Ohio | Environmental Protection Agency

State of Ohio Environmental Protection Agency
Division of Air Pollution Control

Ohio's Recommended Designations for the 2012 Annual $PM_{2.5}$ Standard

DRAFT

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The Ohio Environmental Protection Agency
Division of Air Pollution Control

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Designation Area	Historical Annual $PM_{2.5}$ Nonattainment Designation Counties	Ohio EPA Recommended Nonattainment Counties
(1) Canton-Massillon, OH	Stark	Stark
(2) Cincinnati-Hamilton, OH-KY-IN	Butler Clermont Hamilton Warren	Butler Clermont Hamilton
(3) Cleveland-Akron-Lorain, OH	Cuyahoga Lake Lorain Medina Portage Summit Ashtabula (P)	Cuyahoga
(4) Columbus, OH	Delaware Fairfield Franklin Licking Coshocton (P)	
(5) Dayton-Springfield, OH	Clark Greene Montgomery	
(6) Huntington-Ashland, WV-KY-OH	Lawrence Scioto Adams (P) Gallia (P)	
(7) Parkersburg-Marietta, WV-OH	Washington	
(8) Steubenville-Weirton, OH-WV	Jefferson	Jefferson
(9) Toledo, OH		
(10) Wheeling, WV-OH	Belmont	
(11) Youngstown-Warren-Sharon, OH-PA		

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Background

On December 14, 2012, U.S. EPA strengthened the 1997 primary annual PM2.5 standard, lowering it from 15.0 μg/m^3 to 12.0 μg/m^3, and retained the existing 2006 24-hour PM2.5 standard of 35 μg/m^3 (78 FR 30860).

Under Clean Air Act (CAA) Section 107(d), U.S. EPA is required to make designations after a State submits recommendations. This document is Ohio's recommendations for designations of the 2012 annual PM2.5 standard. These recommendations are due to U.S. EPA by December 13, 2013 and use the three-most recent years of air quality data available at the time, 2010 to 2012. Following this recommendation, U.S. EPA intends to notify States (via a "120-day letter") by August 14, 2014 and to finalize designations, after a public comment period, by December 12, 2014.

Based on the air quality data, and the five-factor analysis discussed below, Ohio is recommending designations of unclassifiable/attainment and nonattainment. The remainder of this document discusses the method used for Ohio's recommendations for nonattainment areas and the resulting analysis. Ohio is recommending all other counties in the State be designated as unclassifiable/attainment. U.S. EPA has historically used the "unclassifiable/attainment" category for areas that monitor attainment and for areas that do not have monitors and there is no reason to believe they are not attainment or are contributing to nearby violations.

An Explanation of Ohio EPA's Five-Factor Analysis for Nonattainment Recommendations

U.S. EPA's guidance "Initial Area Designations for the 2012 Revised Primary Annual Fine Particle National Ambient Air Quality Standard" (April, 16, 2013) (herein referred to as "Designation Guidance") states that each area evaluated for nonattainment should be assessed on a case-by-case basis considering the specific facts and circumstances unique to the area. A nonattainment area must include not only the area that is violating the standard but also nearby areas that contribute to the violation. This area of analysis begins with an evaluation of the entire urbanized area, starting with the 2012 Core Based Statistical Area/Combined Statistical Area (CBSA/CSA) that contains the violating monitor(s). Ohio's CBSA/CSA's are show in Appendix A. Boundary recommendations should be based on an evaluation of the five factors discussed in the Designation Guidance, as well as any other relevant factors or circumstances specific to a particular area.

The five designation factors used to determine nearby areas of influence are:

1. Air quality data
2. Emissions and emissions-related data
3. Meteorology
4. Geography/topography, and
5. Jurisdictional boundaries

The analyses methods for each factor are described below and the actual analysis for each nonattainment area is provided in the section entitled "Recommendations for Nonattainment."

Factor 1: Air quality data

The annual revised standard is 12.0 µg/m^3. Ohio EPA operates a large network of Federal Reference Method (FRM) $PM_{2.5}$ monitors, primarily located in the expected high $PM_{2.5}$ concentration areas with additional attention to more highly populated areas as well. Included in the FRM network is a subset of monitor sites which also monitor $PM_{2.5}$ species (sulfate, nitrate, organic carbon, elemental carbon and 'crustal' or 'other'). Many of Ohio's speciation monitors are co-located monitors to target the highest reading FRM monitors in the area. In some cases, though, the co-located speciation monitor is located in a more rural or less industrialized area.

The air quality analysis begins by looking at the design value of each monitoring site. The design value is the 3-year average, from 2010 to 2012, of the annual mean concentrations. Other air quality analyses that can help determine appropriate boundaries include:

- The amount by which monitored levels exceed the standard may indicate the magnitude of emissions contributing to the exceedance and whether there may be influences from surrounding areas.
- Trends in monitoring values (and design values) in the area.
- The magnitude of quarterly, or even daily, average PM2.5 concentrations over the course of each year may provide clues regarding contributing sources.
- Monthly and seasonal profiles of daily average PM2.5 concentrations may provide an indication of whether seasonal conditions exist.
- Identifying the chemical components of PM2.5 mass (speciation) may give insight into the types of emission sources that are contributing to exceedances, and therefore, the extent of a nonattainment boundary. Speciated data can be synthesized using an urban increment analysis, emissions data analysis and meteorological analysis.[1] PM2.5 mass concentrations are generally higher in urban areas, due to locally generated and directly emitted PM2.5, and are often referred to as the "urban increment" or "urban excess." An urban increment analysis can also be designed to differentiate local contributions from regional contributions and intra-urban differences.

All air monitoring data is retrieved from the U.S. EPA's Air Quality System (AQS) at http://www.epa.gov/ttn/airs/airsaqs/ and is presented in micrograms per cubic meter (µg/m^3) in all tables. The three-year averages for monitors that are

[1] Any analysis of speciation data follows the procedures outlined in the Designation Guidance and was adjusted using U.S. EPA's "SANDWICH" procedure.

violating the standard are highlighted with red. Monitoring sites that have less than 75 percent capture in at least one quarter are highlighted with yellow. AQS data retrieval sheets are provided in Appendix B. The state and local air monitoring stations (SLAMS) data certification report for calendar year 2012 is provided in Appendix C.

Data included in factor 2 are also provided by:

http://www.epa.gov/pmdesignations/2012standards/techinfo.htm#F2

This Web site provides access to a wide variety of data resources, including:

- Summary of 2010-2012 PM2.5 Design Values (also contains 2009-2011 PM2.5 Design Values and Urban Increments) (excel spreadsheet)
- CSN speciation data (SANDWICHED) (excel spreadsheet)
- IMPROVE speciation data (SANDWICHED) (excel spreadsheet)

The following table summarizes all the air quality data for Ohio monitors from 2006 to 2012. In some case, this table will contain more monitor locations than those identified in the nonattainment area analysis because of the historical nature of the data. Monitors included in the nonattainment area analysis include only those operational during the 2010 to 2012 design value period.

Table 1: Ohio's Average Annual PM2.5 Concentrations and 3-Year Averages

Site	County	Year							Average	Average	Average	Average	Average
		2006	2007	2008	2009	2010	2011	2012	'06-'08	07-'09	'08-'10	'09-'11	10-'12
39-003-0009	Allen					10.9	10.8	10.0					10.6
39-009-0003	Athens	11.8	13.0	10.6	9.1	9.2	8.7	8.7	11.8	10.9	9.6	9.0	8.9
39-017-0003	Butler	14.0	15.4	13.8	12.8	13.6	12.7	11.2	14.4	14.0	13.4	13.0	12.5
39-017-0016		14.0	14.9	13.8	13.1	13.5	12.4	10.8	14.2	13.9	13.5	13.0	12.2
39-017-0019							12.7	11.4					
39-017-0020							13.6	13.9					
39-017-1004		13.4	14.6										
39-023-0005	Clark	13.1	14.6	12.7	12.4	13.1	12.3	10.4	13.5	13.2	12.7	12.6	11.9
39-025-0022	Clermont	12.7	14.0	11.7	11.0	12.0	11.0		12.8	12.2	11.6	11.3	11.5
39-035-0027	Cuyahoga	13.0	14.5	13.2	10.6				13.6	12.8			
39-035-0034		11.5	13.6	10.9	10.2	10.9	10.0	9.3	12.0	11.6	10.7	10.4	10.1
39-035-0038		14.9	16.2	14.1	12.8	14.0	12.6	12.3	15.1	14.4	13.6	13.1	13.0
39-035-0045		14.1	15.3	13.7	11.8	13.3	11.9	11.4	14.4	13.6	12.9	12.3	12.2
39-035-0060		15.0	15.9	14.1	12.3	13.7	12.5	13.2	15.0	14.1	13.4	12.8	13.1
39-035-0065		13.1	15.8	14.6	12.4	13.2	12.6	12.3	14.5	14.3	13.4	12.7	12.7
39-035-1002		11.6	13.4	12.0	10.9	11.3	10.4	9.7	12.3	12.1	11.4	10.9	10.5
39-049-0024	Franklin	13.6	14.6	12.8	11.5	13.1	11.9	10.7	13.7	13.0	12.5	12.2	11.9
39-049-0025		13.6	14.7	12.4	11.5	12.6	11.5	10.7	13.6	12.9	12.2	11.9	11.6
39-049-0029						12.6	11.9	9.9					11.5
39-049-0081		12.9	13.1	11.1	10.8	11.9	10.9	10.1	12.4	11.7	11.3	11.2	11.0
39-057-0005	Greene	11.9	13.3	11.6	11.5	13.2	11.3	9.6	12.3	12.1	12.1	12.0	11.4
39-061-0006	Hamilton	13.3	14.6	12.5	12.1	12.7	11.7	10.3	13.5	13.1	12.4	12.2	11.6
39-061-0010							11.8	10.6					
39-061-0014		15.5	16.6	15.1	13.4	14.8	13.2	12.1	15.7	15.0	14.4	13.8	13.4
39-061-0040		13.6	15.1	12.6	12.7	13.3	12.4	12.6	13.8	13.5	12.9	12.8	12.8
39-061-0042		14.9	15.9	14.4	13.7	14.5	13.3	11.7	15.1	14.7	14.2	13.8	13.2
39-061-0043		14.5	14.8	13.3					14.2				
39-061-7001		14.4	15.1	13.7	13.0	14.1			14.4	13.9	13.6		
39-061-8001		15.9	16.1	14.4	13.4	17.6			15.5	14.6			
39-081-0017	Jefferson	13.8	16.2	14.3	12.1	12.7	12.6	11.3	14.8	14.2	13.0	12.5	12.2
39-081-1001		14.6	15.6	14.1	11.2	12.7	11.3	10.0	14.8	13.6	12.7	11.7	11.3
39-085-0007	Lake				10.4	10.4	9.4	9.0				10.1	9.6

Site	County	Year							Average	Average	Average	Average	Average
		2006	2007	2008	2009	2010	2011	2012	'06-'08	07-'09	'08-'10	'09-'11	10-'12
39-085-3002		11.5	13.9	11.5					12.3				
39-087-0010	Lawrence	14.4	15.0	10.8					13.4				
39-087-0012				13.1	11.3	12.1	10.8	10.9			12.2	11.4	11.3
39-093-0016	Lorain	11.5	10.1										
39-093-3002		11.4	12.9	11.4	9.9	10.4	9.4	9.5	11.9	11.4	10.6	9.9	9.8
39-095-0024	Lucas	12.7	14.8	11.9	11.4	11.2	10.6	10.0	13.1			11.1	10.6
39-095-0025		11.9	14.2	12.3					12.8				
39-095-0026		12.6	14.3	12.3	10.9	11.4	10.7	9.9	13.1		11.5	11.0	10.7
39-095-0028					11.4	11.4	11.4	10.0		12.6	11.7	11.4	10.9
39-099-0005	Mahoning	12.9	14.2	13.2	11.3	12.4	10.6	10.6	13.4	12.9	12.3	11.4	11.2
39-099-0014		13.5	14.1	13.1	11.7	12.4	11.3	10.1	13.6	13.0	12.4	11.8	11.3
39-103-0003	Medina	11.9	12.7	11.8	10.8	10.8			12.1	11.8	11.1		
39-103-0004							10.8	9.3				10.8	10.3
39-113-0031	Montgomery	13.1											
39-113-0032		13.6	15.6	13.2	12.4	14.0	12.1	10.7	14.1	13.7	13.2	12.8	12.3
39-133-0002	Portage	12.0	13.7	12.1	11.1	11.2	10.5	9.3	12.6	12.3	11.5	10.9	10.3
39-135-1001	Preble	12.5	13.6	12.0	11.1	12.0	10.9	9.3	12.7	12.2	11.7	11.3	10.7
39-145-0013	Scioto	14.3	14.0	12.2	10.9	11.8	10.2	9.8	13.5	12.4	11.6	11.0	10.6
39-151-0017	Stark	14.6	15.9	13.9	13.1	14.4	12.8	11.9	14.8	14.3	13.8	13.4	13.0
39-151-0020		11.9	14.4	12.4	11.9	13.8	11.3	10.4	12.9	12.9	12.7	12.3	11.8
39-153-0017	Summit	13.5	14.8	13.8	12.6	13.4	11.8	10.8	14.0	13.7	13.3	12.6	12.0
39-153-0023		12.8	13.7	12.9	11.4	12.5	11.1	10.0	13.1	12.7	12.3	11.7	11.2
39-155-0005	Trumbull					11.9	10.6	9.3					10.6
39-155-0007		12.9	14.2	12.8					13.3				
39-165-0007	Warren		14.0	11.9	11.7	11.9	11.0			12.1	11.6	11.5	

Combined data from two adjacent sites
Insufficient data
Violating monitor

Factor 2: Emissions and emissions-related data

The analysis for factor 2 looks at PM2.5-related emissions from areas nearby to an exceeding monitor to determine their contribution. Emissions data are derived from the 2008 and 2011 NEI data[2]. Emissions reductions that may occur beyond those in these inventories that are due to permanent and enforceable emissions controls that will be in place in time for attainment are also discussed.

This analysis looks at emissions of identified sources, and their magnitude, of direct PM2.5, the major components of direct PM2.5 (organic carbon, elemental carbon, crustal material (and/or individual trace metal compounds)), primary nitrate and primary sulfate, and precursor gaseous pollutants (e.g., SO2, NOx, total VOC and NH3).

Analyzing the magnitude and special extent of emissions can further inform the urban/rural air monitoring analysis. Furthermore, combining these analyses with meteorological analysis can further inform the degree of contribution from nearby areas.

Also included in this analysis are current population and population growth, population density and degree of urbanization along with traffic and commuting patterns. Local trends in population growth and patterns may indicate the probable location and magnitude of emissions sources that contribute to nonattainment. The 2011 NEI includes emissions for smaller stationary area and mobile source emissions. Analyzing population density, degree of urbanization, and transportation arteries may provide an indication of the spatial extent emissions from area and mobile sources. Analyzing traffic and commuting patterns, such as analyzing the number and percent of total commuters in each county commuting to counties with violating monitors and analyzing the total vehicle miles traveled (VMT), may help assess the influence of mobile source emissions in an area.

The population data for Ohio counties are provided by the Ohio Department of Development, Office of Strategic Research http://www.odod.state.oh.us/research/.

Point Source emissions for 2011 are provided by the 2011 NEI:
http://www.epa.gov/ttnchie1/net/2011inventory.html#below

Data included in factor 2 are also provided by:
http://www.epa.gov/pmdesignations/2012standards/techinfo.htm#F2

This Web site provides access to a wide variety of data resources, including:

- NEI emissions summaries (excel spreadsheet)
- Vehicle miles traveled (excel spreadsheet)

[2] http://www.epa.gov/ttnchie1/net/2011inventory.html

Factor 3: Meteorology

The meteorology review looks at wind data gathered at stations in and near Ohio by the National Weather Service (NWS). Figures presented for factor 3 indicate the annual average winds by for each NWS site. These data may also suggest that emissions in some directions relative to the violation may be more prone to contribute than emissions in other directions.

Wind rose meteorology data included in factor 2 are provided by U.S. EPA's PM2.5 Designations Mapping Tool:
http://geoplatform2.epa.gov/PM_MAP/index.html

Factor 4: Geography/topography

The geography and topography analysis looks at physical features that might have an effect on the airshed, and therefore, the distribution of particulate matter over an area. Ohio does not have significant topographic features that significantly influence the regional transport of pollutants within the multi-county study areas.

Factor 5: Jurisdictional boundaries

The analysis of jurisdictional boundaries looks at the planning and organizational structure of an area to determine if the implementation of controls in a potential nonattainment area can be carried out in the cohesive manner.

Recommendations for Nonattainment Areas

Canton-Massillon, OH

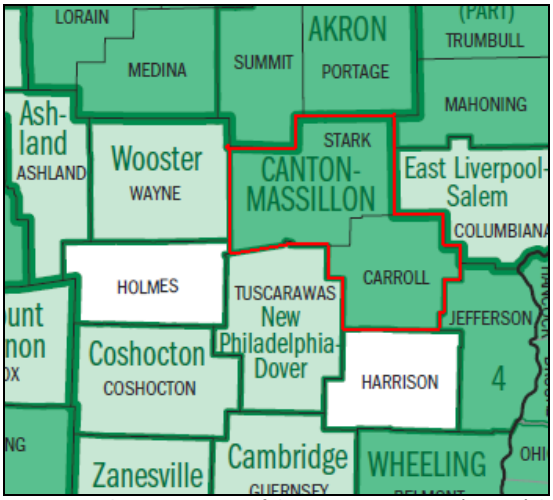
Figure 1: Canton-Massillon, OH Recommended Nonattainment Area

Discussion

There is one county in this historic $PM_{2.5}$ nonattainment area, Stark County. Ohio EPA recommends designating Stark County as nonattainment for the Canton-Massillon area. After considering the five factors, Ohio EPA does not recommend adding any contributing counties to this area.

Stark County contains two monitors, one of which is violating the annual revised standard (site 39-151-0017). Stark County is part of the Canton-Massillon MSA along with Carroll County.

Figure 2: Canton-Massillon MSA



Source: U.S. Department of Commerce Economics and Statistics Administrations, U.S. Census Bureau, 2002 Economic Census

There are nine counties that are adjacent to the Canton-Massillon MSA; Wayne, Holmes, Tuscarawas, Harrison, Jefferson, Columbiana, Mahoning, Portage and Summit Counties. Portage and Summit Counties are discussed in the Cleveland-Akron-Lorain area analysis while Jefferson County is discussed in the Steubenville-Weirton area analysis.

Factor 1: Air quality data

There are two monitors in this area.

Figure 3: Stark County Air Quality Monitors

Monitor 39-151-0017 is violating the standard based on 2010 to 2012 air quality data. The design value for the area is 13.0 µg/m^3. As can be seen from Table 1, air quality trends have declined historically in this area.

Table 2 : Annual Average (µg/m^3)

Site	County	Year			Average
		2010	2011	2012	10-'12
39-151-0017	Stark	14.4	12.8	11.9	13.0
39-151-0020		13.8	11.3	10.4	11.8

Combined data from two adjacent sites
Insufficient data
Violating monitor

Source: U.S. EPA AQS

There is one speciation monitor in this area. It is co-located with the violating monitor.

Table 3: Stark County Speciation Monitors

		Speciation Monitor SANDWICH Mass					
		Sulfate	Nitrate	Organic Carbon	Elemental Carbon	Crustal	FRM Monitor
Stark	2009	4.7	1.4	4.3	0.6	0.6	13.1
	2010	4.5	2.2	4.4	0.9	1.4	14.4
	2011	4.0	1.4	3.9	0.7	0.8	12.8
39-151-0017	2009-2011 Average	4.4	1.7	4.2	0.8	0.9	13.4

Source: CSN speciation data (SANDWICHED) from http://www.epa.gov/pmdesignations/2012standards/techinfo.htm#F1

Organic carbon and sulfate tends to dominate at this monitor.

The 2010 to 2011 urban increments (UI) have also been calculated for this monitor.

Table 4: Stark County Urban Increments

2010-2011 Averages		PM2.5 Total	PM2.5 Total UI	Organic Carbon	Organic Carbon UI	Elemental Carbon	Elemental Carbon UI	Nitrates	Nitrates UI	Sulfates	Sulfates UI	Crustal	Crustal UI
Stark 39-151-0017	Quarter 1	15.4	5.3	4.7	2.8	0.6	0.0	5.4	2.5	4.1	0.0	0.6	0.0
	Quarter 2	11.8	1.6	4.2	0.8	0.9	0.3	0.2	0.1	5.0	0.0	1.5	0.5
	Quarter 3	14.3	3.1	6.4	2.5	0.9	0.2	0.0	0.0	5.8	0.0	1.2	0.3
	Quarter 4	12.7	2.5	5.2	1.3	0.9	0.0	2.3	1.1	3.2	0.0	1.1	0.1
	Annual	13.5	3.1	5.1	1.8	0.8	0.1	2.0	0.9	4.5	0.0	1.1	0.2

Source: U.S. EPA Designations Guidance and Data: http://www.epa.gov/pmdesignations/2012standards/techinfo.htm#F2

Quarter 1 and quarter 3 tend to have higher total PM2.5 and the urban increment seems to be dominated during those periods with organic carbon. Nitrates also appear to dominate in quarter 1.

Factor 2: Emissions and emissions related data

Emission trends

Overall, the most significant emissions in the analysis area emanate from Stark County. Considering all the counties in this analysis area, Stark County accounts for 46% of PM2.5, 43% of NOx, 36% of VOC, 22% of NH3 and 4% of SO2 emissions. Wayne County, located west of the violating monitor, also has higher emissions compared to other counties in the area and it has the highest emissions of SO2 (83%) and NH3 (38%). Columbiana and Mahoning Counties also have high emissions compared to other counties in the analysis area, but are located to the east of the violating monitor. There are two monitors located in Mahoning County, both of which meet the standard.

Table 5: Canton-Massillon Analysis Area Emissions (tpy)

STARK	PM2.5	*OC*	*EC*	NOX	*Nitrate*	SO2	*Sulfate*	NH3	VOC	*Other*
Point - 2011	833.2	n/a	n/a	2,023.0	n/a	376.0	n/a	145.1	901.2	n/a
Point - 2008	1,475.3	166.8	115.8	1,418.6	10.7	544.2	217.9	21.3	919.3	1,430.1
Nonpoint	1,907.0	672.3	72.6	1,614.2	3.5	454.5	29.0	1,787.4	8,957.9	2,213.8
Nonroad	197.9	60.6	96.5	2,291.3	0.3	39.4	0.9	2.5	2,515.6	39.6
Onroad	294.2	97.5	135.5	7,837.1	0.4	36.5	2.4	148.7	4,594.7	58.5
Fire	9.8	4.9	1.1	2.9	0.1	1.2	0.0	1.7	24.3	3.7
Total - 2008	3,884.3	1,002.2	421.4	13,164.0	15.0	1,075.7	250.1	1,961.6	17,011.7	3,745.8

Carroll	PM2.5	*OC*	*EC*	NOX	*Nitrate*	SO2	*Sulfate*	NH3	VOC	*Other*
Point - 2011	86.7	n/a	n/a	675.9	n/a	6.5	n/a	0.0	32.8	n/a
Point - 2008	11.3	3.6	5.8	601.8	0.3	7.2	1.2	-	31.2	3.8
Nonpoint	326.5	113.1	21.0	224.4	0.9	60.8	5.5	373.7	3,640.5	455.2
Nonroad	17.7	5.5	8.5	155.1	0.0	2.6	0.1	0.2	284.8	3.6
Onroad	18.8	6.3	9.1	569.8	0.0	2.2	0.1	10.7	306.4	3.2
Fire	29.4	14.8	3.2	3.0	0.3	2.1	0.1	5.8	43.6	11.0
Total - 2008	403.8	143.2	47.7	1,554.1	1.6	74.9	7.0	390.4	4,306.4	476.8

Wayne	PM2.5	*OC*	*EC*	NOX	*Nitrate*	SO2	*Sulfate*	NH3	VOC	*Other*
Point - 2011	962.4	n/a	n/a	2,832.8	n/a	17,904.5	n/a	0.6	300.1	n/a
Point - 2008	1,163.6	49.9	46.5	2,989.4	1.3	21,655.5	126.3	0.1	175.2	1,029.7
Nonpoint	1,600.5	475.7	90.4	1,169.4	4.0	201.6	24.0	3,392.8	4,913.0	2,383.6
Nonroad	67.8	17.0	41.3	857.1	0.1	14.8	0.3	0.8	677.0	9.1
Onroad	105.7	33.8	53.2	3,004.4	0.1	12.2	0.7	52.3	1,511.4	17.8
Fire	-	-	-	-	-	-	-	-	-	-
Total - 2008	2,937.6	576.4	231.4	8,020.3	5.5	21,884.1	151.4	3,446.0	7,276.6	3,440.2

Holmes	**PM2.5**	***OC***	***EC***	**NOX**	***Nitrate***	**SO2**	***Sulfate***	**NH3**	**VOC**	***Other***
Point - 2011	29.9	n/a	n/a	347.2	n/a	5.7	n/a	3.9	226.8	n/a
Point - 2008	4.9	2.0	3.3	302.5	0.2	0.3	0.7	0.0	17.4	2.2
Nonpoint	590.0	188.2	36.5	387.9	1.7	85.5	9.8	2,211.5	3,867.2	895.1
Nonroad	30.0	8.2	16.7	319.4	0.0	5.4	0.1	0.3	358.0	4.9
Onroad	26.6	8.6	13.5	790.6	0.0	3.2	0.2	14.4	406.2	4.3
Fire	7.8	3.9	0.8	1.6	0.1	0.8	0.0	1.4	20.4	2.9
Total - 2008	659.2	211.0	70.8	1,802.1	2.0	95.1	10.8	2,227.7	4,669.2	909.4

Tuscarawas	**PM2.5**	***OC***	***EC***	**NOX**	***Nitrate***	**SO2**	***Sulfate***	**NH3**	**VOC**	***Other***
Point - 2011	196.2	n/a	n/a	528.6	n/a	2,355.6	n/a	1.6	407.3	n/a
Point - 2008	105.4	18.0	27.0	759.5	2.0	2,182.4	9.7	1.4	351.0	64.3
Nonpoint	875.4	316.8	56.3	543.0	2.5	153.2	15.4	990.7	6,352.8	1,182.7
NonRoad	33.1	9.0	18.7	432.6	0.1	6.9	0.2	0.4	406.0	5.2
Onroad	114.4	34.5	62.0	3,283.0	0.1	11.9	0.7	50.3	1,389.7	17.0
Fire	12.5	6.3	1.4	2.3	0.1	1.2	0.0	2.3	33.5	4.7
Total - 2008	1,140.7	384.5	165.3	5,020.5	4.8	2,355.6	26.1	1,045.2	8,533.0	1,274.0

Harrison	**PM2.5**	***OC***	***EC***	**NOX**	***Nitrate***	**SO2**	***Sulfate***	**NH3**	**VOC**	***Other***
Point - 2011	12.3	n/a	n/a	6.4	n/a	21.2	n/a	-	1.4	n/a
Point - 2008	0.1	0.0	0.1	0.4	0.0	0.1	0.0	-	0.8	0.0
Nonpoint	256.7	66.1	13.4	194.7	0.6	41.4	3.4	190.2	3,657.8	392.3
Nonroad	17.2	5.4	8.0	128.1	0.0	2.3	0.0	0.2	318.5	3.7
Onroad	16.0	5.2	8.0	484.9	0.0	1.8	0.1	8.9	252.4	2.6
Fire	15.4	7.7	1.7	2.8	0.2	1.4	0.1	2.9	41.3	5.8
Total - 2008	305.4	84.5	31.2	810.9	0.8	47.0	3.6	202.1	4,270.8	404.3

Columbiana	**PM2.5**	***OC***	***EC***	**NOX**	***Nitrate***	**SO2**	***Sulfate***	**NH3**	**VOC**	***Other***
Point - 2011	56.3	n/a	n/a	208.3	n/a	4.2	n/a	0.0	141.1	n/a
Point - 2008	29.9	3.4	1.5	165.6	0.3	3.8	2.2	0.0	113.9	36.1
Nonpoint	1,014.2	358.8	74.9	1,084.5	2.8	194.3	16.3	1,002.0	5,103.6	1,314.6
Nonroad	45.0	14.3	20.9	429.1	0.1	7.1	0.2	0.5	834.2	9.6
Onroad	78.5	25.6	37.8	2,224.5	0.1	9.8	0.6	41.6	1,228.7	14.4
Fire	-	-	-	-	-	-	-	-	-	-
Total - 2008	1,167.5	402.1	135.0	3,903.8	3.2	215.0	19.2	1,044.0	7,280.4	1,374.6

Mahoning	**PM2.5**	***OC***	***EC***	**NOX**	***Nitrate***	**SO2**	***Sulfate***	**NH3**	**VOC**	***Other***
Point - 2011	189.2	n/a	n/a	652.0	n/a	1,341.5	n/a	0.7	317.6	n/a
Point - 2008	230.2	30.0	27.8	531.3	1.8	1,252.2	20.9	0.1	298.1	243.9
Nonpoint	1,210.9	430.8	53.9	1,327.5	2.2	247.6	15.1	567.8	6,080.3	1,321.3
Nonroad	80.5	22.3	44.4	972.1	0.1	18.2	0.3	1.1	997.7	13.4
Onroad	235.3	72.3	119.2	6,589.2	0.3	28.6	1.7	115.2	3,189.9	41.8
Fire	-	-	-	-	-	-	-	-	-	-
Total - 2008	1,756.9	555.4	245.3	9,420.1	4.5	1,546.7	38.1	684.2	10,566.1	1,620.4

2008 Total By County	**PM2.5**	***OC***	***EC***	**NOX**	***Nitrate***	**SO2**	***Sulfate***	**NH3**	**VOC**	***Other***
STARK	3,884.3	1,002.2	421.4	13,164.0	15.0	1,075.7	250.1	1,961.6	17,011.7	3,745.8
Carroll	403.8	143.2	47.7	1,554.1	1.6	74.9	7.0	390.4	4,306.4	476.8
Wayne	2,937.6	576.4	231.4	8,020.3	5.5	21,884.1	151.4	3,446.0	7,276.6	3,440.2
Holmes	659.2	211.0	70.8	1,802.1	2.0	95.1	10.8	2,227.7	4,669.2	909.4
Tuscarawas	1,140.7	384.5	165.3	5,020.5	4.8	2,355.6	26.1	1,045.2	8,533.0	1,274.0
Harrison	305.4	84.5	31.2	810.9	0.8	47.0	3.6	202.1	4,270.8	404.3
Columbiana	1,167.5	402.1	135.0	3,903.8	3.2	215.0	19.2	1,044.0	7,280.4	1,374.6
Mahoning	1,756.9	555.4	245.3	9,420.1	4.5	1,546.7	38.1	684.2	10,566.1	1,620.4
Total - 2008	8,371.0	2,357.1	926.6	30,531.7	22.4	26,218.5	256.2	9,039.6	46,902.5	9,499.7

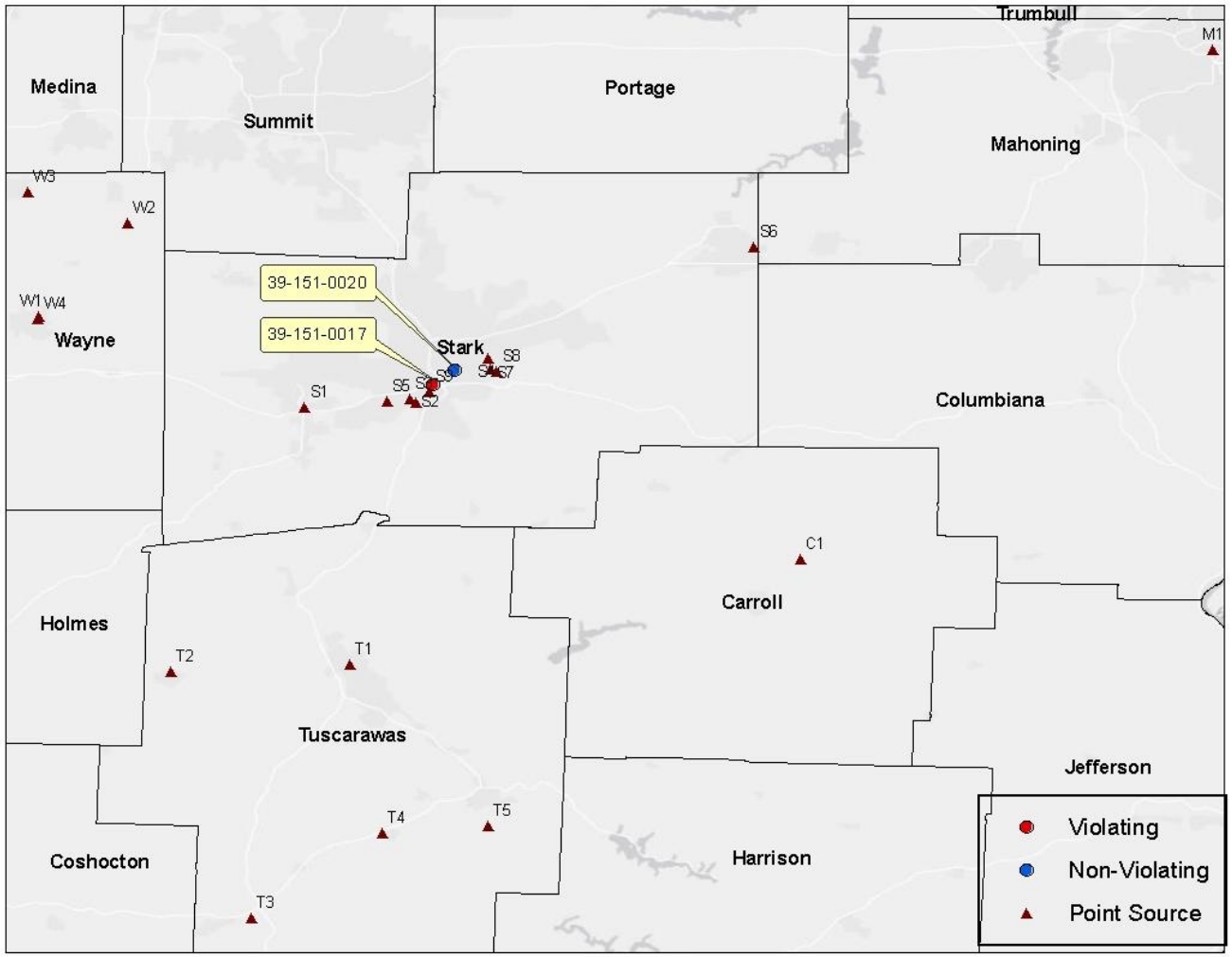
Source: 2008 and 2011 NEI

As seen in Table 6 below, the most significant point emissions of PM2.5, NOx and SO2 in 2011 were from the Orrville Public Utility plant located in Wayne County. Orrville is located approximately 20 miles west-northwest of the violating monitor.

As seen in Figure 4 below, there is a group of four sources (S2, S3, S5 and S9) just southwest of the violating monitor. Included in this group is the Marathon Refinery, a higher emitting PM2.5 and NOx source. The other sources in this group are emitters of VOC and NH3. Just northeast of the monitor is a group of three sources (S4, S7 and S8). Included in this group is Republic Engineered Products, also a higher emitting PM2.5 and NOx source. The other sources in this group are emitters of VOC and NH3.

The following figure[3] and table shows the higher emitting point sources located in the area.

Figure 4: Location of Canton-Massillon Analysis Area Emissions Point Sources



Source: 2008 and 2011 NEI

[3] The table can be used to correlate the location of each point source with the letter (first letter of county) and number next to the symbol on the map in the figure.

Table 6: Canton-Massillon Analysis Area Emissions Point Sources for 2011 (tpy)

PM2.5		
Wayne	**W1-**Department of Public Utilities, City of Orrville, Ohio (0285010188)	744.5
Stark	**S6-**Alliance Casting Co. LLC (1576010014)	215.5
Stark	**S3-**Marathon Petroleum Company LP - Canton Refinery (1576002006)	188.4
Stark	**S7-**Republic Engineered Products, Inc. (1576050694)	174.3
Wayne	**W4-**The Quality Castings Company (0285010001)	129.2
Tuscarawas	**T5-**IMCO Recycling of Ohio LLC (0679030152)	104.0

NOx		
Wayne	**W1-**Department of Public Utilities, City of Orrville, Ohio (0285010188)	1,901.7
Carroll	**C1-**Tennessee Gas Pipline- Station 214 (0210000046)	662.1
Wayne	**W2-**East Ohio Gas - Chippewa Station (0285000366)	653.9
Stark	**S6-**Alliance Casting Co. LLC (1576010014)	613.5
Stark	**S3-**Marathon Petroleum Company LP - Canton Refinery (1576002006)	284.5
Tuscarawas	**T1-**Dover Municipal Light Plant (0679010146)	277.6
Stark	**S7-**Republic Engineered Products, Inc. (1576050694)	224.1

SO2		
Wayne	**W1-**Department of Public Utilities, City of Orrville, Ohio (0285010188)	13,038.0
Wayne	**W3-**Morton Salt, Inc. (0285020059)	4,434.0
Tuscarawas	**T1-**Dover Municipal Light Plant (0679010146)	1,396.0
Mahoning	**M1-**Youngstown Thermal (0250110024)	1,063.3
Tuscarawas	**T2-**The Belden Brick Company (0679000118)	956.6

NH3		
Stark	**S1-**A.R.E. Accessories, LLC (1576131793)	103.2
Stark	**S2-**Marathon Petroleum Company LLC Canton Refinery (1576000301)	7.9
Stark	**S3-**Marathon Petroleum Company LP - Canton Refinery (1576002006)	7.8
Stark	**S4-**FRESH MARK CANTON	6.7
Stark	**S5-**Superior Dairy	6.5

VOC		
Stark	**S3-**Marathon Petroleum Company LP - Canton Refinery (1576002006)	223.8
Wayne	**W4-**The Quality Castings Company (0285010001)	103.2
Stark	**S9-**Harrison Steel (1576222002)	82.3
Stark	**S8-**Republic Storage Systems LLC (1576050866)	86.7
Tuscarawas	**T3-**31 Inc. (0679000284)	79.5
Tuscarawas	**T4-**Plymouth Foam Inc (0679000327)	76.5

Source: 2008 and 2011 NEI

Level of control of emission sources

In Stark County, the emission reduction programs which have had or will have the greatest potential impact on $PM_{2.5}$ concentrations are:

- on-road and off-road diesel control programs in conjunction with ultra-low sulfur diesel fuel requirements
- NO_x trading program
- Clean Air Interstate Rule (CAIR)
- Ohio Clean Diesel Initiatives
- Mercury and Air Toxics Standards (MATS)

CAIR and MATS regulate electric generating units (EGUs, or power plants). CAIR is the program which will bring about largest reductions in precursor or primary emissions of any of the $PM_{2.5}$ species (sulfates, nitrates, organic carbon, elemental carbon and crustal). Compliance with the MATS rule will also lead to additional reductions in precursor species, in particular, sulfates.

Urbanization, population and commuting trends

The following table provides a summary of 2010 population and vehicle miles traveled (VMT) for each of the counties that are discussed in this section.

Table 7: Canton-Massillon Analysis Area County Level VMT, Population, Land Area and Population Density

2010	VMT	Population	Land Area (Sq. Miles)	Population Density (1,000 per Sq. Miles)
STARK	3,078,116,937	375,586	576	0.65
Carroll	208,161,599	28,836	395	0.07
CBSA/CSA	3,286,278,536	404,201	970	0.42
Wayne	1,086,668,001	114,520	555	0.21
Holmes	304,673,244	42,366	423	0.10
Tuscarawas	1,022,612,446	92,582	568	0.16
Harrison	173,483,382	15,864	404	0.04
Columbiana	869,606,918	107,841	532	0.20
Mahoning	2,392,059,141	238,823	415	0.58
Total for Counties	9,135,381,668	1,016,418	3,868	

Source: Office of Strategic Research, Ohio Department of Development (Ohio Populations Only)
U.S. EPA Designations Guidance and Data:
http://www.epa.gov/pmdesignations/2012standards/techinfo.htm#F2

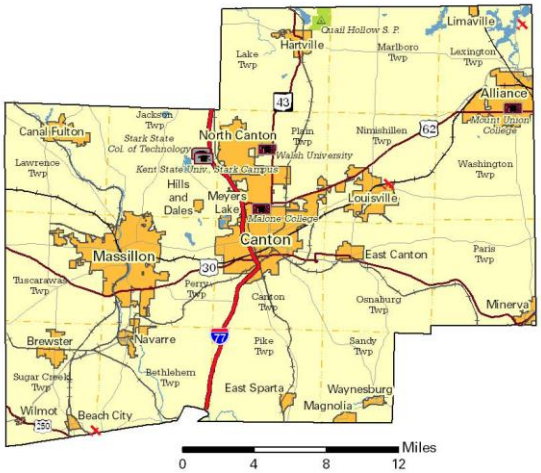
Degree of urbanization and population trends

As seen in Table 7 above, the majority of the population for this analysis area resides in Stark and Mahoning Counties, and to a lesser extent Wayne and Tuscarawas Counties. However, as seen in Figure 5 below, the population in each of these counties is expected to continue declining.

The most urbanized areas are within Stark and Mahoning Counties. Their population and population densities are significantly higher than other areas indicating that population-related emissions in these areas may be high. This is supported by Table 5 above, which indicates these two counties have the highest nonpoint and roadway emissions compared to the others.

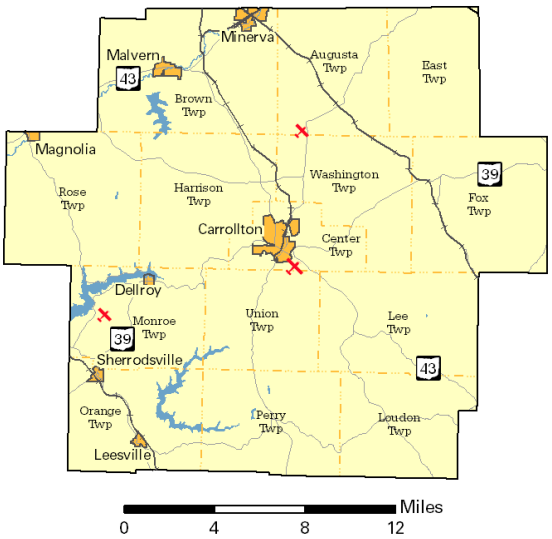
Figure 5: Canton-Massillon Analysis Area County Profiles

Stark County



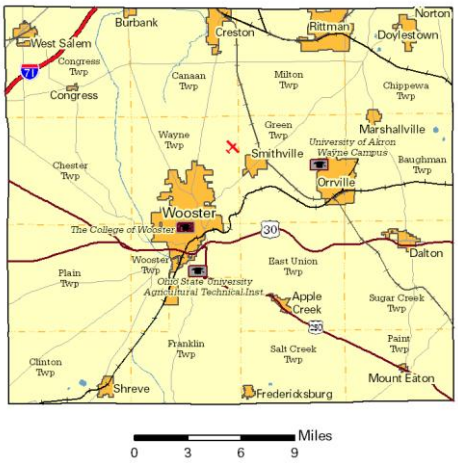
Stark County is 39% forest, 26% cropland, and 22% urban. Massillon and Canton (location of the violating air monitor) are the major urban areas. The 2010 population was 375,586 while it declined to 374,868 in 2012. Population is expected to continue declining in the future to a level of 368,210 by 2020.

Carroll County



Carroll County is 67% forest, 19% cropland, and only 1% urban. Carrollton is the major urban area. The 2010 population was 28,836 while it grew to 28,587 in 2012. Population is expected to minimally grow in the future to a level of 28,770 by 2020.

Wayne County



Wayne County is 23% forest, 60% cropland, and only 5% urban. Wooster is the major urban area. The 2010 population was 114,520 while it grew to 114,848 in 2012. Population is expected to slightly decline in the future to a level of 114,390 by 2020.

Holmes County

Holmes County is 29% forest, 51% cropland, and less than 1% urban. Millersburg is the major urban area. The 2010 population was 42,366 while it grew to 43,025 in 2012. Population is expected to increase in the future to a level of 44,620 by 2020.

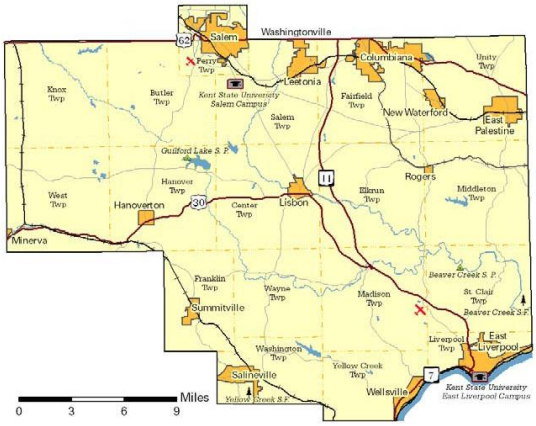
Tuscarawas County

Tuscarawas County is 63% forest, 20% cropland, and 5% urban. Dover/New Philadelphia is the major urban area. The 2010 population was 92,582 while it declined to 92,392 in 2012. Population is expected to slightly decrease in the future to a level of 92,310 by 2020.

Harrison County

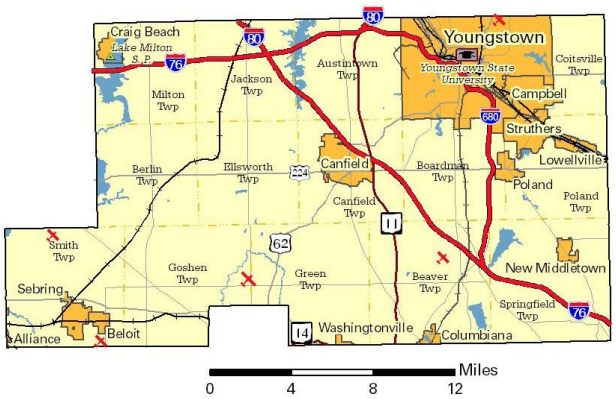
Harrison County is 14% pasture, 71% cropland, and less than 1% urban. Cadiz is the largest major urban area. The 2010 population was 15,864 while it declined to 15,714 in 2012. Population is expected to continue to decline in the future to a level of 15,300 by 2020.

Columbiana County



Columbiana County is 25% forest, 56% cropland, and 6% urban. Salem, East Liverpool and Columbiana are the largest major urban areas. The 2010 population was 107,841 while it declined to 106,507 in 2012. Population is expected to continue to decline in the future to a level of 105,380 by 2020.

Mahoning County



Mahoning County is 41% forest, 23% cropland, and 23% urban. The Youngstown area is the largest major urban areas. The 2010 population was 238,832 while it declined to 235,145 in 2012. Population is expected to continue to decline in the future to a level of 224,680 by 2020.

Source: Ohio Department of Development. Ohio County Profiles: http://development.ohio.gov/reports/reports_countytrends_map.htm

Commuting trends

As can be seen in Table 7, the majority of VMT occurs in Stark and Mahoning Counties, and to a lesser extent Wayne, Tuscarawas and Columbiana Counties. Just over 23% of Stark County's working residents commute to counties outside of Stark County. In turn, just over 20% of Stark County's workforce commutes from other counties into Stark County. Of the Stark County residents that commute to other counties, the majority commute north (over 16%) (Summit, Cuyahoga, Portage, and Medina Counties). To a much lesser extent, some commute to counties in the south, and even to a lesser extent the east and west. Of the non-residents that commute into Stark County, a significant portion also commutes from the same counties to the north (over 7%). However, over twice as many workers are commuting out of Stark County and to the north than commuting in from the north. These counties to the north are a part of the discussion under the Cleveland–Akron-Lorain section. Over 6% of Stark County non-resident workers also commute in from counties to the south (Tuscarawas and Carroll Counties). There are fewer non-residents commuting in from the east and west. As can be seen in Table 8 below, very little commuter travel occurs between Stark and Mahoning Counties, the two counties with the highest VMT. And Figure 1 shows there are no major highways running between these two counties. Overall, there is not a significant amount of commuting in or out of Stark County from the south, east or west.

Table 8: Commuter Travel In and Out of Stark County

Stark		
	Percent of workers that work outside the county	23.2%
	Percent of workers that live outside the county	20.3%

Number of workers living in Stark County		**177,234**
Commute Out To	Number	Percent
Summit Co. OH	22,673	12.8%
Cuyahoga Co. OH	3,043	1.7%
Wayne Co. OH	2,478	1.4%
Tuscarawas Co. OH	2,119	1.2%
Portage Co. OH	1,892	1.1%
Mahoning Co. OH	1,071	0.6%
Columbiana Co. OH	991	0.6%
Carroll Co. OH	940	0.5%
Medina Co. OH	874	0.5%
Holmes Co. OH	332	0.2%

Percent is of workers living in county.

Number of workers working in Stark County		**165,038**
Commute In From	Number	Percent
Summit Co. OH	9,158	5.5%
Tuscarawas Co. OH	5,824	3.5%
Carroll Co. OH	4,959	3.0%
Columbiana Co. OH	3,358	2.0%
Mahoning Co. OH	2,263	1.4%
Wayne Co. OH	2,100	1.3%
Portage Co. OH	1,831	1.1%
Cuyahoga Co. OH	764	0.5%
Medina Co. OH	513	0.3%
Holmes Co. OH	325	0.2%

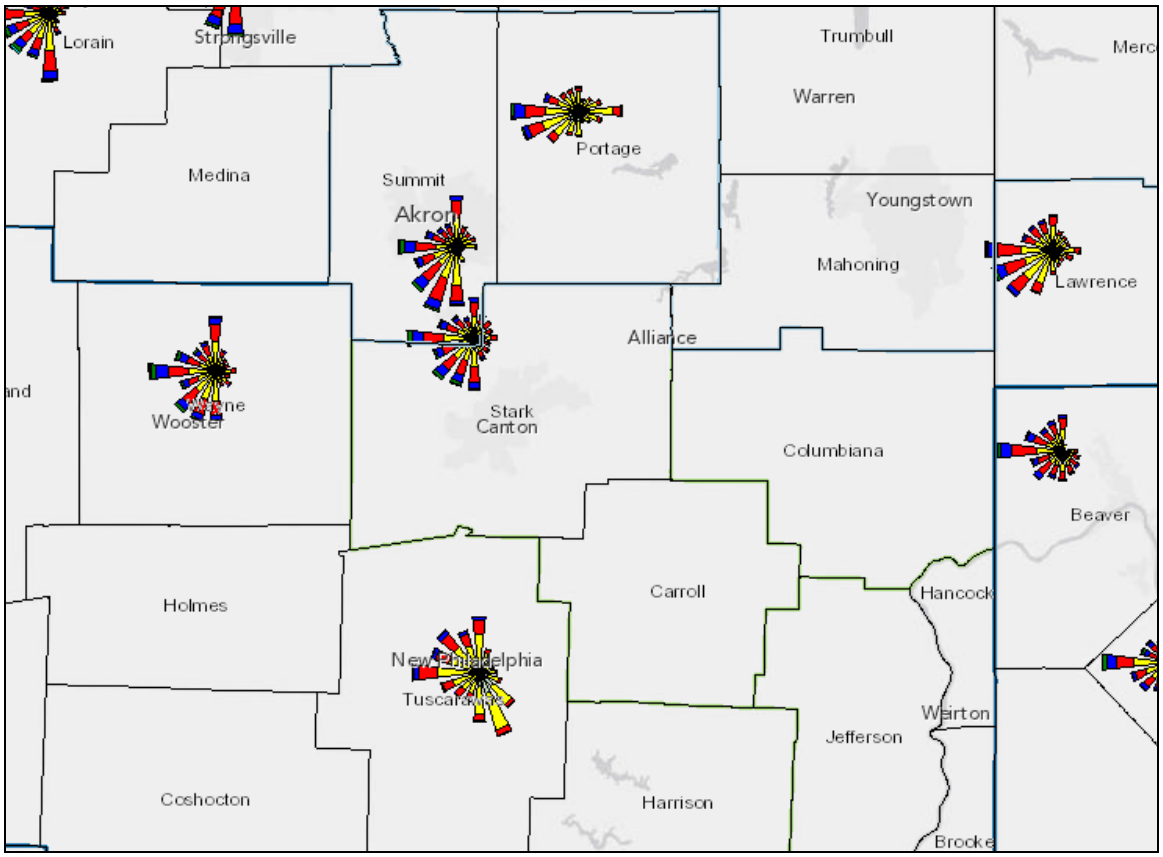
Percent is of workers working in county.

Source: U.S. EPA Designations Guidance and Data: http://www.epa.gov/pmdesignations/2012standards/techinfo.htm#F2

Factor 3: Meteorology

The following wind roses represent this area.

Figure 6: 2009 to 2012 Wind Roses for the Canton-Massillon Analysis Area



Source: U.S. EPA's $PM_{2.5}$ Designations Mapping Tool: http://geoplatform2.epa.gov/PM_MAP/index.html

Winds from the south-southwest and west-southwest (collectively, the southwest quadrant) are prevalent in near the Stark County monitors. This indicates sources of emissions from the southwest quadrant may be contributing to violations at the Stark County monitor.

Factor 4: Geography/topography

This analysis area does not have any geographical or topographical barriers significantly affecting air pollution transport. Therefore, this factor does not play a role in the analysis of this area.

Factor 5: Jurisdictional boundaries

Stark County was designated as a nonattainment county for 1997 and 2006 PM2.5 standards as part of the Canton-Massillon nonattainment area. Mahoning and Columbiana Counties were designated as nonattainment under the 1997

ozone standard as part of the Youngstown-Warren-Sharon OH-PA nonattainment area. Both of these areas have been redesignated to attainment. No other counties a part of this analysis area have been designated nonattainment for PM2.5 or other urban-scale pollutants.

The Canton-Massillon MSA includes Stark and Carroll Counties and the principal cities of Canton and Massillon. The Youngstown-Warren-Boardman, OH-PA MSA includes: Mahoning and Trumbull Counties and Mercer County, PA. The principal cities are Youngstown, Warren and Boardman in Ohio.

The Stark County Transportation Study (SCATS) is the planning agency designated as the Metropolitan Planning Organization (MPO) for Stark County. The SCATS region is composed of Stark County. The Eastgate regional Council of Governments (Eastgate) is the planning agency designated as the Metropolitan Planning Organization for the greater Youngstown area. The Eastgate region is composed of three counties in two states: Mahoning and Trumbull Counties in Ohio and Mercer County in Pennsylvania.

The surrounding counties; Wayne, Holmes, Tuscarawas, Harrison and Carroll are not part of an MPO.

Conclusion

The Canton-Massillon MSA includes Stark and Carroll Counties. There are nine counties that are adjacent to the Canton-Massillon MSA; Wayne, Holmes, Tuscarawas, Harrison, Jefferson, Columbiana, Mahoning, Portage and Summit Counties. Portage and Summit Counties are discussed in the Cleveland-Akron-Lorain area analysis. Jefferson County is discussed in the Steubenville-Weirton area analysis. These are distinct, separate metropolitan areas that are treated separately.

Overall, Stark County's emissions, VMT, population and population density are the most significant of all counties in this analysis area.

Although the most significant emissions of SO2 and NH3 are from Wayne County, it his highly unlikely these are impacting the Stark County violating monitor. The higher emissions of NH3 are likely due to the large percentage of cropland in Wayne County while the higher emissions of SO2 are a result of the Orrville Public Utility plant. As can be seen from Figure 4 above, Orville is located to the northwest of the violating monitor while winds are predominantly from the southwest quadrant (see Figure 6). Orrville does not appear to a be a source contributing to the violating monitor. There is also very little commuter travel between Stark and Wayne Counties.

Columbiana and Mahoning Counties also have high emissions compared to other counties in the analysis area but they have historically been analyzed as part of the Youngstown-Warren OH-PA area. There are two monitors located in Mahoning County (see Table 1) and both indicate attainment of the standard.

Both counties are located to the east of Stark County, and based on meteorology alone, it is unlikely emissions from Columbiana and Mahoning Counties are impacting the Stark County monitor.

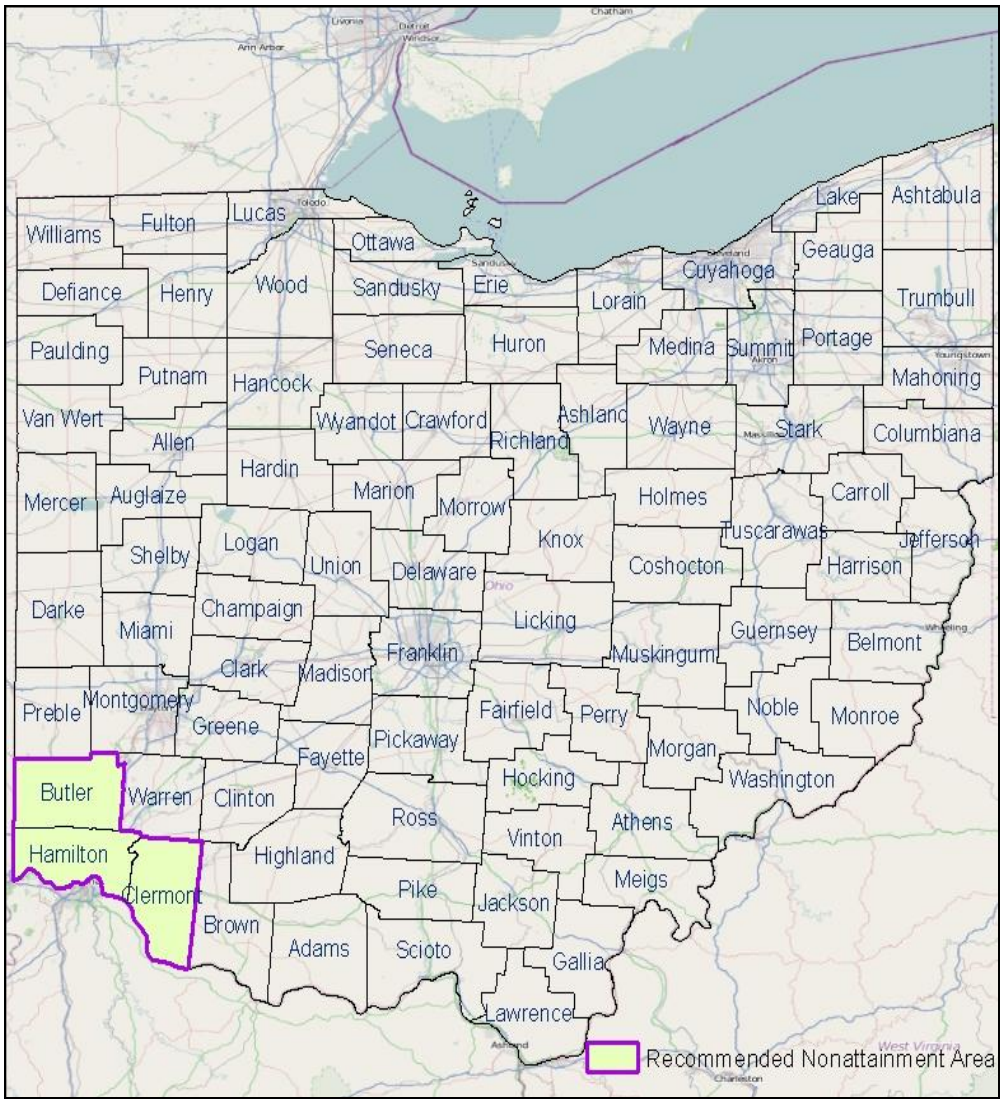
Holmes, Tuscarawas, and Harrison Counties have significantly lower emissions, VMT and commuter travel and are likely not a significant impact on the violating monitor.

Carroll County, located to the southeast of Stark County, is also a part of the Canton-Massillon MSA. However, emissions, VMT, and commuter travel from Carroll County are very low.

Ohio EPA recommends only Stark County be designated nonattainment. No other factors warrant inclusion of any of the other counties included in the analysis of this area, except Stark County.

Cincinnati-Hamilton, OH-KY-IN

Figure 7: Cincinnati-Hamilton, OH-KY-IN Recommended Nonattainment Area – Ohio Portion Only

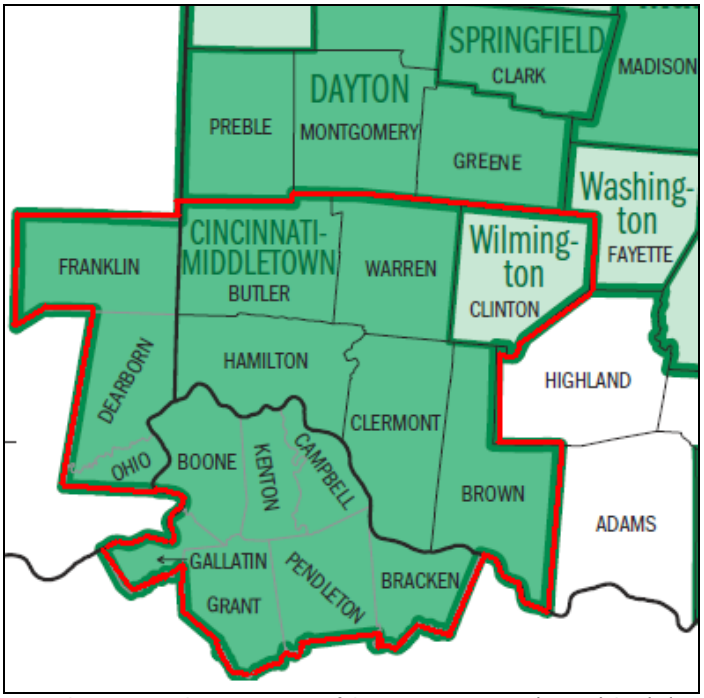


Discussion

There are four Ohio counties in this historic $PM_{2.5}$ nonattainment area: Butler, Clermont, Hamilton, and Warren Counties. In addition to Ohio counties, Boone, Kenton and Campbell Counties in Kentucky, and partial Dearborn County in Indiana were a part of this historic $PM_{2.5}$ nonattainment area. Ohio EPA recommends designating Butler, Clermont, and Hamilton Counties as nonattainment for the Ohio portion of the Cincinnati-Hamilton area. After considering the five factors, Ohio EPA does not recommend adding any additional contributing Ohio counties to this area.

There are two violating monitors in Butler County and three violating monitors in Hamilton County. Butler and Hamilton County are part of the Cincinnati-Middletown-Wilmington CSA. This CSA includes the following additional counties: Warren, Clinton, Clermont and Brown in Ohio; Kenton, Boone, Campbell, Grant, Pendleton, Bracken and Gallatin Counties in Kentucky; and Dearborn, Franklin and Ohio Counties in Indiana.

Figure 8: Middletown-Wilmington CSA



Source: U.S. Department of Commerce Economics and Statistics Administrations, U.S. Census Bureau, 2002 Economic Census

Ohio EPA will not be analyzing any additional adjacent counties adjacent to the CSA counties. Counties to the north are part of the historical Dayton-Springfield PM2.5 nonattainment area which is attaining the newly revised standard. Those to the east of Brown and Clinton Counties will not be analyzed because historically Brown and Clinton Counties have been excluded from the nonattainment area and counties east of them have also been excluded. Ohio

EPA will analyze Brown and Clinton Counties with respect to this newer standard.

Factor 1: Air quality

There are seven monitors in this area.

Figure 9: Cincinnati-Hamilton Area Air Quality Monitors

In Butler County, OH, monitors 39-017-0003 and 39-017-0016, and in Hamilton County, monitors 39-061-0014, 39-061-0040, and 39-061-0042 are violating the standard based on 2010 to 2012 air quality data. The design value for the area is 13.4 µg/m^3. As can be seen from Table 1, air quality trends have declined historically in this area.

Table 9: Annual Average (µg/m^3) for Ohio Monitors

Site	County				Average
		2010	2011	2012	10-'12
39-017-0003	Butler	13.6	12.7	11.2	12.5
39-017-0016		13.5	12.4	10.8	12.2
39-061-0006	Hamilton	12.7	11.7	10.3	11.6
39-061-0014		14.8	13.2	12.1	13.4
39-061-0040		13.3	12.4	12.6	12.8
39-061-0042		14.5	13.3	11.7	13.2

Combined data from two adjacent sites
Insufficient data
Violating monitor
Source: U.S. EPA AQS

Table 10: Annual Average (µg/m^3) for Kentucky Monitors

Site	County				Average
		2010	2011	2012	10-'12
21-037-3002	Campbell	11.8	10.3	9.7	10.6

Combined data from two adjacent sites
Insufficient data
Violating monitor
Source: U.S. EPA AQS

There are two speciation monitors in this area. The Hamilton County speciation monitor is co-located with the violating monitor.

Table 11: Cincinnati-Hamilton Area Speciation Monitors

		Speciation Monitor SANDWICH Mass					FRM Monitor
		Sulfate	Nitrate	Organic Carbon	Elemental Carbon	Crustal	
Hamilton	2009	5.6	1.0	4.4	0.7	0.4	12.7
	2010	5.4	1.7	4.5	0.7	0.4	13.3
39-061-0040	2011	4.9	1.3	4.5	0.6	0.4	12.4
	2009-2011 Average	5.3	1.3	4.5	0.7	0.4	12.8
Kenton, KY	2009	5.6	1.2	2.5	0.6	0.4	-
	2010	5.1	2.7	2.1	0.7	0.5	-
21-117-0007[4]	2011	-	-	-	-	-	-
	2009-2011 Average	3.6	1.3	1.6	0.4	0.3	-

Source: CSN speciation data (SANDWICHED) from http://www.epa.gov/pmdesignations/2012standards/techinfo.htm#F1

Organic carbon and sulfate tends to dominate at both monitors although there is a more significant presence of sulfate and less significant presence of organic carbon at the Kenton County, KY monitor.

[4] This monitor was discontinued after 2010 and is therefore, not included in the annual average table for determining compliance with the standard.

The 2010 to 2011 urban increments (UI) have also been calculated for violating monitors in this area.

Table 12: Cincinnati-Hamilton Area Urban Increments

2010-2011 Averages		PM2.5 Total	PM2.5 Total UI	Organic Carbon	Organic Carbon UI	Elemental Carbon	Elemental Carbon UI	Nitrates	Nitrates UI	Sulfates	Sulfates UI	Crustal	Crustal UI
Hamilton 39-061-0014	Quarter 1	15.3	3.8	5.1	2.2	0.5	0.0	4.6	1.6	4.8	0.0	0.3	0.0
	Quarter 2	12.3	2.1	4.3	0.0	2.0	1.4	0.2	0.1	5.3	0.5	0.6	0.1
	Quarter 3	15.4	2.0	6.4	0.8	0.8	0.2	0.0	0.0	7.8	1.1	0.5	0.0
	Quarter 4	13.0	3.6	6.5	3.0	1.0	0.3	1.5	0.2	3.6	0.0	0.4	0.0
	Annual	14.0	2.9	5.6	1.5	1.1	0.5	1.6	0.5	5.4	0.4	0.4	0.0
Hamilton 39-061-0040	Quarter 1	14.0	2.5	3.8	0.9	0.5	0.0	4.6	1.6	4.8	0.0	0.3	0.0
	Quarter 2	11.7	1.6	5.1	0.9	0.6	0.0	0.2	0.1	5.3	0.5	0.6	0.1
	Quarter 3	15.4	2.0	6.4	0.8	0.8	0.2	0.0	0.0	7.8	1.1	0.5	0.0
	Quarter 4	10.9	1.5	4.6	1.2	0.8	0.1	1.5	0.2	3.6	0.0	0.4	0.0
	Annual	13.0	1.9	5.0	0.9	0.7	0.1	1.6	0.5	5.4	0.4	0.4	0.0
Hamilton 39-061-0042	Quarter 1	15.0	3.5	4.8	1.9	0.5	0.0	4.6	1.6	4.8	0.0	0.3	0.0
	Quarter 2	12.4	2.3	4.3	0.0	2.2	1.6	0.2	0.1	5.3	0.5	0.6	0.1
	Quarter 3	15.9	2.5	6.7	1.1	0.9	0.3	0.0	0.0	7.8	1.1	0.5	0.0
	Quarter 4	12.3	2.9	5.9	2.4	0.9	0.2	1.5	0.2	3.6	0.0	0.4	0.0
	Annual	13.9	2.8	5.4	1.4	1.1	0.5	1.6	0.5	5.4	0.4	0.4	0.0
Butler 39-017-0003	Quarter 1	15.1	3.6	4.9	2.0	0.5	0.0	4.6	1.6	4.8	0.0	0.3	0.0
	Quarter 2	11.5	1.3	4.3	0.0	1.3	0.7	0.2	0.1	5.3	0.5	0.6	0.1
	Quarter 3	15.4	2.0	6.4	0.8	0.8	0.2	0.0	0.0	7.8	1.1	0.5	0.0
	Quarter 4	11.4	2.0	5.1	1.6	0.8	0.2	1.5	0.2	3.6	0.0	0.4	0.0
	Annual	13.4	2.2	5.1	1.1	0.9	0.3	1.6	0.5	5.4	0.4	0.4	0.0
Butler 39-017-0016	Quarter 1	14.8	3.3	4.6	1.7	0.5	0.0	4.6	1.6	4.8	0.0	0.3	0.0
	Quarter 2	11.0	0.9	4.3	0.0	0.8	0.2	0.2	0.1	5.3	0.5	0.6	0.1
	Quarter 3	15.4	2.0	6.4	0.8	0.8	0.2	0.0	0.0	7.8	1.1	0.5	0.0
	Quarter 4	11.6	2.2	5.3	1.8	0.9	0.2	1.5	0.2	3.6	0.0	0.4	0.0
	Annual	13.2	2.1	5.1	1.1	0.7	0.1	1.6	0.5	5.4	0.4	0.4	0.0

Source: U.S. EPA Designations Guidance and Data: http://www.epa.gov/pmdesignations/2012standards/techinfo.htm#F2

Quarter 1 and quarter 3 tend to have higher total PM2.5 for all violating monitors.

There is a higher sulfate UI at all violating monitors during quarter 2, and especially, quarter 3. There is also higher nitrate UI at all monitors during quarter 1.

For organic carbon UI, all monitor exhibit higher UIs for quarters 1 and 4 except for monitor 39-061-0040 which only shows a higher UI in quarter 4.

For elemental carbon UI, all monitors exhibit higher UIs for quarter 2 except for monitors 39-061-0040 and 39-017-0016.

Factor 2: Emissions and emissions related data

Emission trends

Overall, the most significant emissions in the analysis area emanate from Hamilton County, and then Butler County, Clermont County and Dearborn County, IN. Considering all the counties in this analysis area, these four counties account for 70% of PM2.5, 71% of NOx, 51% of VOC, 29% of NH3 and 96% of SO2 emissions.

Clinton and Warren Counties, located east and northeast of the violating monitors, have the highest emissions of NH3, likely due to their rural nature and large percentage of cropland.

Warren, Clinton and Brown Counties, Kenton and Campbell Counties, KY and Franklin County, IN have low emissions compared to the higher emitting counties and the majority of their emissions are related to nonpoint sources. Boone and Pendleton Counties in Kentucky also have lower emissions compared to the higher emitting counties but their emissions are related to a presence of both point sources and nonpoint sources.

Ohio County, IN, Gallatin, Bracken, and Grant Counties, KY all have very low (insignificant) emissions.

Table 13: Cincinnati-Hamilton Analysis Area Emissions (tpy)

HAMILTON	PM2.5	*OC*	*EC*	NOX	*Nitrate*	SO2	*Sulfate*	NH3	VOC	*Other*
Point - 2011	2,434.7	n/a	n/a	37,941.6	n/a	31,210.1	n/a	56.9	978.5	n/a
Point - 2008	6,708.1	241.2	326.2	15,747.3	8.0	31,252.2	710.0	41.6	1,023.4	5,756.9
Nonpoint	3,017.1	1,199.4	139.1	4,120.8	5.3	874.8	56.5	401.2	15,944.0	3,221.7
Nonroad	291.8	79.4	163.8	3,995.1	0.5	70.3	1.5	4.1	3,168.4	46.6
Onroad	699.3	213.3	346.9	15,588.2	0.9	91.4	5.5	353.2	7,763.2	132.6
Fire	27.0	13.5	2.9	5.1	0.3	2.6	0.1	5.0	72.1	10.1
Total - 2008	10,743.3	1,746.9	979.0	39,456.5	15.1	32,291.1	773.6	805.2	27,971.2	9,167.9

BUTLER	PM2.5	*OC*	*EC*	NOX	*Nitrate*	SO2	*Sulfate*	NH3	VOC	*Other*
Point - 2011	1,129.0	n/a	n/a	3,989.3	n/a	5,613.9	n/a	57.6	1,146.6	n/a
Point - 2008	1,564.5	330.8	222.4	4,905.0	13.9	7,627.3	367.7	29.9	1,003.8	1,251.4
Nonpoint	1,488.1	485.4	64.9	1,752.0	2.6	405.6	22.6	457.6	8,072.1	1,823.6
Nonroad	149.7	38.2	89.6	1,947.6	0.2	37.9	0.6	2.0	1,238.9	21.1
Onroad	230.7	71.2	113.4	5,176.1	0.3	30.2	1.8	118.0	2,601.2	43.9
Fire	4.3	2.1	0.5	1.2	0.0	0.5	0.0	0.7	10.6	1.6
Total - 2008	3,437.3	927.9	490.7	13,781.9	17.1	8,101.6	392.7	608.3	12,926.5	3,141.6

Warren	PM2.5	*OC*	*EC*	NOX	*Nitrate*	SO2	*Sulfate*	NH3	VOC	*Other*
Point - 2011	36.9	n/a	n/a	571.4	n/a	19.1	n/a	0.9	262.5	n/a
Point - 2008	37.4	16.8	13.5	1,044.7	0.7	3.8	3.0	0.7	285.5	23.7
Nonpoint	1,348.3	506.6	89.4	798.7	3.8	235.0	24.2	744.4	5,306.4	1,776.9
Nonroad	114.8	28.7	70.1	1,475.1	0.2	30.0	0.4	1.5	933.6	15.4
Onroad	155.1	45.4	82.1	3,788.6	0.2	19.9	1.1	74.0	1,708.9	26.3
Fire	1.4	0.7	0.2	0.4	0.0	0.2	0.0	0.2	3.5	0.5
Total - 2008	1,657.0	598.1	255.3	7,107.5	4.9	288.9	28.7	820.8	8,238.0	1,842.8

Clermont	**PM2.5**	***OC***	***EC***	**NOX**	***Nitrate***	**SO2**	***Sulfate***	**NH3**	**VOC**	***Other***
Point - 2011	6,069.8	n/a	n/a	16,030.0	n/a	108,884.4	n/a	5.3	182.1	n/a
Point - 2008	2,576.3	99.7	133.0	24,278.0	1.8	43,034.5	314.9	3.4	153.2	2,563.5
Nonpoint	1,280.6	516.7	91.9	599.1	3.9	200.6	23.5	124.4	6,958.3	1,599.8
Nonroad	85.4	22.7	49.1	1,019.9	0.1	20.3	0.3	1.1	818.8	13.2
Onroad	134.3	40.8	68.2	3,121.4	0.2	17.4	1.0	69.7	1,493.1	24.1
Fire	-	-	-	-	-	-	-	-	-	-
Total - 2008	4,076.6	680.0	342.1	29,018.4	6.0	43,272.8	339.8	198.6	9,423.5	4,200.5

Clinton	**PM2.5**	***OC***	***EC***	**NOX**	***Nitrate***	**SO2**	***Sulfate***	**NH3**	**VOC**	***Other***
Point - 2011	1.8	n/a	n/a	1.6	n/a	0.3	n/a	-	3.0	n/a
Point - 2008	14.3	2.6	10.8	485.7	0.0	49.0	0.0	-	123.6	0.8
Nonpoint	851.5	180.6	27.7	503.0	1.7	84.0	8.3	1,099.5	3,076.9	1,396.1
NonRoad	44.7	10.4	28.9	495.5	0.1	9.1	0.2	0.4	351.8	5.1
Onroad	77.9	22.8	43.8	2,294.6	0.1	7.9	0.5	33.5	899.9	10.8
Fire	1.9	1.0	0.2	0.5	0.0	0.2	0.0	0.3	5.0	0.7
Total - 2008	990.2	217.4	111.4	3,779.2	1.9	150.3	9.0	1,133.8	4,457.2	1,413.5

Brown	**PM2.5**	***OC***	***EC***	**NOX**	***Nitrate***	**SO2**	***Sulfate***	**NH3**	**VOC**	***Other***
Point - 2011	4.3	n/a	n/a	4.4	n/a	1.6	n/a	8.1	28.9	n/a
Point - 2008	3.6	0.9	0.8	2.8	0.0	0.9	0.4	4.9	18.9	3.7
Nonpoint	834.2	209.3	42.5	476.1	2.0	57.2	9.6	499.6	5,246.0	1,319.3
Nonroad	25.2	5.1	18.0	287.2	0.0	5.8	0.1	0.3	131.0	2.0
Onroad	38.5	12.4	19.5	1,190.9	0.1	4.5	0.3	22.0	635.2	6.3
Fire	4.8	2.4	0.5	1.3	0.1	0.6	0.0	0.8	12.1	1.8
Total - 2008	906.3	230.1	81.4	1,958.2	2.2	69.0	10.3	527.6	6,043.2	1,333.2

Kenton, KY	**PM2.5**	***OC***	***EC***	**NOX**	***Nitrate***	**SO2**	***Sulfate***	**NH3**	**VOC**	***Other***
Point - 2011	24.5	n/a	n/a	147.2	n/a	1.0	n/a	0.0	232.9	n/a
Point - 2008	44.6	10.6	4.3	140.9	0.2	17.3	6.1	0.0	286.3	40.5
Nonpoint	464.9	135.4	24.4	742.6	0.8	31.0	5.7	105.7	3,276.4	576.3
Nonroad	51.9	13.4	30.7	608.0	0.1	11.2	0.2	0.7	478.7	7.5
Onroad	158.3	42.8	87.4	3,735.8	0.2	19.1	1.2	71.5	1,487.0	26.7
Fire	33.5	16.8	3.7	6.6	0.4	3.3	0.1	6.2	89.0	12.5
Total - 2008	753.2	219.0	150.5	5,233.8	1.7	81.9	13.3	184.1	5,617.5	663.6

Boone, KY	**PM2.5**	***OC***	***EC***	**NOX**	***Nitrate***	**SO2**	***Sulfate***	**NH3**	**VOC**	***Other***
Point - 2011	202.9	n/a	n/a	3,569.2	n/a	2,126.6	n/a	27.9	1,019.0	n/a
Point - 2008	583.8	41.5	54.9	5,491.8	1.3	2,823.7	90.1	28.0	945.1	808.5
Nonpoint	533.3	202.3	42.6	379.7	1.6	23.5	9.1	139.4	3,430.4	697.3
Nonroad	77.5	23.4	38.6	808.8	0.1	13.8	0.3	0.9	1,067.3	15.2
Onroad	108.3	28.9	62.4	2,759.5	0.1	12.4	0.7	47.6	945.9	16.2
Fire	2.8	1.4	0.3	0.8	0.0	0.3	0.0	0.5	7.0	1.1
Total - 2008	1,305.7	297.4	198.7	9,440.5	3.2	2,873.8	100.2	216.5	6,395.8	1,538.3

Campbell, KY	**PM2.5**	***OC***	***EC***	**NOX**	***Nitrate***	**SO2**	***Sulfate***	**NH3**	**VOC**	***Other***
Point - 2011	52.8	n/a	n/a	83.0	n/a	1.0	n/a	-	160.6	n/a
Point - 2008	107.8	17.1	21.3	99.5	1.3	2.3	23.8	-	172.5	103.3
Nonpoint	308.6	82.3	12.2	369.9	0.5	19.1	3.9	86.3	3,023.1	416.1
Nonroad	23.3	6.1	13.5	286.5	0.0	5.0	0.1	0.3	307.7	3.5
Onroad	92.5	25.0	51.2	2,212.6	0.1	11.3	0.7	42.9	887.4	15.5
Fire	-	-	-	-	-	-	-	-	-	-
Total - 2008	532.2	130.6	98.3	2,968.6	2.0	37.7	28.5	129.6	4,390.7	538.4

Grant, KY	**PM2.5**	***OC***	***EC***	**NOX**	***Nitrate***	**SO2**	***Sulfate***	**NH3**	**VOC**	***Other***
Point - 2011	2.3	n/a	n/a	13.0	n/a	2.8	n/a	-	79.8	n/a
Point - 2008	7.5	1.2	1.1	17.7	0.1	3.7	0.8	-	44.7	7.7
Nonpoint	197.5	67.4	22.2	529.6	0.6	17.4	3.2	121.1	3,257.3	263.3
Nonroad	14.4	4.6	6.6	108.0	0.0	2.0	0.0	0.1	256.0	3.1
Onroad	48.4	12.2	30.7	1,529.7	0.1	5.2	0.2	19.5	421.7	5.1
Fire	-	-	-	-	-	-	-	-	-	-
Total - 2008	267.7	85.5	60.6	2,185.0	0.7	28.3	4.2	140.8	3,979.6	279.2

Pendleton, KY	**PM2.5**	***OC***	***EC***	**NOX**	***Nitrate***	**SO2**	***Sulfate***	**NH3**	**VOC**	***Other***
Point - 2011	165.9	n/a	n/a	949.2	n/a	853.3	n/a	-	127.6	n/a
Point - 2008	367.6	29.4	4.4	656.1	0.4	760.1	28.7	-	135.7	489.4
Nonpoint	171.3	44.3	16.9	498.8	0.4	20.1	2.2	123.0	2,909.8	252.9
Nonroad	7.4	1.6	5.0	88.1	0.0	1.6	0.0	0.1	52.7	0.7
Onroad	14.3	3.9	8.3	445.5	0.0	2.0	0.1	7.7	183.7	2.0
Fire	15.5	7.8	1.7	2.8	0.2	1.5	0.1	2.9	41.5	5.8
Total - 2008	576.0	87.0	36.3	1,691.4	1.0	785.3	31.1	133.7	3,323.3	750.8

Bracken, KY	**PM2.5**	***OC***	***EC***	**NOX**	***Nitrate***	**SO2**	***Sulfate***	**NH3**	**VOC**	***Other***
Point - 2011	6.6	n/a	n/a	3.7	n/a	0.0	n/a	-	13.4	n/a
Point - 2008	13.2	1.9	0.4	3.8	0.0	0.1	0.1	-	13.4	15.6
Nonpoint	76.7	25.6	8.6	270.8	0.2	4.7	1.3	100.7	2,556.0	103.4
Nonroad	7.0	1.8	4.1	76.5	0.0	1.4	0.0	0.1	118.6	1.0
Onroad	6.9	1.9	4.0	216.0	0.0	1.0	0.0	3.8	90.1	1.0
Fire	1.7	0.9	0.2	0.5	0.0	0.2	0.0	0.3	4.3	0.7
Total - 2008	105.6	32.1	17.2	567.6	0.3	7.4	1.4	104.9	2,782.5	121.6

Gallatin, KY	**PM2.5**	***OC***	***EC***	**NOX**	***Nitrate***	**SO2**	***Sulfate***	**NH3**	**VOC**	***Other***
Point - 2011	177.2	n/a	n/a	609.8	n/a	74.5	n/a	-	87.4	n/a
Point - 2008	191.6	16.6	6.7	477.7	0.7	59.3	24.6	-	81.9	212.4
Nonpoint	84.1	29.0	7.3	144.9	0.2	3.9	1.4	112.8	1,806.6	117.1
Nonroad	4.1	1.3	1.9	42.9	0.0	0.7	0.0	0.1	114.4	0.9
Onroad	32.5	8.1	20.8	1,026.1	0.0	3.4	0.2	12.7	269.6	3.3
Fire	-	-	-	-	-	-	-	-	-	-
Total - 2008	312.3	55.0	36.8	1,691.6	1.0	67.3	26.1	125.6	2,272.4	333.7

Dearborn, IN	**PM2.5**	***OC***	***EC***	**NOX**	***Nitrate***	**SO2**	***Sulfate***	**NH3**	**VOC**	***Other***
Point - 2011	187.1	n/a	n/a	6,530.6	n/a	28,287.1	n/a	28.3	1,573.3	n/a
Point - 2008	1,125.7	46.7	61.7	9,514.7	1.5	28,447.4	187.7	6.2	1,400.0	995.8
Nonpoint	521.1	144.8	24.3	280.7	1.6	120.4	8.5	104.3	3,978.9	748.2
Nonroad	17.7	4.3	10.9	228.3	0.0	4.6	0.1	0.2	178.9	2.3
Onroad	83.0	22.3	47.9	2,441.6	0.1	10.7	0.5	39.3	954.8	12.2
Fire	15.6	7.8	1.7	2.9	0.2	1.5	0.1	2.9	41.9	5.8
Total - 2008	1,763.1	226.0	146.5	12,468.2	3.4	28,584.6	196.9	153.0	6,554.5	1,764.4

Franklin, IN	**PM2.5**	***OC***	***EC***	**NOX**	***Nitrate***	**SO2**	***Sulfate***	**NH3**	**VOC**	***Other***
Point - 2011	0.0	n/a	n/a	0.0	n/a	0.0	n/a	-	0.0	n/a
Point - 2008	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-	0.0	0.0
Nonpoint	482.1	74.7	8.6	229.9	1.0	64.6	4.6	523.4	3,884.6	827.2
Nonroad	20.4	5.3	11.9	211.7	0.0	4.0	0.1	0.2	248.0	3.1
Onroad	27.0	7.4	15.6	821.8	0.0	3.5	0.2	13.6	325.2	3.7
Fire	388.8	195.1	42.5	73.0	4.2	37.0	1.3	72.4	1,040.7	145.7
Total - 2008	918.3	282.6	78.6	1,336.3	5.2	109.1	6.1	609.5	5,498.5	979.8

Ohio, IN	**PM2.5**	***OC***	***EC***	**NOX**	***Nitrate***	**SO2**	***Sulfate***	**NH3**	**VOC**	***Other***
Point - 2011	0.0	n/a	n/a	0.0	n/a	0.0	n/a	-	0.0	n/a
Point - 2008	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-	0.0	0.0
Nonpoint	91.3	18.9	6.1	218.1	0.3	15.8	1.3	90.8	1,601.4	136.8
Nonroad	2.9	0.7	1.7	32.1	0.0	0.6	0.0	0.0	36.4	0.4
Onroad	4.6	1.3	2.6	147.5	0.0	0.7	0.0	2.7	63.8	0.7
Fire	-	-	-	-	-	-	-	-	-	-
Total - 2008	98.8	21.0	10.4	397.8	0.3	17.1	1.3	93.5	1,701.6	137.9

2008 Total By County	**PM2.5**	***OC***	***EC***	**NOX**	***Nitrate***	**SO2**	***Sulfate***	**NH3**	**VOC**	***Other***
HAMILTON	10,743.3	1,746.9	979.0	39,456.5	15.1	32,291.1	773.6	805.2	27,971.2	9,167.9
BUTLER	3,437.3	927.9	490.7	13,781.9	17.1	8,101.6	392.7	608.3	12,926.5	3,141.6
Warren	1,657.0	598.1	255.3	7,107.5	4.9	288.9	28.7	820.8	8,238.0	1,842.8
Clermont	4,076.6	680.0	342.1	29,018.4	6.0	43,272.8	339.8	198.6	9,423.5	4,200.5
Clinton	990.2	217.4	111.4	3,779.2	1.9	150.3	9.0	1,133.8	4,457.2	1,413.5
Brown	906.3	230.1	81.4	1,958.2	2.2	69.0	10.3	527.6	6,043.2	1,333.2
Kenton, KY	753.2	219.0	150.5	5,233.8	1.7	81.9	13.3	184.1	5,617.5	663.6
Boone, KY	1,305.7	297.4	198.7	9,440.5	3.2	2,873.8	100.2	216.5	6,395.8	1,538.3
Campbell, KY	532.2	130.6	98.3	2,968.6	2.0	37.7	28.5	129.6	4,390.7	538.4
Grant, KY	267.7	85.5	60.6	2,185.0	0.7	28.3	4.2	140.8	3,979.6	279.2
Pendleton, KY	576.0	87.0	36.3	1,691.4	1.0	785.3	31.1	133.7	3,323.3	750.8
Bracken, KY	105.6	32.1	17.2	567.6	0.3	7.4	1.4	104.9	2,782.5	121.6
Gallatin, KY	312.3	55.0	36.8	1,691.6	1.0	67.3	26.1	125.6	2,272.4	333.7
Dearborn, IN	1,763.1	226.0	146.5	12,468.2	3.4	28,584.6	196.9	153.0	6,554.5	1,764.4
Franklin, IN	918.3	282.6	78.6	1,336.3	5.2	109.1	6.1	609.5	5,498.5	979.8
Ohio, IN	98.8	21.0	10.4	397.8	0.3	17.1	1.3	93.5	1,701.6	137.9
Total - 2008	28,443.8	5,836.5	3,093.8	133,082.5	65.8	116,766.2	1,963.3	5,985.4	111,575.8	28,207.3

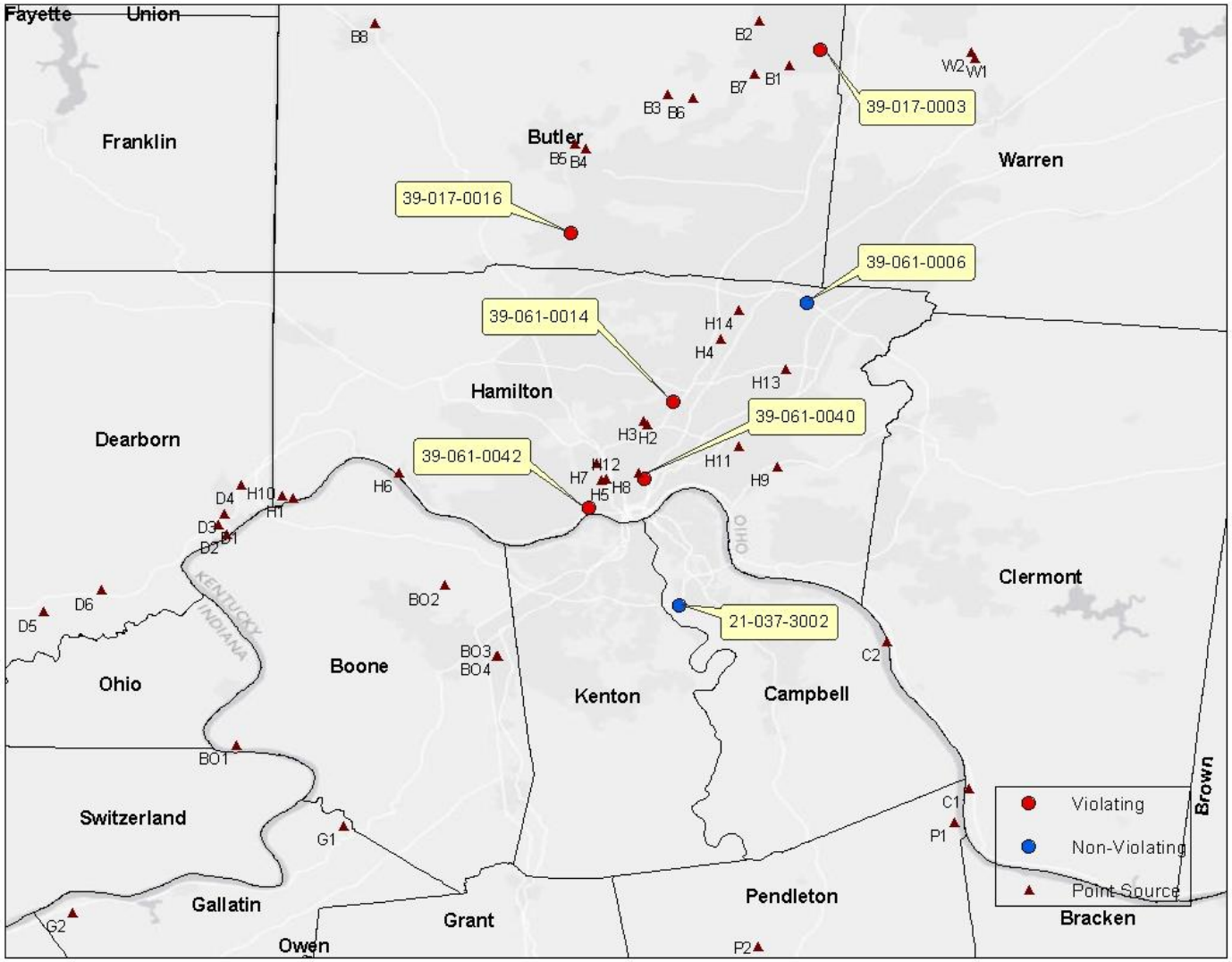
Source: 2008 and 2011 NEI

As seen in Table 14 below, the most significant point emissions of PM2.5 in 2011 were from the three Duke Energy facilities located in Hamilton (Miami Fort) and Clermont (Beckjord and Zimmer) Counties. These facilities also emitted the most NOx and SO2 along with AEP's Tanners Creek in Dearborn County, IN. Tanners Creek and Miami Fort are located west/southwest of the violating monitors while Beckjord and Zimmer are located east/southeast of the violating monitors.

As can be seen from Figure 10, the larger concentration of the larger point sources reside in Butler, Hamilton, Dearborn (IN), and Boone (KY) Counties.

The following figure[5] and table shows the higher emitting point sources located in the area.

Figure 10: Location of Cincinnati-Hamilton Analysis Area Emissions Point Sources



Source: 2008 and 2011 NEI

[5] The table can be used to correlate the location of each point source with the letter (first letter of county) and number next to the symbol on the map in the figure.

Table 14: Cincinnati-Hamilton Analysis Area Emissions Point Sources for 2011 (tpy)

PM2.5		
Clermont	**C2-**Duke Energy Ohio, W.C. Beckjord Station (1413100008)	5,297.1
Hamilton	**H1-**Duke Energy Ohio, Miami Fort Station (1431350093)	2,105.5
Clermont	**C1-**Duke Energy Ohio, Wm. H. Zimmer Station (1413090154)	767.3
Gallatin, KY	**G2-**Gallatin Steel Co	119.6
Hamilton	**H2-**DEGS of St. Bernard, LLC (1431394148)	114.1
Boone, KY	**BO1-**Duke Energy KY East Bend	99.3
Pendleton, KY	**P1-**Carmeuse Lime Inc	89.4
Dearborn, IN	**D2-**AMERICAN ELECTRIC POWER-TANNERS CREEK	67.0

NOx		
Clermont	**C1-**Duke Energy Ohio, Wm. H. Zimmer Station (1413090154)	8,459.9
Clermont	**C2-**Duke Energy Ohio, W.C. Beckjord Station (1413100008)	7,538.3
Hamilton	**H1-**Duke Energy Ohio, Miami Fort Station (1431350093)	6,490.5
Dearborn, IN	**D2-**AMERICAN ELECTRIC POWER-TANNERS CREEK	5,367.4
Boone, KY	**BO1-**Duke Energy KY East Bend	2,667.1
Butler	**B1-**AK Steel Corporation (1409010006)	2,276.2
Pendleton, KY	**P1-**Carmeuse Lime Inc	820.9
Boone, KY	**BO2-**Cincinnati/Northern Ken	740.5
Hamilton	**H2-**DEGS of St. Bernard, LLC (1431394148)	737.4
Hamilton	**H3-**Emery Oleochemicals LLC (1431074278)	646.7
Dearborn, IN	**D3-**Lawrenceburg Distillers Indiana, LLC	536.4
Butler	**B2-**Wausau Paper Towel & Tissue, LLC (1409010043)	426.0
Hamilton	**H4-**General Electric Aviation, Evendale Plant (1431150060)	401.9
Butler	**B3-**MillerCoors LLC (1409000353)	379.9
Gallatin, KY	**G1-**Mississippi Lime Co - Verona Plant	363.9
Warren	**W1-**Texas Eastern Transmission - Lebanon (1483060328)	355.4
Hamilton	**H5-**GESTSTREET	304.5
Dearborn, IN	**D4-**ANCHOR GLASS - LAWRENCEBURG	295.6
Butler	**B4-**City of Hamilton Department of Public Utilities (1409040243)	213.6
Gallatin, KY	**G2-**Gallatin Steel Co	196.6
Hamilton	**H6-**INEOS ABS (USA) Corporation (1431010054)	189.8
Hamilton	**H7-**QUEENSGATE	180.6
Dearborn, IN	**D1-**PSEG LAWRENCEBURG ENERGY COMPANY, INC.	169.2
Warren	**W2-**Lebanon Compressor Station (1483000144)	159.5
Dearborn, IN	**D5-**TEXAS GAS TRANSMISSION - DILLSBORO	158.4
Hamilton	**H8-**University of Cincinnati (1431070849)	148.9
Butler	**B5-**Smart Papers - Hamilton Mill (1409040212)	140.1

SO2		
Clermont	**C2-**Duke Energy Ohio, W.C. Beckjord Station (1413100008)	90,840.4
Dearborn, IN	**D2-**AMERICAN ELECTRIC POWER-TANNERS CREEK	27,331.5
Hamilton	**H1-**Duke Energy Ohio, Miami Fort Station (1431350093)	26,911.1
Clermont	**C1-**Duke Energy Ohio, Wm. H. Zimmer Station 1413090154)	18,042.2
Butler	**B1-**AK Steel Corporation (1409010006)	2,046.0
Hamilton	**H2-**DEGS of St. Bernard, LLC (1431394148)	2,033.1
Boone, KY	**BO1-**Duke Energy KY East Bend	1,999.7
Hamilton	**H3-**Emery Oleochemicals LLC (1431074278)	887.7
Butler	**B3-**MillerCoors LLC (1409000353)	879.6
Dearborn, IN	**D3-**Lawrenceburg Distillers Indiana, LLC	784.6
Butler	**B5-**Smart Papers - Hamilton Mill (1409040212)	724.1
Pendleton, KY	**P1-**Carmeuse Lime Inc	698.7
Butler	**B4-**City of Hamilton Department of Public Utilities (1409040243)	576.6
Butler	**B2-**Wausau Paper Towel & Tissue, LLC (1409010043)	540.1
Butler	**B7-**SunCoke Energy Middletown Operations (1409011031)	475.8
Hamilton	**H6-**INEOS ABS (USA) Corporation (1431010054)	387.5
Butler	**B8-**Miami University (1409090081)	361.7
Hamilton	**H10-**E.I. Du Pont Fort Hill Plant (1431350817)	308.4
Hamilton	**H11-**Rock-Tenn Converting Company (1431070952)	217.8
Hamilton	**H8-**University of Cincinnati (1431070849)	193.5
Dearborn, IN	**D4-**ANCHOR GLASS - LAWRENCEBURG	162.1
Pendleton, KY	**P2-**Griffin Industries	121.3
Hamilton	**H12-**Kao USA Inc. (1431070624)	111.6

NH3		
Boone, KY	**BO1-**Duke Energy KY East Bend	27.9
Dearborn, IN	**D1-**PSEG LAWRENCEBURG ENERGY COMPANY, INC.	27.5
Hamilton	**H9-**Keebler Company (1431070662)	24.9
Butler	**B5-**Smart Papers - Hamilton Mill (1409040212)	23.7
Butler	**B1-**AK Steel Corporation (1409010006)	16.0
Butler	**B6-**Duke Energy Indiana, Madison Generating Station (1409000896)	10.0

VOC		
Dearborn, IN	**D3-**Lawrenceburg Distillers Indiana, LLC	961.2
Butler	**B1-**AK Steel Corporation (1409010006)	675.0
Dearborn, IN	**D6-**AURORA CASKET CO INC	496.5
Butler	**B3-**Miller Coors LLC (1409000353)	172.8
Hamilton	**H13-**Steelcraft Mfg. Co. (1431050879)	157.1
Boone, KY	**BO2-**Cincinnati/Northern Ken	151.2
Dearborn, IN	**D2-**AMERICAN ELECTRIC POWER-TANNERS CREEK	96.7
Hamilton	**H1-**Duke Energy Ohio, Miami Fort Station (1431350093)	96.2
Boone, KY	**BO3-**R R Donnelley - Nielsen Plant	89.9
Hamilton	**H14-**Ford Motor Company (1431140861)	79.5
Gallatin, KY	**G2-**Gallatin Steel Co	78.9
Pendleton, KY	**P2-**Griffin Industries	77.8
Boone, KY	**BO4-**Greif Industrial Packaging & Services LLC	74.6

Source: 2008 and 2011 NEI

Level of control of emission sources

In Cincinnati-Hamilton area, the emission reduction programs which have had or will have the greatest potential impact on $PM_{2.5}$ concentrations are:

- on-road and off-road diesel control programs in conjunction with ultra-low sulfur diesel fuel requirements
- NO_x trading program
- Clean Air Interstate Rule (CAIR)
- Ohio Clean Diesel Initiatives
- Mercury and Air Toxics Standards (MATS)

CAIR and MATS regulate electric generating units (EGUs, or power plants). CAIR is the program which will bring about largest reductions in precursor or primary emissions of any of the $PM_{2.5}$ species (sulfates, nitrates, organic carbon, elemental carbon and crustal). Compliance with the MATS rule will also lead to additional reductions in precursor species, in particular, sulfates.

With respect to the Ohio utilities, Miami Fort in Hamilton County is planning to permanently shut down a 163 MW unit by 2015. This facility will then have two 490 MW units which both have advanced NOx and SO2 controls. The entire Beckjord facility in Clermont Clermont County is planned for permanent shut down by 2015 while the Zimmer facility has advanced NOx and SO2 controls in place.

Urbanization, population and commuting trends

The following table provides a summary of 2010 population and VMT for each of the counties that are discussed in this section.

Table 15: Cincinnati-Hamilton Analysis Area County Level VMT, Population, Land Area and Population Density

2010	VMT	Population	Land Area (Sq. Miles)	Population Density (1,000 per Sq. Miles)
HAMILTON	7,610,354,368	802,374	407	2.08
BUTLER	2,548,325,755	368,130	467	0.71
Warren	1,693,703,439	212,693	400	0.40
Clermont	1,512,452,867	197,363	452	0.39
Clinton	674,377,449	42,040	411	0.10
Brown	429,866,405	44,846	492	0.09
Kenton, KY	1,784,771,009	151,464	162	0.94
Boone, KY	1,177,737,499	257,555	415	0.62
Campbell, KY	654,891,914	66,217	404	0.16
Grant, KY	475,911,092	22,384	260	0.09
Pendleton, KY	170,946,593	14,390	281	0.05
Bracken, KY	83,831,920	8,279	203	0.04
Gallatin, KY	311,378,017	7,870	99	0.08
Dearborn, IN	968,079,465	46,109	305	0.15
Franklin, IN	341,384,8995	22,151.0	386	0.06
Ohio, IN	69,210,955	5,623.0	87	0.06
CBSA/CSA	n/a	2,132,415	4,392	0.49
Total for Counties	20,507,223,646	2,269,488	5,230	

Source: Office of Strategic Research, Ohio Department of Development (Ohio Populations Only)
U.S. EPA Designations Guidance and Data:
http://www.epa.gov/pmdesignations/2012standards/techinfo.htm#F2

Degree of urbanization and population trends

As seen in Table 15 above, the majority of the population for this analysis area resides in Hamilton County. Greater populations are also noted in Butler County and Boone County, KY. However, as seen in Figure 11 below, the populations in Ohio's counties are expected to grow in the future except for Hamilton County. The populations in all counties located in Kentucky and Indiana that are a part of this analysis area are expected to increase through 2020[6].

The most urbanized areas are within Hamilton County and Butler County. Their population and population densities are significantly higher than other areas indicating that population-related emissions in these areas may be high. This is supported by Table 13 above, which indicates these counties have the highest nonpoint and roadway emissions compared to others. Kenton County, KY and

[6] http://ksdc.louisville.edu/index.php/kentucky-demographic-data/projections; http://www.stats.indiana.edu/pop_proj/

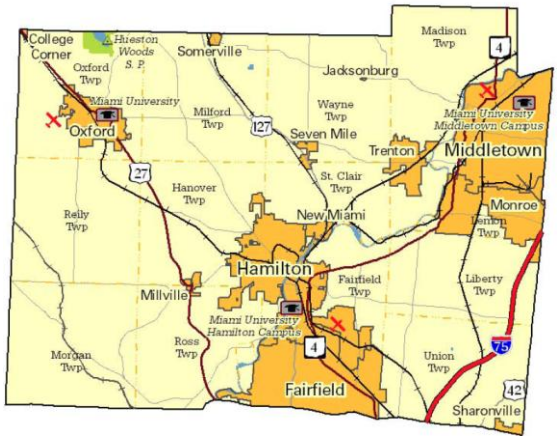
Boone County, KY also have high population densities but their nonpoint and roadway emissions are not comparatively high. Warren and Clermont Counties, and to a lesser extent, Clinton and Brown Counties, also have relatively high nonpoint emissions compared to other counties in this analysis area. Clinton and Brown Counties have very low population densities while Warren and Clermont Counties have mid-range population densities.

Figure 11: Cincinnati-Hamilton Analysis Area County Profiles

Hamilton County

Hamilton County is 46% forest, 10% cropland, and 41% urban. The greater Cincinnati area is the major urban area. The 2010 population was 802,374 while it declined to 802,038 in 2012. Population is expected to continue declining in the future to a level of 790,600 by 2020.

Butler County



Butler County is 23% forest, 51% cropland, and 13% urban. Hamilton, Fairfield (location of the violating air monitor 39-017-0016) and Middletown (location of the violating air monitor 39-017-0003) are the major urban areas. The 2010 population was 368,130 while it grew to 370,859 in 2012. Population is expected to continue growing in the future to a level of 390,110 by 2020.

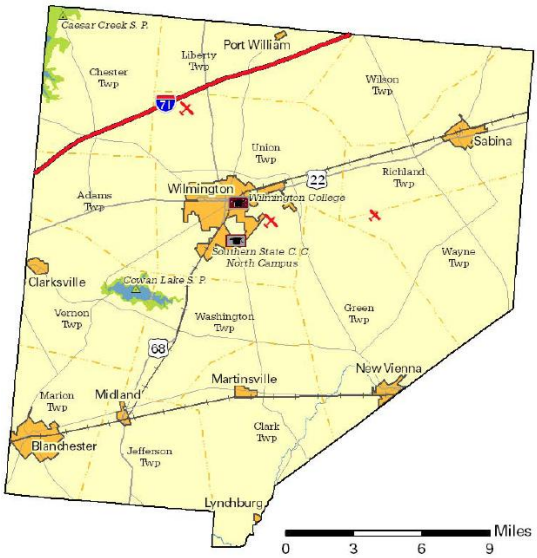
Warren County

Warren County is 29% forest, 56% cropland, and 8% urban. Mason, Lebanon and Springboro are the major urban areas. The 2010 population was 121,693 while it grew to 217,241 in 2012. Population is expected to continue growing in the future to a level of 225,770 by 2020.

Clermont County

Clermont County is 49% forest, 29% cropland, and 11% urban. Union and Miami townships are the major urban areas. The 2010 population was 197,363 while it grew to 199,085 in 2012. Population is expected to continue growing in the future to a level of 208,330 by 2020.

Clinton County



Clinton County is 16% forest, 71% cropland, and 2% urban. Wilmington is the major urban area. The 2010 population was 42,040 while it declined to 41,866 in 2012. Population is expected to grow in the future to a level of 42,100 by 2020.

Brown County

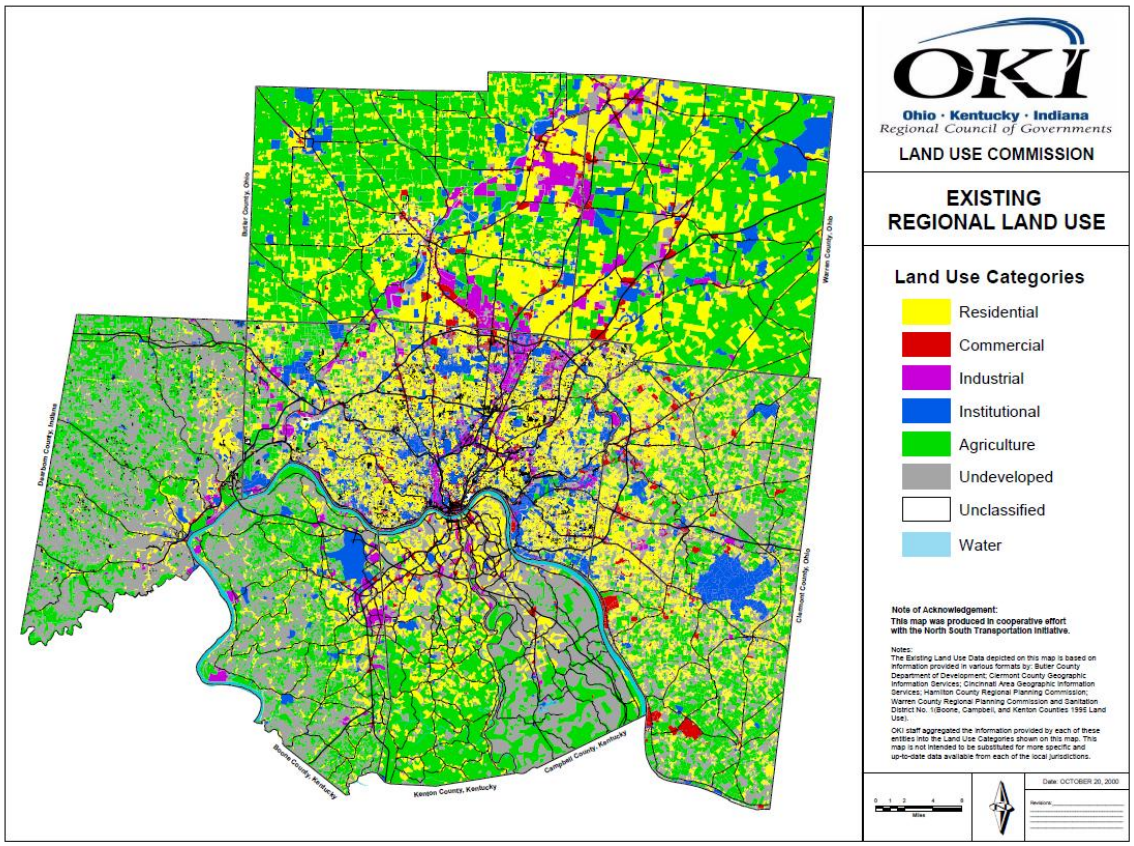
Brown County is 36% forest, 45% cropland, and 3% urban. Georgetown and Perry Township are the major urban areas. The 2010 population was 44,846 while it declined to 44,381 in 2012. Population is expected to grow in the future to a level of 45,850 by 2020.

Source: Ohio Department of Development. Ohio County Profiles: http://development.ohio.gov/reports/reports_countytrends_map.htm

As can be seen from Figure 12 below, for those Indiana and Kentucky counties immediately surrounding the greater Cincinnati area, the majority of those

counties are undeveloped or agriculture lands. However there is a larger urban component concentrated near the Cincinnati area.

Figure 12: Cincinnati-Hamilton Analysis Area Regional Land Use



Source: http://www.oki.org/mapsdata/WebContent/LandUse/Existing%20Land%20Use%20(2000).pdf

Commuting trends

As can be seen in Table 15, the majority of VMT occurs in Hamilton County, and to a lesser extent Butler, Kenton (KY), Warren, Clermont and Boone (KY) Counties. Table 16 below looks at commuter travel in and out of the two counties in this analysis area with nonattainment monitors, Hamilton and Butler. Nearly 18% of Hamilton County's working residents commute to counties outside of Hamilton County while nearly 43% do the same in Butler County. In turn, nearly 40% of Hamilton County's workforce commutes from other counties into Hamilton County while 34% do the same in Butler County. Of the Hamilton County residents that commute to other counties, the greatest percentage commutes north to Butler County (5.5%). To a lesser extent, some commute to Warren County (3.1%), Kenton County, KY (2.2%), Clermont County (2.2%), and Boone County, KY (1.8%). Similarly, but to a greater extent, of the Butler County residents that commute to other counties, the greatest percentage commutes south to Hamilton County (12.2%). Of the non-residents that commute into Hamilton County, the most significant percentage comes from Butler County (9.2%) and then Clermont County (8.1%). Of the non-residents that commute into Butler County, the most significant percentage comes from Hamilton County

(4.2%) and then Warren County (2.1%). Overall, the most significant commuter travel in and out of these counties occurs between Hamilton and Butler Counties, the two counties with the highest VMT. Kenton (KY), Warren, Clermont and Boone (KY) Counties, also with higher VMT, also contribute to the commuter travel but to a lesser extent. Brown and Clinton Counties, and other counties in Kentucky and Indiana not noted above that are part of this analysis, do not significantly contribute to commuter travel in and out of these nonattainment counties.

Table 16: Commuter Travel In and Out of Hamilton and Butler Counties

Hamilton		
	Percent of workers living in county that work outside the county	17.7%
	Percent of workers that live outside the county	37.7%

Number of workers living in Hamilton County		**377,348**
Commute Out To	Number	Percent
Butler Co. OH	20,856	5.5%
Warren Co. OH	11,619	3.1%
Kenton Co. KY	8,260	2.2%
Clermont Co. OH	8,176	2.2%
Boone Co. KY	6,736	1.8%
Campbell Co. KY	3,333	0.9%
Montgomery Co. OH	1,632	0.4%
Dearborn Co. IN	1,312	0.3%
Franklin Co. OH	524	0.1%
Greene Co. OH	346	0.1%
Marion Co. IN	245	0.1%
Ripley Co. IN	208	0.1%

Percent is of workers living in county.

Number of workers working in Hamilton County		**498,465**
Commute In From	Number	Percent
Butler Co. OH	45,965	9.2%
Clermont Co. OH	40,247	8.1%
Warren Co. OH	25,797	5.2%
Kenton Co. KY	19,752	4.0%
Campbell Co. KY	14,183	2.8%
Boone Co. KY	10,662	2.1%
Dearborn Co. IN	8,330	1.7%
Montgomery Co. OH	3,293	0.7%
Brown Co. OH	3,036	0.6%
Franklin Co. IN	1,615	0.3%
Ripley Co. IN	1,146	0.2%
Clinton Co. OH	1,239	0.2%

Percent is of workers working in county.

Butler		
	Percent of workers living in county that work outside the county	42.6%
	Percent of workers that live outside the county	34.0%

Number of workers living in Butler County		**168,999**
Commute Out To	Number	Percent
Hamilton Co. OH	45,965	12.2%
Warren Co. OH	14,201	3.8%
Montgomery Co. OH	4,537	1.2%
Clermont Co. OH	1,314	0.3%
Kenton Co. KY	1,087	0.3%
Boone Co. KY	732	0.2%

Number of workers working in Butler County		**147,004**
Commute In From	Number	Percent
Hamilton Co. OH	20,856	4.2%
Warren Co. OH	10,577	2.1%
Montgomery Co. OH	3,709	0.7%
Clermont Co. OH	3,529	0.7%
Preble Co. OH	2,529	0.5%
Union Co. IN	1,062	0.2%

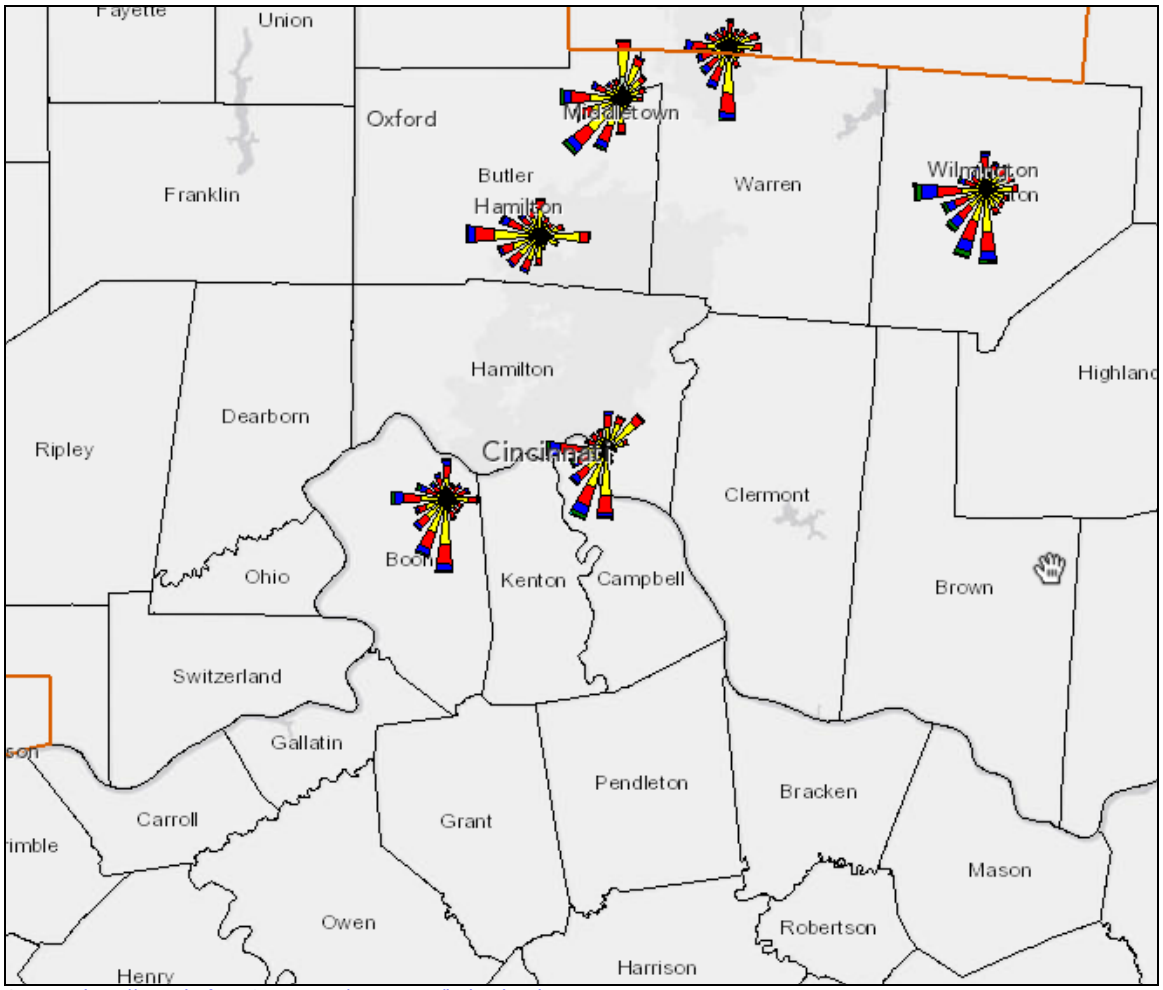
Greene Co. OH	595	0.2%	Boone Co. KY	860	0.2%
Franklin Co. OH	302	0.1%	Dearborn Co. IN	761	0.2%
Preble Co. OH	264	0.1%	Kenton Co. KY	754	0.2%
Dearborn Co. IN	164	0.0%	Campbell Co. KY	735	0.1%
Marion Co. IN	135	0.0%	Franklin Co. IN	692	0.1%
Ripley Co. IN	108	0.0%	Greene Co. OH	503	0.1%
Percent is of workers living in county.			Percent is of workers working in county.		

Source: U.S. EPA Designations Guidance and Data: http://www.epa.gov/pmdesignations/2012standards/techinfo.htm#F2

Factor 3: Meteorology

The following wind roses represent this area.

Figure 13: 2009 to 2012 Wind Roses for the Cincinnati-Hamilton Analysis Area



Source: http://geoplatform2.epa.gov/PM_MAP/index.html

Winds from the south, south-southwest and west-southwest (collectively, the southwest quadrant) are prevalent in this area. This indicates sources of

emissions from the southwest quadrant may be contributing to violations at the Hamilton County and Butler County monitors.

Factor 4: Geography/topography

This analysis area does not have any geographical or topographical barriers significantly affecting air pollution transport. Therefore, this factor does not play a role in the analysis of this area.

Factor 5: Jurisdictional boundaries

Butler, Warren, Clermont, Hamilton, Boone (KY), Kenton (KY), Campbell (KY), and partial Dearborn (IN) Counties were designated as a nonattainment counties for the 1997 PM2.5 standard as part of the Cincinnati-Hamilton OH-KY-IN nonattainment area. The same counties were designated as nonattainment under the 1997 ozone standard; however, under the 2008 ozone standard on partial areas of Boone (KY), Kenton (KY), Campbell (KY) Counties were designted nonattainment. This area been redesignated to attainment for the 1997 PM2.5 and ozone standards. No other counties a part of this analysis have been designated nonattainment for PM2.5 or other urban-scale pollutants.

The Cincinnati-Middletown, OH-KY-IN MSA includes the following counties in Indiana: Dearborn, Franklin and Ohio, in Kentucky: Boone, Bracken, Campbell, Gallatin, Grant, Kenton and Pendleton, and in Ohio: Brown, Butler, Clermont, Hamilton and Warren. The principal cities are Cincinnati and Middletown, Ohio.

The Wilmington OH-KY-IN CSA includes the above counties along with Clinton County.

The Ohio-Kentucky-Indiana regional Council of Governments (OKI) is the planning agency designated as the Metropolitan Planning Organization for the greater Cincinnati area. The OKI region is composed of eight counties in three states: Butler, Clermont, Hamilton and Warren Counties in Ohio; Boone, Campbell and Kenton Counties in Kentucky; and Dearborn County in Indiana. *Please note that the cities of Franklin and Carlisle in Warren County are part of the Miami Valley Regional Planning Commission (MVRPC) planning area.*

Conclusion

Butler, Warren, Clermont, and Hamilton Counties in Ohio have historically been a part of this nonattainment area. Warren and Clermont Counties have lower emissions than Hamilton and Butler Counties. Overall, the most significant emissions in the analysis area emanate from Hamilton County, and then Butler County, Clermont County and Dearborn County, IN. Considering all the counties in this analysis area, these four counties account for 70% of PM2.5, 71% of NOx and 96% of SO2 emissions. Overall, the largest concentration of larger point sources reside in Butler, Hamilton, Dearborn (IN), and Boone (KY) Counties, as can be seen by Figure 10. The most significant point emissions of PM2.5, and

NOx in 2011 were from the three Duke Energy facilities located in Hamilton (Miami Fort) and Clermont (Beckjord and Zimmer) Counties. These facilities also emitted the most SO2 along with AEP's Tanners Creek in Dearborn County, IN. All of the operating units at Ohio utilities in these counties will be fully controlled for NOx and SO2 by 2015.

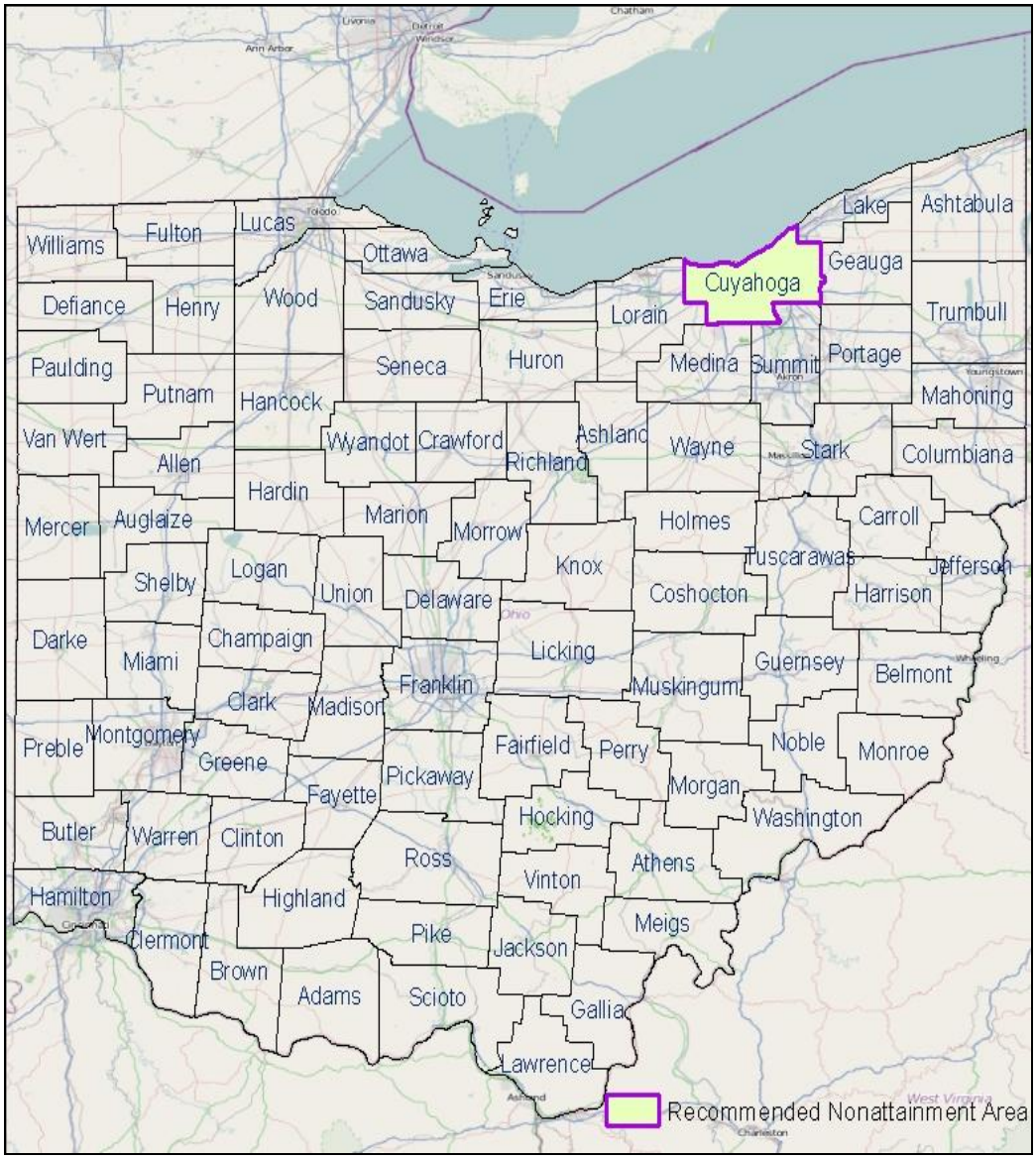
Warren County accounts for 6% of PM2.5, 5% of NOx and 2% of SO2 emission of all counties in this analysis area. There are only two larger point sources of NOx emissions in Warren County, and they are east and northeast of any of the violating monitors. The majority of Warren County's emissions are from nonpoint and roadway emissions. While Warren County does have a moderate population compared to the more rural counties in this analysis area and there is moderate commuting between Warren County and the counties with violating monitors, Ohio EPA does not believe those factors alone warrant including Warren County in the nonattainment designations. SO2 emissions, sulfate at the violating monitors, and the sulfate UI are dominant in this area. Warren County contributes very little SO2 emissions. Historically there was a monitor in the Warren County area (39-165-0007) which was attaining the revised standard for the 2008 to 2010 and the 2009 to 2012 periods.

With respect to the remaining Ohio counties in this analysis area, none of the factors support including Clinton County or Brown County. These counties have very low emissions, low populations, low population densities, low VMT and low commuting patterns with the counties with violating monitors.

Ohio EPA recommends Hamilton, Butler and Clermont Counties be designated nonattainment.

Cleveland-Akron-Lorain, OH

Figure 14: Cleveland-Akron-Lorain, OH Recommended Nonattainment Area

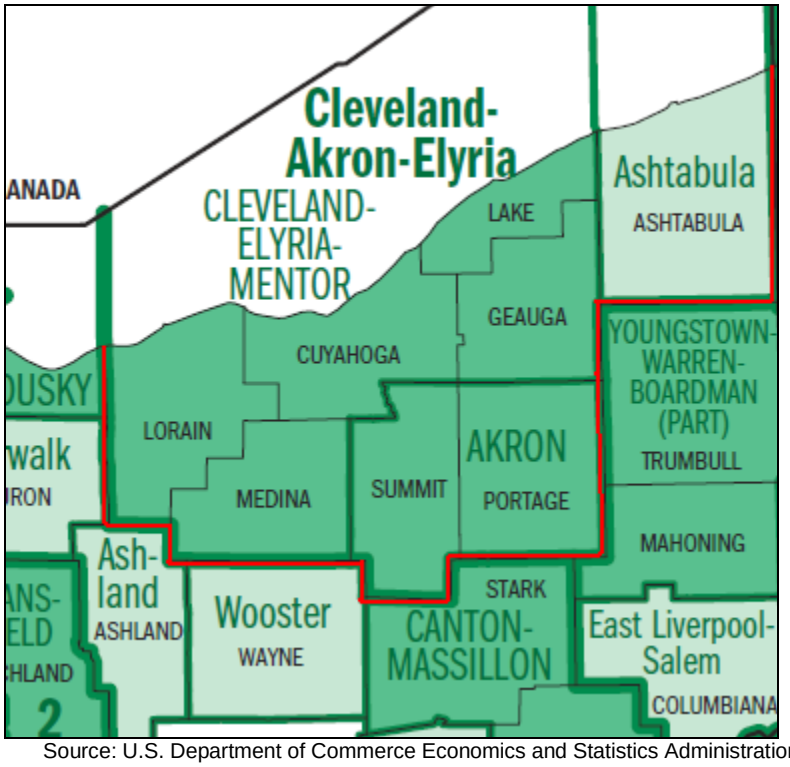


Discussion:

There are six to seven counties in the historic $PM_{2.5}$ nonattainment areas: Ashtabula (partial, only for the 1997 annual standard), Cuyahoga, Lake, Lorain, Medina, Portage, and Summit Counties. Ohio EPA recommends designating Cuyahoga County as nonattainment. After considering the five factors, Ohio EPA does not recommend including any other contributing counties in this area.

There are eleven monitors in this area of which six are in Cuyahoga County. Four of the Cuyahoga County monitors are violating the annual revised standard (sites 39-035-0038, -0045, -0060 and -0065). Cuyahoga County is part of the Cleveland-Akron-Elyria CSA which is comprised of the Cleveland-Elyria-Mentor MSA (Cuyahoga, Lake, Lorain, Medina and Geauga Counties) and the Akron MSA (Summit and Portage Counties) and Ashtabula County.

Figure 15: Cleveland-Akron-Elyria CSA



Source: U.S. Department of Commerce Economics and Statistics Administrations, U.S. Census Bureau, 2002 Economic Census

There are seven counties that are adjacent to the Cleveland-Akron-Elyria CSA; Erie, Huron, Ashland, Wayne, Stark, Mahoning and Trumbull Counties. Stark County is discussed in the Canton-Massillon area.

Factor 1: Air quality data

There are eleven monitors in this area.

Figure 16: Cleveland-Akron-Lorain Area Air Quality Monitors

Monitors 39-035-0038, -0045, -0060 and -0065 are violating the standard based on 2010 to 2012 air quality data. These four monitors are located in Cuyahoga County in the central Cleveland area, an industrialized area. As can be seen from Table 1, air quality trends have declined historically in this area.

Table 17: Annual Average (µg/m^3)

Site	County	Year			Average
		2010	2011	2012	10-'12
39-035-0034	Cuyahoga	10.9	10.0	9.3	10.1
39-035-0038		14.0	12.6	12.3	13.0
39-035-0045		13.3	11.9	11.4	12.2
39-035-0060		13.7	12.5	13.2	13.1
39-035-0065		13.2	12.6	12.3	12.7
39-035-1002		11.3	10.4	9.7	10.5
39-085-0007	Lake	10.4	9.4	9.0	9.6
39-093-3002	Lorain	10.4	9.4	9.5	9.8
39-133-0002	Portage	11.2	10.5	9.3	10.3
39-153-0017	Summit	13.4	11.8	10.8	12.0
39-153-0023		12.5	11.1	10.0	11.2

Combined data from two adjacent sites
Insufficient data
Violating monitor

Source: U.S. EPA AQS

There are four speciation monitors in this area. The design value for the area is 13.1 µg/m^3. Two of them are co-located with the two highest violating monitors while the other two are co-located with non-violating monitors.

Table 18: Cleveland-Akron-Lorain Area Speciation Monitors

		Speciation Monitor SANDWICH Mass					FRM Monitor
		Sulfate	Nitrate	Organic Carbon	Elemental Carbon	Crustal	
Cuyahoga	2009	4.5	1.6	4.1	0.8	0.9	12.8
	2010	4.3	2.8	4.2	1.0	1.2	14.0
39-035-0038	2011	4.2	1.2	3.9	0.7	1.1	12.6
	2009-2011 Average	4.4	1.9	4.1	0.9	1.1	13.1
Cuyahoga	2009	4.8	2.1	3.5	0.8	0.8	12.3
	2010	5.3	1.7	3.1	1.2	1.5	13.7
39-035-0060	2011	4.8	1.3	3.5	1.1	1.4	12.5
	2009-2011 Average	4.9	1.7	3.4	1.0	1.2	12.8
Lorain	2009	3.8	1.7	2.6	0.5	0.5	9.9
	2010	3.9	1.5	3.2	0.6	0.6	10.4
39-093-3002	2011	4.1	0.8	3.5	0.5	0.5	9.4
	2009-2011 Average	3.9	1.3	3.1	0.6	0.5	9.9

		Speciation Monitor SANDWICH Mass					FRM Monitor
		Sulfate	Nitrate	Organic Carbon	Elemental Carbon	Crustal	
Summit	**2009**	4.7	1.6	3.4	0.5	0.3	11.4
	2010	4.9	1.8	4.6	0.6	0.4	12.5
39-153-0023	**2011**	5.5	1.8	2.7	0.6	0.3	11.1
	2009-2011 Average	5.0	1.8	3.6	0.6	0.4	11.7

Source: CSN speciation data (SANDWICHED) from http://www.epa.gov/pmdesignations/2012standards/techinfo.htm#F1

Organic carbon and sulfate tends to dominate at these monitors. The violating monitors in the Cleveland area have a higher fraction of elemental carbon and crustal material than the non-violating monitors.

The 2010 to 2011 urban increments (UI) have also been calculated for the four violating monitors.

Table 19: Cleveland-Akron-Lorain Area Urban Increments

2010-2011 Averages		PM2.5 Total	PM2.5 Total UI	Organic Carbon	Organic Carbon UI	Elemental Carbon	Elemental Carbon UI	Nitrates	Nitrates UI	Sulfates	Sulfates UI	Crustal	Crustal UI
Cuyahoga 39-035-0038	Quarter 1	15.6	5.0	3.5	1.6	1.2	0.7	4.9	1.3	4.8	0.8	1.1	0.5
	Quarter 2	11.7	2.0	3.6	0.3	1.1	0.6	0.3	0.1	5.4	0.4	1.4	0.6
	Quarter 3	14.2	3.3	4.5	0.8	2.0	1.3	0.0	0.0	6.6	0.6	1.2	0.5
	Quarter 4	12.6	3.8	4.4	1.1	1.4	0.7	1.0	0.1	3.9	0.8	1.8	1.1
	Annual	13.5	3.5	4.0	1.0	1.4	0.9	1.6	0.4	5.2	0.6	1.4	0.7
Cuyahoga 39-035-0045	Quarter 1	15.2	4.6	3.4	1.4	1.1	0.6	4.9	1.3	4.7	0.8	1.0	0.5
	Quarter 2	11.6	1.9	3.6	0.4	1.1	0.6	0.3	0.1	5.4	0.4	1.4	0.6
	Quarter 3	13.6	2.6	4.3	0.6	1.6	0.9	0.0	0.0	6.6	0.5	1.2	0.5
	Quarter 4	12.5	3.7	4.4	1.1	1.4	0.7	1.1	0.1	3.9	0.7	1.8	1.0
	Annual	13.2	3.2	3.9	0.9	1.3	0.7	1.6	0.4	5.1	0.6	1.3	0.7
Cuyahoga 39-035-0060	Quarter 1	15.3	4.7	3.3	1.4	1.1	0.6	5.0	1.3	4.9	0.9	1.1	0.5
	Quarter 2	11.9	2.0	3.6	0.3	1.1	0.6	0.3	0.1	5.4	0.4	1.4	0.6
	Quarter 3	14.0	3.1	4.8	1.2	1.4	0.8	0.0	0.0	6.6	0.6	1.3	0.6
	Quarter 4	12.9	4.0	4.5	1.1	1.5	0.8	1.0	0.1	3.9	0.8	2.0	1.2
	Annual	13.5	3.5	4.0	1.0	1.3	0.7	1.6	0.4	5.2	0.6	1.5	0.7
Cuyahoga 39-035-0065	Quarter 1	14.4	3.9	3.0	1.1	0.9	0.4	4.9	1.2	4.6	0.7	1.0	0.4
	Quarter 2	12.1	2.5	3.8	0.6	1.4	0.9	0.2	0.1	5.3	0.4	1.3	0.5
	Quarter 3	13.9	2.9	4.5	0.8	1.7	1.1	0.0	0.0	6.6	0.5	1.1	0.5
	Quarter 4	12.3	3.5	4.3	1.0	1.3	0.6	1.1	0.2	3.8	0.7	1.6	0.9
	Annual	13.2	3.2	3.9	0.9	1.3	0.8	1.6	0.4	5.1	0.6	1.2	0.6

Source: U.S. EPA Designations Guidance and Data: http://www.epa.gov/pmdesignations/2012standards/techinfo.htm#F2

Quarter 1 and quarter 4 tend to have higher total PM2.5 for all violating monitors.

There is a slightly higher sulfate UI at all violating monitors during quarter 1 and quarter 4, higher nitrate UI at all monitors during quarter 1, and higher crustal UI at all monitors during quarter 4.

For organic carbon UI, all monitor exhibit higher UIs for quarters 1 and 4 but it is less distinct at monitors 39-035-0060 and 39-035-0065.

For elemental carbon UI, all monitors exhibit slightly higher UIs for quarter 3, especially at monitor 39-035-0038.

Factor 2: Emissions and emissions related data

Emission trends

Overall, the most significant emissions in the analysis area emanate from Cuyahoga County. Considering all the counties in this analysis area, Cuyahoga County accounts for 19% of PM2.5, 25% of NOx, 24% of VOC, 11% of NH3 and 8% of SO2 emissions. With respect to the counties that were a part of the historical nonattainment areas, the most significant emissions come from Cuyahoga, Lorain, Lake and Summit Counties. These counties account for 51% of PM2.5, 58% of NOx, 49% of VOC, and 68% of SO2 emissions for all counties in this analysis area. Or if you compare the emissions to only those counties in the historic nonattainment area, these four counties account for: 79% of PM2.5, 81% of NOx, 73% of VOC, and 95% of SO2. Medina, Portage, Geauga and Ashtabula Counties do not have significant emissions in comparison to the above counties. And as seen before, the more rural counties tend to have higher NH3 emissions. Wayne County, located west of the violating monitor, also has higher emissions compared to some counties due to Orrville. Trumbull County also has high emissions compared to some other counties in the analysis area, but it is located to the east of the violating monitor. There is one monitor located in Trumbull County, which meets the standard.

As can be seen from Figure 17, the larger concentration of the larger point sources reside in Cuyahoga County with many of them located in close proximity to the violating monitors in the industrialized area of Cleveland. Two larger emitting steel plants, Arcelor Mittal and Charter, are located just southwest of the violating monitors. There are also larger concentrations, but to a lesser extent, of larger point sources in Lorain County.

Table 20: Cleveland-Akron-Lorain Analysis Area Emissions (tpy)

CUYAHOGA	PM2.5	*OC*	*EC*	NOX	*Nitrate*	SO2	*Sulfate*	NH3	VOC	*Other*
Point - 2011	1,111.9	n/a	n/a	4,193.1	n/a	6,492.5	n/a	89.8	1,173.1	n/a
Point - 2008	1,503.2	299.1	277.6	5,837.4	20.0	9,487.7	267.6	18.4	1,006.7	1,380.7
Nonpoint	4,037.1	1,746.2	239.4	8,053.4	7.5	1,731.1	91.4	796.8	20,858.3	3,751.4
Nonroad	546.6	173.4	253.5	7,238.5	0.9	116.2	2.3	8.5	9,977.9	116.6
Onroad	971.5	302.5	472.8	21,318.4	1.3	124.9	7.8	454.1	11,049.6	187.2
Fire	2.8	1.4	0.3	0.8	0.0	0.3	0.0	0.5	7.0	1.1
Total - 2008	7,061.2	2,522.6	1,243.7	42,448.5	29.6	11,460.3	369.1	1,278.3	42,899.5	5,436.9

Lorain	PM2.5	*OC*	*EC*	NOX	*Nitrate*	SO2	*Sulfate*	NH3	VOC	*Other*
Point - 2011	730.5	n/a	n/a	5,389.8	n/a	32,418.3	n/a	6.5	955.6	n/a
Point - 2008	1,562.0	163.2	74.4	6,361.0	5.7	23,087.0	264.8	2.7	810.0	1,638.5
Nonpoint	1,388.4	412.1	73.2	2,491.3	2.4	291.7	18.1	445.7	7,205.1	1,775.9
Nonroad	180.2	55.7	86.6	2,316.6	0.3	39.3	0.7	2.6	3,628.5	36.9
Onroad	226.0	72.0	108.6	4,994.6	0.3	28.6	1.8	113.0	2,497.9	43.2
Fire	2.8	1.4	0.3	0.8	0.0	0.3	0.0	0.5	7.0	1.1
Total - 2008	3,359.3	704.6	343.1	16,164.2	8.7	23,447.0	285.3	564.5	14,148.5	3,495.6

Lake	PM2.5	*OC*	*EC*	NOX	*Nitrate*	SO2	*Sulfate*	NH3	VOC	*Other*
Point - 2011	4,227.3	n/a	n/a	9,667.4	n/a	51,964.8	n/a	2.7	262.5	n/a
Point - 2008	3,987.1	344.2	195.9	11,078.2	7.3	58,673.6	261.8	2.6	288.4	3,431.9
Nonpoint	930.6	323.8	61.5	2,840.9	1.6	702.9	35.5	117.6	5,646.2	1,016.0
Nonroad	124.7	42.0	52.6	1,845.0	0.2	27.0	0.5	2.1	3,528.5	29.4
Onroad	206.3	63.6	102.9	4,655.7	0.3	25.8	1.6	94.8	2,256.8	38.0
Fire	-	-	-	-	-	-	-	-	-	-
Total - 2008	5,248.8	773.5	413.0	20,419.8	9.3	59,429.3	299.4	217.2	11,719.9	4,515.3

Medina	**PM2.5**	***OC***	***EC***	**NOX**	***Nitrate***	**SO2**	***Sulfate***	**NH3**	**VOC**	***Other***
Point - 2011	55.3	n/a	n/a	74.7	n/a	78.8	n/a	0.2	228.8	n/a
Point - 2008	61.9	41.7	4.0	103.6	0.1	75.2	0.6	0.3	221.1	49.8
Nonpoint	1,297.3	507.7	102.5	1,066.9	4.0	176.9	24.1	296.3	5,355.5	1,700.1
Nonroad	98.7	28.2	52.5	1,087.0	0.1	21.5	0.3	1.2	1,215.5	17.5
Onroad	159.9	46.9	87.3	3,985.7	0.2	18.4	1.0	69.7	1,567.9	24.5
Fire	-	-	-	-	-	-	-	-	-	-
Total - 2008	1,617.9	624.5	246.4	6,243.3	4.4	291.9	26.1	367.6	8,359.9	1,791.9

Summit	**PM2.5**	***OC***	***EC***	**NOX**	***Nitrate***	**SO2**	***Sulfate***	**NH3**	**VOC**	***Other***
Point - 2011	87.2	n/a	n/a	709.5	n/a	4,134.3	n/a	3.3	481.4	n/a
Point - 2008	148.5	13.5	12.1	793.9	1.6	4,571.8	14.2	4.0	327.8	141.6
Nonpoint	2,009.4	908.9	107.3	2,850.9	3.9	595.6	32.6	295.0	11,143.6	1,742.8
NonRoad	194.2	56.6	100.9	2,404.1	0.3	42.6	0.9	2.6	2,583.0	35.5
Onroad	538.9	172.2	257.4	11,704.7	0.7	67.4	4.3	262.7	5,834.8	104.3
Fire	1.4	0.7	0.2	0.4	0.0	0.2	0.0	0.2	3.5	0.5
Total - 2008	2,892.5	1,151.9	477.9	17,754.0	6.5	5,277.5	52.0	564.5	19,892.7	2,024.8

Portage	**PM2.5**	***OC***	***EC***	**NOX**	***Nitrate***	**SO2**	***Sulfate***	**NH3**	**VOC**	***Other***
Point - 2011	57.7	n/a	n/a	101.1	n/a	14.7	n/a	5.2	336.3	n/a
Point - 2008	36.5	12.0	10.0	84.9	0.6	13.2	2.5	0.3	245.2	32.2
Nonpoint	1,299.0	535.5	114.6	1,421.4	4.0	241.1	24.4	365.5	5,386.6	1,574.2
Nonroad	101.0	32.3	46.3	988.3	0.1	18.3	0.3	1.2	1,669.7	21.9
Onroad	179.0	53.8	96.1	4,326.5	0.2	19.7	1.2	79.9	1,657.5	27.8
Fire	-	-	-	-	-	-	-	-	-	-
Total - 2008	1,615.5	633.6	266.9	6,821.0	4.9	292.3	28.4	446.9	8,959.0	1,656.1

Geauga	**PM2.5**	***OC***	***EC***	**NOX**	***Nitrate***	**SO2**	***Sulfate***	**NH3**	**VOC**	***Other***
Point - 2011	7.0	n/a	n/a	9.2	n/a	4.6	n/a	0.1	14.1	n/a
Point - 2008	0.1	0.0	0.1	0.5	0.0	0.1	0.0	-	0.9	0.0
Nonpoint	953.9	392.9	79.6	454.6	3.3	247.9	21.9	303.6	4,761.0	1,298.6
Nonroad	68.7	23.8	27.7	648.0	0.1	10.9	0.2	0.8	1,170.7	17.0
Onroad	63.6	19.7	32.7	1,590.5	0.1	8.3	0.4	32.8	750.4	10.7
Fire	8.3	4.2	0.9	1.6	0.1	0.8	0.0	1.5	22.2	3.1
Total - 2008	1,094.7	440.6	141.0	2,695.2	3.6	268.0	22.6	338.8	6,705.2	1,329.4

Ashtabula	**PM2.5**	***OC***	***EC***	**NOX**	***Nitrate***	**SO2**	***Sulfate***	**NH3**	**VOC**	***Other***
Point - 2011	411.3	n/a	n/a	1,423.5	n/a	3,480.0	n/a	2.9	2,603.0	n/a
Point - 2008	499.6	41.2	52.0	1,729.5	2.4	3,881.8	53.8	2.5	4,295.4	488.1
Nonpoint	1,076.3	369.6	112.6	3,389.1	2.8	778.8	41.6	587.4	6,549.0	1,276.5
Nonroad	100.5	35.0	39.9	1,021.3	0.1	16.6	0.3	1.3	2,873.6	25.2
Onroad	118.4	36.7	62.4	3,339.4	0.2	12.3	0.8	52.4	1,473.2	18.3
Fire	-	-	-	-	-	-	-	-	-	-
Total - 2008	1,794.9	482.5	267.0	9,479.4	5.5	4,689.6	96.4	643.7	15,191.1	1,808.1

Trumbull	**PM2.5**	***OC***	***EC***	**NOX**	***Nitrate***	**SO2**	***Sulfate***	**NH3**	**VOC**	***Other***
Point - 2011	532.0	n/a	n/a	2,098.5	n/a	7,194.3	n/a	16.0	2,306.1	n/a
Point - 2008	834.0	128.4	90.2	5,082.6	5.8	16,572.0	132.2	25.3	2,153.2	841.5
Nonpoint	1,680.1	719.7	134.4	1,317.9	5.0	330.3	32.6	419.6	7,746.5	1,998.2
Nonroad	69.5	18.3	40.4	1,001.6	0.1	16.7	0.4	0.9	809.5	10.3
Onroad	208.8	65.6	102.6	5,839.1	0.3	26.6	1.6	108.5	3,039.8	38.8
Fire	1.4	0.7	0.2	0.4	0.0	0.2	0.0	0.2	3.4	0.5
Total - 2008	2,793.8	932.7	367.7	13,241.6	11.3	16,945.8	166.9	554.5	13,752.4	2,889.3

Mahoning	**PM2.5**	***OC***	***EC***	**NOX**	***Nitrate***	**SO2**	***Sulfate***	**NH3**	**VOC**	***Other***
Point - 2011	189.2	n/a	n/a	652.0	n/a	1,341.5	n/a	0.7	317.6	n/a
Point - 2008	230.2	30.0	27.8	531.3	1.8	1,252.2	20.9	0.1	298.1	243.9
Nonpoint	1,210.9	430.8	53.9	1,327.5	2.2	247.6	15.1	567.8	6,080.3	1,321.3
Nonroad	80.5	22.3	44.4	972.1	0.1	18.2	0.3	1.1	997.7	13.4
Onroad	235.3	72.3	119.2	6,589.2	0.3	28.6	1.7	115.2	3,189.9	41.8
Fire	-	-	-	-	-	-	-	-	-	-
Total - 2008	1,756.9	555.4	245.3	9,420.1	4.5	1,546.7	38.1	684.2	10,566.1	1,620.4

Wayne	**PM2.5**	***OC***	***EC***	**NOX**	***Nitrate***	**SO2**	***Sulfate***	**NH3**	**VOC**	***Other***
Point - 2011	962.4	n/a	n/a	2,832.8	n/a	17,904.5	n/a	0.6	300.1	n/a
Point - 2008	1,163.6	49.9	46.5	2,989.4	1.3	21,655.5	126.3	0.1	175.2	1,029.7
Nonpoint	1,600.5	475.7	90.4	1,169.4	4.0	201.6	24.0	3,392.8	4,913.0	2,383.6
Nonroad	67.8	17.0	41.3	857.1	0.1	14.8	0.3	0.8	677.0	9.1
Onroad	105.7	33.8	53.2	3,004.4	0.1	12.2	0.7	52.3	1,511.4	17.8
Fire	-	-	-	-	-	-	-	-	-	-
Total - 2008	2,937.6	576.4	231.4	8,020.3	5.5	21,884.1	151.4	3,446.0	7,276.6	3,440.2

Ashland	**PM2.5**	***OC***	***EC***	**NOX**	***Nitrate***	**SO2**	***Sulfate***	**NH3**	**VOC**	***Other***
Point - 2011	37.6	n/a	n/a	18.8	n/a	2.6	n/a	-	23.4	n/a
Point - 2008	18.5	4.4	6.8	25.5	0.4	1.3	1.5	0.5	12.0	11.2
Nonpoint	1,034.8	230.3	42.8	699.3	2.1	83.1	10.2	1,159.4	4,393.7	1,666.6
Nonroad	162.4	66.2	43.6	871.2	0.2	12.5	0.3	1.8	3,025.4	52.2
Onroad	76.2	23.1	41.4	2,187.2	0.1	7.7	0.5	32.8	904.4	11.1
Fire	-	-	-	-	-	-	-	-	-	-
Total - 2008	1,291.9	323.9	134.6	3,783.1	2.7	104.6	12.5	1,194.6	8,335.6	1,741.0

Huron	**PM2.5**	***OC***	***EC***	**NOX**	***Nitrate***	**SO2**	***Sulfate***	**NH3**	**VOC**	***Other***
Point - 2011	122.6	n/a	n/a	540.9	n/a	5.5	n/a	0.6	1,239.5	n/a
Point - 2008	36.3	4.3	12.2	542.7	0.1	4.6	4.5	0.6	1,478.2	24.3
Nonpoint	1,288.3	267.8	62.8	1,492.0	2.5	109.3	13.0	1,571.6	4,170.3	2,083.4
Nonroad	48.8	12.4	29.3	546.8	0.1	9.5	0.2	0.5	548.8	6.8
Onroad	43.9	14.2	21.4	1,242.5	0.1	5.4	0.3	22.9	678.2	7.9
Fire	3.4	1.7	0.4	0.9	0.0	0.4	0.0	0.6	8.5	1.3
Total - 2008	1,420.6	300.4	126.1	3,824.8	2.7	129.2	18.0	1,596.2	6,884.0	2,123.6

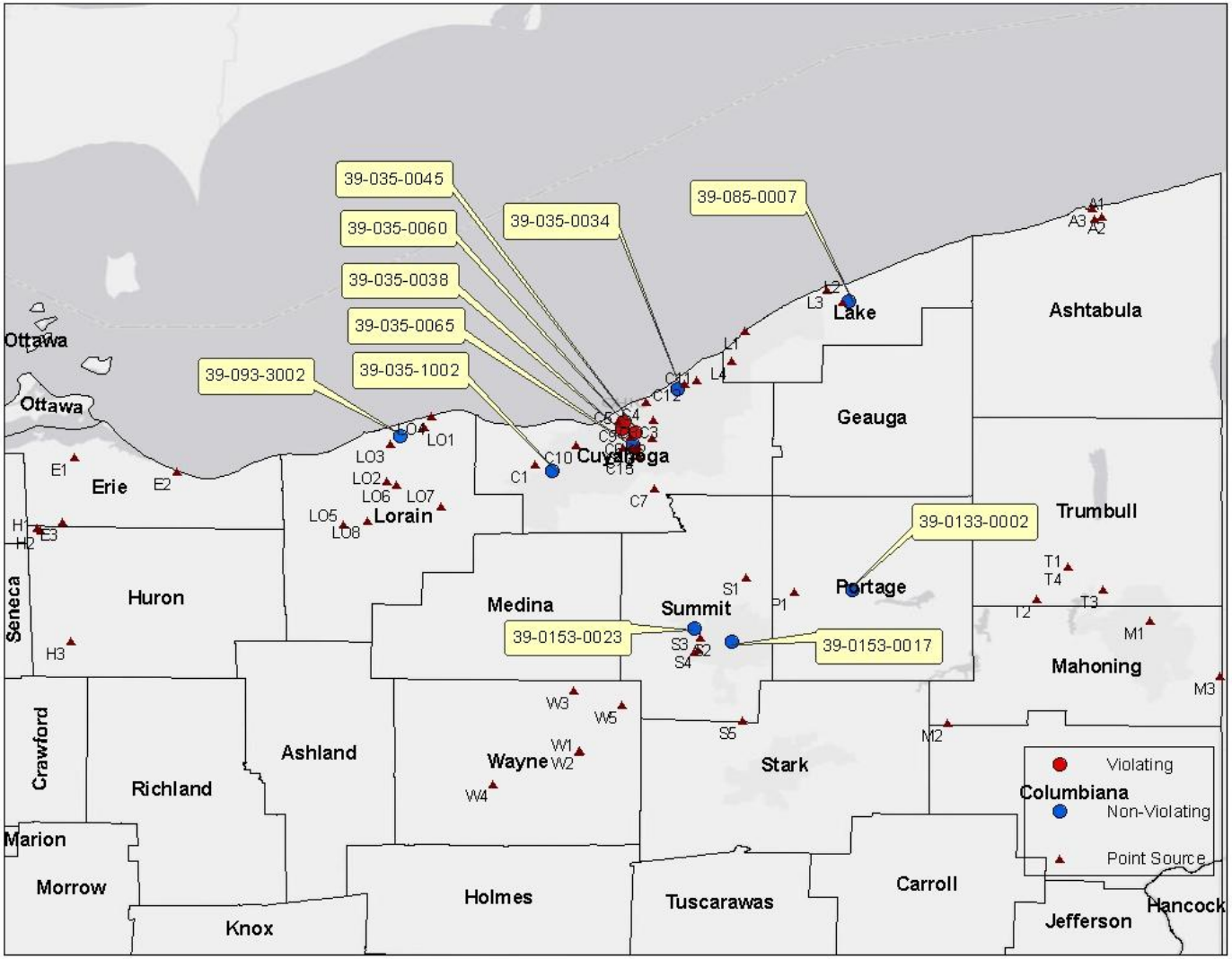
Erie	**PM2.5**	***OC***	***EC***	**NOX**	***Nitrate***	**SO2**	***Sulfate***	**NH3**	**VOC**	***Other***
Point - 2011	426.4	n/a	n/a	661.3	n/a	51.2	n/a	0.4	297.3	n/a
Point - 2008	421.9	56.4	17.8	673.2	1.8	146.9	113.2	0.5	245.6	297.5
Nonpoint	818.2	232.1	74.2	2,086.6	1.7	178.6	10.6	220.7	2,854.5	1,091.2
Nonroad	83.4	29.6	31.9	1,081.2	0.1	15.6	0.2	1.4	2,676.9	21.6
Onroad	126.1	35.4	74.2	3,744.8	0.2	12.1	0.7	51.0	1,248.8	15.6
Fire	1.4	0.7	0.2	0.4	0.0	0.2	0.0	0.2	3.5	0.5
Total - 2008	1,451.1	354.2	198.3	7,586.1	3.8	353.4	124.7	273.8	7,029.3	1,426.5

2008 Total By County	**PM2.5**	***OC***	***EC***	**NOX**	***Nitrate***	**SO2**	***Sulfate***	**NH3**	**VOC**	***Other***
CUYAHOGA	7,061.2	2,522.6	1,243.7	42,448.5	29.6	11,460.3	369.1	1,278.3	42,899.5	5,436.9
Lorain	3,359.3	704.6	343.1	16,164.2	8.7	23,447.0	285.3	564.5	14,148.5	3,495.6
Lake	5,248.8	773.5	413.0	20,419.8	9.3	59,429.3	299.4	217.2	11,719.9	4,515.3
Medina	1,617.9	624.5	246.4	6,243.3	4.4	291.9	26.1	367.6	8,359.9	1,791.9
Summit	2,892.5	1,151.9	477.9	17,754.0	6.5	5,277.5	52.0	564.5	19,892.7	2,024.8
Portage	1,615.5	633.6	266.9	6,821.0	4.9	292.3	28.4	446.9	8,959.0	1,656.1
Geauga	1,094.7	440.6	141.0	2,695.2	3.6	268.0	22.6	338.8	6,705.2	1,329.4
Ashtabula	1,794.9	482.5	267.0	9,479.4	5.5	4,689.6	96.4	643.7	15,191.1	1,808.1
Trumbull	2,793.8	932.7	367.7	13,241.6	11.3	16,945.8	166.9	554.5	13,752.4	2,889.3
Mahoning	1,756.9	555.4	245.3	9,420.1	4.5	1,546.7	38.1	684.2	10,566.1	1,620.4
Wayne	2,937.6	576.4	231.4	8,020.3	5.5	21,884.1	151.4	3,446.0	7,276.6	3,440.2
Ashland	1,291.9	323.9	134.6	3,783.1	2.7	104.6	12.5	1,194.6	8,335.6	1,741.0
Huron	1,420.6	300.4	126.1	3,824.8	2.7	129.2	18.0	1,596.2	6,884.0	2,123.6
Erie	1,451.1	354.2	198.3	7,586.1	3.8	353.4	124.7	273.8	7,029.3	1,426.5
Total - 2008	36,336.8	10,376.8	4,702.2	167,901.6	103.0	146,119.7	1,690.8	12,170.8	181,719.9	35,299.0

Source: 2008 and 2011 NEI

The following figure[7] and table shows the higher emitting point sources located in the area.

Figure 17: Location of Cleveland-Akron-Lorain Analysis Area Emissions Point Sources



Source: 2008 and 2011 NEI

[7] The table can be used to correlate the location of each point source with the letter (first letter of county) and number next to the symbol on the map in the figure.

Table 21: Cleveland-Akron-Lorain Analysis Area Emissions Point Sources for 2011 (tpy)

PM2.5		
Lake	**L1-**CLEVELAND ELECTRIC ILLUMINATING CO., EASTLAKE PLANT (0243160009)	4,023.0
Wayne	**W2-**Department of Public Utilities, City of Orrville, Ohio (0285010188)	744.5
Cuyahoga	**C6-**ArcelorMittal Cleveland Inc. (1318001613)	553.2
Lake	**LO4-**Avon Lake Power Plant (0247030013)	394.2
Erie	**E2-**Huron Lime, Inc. (0322010062)	320.5
Ashtabula	**A3-**FirstEnergy Generation Corp., Ashtabula Plant (0204010000)	317.2
Trumbull	**T1-**Severstal Warren (0278000463)	262.9
Lake	**L2-**PAINESVILLE MUNICIPAL ELECTRIC PLANT (0243110008)	150.3
Cuyahoga	**C8-**Charter Steel - Cleveland Inc (1318171623)	138.4
Wayne	**W1-**The Quality Castings Company (0285010001)	129.2
Lorain	**LO6-**Elyria Foundry (0247040014)	115.9
Trumbull	**T4-**ArcelorMittal Warren Inc. (0278000648)	115.6
Huron	**H1-**Solae LLC (0339010005)	102.4

NOx		
Lake	**L1-**CLEVELAND ELECTRIC ILLUMINATING CO., EASTLAKE PLANT (0243160009)	8445.9
Lorain	**LO4-**Avon Lake Power Plant (0247030013)	4659.4
Wayne	**W2-**Department of Public Utilities, City of Orrville, Ohio (0285010188)	1901.7
Cuyahoga	**C6-**ArcelorMittal Cleveland Inc. (1318001613)	1164.9
Ashtabula	**A3-**FirstEnergy Generation Corp., Ashtabula Plant (0204010000)	1148.0
Trumbull	**T3-**Niles Plant (0278060023)	895.1
Cuyahoga	**C4-**Cleveland Electric Illuminating Co., Lake Shore Plant (1318000245)	771.3
Trumbull	**T4-**ArcelorMittal Warren Inc. (0278000648)	665.8
Wayne	**W5-**East Ohio Gas - Chippewa Station (0285000366)	653.9
Cuyahoga	**C1-**Cleveland-Hopkins Intl	599.3
Lake	**L3-**Carmeuse Lime, Inc - Grand River Operations (0243030257)	520.1
Lake	**L2-**PAINESVILLE MUNICIPAL ELECTRIC PLANT (0243110008)	509.0
Erie	**E2-**Huron Lime, Inc. (0322010062)	305.2
Huron	**H2-**BELLEVUE	281.5
Summit	**S2-**City of Akron Steam Generating (1677010757)	253.7
Cuyahoga	**C5-**Cleveland Thermal LLC (1318000246)	252.1
Trumbull	**T1-**Severstal Warren (0278000463)	238.2
Erie	**E3-**BELLEVUE	215.9
Cuyahoga	**C3-**The Medical Center Company (1318003059)	204.1
Wayne	**W3-**Morton Salt, Inc. (0285020059)	194.7
Ashtabula	**A1-**Millennium Inorganic Chemicals, Inc. - Plant 2 (0204010193)	192.9
Mahoning	**M2-**Carbon Limestone Landfill Gas Power Station (0250050996)	178.1
Huron	**H3-**WILLARD	172.8

Lorain	**LO7-**Ross Incineration Services, Inc. (0247050278)	162.3
Cuyahoga	**C12-**COLLINWOOD	159.0
Cuyahoga	**C13-**FERRO CORPORATION - CLEVELAND FRIT PLANT (1318170235)	148.9
Lorain	**LO8-**Lorain County LFG Power Station (0247100968)	146.4
Cuyahoga	**C14-**MARCY	143.3
Trumbull	**T2-**General Motors LLC - Lordstown Complex (0278000199)	142.7
Summit	**S3-**Cargill, Incorporated - Salt Division (Akron, OH) (1677010027)	140.1
Cuyahoga	**C15-**Southerly Wastewater Treatment Center (1318172479)	131.8
Lake	**L4-**The Lubrizol Corporation - Wickliffe Facility (0243150025)	123.7
Mahoning	**M1-**Youngstown Thermal (0250110024)	122.5
Summit	**S5-**Akron-Canton Regional	117.5
Summit	**S4-**Emerald Performance Materials, LLC (1677010029)	115.3
Cuyahoga	**C8-**Charter Steel - Cleveland Inc (1318171623)	110.9
Lorain	**LO3-**Lorain Tubular Company LLC (0247080961)	102.1

SO2		
Lake	**L1-**CLEVELAND ELECTRIC ILLUMINATING CO., EASTLAKE PLANT (0243160009)	48300.3
Lorain	**LO4-**Avon Lake Power Plant (0247030013)	32041.4
Wayne	**W2-**Department of Public Utilities, City of Orrville, Ohio (0285010188)	13038.0
Trumbull	**T3-**Niles Plant (0278060023)	4857.8
Wayne	**W3-**Morton Salt, Inc. (0285020059)	4434.0
Ashtabula	**A3-**FirstEnergy Generation Corp., Ashtabula Plant (0204010000)	3454.0
Lake	**L2-**PAINESVILLE MUNICIPAL ELECTRIC PLANT (0243110008)	2745.2
Cuyahoga	**C3-**The Medical Center Company (1318003059)	2133.1
Cuyahoga	**C4-**Cleveland Electric Illuminating Co., Lake Shore Plant (1318000245)	1942.0
Trumbull	**T1-**Severstal Warren (0278000463)	1918.0
Summit	**S2-**City of Akron Steam Generating (1677010757)	1728.9
Summit	**S3-**Cargill, Incorporated - Salt Division (Akron, OH) (1677010027)	1516.3
Mahoning	**M1-**Youngstown Thermal (0250110024)	1063.3
Cuyahoga	**C5-**Cleveland Thermal LLC (1318000246)	930.2
Lake	**L3-**Carmeuse Lime, Inc - Grand River Operations (0243030257)	890.6
Summit	**S4-**Emerald Performance Materials, LLC (1677010029)	869.0
Cuyahoga	**C6-**ArcelorMittal Cleveland Inc. (1318001613)	722.5
Cuyahoga	**C7-**DiGeronimo Aggregates LLC (1318270383)	523.9
Wayne	**W4-**College of Wooster (0285030180)	405.4
Trumbull	**T4-**ArcelorMittal Warren Inc. (0278000648)	386.5
Lorain	**LO5-**OBERLIN COLLEGE (0247100408)	325.3
Mahoning	**M2-**Whitacre-Greer (0250000005)	144.0

NH3		
Cuyahoga	**C9-**Alumitech Of Cleveland	25.1
Cuyahoga	**C10-**Walker Heat Treating	24.5
Cuyahoga	**C11-**GE Tungsten Prods Plant	21.6

Trumbull	**T4-**ArcelorMittal Warren Inc. (0278000648)	12.0
Cuyahoga	**C6-**ArcelorMittal Cleveland Inc. (1318001613)	11.0

VOC		
Ashtabula	**A1-**Millennium Inorganic Chemicals, Inc. - Plant 2 (0204010193)	1697.2
Trumbull	**T1-**Severstal Warren (0278000463)	1682.4
Huron	**H1-**Solae LLC (0339010005)	1053.1
Ashtabula	**A2-**Millennium Inorganic Chemicals, Inc. Plant #I (0204010200)	732.6
Lorain	**LO1-**Ford Motor Company - Ohio Assembly Plant (0247030471)	440.3
Trumbull	**T2-**General Motors LLC - Lordstown Complex (0278000199)	334.2
Lorain	**LO2-**3M Elyria (0247040822)	172.7
Portage	**P1-**Smithers-Oasis U.S.A. (1667040037)	167.7
Cuyahoga	**C1-**Cleveland-Hopkins Intl	136.9
Lorain	**LO3-**Lorain Tubular Company LLC (0247080961)	124.8
Summit	**S1-**Morgan Adhesives Company (MACtac) (1677110026)	124.4
Cuyahoga	**C2-**North Coast Container Corp. (1318000399)	113.5
Erie	**E1-**Automotive Components Holdings, LLC - Sandusky Plastics (0322020042)	112.0
Wayne	**W1-**The Quality Castings Company (0285010001)	103.2
Lake	**L1-**CLEVELAND ELECTRIC ILLUMINATING CO., EASTLAKE PLANT (0243160009)	102.6

Source: 2008 and 2011 NEI

Level of control of emission sources

In the Cleveland-Akron-Lorain area, the emission reduction programs which have had or will have the greatest potential impact on $PM_{2.5}$ concentrations are:

- on-road and off-road diesel control programs in conjunction with ultra-low sulfur diesel fuel requirements
- NO_x trading program
- Clean Air Interstate Rule (CAIR)
- Ohio Clean Diesel Initiatives
- Mercury and Air Toxics Standards (MATS)

CAIR and MATS regulate electric generating units (EGUs, or power plants). CAIR is the program which will bring about largest reductions in precursor or primary emissions of any of the $PM_{2.5}$ species (sulfates, nitrates, organic carbon, elemental carbon and crustal). Compliance with the MATS rule will also lead to additional reductions in precursor species, in particular, sulfates.

With respect to the Ohio utilities, Avon Lake in Lorain County is planning to convert their 101 MW and 671 MW units to natural gas in the near future. As can be seen in Table 21 above, Avon Lake had some of the most significant emissions of NOx, SO2 and PM2.5 in the entire analysis area. Avon Lake's emissions accounted for 99% of SO2, 86% of NOx and 54% of PM2.5 point source emissions in 2011 in Lorain County.

Eastlake in Lake County announced plans in June of 2013 to convert their 240 MW and 497 MW units to reactive power in the near future. These units are currently in cold storage. Eastlake also has three 132 MW units, currently only used for emergency power since 2011, that will either be permanently shut down or also converted to reactive power by 2015. As can be seen in Table 21 above, Eastlake had the most significant emissions of NOx, SO2 and PM2.5 in the entire analysis area. Eastlake's emissions accounted for 93% of SO2, 87% of NOx and 95% of PM2.5 point source emissions in 2011 in Lake County.

Lake Shore in Cuyahoga County is planned for permanent shut down by the middle of 2015.

Urbanization, population and commuting trends

The following table provides a summary of 2010 population and VMT for each of the counties that are discussed in this section.

Table 22: Cleveland-Akron-Lorain Analysis Area County Level VMT, Population, Land Area and Population Density

2010	VMT	Population	Land Area (Sq. Miles)	Population Density (1,000 per Sq. Miles)
CUYAHOGA	10,441,337,655	1,280,122	458	2.79
Lorain	2,435,782,506	301,356	493	0.61
Lake	2,172,294,290	230,041	228	1.01
Medina	1,580,013,546	172,332	422	0.41
Summit	5,636,455,011	541,781	413	1.31
Portage	1,703,175,680	161,419	492	0.33
Geauga	765,557,120	93,389	404	0.23
Ashtabula	1,071,810,361	101,497	702	0.14
CBSA/CSA	25,806,426,171	2,881,937	3,612	0.80
Trumbull	2,280,643,181	210,312	616	0.34
Mahoning	2,392,059,141	238,823	415	0.58
Wayne	1,086,668,001	114,520	555	0.21
Ashland	668,271,617	53,139	424	0.13
Huron	479,690,473	59,626	493	0.12
Erie	1,032,011,123	77,079	255	0.30
Total for Counties	33,745,769,707	3,635,436	6,371	

Source: Office of Strategic Research, Ohio Department of Development (Ohio Populations Only)
U.S. EPA Designations Guidance and Data:
http://www.epa.gov/pmdesignations/2012standards/techinfo.htm#F2

Degree of urbanization and population trends

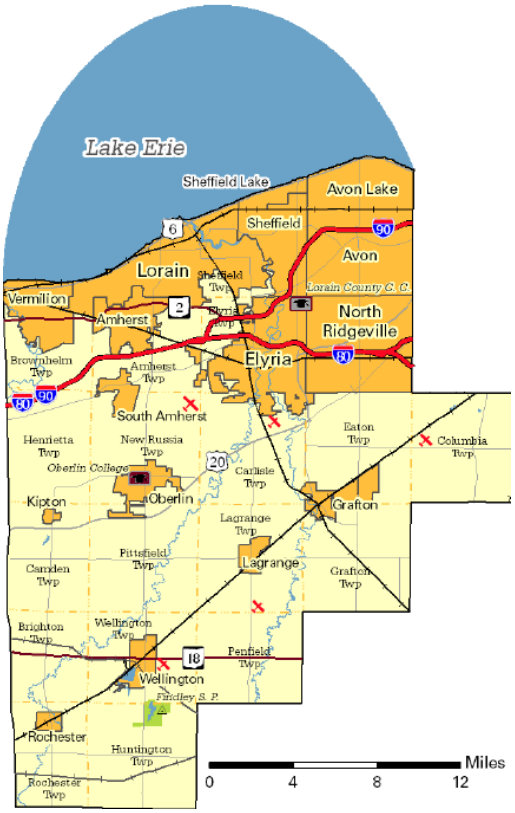
As seen in Table 22 above, the majority of the population for this analysis area resides in Cuyahoga County, and to a lesser extent, Summit County. Other more populated counties include Lorain, Lake, Trumbull and Mahoning Counties. Cuyahoga County also has a very high population density; therefore, population-related emissions are expected to be high. Lake and Summit Counties also have higher population densities. This is supported by Table 20 above, which indicates Cuyahoga and Summit Counties have the highest nonpoint and roadway emissions. However, Lake County does not have comparatively high population related emissions.

Figure 18: Cleveland-Akron-Lorain Analysis Area County Profiles

Cuyahoga County

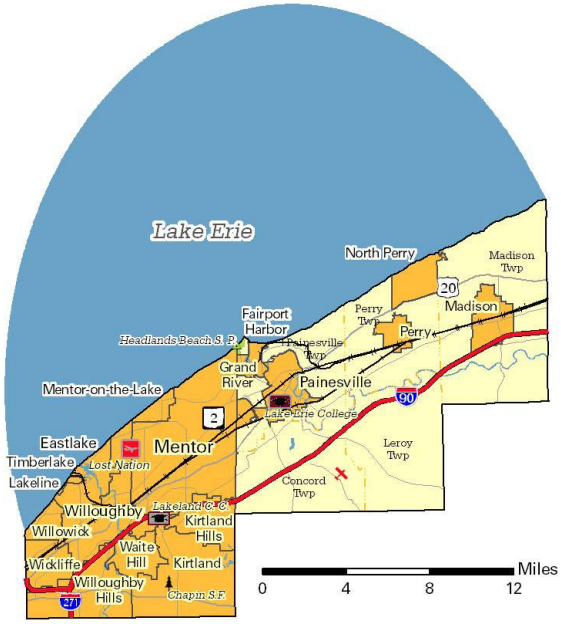
Cuyahoga County is 31% forest and 67% urban. Cleveland, the location of the violating monitors, is the major urban area. The 2010 population was 1,280,122 while it declined to 1,265,111 in 2012. Population is expected to continue declining in the future to a level of 1,209,550 by 2020.

Lorain County



Lorain County is 23% forest, 38% cropland, and 27% urban. Lorain and Elyria are the major urban areas. The 2010 population was 301,356 while it grew to 301,478 in 2012. Population is expected to continue growing in the future to a level of 310,230 by 2020.

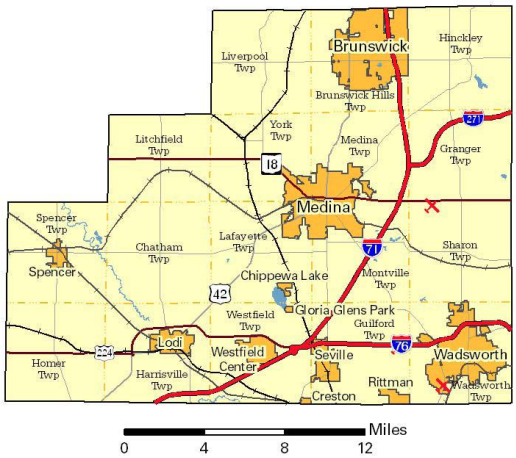
Lake County



Lake County is 49% forest, 14% cropland, and 32% urban. Mentor is the major urban area. The 2010 population was 230,041 while it declined to 229,582 in 2012. Population is expected to continue declining in the future to a level of 228,600 by 2020.

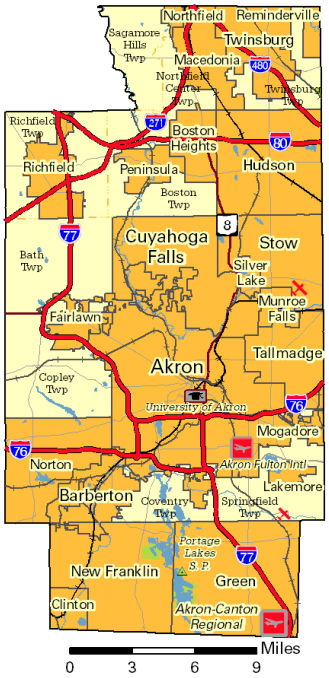
-

Medina County



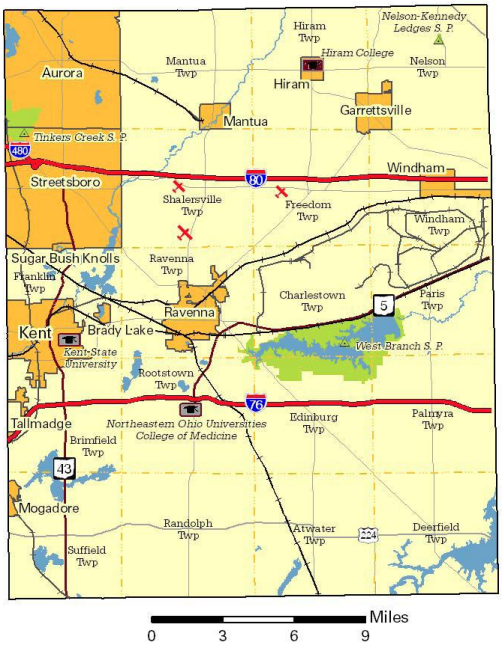
Medina County is 35% forest, 38% cropland, and 14% urban. Brunswick and Medina are the major urban areas. The 2010 population was 172,332 while it grew to 173,684 in 2012. Population is expected to continue growing in the future to a level of 184,670 by 2020.

Summit County



Summit County is 41% forest, 5% cropland, and 47% urban. Akron is the major urban area. The 2010 population was 541,781 while it declined to 540,811 in 2012. Population is expected to continue declining in the future to a level of 534,150 by 2020.

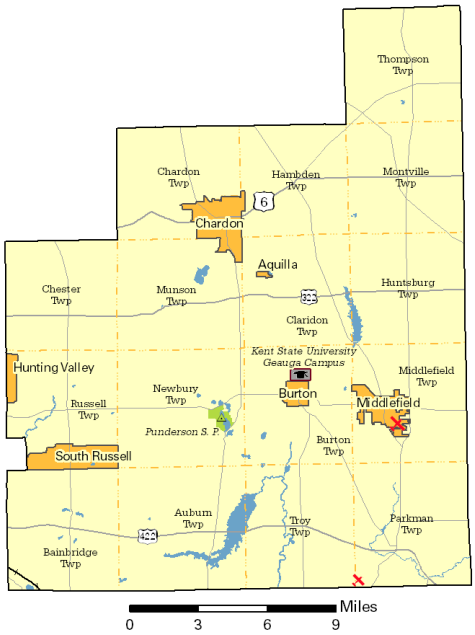
Portage County



Portage County is 46% forest, 23% cropland, and 13% urban. Kent is the major urban area. The 2010 population was 161,419 while it slightly grew to 161,451 in 2012. Population is expected to slightly decline in the future to a level of 161,410 by 2020.

-

Geauga County



Geauga County is 60% forest, 21% cropland, and 11% urban. Bainbridge and Chester are the major urban areas. The 2010 population was 93,389 while it grew to 93,680 in 2012. Population is expected to slightly decline in the future to a level of 93,510 by 2020.

-

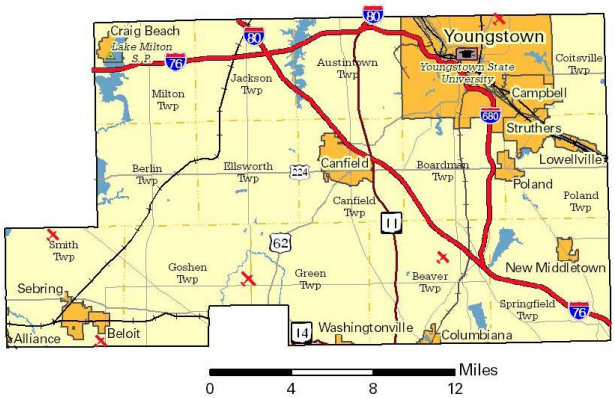
Ashtabula County

Ashtabula County is 39% forest, 32% cropland, and 7% urban. Ashtabula and Conneaut are the major urban areas. The 2010 population was 101,497 while it declined to 100,389 in 2012. Population is expected to continue growing in the future to a level of 101,230 by 2020.

Trumbull County

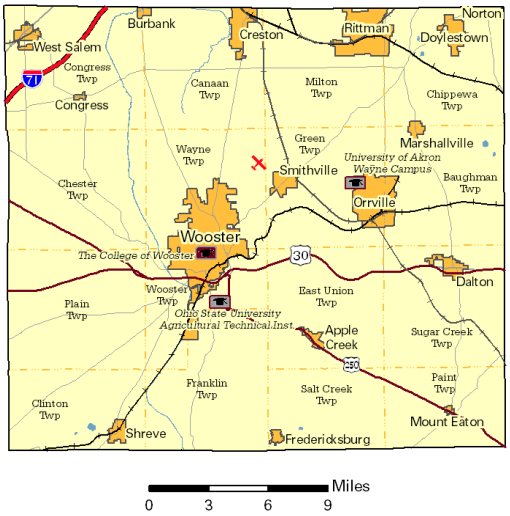
Trumbull County is 42% forest, 28% cropland, and 16% urban. Warren is the major urban area. The 2010 population was 210,312 while it declined to 207,406 in 2012. Population is expected to continue declining in the future to a level of 200,840 by 2020.

Mahoning County



Mahoning County is 41% forest, 23% cropland, and 23% urban. The Youngstown area is the largest major urban areas. The 2010 population was 238,823 while it declined to 235,145 in 2012. Population is expected to continue to decline in the future to a level of 224,680 by 2020.

Wayne County

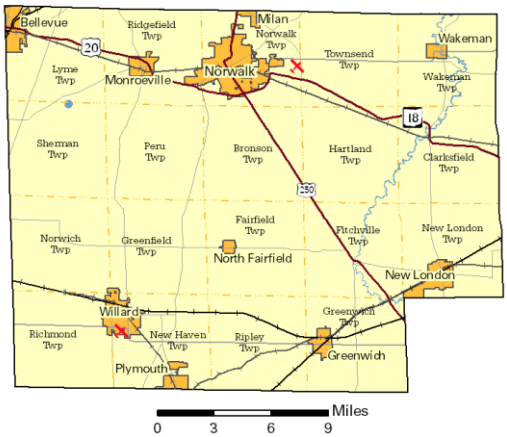


Wayne County is 23% forest, 60% cropland, and 5% urban. Wooster is the major urban area. The 2010 population was 114,520 while it grew to 114,848 in 2012. Population is expected to slightly decline in the future to a level of 114,390 by 2020.

Ashland County

Ashland County is 37% forest, 48% cropland, and 2% urban. Ashland is the major urban area. The 2010 population was 53,139 while it declined to 52,962 in 2012. Population is expected to grow in the future to a level of 53,980 by 2020.

Huron County



Huron County is 16% forest, 71% cropland, and 4% urban. Norwalk is the major urban area. The 2010 population was 59,626 while it declined to 59,280 in 2012. Population is expected to continue declining in the future to a level of 58,740 by 2020.

Erie County

Erie County is 16% forest, 53% cropland, and 13% urban. Sandusky is the major urban area. The 2010 population was 77,079 while it declined to 76,398 in 2012. Population is expected to continue declining in the future to a level of 72,900 by 2020.

Source: Ohio Department of Development. Ohio County Profiles: http://development.ohio.gov/reports/reports_countytrends_map.htm

Commuting trends

As can be seen in Table 22, the majority of VMT occurs in Cuyahoga County and then Summit County, and then to a lesser extent Lorain, Lake, Trumbull and Mahoning Counties. Table 23 below looks at commuter travel in and out of the county, Cuyahoga, in this analysis area with nonattainment monitors. Only 10% of Cuyahoga County's working residents commute to counties outside of Cuyahoga County. In turn, over 27% of Cuyahoga County's workforce commutes from other counties into Cuyahoga County. Of the Cuyahoga County residents that commute to other counties, the greatest percentage commutes south to Summit County (2.8%), northeast to Lake County (2.3%), and west to Lorain County (1.8%). To a lesser extent, some commute to Medina, Portage

and Geauga Counties (1.9% combined). Of the non-residents that commute into Cuyahoga County, the majority comes from Lake County (5.2%) and Summit County (5.0%). Overall, the most significant commuter travel in and out of these counties occurs between Cuyahoga, Lake and Summit Counties.

Table 23: Commuter Travel In and Out of Cuyahoga County

Cuyahoga		
	Percent of workers living in county that work outside the county	10.2%
	Percent of workers that live outside the county	27.3%

Number of workers living in Cuyahoga County		**579,485**
Commute Out To	Number	Percent
Summit Co. OH	15,992	2.8%
Lake Co. OH	13,334	2.3%
Lorain Co. OH	10,475	1.8%
Medina Co. OH	5,383	0.9%
Portage Co. OH	2,969	0.5%
Geauga Co. OH	2,830	0.5%
Stark Co. OH	764	0.1%
Franklin Co. OH	589	0.1%
Erie Co. OH	318	0.1%
Trumbull Co. OH	316	0.1%

Percent is of workers living in county.

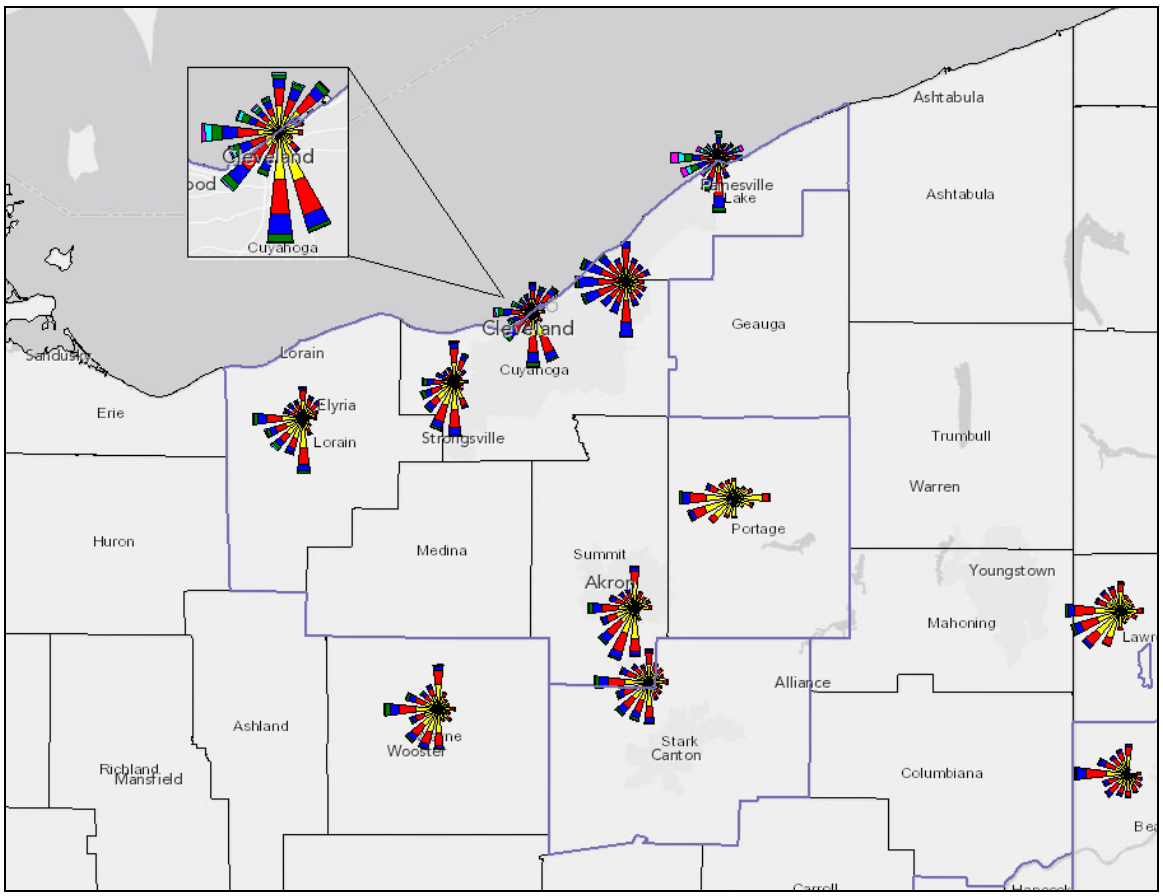
Number of workers working in Cuyahoga County		**715,297**
Commute In From	Number	Percent
Lorain Co. OH	42,171	5.9%
Lake Co. OH	37,191	5.2%
Summit Co. OH	35,883	5.0%
Medina Co. OH	28,550	4.0%
Geauga Co. OH	16,321	2.3%
Portage Co. OH	12,909	1.8%
Ashtabula Co. OH	2,641	0.4%
Trumbull Co. OH	2,018	0.3%
Erie Co. OH	1,740	0.2%
Mahoning Co. OH	1,149	0.2%

Percent is of workers working in county.

Factor 3: Meteorology

The following wind roses represent this area.

Figure 19: 2009 to 2012 Wind Roses for the Cleveland-Akron-Lorain Analysis Area



Source: U.S. EPA's $PM_{2.5}$ Designations Mapping Tool: http://geoplatform2.epa.gov/PM_MAP/index.html

Winds from the south-southwest and west-southwest (collectively, the southwest quadrant) are prevalent in this analysis area. However, lake effect winds can produce more of a variety of wind direction frequencies near the lake and especially near the nonattainment monitors located within Cleveland.

Factor 4: Geography/topography

This analysis area does not have any geographical or topographical barriers significantly affecting air pollution transport. Therefore, this factor does not play a role in the analysis of this area.

Factor 5: Jurisdictional boundaries

Lake, Lorain, Cuyahoga, Medina, Summit, and Portage Counties were designated as a nonattainment counties for the 2006 PM2.5 standard as part of the Cleveland-Akron-Lorain nonattainment area. The same counties and a partial area of Ashtabula County were designated as nonattainment under the 1997 PM2.5 standard. With respect to the 1997 and 2008 ozone standards, the same counties were designated as nonattainment, and in addition all of Ashtabula and Geauga Counties were included in the area. Mahoning County was designated as nonattainment under the 1997 ozone standard as part of the Youngstown-Warren-Sharon OH-PA nonattainment area. These areas have been redesignated to attainment for the 1997 and 2006 PM2.5 standards and 1997 ozone standards. No other counties a part of this analysis have been designated nonattainment for PM2.5 or other urban-scale pollutants.

Cuyahoga County is part of the Cleveland-Akron-Elyria CSA which is comprised of the Cleveland-Elyria-Mentor MSA (Cuyahoga, Lake, Lorain, Medina and Geauga Counties) and the Akron MSA (Summit and Portage Counties) and Ashtabula County.

The Northeast Ohio Areawide coordinating Agency (NOACA) is the planning agency designated as the Metropolitan Planning Organization for the greater Cleveland area. The NOACA region is composed of five counties: Cuyahoga, Geauga, Lake, Lorain and Medina.

The Akron Metropolitan Area Transportation Study (AMATS) is the planning agency designated as the MPO for the Akron area. The AMATS region is composed of two counties: Summit and Portage.

Conclusion

Ashtabula (partial, only for the 1997 annual standard), Cuyahoga, Lake, Lorain, Medina, Portage, and Summit Counties have historically been a part of this nonattainment area.

Ashtabula County was a part of the designations of nonattainment under the 1997 PM2.5 standard but not the 2006 standard. On December 9, 2008, Ohio EPA submitted additional information regarding the First Energy power plant in Ashtabula County in support of excluding it from nonattainment designations under the 2006 standard. This information remains applicable. Furthermore, emissions in Ashtabula County continue to be dominated by nonpoint emissions and point emissions (including First Energy) continue to decline from 2008 to 2011.

As was the case with the 1997 and 2006 standards, Geauga County continues to have very low emissions and little to no population or commuter travel with Cuyahoga County. There are also no larger point sources in Geauga County.

Comparatively, Wayne County has moderately high SO2 and PM2.5 emissions, due to Orrville. However, Wayne County, not a part of this metropolitan area, is significantly south of the violating monitors. Wayne would more likely impact the monitors in Medina or Summit Counties, both of which are attaining the standard. There is also negligible commuting between Wayne and Cuyahoga Counties.

Although Trumbull and Mahoning Counties, a part of a different metropolitan area, have relatively high emissions for some pollutants, they are a significant distance to the east of the violating monitors. They also have monitors demonstrating attainment of the standard, as do Portage and Lake Counties which are closer to Trumbull County. Trumbull and Mahoning Counties emissions are also dominated by local nonpoint emissions. There is also negligible commuting between these counties and Cuyahoga County.

Ashland, Huron and Erie Counties have very low emissions and little to no commuter travel with Cuyahoga County.

The remaining counties include Cuyahoga (four violating monitors in Cleveland), Lorain (non-violating monitor), Lake (non-violating monitor), Medina (historic and recent monitoring indicates attainment), Summit (two non-violating monitors) and Portage (non-violating monitor) Counties. These counties were designated as nonattainment as part of the 2006 PM2.5 standard. On February 13, 2009, Ohio EPA submitted additional information and comments requesting these counties be designated as attainment/unclassifiable for the 2006 PM2.5 standard. These comments still apply considering the latest available data and information.

Just as in 2009, only Cuyahoga County is not attaining the revised standard. As identified in Figure 16 above, these monitors are all located geographically in the heart of the Cleveland metropolitan/industrial area. Figure 17 demonstrates the significant amount of point source emissions condensed nearby the violating monitors. Cuyahoga County has by far the highest population in the area, although it is projected to steadily decline in the future, and VMT.

It is Ohio's belief that violations at these monitors can be attributed to local industrial sources and nearby on-road and off-road emissions. The monitors are positioned in close proximity to one of the largest steel producing facilities in the country.

Although some of the counties in the metropolitan area have emissions comparable to Cuyahoga County, some of those emissions can be attributed to utilities which will see significant reductions needed in time for attainment of this standard. As discussed above, the two largest coal burning utilities in the area (in Lake and Lorain Counties) will be converting to reactive power and natural gas in the near future. In addition, the lone utility in Cuyahoga County, will be permanently shutting down operations. This will bring about significant reductions in PM2.5 and its precursors.

The speciation data for these monitors indicates a large sulfate and organic carbon component. Sulfate is often attributed to coal burning utilities while organic carbon tends to be from local sources.

Although there is some commuter travel between Cuyahoga County and these counties, the majority comes into Cuyahoga County from Lake, Lorain, Summit and Medina Counties. Portage County has very little commuter travel with Cuyahoga County and has low emissions, and mostly nonpoint local emissions. Medina County also has low emissions, mostly attributed to local nonpoint sources.

With the changes at the utilities in Lorain and Lake County, emissions will drop significantly to comparable emissions of counties historically excluded from this nonattainment area. The majority of Summit County's emissions are local nonpoint emissions and point source emissions (to a lesser extent). However, as noted above, these counties all have monitors showing attainment. Ohio EPA does not believe the sole reason for inclusion of some of these counties should be based upon limited commuter travel.

Ohio EPA continues to believe the PM2.5 nonattainment area should be limited to Cuyahoga County.

Steubenville-Weirton, OH-WV

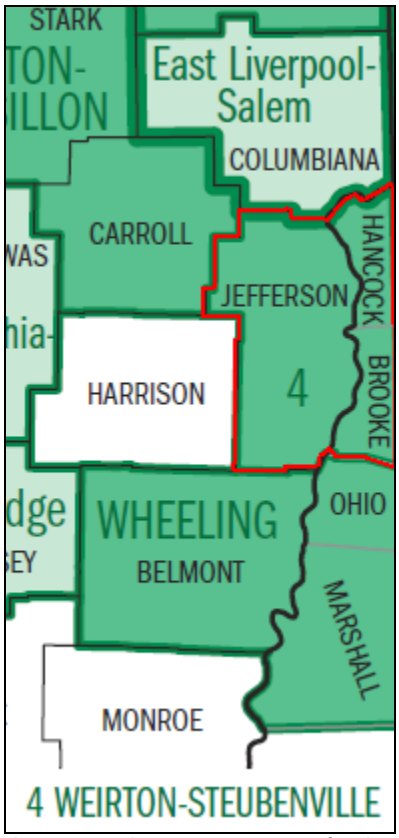
Figure 20: Steubenville-Weirton, OH-WV Recommended Nonattainment Area – Ohio Portion Only

Discussion

There is one Ohio county and two West Virginia counties in this historic 1997 and 2006 $PM_{2.5}$ standards nonattainment area, Jefferson County, Ohio and Hancock and Brooke Counties in WV. Ohio EPA recommends designating Jefferson County as nonattainment for the Ohio portion of the Steubenville-Weirton area.

There is one violating monitors in Jefferson County and one violating monitor in Brooke County, WV. Jefferson and Brooke (WV) Counties are part of the Weirton-Steubenville MSA along with Hancock County, WV.

Figure 21: Weirton-Steubenville MSA



Source: U.S. Department of Commerce Economics and Statistics Administrations, U.S. Census Bureau, 2002 Economic Census

There are four Ohio counties adjacent to the Weirton-Steubenville MSA: Columbiana, Carroll, Harrison and Belmont Counties. Belmont County is part of the historical Wheeling PM2.5 nonattainment area which is discussed later. Ohio EPA will not be analyzing other adjacent areas in WV and PA. Ohio County, WV will also be discussed in the Wheeling section and Pennsylvania counties have not historically been a part of this analysis area.

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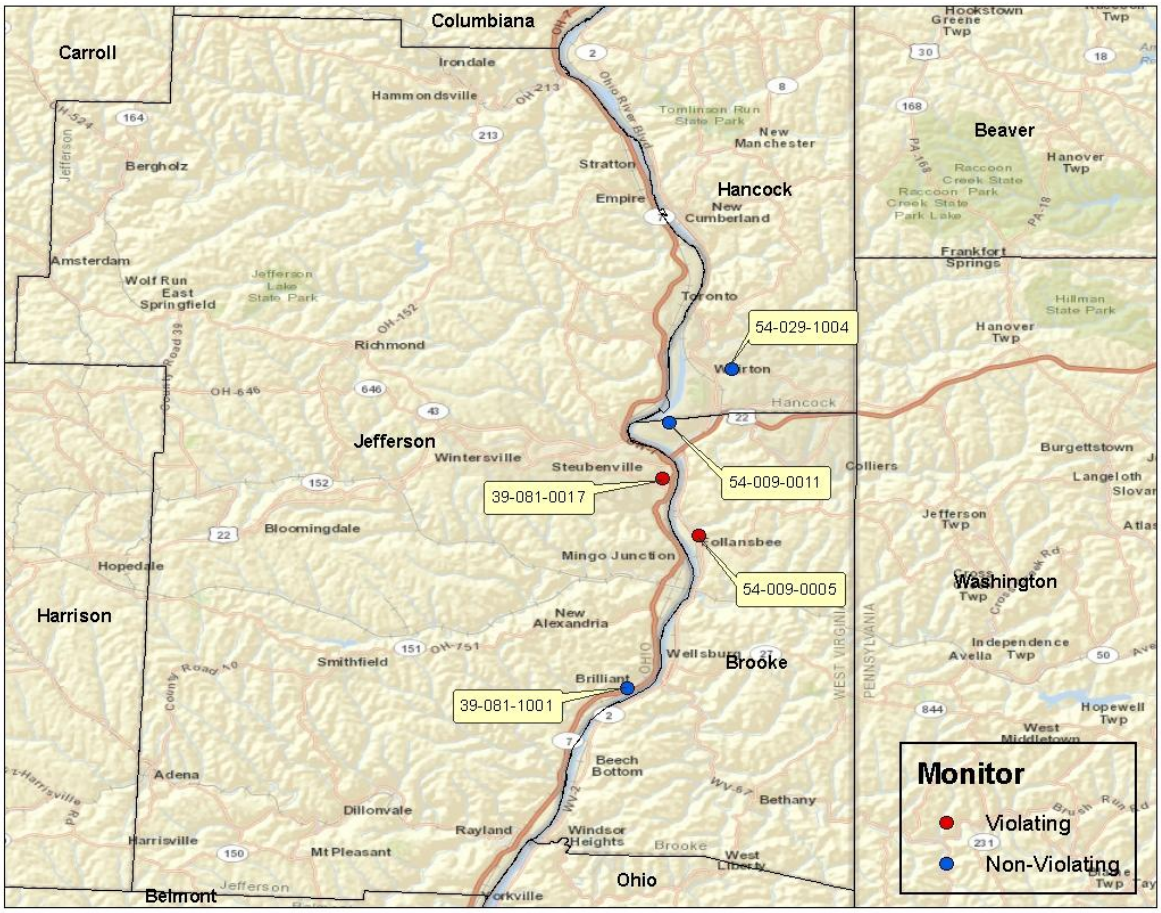
Factor 1: Air quality data

There are five monitors in this area.

Figure 22: Steubenville-Weirton Area Air Quality Monitors



In Jefferson County, OH, monitor 39-081-0017 and in Brooke County, WV monitor 54-009-0005 are violating the standard based on 2010 to 2012 air quality data. The design value for the area is 12.7 µg/m^3. As can be seen from Table 1, air quality trends have declined historically in this area.

Table 24: Annual Average (µg/m^3) for Ohio Monitors

Site	County				Average
		2010	2011	2012	10-'12
39-081-0017	Jefferson	12.7	12.6	11.3	12.2
39-081-1001		12.7	11.3	10.0	11.3

Combined data from two adjacent sites
Insufficient data
Violating monitor

Source: U.S. EPA AQS

Table 25: Annual Average (µg/m^3) for West Virginia Monitors

Site	County				Average
		2010	2011	2012	10-'12
54-009-0005	Brooke	14.1	12.6	11.2	12.7
54-009-0011		13.5	9.4	10.6	11.1
54-029-1004	Hancock	12.6	11.3	10.1	11.3

Combined data from two adjacent sites
Insufficient data
Violating monitor

Source: U.S. EPA AQS

There is one speciation monitor in this area. It is co-located with the non-violating Ohio monitor.

Table 26: Steubenville-Weirton Area Speciation Monitors

		Speciation Monitor SANDWICH Mass					FRM Monitor
		Sulfate	Nitrate	Organic Carbon	Elemental Carbon	Crustal	
Jefferson	2009	7.1	0.8	1.2	0.8	0.4	11.2
	2010	5.8	0.8	2.9	0.9	0.5	12.7
	2011	6.2	0.7	2.4	0.9	0.4	11.3
39-081-1001	2009-2011 Average	6.4	0.8	2.2	0.9	0.4	11.7

Source: CSN speciation data (SANDWICHED) from http://www.epa.gov/pmdesignations/2012standards/techinfo.htm#F1

Sulfate dominates at this monitor. Organic carbon also has a strong presence.

The 2010 to 2011 urban increments (UI) have also been calculated for the violating monitors.

Table 27: Steubenville-Weirton Area Urban Increments

2010-2011 Averages		PM2.5 Total	PM2.5 Total UI	Organic Carbon	Organic Carbon UI	Elemental Carbon	Elemental Carbon UI	Nitrates	Nitrates UI	Sulfates	Sulfates UI	Crustal	Crustal UI
Jefferson 39-081-0017	Quarter 1	12.3	3.9	2.1	0.5	2.4	1.9	2.3	0.3	5.2	1.2	0.4	0.0
	Quarter 2	11.6	2.2	2.9	0.0	1.3	0.8	0.0	0.0	6.9	1.4	0.4	0.0
	Quarter 3	14.6	2.5	5.2	1.2	1.3	0.7	0.0	0.0	7.6	0.5	0.5	0.0
	Quarter 4	11.2	3.2	3.3	0.9	1.1	0.4	1.4	0.4	5.0	1.5	0.4	0.0
	Annual	12.4	3.0	3.4	0.7	1.6	1.0	0.9	0.2	6.2	1.1	0.4	0.0
Brooke, WV 54-009-0005	Quarter 1	14.7	6.3	2.6	1.0	4.3	3.8	2.3	0.3	5.2	1.2	0.4	0.0
	Quarter 2	12.4	3.0	2.9	0.0	2.1	1.6	0.0	0.0	6.9	1.4	0.4	0.0
	Quarter 3	14.9	2.8	5.4	1.5	1.4	0.8	0.0	0.0	7.6	0.5	0.5	0.0
	Quarter 4	11.5	3.5	3.5	1.1	1.2	0.5	1.4	0.4	5.0	1.5	0.4	0.0
	Annual	13.4	3.9	3.6	0.9	2.3	1.7	0.9	0.2	6.2	1.1	0.4	0.0

Source: U.S. EPA Designations Guidance and Data: http://www.epa.gov/pmdesignations/2012standards/techinfo.htm#F2

Quarter 1 and especially quarter 3 tend to have higher total PM2.5 although the PM2.5 UI is most dominant in quarter 1 and quarter 4. Organic carbon UI is highest in quarter 3 while the elemental carbon UI is highest in quarter 1. The nitrate UI is not dominant but more present in quarter 1 and quarter 4. The sulfate UI is dominant in quarters 1, 2 and 4.

Factor 2: Emissions and emissions related data

Emission trends

Overall, the most significant emissions in the analysis area emanate from Jefferson County. Considering all the counties in this analysis area, Jefferson County accounts for 82% of PM2.5, 80% of NOx, 21% of VOC, 11% of NH3 and 98% of SO2 emissions. It is important to note there are significant reductions in emissions from point sources between 2008 and 2011 in Jefferson County.

As can be seen in Figure 23, all the larger point sources are along the Ohio River.

Table 28: Steubenville-Weirton Analysis Area Emissions (tpy)

JEFFERSON	PM2.5	*OC*	*EC*	NOX	*Nitrate*	SO2	*Sulfate*	NH3	VOC	*Other*
Point - 2011	7,614.0	n/a	n/a	10,281.5	n/a	29,509.9	n/a	6.3	255.1	n/a
Point - 2008	11,039.8	445.4	528.1	36,876.7	12.3	136,297.3	1,231.7	11.8	453.9	9,600.8
Nonpoint	599.6	245.9	49.1	443.5	1.8	138.0	10.9	184.9	3,870.1	719.6
Nonroad	22.0	7.2	9.6	216.6	0.0	3.5	0.1	0.3	429.6	5.0
Onroad	59.2	19.9	27.6	1,673.9	0.1	7.6	0.5	32.5	955.0	11.2
Fire	5.7	2.8	0.6	1.6	0.1	0.7	0.0	1.0	14.0	2.1
Total - 2008	11,726.3	721.3	615.1	39,212.4	14.3	136,447.0	1,243.2	230.4	5,722.6	10,338.6

BROOKE, WV	PM2.5	*OC*	*EC*	NOX	*Nitrate*	SO2	*Sulfate*	NH3	VOC	*Other*
Point - 2011	164.5	n/a	n/a	1,160.0	n/a	729.6	n/a	13.3	510.6	n/a
Point - 2008	167.2	16.9	18.3	789.8	1.0	766.5	25.8	77.3	729.8	196.4
Nonpoint	176.5	61.3	16.3	295.5	0.6	152.3	3.4	25.2	1,860.0	222.9
Nonroad	9.2	2.4	5.4	169.5	0.0	2.2	0.1	0.1	137.0	1.3
Onroad	17.0	5.2	8.2	498.8	0.0	2.8	0.1	9.8	262.0	3.5
Fire	1.4	0.7	0.2	0.4	0.0	0.2	0.0	0.2	3.5	0.5
Total - 2008	371.4	86.5	48.3	1,754.0	1.6	924.0	29.5	112.6	2,992.4	424.7

Hancock, WV	PM2.5	*OC*	*EC*	NOX	*Nitrate*	SO2	*Sulfate*	NH3	VOC	*Other*
Point - 2011	23.0	n/a	n/a	424.8	n/a	63.1	n/a	5.0	146.1	n/a
Point - 2008	103.0	13.6	12.2	574.7	0.8	613.0	25.6	5.4	125.6	81.2
Nonpoint	171.4	59.3	19.5	474.1	0.6	240.4	3.5	19.6	1,550.9	201.3
Nonroad	8.0	2.3	4.2	119.1	0.0	1.8	0.1	0.1	172.7	1.4
Onroad	14.9	4.6	7.3	460.8	0.0	2.5	0.1	9.0	235.9	2.9
Fire	-	-	-	-	-	-	-	-	-	-
Total - 2008	297.3	79.9	43.2	1,628.7	1.4	857.7	29.3	34.1	2,085.0	286.9

Carroll	**PM2.5**	***OC***	***EC***	**NOX**	***Nitrate***	**SO2**	***Sulfate***	**NH3**	**VOC**	***Other***
Point - 2011	86.7	n/a	n/a	675.9	n/a	6.5	n/a	0.0	32.8	n/a
Point - 2008	11.3	3.6	5.8	601.8	0.3	7.2	1.2	-	31.2	3.8
Nonpoint	326.5	113.1	21.0	224.4	0.9	60.8	5.5	373.7	3,640.5	455.2
Nonroad	17.7	5.5	8.5	155.1	0.0	2.6	0.1	0.2	284.8	3.6
Onroad	18.8	6.3	9.1	569.8	0.0	2.2	0.1	10.7	306.4	3.2
Fire	29.4	14.8	3.2	3.0	0.3	2.1	0.1	5.8	43.6	11.0
Total - 2008	403.8	143.2	47.7	1,554.1	1.6	74.9	7.0	390.4	4,306.4	476.8

Harrison	**PM2.5**	***OC***	***EC***	**NOX**	***Nitrate***	**SO2**	***Sulfate***	**NH3**	**VOC**	***Other***
Point - 2011	12.3	n/a	n/a	6.4	n/a	21.2	n/a	-	1.4	n/a
Point - 2008	0.1	0.0	0.1	0.4	0.0	0.1	0.0	-	0.8	0.0
Nonpoint	256.7	66.1	13.4	194.7	0.6	41.4	3.4	190.2	3,657.8	392.3
Nonroad	17.2	5.4	8.0	128.1	0.0	2.3	0.0	0.2	318.5	3.7
Onroad	16.0	5.2	8.0	484.9	0.0	1.8	0.1	8.9	252.4	2.6
Fire	15.4	7.7	1.7	2.8	0.2	1.4	0.1	2.9	41.3	5.8
Total - 2008	305.4	84.5	31.2	810.9	0.8	47.0	3.6	202.1	4,270.8	404.3

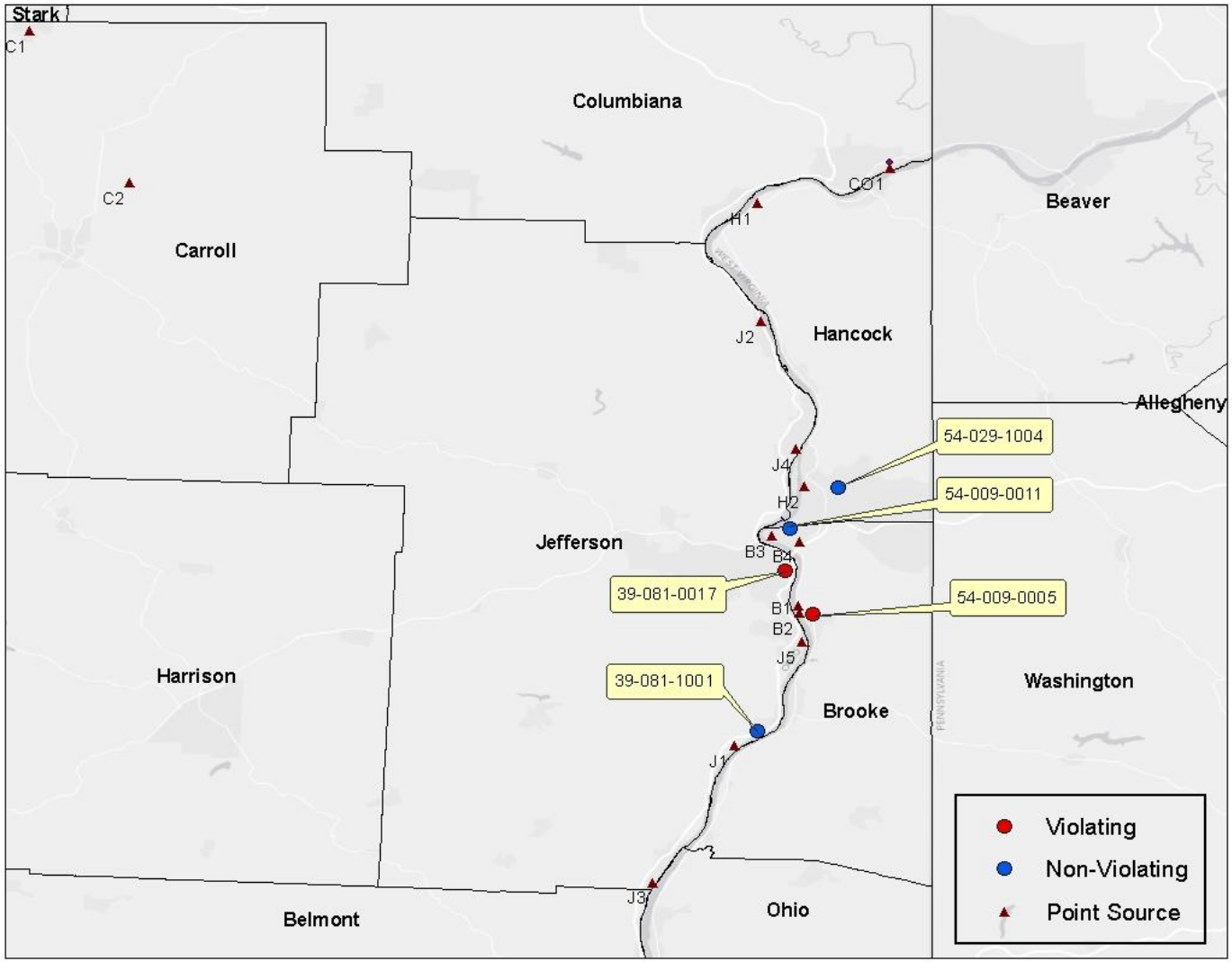
Columbiana	**PM2.5**	***OC***	***EC***	**NOX**	***Nitrate***	**SO2**	***Sulfate***	**NH3**	**VOC**	***Other***
Point - 2011	56.3	n/a	n/a	208.3	n/a	4.2	n/a	0.0	141.1	n/a
Point - 2008	29.9	3.4	1.5	165.6	0.3	3.8	2.2	0.0	113.9	36.1
Nonpoint	1,014.2	358.8	74.9	1,084.5	2.8	194.3	16.3	1,002.0	5,103.6	1,314.6
Nonroad	45.0	14.3	20.9	429.1	0.1	7.1	0.2	0.5	834.2	9.6
Onroad	78.5	25.6	37.8	2,224.5	0.1	9.8	0.6	41.6	1,228.7	14.4
Fire	-	-	-	-	-	-	-	-	-	-
Total - 2008	1,167.5	402.1	135.0	3,903.8	3.2	215.0	19.2	1,044.0	7,280.4	1,374.6

2008 Total By County	**PM2.5**	***OC***	***EC***	**NOX**	***Nitrate***	**SO2**	***Sulfate***	**NH3**	**VOC**	***Other***
JEFFERSON	11,726.3	721.3	615.1	39,212.4	14.3	136,447.0	1,243.2	230.4	5,722.6	10,338.6
BROOKE, WV	371.4	86.5	48.3	1,754.0	1.6	924.0	29.5	112.6	2,992.4	424.7
Hancock, WV	297.3	79.9	43.2	1,628.7	1.4	857.7	29.3	34.1	2,085.0	286.9
Carroll	403.8	143.2	47.7	1,554.1	1.6	74.9	7.0	390.4	4,306.4	476.8
Harrison	305.4	84.5	31.2	810.9	0.8	47.0	3.6	202.1	4,270.8	404.3
Columbiana	1,167.5	402.1	135.0	3,903.8	3.2	215.0	19.2	1,044.0	7,280.4	1,374.6
Total - 2008	14,271.6	1,517.6	920.3	48,863.8	22.9	138,565.7	1,331.8	2,013.5	26,657.6	13,305.9

Source: 2008 and 2011 NEI

The following figure[8] and table shows the higher emitting point sources located in the area.

Figure 23: Location of Steubenville-Weirton Analysis Area Emissions Point Sources



Source: 2008 and 2011 NEI

[8] The table can be used to correlate the location of each point source with the letter (first letter of county) and number next to the symbol on the map in the figure.

Table 29: Steubenville-Weirton Analysis Area Emissions Point Sources for 2011 (tpy)

PM2.5		
Jefferson	**J2-**W. H. SAMMIS PLANT (0641160017)	6,916.4
Jefferson	**J1-**Cardinal Power Plant (Cardinal Operating Company) (0641050002)	616.4
Brooke, WV	**B1-**MOUNTAIN STATE CARBON, LLC	126.5
Carroll	**C1-**Imperial Aluminum - Minerva, LLC (0210000107)	54.1

NOx		
Jefferson	**J2-**W. H. SAMMIS PLANT (0641160017)	7,544.4
Jefferson	**J1-**Cardinal Power Plant (Cardinal Operating Company) (0641050002)	2,250.1
Brooke, WV	**B1-**MOUNTAIN STATE CARBON, LLC	964.9
Carroll	**C2-**Tennessee Gas Pipline- Station 214 (0210000046)	662.1
Hancock, WV	**H2-**ARCELORMITTAL WEIRTON INC.	310.9
Jefferson	**J4-**Titanium Metals Corporation (0641180064)	265.6
Jefferson	**J5-**Mingo Junction Energy Center, LLC (0641090234)	155.6
Brooke, WV	**B2-**KOPPERS FOLLANSBEE	146.0
Hancock, WV	**H1-**ERGON - WEST VIRGINIA, INC.	113.8

SO2		
Jefferson	**J1-**Cardinal Power Plant (Cardinal Operating Company) (0641050002)	25,121.8
Jefferson	**J2-**W. H. SAMMIS PLANT (0641160017)	4,152.8
Brooke, WV	**B1-**MOUNTAIN STATE CARBON, LLC	696.8
Jefferson	**J5-**Mingo Junction Energy Center, LLC (0641090234)	222.5

NH3		
Brooke, WV	**B1-**MOUNTAIN STATE CARBON, LLC	12.9
Hancock, WV	**H1-**ERGON - WEST VIRGINIA, INC.	5.0
Jefferson	**J1-**Cardinal Power Plant (Cardinal Operating Company) (0641050002)	2.9
Jefferson	**J2-**W. H. SAMMIS PLANT (0641160017)	1.3
Jefferson	**J3-**RG Steel Wheeling, LLC - Yorkville Plant (0641120012)	1.1

VOC		
Brooke, WV	**B1-**MOUNTAIN STATE CARBON, LLC	222.4
Jefferson	**J2-**W. H. SAMMIS PLANT (0641160017)	140.7
Brooke, WV	**B3-**BALL METAL FOOD CONTAINER CORP.	132.5
Hancock, WV	**H1-**ERGON - WEST VIRGINIA, INC.	121.8
Jefferson	**J1-**Cardinal Power Plant (Cardinal Operating Company) (0641050002)	103.2
Brooke, WV	**B4-**PRECOAT METALS	57.6
Columbiana	**CO1-**Heritage - WTI, Inc. (0215020233)	52.8

Source: 2008 and 2011 NEI

Level of control of emission sources

In the Weirton-Steubenville area, the emission reduction programs which have had or will have the greatest potential impact on $PM_{2.5}$ concentrations are:

- on-road and off-road diesel control programs in conjunction with ultra-low sulfur diesel fuel requirements
- NO_x trading program
- Clean Air Interstate Rule (CAIR)
- Ohio Clean Diesel Initiatives
- Mercury and Air Toxics Standards (MATS)

CAIR and MATS regulate electric generating units (EGUs, or power plants). CAIR is the program which will bring about largest reductions in precursor or primary emissions of any of the $PM_{2.5}$ species (sulfates, nitrates, organic carbon, elemental carbon and crustal). Compliance with the MATS rule will also lead to additional reductions in precursor species, in particular, sulfates.

With respect to the Ohio utilities, Cardinal power plant and W.H. Sammis power plant are located in Jefferson County. Cardinal has two 600 MW units and one 630 MW unit with advanced NOx and SO2 controls. The NOx controls have operated since 2003, the SO2 control for the two 600 MW units has operated since early 2008. However, the advanced SO2 control for the 630 MW unit only became operational in December of 2012 and; therefore, is not reflected in the emissions tables above.

The W.H. Sammis plant has four 180 MW units and two 600 MW units all with advanced NOx and SO2 controls. The NOx controls on the 180 MW units have been operational since 2006 while the two 600 MW units had advanced NOx controls implement in the spring of 2010 (SNCR to SCR). This is evident in the emissions drop between 2008 and 2011 for NOx point sources in Jefferson County. Advanced SO2 controls for all units became operational between January and April of 2010, again evident in the significant drop in SO2 emissions from Jefferson County point sources.

Urbanization, population and commuting trends

The following table provides a summary of 2010 population and VMT for each of the counties that are discussed in this section.

Table 30: Steubenville-Weirton Analysis Area County Level VMT, Population, Land Area and Population Density

2010	VMT	Population	Land Area (Sq. Miles)	Population Density (1,000 per Sq. Miles)
JEFFERSON	676,699,867	69,709	410	0.17
BROOKE, WV	210,542,718	25,447	89	0.29

2010	VMT	Population	Land Area (Sq. Miles)	Population Density (1,000 per Sq. Miles)
Hancock, WV	192,415,179	32,667	83	0.39
CBSA/CSA	1,079,657,764	127,823	581	0.22
Carroll	208,161,599	28,836	395	0.07
Harrison	173,483,382	15,864	404	0.04
Columbiana	869,606,918	107,841	532	0.20
Total for Counties	2,330,909,662	280,364	1,912	

Source: Office of Strategic Research, Ohio Department of Development (Ohio Populations Only)
U.S. EPA Designations Guidance and Data:
http://www.epa.gov/pmdesignations/2012standards/techinfo.htm#F2

Degree of urbanization and population trends

As seen in Table 30 above, the majority of the population for this analysis area resides in Columbiana County, and to a lesser extent Jefferson County. However, as seen in Figure 24 below, the population of these counties is expected to decline.

The most urbanized areas are within Jefferson, Brooke (WV) and Hancock Counties (WV) (see Figure 25 below). The population densities of Brooke and Hancock Counties (WV) are significantly higher than other counties yet their populations are lower.

Figure 24: Steubenville-Weirton Analysis Area County Profiles

Jefferson County

Jefferson County is 76% forest, 11% cropland, and 4% urban. The greater Cincinnati area is the major urban area. The 2010 population was 69,709 while it declined to 68,389 in 2012. Population is expected to continue declining in the future to a level of 66,540 by 2020.

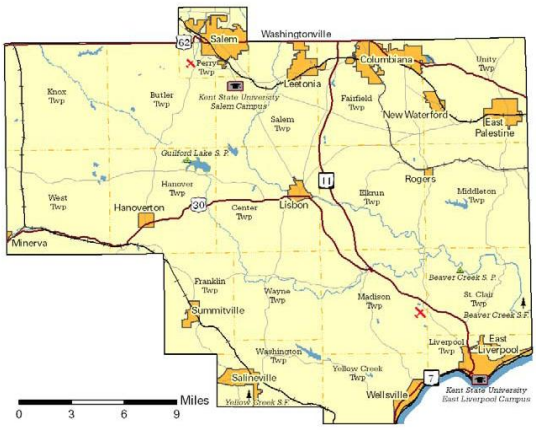
Carroll County

Carroll County is 67% forest, 19% cropland, and only 1% urban. Carrollton is the major urban area. The 2010 population was 28,836 while it declined to 28,587 in 2012. Population is expected to minimally grow in the future to a level of 28,770 by 2020.

Harrison County

Harrison County is 14% pasture, 71% cropland, and less than 1% urban. Cadiz is the largest major urban area. The 2010 population was 15,864 while it declined to 15,714 in 2012. Population is expected to continue to decline in the future to a level of 15,300 by 2020.

Columbiana County

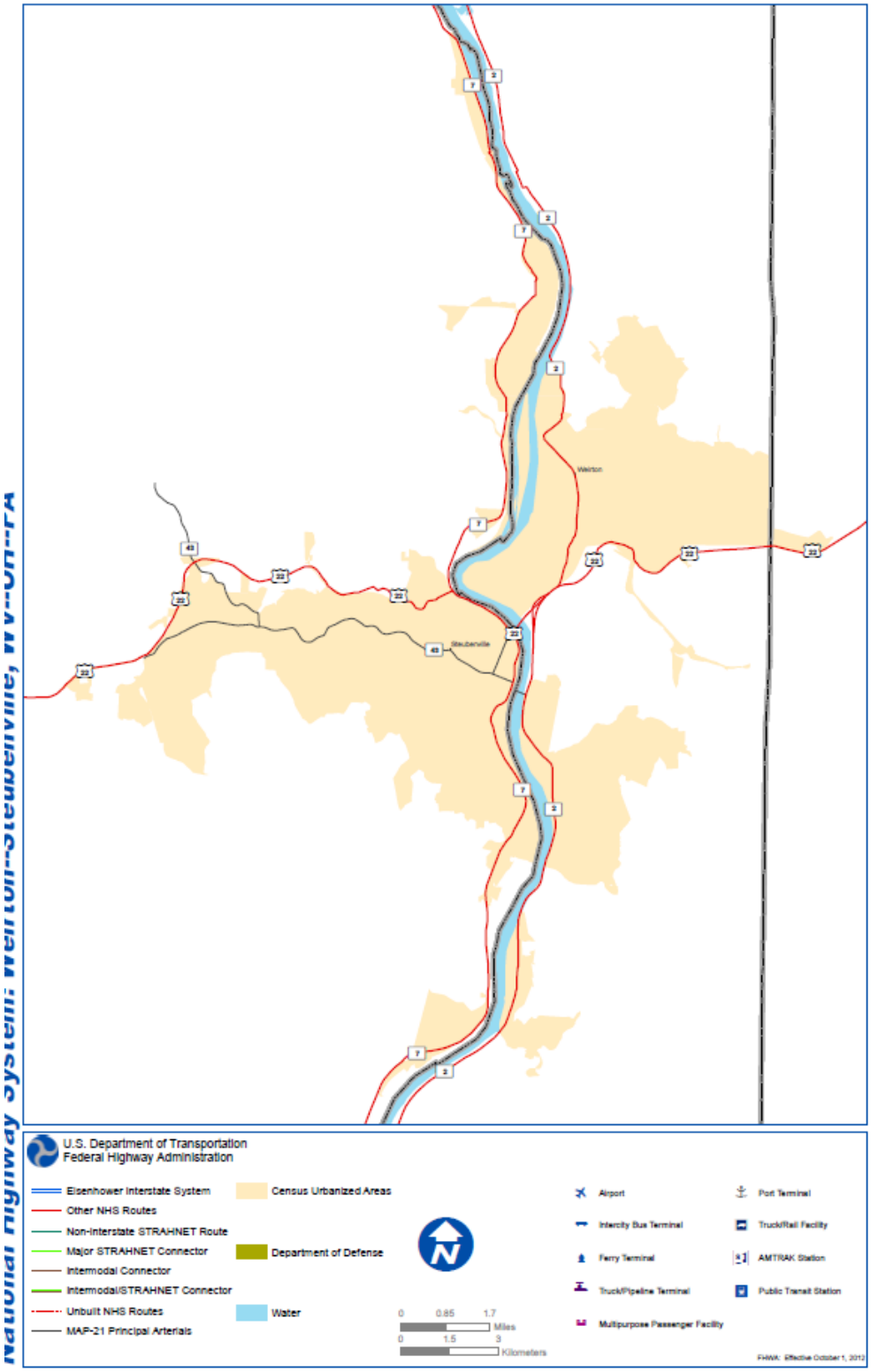


Columbiana County is 25% forest, 56% cropland, and 6% urban. Salem, East Liverpool and Columbiana are the largest major urban areas. The 2010 population was 107,841 while it declined to 106,507 in 2012. Population is expected to continue to decline in the future to a level of 105,380 by 2020.

Source: Ohio Department of Development. Ohio County Profiles: http://development.ohio.gov/reports/reports_countytrends_map.htm

As can be seen from Figure 25 below, the most urbanized area in this analysis area is along the Ohio River and major highways on both the West Virginia and Ohio sides.

Figure 25: Steubenville-Weirton Analysis Urbanized Areas



Source: http://www.fhwa.dot.gov/planning/national_highway_system/nhs_maps/west_virginia/weirton_wv.pdf

The populations in all counties located in West Virginia that are a part of this analysis area are expected to decline through 2020[9].

Commuting trends

As can be seen in Table 30, the majority of VMT occurs in Columbiana County, and to a lesser extent Jefferson County. Table 31 below looks at commuter travel in and out of the two counties in this analysis area with nonattainment monitors, Jefferson and Brooke (WV) Counties. Nearly 32% of Jefferson County's working residents commute to counties outside of Jefferson County while nearly 57% do the same in Brooke County, WV. In turn, nearly 27% of Jefferson County's workforce commutes from other counties into Jefferson County while 48% do the same in Brooke County, WV. Of the Jefferson County residents that commute to other counties, the greatest percentage commutes east (14.4%) to Brooke (WV), Hancock (WV) and Allegheny (PA) Counties. To a lesser extent, some commute south to Belmont County (4.8%). Similarly, 12.4% of the Brooke County (WV) residents that commute to other counties, commute to Allegheny (PA), Hancock (WV) and Ohio (WV) Counties. In addition 4.2% commute to Jefferson County. Of the non-residents that commute into Jefferson County, the most significant percentage comes from the east; 9.7% from Brooke (WV), Hancock (WV), and Allegheny (PA) Counties. An additional 8.2% come from Harrison and Belmont Counties. Of the non-residents that commute into Brooke County, WV, the most significant percentage comes from Jefferson County (5.7%) and Hancock (WV) County (5.7%). Overall, a significant portion of the working population in both of these counties commute outside the county and often between Jefferson, Brooke and Hancock Counties. Columbiana, Carroll and Harrison Counties are not significant commuters to commuter travel in and out of these nonattainment counties.

[9] Figure 2 at http://www.be.wvu.edu/demographics/documents/WVPopProjectionbyCounty2011_001.pdf

Table 31: Commuter Travel In and Out of Jefferson County and Brooke County, WV

Jefferson		
	Percent of workers living in county that work outside the county	31.9%
	Percent of workers that live outside the county	27.4%

Number of workers living in Jefferson County		**28,489**
Commute Out To	Number	Percent
Brooke Co. WV	1,522	5.3%
Belmont Co. OH	1,370	4.8%
Hancock Co. WV	1,364	4.8%
Allegheny Co. PA	1,213	4.3%
Ohio Co. WV	949	3.3%
Columbiana Co. OH	479	1.7%
Harrison Co. OH	335	1.2%

Percent is of workers living in county.

Number of workers working in Jefferson County		**26,692**
Commute In From	Number	Percent
Brooke Co. WV	1,199	4.5%
Harrison Co. OH	1,118	4.2%
Hancock Co. WV	1,065	4.0%
Belmont Co. OH	1,055	4.0%
Columbiana Co. OH	966	3.6%
Allegheny Co. PA	315	1.2%
Carroll Co. OH	258	1.0%

Percent is of workers working in county.

Brooke, WV		
	Percent of workers living in county that work outside the county	56.9%
	Percent of workers that live outside the county	48.0%

Number of workers living in Brooke County		**10,261**
Commute Out To	Number	Percent
Allegheny Co. PA	1,522	5.3%
Hancock Co. WV	1,222	4.3%
Jefferson Co. OH	1,199	4.2%
Ohio Co. WV	802	2.8%
Washington Co. PA	555	1.9%
Belmont Co. OH	144	0.5%

Percent is of workers living in county.

Number of workers working in Brooke County		**8,522**
Commute In From	Number	Percent
Jefferson Co. OH	1,522	5.7%
Hancock Co. WV	1,509	5.7%
Ohio Co. WV	256	1.0%
Belmont Co. OH	231	0.9%
Washington Co. PA	115	0.4%
Allegheny Co. PA	108	0.4%

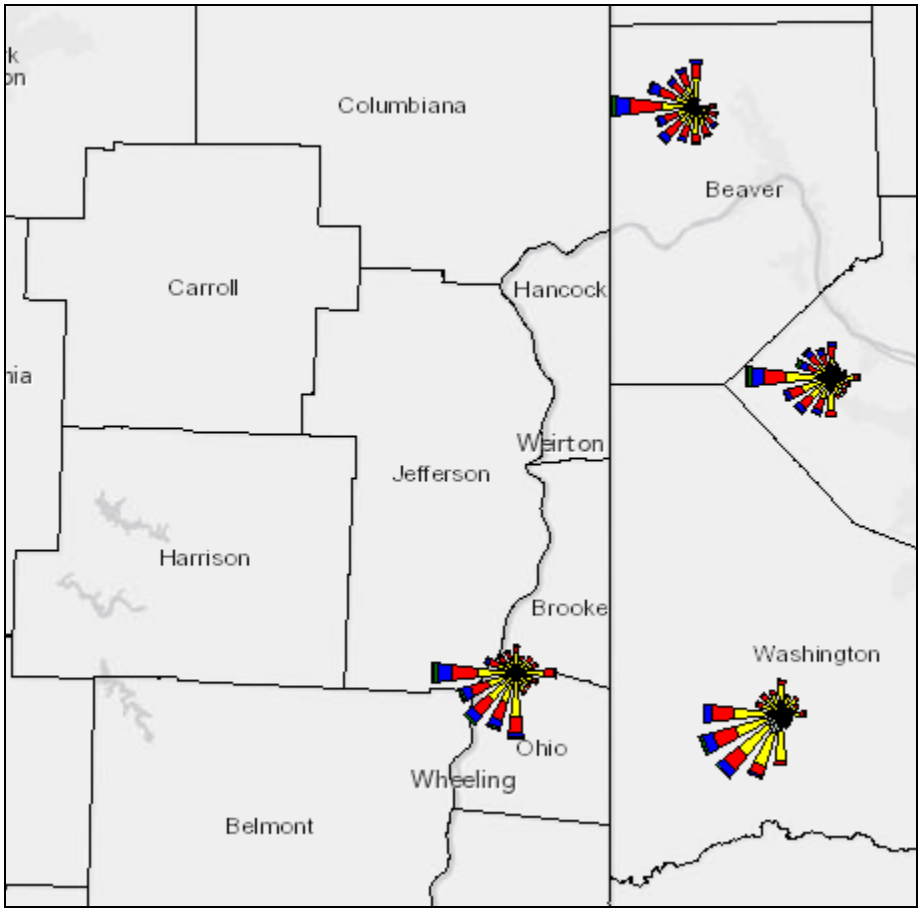
Percent is of workers working in county.

Source: U.S. EPA Designations Guidance and Data: http://www.epa.gov/pmdesignations/2012standards/techinfo.htm#F2

Factor 3: Meteorology

The following wind roses represent this area.

Figure 26: 2009 to 2012 Wind Roses for the Steubenville-Weirton Analysis Area



Source: U.S. EPA's $PM_{2.5}$ Designations Mapping Tool: http://geoplatform2.epa.gov/PM_MAP/index.html

Winds from the west south, south-southwest and west-southwest (collectively, the southwest quadrant) are prevalent in this area. This indicates sources of emissions from the southwest quadrant may be contributing to violations at the monitors.

Factor 4: Geography/topography

This analysis area does not have any geographical or topographical barriers significantly affecting air pollution transport. Therefore, this factor does not play a role in the analysis of this area.

Factor 5: Jurisdictional boundaries

Jefferson, Brooke (WV) and Hancock (WV) Counties were designated as nonattainment counties for the 1997 and 2006 PM2.5 standards as part of the Steubenville-Weirton OH-WV nonattainment area. The same counties were designated as nonattainment under the 1997 ozone standard. Columbiana County was designated as nonattainment under the 1997 ozone standard as part of the Youngstown-Warren-Sharon OH-PA nonattainment area. These areas have been redesignated to attainment for the PM2.5 and ozone standards. No other counties a part of this analysis have been designated nonattainment for PM2.5 or other urban-scale pollutants.

The Weirton-Steubenville, WV-OH MSA includes: Brooke and Hancock Counties, West Virginia and Jefferson County, Ohio.

The Brooke-Hancock-Jefferson Metropolitan Planning Commission (BHJMPO) is the planning agency designated as the Metropolitan Planning Organization for the Weirton-Steubenville area. The BHJMPO region is composed of three counties: Hancock and Brooke Counties in WV and Jefferson County.

Conclusion

Jefferson, Brooke (WV) and Hancock (WV) Counties have historically been a part of this nonattainment area.

The most significant emissions of PM2.5 and its precursors are from Jefferson County, predominantly from power plants. The violating monitor also shows a high presence of sulfate. As demonstrated above, significant reductions have occurred during and after the time these inventories were created and we will continue to see a decline in power plant related emissions.

The majority of the population and VMT for this analysis area are in Columbiana County, and to a lesser extent Jefferson County. While populations are lower, the population densities of Brooke and Hancock Counties (WV) are significantly higher than other counties. Columbiana County also has high emissions compared to other counties in the analysis area but they have historically been analyzed as part of the Youngstown-Warren OH-PA area. There are two monitors located in Mahoning County (see Table 1) and both indicate attainment of the standard. Columbiana County is located to the north of Jefferson and Brooke Counties, and based on meteorology alone, it is unlikely emissions from Columbiana County are impacting these monitors.

There is fairly significant commuter travel in and out of both Jefferson and Brooke (WV) Counties. The majority of commuting occurs between Jefferson, Brooke (WV) and Hancock (WV) Counties.

Carroll and Harrison Counties have very little emissions, population and commuter travel.

Ohio EPA is recommending only Jefferson County be designated nonattainment with respect to the Ohio portion of this area.

Wheeling, WV-OH:

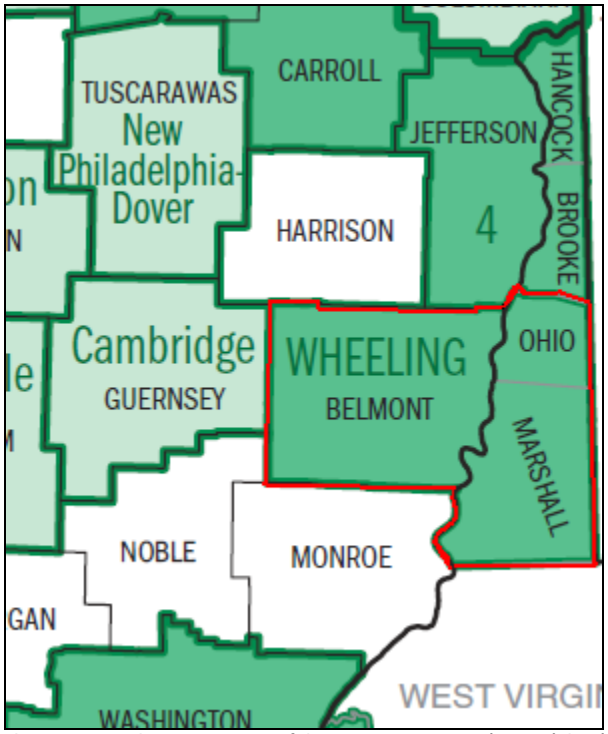
Figure 27: Wheeling WV-OH Recommended Nonattainment Area – Ohio Portion Only

Discussion

There is one Ohio County in this historic $PM_{2.5}$ nonattainment area, Belmont County. In addition to Ohio counties, Ohio and Marshall Counties in West Virginia were parts of this historic $PM_{2.5}$ nonattainment area. Ohio EPA recommends not designating Belmont County as nonattainment for the Wheeling WV-OH area.

There is one violating monitor in Marshall County, WV. Belmont, Marshall (WV) and Ohio (WV) Counties are part of the Wheeling WV-OH MSA.

Figure 28: Wheeling WV-OH MSA



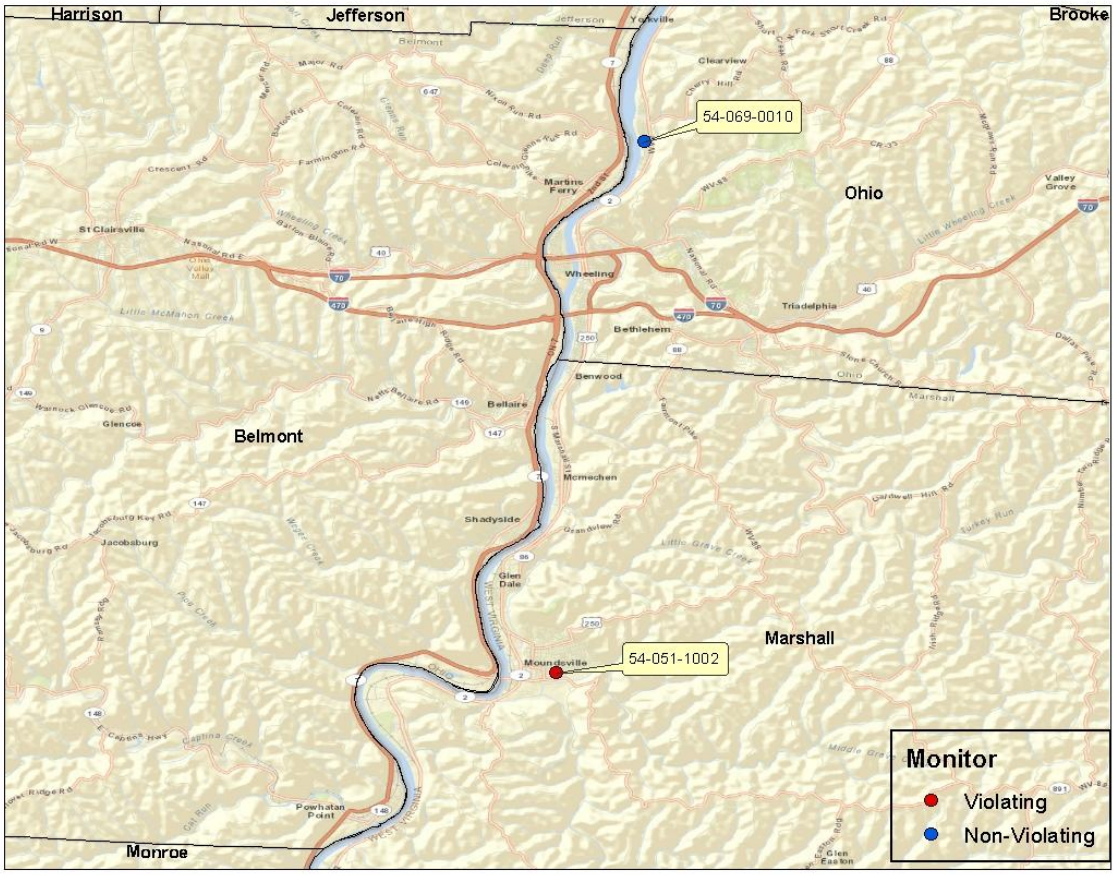
Source: U.S. Department of Commerce Economics and Statistics Administrations, U.S. Census Bureau, 2002 Economic Census

Ohio EPA will not be analyzing any additional adjacent counties. Counties to the north of are part of the historical Steubenville-Weirton PM2.5 nonattainment area and are analyzed in that section of this recommendation document. The remaining Ohio counties surrounding this CSA are rural with little emissions sources that would contribute to nonattainment in Marshall County, WV.

Factor 1: Air quality data

There are two monitors in this area.

Figure 29: Wheeling WV-OH Area Air Quality Monitors



In Marshall County, WV, monitor 54-051-1002 is violating the standard based on 2010 to 2012 air quality data. The design value for the area is 12.8 µg/m^3.

Table 32: Annual Average (µg/m^3) for West Virginia Monitors

Site	County				Average
		2010	2011	2012	10-'12
54-051-1002	Marshall	14.1	12.6	11.8	12.8
54-069-0010	Ohio	12.9	11.3	10.4	11.6

Combined data from two adjacent sites
Insufficient data
Violating monitor

Source: U.S. EPA AQS

There is one speciation monitors in this area. It is co-located with the violating monitor.

Table 33: Wheeling Area Speciation Monitors

		Speciation Monitor SANDWICH Mass					FRM Monitor
		Sulfate	Nitrate	Organic Carbon	Elemental Carbon	Crustal	
Marshall, WV	2009	6.0	0.5	3.8	0.4	0.5	12.2
	2010	-	-	-	-	-	14.1
54-051-1002	2011	4.1	0.3	3.9	0.7	1.0	12.6
	2009-2011 Average	3.4	0.3	2.6	0.4	0.5	13.0

Source: CSN speciation data (SANDWICHED) from http://www.epa.gov/pmdesignations/2012standards/techinfo.htm#F1

Organic carbon and sulfate tends to dominate at this monitor.

The 2010 to 2011 urban increments (UI) have also been calculated for the violating monitor.

Table 34: Wheeling Area Urban Increments

2010-2011 Averages		PM2.5 Total	PM2.5 Total UI	Organic Carbon	Organic Carbon UI	Elemental Carbon	Elemental Carbon UI	Nitrates	Nitrates UI	Sulfates	Sulfates UI	Crustal	Crustal UI
Marshall 54-051-1002	Quarter 1	15.0	4.5	5.0	2.6	1.1	0.6	4.0	0.8	4.5	0.4	0.5	0.1
	Quarter 2	11.5	2.1	4.8	1.1	0.9	0.4	0.1	0.0	4.9	0.4	0.8	0.2
	Quarter 3	15.2	3.8	7.0	2.4	1.3	0.8	0.0	0.0	6.1	0.4	0.7	0.2
	Quarter 4	11.7	2.8	4.7	1.4	1.0	0.4	1.7	0.3	3.5	0.3	0.8	0.3
	Annual	13.4	3.3	5.4	1.9	1.1	0.5	1.5	0.3	4.7	0.4	0.7	0.2

Source: U.S. EPA Designations Guidance and Data: http://www.epa.gov/pmdesignations/2012standards/techinfo.htm#F2

Quarter 1 and quarter 3 tend to have higher total PM2.5 and PM2.5 UI for the violating monitor.

There is a higher organic carbon UI and elemental carbon UI in quarter 1 and quarter 3. The nitrate UI is more dominant in quarter 4 and especially quarter 1.

Factor 2: Emissions and emissions related data

Emission trends

As noted above, Ohio EPA is not analyzing other Ohio counties adjacent to this MSA. Jefferson County is analyzed under the Steubenville-Weirton PM2.5 nonattainment area section of this recommendation document. The remaining Ohio counties surrounding this MSA are rural with little emissions sources that could contribute to nonattainment in Marshall County, WV. As seen in Table 35 below, for PM2.5 and major precursors, SO2 and NOx, these adjacent counties have a small percentage of the total emissions (sum of all emissions from the MSA and the adjacent counties).

Table 35: Percent of Total Emissions for Adjacent Counties

2008 Totals	PM2.5	% All Emissions	NOx	% All Emissions	SO2	% All Emissions
Harrison	305.4	4%	810.9	2%	47.0	0%
Guernsey	588.6	7%	5,507.4	13%	538.5	1%
Noble	260.0	3%	1,169.6	3%	18.1	0%
Monroe	695.8	8%	981.9	2%	2,471.0	4%
Total	1,849.7		8,469.8		3,074.6	

Source: 2008 and 2011 NEI

Overall, the most significant emissions in the analysis area emanate from Marshall County, WV, and predominantly from utilities. Considering all the counties in this analysis area, Marshall County, WV accounts for 79% of PM2.5, 78% of NOx, 28% of VOC, 22% of NH3 and 77% of SO2 emissions. Ohio County, WV does not have significant emissions. Emissions from Belmont County are moderate but as can be seen from Table 36 below, point source emissions dropped significantly from 2008 to 2011 resulting in Belmont County emissions being as insignificant as Ohio County, WV emissions. And as seen before, the more rural counties tend to have higher NH3 emissions. Belmont County, located west of the violating monitor, also has higher VOC emissions from local nonpoint sources predominantly.

As can be seen from Figure 301, the majority of larger point sources are along the Ohio River. All larger point sources of SO2, NOx and PM2.5 are in Marshall County and south, southwest of the violating monitor. The point sources in Belmont County are fairly low emitters of NH3 and VOC and are located north of the monitor.

Table 36: Wheeling Analysis Area Emissions (tpy)

Belmont	**PM2.5**	***OC***	***EC***	**NOX**	***Nitrate***	**SO2**	***Sulfate***	**NH3**	**VOC**	***Other***
Point - 2011	16.7	n/a	n/a	11.5	n/a	1.7	n/a	29.4	53.2	n/a
Point - 2008	356.6	19.8	18.3	2,687.4	0.5	15,126.4	46.1	56.4	51.8	418.4
Nonpoint	574.3	230.8	42.8	321.8	1.8	105.1	10.0	232.6	5,051.2	700.8
Nonroad	24.7	7.3	12.5	205.9	0.0	3.6	0.1	0.2	395.4	4.7
Onroad	99.9	30.2	53.9	2,843.5	0.1	10.5	0.6	44.3	1,226.2	15.0
Fire	15.8	7.9	1.7	2.9	0.2	1.5	0.1	3.0	42.4	5.9
Total - 2008	1,071.2	296.0	129.3	6,061.5	2.6	15,247.0	56.8	336.5	6,767.0	1,144.8

MARSHALL, WV	**PM2.5**	***OC***	***EC***	**NOX**	***Nitrate***	**SO2**	***Sulfate***	**NH3**	**VOC**	***Other***
Point - 2011	1,887.2	n/a	n/a	9,159.4	n/a	34,022.1	n/a	2.7	250.4	n/a
Point - 2008	4,851.1	153.8	205.2	26,027.6	3.4	51,576.3	630.4	31.9	320.5	4,214.9
Nonpoint	193.1	68.5	15.9	298.9	0.6	56.5	2.9	78.9	2,945.0	237.4
Nonroad	10.4	2.6	6.3	107.8	0.0	1.8	0.0	0.1	163.4	1.4
Onroad	16.7	5.1	8.2	523.4	0.0	2.8	0.1	10.4	269.3	3.3
Fire	10.4	5.2	1.1	2.0	0.1	1.0	0.0	1.9	27.8	3.9
Total - 2008	5,081.7	235.2	236.7	26,959.7	4.1	51,638.5	633.5	123.2	3,726.1	4,460.9

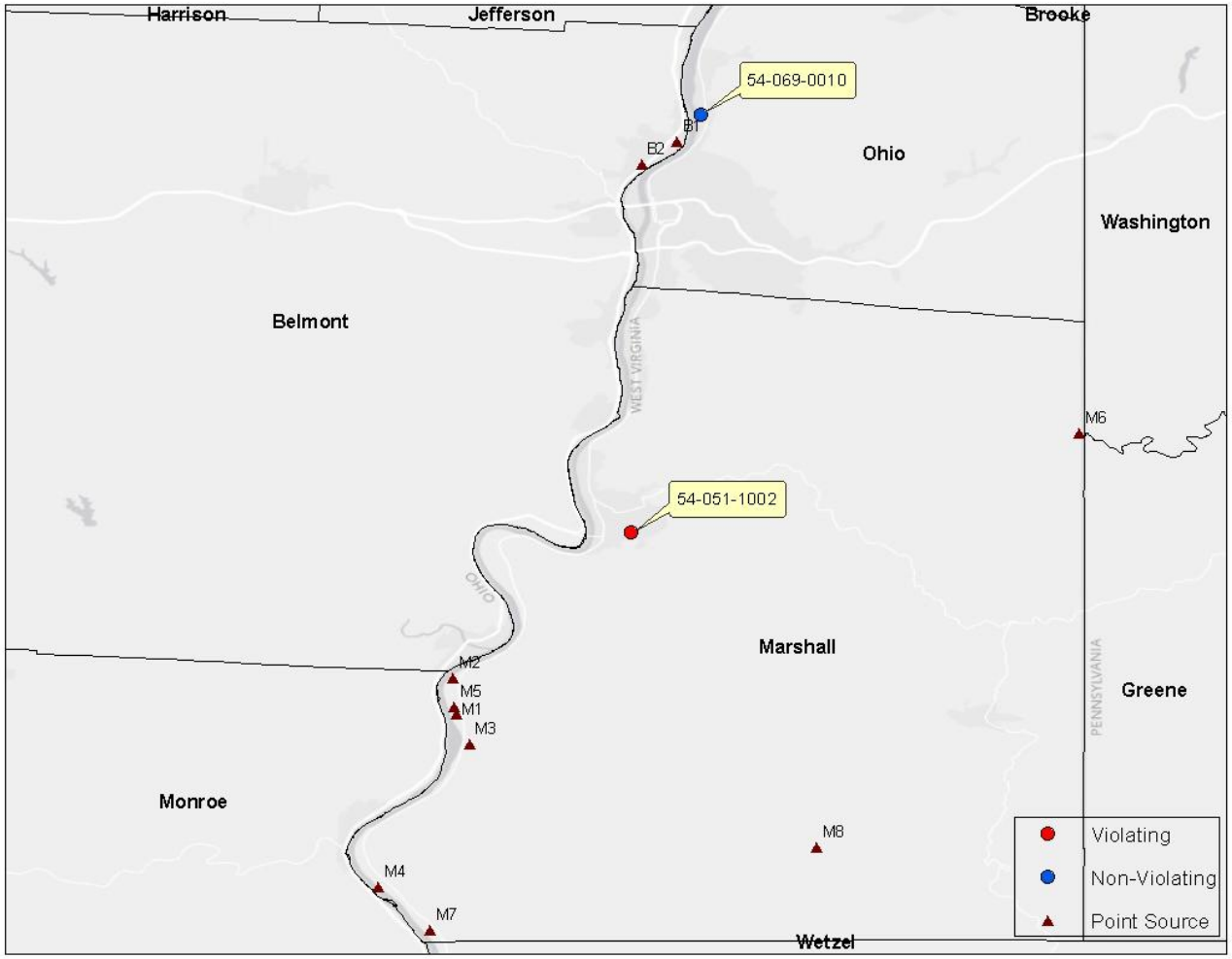
OHIO, WV	**PM2.5**	***OC***	***EC***	**NOX**	***Nitrate***	**SO2**	***Sulfate***	**NH3**	**VOC**	***Other***
Point - 2011	7.1	n/a	n/a	7.9	n/a	1.7	n/a	-	9.3	n/a
Point - 2008	4.0	0.6	0.9	5.6	0.0	1.2	0.7	-	10.7	3.9
Nonpoint	239.2	96.0	18.6	162.0	0.8	115.8	4.7	67.3	1,979.9	298.4
Nonroad	19.0	6.1	8.6	157.5	0.0	2.7	0.1	0.2	367.0	4.2
Onroad	49.9	14.1	27.0	1,413.8	0.1	6.6	0.4	23.0	603.3	8.4
Fire	-	-	-	-	-	-	-	-	-	-
Total - 2008	312.1	116.8	55.1	1,738.9	0.9	126.3	5.8	90.6	2,960.9	314.9

2008 Total By County	**PM2.5**	***OC***	***EC***	**NOX**	***Nitrate***	**SO2**	***Sulfate***	**NH3**	**VOC**	***Other***
Belmont	1,071.2	296.0	129.3	6,061.5	2.6	15,247.0	56.8	336.5	6,767.0	1,144.8
MARSHALL, WV	5,081.7	235.2	236.7	26,959.7	4.1	51,638.5	633.5	123.2	3,726.1	4,460.9
OHIO, WV	312.1	116.8	55.1	1,738.9	0.9	126.3	5.8	90.6	2,960.9	314.9
Total - 2008	6,465.1	648.1	421.0	34,760.1	7.6	67,011.9	696.1	550.2	13,454.0	5,920.6

Source: 2008 and 2011 NEI

The following figure[10] and table shows the higher emitting point sources located in the area.

Figure 30: Location of Wheeling Analysis Area Emissions Point Sources



Source: 2008 and 2011 NEI

[10] The table can be used to correlate the location of each point source with the letter (first letter of county) and number next to the symbol on the map in the figure.

Table 37: Wheeling Analysis Area Emissions Point Sources for 2011 (tpy)

PM2.5		
Marshall, WV	**M1-**OHIO POWER - MITCHELL PLANT	1091.9
Marshall, WV	**M4-**PPG INDUSTRIES, INC.	348.3
Marshall, WV	**M5-**RAIN CII CARBON MOUNDSVILLE CALCINING	207.8
Marshall, WV	**M2-**OHIO POWER - KAMMER PLANT	167.6
Marshall, WV	**M3-**CERTAINTEED MOUNDSVILLE FACILITY	62.2

NOx		
Marshall, WV	**M2-**OHIO POWER - KAMMER PLANT	3590.0
Marshall, WV	**M1-**OHIO POWER - MITCHELL PLANT	2283.9
Marshall, WV	**M4-**PPG INDUSTRIES, INC.	2026.4
Marshall, WV	**M6-**MAJORSVILLE 7C5510/20	431.0
Marshall, WV	**M5-**RAIN CII CARBON MOUNDSVILLE CALCINING	413.6
Marshall, WV	**M8-**ADALINE 7C6600	273.6
Marshall, WV	**M7-**BAYER MATERIALSCIENCE	88.9
Marshall, WV	**M3-**CERTAINTEED MOUNDSVILLE FACILITY	51.4

SO2		
Marshall, WV	**M2-**OHIO POWER - KAMMER PLANT	16712.0
Marshall, WV	**M4-**PPG INDUSTRIES, INC.	6759.1
Marshall, WV	**M5-**RAIN CII CARBON MOUNDSVILLE CALCINING	6030.9
Marshall, WV	**M1-**OHIO POWER - MITCHELL PLANT	4519.2

NH3		
Marshall, WV	**M4-**PPG INDUSTRIES, INC.	34.1
Belmont	**B1-**RG Steel Wheeling LLC - Martins Ferry (0607090013)	29.4
Marshall, WV	**M1-**OHIO POWER - MITCHELL PLANT	2.4

VOC		
Marshall, WV	**M1-**OHIO POWER - MITCHELL PLANT	109.1
Marshall, WV	**M2-**OHIO POWER - KAMMER PLANT	48.0
Belmont	**B2-**Nickles Bakery of Martins Ferry Inc. (0607090208)	47.0
Marshall, WV	**M3-**CERTAINTEED MOUNDSVILLE FACILITY	46.9

Source: 2008 and 2011 NEI

Level of control of emission sources

In the Wheeling area, the emission reduction programs which have had or will have the greatest potential impact on $PM_{2.5}$ concentrations are:

- on-road and off-road diesel control programs in conjunction with ultra-low sulfur diesel fuel requirements
- NO_x trading program
- Clean Air Interstate Rule (CAIR)
- Ohio Clean Diesel Initiatives
- Mercury and Air Toxics Standards (MATS)

CAIR and MATS regulate electric generating units (EGUs, or power plants). CAIR is the program which will bring about largest reductions in precursor or primary emissions of any of the $PM_{2.5}$ species (sulfates, nitrates, organic carbon, elemental carbon and crustal). Compliance with the MATS rule will also lead to additional reductions in precursor species, in particular, sulfates.

Urbanization, population and commuting trends

The following table provides a summary of 2010 population and VMT for each of the counties that are discussed in this section.

Table 38: Wheeling Analysis Area County Level VMT, Population, Land Area and Population Density

2010	VMT	Population	Land Area (Sq. Miles)	Population Density (1,000 per Sq. Miles)
Belmont	903,403,311	70,400	537	0.13
MARSHALL, WV	221,442,708	35,519	307	0.12
Ohio, WV	493,379,169	47,427	106	0.45
CBSA/CSA	1,618,225,188	153,346	951	0.16
Total for Counties	1,618,225,188	153,346	951	

Source: Office of Strategic Research, Ohio Department of Development (Ohio Populations Only)
U.S. EPA Designations Guidance and Data:
http://www.epa.gov/pmdesignations/2012standards/techinfo.htm#F2

Degree of urbanization and population trends

As seen in Table 38 above, the majority of the population for this analysis area resides in Belmont County. However, as seen in Figure 31 below, the population of Belmont County is expected to decline.

The populations in all counties located in West Virginia that are a part of this analysis area are expected to decline through 2020[11].

The most urbanized areas are along the Ohio River within Ohio County, WV (Wheeling) and Marshall County, WV (Moundsville) (see Figure 32 below). The population density of Ohio County, WV is significantly higher than other counties.

Figure 31: Wheeling Analysis Area County Profiles

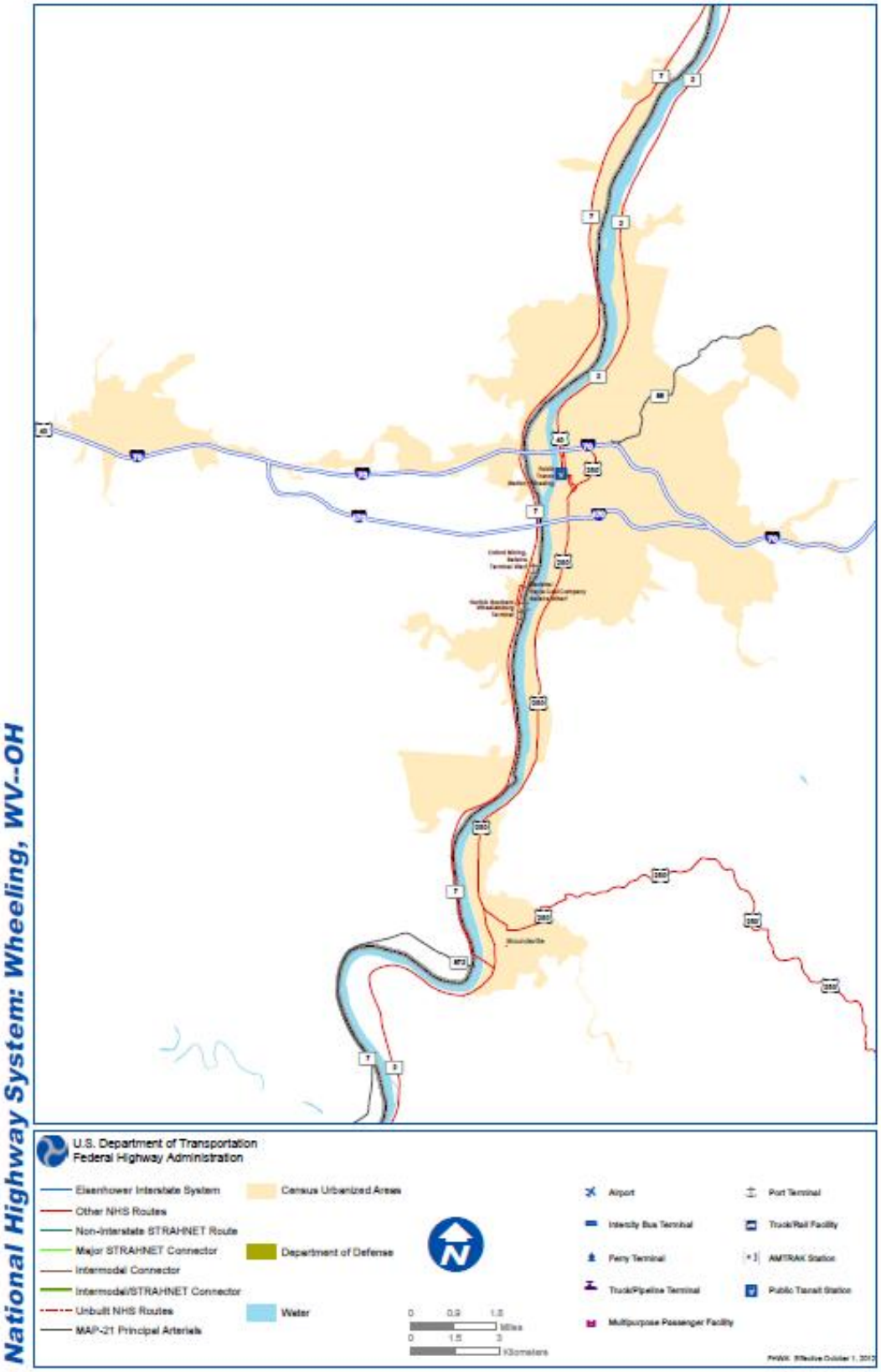
Belmont County

Belmont County is 70% forest, 15% cropland, and 2% urban. Richland Township is the major urban area. The 2010 population was 70,400 while it declined to 69,671 in 2012. Population is expected to continue declining in the future to a level of 68,880 by 2020.

Source: Ohio Department of Development. Ohio County Profiles: http://development.ohio.gov/reports/reports_countytrends_map.htm

[11] Figure 2: http://www.be.wvu.edu/demographics/documents/WVPopProjectionbyCounty2011_001.pdf

Figure 32: Wheeling Analysis Urbanized Areas



Source: http://www.fhwa.dot.gov/planning/national_highway_system/nhs_maps/west_virginia/wheeling_wv.pdf

Commuting trends

As can be seen in Table 38, the majority of VMT occurs in Belmont County, and to a lesser extent Ohio County, WV. Table 39 below looks at commuter travel in and out of the county in this analysis area with a nonattainment monitor, Marshall County, WV. Belmont County commuter travel is also included in this analysis. Nearly 52% of Marshall County's working residents commute to counties outside of Marshall County. In turn, nearly 42% of Marshall County's workforce commutes from other counties into Marshall County. Of the Marshall County residents that commute to other counties, a significant percentage commutes north to Ohio County, WV (31.7%). To a lesser extent, some commute to Belmont County (7.6%). Of the non-residents that commute into Marshall County, approximately equal percentages come from Belmont County (12.9%) and Ohio County, WV (12.3%). Overall, the most significant commuter travel in and out of Marshall County occurs between Marshall and Ohio Counties in West Virginia.

The majority of workers commuting in and out of Belmont County occur in and out of Ohio County (48.3% in, 12.9% out) while the violating monitor is located south of this commuter travel in Marshall County, WV.

It is unlikely that emissions from commuter travel in and out of Belmont County impact the violating Marshall County, WV monitor.

Table 39: Commuter Travel In and Out of Marshall County, WV and Belmont County

Marshall, WV		
	Percent of workers living in county that work outside the county	51.8%
	Percent of workers that live outside the county	41.9%

Number of workers living in Marshall County		**12,870**
Commute Out To	Number	Percent
Ohio Co. WV	4,079	31.7%
Belmont Co. OH	980	7.6%
Washington Co. PA	279	2.2%
Wetzel Co. WV	276	2.1%
Jefferson Co. OH	202	1.6%
Greene Co. PA	143	1.1%
Allegheny Co. PA	131	1.0%
Brooke Co. WV	131	1.0%
Monroe Co. OH	104	0.8%

Percent is of workers living in county.

Number of workers working in Marshall County		**10,669**
Commute In From	Number	Percent
Belmont Co. OH	1,378	12.9%
Ohio Co. WV	1,316	12.3%
Wetzel Co. WV	473	4.4%
Monroe Co. OH	231	2.2%
Jefferson Co. OH	214	2.0%
Tyler Co. WV	185	1.7%
Washington Co. PA	80	0.7%
Hancock Co. WV	74	0.7%
Harrison Co. OH	65	0.6%

Percent is of workers working in county.

Belmont		
	Percent of workers living in county that work outside the county	41.6%
	Percent of workers that live outside the county	26.7%

Number of workers living in Belmont County		29,369
Commute Out To	Number	Percent
Ohio Co. WV	6,221	48.3%
Marshall Co. WV	1,378	10.7%
Jefferson Co. OH	1,055	8.2%
Guernsey Co. OH	494	3.8%
Monroe Co. OH	540	4.2%
Allegheny Co. PA	334	2.6%
Percent is of workers living in county.		

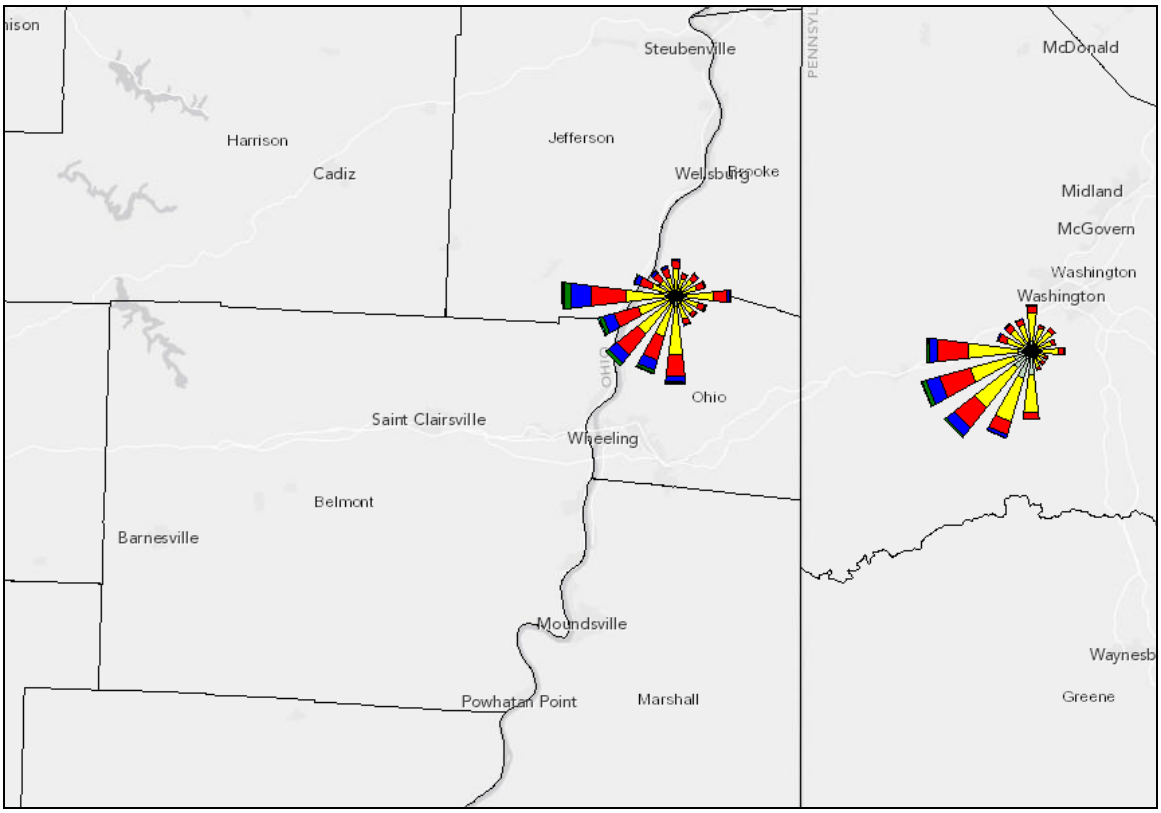
Number of workers working in Belmont County		23,434
Commute In From	Number	Percent
Ohio Co. WV	1,925	18.0%
Jefferson Co. OH	1,370	12.8%
Marshall Co. OH	980	9.2%
Monroe Co. OH	486	4.6%
Harrison Co. OH	449	4.2%
Guernsey Co. OH	306	2.9%
Percent is of workers working in county.		

Source: U.S. EPA Designations Guidance and Data: http://www.epa.gov/pmdesignations/2012standards/techinfo.htm#F2

Factor 3: Meteorology

The following wind roses represent this area.

Figure 33: 2009 to 2012 Wind Roses for the Wheeling Analysis Area



Source: U.S. EPA's $PM_{2.5}$ Designations Mapping Tool: http://geoplatform2.epa.gov/PM_MAP/index.html

Winds from the south, south-southwest, west-southwest, and west (collectively, the southwest quadrant) are prevalent in this area. This indicates sources of emissions from the southwest quadrant may be contributing to violations at the Marshall County monitor.

Factor 4: Geography/topography

This analysis area does not have any geographical or topographical barriers significantly affecting air pollution transport. Therefore, this factor does not play a role in the analysis of this area.

Factor 5: Jurisdictional boundaries

Belmont, Marshall (WV) and Ohio (WV) Counties were designated as a nonattainment counties for the 1997 PM2.5 and ozone standards as part of the Wheeling WV-OH nonattainment area. This area been redesignated to attainment for both the 1997 PM2.5 and ozone standards. No other counties a part of this analysis have been designated nonattainment for PM2.5 or other urban-scale pollutants.

The Wheeling, WV-OH MSA includes Belmont, Marshall (WV) and Ohio (WV) Counties.

The Belomar regional Council (Belomar) is the planning agency designated as the Metropolitan Planning Organization for the greater Wheeling, WV area. The Belomar region is composed of three counties: Marshall and Ohio Counties in West Virginia and Belmont County.

Conclusion

Belmont, Ohio (WV) and Marshall (WV) Counties have historically been a part of this nonattainment area.

Overall, the most significant emissions in the analysis area emanate from Marshall County, WV, and predominantly from utilities. Organic carbon and sulfate tends to dominate at this monitor. Point source emissions in Belmont County have dropped significantly from 2008 to 2011 resulting in Belmont County emissions being as insignificant as Ohio County, WV emissions. Winds from the southwest quadrant are prevalent in this area and as can be seen from Figure 30, all larger point sources of SO2, NOx and PM2.5 are in Marshall County and south, southwest of the violating monitor. The point sources in Belmont County are fairly low emitters of NH3 and VOC and are located north of the monitor.

Belmont County has the highest population and VMT, but a relatively low population density. Ohio County, WV has the highest population density. There is significant commuter travel in and out of the county with the violating monitor, Marshall County, WV. A significant percentage (32%) leaves Marshall County, WV to commute to Ohio County, WV while a lower percentage (25%) commutes into Marshall County, WV, from both Belmont and Ohio Counties, WV. The majority of workers that commute out of Belmont County actually commute to Ohio County, WV, north of the violating monitor. It is unlikely that emissions from commuter travel in and out of Belmont County impact the violating Marshall County, WV monitor.

Ohio EPA is not recommending any Ohio counties as nonattainment as a part of the Ohio portion of this nonattainment area.