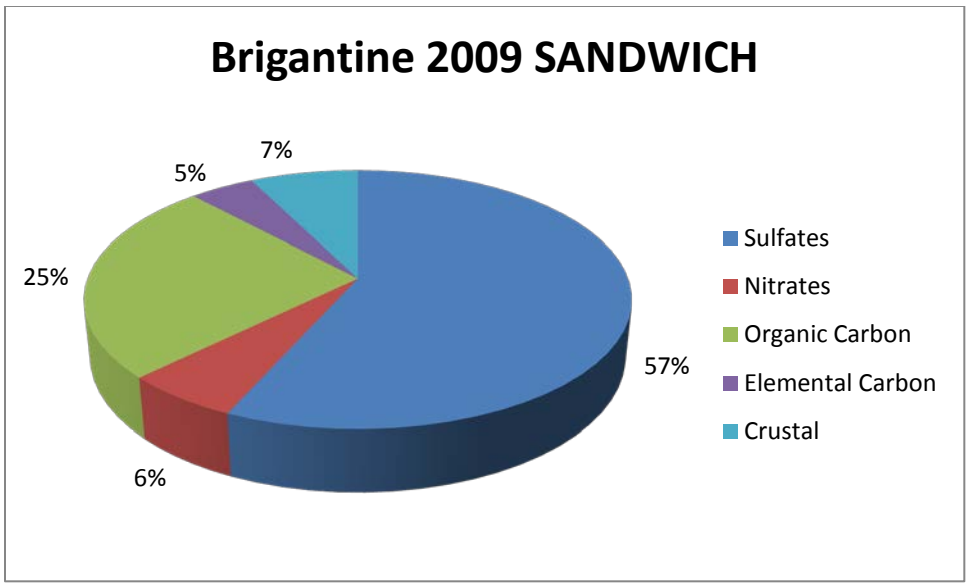


Figure 2.15: MLK Speciated SANDWICH

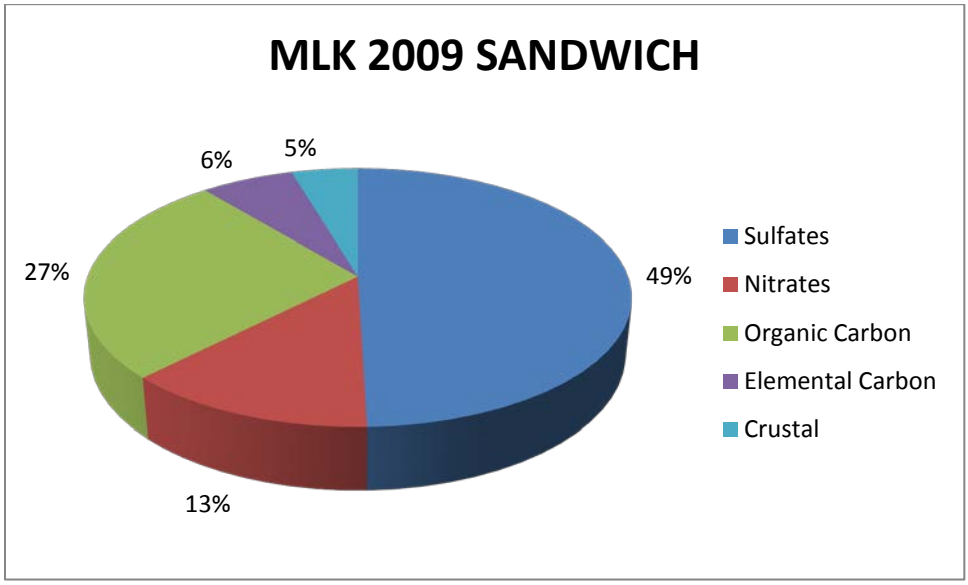
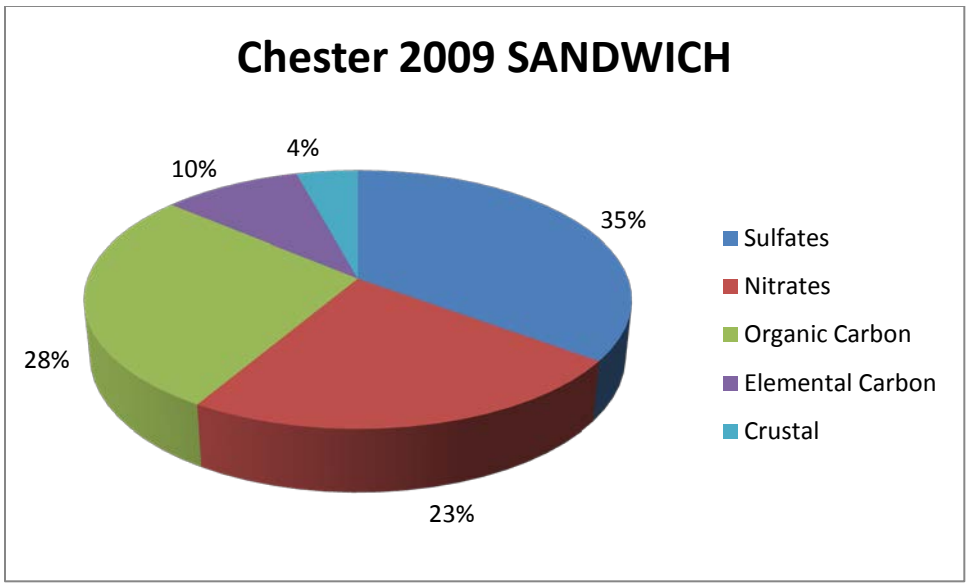


Figure 2.16: Chester Speciated SANDWICH



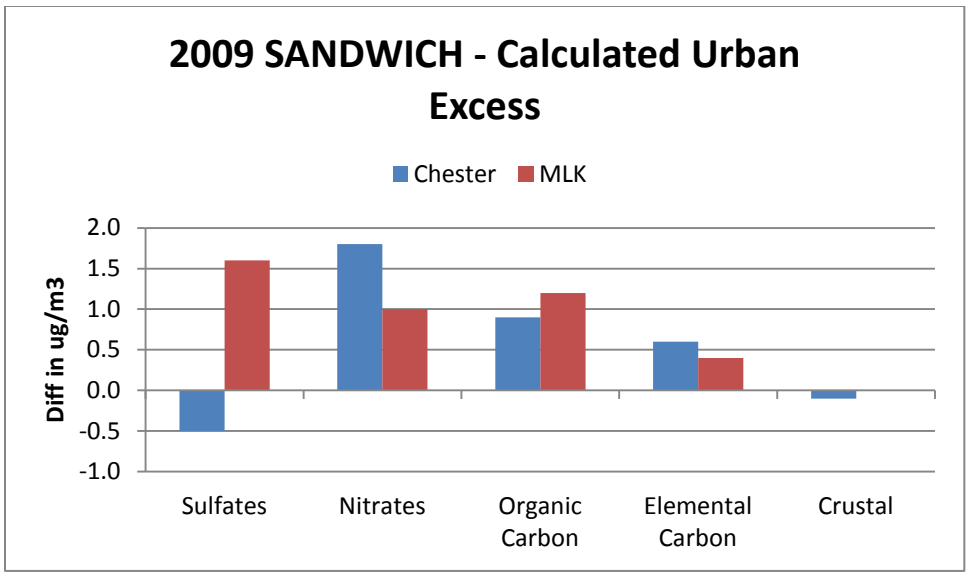
EPA guidance also discusses the use of this SANDWICH data to estimate the urban excess by subtracting the rural site background concentrations (Brigantine) from the urban site concentrations (MLK and Chester). Table 2.7 shows the urban excess calculated values for MLK and Chester for 2009.

Table 2.7: MLK and Chester vs. Brigantine Urban Excess

	Sulfates	Nitrates	Organic Carbon	Elemental Carbon	Crustal
MLK – Brigantine	1.6	1.0	1.2	0.4	0.0
Chester - Brigantine	-0.5	1.8	0.9	0.6	-0.1

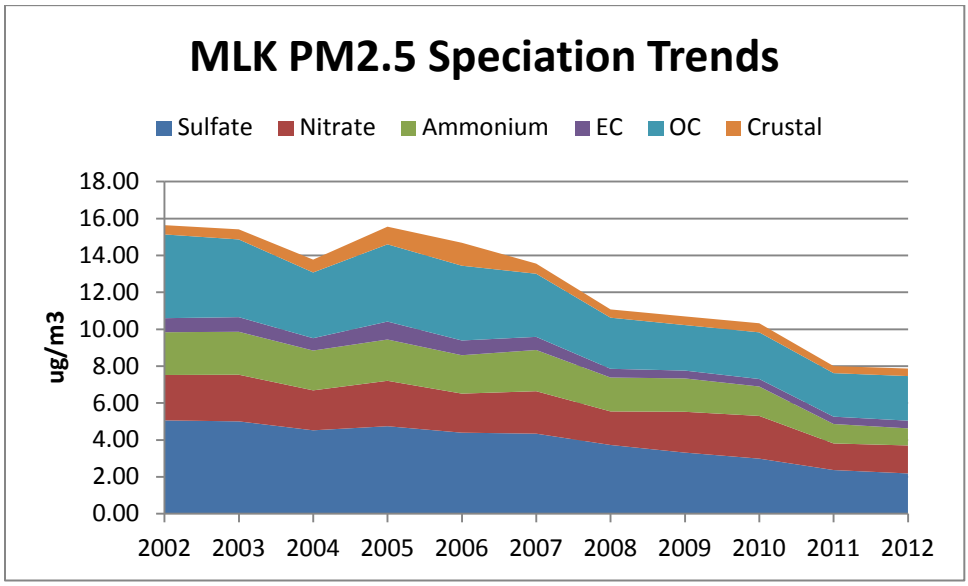
Figure 2.17 is a graphical presentation of the data in Table 2.7, which shows the speciated data and urban excess calculations support the different nature of the $PM_{2.5}$ concentrations between MLK and Chester; the Chester site shows more local source influence (greater excess in the nitrate and elemental carbon fractions) compared to MLK urban excess (sulfates and organic carbon).

Figure 2.17: MLK and Chester vs. Brigantine Urban Excess



Trends in $PM_{2.5}$ composition at the MLK DE site are shown in Figure 2.18 using speciation data (non-SANDWICH). The most significant decrease over time is shown in the sulfate component (associated with regional transport) followed by the organic carbon, ammonium and nitrate fractions. Equivalent data from the Chester site was not available after 2009 and is therefore not included here.

Figure 2.18: MLK non-SANDWICH data



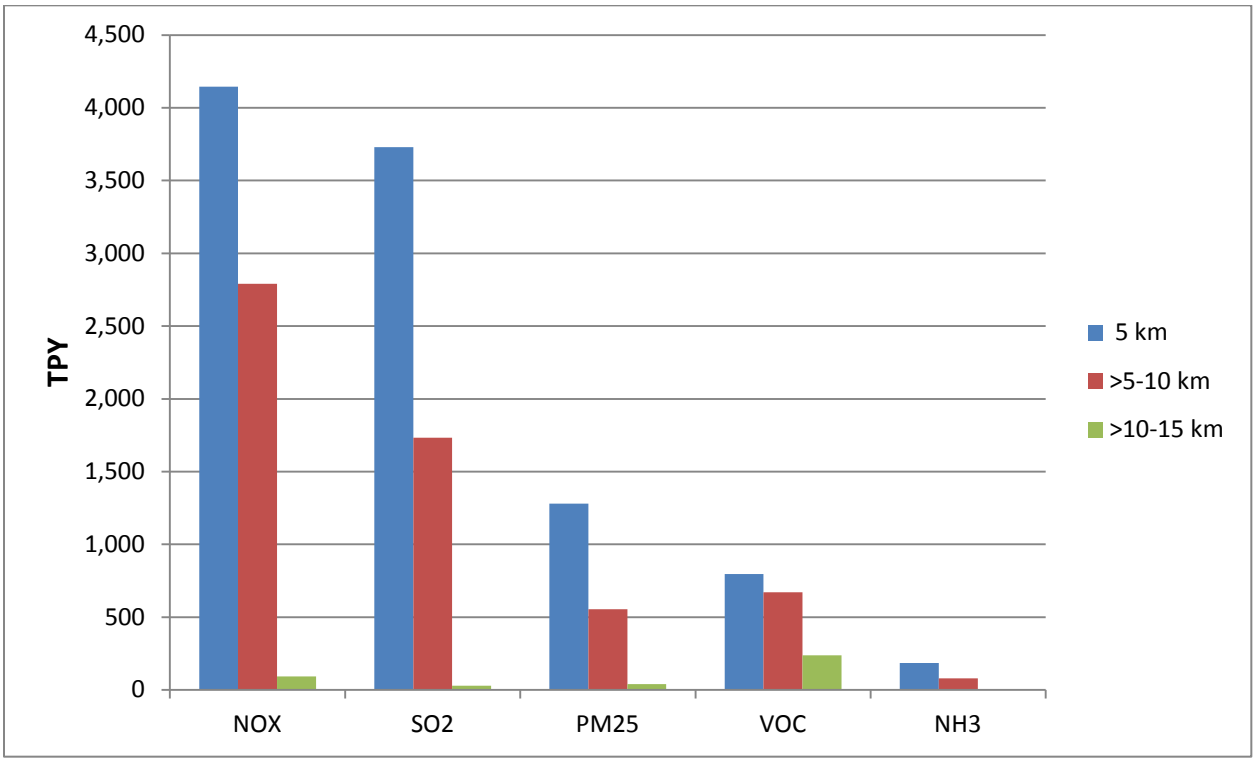
2.7 Chester Monitor (Delaware County, PA)

As discussed previously, the ambient data analyses indicate that the Chester monitoring site likely has significant impact from local sources. Local impact was indicated by 1) the Chester monitor deviating significantly from the downward trend of the other CBSA monitors, 2) the increasing difference with time between concentrations at MLK and Chester, 3) the more pronounced higher average concentrations when winds are from specific directions, and 4) the analysis of speciated data.

Delaware notes that the Chester monitor is located near the Delaware River waterfront in a heavily industrialized area. About 2-miles to the southwest is the Marcus Hook Petroleum refinery, and about 3-miles to the northeast is Exelon's Eddystone Generating Station, and there are many other heavy industrial sources in this 5-mile stretch between this refinery and power plant.

Figure 2.19 illustrates the magnitude of the point sources within 0-10 km of the Chester monitor. Figure 2.19 shows that there are significant point source emissions close to the Chester monitor, and that emissions decrease significantly with distance from the Chester monitor, based upon 5 kilometer increments.[7,8]

Figure 2.19: 2011 Points Source Emissions vs. Distance from Chester Monitor



Delaware also notes that the Chester monitor is located on an unpaved area within the fence line of the Evonik Corporation (see Picture 1). Evonik manufactures silica from sodium silicate using spray dryers, silos, granulator system, and packaging system, and is a significant source of direct $PM_{2.5}$ emissions.

[7] DAQ believes regional factors play a bigger role beyond 15 km, so the evaluation only involved 0-15 km.
[8] The 5 km cutoff captured only facilities located in Delaware County, PA.

Picture 1: Chester Monitor Located Within the Fence Line of Evonik Corporation

Given that the air quality analysis and a physical evaluation of the Chester monitor indicates that the monitor is significantly influenced by local sources, Delaware does not believe that data from this monitor is appropriate for use in setting nonattainment boundaries that encompass any area broader than the footprint of such local sources.

2.8 Summary of Air Quality Analysis

In summary, this ambient air quality analysis indicates that all areas of Delaware are monitoring $PM_{2.5}$ concentrations that are well below the NAAQS, and that two nearby sites in Pennsylvania are currently monitoring PM2.5 concentrations that exceed the annual average $PM_{2.5}$ NAAQS. This analysis indicates that the air quality in New Castle County is different than the air quality at the two Pennsylvania sites, and the air quality analysis supports not associating any part of Delaware with those two areas.

- The New Garden site in Chester County data is typical of a site dominated by regional transport as shown by the seasonal and annual trends analysis. The change in monitoring method from the FRM to an FEM appears to have introduced a high bias into recent design values. Returning that site to the FRM appears to be returning data from that site to trends that are expected, and that follow the trends of other sites within the Philadelphia CBSA that are below the annual average NAAQS.

- The Chester site in Delaware County is significantly impacted by local sources as shown by ambient air quality trends and seasonal patterns, evaluation of high concentration days, speciation data analysis (SANDWICH and urban excess calculations), and emissions vs. distance (Figure 2.19). The Chester site is therefore not representative of the larger Philadelphia CBSA.

Examination of the specific site characteristics also indicates high potential for nearby source impact.

Delaware concludes from this ambient air quality analysis that the New Garden and Chester monitoring sites are not representative of the larger Philadelphia CBSA, and that no part of Delaware, including New Castle County, should be designated as nonattainment due to the air quality in any nearby area.

3 METEOROLOGY (WEATHER/TRANSPORT PATTERNS)

3.1 General Comments

EPA recommends that states consider meteorology in areas included versus excluded from the nonattainment area, as one of the factors in determining appropriate nonattainment area boundaries. Given that monitoring data indicates all areas of Delaware are attaining the $PM_{2.5}$ standard, this analysis focuses on how meteorology may link Delaware to any nearby nonattainment area that the EPA may associate with Delaware.

3.2 Trajectory Cluster Analysis

Back trajectories provide information on the origins of air mass and often used in air pollution analysis. Cluster analysis groups similar air masses originating from similar geographic regions, and it can provide information on pollution species with similar chemical histories. They are useful in evaluating trends in concentrations by air mass. Delaware performed back trajectory cluster analyses for its MLK site in Wilmington, and the Chester monitoring site in Pennsylvania, and evaluated if the two sites are impacted differently.

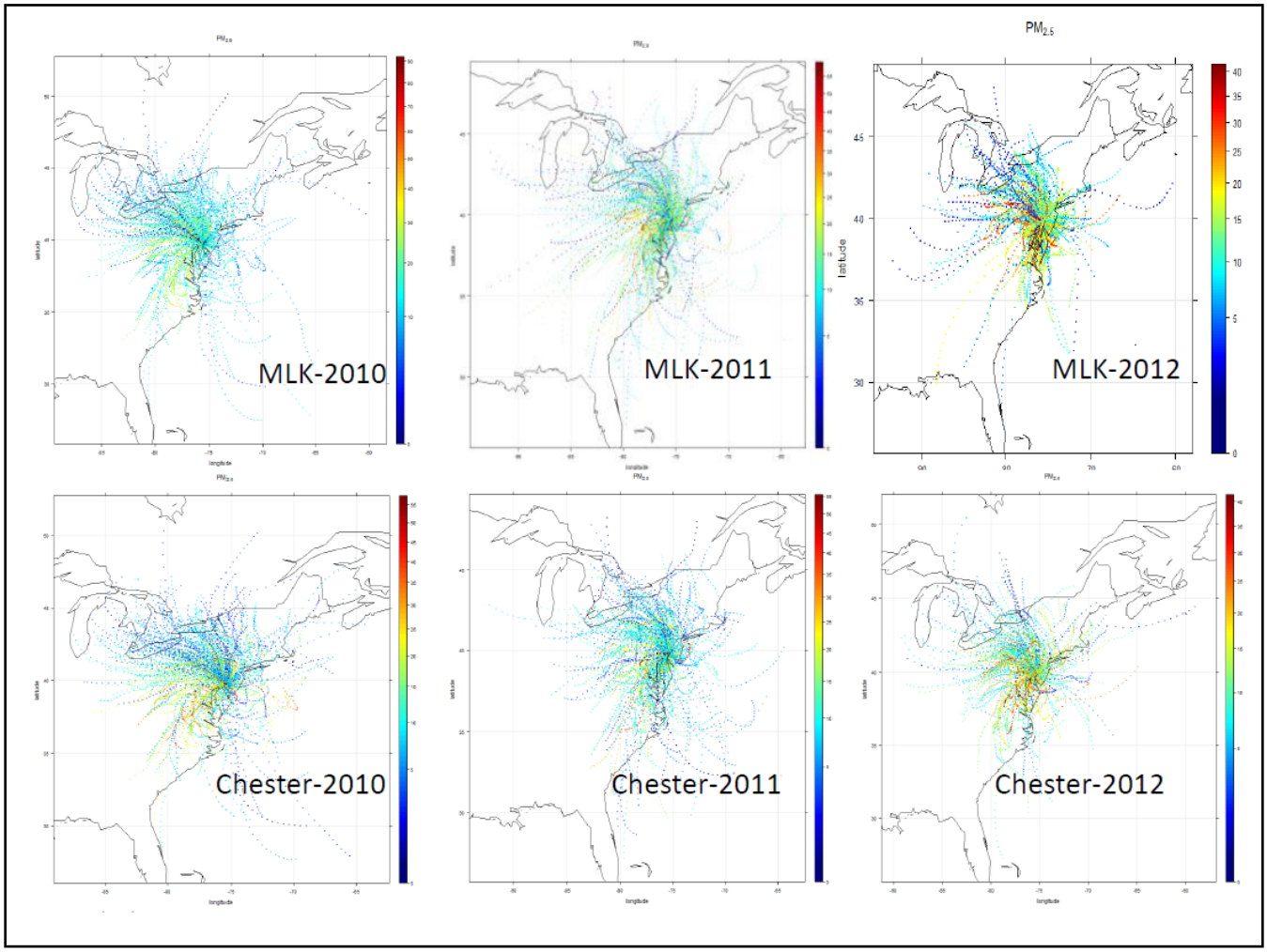
Back trajectories needed for the cluster analysis are generated for these two locations with the Hybrid Single Particle Lagrangian Integrated Trajectory Model (HYSPLIT).[9] We limit the analysis to the most recent three years of meteorological data – 2010 to 2012. For our initial analysis we generated 24-hour back trajectories for these two locations at 2:00 pm using the EDAS (Eta Data Assimilation System) data archives produced by the National Weather Service's National Centers for Environmental Prediction (NCEP).

Additional information on this model can be found on NCEP's website.[10] The tools that we used in the trajectory cluster analysis are R[11] (A Language and Environment for Statistical Computing), and openair package for R[12,13].

For our initial analysis we plotted back trajectories colored by the $PM_{2.5}$ concentrations observed at MLK DE and Chester PA monitors shown in Figure 3.1. From this figure we can make out that MLK DE and Chester PA monitors are impacted differently, that is; different air masses are bringing different levels of $PM_{2.5}$ to these two monitors. Without further analysis, however, we cannot make out what these differences are.

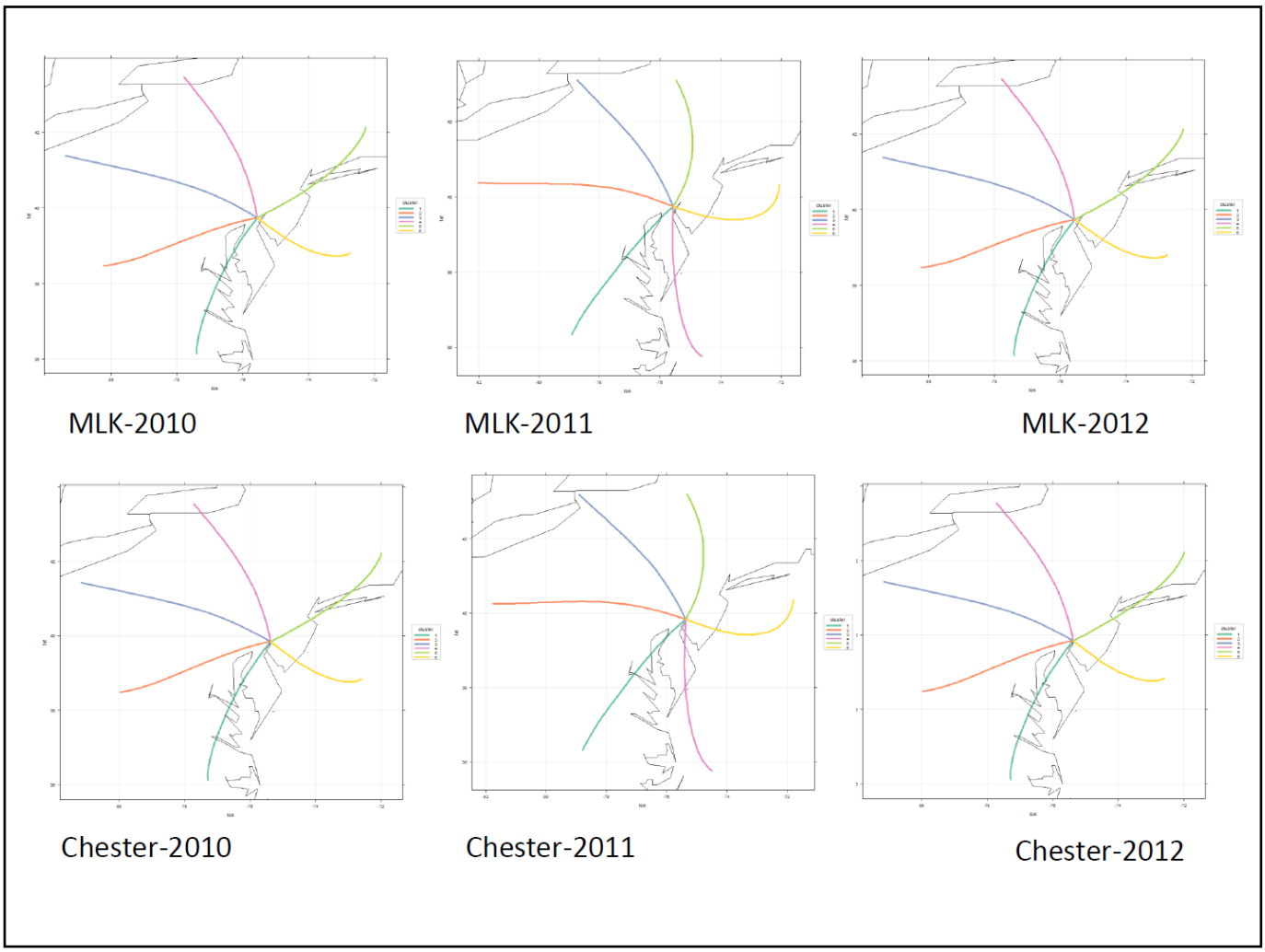
[9] http://ready.arl.noaa.gov/HYSPLIT.php
[10] http://www.nco.ncep.noaa.gov/pmb/products/
[11] http://www.R-project.org
[12] Carslaw, D.C. and K. Ropkins, (2012). Open air — an R package for air quality data analysis. Environmental Modelling & Software. Volume 27-28, 52-61.
Carslaw, D.C. (2013). The open air manual — open-source tools for analyzing air pollution data. Manual for version 0.8-0, King's College London.
[13] http://www.openair-project.org

Figure 3.1: 24-hour HYSPLIT back trajectories originated at 2:00 pm from MLK DE (top) and Chester PA (bottom) monitors for 2010-2012 colored by $PM_{2.5}$ concentration ($\mu g/m^3$)



Back trajectory cluster analysis is likely to explain the differences in impacts at these monitors. For this analysis we generated 24-hour back trajectories at 3-hour intervals starting at hour 0. We chose to lump the trajectories into six clusters. To simplify the analysis we chose to display the mean trajectories for each of the clusters, and they are shown in Figure 3.2. In general, clusters 1 through 4 seem to represent flows from west, south-west or north-west directions, whereas clusters 5 and 6 from north-east/east and east. The directions of the clusters can change significantly from year to year as noticed in Figure 3.2. The mean cluster paths, although they can explain the origins of the clusters, cannot explain how the $PM_{2.5}$ concentrations vary from cluster to cluster and how they vary temporally.

Figure 3.2: Six clusters to back trajectories at MLK DE (top) and Chester PA (bottom) monitors for 2010-2012 showing the mean trajectory for each cluster



To further explain the differences in the mean cluster paths, we analyzed how the $PM_{2.5}$ concentrations vary by cluster and by month. In order to accomplish this, we merged the cluster data with 24-hour $PM_{2.5}$ measurements at MLK DE and Chester PA; this makes it possible to identify the data by cluster size. In merging the two datasets it is not necessary to retain information for all 24 back trajectory hours; therefore we extracted the cluster size for the first hour, which provides $PM_{2.5}$ data identified by cluster. The numbers of trajectories in each cluster by monitor are summarized in Table 3.1.

Table 3.1: Numbers of Each Cluster by Monitor

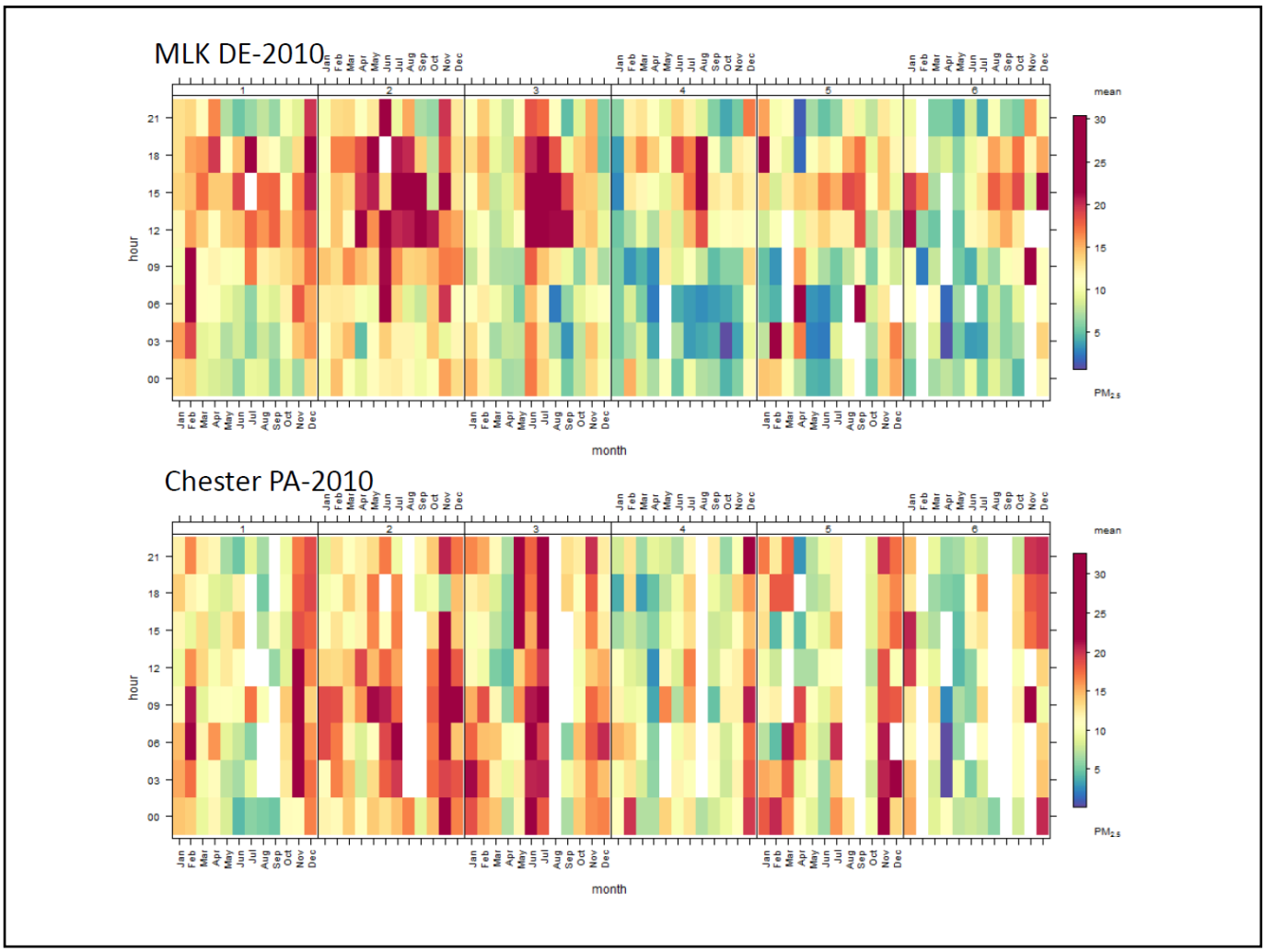
Monitor	***Year***	***C1***	***C2***	***C3***	***C4***	***C5***	***C6***
MLK DE	2010	585	558	494	306	429	298
	2011	715	700	520	357	302	295
	2012	584	448	718	529	339	300
Chester PA	2010	585	581	483	298	433	289
	2011	693	685	549	350	315	297
	2012	557	438	738	543	343	300

We notice that for the MLK DE monitor the sequence of dominant clusters in 2010 is 1, 2, 3, 5, 4, and 6; in 2011 it is 1, 2, 3, 4, 5, and 6; in 2012 it is 3, 1, 4, and 2, followed by 5 and 6. We also notice the same behavior at the Chester PA monitor. Although the dominant clusters vary from year to year (from west, north-west, south-west, and south), they are the same for both the monitors.

The analysis of how the $PM_{2.5}$ concentrations vary temporally by cluster is more meaningful. A graphical representation of the variation in the mean $PM_{2.5}$ concentrations by month and hour of the day at both the monitors is displayed in Figure 3.3, Figure 3.4, and Figure 3.5.

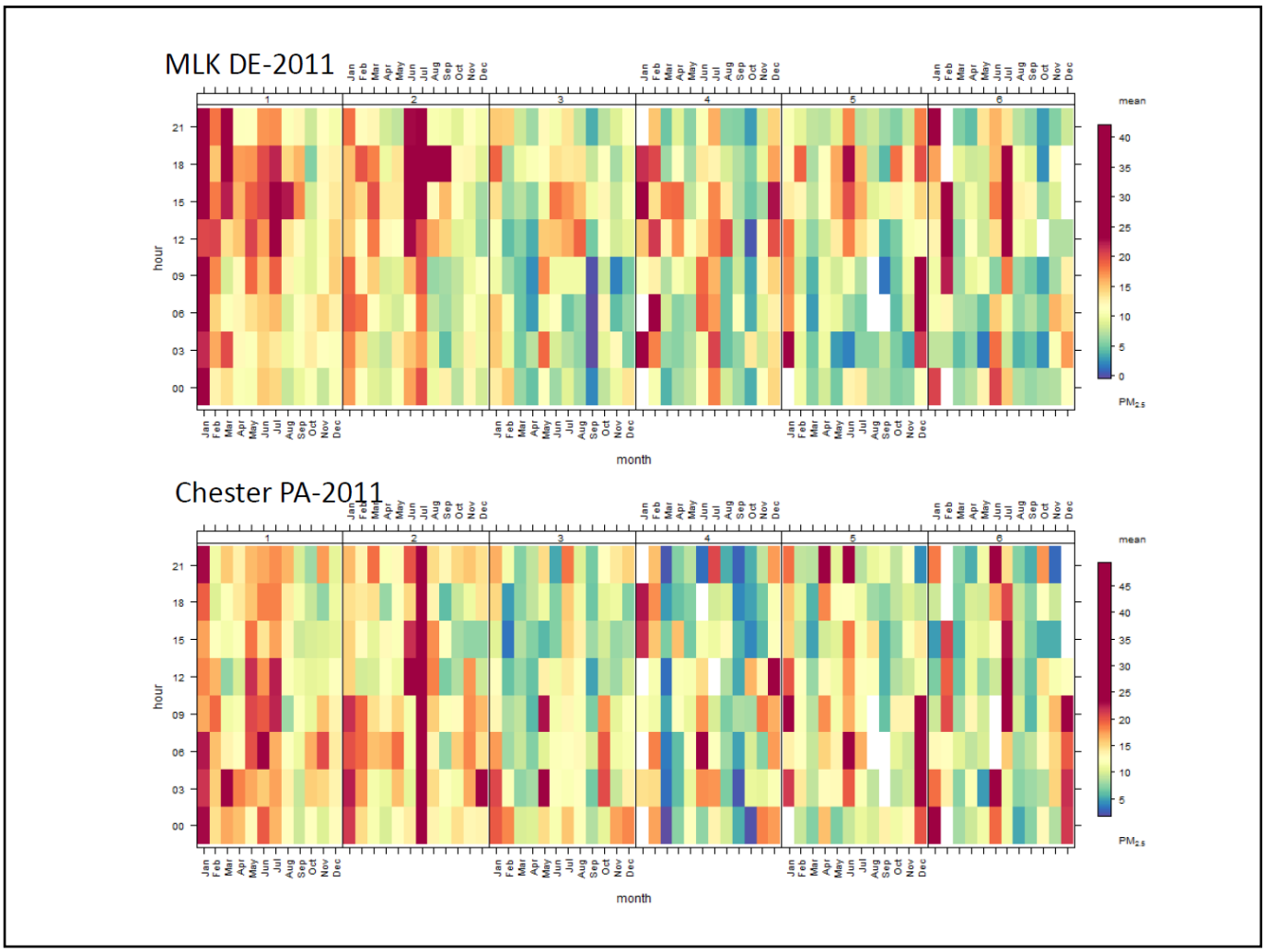
Although the dominant clusters are the same for both the monitors, the differences in temporal behavior are clearly evident in these figures. For example, in year 2010 cluster 1 (north-west) at MLK DE is impacted more in the winter and summer months while cluster 1 at Chester PA monitor is impacted more in the winter months; furthermore, morning and afternoon differences in $PM_{2.5}$ variations are also evident, which is a sign of local, rather than regional, impacts at the Chester PA monitor. Similar temporal differences are also observed in clusters 3, 4 and 5. Clusters 5 and 6 (easterly flows) show somewhat different behavior; in winter the Chester PA monitor is impacted more than the MLK DE monitor. In general in winter months the Chester PA monitor shows more variation in $PM_{2.5}$ concentrations in all the clusters, which is a sign of local impacts.

Figure 3.3: Variation of $PM_{2.5}$ by month and hour of the day by wind direction cluster at MLK DE (top) and Chester PA (bottom) monitors for 2010



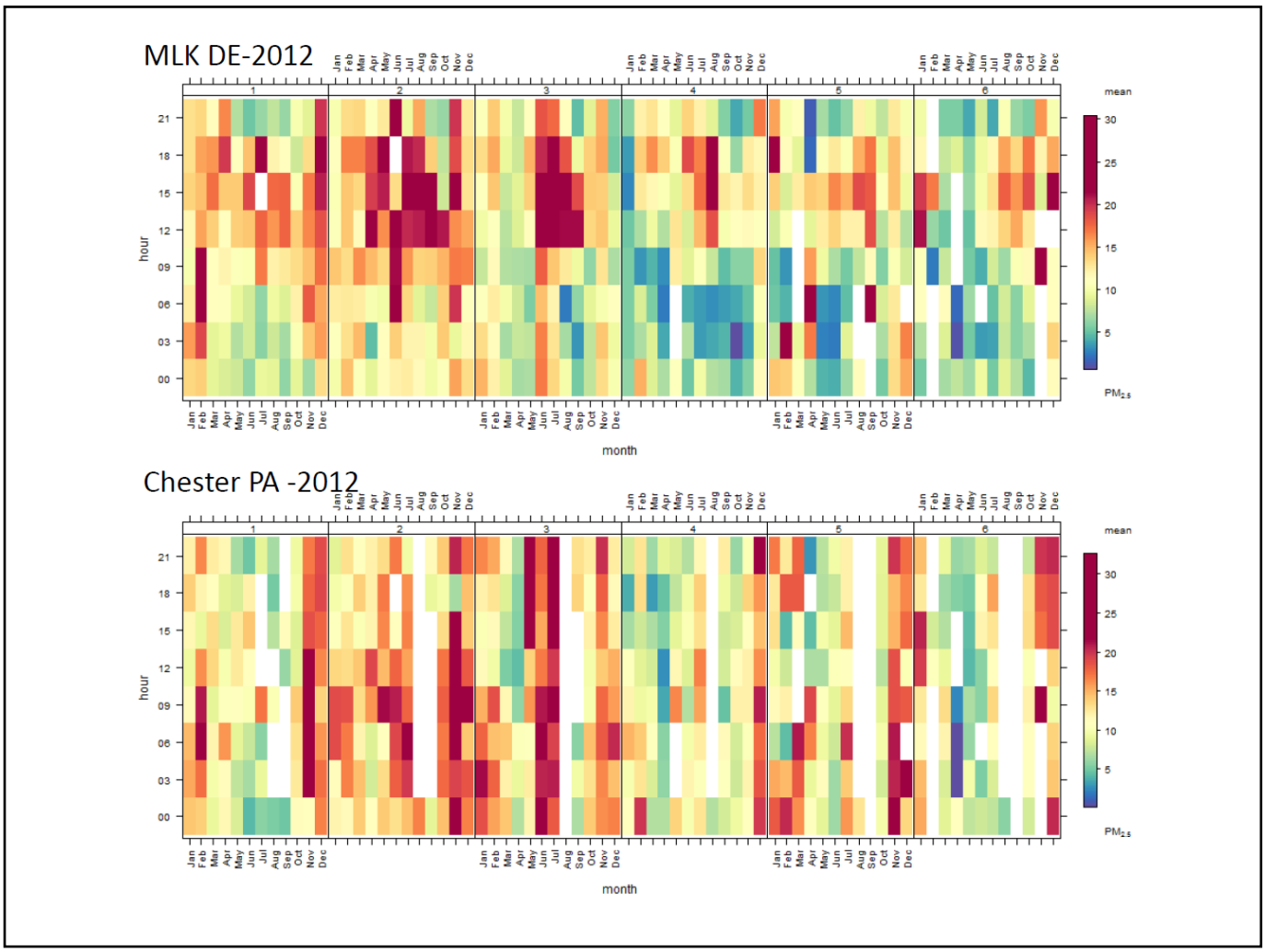
The sequence of dominant clusters at both the monitors in 2011 is the same. The behavior in variation of PM-$_{2.5}$ concentrations by cluster in 2011 is similar to that observed for 2010.

Figure 3.4: Variation of $PM_{2.5}$ by month and hour of the day by wind direction cluster at MLK DE (top) and Chester PA (bottom) monitors for 2011



The sequence of dominant clusters in 2012 is the same at both the monitors. The behavior in variation of PM-$_{2.5}$ concentrations by cluster in 2012 is similar to that observed in 2010 and 2011.

Figure 3.5: Variation of $PM_{2.5}$ by month and hour of the day by wind direction cluster at MLK DE (top) and Chester PA (bottom) monitors for 2012



3.3 Summary of Trajectory Cluster Analysis

In this analysis for three years of meteorology, we noticed that the dominant clusters are the same for both the monitors. Between the two monitors, we witnessed temporal differences in $PM_{2.5}$ concentrations from cluster to cluster. In the morning hours the Chester PA monitor shows higher $PM_{2.5}$ concentrations than the MLK DE monitor, and also in winter months the Chester PA monitor shows more variation in $PM_{2.5}$ concentrations in all the clusters. These observations demonstrate that while both the monitors are impacted by regional sources, the Chester PA monitor is impacted more by local sources when compared to the MLK DE monitor.

4 EMISSIONS AND EMISSIONS-RELATED DATA

As in past $PM_{2.5}$ designations, EPA will be evaluating the entire Philadelphia CBSA, plus adjacent counties (CBSA+) that may contribute to a violation. Thus, EPA recommends that states consider emissions potentially included versus excluded from the CBSA nonattainment area as one of the factors in determining appropriate nonattainment area boundaries.

4.1 2011 EPA National Emissions Inventory

The latest inventory available is the 2011 National Emissions Inventory (NEI), version 1. The 2011 NEI tons per year (tpy) emission data for counties in the Philadelphia CBSA+ are provided below in Table 4.1.[14] The data shows that in 2011, New Castle County total $PM_{2.5}$-related pollutant emissions were ranked 10th.[15]

Table 4.1: 2011 NEI Philadelphia CBSA+

State	County	NH3	*NH3 Rank*	NOX	*NOX Rank*	PM25	*PM25 Rank*	SO2	*SO2 Rank*	VOC	*VOC Rank*	SUM	*SUM Rank*
PA	York	3495	*3*	33810	*1*	3758	*2*	26590	*1*	14024	*5*	81677	*1*
PA	Lancaster	15753	*1*	13881	*9*	4107	*1*	1802	*11*	13584	*6*	49127	*2*
PA	**Philadelphia**	**801**	***9***	**22394**	***2***	**2722**	***4***	**2788**	***5***	**17548**	***1***	**46254**	***3***
PA	Northampton	614	*17*	14074	*8*	2274	*7*	20024	*2*	5404	*20*	42390	*4*
PA	Berks	4095	*2*	14390	*7*	3023	*3*	6140	*4*	12848	*8*	40495	*5*
PA	**Montgomery**	**779**	***10***	**17275**	***4***	**2508**	***6***	**2522**	***6***	**15308**	***4***	**38393**	***6***
PA	**Delaware**	**595**	***18***	**17964**	***3***	**2579**	***5***	**6559**	***3***	**10166**	***12***	**37863**	***7***
NJ	Middlesex	526	*20*	14766	*6*	1843	*11*	771	*17*	16651	*2*	34558	*8*
PA	**Bucks**	**1024**	***7***	**13277**	***10***	**1965**	***10***	**2040**	***9***	**15477**	***3***	**33783**	***9***
DE	**New Castle**	**922**	***8***	**15866**	***5***	**2099**	***8***	**2383**	***7***	**11469**	***10***	**32739**	***10***
PA	**Chester**	**1906**	***5***	**12177**	***11***	**2002**	***9***	**2178**	***8***	**10454**	***11***	**28717**	***11***
NJ	Monmouth	740	*12*	10365	*12*	1307	*16*	670	*18*	12541	*9*	25624	*12*
NJ	Ocean	335	*25*	7972	*17*	1397	*15*	479	*22*	13185	*7*	23367	*13*
PA	Lehigh	620	*16*	8921	*13*	1398	*14*	1323	*14*	9748	*14*	22010	*14*
NJ	**Burlington**	**556**	***19***	**8448**	***15***	**1405**	***13***	**525**	***21***	**9981**	***13***	**20915**	***15***
NJ	**Camden**	**244**	***28***	**8660**	***14***	**1772**	***12***	**611**	***19***	**9203**	***15***	**20490**	***16***
NJ	**Gloucester**	**362**	***24***	**8015**	***16***	**1113**	***18***	**1366**	***13***	**8940**	***16***	**19796**	***17***
NJ	Mercer	254	*27*	7513	*18*	1260	*17*	948	*15*	7560	*17*	17535	*18*
DE	Kent	2462	*4*	5673	*21*	922	*21*	1839	*10*	4298	*23*	15193	*19*
NJ	Somerset	264	*26*	5960	*20*	665	*23*	241	*28*	7015	*19*	14145	*20*
NJ	Atlantic	241	*29*	4905	*22*	900	*22*	425	*24*	7062	*18*	13534	*21*
MD	Harford	495	*21*	6169	*19*	945	*20*	525	*20*	5163	*21*	13298	*22*

[14] Paved road dust emissions were not included in the summaries due to inconsistencies in data (e.g. Philadelphia County had 2011 NEI emissions of 17 tpy of $PM_{2.5}$ from paved road dust while New Castle County had 408 tpy). Wildfires were also removed, since they are not an anthropogenic source and uncontrollable. They were also calculated by EPA using satellites, which do not match DAQ's estimates (EPA 502 tpy vs. DE 20 tpy of $PM_{2.5}$). Biogenic emissions are also not included in any of the emission tables in this TSD.

[15] Due to the EME Homer City vs. EPA court decision, VOC and ammonia are required to be considered as precursors. Henceforth, the "SUM" of all $PM_{2.5}$-related pollutants will be used as the final indicator of relative rankings (NOTE: Delaware could not perform a weighted emissions score due to lack of recent speciated data for each county in the CBSA).

State	County	NH3	*NH3 Rank*	NOX	*NOX Rank*	PM25	*PM25 Rank*	SO2	*SO2 Rank*	VOC	*VOC Rank*	SUM	*SUM Rank*
NJ	Cumberland	459	*22*	4078	*23*	1081	*19*	792	*16*	4888	*22*	11299	*23*
MD	**Cecil**	**651**	***15***	**3653**	***24***	**589**	***25***	**323**	***27***	**2788**	***26***	**8005**	***24***
NJ	Salem	708	*14*	3239	*26*	453	*28*	1405	*12*	2122	*27*	7926	*25*
NJ	Hunterdon	450	*23*	3446	*25*	434	*29*	328	*25*	3139	*24*	7797	*26*
MD	Queen Anne's	1897	*6*	2943	*27*	626	*24*	449	*23*	1727	*28*	7643	*27*
NJ	Warren	710	*13*	2622	*28*	521	*26*	328	*26*	3010	*25*	7192	*28*
MD	Kent	744	*11*	1026	*29*	487	*27*	204	*29*	1215	*29*	3675	*29*

** **Bold** font indicates those counties which are part of the Philadelphia CBSA

Table 4.2 shows only the Philadelphia CBSA counties, and that in 2011, New Castle County's total $PM_{2.5}$- related pollutant emissions were ranked No. 5th (down from 1st in 2002) and barely above Delaware County. Furthermore, although New Castle's emissions are about the same as Delaware County, the closest DE monitor to the Chester monitor in Delaware County is Bellefonte (~8 mi.), with a 2010-2012 DV of only 9.8 µg/m^3. This is significantly less than the Chester DV of 13.1 µg/m^3, leading Delaware to conclude that local emissions significantly influence the Chester monitor. Details on how New Castle compares with other counties' emission reductions are discussed in section 4.3.

Table 4.2: 2011 NEI Philadelphia CBSA

State	County	NH3	*NH3 Rank*	NOX	*NOX Rank*	PM25	*PM25 Rank*	SO2	*SO2 Rank*	VOC	*VOC Rank*	SUM	*SUM Rank*
PA	Philadelphia County	801	*4*	22394	*1*	2722	*1*	2788	*2*	17548	*1*	46254	*1*
PA	Montgomery County	779	*5*	17275	*3*	2508	*3*	2522	*3*	15308	*3*	38393	*2*
PA	Delaware County	595	*7*	17964	*2*	2579	*2*	6559	*1*	10166	*6*	37863	*3*
PA	Bucks County	1024	*2*	13277	*5*	1965	*6*	2040	*6*	15477	*2*	33783	*4*
DE	**New Castle County**	**922**	***3***	**15866**	***4***	**2099**	***4***	**2383**	***4***	**11469**	***4***	**32739**	***5***
PA	Chester County	1906	*1*	12177	*6*	2002	*5*	2178	*5*	10454	*5*	28717	*6*
NJ	Burlington County	556	*8*	8448	*8*	1405	*8*	525	*10*	9981	*7*	20915	*7*
NJ	Camden County	244	*11*	8660	*7*	1772	*7*	611	*9*	9203	*8*	20490	*8*
NJ	Gloucester County	362	*10*	8015	*9*	1113	*9*	1366	*7*	8940	*9*	19796	*9*
MD	Cecil County	651	*6*	3653	*11*	589	*11*	323	*11*	2788	*11*	8005	*11*

4.2 Emissions Related Data

4.2.1 Population

EPA recommends that states consider the population density and the degree of urbanization in areas included versus excluded from the nonattainment area as one of the factors in determining appropriate nonattainment area boundaries. Population, growth rates, population densities and rankings for the Philadelphia CBSA and surrounding counties (CBSA+) are presented in Table 4.3, and shows that New Castle County ranks:

- 7th for 2010 population for the CBSA+
- 12th in population growth between 2000-2010 for the CBSA+
- 7th in 2010 population density CBSA+

- 5th for 2010 population for the CBSA
- 4th in population growth between 2000-2010 for the CBSA
- 5th in 2010 population density CBSA

Table 4.3: 2000-2010 Population Statistics - Philadelphia CBSA+

State	County	2000[1]	2010[2]	2010 Rank	CBSA Rank	% Growth	CBSA+ Rank	CBSA Rank	Sq. Miles	Pop. Density	CBSA+ Rank	CBSA Rank
PA	**Philadelphia**	**1,517,562**	**1,526,006**	**1**	**1**	**1%**	**25**	**8**	**135**	**11,304**	**1**	**1**
PA	**Montgomery**	**749,409**	**799,874**	**2**	**2**	**7%**	**14**	**5**	**483**	**1,656**	**4**	**4**
NJ	Monmouth	615,253	630,380	3		2%	22		472	1,336	6	
PA	**Bucks**	**597,548**	**625,249**	**4**	**3**	**5%**	**19**	**7**	**607**	**1,030**	**8**	**6**
NJ	Ocean	510,950	576,567	5		13%	4		636	907	10	
PA	**Delaware**	**551,722**	**558,979**	**6**	**4**	**1%**	**23**	**8**	**184**	**3,038**	**2**	**2**
DE	**New Castle**	**500,294**	**538,479**	**7**	**5**	**8%**	**12**	**4**	**426**	**1,264**	**7**	**5**
PA	Lancaster	470,783	519,445	8		10%	9		949	547	16	
NJ	**Camden**	**507,075**	**513,657**	**9**	**6**	**1%**	**24**		**222**	**2,314**	**3**	**3**
PA	**Chester**	**433,208**	**498,886**	**10**	**7**	**15%**	**3**	**2**	**756**	**660**	**13**	**8**
NJ	**Burlington**	**423,329**	**448,734**	**11**	**8**	**6%**	**16**	**6**	**805**	**557**	**14**	**9**
PA	Berks	373,712	411,442	12		10%	10		859	479	18	
NJ	Mercer	350,773	366,513	13		4%	20		226	1,622	5	
PA	Lehigh	311,746	349,497	14		12%	6		347	1,007	9	
PA	Northampton	267,446	297,735	15		11%	8		374	796	12	
NJ	**Gloucester**	**255,946**	**288,288**	**16**	**9**	**13%**	**5**	**3**	**325**	**887**	**11**	**7**
NJ	Atlantic	253,210	274,549	17		8%	11		561	489	17	
MD	Harford	218,914	244,826	18		12%	7		440	556	15	
DE	Kent	126,771	162,310	19		28%	1		591	275	24	
NJ	Cumberland	146,454	156,898	20		7%	13		489	321	20	
NJ	Hunterdon	122,110	128,349	21		5%	18		430	298	22	
NJ	Warren	102,383	108,692	22		6%	15		358	304	21	
MD	**Cecil**	**85,964**	**101,108**	**23**	**10**	**18%**	**2**	**1**	**348**	**291**	**23**	**10**
NJ	Cape May	102,323	97,265	24		-5%	26		255	381	19	
NJ	Salem	64,272	66,083	25		3%	21		338	196	25	
MD	Kent	19,201	20,197	26		5%	17		279	72	26	

1 The April 1, 2000 Population Estimates base reflects changes to the Census 2000 population from the Count Question Resolution program, legal boundary updates, and other geographic program revisions."

2 The data source for April 1, 2010 is the 2010 Census count. Note: All geographic boundaries for the 2000-2010 intercensal estimates are defined as of January 1, 2010.

Citation 2000-2010 data: Table 1. Intercensal Estimates of the Resident Population for Counties of Delaware: April 1, 2000 to July 1, 2010 (CO-EST00INT-01-10). Source: U.S. Census Bureau, Population Division, Release Date: September 2011

http://www.census.gov/popest/data/intercensal/county/CO-EST00INT-01.html

** **Bold** font indicates those counties which are part of the Philadelphia CBSA

Based on population vs. air quality data, Delaware believes that ambient concentrations of $PM_{2.5}$ do not necessarily correlate with population parameters. For instance, Philadelphia County is not violating the NAAQS, while its population and population density is almost three and four times greater, respectively, than Delaware County (nonattainment). Furthermore, the highest Philadelphia County design value is only 11.0 µg/m^3 while Delaware County's is 13.1 µg/m^3, a difference of 3.1 µg/m^3; or about 25% of the NAAQS. Similarly, Camden County NJ has almost twice the population density as New Castle, DE yet Camden's 2012 DVs is only 9.5 µg/m^3, compared to New Castle's highest DV of 10.4 µg/m^3.

To further evaluate the relationship of population vs. DVs, Delaware obtained a listing of the top 25 CBSAs by population from EPA's website, and then looked at the attainment status using 2009-2011 DVs. Delaware performed a statistical analysis of population vs. design values and found insignificant correlation between the two datasets (r = 0.31).[16] Table 4.4 ranks the top CBSAs by population with their corresponding 2009-2011 DVs.

Table 4.4: Top 25 CBSA[17] - Attainment Status (2009-2011 DVs)

CBSA Name	Population 2010	2009-2011 DV
New York-Northern New Jersey-Long Island, NY-NJ-PA	18,919,649	11.9
Los Angeles-Long Beach-Santa Ana, CA	12,844,371	13.9
Chicago-Joliet-Naperville, IL-IN-WI	9,472,584	12.7
Dallas-Fort Worth-Arlington, TX	6,400,511	10.6
Houston-Sugar Land-Baytown, TX	5,976,470	12.4
Philadelphia-Camden-Wilmington, PA-NJ-DE-MD	**5,971,589**	**13.1**
Washington-Arlington-Alexandria, DC-VA-MD-WV	5,609,150	10.8
Miami-Fort Lauderdale-Pompano Beach, FL	5,578,080	7.5
Atlanta-Sandy Springs-Marietta, GA	5,286,296	13.2
Boston-Cambridge-Quincy, MA-NH	4,559,372	10.2
San Francisco-Oakland-Fremont, CA	4,343,381	9.9
Detroit-Warren-Livonia, MI	4,290,722	11.6
Riverside-San Bernardino-Ontario, CA	4,245,005	16.2
Phoenix-Mesa-Glendale, AZ	4,209,070	9.9
Seattle-Tacoma-Bellevue, WA	3,447,886	8.3
Minneapolis-St. Paul-Bloomington, MN-WI	3,285,913	9.7
San Diego-Carlsbad-San Marcos, CA	3,105,115	13.1
St. Louis, MO-IL	2,814,722	13.1
Tampa-St. Petersburg-Clearwater, FL	2,788,151	7.8
Baltimore-Towson, MD	2,714,546	11.1
Denver-Aurora-Broomfield, CO	2,554,569	8.1
Pittsburgh, PA	2,357,951	13.7
Portland-Vancouver-Hillsboro, OR-WA	2,232,896	7.9
Sacramento--Arden-Arcade--Roseville, CA	2,154,583	10
San Antonio-New Braunfels, TX	2,153,891	9.2
Correlation of Population vs. Design Values	**0.31**	

Setting the low correlation score of 0.31 (population vs. DV) aside for the moment, Delaware is well aware that some source categories utilize population as the activity data in non-point (area) source emission calculations. Based on previous EPA designation letters to Delaware, this is one of the main reasons EPA includes population as one of the 5-factor analysis. However, in the case of Delaware emissions, the only area source categories in the 2011 NEI that are strictly population-dependent are:

[16] An r score of 0.75 or higher would suggest a correlation, therefore a score of 0.31 is highly non-correlated.
[17] http://www.city-data.com/top1.html

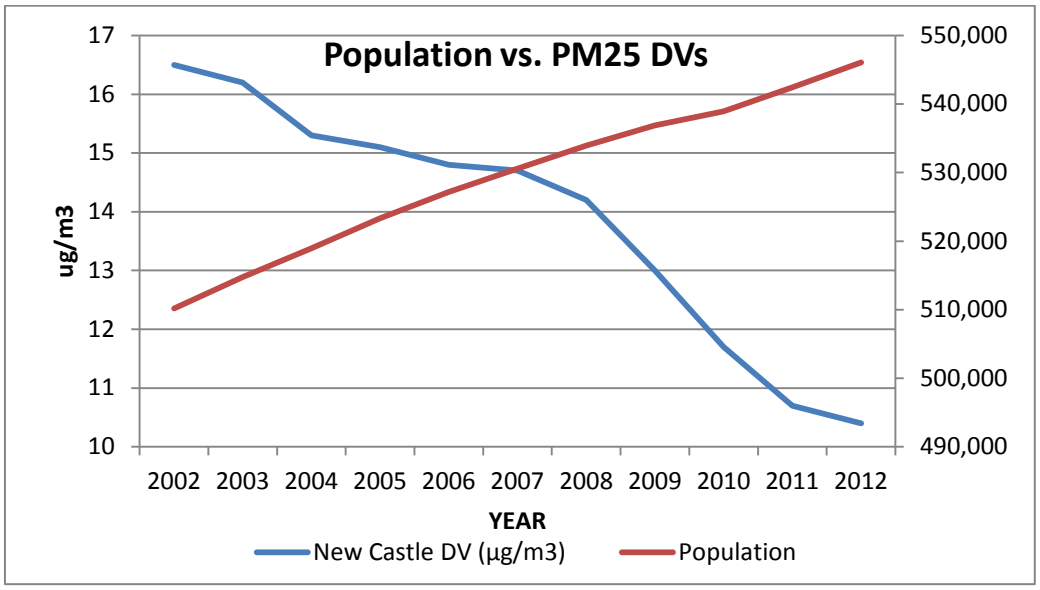
- Consumer and Commercial Products,
- Industrial Adhesives,
- AIM Coatings, and
- Commercial Cooking
- Stage I and Stage 2
- Dry Cleaning

Of these source categories, all but commercial cooking exclusively emits VOC, which are already strictly controlled via reasonably available control technology (RACT) under 7 DE Admin. Code 1124. The commercial cooking category includes both $PM_{2.5}$ and VOC which are not economically conducive to emission control (discussed in more detail in Section 4.4). Furthermore, due to low stack heights and flow rates, Delaware considers VOC and $PM_{2.5}$ from commercial cooking to be localized, and not a regional contributor.

There are also some categories that rely on occupied housing numbers, which are indirectly related to human population. The residential open burning category and residential wood combustion are the two categories which use housing data. Delaware already strictly regulates open burning through 7 DE Admin. Code 1113, and woodstoves are regulated by the EPA under New Source Performance Standards. Either way, due to low stack heights and flow rates from fireplaces and ground-level open burning, Delaware considers emission contribution from these categories to be localized and not contributors to $PM_{2.5}$ concentrations at the Chester monitor.

Figure 4.1 plots New Castle County's population against New Castle DVs. This figure illustrates that population is not well correlated with air quality data.

Figure 4.1: NCC 3-year Rolling DVs vs. NCC Population (over 10 years)



In summary, Delaware believes population and related criteria are not suitable as a tool in making boundary determinations for New Castle County, or at the very least should be low priority in EPA boundary considerations.

4.2.2 Expected growth

Growth in New Castle County is likely to be regulated beyond most other areas because of Delaware's existing environmentally protective programs. These include Delaware's New Source Review (NSR) program, Delaware's Coastal Zone Program, where offsets are required for any increase in emissions (no de minimis), and the Livable Delaware initiative which is designed to promote smart growth principles.

Table 4.5 shows the 2010 and 2035[18] populations, rankings and growth rates of counties within the CBSA/CBSA+. It can be seen that of the CBSA+ nonattaining counties, Chester and Delaware are ranked 8th and 10th for population growth in 2035, and 7th and 25th for growth rate rankings, respectively.

Meanwhile, New Castle County ranks 9th and 21st for 2035 population and 2035 growth rate, respectively. Thus, while all three nearby counties have similar rankings in 2010, New Castle County has one of the lowest projected growth rates for 2035. Note that in the CBSA, New Castle is ranked 7th out of 10 counties. Consequently, New Castle future emission increases due to population can reasonably be expected to be minimal.

Table 4.5: 2010-2035 Population, Growth and Rankings – Philadelphia CBSA+

State	County **	2010	2035 (1)	CBSA+ Rank	Absolute Change	2035 Growth Rate	CBSA+ Rank	CBSA Rank
PA	Lehigh	349,497	833,441	3	483,944	58%	1	
MD	**Cecil**	**101,108**	**156,133**	**21**	**55,025**	**35%**	**2**	**1**
NJ	Ocean	576,567	776,300	4	199,733	26%	3	
NJ	Atlantic	274,549	357,570	17	83,021	23%	4	
PA	Northampton	297,735	384,873	15	87,138	23%	5	
NJ	**Gloucester**	**288,288**	**369,370**	**16**	**81,082**	**22%**	**6**	**2**
PA	**Chester**	**498,886**	**622,500**	**8**	**123,614**	**20%**	**7**	**3**
NJ	Warren	108,692	134,200	23	25,508	19%	8	
DE	Kent	162,310	199,065	19	36,755	18%	9	
PA	Lancaster	519,445	632,595	7	113,150	18%	10	
NJ	**Burlington**	**448,734**	**541,200**	**11**	**92,466**	**17%**	**11**	**4**
PA	**Bucks**	**625,249**	**753,780**	**5**	**128,531**	**17%**	**12**	**5**
MD	Harford	244,826	292,620	18	47,794	16%	13	
NJ	Cape May	97,265	116,010	24	18,745	16%	14	
MD	Kent	20,197	23,850	26	3,653	15%	15	
NJ	Hunterdon	128,349	147,800	22	19,451	13%	16	
NJ	Monmouth	630,380	717,900	6	87,520	12%	17	
NJ	Cumberland	156,898	176,060	20	19,162	11%	18	
PA	**Montgomery**	**799,874**	**894,140**	**2**	**94,266**	**11%**	**19**	**6**
PA	Berks	411,442	459,221	13	47,779	10%	20	
DE	**New Castle**	**538,479**	**598,312**	**9**	**59,833**	**10%**	**21**	**7**
NJ	Mercer	366,513	403,980	14	37,467	9%	22	
NJ	Salem	66,083	72,710	25	6,627	9%	23	
NJ	**Camden**	**513,657**	**524,680**	**12**	**11,023**	**2%**	**24**	**8**

[18] The year 2035 was chosen because States have at least until 2020 to achieve compliance with the 2012 NAAQS, and subsequent maintenance plans typically address emissions and control measures, such as mobile budgets maintenance at least 15 years later or more.

State	County **	2010	2035 (1)	CBSA+ Rank	Absolute Change	2035 Growth Rate	CBSA+ Rank	CBSA Rank
PA	**Delaware**	**558,979**	**559,960**	**10**	**981**	**0%**	**25**	**9**
PA	**Philadelphia**	**1,526,006**	**1,480,000**	**1**	**-46,006**	**-3%**	**26**	**10**

Delaware 2010-2035 projections data: Wilmington Area Planning Council, *WILMAPCO 2012 Inter-Regional Report*. http://www.wilmapco.org/wilmapco-council/

** **Bold** font indicates those counties which are part of the Philadelphia CBSA

4.2.3 Traffic and commuting patterns

Table 4.6 shows that New Castle County ranks 5th (on average) for 1) Number of residents commuting to any violating counties, 2) Percent Commuting to any violating counties, 3) Number commuting into and within the CBSA/CBSA+ and 4) Percent commuting into and within CBSA. Of particular importance is the data showing only 6.2% of Delaware commuters going to either Delaware or Chester Counties. And, although this presents evidence that Delaware citizens/commuters contribute some pollution via cars to air quality monitored in each of those Counties, it is small in relation to the previously discussed contributions of local point sources, particularly the Chester monitor in Delaware County[19] as discussed in section 2.7.

Table 4.6: CBSA+ Commuting Patterns

State	County**	Number commuting to any violating counties	CBSA+ Rank	Percent Commuting to any violating counties	CBSA+ Rank	Number commuting into and within CBSA+	CBSA+ Rank	Percent commuting into and within CBSA+	CBSA+ Rank	CBSA Rank
PA	**Chester**	**172,644**	**1**	**70.9%**	**1**	**232,571**	**6**	**95.6%**	**4**	**1**
PA	**Delaware**	**157,218**	**2**	**60.9%**	**2**	**254,548**	**4**	**98.6%**	**1**	**2**
PA	**Montgomery**	**37,819**	**3**	**9.4%**	**3**	**387,702**	**2**	**96.9%**	**3**	**3**
PA	**Philadelphia**	**25,038**	**4**	**4.2%**	**6**	**588,694**	**1**	**98.4%**	**2**	**4**
DE	**New Castle**	**15,794**	**5**	**6.2%**	**4**	**243,130**	**5**	**94.7%**	**5**	**5**
PA	**Berks**	**8,687**	**6**	**4.6%**	**5**	**26,410**	**10**	**13.9%**	**12**	
PA	**Lancaster**	**8,421**	**7**	**3.4%**	**7**	**11,661**	**14**	**4.8%**	**19**	
PA	**Bucks**	**5,177**	**8**	**1.7%**	**11**	**270,365**	**3**	**87.5%**	**8**	**6**
NJ	**Gloucester**	**4,226**	**9**	**3.1%**	**8**	**123,031**	**9**	**89.8%**	**7**	**7**
NJ	**Camden**	**2,922**	**10**	**1.2%**	**12**	**222,034**	**7**	**93.4%**	**6**	**8**
NJ	**Burlington**	**1,751**	**11**	**0.8%**	**13**	**174,516**	**8**	**81.5%**	**9**	**9**
MD	**Cecil**	**1,363**	**12**	**2.9%**	**9**	**14,359**	**11**	**30.2%**	**11**	**10**
PA	Lehigh	706	13	0.4%	14	12,057	13	7.6%	16	
NJ	Salem	604	14	2.1%	10	10,736	15	37.1%	10	
PA	Northampton	359	15	0.3%	18	4,813	20	3.6%	20	
NJ	Mercer	309	16	0.2%	20	13,545	12	8.3%	15	
DE	Kent	294	17	0.4%	16	9,635	16	13.8%	13	

[19] Based on trends and changing their monitor from FEM to FRM, DAQ believes the New Garden monitor in Chester County PA is likely to be attainment based upon 2011-2013 data.

State	County**	Number commuting to any violating counties	CBSA+ Rank	Percent Commuting to any violating counties	CBSA+ Rank	Number commuting into and within CBSA+	CBSA+ Rank	Percent commuting into and within CBSA+	CBSA+ Rank	CBSA Rank
NJ	Atlantic	265	18	0.2%	19	8,953	17	7.2%	17	
MD	Harford	231	19	0.2%	21	1,764	23	1.4%	23	
NJ	Cumberland	213	20	0.3%	17	6,522	19	10.6%	14	
NJ	Monmouth	196	21	0.1%	23	2,842	21	1.1%	24	
NJ	Ocean	145	22	0.1%	24	6,902	18	3.0%	22	
NJ	Warren	71	23	0.1%	22	430	25	0.8%	25	
MD	Kent	40	24	0.4%	15	670	24	7.1%	18	
NJ	Hunterdon	21	25	0.0%	25	2,012	22	3.3%	21	
MD	Queen Anne's	0	26	0.0%	26	0	26	0.0%	26	
NJ	Middlesex	0	26	0.0%	27	0	26	0.0%	26	
NJ	Somerset	0	26	0.0%	28	0	26	0.0%	26	
PA	York	0	26	0.0%	29	0	26	0.0%	26	

** Bold font indicates those counties which are part of the Philadelphia CBSA

4.2.4 Vehicle Miles Traveled

Table 4.7 shows that while New Castle County is ranked 4th in the CBSA+ for 2010 vehicle miles traveled (VMT), relative to 2002 vehicle miles traveled (VMT), New Castle County had the 18th lowest growth rate at ***negative*** 3%, and was ranked 8th out of 10 Counties in the Philadelphia CBSA.

Table 4.7: CBSA+ 2002-2010 Vehicle Miles Traveled and Rankings

State	County**	2002 (million VMT)	2010 (million VMT)	*CBSA+ Rank*	% Growth	*CBSA+ Rank*	*CBSA Rank*
PA	**Montgomery**	**4,677**	**6,452**	**1**	**38%**	**1**	**1**
NJ	Salem	**734**	977	25	33%	2	
PA	**Chester**	**3,128**	**4,134**	**7**	**32%**	**3**	**2**
NJ	Cape May	**749**	987	24	32%	4	
NJ	Atlantic	**2,236**	2,766	14	24%	5	
PA	**Bucks**	**3,830**	**4,686**	**5**	**22%**	**6**	**3**
NJ	**Burlington**	**3,748**	**4,449**	**6**	**19%**	**7**	**4**
NJ	Monmouth	5,146	6,098	2	18%	8	
NJ	**Gloucester**	**2,312**	**2,610**	**16**	**13%**	**9**	**5**
NJ	Warren	1,473	1,556	21	6%	10	
MD	Harford	2,208	2,322	17	5%	11	
NJ	Ocean	3,641	3,705	10	2%	12	
PA	**Delaware**	**3,513**	**3,545**	**11**	**1%**	**13**	**6**
PA	**Cecil**	**1,340**	**1,350**	**22**	**1%**	**14**	**7**
PA	Lehigh	2,738	2,720	15	-1%	15	
DE	Kent	1,633	1,620	20	-1%	16	

State	County**	2002 (million VMT)	2010 (million VMT)	*CBSA+ Rank*	% Growth	*CBSA+ Rank*	*CBSA Rank*
PA	Lancaster	4,004	3,964	8	-1%	17	
DE	**New Castle**	**5,338**	**5,201**	**4**	**-3%**	**18**	**8**
NJ	Hunterdon	1,893	1,843	19	-3%	19	
NJ	Cumberland	**1,166**	1,115	23	-4%	20	
NJ	**Camden**	**4,332**	**3,880**	**9**	**-10%**	**21**	**9**
PA	Northampton	2,132	1,871	18	-12%	22	
NJ	Mercer	3,869	3,286	12	-15%	23	
PA	Berks	3,952	3,128	13	-21%	24	
PA	**Philadelphia**	**10,213**	**5,579**	**3**	**-45%**	**25**	**10**

Data sources:
2010 non-DE VMT - http://www.epa.gov/airquality/particlepollution/designations/2012standards/techinfo.htm
2002 and 2010 Delaware VMT: http://www.deldot.gov/information/projects/hpms/pages/hpms_2011.shtml
** Bold font indicates those counties which are part of the Philadelphia CBSA

Regardless of the fact that Montgomery County, PA ranks 1st in 2010 VMT, and also 1st in 2002-2010 VMT growth, the Montgomery County, PA 2012 DV is only 9.8 µg/m^3. And, although Delaware county VMT has stayed relatively the same since 2002, its 2010-2012 DV remains the highest in the CBSA.

Therefore, if increasing levels of VMT can result in non-violations, and New Castle VMT growth has been negative, Delaware believes EPA should not consider VMT (and thus commuting) as a possible reason to include New Castle County in any nonattainment area.

4.3 Emission Reductions

4.3.1 General Discussion

Over the past decade Delaware and Regional Planning Organizations have conducted many studies relative to visibility and fine particulate matter ($PM_{2.5}$) concerns.[20,21,22,23] The studies included modeling, emissions analysis and source contribution assessments. As a result, Delaware learned that sulfate was the largest contributor to $PM_{2.5}$ nonattainment in the eastern United States, followed by nitrates, organic compounds and, depending on the location of the monitor to highways and/or point sources, direct $PM_{2.5}$.

These studies also reveal that the previous $PM_{2.5}$ nonattainment status for both Delaware and the Philadelphia Combined Statistical Area CSA (Philadelphia-Camden-Wilmington, PA-NJ-DE-MD) was caused primarily by a combination of underlying long-range interstate transport of sulfate and nitrates from power plants in the Ohio River valley, and local sources of direct $PM_{2.5}$ (mobile and point). Since sulfur dioxide (SO_2) and oxides of nitrogen (NOx) are precursors to sulfate and nitrate; SO_2 and NOx are

[20] Contributions to Regional Haze in the Northeast and Mid-Atlantic United States Mid-Atlantic/Northeast Visibility Union (MANE-VU) Contribution Assessment, Prepared by NESCAUM for the Mid-Atlantic/Northeast Visibility Union (MANE-VU), August 2006
[21] *A Guide to Mid-Atlantic Regional Air Quality*, Mid-Atlantic Regional Air Management Association, October 2005
[22] The Nature of the Fine Particle and Regional Haze Air Quality Problems in the MANE-VU Region: A Conceptual Description, by NESCAUM Boston, MA November 2, 2006
[23] Philip K. Hopke and Eugene Kim, *Analysis of Speciation Trends Network Data Measured at the State of Delawar*e, Center for Air Resources Engineering and Science Clarkson University, Potsdam, NY, January 20, 2005

the largest pollutants of concern due to regional and long-range transport, while emissions of direct $PM_{2.5}$ and certain carbonaceous compounds tend to affect air quality more on a local level, particularly onroad mobile sources. Thus, it is generally understood that sulfates and nitrates are more regional in nature, while direct $PM_{2.5}$ and volatile organic compounds (VOC) are more locally-oriented.

All non-trivial Delaware sources of $PM_{2.5}$-related pollutants are currently well controlled.

4.3.2 Delaware's 2012 Point Source Reductions Since 2002

As can be seen in Table 4.8, total 2012 emissions of direct $PM_{2.5}$ and its precursors from New Castle County's largest point sources[24] decreased 87% between 2002 and 2012. This included a massive 99% reduction in SO_2, followed by a 65% reduction in direct $PM_{2.5}$, and a 52% decrease of NOx. VOC reductions of 54% have taken place since the early 1990s due to Delaware's ozone nonattainment issues over the years. NH_3 emissions have been reduced 52%, even though New Castle County emissions of ammonia in 2002 from these largest point sources were only 82 tons per year (tpy).

Table 4.8: New Castle County - Top Point Source Emitters in 2002 and 2012

New Castle Top Emitting Facilities	NH3		NOx		SO2		PM2.5		VOC		Sum of PM2.5 related Pollutants	
	2002	2012	2002	2012	2002	2012	2002	2012	2002	2012	2002	2012
Calpine Edge Moor	30	16	3,138	463	9,854	48	517	4	36	33	13,575	564
Calpine Hay Road	0	1	566	696	11	13	3	142	10	45	590	897
DE City Refinery	43	12	3,555	2,083	34,096	304	905	312	829	208	39,428	2,919
DuPont Edgemoor	1	1	35	29	92	21	27	1	83	98	239	150
DuPont Experimental Station	3	3	208	176	593	226	37	18	8	11	849	434
Evraz Steel	0	0	125	227	11	40	45	59	67	67	248	393
Formosa	4	6	31	31	0	1	35	15	124	69	194	122
TOTALS	**82**	**39**	**7,658**	**3,705**	**44,658**	**653**	**1,569**	**551**	**1,157**	**531**	**57,126**	**7,491**
2002-2012 % Reduction	**52%**		**52%**		**99%**		**65%**		**54%**		**87%**	

4.3.3 CBSA Emission Reductions between 2002 and 2011

Table 4.9, Table 4.10, and Table 4.11 contain emissions data showing the Philadelphia CBSA emissions in 2002 and 2011, along with the corresponding emission reductions and rankings. As can be seen from the tables, New Castle ranked 1st of the 10 counties in total $PM_{2.5}$-related emissions during 2002. On the other hand, due to the significant control measures Delaware has implemented since 2002, New Castle now ranks 5th in total emissions, and more importantly, ranks 1st in total emission reductions.

[24] 2012 emissions ≥ 50 tpy for any PM2.5-related pollutant

Table 4.9: Philadelphia CBSA 2002 Emissions and Rank

State	County	NH3	NOX	PM25	SO2	VOC	SUM	*SUM Rank*
DE	New Castle	1940	29995	3920	50155	19917	105926	*1*
PA	Philadelphia	1084	30595	2988	9508	35725	79900	*2*
PA	Montgomery	1450	25686	3642	5171	29971	65920	*3*
PA	**Delaware**	**870**	**23699**	**2292**	**16028**	**17287**	**60175**	***4***
PA	Bucks	1774	19800	2881	3825	23218	51497	*5*
PA	Chester	2521	18476	3075	5507	17853	47432	*6*
NJ	Burlington	1524	17832	2102	3429	18599	43486	*7*
NJ	Gloucester	1003	14106	1411	7169	16008	39696	*8*
NJ	Camden	1207	14785	1461	1909	16352	35713	*9*
MD	Cecil	530	4669	1019	640	6050	12908	*11*

Table 4.10: Philadelphia CBSA 2011 Emissions and Rank

State	County	NH3	NOX	PM25	SO2	VOC	SUM	*Rank*
PA	Philadelphia	801	22394	2722	2788	17548	46254	1
PA	Montgomery	779	17275	2508	2522	15308	38393	2
PA	Delaware	595	17964	2579	6559	10166	37863	3
PA	Bucks	1024	13277	1965	2040	15477	33783	4
DE	New Castle	922	15866	2099	2383	11469	32739	5
PA	Chester	1906	12177	2002	2178	10454	28717	6
NJ	Burlington	556	8448	1405	525	9981	20915	7
NJ	Camden	244	8660	1772	611	9203	20490	8
NJ	Gloucester	362	8015	1113	1366	8940	19796	9
MD	Cecil	651	3653	589	323	2788	8005	11

Table 4.11: Philadelphia CBSA 2002-2011 Reductions and Rankings

State	County	NH3	*NH3 Rank*	NOX	*NOX Rank*	PM25	*PM25 Rank*	SO2	*SO2 Rank*	VOC	*VOC Rank*	SUM	*SUM Rank*
DE	**New Castle**	**1018**	***1***	**14129**	***1***	**1821**	***1***	**47772**	***1***	**8448**	***4***	**73188**	***1***
PA	Philadelphia	283	*8*	8201	*4*	266	*8*	6720	*3*	18177	*1*	33646	*2*
PA	Montgomery	671	*5*	8411	*3*	1134	*2*	2649	*7*	14663	*2*	27527	*3*
NJ	Burlington	968	*2*	9384	*2*	697	*5*	2904	*6*	8618	*3*	22571	*4*
PA	Delaware	275	*9*	5735	*9*	-287	*10*	9469	*2*	7121	*8*	22313	*5*
NJ	Gloucester	641	*6*	6091	*8*	298	*7*	5803	*4*	7068	*9*	19901	*6*
PA	Chester	615	*7*	6299	*6*	1073	*3*	3329	*5*	7399	*6*	18715	*7*
PA	Bucks	750	*4*	6523	*5*	916	*4*	1785	*9*	7741	*5*	17715	*8*
NJ	Camden	963	*3*	6125	*7*	-311	*11*	1298	*10*	7149	*7*	15224	*9*
MD	Cecil	-121	*11*	1016	*11*	430	*6*	317	*11*	3262	*10*	4903	*11*

Figure 4.2 illustrates the emission reductions ("SUM") from Table 4.11, and it is important to note that New Castle County obtained more than double the reductions than the next highest ranking County – Philadelphia County – and over three times more than Delaware County.

Figure 4.2: Philadelphia CBSA 2002-2011 Reductions and Rankings

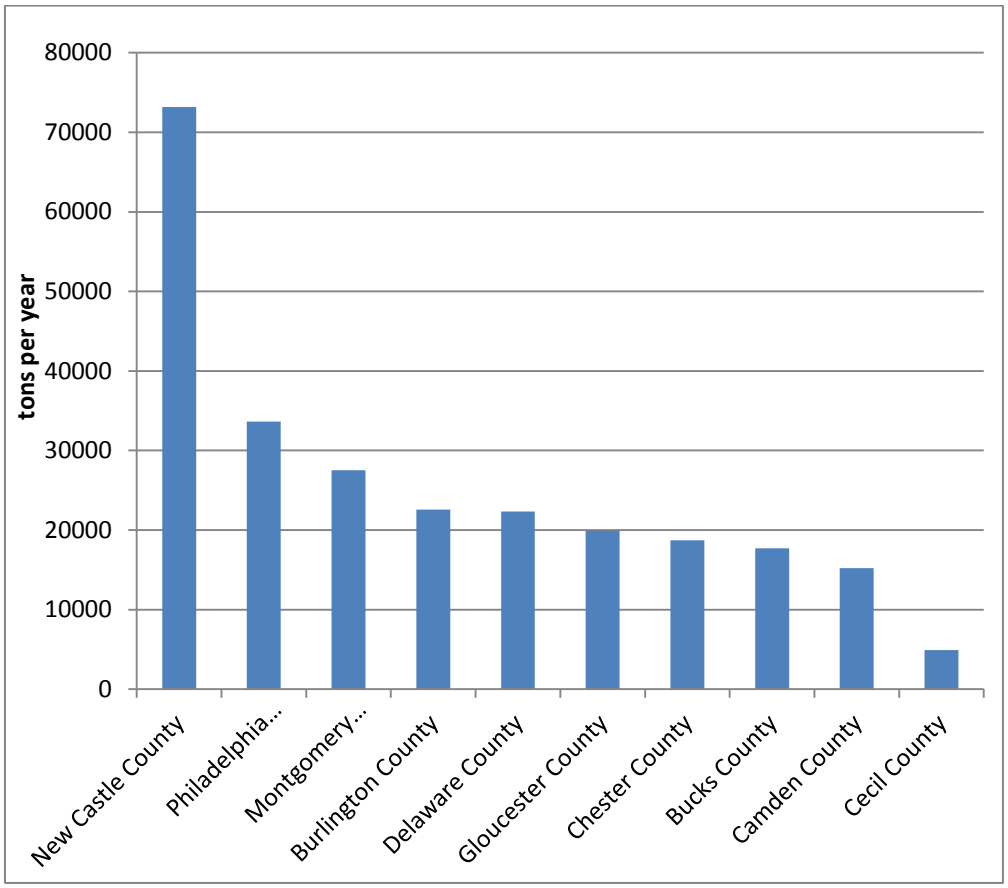


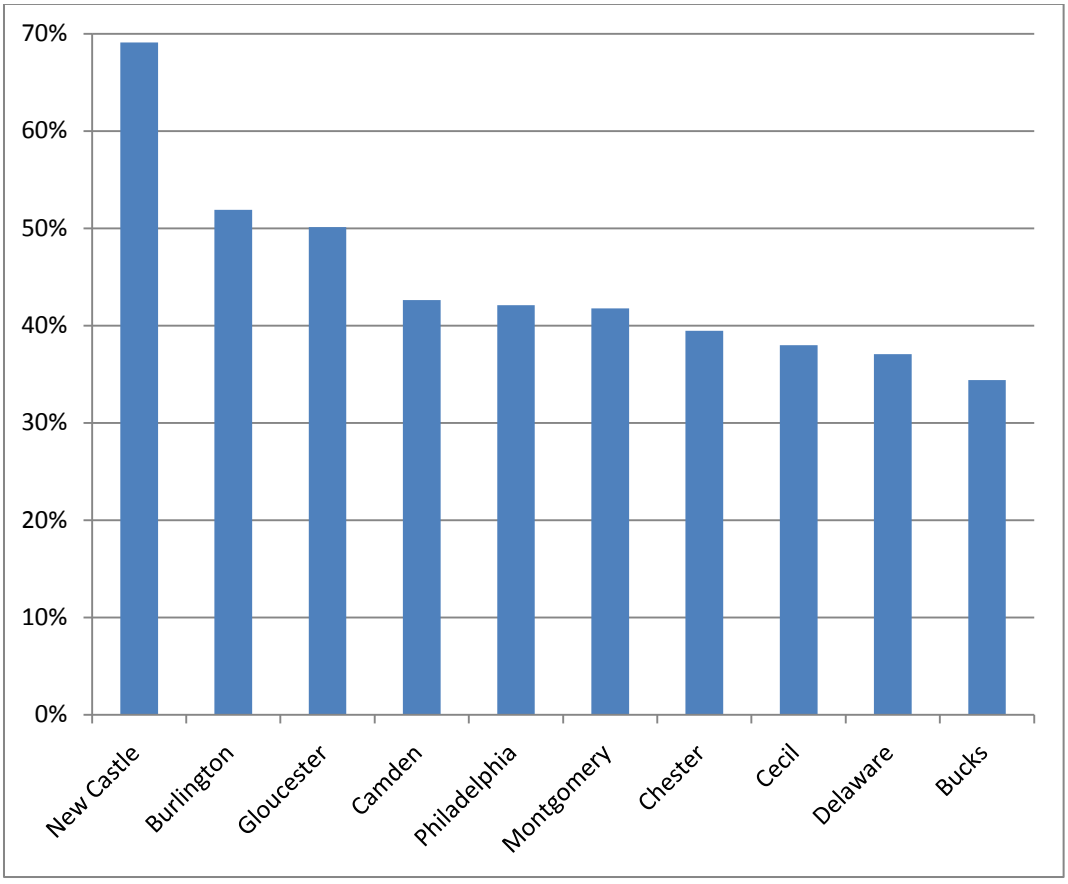
Table 4.12 shows the data in Table 4.11 in terms of percent reductions, with New Castle County being number one with a 69% reduction of PM2.5-related pollutants. Again, it is noteworthy that the next highest County (Philadelphia) has comparative 42% reductions, and the two nonattaining CBSA counties of Chester and Delaware both have only 39% and 37% reductions, respectively.

Table 4.12: Philadelphia CBSA 2002-2011 Percent Reductions

State	County	NH3	NOX	PM25	SO2	VOC	SUM
DE	New Castle	52%	47%	46%	95%	42%	69%
NJ	Burlington	64%	53%	33%	85%	46%	52%
NJ	Gloucester	64%	43%	21%	81%	44%	50%
NJ	Camden	80%	41%	-21%	68%	44%	43%
PA	Philadelphia	26%	27%	9%	71%	51%	42%
PA	Montgomery	46%	33%	31%	51%	49%	42%
PA	Chester	24%	34%	35%	60%	41%	39%
MD	Cecil	-23%	22%	42%	49%	54%	38%
PA	Delaware	32%	24%	-13%	59%	41%	37%
PA	Bucks	42%	33%	32%	47%	33%	34%

Figure 4.3 illustrates the data in Table 4.12

Figure 4.3: Philadelphia CBSA 2002-2011 Percent Reductions



4.3.4 Philadelphia CBSA and CBSA+ 2002 and 2011 Emissions and Reductions

Table 4.13, Table 4.14, Table 4.15, and Table 4.16 contain emissions data showing the Philadelphia CBSA+ emissions in 2002 and 2011, along with the corresponding emission reductions, rankings and percent reductions. As can be seen from tables, New Castle ranked 2nd of the 29 counties in total $PM_{2.5}$-related emissions during 2002. However, due to the significant control measures Delaware has implemented since 2002, New Castle now ranks 10th in total CBSA+ emissions, and again ranks 1st in total emission reductions, as well as in terms of total percent reductions (out of 29 counties). This data shows that Delaware has led the Philadelphia CBSA and surrounding counties in developing post-2002 control measures. As discussed in the next section, either EPA or Delaware has already regulated every non-trivial source with reasonable available control technology.

Table 4.13: Philadelphia CBSA+ 2002 Emissions and Total Rank

State	County	FIPS	NH3	NOX	PM25	SO2	VOC	SUM	*Rank*
PA	York	42133	3862	37634	5647	82669	20079	149891	*1*
DE	**New Castle**	**10003**	**1940**	**29995**	**3920**	**50155**	**19917**	**105926**	***2***
PA	Northampton	42095	722	24212	3473	58764	10648	97819	*3*
PA	**Philadelphia**	**42101**	**1084**	**30595**	**2988**	**9508**	**35725**	**79900**	***4***
PA	Lancaster	42071	16400	19652	4529	3974	25647	70203	*5*
PA	Berks	42011	4610	21748	3585	17595	19341	66880	*6*
PA	**Montgomery**	**42091**	**1450**	**25686**	**3642**	**5171**	**29971**	**65920**	***7***
NJ	Middlesex	34023	2032	25931	2193	2117	30993	63267	*8*
PA	**Delaware**	**42045**	**870**	**23699**	**2292**	**16028**	**17287**	**60175**	***9***
NJ	Mercer	34021	1012	24978	1369	15508	12719	55585	*10*
PA	**Bucks**	**42017**	**1774**	**19800**	**2881**	**3825**	**23218**	**51497**	***11***
PA	**Chester**	**42029**	**2521**	**18476**	**3075**	**5507**	**17853**	**47432**	***12***
NJ	Monmouth	34025	1714	17316	1722	1670	24780	47200	*13*
NJ	**Burlington**	**34005**	**1524**	**17832**	**2102**	**3429**	**18599**	**43486**	***14***
NJ	Ocean	34029	1214	10120	2363	1074	27598	42369	*15*
NJ	**Gloucester**	**34015**	**1003**	**14106**	**1411**	**7169**	**16008**	**39696**	***16***
NJ	**Camden**	**34007**	**1207**	**14785**	**1461**	**1909**	**16352**	**35713**	***17***
PA	Lehigh	42077	825	14203	1893	3764	13855	34541	*18*
NJ	Somerset	34035	1100	9970	1732	637	15032	28472	*19*
NJ	Atlantic	34001	832	8152	1080	885	15277	26226	*20*
DE	Kent	10001	2191	10095	1228	4039	6384	23937	*21*
MD	Harford	24025	980	8218	1738	1205	10200	22341	*22*
NJ	Cumberland	34011	644	6865	927	3217	8077	19730	*23*
NJ	Hunterdon	34019	962	6323	1270	613	9024	18193	*24*
NJ	Salem	34033	656	6498	784	5452	4736	18127	*25*
NJ	Warren	34041	706	5006	1119	565	7284	14679	*26*
MD	**Cecil**	**24015**	**530**	**4669**	**1019**	**640**	**6050**	**12908**	***27***
MD	Queen Anne's	24035	1550	2780	946	551	3864	9691	*28*
MD	Kent	24029	719	1166	594	386	2356	5221	*29*

** Bold font indicates those counties which are part of the Philadelphia CBSA

Table 4.14: Philadelphia CBSA+ 2011 Emissions and Rankings

State	County	FIPS	NH3	NOX	PM25	SO2	VOC	SUM	*Rank*
PA	York County	42133	3495	33810	3758	26590	14024	81677	*1*
PA	Lancaster	42071	15753	13881	4107	1802	13584	49127	*2*
PA	**Philadelphia**	**42101**	**801**	**22394**	**2722**	**2788**	**17548**	**46254**	***3***
PA	Northampton	42095	614	14074	2274	20024	5404	42390	*4*
PA	Berks	42011	4095	14390	3023	6140	12848	40495	*5*
PA	**Montgomery**	**42091**	**779**	**17275**	**2508**	**2522**	**15308**	**38393**	***6***
PA	**Delaware**	**42045**	**595**	**17964**	**2579**	**6559**	**10166**	**37863**	***7***
NJ	Middlesex	34023	526	14766	1843	771	16651	34558	*8*
PA	**Bucks**	**42017**	**1024**	**13277**	**1965**	**2040**	**15477**	**33783**	***9***
DE	**New Castle**	**10003**	**922**	**15866**	**2099**	**2383**	**11469**	**32739**	***10***
PA	**Chester**	**42029**	**1906**	**12177**	**2002**	**2178**	**10454**	**28717**	***11***
NJ	Monmouth	34025	740	10365	1307	670	12541	25624	*12*
NJ	Ocean	34029	335	7972	1397	479	13185	23367	*13*
PA	Lehigh	42077	620	8921	1398	1323	9748	22010	*14*
NJ	**Burlington**	**34005**	**556**	**8448**	**1405**	**525**	**9981**	**20915**	***15***
NJ	**Camden**	**34007**	**244**	**8660**	**1772**	**611**	**9203**	**20490**	***16***
NJ	**Gloucester**	**34015**	**362**	**8015**	**1113**	**1366**	**8940**	**19796**	***17***
NJ	Mercer	34021	254	7513	1260	948	7560	17535	*18*
DE	Kent	10001	2462	5673	922	1839	4298	15193	*19*
NJ	Somerset	34035	264	5960	665	241	7015	14145	*20*
NJ	Atlantic	34001	241	4905	900	425	7062	13534	*21*
MD	Harford	24025	495	6169	945	525	5163	13298	*22*
NJ	Cumberland	34011	459	4078	1081	792	4888	11299	*23*
MD	**Cecil**	**24015**	**651**	**3653**	**589**	**323**	**2788**	**8005**	***24***
NJ	Salem	34033	708	3239	453	1405	2122	7926	*25*
NJ	Hunterdon	34019	450	3446	434	328	3139	7797	*26*
MD	Queen Anne's	24035	1897	2943	626	449	1727	7643	*27*
NJ	Warren	34041	710	2622	521	328	3010	7192	*28*
MD	Kent	24029	744	1026	487	204	1215	3675	*29*

** Bold font indicates those counties which are part of the Philadelphia CBSA

Table 4.15: Philadelphia CBSA+ 2002-2011 Emission Reductions and Rankings

State	County	FIPS	NH3	NOX	PM25	SO2	VOC	SUM	*Rank*
DE	**New Castle**	**10003**	**1018**	**14129**	**1821**	**47772**	**8448**	**73187**	***1***
PA	York	42133	367	3824	1889	56079	6055	68214	*2*
PA	Northampton	42095	108	10138	1199	38740	5244	55429	*3*
NJ	Mercer	34021	758	17465	109	14560	5159	38050	*4*
PA	**Philadelphia**	**42101**	**283**	**8201**	**266**	**6720**	**18177**	**33646**	***5***
NJ	Middlesex	34023	1506	11165	350	1346	14342	28709	*6*
PA	**Montgomery**	**42091**	**671**	**8411**	**1134**	**2649**	**14663**	**27527**	***7***
PA	Berks	42011	515	7358	562	11455	6493	26385	*8*
NJ	**Burlington**	**34005**	**968**	**9384**	**697**	**2904**	**8618**	**22571**	***9***
PA	**Delaware**	**42045**	**275**	**5735**	**-287**	**9469**	**7121**	**22312**	***10***
NJ	Monmouth	34025	974	6951	415	1000	12239	21576	*11*
PA	Lancaster	42071	647	5771	422	2172	12063	21076	*12*
NJ	**Gloucester**	**34015**	**641**	**6091**	**298**	**5803**	**7068**	**19900**	***13***
NJ	Ocean	34029	879	2148	966	595	14413	19002	*14*
PA	**Chester**	**42029**	**615**	**6299**	**1073**	**3329**	**7399**	**18715**	***15***
PA	**Bucks**	**42017**	**750**	**6523**	**916**	**1785**	**7741**	**17714**	***16***
NJ	**Camden**	**34007**	**963**	**6125**	**-311**	**1298**	**7149**	**15223**	***17***
NJ	Somerset	34035	836	4010	1067	396	8017	14327	*18*
NJ	Atlantic	34001	591	3247	180	460	8215	12692	*19*
PA	Lehigh	42077	205	5282	495	2441	4107	12531	*20*
NJ	Hunterdon	34019	512	2877	836	285	5885	10396	*21*
NJ	Salem	34033	-52	3259	331	4047	2614	10201	*22*
MD	Harford	24025	485	2049	793	680	5037	9043	*23*
DE	Kent	10001	-271	4422	306	2200	2086	8744	*24*
NJ	Cumberland	34011	185	2787	-154	2425	3189	8431	*25*
NJ	Warren	34041	-4	2384	598	237	4274	7487	*26*
MD	**Cecil**	**24015**	**-121**	**1016**	**430**	**317**	**3262**	**4903**	***27***
MD	Queen Anne's	24035	-347	-163	320	102	2137	2048	*28*
MD	Kent	24029	-25	140	107	182	1141	1546	*29*

** Bold font indicates those counties which are part of the Philadelphia CBSA

Table 4.16: Philadelphia CBSA+ 2002-2011 Percent Reductions and Rankings

State	County	FIPS	NH3	NOX	PM25	SO2	VOC	SUM	*Rank*
DE	**New Castle**	**10003**	**52%**	**47%**	**46%**	**95%**	**42%**	**69%**	**1**
NJ	Mercer	34021	75%	70%	8%	94%	41%	68%	2
NJ	Hunterdon	34019	53%	46%	66%	46%	65%	57%	3
PA	Northampton	42095	15%	42%	35%	66%	49%	57%	4
NJ	Salem	34033	-8%	50%	42%	74%	55%	56%	5
NJ	**Burlington**	**34005**	**64%**	**53%**	**33%**	**85%**	**46%**	**52%**	**6**
NJ	Warren	34041	-1%	48%	53%	42%	59%	51%	7
NJ	Somerset	34035	76%	40%	62%	62%	53%	50%	8
NJ	**Gloucester**	**34015**	**64%**	**43%**	**21%**	**81%**	**44%**	**50%**	**9**
NJ	Atlantic	34001	71%	40%	17%	52%	54%	48%	10
NJ	Monmouth	34025	57%	40%	24%	60%	49%	46%	11
PA	York	42133	10%	10%	33%	68%	30%	46%	12
NJ	Middlesex	34023	74%	43%	16%	64%	46%	45%	13

State	County	FIPS	NH3	NOX	PM25	SO2	VOC	SUM	*Rank*
NJ	Ocean	34029	72%	21%	41%	55%	52%	45%	14
NJ	Cumberland	34011	29%	41%	-17%	75%	39%	43%	15
NJ	**Camden**	**34007**	**80%**	**41%**	**-21%**	**68%**	**44%**	**43%**	**16**
PA	**Philadelphia**	**42101**	**26%**	**27%**	**9%**	**71%**	**51%**	**42%**	**17**
PA	**Montgomery**	**42091**	**46%**	**33%**	**31%**	**51%**	**49%**	**42%**	**18**
MD	Harford	24025	49%	25%	46%	56%	49%	40%	19
PA	**Chester**	**42029**	**24%**	**34%**	**35%**	**60%**	**41%**	**39%**	**20**
PA	Berks	42011	11%	34%	16%	65%	34%	39%	21
MD	**Cecil**	**24015**	**-23%**	**22%**	**42%**	**49%**	**54%**	**38%**	**22**
PA	**Delaware**	**42045**	**32%**	**24%**	**-13%**	**59%**	**41%**	**37%**	**23**
DE	Kent	10001	-12%	44%	25%	54%	33%	37%	24
PA	Lehigh	42077	25%	37%	26%	65%	30%	36%	25
PA	**Bucks**	**42017**	**42%**	**33%**	**32%**	**47%**	**33%**	**34%**	**26**
PA	Lancaster	42071	4%	29%	9%	55%	47%	30%	27
MD	Kent	24029	-3%	12%	18%	47%	48%	30%	28
MD	Queen Anne's	24035	-22%	-6%	34%	19%	55%	21%	29

** Bold font indicates those counties which are part of the Philadelphia CBSA

4.4 Control Measure Analysis for $PM_{2.5}$-Related Pollutants

Delaware's 2011 NEI encompasses all emissions that could contribute to downwind areas. Delaware has used this inventory for a control measure analysis. The sections that follow present Delaware's analyses of federal and Delaware control measures on a pollutant-by-pollutant basis, demonstrating that Delaware has controlled emission sources causing local ambient $PM_{2.5}$ issues, and that may contribute to nonattainment and/or maintenance areas downwind. The analysis includes every source for each pollutant that is ≥ 25 tpy or ≥ 95% of all sources, and shows that all non-trivial sources are already controlled.

Including New Castle in a nonattainment area under CAA 107(d)(1) would result in no additional emission reductions in New Castle County.

4.4.1 Sulfur Dioxide (SO_2)

Because sulfates were determined to be the largest contributor to $PM_{2.5}$ nonattainment in the northeast, Delaware adopted and implemented SIP provisions that cover all SO_2 emitting sources and source categories and all such emissions in Delaware are now well controlled.

In June 2013, Delaware submitted a technical support document to EPA, which presented a combination of ambient monitoring data analysis and conservative source-specific modeling to support a designation of attainment for the 2010 1-hour SO_2 NAAQS for the entire state of Delaware. In summary, Delaware's SO_2 control efforts have focused primarily on requiring advanced SO_2 emission controls on its largest point sources, and lowering the sulfur content of fuel used by all in-state sources, e.g.:

- Recent amendments to 7 DE Admin. Code 1108 will reduce the sulfur limit for residual oil to 0.5%, statewide, for all source sectors.
- As of 12/31/2012, New Castle County's two coal-fired EGUs, switched to natural gas, with one using residual oil. SO_2 emission rates have been set at or below 0.26 lb/mmbtu since 2006 (7 DE Admin. Code 1146).

- The allowable sulfur content of residual oil fired EGUs was reduced to an allowable level of 0.5% in 2006 (7 DE Admin. Code 1146).
- The carbon monoxide (CO) boilers at the Delaware City Refinery, historically the largest SO_2 emitters in the state, were controlled with scrubbers in 2007/8 (Consent Decree).
- Distillate oil has been regulated statewide at a level of 3000 ppm since 1971 (7 DE Admin. Code 1108), and recent amendments to this regulation effective 07/2013 reduce the allowable limit to 15 ppm.

These controls, along with federal on-and-off-road fuel sulfur limits, have dramatically reduced New Castle's SO_2 emissions inventory. Delaware's first SO_2 SIP from 1970 indicates that statewide 1970 SO_2 emissions were 232,000 tons per year, and in 2011 they have been reduced to 14,273 tons (a 94% reduction). This indicates that Delaware's SO_2 control strategy has been very effective. Appendix A, Table 1 discusses the emission sources and federal and Delaware controls that have been implemented for those sources.

4.4.2 Oxides of Nitrogen (NOx)

Delaware has been nonattainment for the pollutant ozone since a standard was first established in 1971. Over the past 40 years Delaware has learned that transport is very significant relative to ozone, and that the only way to reduce ozone concentrations is to reduce the volatile organic compound (VOC) and nitrogen oxides (NOx) emissions that are causing them. As discussed above, VOC and NOx are also precursors to $PM_{2.5}$. Over the last twenty years Delaware has adopted and implemented SIP provisions that cover all NOx emitting sources and source categories, and all such emissions in Delaware are now well controlled.

Appendix A, Table 2 demonstrates 1) that the Delaware SIP contains measures that cover every non-trivial NOx emitting source and source category in the State. Thus, Delaware concludes that the Delaware emissions that would contribute to nonattainment and maintenance in downwind areas are those NOx emissions that are already reduced by the following adequate measures in Delaware's SIP:

- Vehicle I/M requirements, which is one of the few cost effective means available to States to significantly reduce on-road mobile emissions (7 DE Admin. Code 1126 and 1136)
- RACT on all major NOx stationary sources, which establishes a baseline level of control and achieves large, cost effective reductions (7 DE Admin. Code 1112 and 1125).
- BACT on all coal and residual oil fired EGUs, and large industrial boilers, which ensure the largest emitters are well controlled (7 DE Admin. Code 1142 and 1146)
- BACT on all sources with high daily emissions, despite low annual emissions, which ensure all emissions on high $PM_{2.5}$ days are controlled (7 DE Admin. Code 1144 and 1148.)
- Adoption of available regional measures to reduce emission from large non-point source categories (7 DE Admin. Code 1141, Sections 1, 2 and 4)
- Major and minor new source review, which ensures new units are well controlled (7 DE Admin. Code 1125)

4.4.3 Direct $PM_{2.5}$

Delaware has been nonattainment for the pollutant $PM_{2.5}$ since 2005 under the 1997 annual $PM_{2.5}$ NAAQS, and since 2009 under the 2006 daily $PM_{2.5}$ NAAQS. In November, 2012 EPA proposed a rule approving Delaware's 2008 $PM_{2.5}$ Attainment Demonstration and a 2012 revision to that SIP to address MOVES.[25] Since then, Delaware's monitors are showing attainment and Delaware has submitted a redesignation request and maintenance plan to EPA under the annual and daily $PM_{2.5}$ NAAQS. Appendix A, Table 3 discusses the emission sources and federal and Delaware controls that have been implemented for those $PM_{2.5}$ sources.

4.4.4 Volatile Organic Compounds (VOC)

Delaware has been nonattainment for the pollutant ozone since a standard was first established in 1971. Appendix A, Table 4 demonstrates that the Delaware SIP contains measures that cover every non-trivial VOC emitting source and source category in the State. Thus, Delaware concludes that the Delaware emissions that would contribute to nonattainment and maintenance in downwind areas are those VOC emissions that are already significantly controlled by the following measures in Delaware's SIP:

- Vehicle I/M requirements, which is one of the few cost effective means available to States to significantly reduce on-road mobile emissions (7 DE Admin. Code 1126 and 1136)
- RACT on all major NOx and VOC stationary sources, which establishes a baseline level of control and achieves large, cost effective reductions (7 DE Admin. Code 1112 and 1125).
- BACT on all coal and residual oil fired EGUs, and large industrial boilers, which ensure the largest emitters are well controlled (7 DE Admin. Code 1142 and 1146)
- BACT on all sources with high daily emissions, despite low annual emissions, which ensure all emissions on high $PM_{2.5}$ days are controlled (7 DE Admin. Code 1144 and 1148.)
- Adoption of available regional measures to reduce emission from large non-point source categories (7 DE Admin. Code 1141, Sections 1, 2 and 4)
- Adopting all federal Control Techniques Guidelines (CTGs) or issuance of a negative declaration
- Major and minor new source review, which ensures new units are well-controlled (7 DE Admin. Code 1125)
- VOC Control Measures on numerous area sources (7 DE Admin. Code 1124)

4.4.5 Ammonia (NH_3)

Due to the lack of quality emission factors, effective control measures and relatively low emissions in New Castle County, Delaware has not focused on controlling ammonia emissions. Nonetheless, 2011 emissions of ammonia have decreased 1,018 tpy from 2002 levels (1,940 vs. 922), or a 52 percent reduction. Appendix A, Table 5 discusses Delaware's ammonia analysis.

[25] The Homer vs. EPA ruling has held up final approval of this SIP but DNREC and EPA expect it to be approved.

4.5 Summary of Emissions and Control Measure Analysis

The previous discussions in Section 4, as well as Appendix A demonstrate that:

1. the Delaware SIP contains measures that cover every non-trivial $PM_{2.5}$-related pollutant emitting source and source category in the State, and

2. that implementation of these measures has resulted in significant emission reductions in New Castle County (and Delaware has achieved more reductions than any other county since 2002)

Thus, Delaware concludes based on this analysis of emissions and emissions related data that no part of Delaware should be designated as nonattainment due to the air quality in any nearby area.

5 GEOGRAPHY/TOPOGRAPHY

Not applicable to Delaware and surrounding counties. The terrain is relatively flat.

6 JURISDICTIONAL BOUNDARIES

All of New Castle County's air quality management is under the jurisdictional authority of the State of Delaware. Air quality issues are handled by a single agency, the Delaware Department of Natural Resources and Environmental Control.

Delaware does not participate as a member of Delaware Valley Regional Planning Commission, which serves PA and NJ mobile planning efforts. As such, there have been no coordinated planning efforts for mobile control measures between Delaware, NJ and PA for $PM_{2.5}$. Mobile source controls are planned and implemented exclusively through DNREC, DELDOT and the Kent and Wilmington Area Planning Councils. In addition, since 2002 when Delaware was first designated nonattainment under the 1997 annual NAAQS, no coordination of control measures occurred between Delaware and Pennsylvania for the other sources sectors (this included ozone control coordination as well). Furthermore, given that New Castle County ambient concentrations are well below the 2012 annual standard, DNREC does not foresee any multi-jurisdictional controls as a viable option. And finally, Delaware believes that 1) since the violations in PA appear to be highly influence by local emissions, and 2) the dominant boundary is the state lines and not the CBSA, then 3) it is impractical for Delaware to coordinate with PA on their local control measures, in order to bring PA violating monitors into attainment (e.g. Delaware has no influence on PA's regulation determinations).

Designating New Castle County as a stand-alone attainment area, separate from the Philadelphia CBSA, will continue to simplify administrative and legal authorities relative to nonattainment requirements. Delaware will continue to actively interact with EPA and the regional planning organizations (OTC, MANEVU).

7 CONCLUSIONS

- All of Delaware's monitors are recording $PM_{2.5}$ concentrations that are significantly below the 2012 NAAQS. In the Philadelphia CBSA, only Delaware and Chester Counties in Pennsylvania are monitoring concentrations that are above the 2012 NAAQS.

- Ambient air quality analysis indicates that the nearby sites in Pennsylvania currently exceeding the annual average $PM_{2.5}$ NAAQS are not representative of air quality in New Castle County, Delaware, and the air quality analysis supports not associating any part of Delaware with those two areas for the following reasons.

    - The New Garden site in Chester County data is typical of a site dominated by regional transport as shown by the seasonal and annual trends analysis. The change in monitoring method from the FRM to an FEM appears to have introduced a high bias into recent design values. Returning that site to the FRM appears to be returning data from that site to trends that are expected, and that follow the trends of other sites within the Philadelphia CBSA that are below the annual average NAAQS.

    - The Chester site in Delaware County is significantly impacted by local sources as shown by ambient air quality trends and seasonal patterns, evaluation of high concentration days, speciation data analysis (SANDWICH and urban excess calculations), and emissions vs. distance. The Chester site is therefore not representative of the larger Philadelphia CBSA. Examination of the specific site characteristics also indicates high potential for nearby source impact. The Chester monitor is located within the fence line of a point source which manufactures sodium silicate and is also installed in an unpaved area.

- Analysis of three years of meteorology indicates that while both Delaware's MLK monitor and Pennsylvania's Chester monitor are impacted by regional sources, the Chester monitor is impacted more by local sources when compared to the MLK monitor.

- In 2002, New Castle County's total $PM_{2.5}$- related pollutant emissions were ranked 1st in the CBSA. In 2011 New Castle ranked 5th in the CBSA – with approximately 5,000 tpy less than Delaware County's total PM2.5-related emissions.

- Although New Castle's emissions are only two ranks below only two ranks below Delaware County, the closest DE monitor to the Chester monitor in Delaware County is Bellefonte (~8 mi.), with a 2010-2012 DV of only 9.8 µg/m^3. This is significantly less than the Chester DV (13.1 µg/m^3), leading Delaware to conclude local emissions play a major role in violations at the Chester monitor.

- Based on population vs. DVs over the years, Delaware believes population is not suitable as a tool in making boundary determinations for New Castle County because they are in fact inversely related. Since increased VMT and commuting are related to population, and Delaware statewide VMT does not correlate with air quality data, it also follows that these parameters should not be used in boundary designations. Also, relative to 2002 vehicle miles traveled (VMT), New Castle 2010 VMT growth was negative 3%, the 18th lowest growth rate in the CBSA+ and ranked 8th in the CBSA.

- Total 2012 emissions of direct $PM_{2.5}$ and its precursors from Delaware's largest point sources decreased 87% between 2002 and 2012. This included a massive 99% reduction in SO_2, followed by a 65% reduction in direct $PM_{2.5}$, and NOx with a 52% decrease. VOC reductions of 54% have been taking place since the early 1990s due to Delaware's ozone nonattainment issues over the years. Although NH_3 has been reduced around 52%, this is still a significant reduction, since total New Castle County 2002 *point* source emissions were only 82 tons per year (tpy).

- Based on 2002 emission inventories, New Castle ranked as the highest emitter in the Philadelphia CBSA of all $PM_{2.5}$-related pollutants. However, due to the significant control measures Delaware has implemented since 2002, **New Castle now ranks the highest in total emission reductions**, both for the CBSA and CBSA+.

- In terms of percent reductions between 2002 and 2011 in the CBSA, New Castle County is number one with a 69% overall reduction of $PM_{2.5}$-related pollutants. The 2nd ranking County has a 52% overall reduction, and the two nonattaining counties Chester and Delaware have 39% and 37% reductions, respectively. This demonstrates that Delaware emission sources are well controlled.

Based on this analysis Delaware concludes that the air quality in all of Delaware is below the 2012 NAAQS, and that emissions from Delaware do not contribute to violations of the NAAQS in any nearby area, and that no part of Delaware, including New Castle County, should be designated as nonattainment under CAA 107(d).

APPENDIX A

CONTROL MEASURE ANALYSIS

FOR $PM_{2.5}$-RELATED POLLUTANTS

Table 1: SO_2 Emission and Control Analysis –NCC 2011 NEI (≥ 25 TPY and ≥ 95%)

Source Category	2011 TPY	% of 2011 NEI	Description of Federal Control Measures and Measures in Delaware's SIP	Potential Additional Control Measures
Commercial Marine Vessels (primarily in-transit emissions from residual oil combustion)	972	40.8%	Commercial Marine Vessels include ocean-going ships and other large craft. This category is subject to applicable federal measures such as the EPA C-3 Marine Engine Rule, and the Emission Control Areas established by the IMO, which require usage of ≤10,000 ppm sulfur residual fuel beginning in 2011, and ≤ 1,000 ppm beginning in 2017.	Delaware has limited authority under the CAA to regulate off-road mobile sources.
Commercial/Industrial/Residential Combustion fired on Oil	441	18.5%	The commercial/institutional fuel combustion category includes small boilers, furnaces, heaters, and other heating units too small to be considered point sources. The commercial/institutional sector includes wholesale and retail businesses; health institutions; social and educational institutions; and federal, state, and local governments (i.e., prisons, office buildings) and are defined by SIC codes 50-99. The fuel types included in this source category are coal (SCC 2103002000), distillate oil (SCC 2103004000), residual oil (SCC 2103005000), natural gas (SCC 2103006000), and liquefied petroleum gas (LPG) (SCC 2103007000). Uses of distillate oil and kerosene include space and water heating. Emissions in this category are from many small units throughout the State. Recent amendments to 7 DE Admin. Code 1108 reduced the sulfur limit for residual oil to 0.5%, statewide, for all source sectors. Distillate oil has been regulated statewide at a level of 3,000 ppm since 1971 (7 DE Admin. Code 1108), and recent amendments to this regulation reduced the allowable limit to 15 ppm.	This source category is well controlled by the stringent allowable sulfur content limits in 7 DE Admin. Code 1108. No economically feasible additional control measures have been identified.

Table 1: SO_2 Emission and Control Analysis –NCC 2011 NEI (≥ 25 TPY and ≥ 95%)

Source Category	2011 TPY	% of 2011 NEI	Description of Federal Control Measures and Measures in Delaware's SIP	Potential Additional Control Measures
Delaware City Refinery (Premcor)	333	14.0%	The main SO_2 emission sources at the refinery are the Coker and Cracker CO boilers. Both of these units are well controlled with scrubbers that were installed under a federal consent decree. 2005 emissions from these two units were > 29,000 tpy, and 2012 emissions were less than 304 tpy.	No strategies have been identified to further reduce SO_2 emissions from the refinery.
DuPont Experimental Station	248	10.4%	This facility has four (4) residual oil fired boilers and one (1) gas fired boiler, all rated at 96 mmBTU/hr each. All four oil fired boilers are currently permitted to use residual oil with a sulfur content not to exceed 0.5%. DuPont Experimental Station is currently paying for the installation of a natural gas line to the facility, after which all boilers will operate using natural gas. The goal is to have all boilers converted to natural gas by mid-2017.	No strategies have been identified to further reduce SO_2 emissions from this facility.
Calpine - Edge Moor (Conectiv)	83	3.5%	This facility is a power plant that consists of three gas/oil fired EGUs. (i.e., 86 MW, 174 MW, and 450 MW). All of Delaware EGUs 25 MW and greater are subject to 7 DE Admin. Code 1146, Electric Generating Unit (EGU) Multi-Pollutant Regulation. 1146 limits SO_2 emissions from oil fired EGUs to a rate resulting from combusting 0.5% sulfur oil. Unit 3 fires gas as a primary fuel, with oil as a backup. Unit 3 has taken permit (permit AQM-003/00007) conditions that include a restriction on the annual total hours of operation on residual fuel oil (no greater than 876 hrs/yr) and a restriction on total annual operating hours to not exceed 59% capacity	No additional economically feasible SO_2 control measures have been identified.

Table 1: SO_2 Emission and Control Analysis –NCC 2011 NEI (≥ 25 TPY and ≥ 95%)

Source Category	2011 TPY	% of 2011 NEI	Description of Federal Control Measures and Measures in Delaware's SIP	Potential Additional Control Measures
			factor. The 0.5% sulfur in fuel limit of 7 DE Admin Code 1146 and these operating limits effectively cap the annual SO_2 mass emissions levels below those included in 7 DE Admin Code 1146. Unit 4 fires gas as a primary fuel, with oil as a backup. Unit 4 has taken permit (permit AQM-003/00007) conditions that include a restriction on the annual total hours of operation on residual fuel oil (no greater than 876 hrs/yr) and a restriction on total annual operating hours to not exceed 59% capacity factor. The 0.5% sulfur in fuel limit of 7 DE Admin Code 1146 and these operating limits effectively cap the annual SO_2 mass emissions levels below those included in 7 DE Admin Code 1146. Unit 5, using residual fuel oil as primary fuel, is subject to the 0.5% sulfur in fuel limit of 7 DE Admin Code 1146, and the associated annual SO_2 mass emissions cap.	
DuPont - Chestnut Run	67	2.8%	SO_2 emissions are from a 48 mmbtu/hr boiler and a 96 mmbtu/hr boiler. Both boilers converted to gas in 2011, and are no longer allowed to fire oil. The firing of gas itself ensures these units are well controlled for SO_2.	No additional strategies have been identified to further reduce SO_2 emissions from this facility.

Table 1: SO_2 Emission and Control Analysis –NCC 2011 NEI (≥ 25 TPY and ≥ 95%)

Source Category	2011 TPY	% of 2011 NEI	Description of Federal Control Measures and Measures in Delaware's SIP	Potential Additional Control Measures
On-Road Mobile	48	2.0%	New vehicles must meet California vehicle emission standards (CA LEV 3) under 7 DE Admin. Code 1140. New and existing vehicles must be maintained under Delaware's vehicle Inspection and Maintenance program, 7 DE Admin. Code 1126 and 1131. Extended idling of heavy duty vehicles is prohibited under 7 DE Admin Code 1145. EPA 2007 Heavy-Duty Highway Rule (40 CFR Part 86, Subpart P) limits the sulfur content in on-road diesel to 15ppm.	No additional strategies have been identified to further reduce SO_2 emissions from this source category.
DuPont - Red Lion	46	1.9%	This facility is a Sulfuric Acid Plant. The emissions from this facility are primarily from the flare. The flare is the control device, and at this time no reasonable control measures to reduce flared-emissions have been identified.	No additional strategies have been identified to further reduce SO_2 emissions from this facility.
Evraz Claymont Steel	42	1.8%	This facility ceased operations beginning December, 2013.	Not Applicable
Total - categories covering all 2011 NEI sources that emit more than 25 TPY and ≥ 95% of SO_2	2280	95.7%		
Total - all other 2011 NEI facilities and source categories not included above	102	4.3%	This SO_2 quantity also includes many combustion turbines and diesel generators with very low TPY emissions. These units' fuel sulfur limits are regulated under 7 DE Admin. Code 1108.	
Total 2011 Anthropogenic Emissions (TPY)	2,383	100%		

Table 2: NOx Emission and Control Analysis – NCC 2011 NEI (≥ 25 TPY and ≥ 95%)

Source Category	2011 TPY	% of 2011 NEI	Description of Federal Control Measures and Measures in Delaware's SIP	Potential Additional Control Measures
On-Road Mobile	7,495	47.2%	New vehicles must meet California vehicle emission standards (CA LEV 3) under 7 DE Admin. Code 1140. New and existing vehicles must be maintained under Delaware's vehicle Inspection and Maintenance program, 7 DE Admin. Code 1126 and 1131. Extended idling of heavy duty vehicles is prohibited under 7 DE Admin Code 1145. Overall on-road mobile NOx emissions are capped in each of Delaware's three counties by ozone SIP budgets, which are managed under 7 DE Admin. Code 1132, transportation conformity.	Delaware has no authority under the CAA to further regulate tailpipe emissions. Aside from I/M program upgrades, all other identified measures are in the form of transportation control measures (TCMs), which generally gain small incremental reductions (i.e., on the order of tons per year, not hundreds of tons per year), and that have a $/ton cost of $50,000 to over $1 million.
Commercial Marine Vessels	2,256	14.2%	Commercial Marine Vessels include ocean-going ships and other large craft. This category is subject to applicable federal measures such as the EPA C-3 Marine Engine Rule, which specifically regulates NOx emissions from new engines.	Delaware has limited authority under the CAA to regulate off-road mobile sources.
Non-Road equipment	1,659	10.5%	These categories are subject to applicable federal measures only.	Delaware has limited authority under the CAA to regulate off-road mobile sources. Delaware, as part of the Ozone Transport Commission (OTC), is currently evaluating the feasibility of an off-road anti-idling regulation. Other potential measures include programs such as lawn-mower trade-in programs which generally gain small incremental reductions (i.e., on the order of tenths of a ton to several tons per year), and that have a $/ton cost of

Table 2: NOx Emission and Control Analysis – NCC 2011 NEI (≥ 25 TPY and ≥ 95%)

Source Category	2011 TPY	% of 2011 NEI	Description of Federal Control Measures and Measures in Delaware's SIP	Potential Additional Control Measures
				$50,000 to over $1 million.
Commercial/ Industrial/ Residential Combustion fired on Gas	1,177	7.4%	The commercial/institutional fuel combustion category includes small boilers, furnaces, heaters, and other heating units too small to be considered point sources. The commercial/institutional sector includes wholesale and retail businesses; health institutions; social and educational institutions; and federal, state, and local governments (i.e., prisons, office buildings) and are defined by SIC codes 50-99. The fuel types included in this source category are coal (SCC 2103002000), distillate oil (SCC 2103004000), residual oil (SCC 2103005000), natural gas (SCC 2103006000), and liquefied petroleum gas (LPG) (SCC 2103007000). Uses of natural gas and LPG in this sector include space heating, water heating, and cooking. Uses of distillate oil and kerosene include space and water heating. Emissions in this category are from many small units throughout the State, where facility-wide NOx emissions are generally less than 25 TPY (i.e., those not covered in the point source inventory). 7 DE Admin Code 1112 requires the control of NOx emissions from fuel burning equipment. Under 1112, units with maximum rated heat input capacities equal to or larger than 50 MMBtu/hr must be controlled by installation of either low excess air and low NO_x burner technology or flue gas recirculation technology. Units between 15 and 50 MMBtu/hr must receive an annual tune up performed by qualified personnel to minimize NOx emissions. Most commercial/institutional combustion units are subject to the annual tune-up requirements, or are less than 15MMBtu/hr and are exempt from the requirements of 1112.	Additional control measures for this category are possible. 7 DE Admin. Code 1112 could be revised to achieve some additional NOx reductions: • 1112 could be revised such that it is applicable to combustion units at facilities with the potential to emit less than major thresholds; and the low-end exemption of 1112 could be revised from 15MMBTU/hr to 5MMBTU/hr. Covered units would be predominately small units subject to annual tune-ups, and a NOx reduction of about 5% from each subject unit. • 1112 could be revised to require boilers in the 25 MMBTU/hr – 50 MMBTU/hr size range to install either low excess air and low NO_x burner technology or flue gas recirculation technology. This would reduce NOx by up to 50% for each subject unit Other measures could likely be identified at similar reductions and cost effectiveness. Given the high control costs, and the large number of very small sources in this category, this category is best regulated through turnover of equipment (Note that section 4.0 of 7 DE Admin. Code 1125 requires BACT for any new source that emits greater than 5 TPY of NOx).

Table 2: NOx Emission and Control Analysis – NCC 2011 NEI (≥ 25 TPY and ≥ 95%)

Source Category	2011 TPY	% of 2011 NEI	Description of Federal Control Measures and Measures in Delaware's SIP	Potential Additional Control Measures
Delaware City Refinery	1,072	6.8%	The Delaware City Refinery is a petroleum refinery. NOx emissions are controlled under 7 DE Admin Code 1112 (NOx RACT), and also under a NOx cap/PAL established pursuant to Section 2.0 of 7 DE Admin Code 1142 and 1125. The NOx cap began in 2011 at 2,525 TPY (i.e., actual 2008 emission levels), and decreases to 1,650 TPY beginning 2015. Delaware's March 15, 2011 SIP revision, "*Demonstration that Amendments to Section 2.0 of 7 DE Admin Code 1142, Control of NO_x Emissions from Industrial Boilers and Process Heaters at Petroleum Refineries Do not Interfere with Any Applicable Requirement of the Clean Air Act*" provides a detailed discussion of the facility-wide NOx cap. The following information demonstrates the stringency of the facility-wide NOx cap: • Thirteen of the refinery's industrial boilers were subject to the EPA NOx SIP Call, which was implemented in Delaware under 7 DE Admin Code 1139. • The initial 2,525 TPY NOx cap is significantly less than the annualized NOx SIP Call cap[1], 3,333 TPY, which indicates that implementation of RACT and NSR at the refinery have resulted in the implementation of NOx controls at the refinery. • The 1,650 TPY NOx cap represents a 35%	Delaware concludes that it is not feasible to lower the NOx cap at this time, and no additional control measures have been identified that would significantly reduce NOx levels below the refinery NOx cap.

[1] The referenced SIP revision includes a demonstration that the refinery emissions are uniform across the year, and regulation on a TPY basis and not on an ozone season basis is acceptable. Based on this the 1139 budgets were annualized by multiplying by 12/5.

Table 2: NOx Emission and Control Analysis – NCC 2011 NEI (≥ 25 TPY and ≥ 95%)

Source Category	2011 TPY	% of 2011 NEI	Description of Federal Control Measures and Measures in Delaware's SIP	Potential Additional Control Measures
			reduction beyond RACT limits (i.e., actual 2008 levels), and more than an additional 50% reduction below NOx SIP Call levels. In addition, all future growth at the refinery must occur under this NOx cap.	
Calpine - Hay Road (Conectiv)	602	3.8%	This facility is a power plant that consists of six combined cycle gas-fired (oil backup) EGUs. Units 1-3 are subject to 7 DE Admin Code 1112 (NOx RACT) limits of 25 to 88 ppm, 1-hour average, depending on fuel and firing mode. Units 5-7 are subject to 7 DE Admin. Code 1112, plus they are controlled by SCR as required by 7 DE Admin. Code 1125 (NOx LAER plus offsets).	SCR is the most effective commercially available NOx emission control technology commercially available for combustion turbine and combined cycle electric generating units such as those installed at Hay Road. Hay Road units 5, 6 and 7 already incorporate SCR. It is technically feasible to retrofit SCR on the Hay Road units 1, 2, and 3 that do not presently incorporate SCR. Assuming a 10-year life and using the 2011 annual heat input, it is estimated that the incremental cost of reducing NOx for Hay Road units 1, 2, and 3 collectively is approximately $8,800 per incremental ton of NOx reduced. This would reduce NOx mass emissions by approximately 72% (or 433 TPY based on actual 2011 data).
Calpine - Edge Moor (Conectiv)	346	2.2%	This facility is a power plant that consists of three gas/oil fired EGUs. (i.e., 86 MW, 174 MW, and 450 MW). NOx emissions are regulated under 7 DE Admin Code 1112, NOx RACT, and 7 DE Admin Code 1146 Electric Generating Unit (EGU) Multi-Pollutant Regulation. All units complied with 1112 through the installation of low NOx burners. 1146 imposes both a unit specific annual NOx cap, and a 0.125 lb/MMBTU emission limitation, demonstrated on a	SCR is the most effective commercially available NOx emissions control technology for a gas/oil fired steam generating units such as these at the Calpine-Edge Moor facility. Additional control is possible by replacing the existing low NOx burner and SNCR technology with SCR technology on each of the following two EGUs:

Table 2: NOx Emission and Control Analysis – NCC 2011 NEI (≥ 25 TPY and ≥ 95%)

Source Category	2011 TPY	% of 2011 NEI	Description of Federal Control Measures and Measures in Delaware's SIP	Potential Additional Control Measures
			rolling 24-hour average basis. Unit 3 fires gas as a primary fuel, with oil as a backup. Unit 3 NOx emissions are controlled by: low-NOx burners, overfire air, and SNCR. Unit 3 has taken permit (permit AQM-003/00007) conditions that include a restriction on the annual total hours of operation on residual fuel oil (no greater than 876 hrs/yr) and a restriction on total annual operating hours to not exceed 59% capacity factor. The use of gas as a primary fuel, and the 0.125 lb/MMBTU limit of 7 DE Admin Code 1146 and these operating limits effectively cap the annual NOx mass emissions levels below those included in 7 DE Admin Code 1146. Unit 4 fires gas as a primary fuel, with oil as a backup. Unit 4 has taken permit (permit AQM-003/00007) conditions that include a restriction on the annual total hours of operation on residual fuel oil (no greater than 876 hrs/yr) and a restriction on total annual operating hours to not exceed 59% capacity factor. The use of gas as a primary fuel, and the 0.125 lb/MMBTU limit of 7 DE Admin Code 1146 and these operating limits effectively cap the annual NOx mass emissions levels below those included in 7 DE Admin Code 1146. Unit 5's primary fuel is residual fuel oil, and incorporates low-NOx burners, overfire air, and SNCR for NOx emissions rate reduction. Unit 5 is subject to the 0.125 lb/MMBTU limit of 7 DE Admin Code 1146 and the associated annual NOx mass cap in 7 DE Admin Code 1146.	• Unit 3: The estimated incremental cost of reducing the NOx emission rate lower than the unit's 2011 annual average value (assuming a 10 year life, using the 2011 annual heat input, and using a 0.04 lb/MMBTU attainable NOx emissions rate basement) is $26,348 per incremental ton of NOx reduced. This would reduce mass emissions by 32% (37 TPY based on actual 2011 data). • Unit 4: The estimated incremental cost of reducing the NOx emission rate lower than the unit's 2011 annual average value (assuming a 10 year life, using the 2011 annual heat input, and using a 0.04 lb/MMBTU attainable NOx emissions rate basement) is $37,277 per incremental ton of NOx reduced. This would reduce mass emissions by 57% (50 TPY based on actual 2011 data).

Table 2: NOx Emission and Control Analysis – NCC 2011 NEI (≥ 25 TPY and ≥ 95%)

Source Category	2011 TPY	% of 2011 NEI	Description of Federal Control Measures and Measures in Delaware's SIP	Potential Additional Control Measures
Locomotives	272	1.7%	These categories are subject to applicable federal measures only.	Delaware has limited authority under the CAA to regulate off-road mobile sources.
DuPont Experimental Station	180	1.1%	This facility has four (4) residual oil fired boilers and one gas fired boiler, each rated at 96 mmBTU/hr each. Each boiler is equipped with low NOx burner and low excess air technology under 7 DE Admin Code 1112 (NOx RACT). DuPont Experimental Station is currently paying for the installation of a natural gas line to the facility, after which all boilers will operate using natural gas. The goal is to have all boilers converted to natural gas by mid-2017.	SNCR and SCR are technically feasible post-combustion NOx reduction technologies applicable to gas-fired boilers. Incremental costs would be relatively high for these gas boilers.
Commercial/ Industrial/ Residential Combustion fired on Oil	175	1.1%	The commercial/institutional fuel combustion category includes small boilers, furnaces, heaters, and other heating units too small to be considered point sources. The commercial/institutional sector includes wholesale and retail businesses; health institutions; social and educational institutions; and federal, state, and local governments (i.e., prisons, office buildings) and are defined by SIC codes 50-99. The fuel types included in this source category are coal (SCC 2103002000), distillate oil (SCC 2103004000), residual oil (SCC 2103005000), natural gas (SCC 2103006000), and liquefied petroleum gas (LPG) (SCC 2103007000). Uses of natural gas and LPG in this sector include space heating, water heating, and cooking. Uses of distillate oil and kerosene include space and water heating. Emissions in this category are from many small units	Additional control measures for this category are possible. 7 DE Admin. Code 1112 could be revised to achieve some additional NOx reductions: • 1112 could be revised such that it is applicable to combustion units at facilities with the potential to emit less than major thresholds; and the low-end exemption of 1112 could be revised from 15MMBTU/hr to 5MMBTU/hr. Covered units would be predominately small units subject to annual tune-ups, and a NOx reduction of about 5% from each subject unit. • 1112 could be revised to require boilers in the 25 MMBTU/hr – 50 MMBTU/hr size range to install low excess air and low NO_x burner technology or flue gas

Table 2: NOx Emission and Control Analysis – NCC 2011 NEI (≥ 25 TPY and ≥ 95%)

Source Category	2011 TPY	% of 2011 NEI	Description of Federal Control Measures and Measures in Delaware's SIP	Potential Additional Control Measures
			throughout the State, where facility-wide NOx emissions are generally less than 25 TPY (i.e., those not covered in the point source inventory). Most commercial/institutional combustion units are subject to the annual tune-up requirements, or are less than 15MMBtu/hr and are exempt from the requirements of 1112.	recirculation technology. This would reduce NOx by up to 50% for each subject unit. Other measures could likely be identified at similar reductions and cost effectiveness. Given the high control costs, and the large number of very small sources in this category, this category is best regulated through turnover of equipment (Note that section 4.0 of 7 DE Admin. Code 1125 requires BACT for any new source that emits greater than 5 TPY of NOx).
Evraz Claymont Steel	166	1.0%	This facility ceased operations beginning December, 2013.	Not Applicable
Residential Wood Combustion	60	0.4%	This category is regulated under 40 C.F.R. Part 60 Subpart AAA New Source Performance Standards ("NSPS")	No economically feasible NOx emission control strategies for this source category have been identified.
Sunoco	54	0.3%	This facility was subject to 7 DE Admin. Code 1112 (NOx RACT). It was subject to beyond-RACT NOx control under Section 1 of 7 DE Admin. Code 1142.	The facility is now shutdown.
DuPont - Chestnut Run	48	0.3%	48 mmbtu/hr boiler subject to annual tune-up to minimize NOx emission under 7 DE Admin Code 1112 (NOx RACT). 96 mmbtu/hr boiler equipped with low NOx burner and low excess air technology under 7 DE Admin Code 1112 (NOx RACT). All boilers at this facility converted to gas in 2011, and are no longer allowed to fire oil.	SNCR and SCR are technically feasible post-combustion NOx reduction technologies applicable to oil fired boilers. Incremental costs would be relatively high for these gas fired boilers.

Table 2: NOx Emission and Control Analysis – NCC 2011 NEI (≥ 25 TPY and ≥ 95%)

Source Category	2011 TPY	% of 2011 NEI	Description of Federal Control Measures and Measures in Delaware's SIP	Potential Additional Control Measures
Formosa Plastics	32	0.2%	This facility produces vinyl chloride monomer. NOx emissions are from a 30 and a 40 mmBTU/hr boiler, subject to annual tune-up requirements to minimize NOx emissions under 7 DE Admin Code 1112 (NOx RACT).	SNCR and SCR are technically feasible post-combustion NOx reduction technologies applicable to oil and gas fired boilers. • The estimated cost effectiveness for retrofit of SNCR on these boilers ranges from $5,540 per incremental ton of NOx reduction to $19,450 per incremental ton of NOx reduction to achieve an overall reduction of 40% in NOx emissions. • The estimated cost effectiveness for retrofit of SCR on these boilers ranges from $12,100 per incremental ton of NOx reduction to $15,900 per incremental ton of NOx reduction to achieve an overall reduction of 80% in NOx emissions. Given that these units are already controlled, and that emissions are projected to continue to be low in the future, additional control beyond RACT is not warranted.
FMC	31	0.2%	NOx emissions from two 25 mmBTU/hr boilers and three small spray dryers. Annual tune-ups to minimize NOx emissions on all NOx emitting units is required by 7 DE Admin. Code 1112 (NOx RACT).	No control measures to further reduce emission from this facility have been identified. Given that these units are already controlled, and that emissions are projected to continue to be low in the future, additional control beyond RACT is not warranted.

Table 2: NOx Emission and Control Analysis – NCC 2011 NEI (≥ 25 TPY and ≥ 95%)

Source Category	2011 TPY	% of 2011 NEI	Description of Federal Control Measures and Measures in Delaware's SIP	Potential Additional Control Measures
DuPont - Edge Moor	27	0.2%	NOx emissions are from small (<50 mmBTU/hr) combustion units, which are subject to annual tune-up requirements to minimize NOx under 7 DE Admin Code 1112 (NOx RACT).	No control measures to further reduce emission from this facility have been identified. Given that these units are already controlled, and that emissions are projected to continue to be low in the future, additional control beyond RACT is not warranted
Total - categories covering all 2011 NEI sources that emit more than 25 TPY and ≥ 95% of NOx.	**15,654**	**98.7%**		
Total - all other 2011 NEI facilities and source categories not included above.	212	1.3%	Many of these small sources are also controlled under the measures in Delaware's SIP. This includes small sources covered by 7 DE Admin. Code 1112, 1144 and 1148.	
Total 2011 Anthropogenic Emissions (TPY)	**15,866**	**100**		

Table 3: $PM_{2.5}$ Emission and Control Analysis – NCC 2011 NEI (≥ 25 TPY and ≥ 95%)

Source Category	2011 TPY	% of 2011 NEI	Description of Federal Control Measures and Control Measures in Delaware's SIP	Potential Additional Control Measures
Residential Wood Combustion	521	20.8%	This category is regulated under 40 C.F.R. Part 60 Subpart AAA New Source Performance Standards ("NSPS") and 7 DE Admin. Code 1114 and 7 DE Admin. Code 1114, Visible Emissions.	The NSPS covers new wood stoves only. A potential additional measure is the adoption of a wood stove change-out program. Based on a study done by New Hampshire DES[2], the cost of their change-out program was $35,250- 47,000 per ton of $PM_{2.5}$ reduced, and which realized 3-4 tpy reductions of $PM_{2.5}$.
Paved Road Dust	408	16.3%	This is an on-road category and no reasonable measures have been identified to reduce these emissions. Delaware does not regulate this category in its SIP. Note: these emissions do not take into account the transport fraction.	None
Delaware City Refinery (Premcor)	281	11.2%	The main $PM_{2.5}$ emission sources at the refinery are the Coker and Catalytic Cracker CO boilers. Both of these units are well controlled with scrubbers that were installed under a federal consent decree. 2002 emissions from these two units were 1,241 tpy and total 2012 $PM_{2.5}$ from the entire refinery was 312 TPY.	No economically feasible additional control measures have been identified to further reduce $PM_{2.5}$ emissions from the refinery.
On-road Mobile	241	9.6%	New vehicles must meet California vehicle emission standards (CA LEV 3) under 7 DE Admin. Code 1140. New and existing vehicles must be maintained under Delaware's vehicle Inspection and Maintenance program, 7 DE Admin. Code 1126 and 1131. Extended idling of heavy duty vehicles is prohibited under 7 DE Admin Code 1145.	Delaware has no authority under the CAA to further regulate tailpipe emissions. Aside from I/M program upgrades, all other identified measures are in the form of transportation control measures (TCMs), which generally gain small incremental reductions (i.e., on the order of tons per year, not hundreds of tons per year), and that have a $/ton cost of $50,000 to over $1 million.

[2] *Keene Woodstove Changeout Campaign 2009-2010*, Final Report. New Hampshire Department of Environmental Services, September 2010. .

Table 3: $PM_{2.5}$ Emission and Control Analysis – NCC 2011 NEI (≥ 25 TPY and ≥ 95%)

Source Category	2011 TPY	% of 2011 NEI	Description of Federal Control Measures and Control Measures in Delaware's SIP	Potential Additional Control Measures
			Overall on-road mobile emissions are capped in New Castle County by $PM_{2.5}$ SIP budgets, which are managed under 7 DE Admin. Code 1132, transportation conformity.	
Construction Dust (road, residential and commercial)	174	6.9%	Delaware Admin Code 1106 - Particulate Emissions from Construction and Materials Handling (effective 2/01/1981, administratively revised 9/01/2008). In summary, regulation 1106 states that any persons doing demolition, land clearing, land grading (including grading for roads), excavation, material transport, or the use of non-paved roads on private property are required to employ control dust control measures, when the Department determines that such activities could emit dust in quantities sufficient to cause air pollution.	EPA's Menu of Options states that "The dust control plan includes chemical suppression and water treatment of disturbed soil at construction sites." However, it says this option is "mainly for PM10" and DNREC is not aware of alternative control measures for direct PM2.5. [Note that transport fraction not yet applied]
Non-Road Equipment	161	6.4%	These categories are subject to applicable federal measures only.	Delaware has limited authority under the CAA to regulate off-road mobile sources. Delaware, as part of the Ozone Transport Commission (OTC), is currently evaluating the feasibility of an off-road anti-idling regulation. Other potential measures include programs such as lawn-mower trade-in programs which generally gain small incremental reductions (i.e., on the order of tenths of a ton to several tons per year).
Commercial Marine Vessels (primarily in-transit emissions from residual oil combustion)	138	5.5%	Commercial Marine Vessels include ocean-going ships and other large craft. This category is subject to applicable federal measures only, such as the EPA C-3 Marine Engine Rule.	Delaware has limited authority under the CAA to regulate off-road mobile sources.
Commercial Cooking	135	5.4%	7 DE Admin. Code 1114, Visible Emissions, applies to this source category.	Additional control is possible. EPA's 2012 Menu of Options lists only chain driven emissions as controllable. Chain driven emissions were

Table 3: $PM_{2.5}$ Emission and Control Analysis – NCC 2011 NEI (≥ 25 TPY and ≥ 95%)

Source Category	2011 TPY	% of 2011 NEI	Description of Federal Control Measures and Control Measures in Delaware's SIP	Potential Additional Control Measures
				estimated at 1.8 tpy $PM_{2.5}$ in Delaware's 2008 emissions inventory. Given the low level of overall emissions that can be controlled, potential reductions are small.
Calpine - Hay Road (Conectiv)	106	4.2%	The Hay Road EGUs are fired on natural gas and distillate oil. Much of the $PM_{2.5}$ emissions are condensable. Direct $PM_{2.5}$emissions are limited to 0.3 lb/mmbtu under 7 DE Admin. Code 1104, Particulate Emissions From Fuel Burning Equipment.	No economically feasible emission control technology to reduce direct $PM_{2.5}$ emissions from this facility has been identified. 7 DE Admin. Code 1108 and 1112 regulate the precursors SO_2 and NOx, and ensure this source category is well controlled relative to its impact on ambient $PM_{2.5}$ concentrations.
Evraz Claymont Steel	63	2.5%	This facility ceased operations beginning December, 2013.	Not Applicable
Crop Production	47	1.9%	Delaware farmers employ crop rotation and no-till practices. [Note that transport fraction not yet applied]	No additional control measures to reduce $PM_{2.5}$ due to farming have been identified.
Formosa Plastics	33	1.3%	This facility produces vinyl chloride monomer. Emissions almost exclusively from polymer drying (presumable from VOC condensation). $PM_{2.5}$ is controlled by baghouses.	No additional direct $PM_{2.5}$ control measures have been identified for this facility.
Sunoco	30	1.2%	Not applicable – this facility is now closed.	Not Applicable
Commercial/ Industrial/ Residential Combustion fired on Oil	21	0.8%	The commercial/institutional fuel combustion category includes small boilers, furnaces, heaters, and other heating units too small to be considered point sources. The commercial/institutional sector includes wholesale and retail businesses; health institutions; social and educational institutions; and federal, state, and local governments (i.e., prisons, office buildings) and are defined by SIC codes 50-99. The fuel types included in this source category are coal (SCC 2103002000), distillate oil (SCC 2103004000), residual oil (SCC 2103005000), natural gas (SCC 2103006000), and liquefied petroleum gas (LPG) (SCC 2103007000). Uses of natural gas and LPG in this	No economically feasible emission control technology to reduce direct $PM_{2.5}$ emissions from this source category has been identified. 7 DE Admin. Code 1108 and 1112 regulate the precursors SO_2 and NOx, and ensure this source category is well controlled relative to its impact on ambient $PM_{2.5}$ concentrations.

Table 3: $PM_{2.5}$ Emission and Control Analysis – NCC 2011 NEI (≥ 25 TPY and ≥ 95%)

Source Category	2011 TPY	% of 2011 NEI	Description of Federal Control Measures and Control Measures in Delaware's SIP	Potential Additional Control Measures
			sector include space heating, water heating, and cooking. Uses of distillate oil and kerosene include space and water heating. Emissions in this category are from many small units throughout the State,. Direct $PM_{2.5}$ emissions are limited to 0.3 lb/mmbtu under 7 DE Admin. Code 1104, Particulate Emissions From Fuel Burning Equipment.	
FMC Biopolymer	19	0.8%	Emissions are primarily from the "Air Dryers". Control device for PM is scrubbers.	No economically feasible emission control technology to reduce direct $PM_{2.5}$ emissions from this facility has been identified.
DuPont Experimental Station	19	0.7%	This facility has four (4) residual oil fired boilers and one gas fired boiler, each rated at 96 mmBTU/hr each. Direct $PM_{2.5}$ emissions are limited to 0.3 lb/mmbtu under 7 DE Admin. Code 1104, Particulate Emissions From Fuel Burning Equipment. DuPont Experimental Station is currently paying for the installation of a natural gas line to the facility, after which all boilers will operate using natural gas. The goal is to have all boilers converted to natural gas by mid-2017.	No economically feasible emission control technology to reduce direct $PM_{2.5}$ emissions from these units has been identified. The precursors SO_2 and NOx are well controlled, which ensures these units are well controlled relative to their impact on ambient $PM_{2.5}$ concentrations.
Total - categories covering all 2011 NEI sources that emit more than 25 TPY and ≥ 95% of PM2.5	**2,396**	**95.6%**		
Total - all other 2011 NEI facilities and source categories not included above	112	4.4%		

Table 3: $PM_{2.5}$ Emission and Control Analysis – NCC 2011 NEI (≥ 25 TPY and ≥ 95%)

Source Category	2011 TPY	% of 2011 NEI	Description of Federal Control Measures and Control Measures in Delaware's SIP	Potential Additional Control Measures
Total 2011 Anthropogenic Emissions (TPY)	**2,507**	**100%**		

Table 4: VOC Emission and Control Analysis - NCC 2011 NEI (≥ 25 TPY and ≥ 95%)

Source Category	2011 TPY	% of 2011 Inventory	Description of Federal Control Measures and Control Measures in Delaware's SIP	Potential Additional Control Measures
On-Road Mobile	3,285	28.6%	New vehicles must meet California vehicle emission standards (CA LEV 3) under 7 DE Admin. Code 1140. New and existing vehicles must be maintained under Delaware's vehicle Inspection and Maintenance program, 7 DE Admin. Code 1126 and 1131. Extended idling of heavy duty vehicles is prohibited under 7 DE Admin Code 1145. Overall on-road mobile emissions are capped in each of Delaware's three counties by ozone SIP budgets, which are managed under 7 DE Admin. Code 1132, transportation conformity.	Delaware has no authority under the CAA to further regulate tailpipe emissions. Aside from I/M program upgrades, all other identified measures are in the form of transportation control measures (TCMs), which generally gain small incremental reductions (i.e., on the order of tons per year, not hundreds of tons per year), and that have a $/ton cost of $50,000 to over $1 million.
Non-Road equipment	2,094	18.3%	These categories are subject to applicable federal measures only.	Delaware has limited authority under the CAA to regulate off-road mobile sources. Delaware, as part of the Ozone Transport Commission (OTC), is currently evaluating the feasibility of an off-road anti-idling regulation. Other potential measures include programs such as lawn-mower trade-in programs which generally gain small incremental reductions (i.e., on the order of tenths of a ton to several tons per year), and that have a $/ton cost of $50,000 to over $1 million.
Commercial/Consumer Products	1,245	10.9%	Commercial and consumer products are defined as non-industrial products used around the home,	Delaware's SIP currently contains the most stringent provisions feasible at this point (i.e.,

Table 4: VOC Emission and Control Analysis - NCC 2011 NEI (≥ 25 TPY and ≥ 95%)

Source Category	2011 TPY	% of 2011 Inventory	Description of Federal Control Measures and Control Measures in Delaware's SIP	Potential Additional Control Measures
			office, institution, or similar settings. Included are hundreds of individual products, including personal care products (SCC 2460100000), household products (SCC 2460200000), automotive aftermarket products (SCC 2460400000), coatings and related products (SCC 2460500000), adhesives and sealants (SCC 2460600000), Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) related products (SCC 2460800000), and other miscellaneous products (SCC 2460900000). The VOCs in these products may act either as the carriers for the active product ingredients or as the active ingredients themselves. This category has undergone three rounds of regulation in Delaware. First under a 1998 National Rule (*63 FR 48819)*, then under a more stringent 2002 Delaware regulation (Section 2.0 of 7 DE Admin. Code 1141) which was based on an OTC model rule. Finally, under an update to Section 2.0 of 7 DE Admin. Code 1141 which was based on a 2006 revised OTC model rule, and which had a 2009 compliance date.	those of the most recent OTC model rule adopted by any state). [3] Delaware does not have the authority to directly regulate manufacturers outside of the boundaries of the State of Delaware. Because of this, the only means available to Delaware to regulate emission in this category is to regulate the allowable VOC content of products sold in Delaware. Delaware represents a very small market share to these manufacturers and any attempt by Delaware to further reduce allowable VOC content on our own would result in the manufacturers not selling in Delaware, rather than having the desired effect of reformulation to lower VOC emitting products. In other words, Delaware's market share alone is not large enough for manufacturers to justify the expense of reformulating their products. Separate from a national or regional rule, it is not feasible for Delaware to regulate this category further. [4]
Residential Wood Combustion	633	5.5%	Delaware does not regulate this category in its SIP. Woodstoves are regulated under 40 C.F.R. Part 60 Subpart AAA New Source Performance Standards ("NSPS").	No economically feasible VOC emission control strategies for this source category have been identified.
Architectural and Industrial Maintenance (AIM) Coatings	619	5.4%	Architectural surface coating operations consist of applying a thin layer of coating such as paint,	Delaware's SIP currently contains the most stringent provisions feasible at this point (i.e.,

[3] The OTC commissioners approved an updated consumer products model rule in May 2012. Delaware plans to propose an update to its regulations based on this model rule in the future

[4] Note that the OTR states are currently considering an update to their model rule. This is based on CARB 2006 amendments, plus potential increased benefit by adding paint thinner and multi-purpose solvents, and has the potential to reduce Delaware VOC emissions by 365 TPY.

Table 4: VOC Emission and Control Analysis - NCC 2011 NEI (≥ 25 TPY and ≥ 95%)

Source Category	2011 TPY	% of 2011 Inventory	Description of Federal Control Measures and Control Measures in Delaware's SIP	Potential Additional Control Measures
(Area Source Category)			paint primer, varnish, or lacquer to architectural surfaces, and the use of solvents as thinners and for cleanup. Surface coatings include either a water-based or solvent-based liquid carrier that generally evaporates in the curing process. Architectural surface coatings are applied to protect the substrate and/or to increase the aesthetic value of a structure. Industrial maintenance coatings include primers, sealers, undercoats, and intermediate and topcoats formulated for and applied to substrates in industrial, commercial, coastal, or institutional situations that are exposed to extreme environmental and physical conditions. These conditions include immersion in water, chemical solutions and corrosives, and exposures to high temperatures. AIM coatings are regulated under Section 1 of 7 DE Admin. Code 1141. This regulation is based on an Ozone Transport Commission (OTC) model rule (which was based on California regulations), and which is much more stringent than the current federal rule. The compliance date of this regulation was 1/1/2005.	those of the most recent OTC model rule adopted by any state)[5]. Delaware does not have the authority to directly regulate manufacturers outside of the boundaries of the State of Delaware. Because of this, the only means available to Delaware to regulate emission in this category is to regulate the allowable VOC content of products sold in Delaware. Delaware represents a very small market share to these manufacturers and any attempt by Delaware to further reduce allowable VOC content on our own would result in the manufacturers not selling in Delaware, rather than having the desired effect of reformulation to lower VOC emitting products. In other words, Delaware's market share alone is not large enough for manufacturers to justify the expense of reformulating their products. Separate from a national or regional rule, it is not feasible for Delaware to regulate this category further.
Graphic Arts (Area Source Category)	507	4.4%	Printing operations are a source of VOC emissions due to the volatile organic content of inks and thinners used in the industry. It is estimated that, on average, half of the graphic arts establishments are in-house printing services in non-printing industries. The remaining establishments are located at businesses whose	Delaware's SIP currently contains the most stringent identified provisions feasible at this point (i.e., those of the most recent EPA CTGs).

[5] An update AIM model rule was approved by the OTC on June 3, 2010, which has not yet been adopted by any state. Delaware plans to propose an update to its regulations based on this model rule in the future.

Table 4: VOC Emission and Control Analysis - NCC 2011 NEI (≥ 25 TPY and ≥ 95%)

Source Category	2011 TPY	% of 2011 Inventory	Description of Federal Control Measures and Control Measures in Delaware's SIP	Potential Additional Control Measures
			main function is printing or graphic arts. Large printing operations with VOC emissions of 10 TPY or more are included in the point source inventory. All sources with maximum theoretical emissions equal to or greater than 7.7 TPY are subject to the CTG based requirements in Section 37 of 7 DE Admin Code 1124 (VOC RACT). Offset lithographic and letterpress emission sources with maximum theoretical emissions equal to or greater than 15 pounds per day are subject to the CTG based requirements in Section 47 of 7 DE Admin Code 1124 (VOC RACT).	
Retail Gasoline Marketing – • **Stage I Vapor Recovery** • **Stage II Vapor Recovery** • **Tank Breathing** • **Trucks in Transit**	442	3.9%	Stage I emissions (i.e., tank truck refilling of storage tanks) are controlled by vapor balancing under Section 26 of 7 DE Admin. Code 1124 (VOC RACT). Stage II emissions (i.e., refueling of vehicles) are controlled by vapor balancing under Section 36 of 7 DE Admin. Code 1124 (VOC RACT). Gasoline tank breathing emissions are subject to annual leak testing and permitting requirements under Section 36 of 7 DE Admin. Code 1124 (VOC RACT) Gasoline tank truck emissions are subject to annual leak testing and permitting requirements under Section 27 of 7 DE Admin. Code 1124 (VOC RACT).	No control measures to further reduce emission from Tank Breathing, and trucks in transit have been identified. Additional reductions could be achieved by revising Stage I and Stage II requirements to California EVR requirements. Delaware has begun the process to revise its Stage I and Stage II requirements. This revision could yield VOC reductions of up to 100 TPY.
Auto body Refinishing	404	3.5%	Auto refinishing is the repairing of worn or damaged automobiles, light trucks, and other vehicles, and refers to any coating applications that occur subsequent to those at original	Delaware's SIP represents the current level of technology for this source category.

Table 4: VOC Emission and Control Analysis - NCC 2011 NEI (≥ 25 TPY and ≥ 95%)

Source Category	2011 TPY	% of 2011 Inventory	Description of Federal Control Measures and Control Measures in Delaware's SIP	Potential Additional Control Measures
			equipment manufacturer (OEM) assembly plants (i.e., coating of new cars is not included in this category). The majority of these operations occur at small body shops that repair and refinish automobiles. This category covers solvent emissions from the refinishing of automobiles, including paint solvents, thinning solvents, and solvents used for surface preparation and cleanup. Autobody refinishing is regulated under Section 11 of 7 DE Admin Code 1124. This source category has undergone three rounds of regulation in Delaware since 1990 (i.e., 1st CTG RACT, then OTC Model Rule 1 in 2002, and now OTC Model Rule 2 which had a compliance date of 1/1/2012).	
Gasoline Marketing - Portable Fuel Containers	374	3.3%	Portable fuel containers are regulated nationally by the EPA under 40 CFR Part 59, Subpart F.	No control measures to further reduce emission from this category have been identified.
Industrial Adhesives (Area Source Category)	294	2.6%	Regulated under Section 4.0 of 7 DE Admin. Code 1141. 1141 is much more stringent than the most recent EPA CTG, and has broader coverage than the CTG (i.e., it covers field applied roofing adhesives and sealants not covered by the CTG). These requirements took effect on 5/1/2009.	Delaware's SIP represents the current level of technology for this source category. Additional regulation of this category is not feasible at this time.
Degreasing (Area Source Category)	191	1.7%	Solvent cleaning is the process of using organic solvents to remove grease, fats, oils, wax or soil from various metal, glass, or plastic items. Non-aqueous solvents such as petroleum distillates, chlorinated hydrocarbons, ketones, and alcohols have been used historically; however, the use of aqueous cleaning systems for some applications has recently gained acceptance. The types of equipment used in this method are categorized as cold cleaners, open top vapor degreasers, or conveyorized degreasers.	This category has undergone two rounds of regulation in Delaware (i.e., 1st CTG RACT, then OTC Model Rule 1 in 2002). This category is regulated much more stringently than required by the CTG. DNREC has started working on a revision to DE Admin Code 1124, Section 33.0 "Solvent Cleaning and Drying, which is estimated to reduce VOC emissions by an additional 1 TPD.

Table 4: VOC Emission and Control Analysis - NCC 2011 NEI (≥ 25 TPY and ≥ 95%)

Source Category	2011 TPY	% of 2011 Inventory	Description of Federal Control Measures and Control Measures in Delaware's SIP	Potential Additional Control Measures
			Degreasing is regulated under Section 33 of 7 DE Admin. Code 1124.	
Gasoline Marketing – Commercial Marine Vessel Evaporation Losses	142	1.2%	Not regulated beyond any applicable federal measures.	No control measures to reduce emission from this category have been identified.
Delaware City Refinery	139	1.2%	The Delaware City Refinery is a petroleum refinery. VOC emissions are subject to 7 DE Admin Code 1124 (VOC RACT). In addition, numerous sources at the facility are subject to emission limits established under 7 DE Admin. Code 1125 (LAER plus offsets).	The OTC finalized a model rule in 2010 to address VOC emissions from large aboveground VOC storage tanks (ASTs). In June 2010, Delaware and other nine OTC member states signed a MOU, which requested the undersigned OTC members to adopt the model rule, or to revise existing rule to reflect the model rule, by January 2014 or as soon thereafter as practical. Delaware is pursuing adoption now.
Industrial Surface Coatings (Area Source Category)	139	1.2%	This source category is covered under Section 1 of 7 DE Admin. Code 1141 and several sections of 7 DE Admin. Code 1124, based on CTGs.	Delaware's SIP represents the current level of technology for this source category. Additional regulation of this category is not feasible at this time.
Land application of Agriculture Herbicides & Pesticides	114	1.0%	None.	Regulation of this category is not feasible by the State of Delaware. The only identified potential control measure for this source category is to reduce the VOC content of the herbicide or pesticide. Delaware does not command sufficient market share for this to be feasible. This category is best regulated by the EPA under a national rule.

Table 4: VOC Emission and Control Analysis - NCC 2011 NEI (≥ 25 TPY and ≥ 95%)

Source Category	2011 TPY	% of 2011 Inventory	Description of Federal Control Measures and Control Measures in Delaware's SIP	Potential Additional Control Measures
DuPont - Edge Moor	99	0.9%	VOC emissions are subject to an 81% reduction under Section 50 of 7 DE Admin Code 1124 (VOC RACT).	No control measures to further reduce emission from this facility have been identified.
Commercial Marine Vessels	71	0.6%	Commercial Marine Vessels include ocean-going ships and other large craft. This category is subject to the federal EPA C-3 Marine Engine Rule, which established standards for emissions of hydrocarbons from new Category 3 engines.	Delaware has limited authority under the CAA to regulate off-road mobile sources.
Evraz Claymont Steel	69	0.6%	This facility ceased operations beginning December, 2013.	Not Applicable
Formosa Plastics	59	0.5%	This facility produces vinyl chloride monomer. This facility is subject to 7 DE Admin. Code 1112 and 1124 (VOC RACT).	No additional feasible controls have been identified to reduce VOC emissions from this facility.
Commercial/Industrial/ Residential Combustion fired on Gas	56	0.5%	The commercial/institutional fuel combustion category includes small boilers, furnaces, heaters, and other heating units too small to be considered point sources. The commercial/institutional sector includes wholesale and retail businesses; health institutions; social and educational institutions; and federal, state, and local governments (i.e., prisons, office buildings) and are defined by SIC codes 50-99. The fuel types included in this source category are coal (SCC 2103002000), distillate oil (SCC 2103004000), residual oil (SCC 2103005000), natural gas (SCC 2103006000), and liquefied petroleum gas (LPG) (SCC 2103007000). Uses of natural gas and LPG in this sector include space heating, water heating, and cooking. Uses of distillate oil and kerosene include space and water heating.	No economically feasible emission control technology to reduce VOC emissions from this source category has been identified. 7 DE Admin. Code 1108 and 1112 regulate the precursors SO_2 and NOx, and ensure this source category is well controlled relative to its impact on ambient $PM_{2.5}$ concentrations.

Table 4: VOC Emission and Control Analysis - NCC 2011 NEI (≥ 25 TPY and ≥ 95%)

Source Category	2011 TPY	% of 2011 Inventory	Description of Federal Control Measures and Control Measures in Delaware's SIP	Potential Additional Control Measures
			Emissions in this category are from many small units throughout the State, where facility-wide VOC emissions are generally less than 5 TPY (i.e., those not covered in the point source inventory). VOC emissions from this source category are not regulated.	
Prescribed Fires	52	0.5%	Open burning is restricted under 7 DE Admin. Code 1113.	No economically feasible additional control measures to reduce VOC emission from this source category have been identified.
Sunoco	46	0.4%	This facility was subject to 7 DE Admin. Code 1112 and 1124 (VOC RACT).	The facility is now shutdown.
Printpack	44	0.4%	The emissions from the facility are from seven flexographic printing presses, a photopolymer plate making system, and automatic parts washer, and a waste solvent tank. Emissions are controlled by a regenerative thermal oxidizer operated pursuant to 7 DE Admin. Code 1124 (VOC RACT).	No economically feasible control measures to further reduce VOC emissions from this facility have been identified.
Magellan Terminals	39	0.3%	Magellan Terminals is a liquid fuels marketing and bulk fuels terminal and subject to 7 DE Admin. Code 1124 (VOC RACT), Sections , 30, 31, and 49. Magellan, to avoid Nonattainment New Source Review, plans to keep their net emission increase per unit below the significant emission rate of 25 TPY.	The OTC finalized a model rule in 2010 to address VOC emissions from large aboveground VOC storage tanks (ASTs). In June 2010, Delaware and other nine OTC member states signed a MOU, which requested the undersigned OTC members to adopt the model rule, or to revise existing rule to reflect the model rule, by January 2014 or as soon thereafter as practical. Delaware is pursuing adoption now.

Table 4: VOC Emission and Control Analysis - NCC 2011 NEI (≥ 25 TPY and ≥ 95%)

Source Category	2011 TPY	% of 2011 Inventory	Description of Federal Control Measures and Control Measures in Delaware's SIP	Potential Additional Control Measures
Traffic Markings (Area Source Category)	37	0.3%	The VOC of traffic marking coatings is limited to 150 grams of VOC per liter of coating under Section 1 of 7 DE Admin. Code 1141, Architectural and Industrial Maintenance Coatings.	No feasible additional control measures have been identified to reduce VOC emissions from this source category.
Calpine - Hay Road (Conectiv)	33	0.3%	This facility is a power plant that consists of six combined cycle gas fired (oil backup) EGUs.	No feasible additional control measures have been identified to reduce VOC emissions from gas-and oil-fired EGUs.
Calpine - Edge Moor (Conectiv)	25	0.2%	This facility is a power plant that consists of three gas/oil fired EGUs. (i.e., 86 MW, 174 MW, and 450 MW). Calpine's permit establishes a facility-wide VOC limit of 148 tpy.	No feasible additional control measures have been identified to reduce VOC emissions from gas-and oil-fired EGUs.
Total - categories covering all 2011 NEI sources that emit more than 25 TPY and ≥ 95% of VOC	**11,254**	**98.1%**		
Total - all other 2011 NEI facilities and source categories not included above	215	1.9%	Many of these small sources are also controlled under the adequate measures in Delaware's SIP. This includes small sources covered by CTG and non-CTG RACT that are established under 7 DE Admin. Code 1124.	
Total 2011 Anthropogenic Emissions (TPY)	**11,469**	**100%**		

Table 5: NH_3 Emission and Control Analysis –NCC 2011 NEI (≥ 25 TPY and ≥ 95%)

Source Category	2011 TPY	% of 2011 Inventory	Description of Federal Control Measures and Control Measures in Delaware's SIP	Potential Additional Control Measures
Animal Husbandry	230	25.0%	Delaware regulates Concentrated Animal Feeding Operation (CAFO) under State regulations and permitting program that meet the requirements of the federal Clean Water Act (§2202, Title 3 of the Delaware Code.	No feasible additional control measures have been identified to reduce NH_3 emissions from this source category.
Fertilizers	229	24.9%	Not regulated.	Regulation of this category is not feasible by the State of Delaware. The only identified potential control measure for this source category is to reduce the NH_3 content of the fertilizer. Delaware does not command sufficient market share for this to be feasible. This category is best regulated by the EPA under a national rule.
On-road Mobile	189	20.5%	New vehicles must meet California vehicle emission standards (CA LEV 3) under 7 DE Admin. Code 1140. New and existing vehicles must be maintained under Delaware's vehicle Inspection and Maintenance program, 7 DE Admin. Code 1126 and 1131. Extended idling of heavy duty vehicles is prohibited under 7 DE Admin Code 1145.	Delaware has no authority under the CAA to further regulate tailpipe emissions. Aside from I/M program upgrades, all other identified measures are in the form of transportation control measures (TCMs), which generally gain small incremental reductions.
Commercial/ Industrial/ Residential Combustion fired on Gas	122	13.2%	The commercial/institutional fuel combustion category includes small boilers, furnaces, heaters, and other heating units too small to be considered point sources. The commercial/institutional sector includes wholesale and retail businesses; health institutions; social and educational institutions; and federal, state, and local governments (i.e., prisons, office buildings) and are defined by SIC	No additional economically feasible emission control technology to reduce NH_3 emissions from this source category has been identified.

Table 5: NH_3 Emission and Control Analysis –NCC 2011 NEI (≥ 25 TPY and ≥ 95%)

			codes 50-99. The fuel types included in this source category are coal (SCC 2103002000), distillate oil (SCC 2103004000), residual oil (SCC 2103005000), natural gas (SCC 2103006000), and liquefied petroleum gas (LPG) (SCC 2103007000). Uses of distillate oil and kerosene include space and water heating. Emissions in this category are from many small units throughout the State. NH3 emissions for this source category are not regulated.	
Hay Road	53	5.7%	No known ammonia controls for fuel combustion Note: ammonia injection to reduce NOx contributes to additional NH3 emissions, but this trade-off is necessary	Not applicable.
Residential Wood Combustion	32	3.5%	Delaware does not regulate this category in its SIP. It is regulated under 40 C.F.R. Part 60 Subpart AAA New Source Performance Standards ("NSPS")	Because all four New Castle County monitors are significantly below the 2012 PM2.5 NAAQS, economic and political obstacles would have to be overcome before Delaware could adopt measures to regulate this source, unless those measures are voluntary. Delaware is currently assessing EPA's PM2.5 Advance program[6] as a means of sources to voluntarily reduce emissions from this and other categories.
Calpine - Edge Moor (Conectiv)	11	1.2%	This facility is a power plant that consists of three gas/oil fired EGUs. (i.e., 86 MW, 174 MW, and 450 MW). Note: Calpine may use urea injection to reduce NOx, but urea contributes to additional NH_3 emissions. This trade-off is necessary to reduce NOx for helping meet the ozone NAAQS.	No feasible additional control measures have been identified to reduce NH_3 emissions from these units.

[6] http://epa.gov/ozonepmadvance/index.html

Table 5: NH_3 Emission and Control Analysis –NCC 2011 NEI (≥ 25 TPY and ≥ 95%)

			However, the urea injection is not needed at the present time. NH_3 limits will be established only if urea is required to meet NOx emission standards.	
Formosa Plastics	11	1.1%	NH_3 emissions from this facility are not regulated.	No feasible additional control measures have been identified to reduce NH_3 emissions from this facility.
Total - categories covering all 2011 NEI sources that emit more than 25 TPY and ≥ 95% of NH3	**876**	**95.1%**		
Total - all other 2011 NEI facilities and source categories not included above	45	4.9%		
Total 2011 Anthropogenic Emissions (TPY)	**922**	**100%**		