Environmental Protection Agency

Ohio's Recommended Designations for the 2024 Revised Primary Annual $PM_{2.5}$ NAAQS

The Ohio Environmental Protection Agency

Division of Air Pollution Control

Air Quality Evaluation and Planning Section

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CSAs	Counties in the CSA	Historical 1997 Nonattainment Counties	Historical 2012 Nonattainment Counties	Recommended Nonattainment Counties for 2024 NAAQS
Cincinnati-Wilmington-Maysville OH-KY-IN	Butler Hamilton Clermont Brown Clinton Warren Union (IN) Franklin (IN) Dearborn (IN) Ohio (IN) Boone (KY) Kenton (KY) Campbell (KY) Gallatin (KY) Grant (KY) Pendleton (KY) Bracken (KY) Mason (KY)	Butler Warren Clermont Hamilton Dearborn (IN) Boone (KY) Kenton (KY) Campbell (KY)		Butler Hamilton
Dayton-Springfield-Kettering OH	Darke Shelby Miami Montgomery Greene Clark Champaign	Montgomery Greene Clark		
Charleston-Huntington-Ashland WV-KY-OH	Scioto Lawrence Gallia Mason (WV) Jackson (WV) Lincoln (WV) Boone (KY) Clay (WV) Wayne (WV) Putnam (WV) Kanawha (WV) Cabell (WV) Boyd (KY)	Scioto Lawrence Gallia Mason (WV) Wayne (WV) Cabell (WV) Boyd (KY) Lawrence (KY) Adams		

	Greenup (KY) Carter (KY)			
Columbus-Marion-Zanesville OH	Franklin Delaware Licking Fairfield Pickaway Hocking Perry Morrow Madison Union Ross Knox Marion Logan Muskingum Guernsey	Franklin Delaware Licking Fairfield Coshocton		
Cleveland-Akron-Canton OH	Lake Cuyahoga Geauga Lorain Medina Summit Portage Ashtabula Stark Caroll Wayne Huron Erie Tuscarawas	Lake Cuyahoga Medina Summit Portage Ashtabula Stark Lorain	Cuyahoga Lorain	Cuyahoga Stark-*unclassifiable*
Pittsburgh-New Castle-Weirton PA-OH-WV	Jefferson Hancock (WV) Brooke (WV) Belmont Ohio (WV) Marshall (WV) Washington (PA) Beaver (PA) Allegheny (PA) Butler (PA)	Jefferson Hancock (WV) Brooke (WV) Belmont Ohio (WV) Marshall (WV)		Jefferson

	Fayette (PA) Westmoreland (PA) Armstrong (PA)			
Parkersburg-Marietta-Vienna WV-OH	Washington Wood (WV) Wirt (WV)	Washington Wood (WV) Pleasants (WV)		
Toledo-Findlay-Tiffin OH	Lucas Ottawa Wood Fulton Henry Hancock Sandusky Seneca			

Background

On February 27, 2024, U.S. EPA strengthened the 2012 primary annual $PM_{2.5}$ standard, lowering it from 12.0 µg/m^3 to 9.0 µg/m^3, and retained the existing 2006 24-hour $PM_{2.5}$ of 35 µg/m^3 (89 FR 16202).

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 2024 annual $PM_{2.5}$ standard. These recommendations are due to U.S. EPA by February 7, 2025, and use the three-most recent years of air quality data available at the time, 2021 to 2023. Following this recommendation, U.S. EPA intends to notify States (via a "120-day letter") by October 9, 2025, and to finalize designations, after a public comment period, by February 6, 2026. It is expected that U.S. EPA will make final designations considering air quality data from 2022 to 2024. This additional year of data may result in changes to Ohio's recommendations. Ohio EPA will work with U.S. EPA to make any warranted adjustments to our recommendations within this document.

Based on the air quality data, and the five-factor analysis discussed below, Ohio is recommending designations of unclassifiable/attainment, unclassifiable and nonattainment. The remainder of this document discusses the method used for Ohio's recommendations for unclassifiable and 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 Unclassifiable and Nonattainment Recommendations

U.S. EPA's guidance "Initial Area Designations for the 2024 Revised Primary Annual Fine Particle National Ambient Air Quality Standard" (February 7, 2024) (herein referred to as "Designation Guidance") states that each area evaluated 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 Core Based Statistical Area/Combined Statistical Area (CBSA/CSA) that contains the violating monitor(s). Ohio's CBSA/CSA boundaries are provided by the U.S EPA

$PM_{2.5}$ Designations Mapping Tool. In all cases below, Ohio EPA is focusing on recommendations based upon an analysis of the Metropolitan Statistical Area (MSA) and in some cases, surrounding counties. 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 Unclassifiable or Nonattainment."

Factor 1: Air Quality Data

The annual revised standard is 9.0 $\mu g/m^3$. Ohio EPA operates a large network of Federal Reference Method (FRM) and Federal Equivalent Method (FEM) $PM_{2.5}$ 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/FEM network is a subset of monitoring 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/FEM 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 2021-2023, 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.
- Focused analysis of monitors within and across urban areas and monitors in the surrounding suburban and rural areas to understand exceedance variabilities in the urban area monitors.

- Trends in monitoring values (and design values) in the area.
- The magnitude of quarterly, or even daily, average $PM_{2.5}$ concentrations over the course of each year may provide clues regarding contributing sources.
- Monthly and seasonal profiles of daily average $PM_{2.5}$ concentrations may provide an indication of whether seasonal conditions exist.
- Identifying the chemical components of $PM_{2.5}$ 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] $PM_{2.5}$ mass concentrations are generally higher in urban areas, due to locally generated and directly emitted $PM_{2.5}$ 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 ($\mu g/m^3$) in all tables. The three-year averages for monitors that are violating the standard are bolded, italicized red numbers. Monitoring sites that have less than 75 percent capture in at least one quarter are highlighted orange cells. AQS data retrieval sheets are provided in Appendix A. The state and local air monitoring stations (SLAMS) data certification report for calendar year 2021, 2022, and 2023 are provided in Appendix B.

Data included in factor 1 are also provided by U.S. EPA's designations tools for the 2024 revised annual $PM_{2.5}$ standard:

> https://www.epa.gov/particle-pollution-designations/particle-pollution-designations-memorandum-and-data-2024-revised

This web site provides access to a wide variety of factor 1 data resources, including:

- CSN speciation data for 2020-2022
- IMPROVE speciation data for 2020-2022
- PM2.5 Design Values 2021-2023 with Urban Increments

The following tables (tables 1 and 2) summarize all the air quality data for Ohio monitoring sites from 2012 to 2023. In some case, these tables will contain more monitor locations than those identified in the unclassifiable or nonattainment area analysis because of the historical nature

[1] Any analysis of speciation data follows the procedures outlined in the Designation Guidance

of the data. Monitoring sites included in the unclassifiable or nonattainment area analysis include only those operational during the 2021-2023 design value period.

Table 1: Ohio's Average Annual $PM_{2.5}$ Concentrations (2012 - 2023)

County	SITEID	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Allen	39-003-0009	10.0	9.9	9.5	9.7	7.5	7.6	8.3	7.4	5.4	6.9	7.1	8.5
Athens	39-009-0003	8.7	8.1	7.8	7.6	6.2	6.3	6.7	6.4	6.1	6.2	5.5	6.8
Belmont	39-013-0006				8.7	8.3	7.7	7.7	8.7	7.1	8.1	6.7	8.5
Butler	39-017-0003	11.2	11.1	11.3	10.3	9.7							
	39-017-0015					9.8	9.3	9.4	9.3	8.9	9.8	8.4	10.5
	39-017-0016	10.8	10.7	10.7	9.5	9.2	8.5	8.7	8.7	8.1	8.8	7.8	
	39-017-0019	11.4	11.0	11.2	10.2	9.3	8.7	8.8	9.2	8.4	9.4	8.0	10.1
	39-017-0020[2]	13.9	13.3	12.9	11.8	11.6	10.3	10.9	11.9	10.4	11.6	9.9	12.0
	39-017-0022				12.1	10.9	10.3	10.2	10.8	9.8	11.0	9.5	12.1
Clark	39-023-0005	10.4	10.1	10.0	9.0	8.4	8.1	9.6	9.8	7.4	9.1	7.5	9.8
Cuyahoga	39-035-0034	9.3	9.5	9.6	9.20	7.80	7.8	7.9	7.2	6.8	7.5	6.7	8.4
	39-035-0038	12.3	12.2	12.3	11.8	10.0	9.9	9.5	9.1	8.8	9.8	8.9	11.2
	39-035-0045	11.4	11.2	11.4	11.0	9.4	9.8	9.5	9.2	8.8	9.9	8.2	8.9
	39-035-0060	13.2	12.1	11.9	12.3	9.6	9.7	9.9	10.2	7.9	9.7	8.8	11.9
	39-035-0065	12.3	11.4	12.5	13.3	10.7	11.2	11.1	10.8	10.4	12.7	11.0	12.8
	39-035-0073						7.3	7.9	8.2	8.4	8.8	7.6	9.1
	39-035-1002	9.7	9.2	9.7	9.1	7.8	8.1	7.8	7.4	5.9	7.5	6.5	
Franklin	39-049-0024	10.7	10.1	10.1	10.0	8.7	8.3	8.1					
	39-049-0025	10.7	10.2	11.5									
	39-049-0029	9.9	9.8	10.9	9.5	7.0							
	39-049-0034							9.9	8.8	7.7	9.1	7.7	10.3
	39-049-0038						8.8	9.1	9.7	7.8	9.3	7.9	10.7
	39-049-0039			9.0	10.4	8.4	8.2	8.6	8.2				
	39-049-0040											8.7	10.2
	39-049-0081	10.1	9.8	10.3	9.8	8.0	8.2	8.5	8.7	8.2	9.0	7.3	9.9
Greene	39-057-0005	9.6	9.7	9.8	8.3	7.8	7.4	8.1					
Hamilton	39-061-0006	10.3	10.1	10.3	9.3	8.8	8.8	9.3	9.0	8.7	10.2	8.6	8.9
	39-061-0010	10.6	10.5	10.4	9.2	8.8	8.2						
	39-061-0014	12.1	11.6	11.3	10.7	10.1	9.5	9.4	9.2	9.9	10.0	8.7	10.9
	39-061-0040	10.5	10.6	10.4	9.2	8.8	8.8	9.8	9.5	8.6	9.1	7.6	10.0

Insufficient data

| County | SITEID | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 |

[2] Annual NAAQS exclusionary (80 FR 18537)

Hamilton	39-061-0042	11.7	11.5	11.2	10.1	9.5	8.8	9.2	8.7	8.7	9.8	8.1	10.1
	39-061-0048			12.9			10.9	12.4	11.9	10.3	10.8	9.7	9.8
Harrison	39-067-0004							7.3					
	39-067-0005							6.5	7.6	6.5	7.9	7.0	
Jefferson	39-081-0017	11.0	9.9	12.1	12.1	11.0	8.9	8.7	9.0	8.9	11.1	9.1	9.8
	39-081-0021		7.6	10.6	9.6	7.6	8.2	8.8					
	39-081-1001	10.0	11.0										
Lake	39-085-0007	9.0	8.6	8.7	8.1	6.8	7.2	7.0	6.5	6.2	6.9	6.2	8.5
Lawrence	39-087-0012	10.9	9.1	7.5	7.3	6.7	6.6	6.4	6.7	7.3	8.2	7.1	8.5
Lorain	39-093-3002	9.5	8.8	9.1	8.2	7.0	7.6	7.8	7.2	6.7	7.6		
Lucas	39-095-0024	10.0	9.6	10.5	10.1	8.6	8.3	8.6	8.1	7.9	8.6	6.6	9.8
	39-095-0026	9.9	9.6	10.3	9.6	8.2	8.1	8.0	7.7	7.3	8.4	6.9	9.1
	39-095-0028	10.0	9.5	10.6	10.0	8.2	10.2						
	39-095-1003						8.5	8.9	8.8	9.5	8.9	8.7	10.5
Mahoning	39-099-0005	10.6	10.9	9.9	11.0	7.9	8.0	8.5	7.4				
	39-099-0014	10.1	9.7	9.8	10.2	8.0	7.9	7.8	8.3	7.9	8.8		
	39-099-0015										7.7	7.8	9.9
Medina	39-103-0004	9.3	9.1	8.6	10.1	7.6	7.8	7.5	8.1	6.5	6.9	6.3	9.1
Montgomery	39-113-0032	10.7	10.3	11.1									
	39-113-0038			8.7	9.6	8.9	8.3	8.2	9.0	9.0	9.3	7.9	9.8
Portage	39-133-0002	9.3	8.9	9.0	8.9	7.1	7.4	7.3	7.6	6.9	7.3	6.4	
Preble	39-135-1001	9.3	9.7	9.2	8.4	7.5	7.3	8.7	8.3	7.4	7.9	7.1	9.0
Scioto	39-145-0013	9.8	9.0	8.2	8.5	8.3	6.9	7.1	6.7	6.6	7.1	6.8	8.7
	39-145-0015									6.8	7.1	7.1	8.8
Stark	39-151-0017	11.9	11.6	11.7	11.4	9.3	9.4	9.1	9.3	8.3	9.4	8.2	11.0
	39-151-0020	10.4	10.7	10.6	10.5	8.2	8.3	8.8	9.6	8.7	9.4	7.9	10.3
Summit	39-153-0017	10.8	10.4	10.8	12.5	9.7	8.4	8.8	8.7	8.8	8.6	7.9	9.3
	39-153-0023	10.0	9.9	10.0	9.7	7.8	8.0	7.7	8.1	7.5	8.7	6.8	11.2
Trumbull	39-155-0005	9.3	9.8	10.3	10.5								
	39-155-0014					7.5	8.2	7.8	7.2	6.2	8.7	7.3	10.1

Source: U.S. EPA AQS

Insufficient data

Table 2: Ohio's 3-Year Annual Average $PM_{2.5}$ Concentrations (2012 - 2023)

County	SITEID	2012-2014	2013-2015	2014-2016	2015-2017	2016-2018	2017-2019	2018-2020	2019-2021	2020-2022	2021-2023
Allen	39-003-0009	9.8	9.7	8.9	8.3	7.8	7.8	7.0	6.6	6.4	7.5
Athens	39-009-0003	8.2	7.8	7.2	6.7	6.4	6.5	6.4	6.2	5.9	6.1
Belmont	39-013-0006		8.7	8.5	8.2	7.9	8.0	7.8	8.0	7.3	7.8
Butler	39-017-0003	11.2	10.9	10.4	10.0	9.7					
	39-017-0015			9.8	9.6	9.5	9.3	9.2	9.3	9.0	***9.6***
	39-017-0016	10.7	10.3	9.8	9.1	8.8	8.6	8.5	8.5	8.2	8.3
	39-017-0019	11.2	10.8	10.2	9.4	8.9	8.9	8.8	9.0	8.6	***9.1***
	39-017-0020[3]	13.4	12.7	12.1	11.2	10.9	11.0	11.1	11.3	10.7	***11.2***
	39-017-0022		12.1	11.5	11.1	10.5	10.4	10.2	10.5	10.1	***10.9***
Clark	39-023-0005	10.2	9.7	9.1	8.5	8.7	9.2	8.9	8.8	8.0	8.8
Cuyahoga	39-035-0034	9.5	9.4	8.9	8.2	7.8	7.6	7.3	7.1	7.0	7.5
	39-035-0038	12.3	12.1	11.4	10.6	9.8	9.5	9.1	9.2	9.2	***10.0***
	39-035-0045	11.3	11.2	10.6	10.1	9.6	9.5	9.2	9.3	9.0	9.0
	39-035-0060	12.4	12.1	11.2	10.5	9.7	9.9	9.3	9.3	8.8	***10.2***
	39-035-0065	12.0	12.4	12.2	11.7	11.0	11.0	10.8	11.3	11.4	***12.2***
	39-035-0073				7.3	7.6	7.8	8.2	8.5	8.2	8.5
	39-035-1002	9.5	9.3	8.9	8.3	7.9	7.8	7.0	6.9	6.6	7.0
Franklin	39-049-0024	10.3	10.1	9.6	9.0	8.4	8.2	8.1			
	39-049-0025	10.8	10.9	11.5							
	39-049-0029	10.2	10.1	9.2	8.3	7.0					
	39-049-0034					9.9	9.3	8.8	8.5	8.2	9.0
	39-049-0038				8.8	8.9	9.2	8.8	8.9	8.3	***9.3***
	39-049-0039	9.0	9.7	9.3	9.0	8.4	8.3	8.4	8.2		
	39-049-0040									8.7	***9.4***
	39-049-0081	10.1	10.0	9.4	8.7	8.2	8.5	8.5	8.7	8.2	8.7
Greene	39-057-0005	9.7	9.3	8.6	7.8	7.8	7.7	8.1			
Hamilton	39-061-0006	10.2	9.9	9.5	9.0	9.0	9.0	9.0	9.3	9.2	***9.2***
	39-061-0010	10.5	10.0	9.4	8.7	8.5	8.2				
	39-061-0014	11.7	11.2	10.7	10.1	9.7	9.4	9.5	9.7	9.5	***9.9***
	39-061-0040	10.5	10.1	9.4	8.9	9.1	9.4	9.3	9.1	8.5	8.9

Insufficient data ***X.X*** Violating monitor

County	SITEID	2012-2014	2013-2015	2014-2016	2015-2017	2016-2018	2017-2019	2018-2020	2019-2021	2020-2022	2021-2023
Hamilton	39-061-0042	11.5	11.0	10.3	9.5	9.2	8.9	8.9	9.1	8.9	***9.3***

[3] Annual NAAQS exclusionary (80 FR 18537)

	39-061-0048	12.9	12.9	12.9	10.9	11.7	11.8	11.6	11.0	10.3	***10.1***
Harrison	39-067-0004					7.3	7.3	7.3			
	39-067-0005					6.5	7.1	6.9	7.3	7.1	7.4
Jefferson	39-081-0017	11.0	11.4	11.8	10.7	9.5	8.8	8.8	9.7	9.7	***10.0***
	39-081-0021	9.1	9.3	9.3	8.5	8.2	8.5	8.8			
	39-081-1001	10.5	11.0								
Lake	39-085-0007	8.7	8.5	7.9	7.4	7.0	6.9	6.6	6.5	6.4	7.2
Lawrence	39-087-0012	9.2	8.0	7.1	6.8	6.6	6.6	6.8	7.4	7.5	7.9
Lorain	39-093-3002	9.1	8.7	8.1	7.6	7.5	7.5	7.2	7.2	7.2	7.6
Lucas	39-095-0024	10.0	10.1	9.8	9.0	8.5	8.3	8.2	8.2	7.7	8.3
	39-095-0026	10.0	9.8	9.4	8.6	8.1	7.9	7.7	7.8	7.5	8.1
	39-095-0028	10.1	10.0	9.6	9.4	9.2	10.2				
	39-095-1003				8.5	8.7	8.7	9.1	9.1	9.1	***9.4***
Mahoning	39-099-0005	10.5	10.6	9.6	9.0	8.2	8.0	8.0	7.4		
	39-099-0014	9.9	9.9	9.3	8.7	7.9	8.0	8.0	8.3	8.3	8.8
	39-099-0015								7.7	7.8	8.5
Medina	39-103-0004	9.0	9.3	8.8	8.5	7.6	7.8	7.3	7.2	6.6	7.4
Montgomery	39-113-0032	10.7	10.7	11.1							
	39-113-0038	8.7	9.1	9.1	8.9	8.5	8.5	8.8	9.1	8.8	9.0
Portage	39-133-0002	9.1	8.9	8.3	7.8	7.3	7.4	7.3	7.3	6.9	6.9
Preble	39-135-1001	9.4	9.1	8.4	7.7	7.8	8.1	8.1	7.9	7.5	8.0
Scioto	39-145-0013	9.0	8.6	8.3	7.9	7.4	6.9	6.8	6.8	6.8	7.6
	39-145-0015							6.8	6.9	7.0	7.7
Stark	39-151-0017	11.7	11.6	10.8	10.1	9.3	9.3	8.9	9.0	8.6	***9.4***
	39-151-0020	10.6	10.6	9.7	9.0	8.4	8.9	9.0	9.2	8.6	***9.2***
Summit	39-153-0017	10.7	11.2	11.0	10.2	9.0	8.6	8.8	8.7	8.4	8.6
	39-153-0023	10.0	9.9	9.2	8.5	7.8	7.9	7.8	8.1	7.7	8.9
Trumbull	39-155-0005	9.8	10.2	10.4	10.5						
	39-155-0014			7.5	7.9	7.8	7.7	7.1	7.4	7.4	8.7

Source: U.S. EPA AQS

Insufficient data ***X.X*** Violating monitor

Exceptional Events

From June to August in the summer of 2023, there were several days where smoke from Canadian wildfires was present in Ohio. This caused many sites across the state to have high daily $PM_{2.5}$ values, for those days in the summer, and overall led to higher trending design values for 2023 than what was observed in previous years. Ohio EPA is submitting "Exceptional Events" demonstrations for 2023 wildfire smoke-driven $PM_{2.5}$ episodes to the U.S. EPA regarding these wildfire smoke days; however, these demonstrations were being worked on concurrently with these recommendations. Therefore, the design values in table 1 and table 2 above still include the wildfire smoke days with high $PM_{2.5}$ values and in some cases do not reflect the design values Ohio EPA is using to inform the final designations for Ohio unclassifiable or nonattainment areas.

Columbus Area

As can be seen in table 2 above and table 3 below, there is one violating monitoring site (39-049-0038) in Franklin County. Historically, Franklin County was part of the 1997 annual $PM_{2.5}$ nonattainment area along with Delaware, Licking, Fairfield, and Coshocton Counties. This monitoring site is the only site in this CSA with violating 2021-2023 design values. The surrounding counties do not have $PM_{2.5}$ monitoring.

On January 6, 2025, Ohio EPA submitted to U.S. EPA an exceptional events demonstration requesting the exclusion of seven $PM_{2.5}$ daily values at monitoring site 39-049-0038 affected by regulatorily significant wildfire smoke events. If U.S. EPA approves these exclusions, the new 2021-2023 annual design value at this site would be attaining at 9.0 $\mu g/m^3$. Site 39-049-0040 has insufficient data for computing a valid 2021-2023 annual design value and therefore will not be used for designation purposes. This monitoring site began operating in May of 2022 leading to the invalid 2021-2023 design value. Ohio EPA also requested the exclusion of certain $PM_{2.5}$ daily values at monitoring sites 39-049-0034, 39-049-0040, and 39-049-0081 due to impacts from the regulatorily significant wildfire smoke events; however, those additional demonstrations do not impact the outcome of Ohio's recommendations contained within.

Therefore, Ohio EPA is including Franklin County in Ohio's request for unclassifiable/attainment designations.

Table 3: Annual Average (µg/m³) for Franklin County Monitoring Sites (before and after the Exceptional Events (EE) Demonstration)

		Annual Averages			2021-2023 3-Year Annual Average	
County	**Site ID**	**2021**	**2022**	**2023**	**Before EE**	**After EE**
Franklin OH	39-049-0034	9.1	7.7	10.3	9.0	8.7
	39-049-0038	9.3	7.9	10.7	***9.3***	9.0
	39-049-0040		8.7	10.2	9.4	9.4
	39-049-0081	9.0	7.3	9.9	8.7	8.5

Source: U.S. EPA AQS

Insufficient data ***X.X*** Violating monitor

Toledo Area

As can be seen from table 2 and table 4, there is one violating monitoring site (39-095-1003) in Lucas County. Historically, Lucas County has not been a part of any $PM_{2.5}$ nonattainment areas, and surrounding counties do not contain $PM_{2.5}$ monitoring sites.

On December 9, 2024, Ohio EPA submitted to U.S. EPA an exceptional events demonstration requesting the exclusion of two $PM_{2.5}$ daily values at monitoring site 39-095-1003 affected by regulatorily significant wildfire smoke events. If U.S. EPA approves these exclusions, the new 2021-2023 annual design value at this site would be 9.0 µg/m³. As part of this exceptional events demonstration, Ohio EPA also requested the exclusion of certain $PM_{2.5}$ daily values at monitoring sites 39-095-0024 and 39-095-0026 due to impacts from the regulatorily significant wildfire smoke events; however, those additional demonstrations do not impact the outcome of Ohio's recommendations contained within.

Therefore, Ohio EPA is including Lucas County in Ohio's request for unclassifiable/attainment designations.

Table 4: Annual Average (µg/m³) for Lucas County Monitoring Sites (before and after the Exceptional Events (EE) Demonstration)

		Annual Averages			2021-2023 3-Year Annual Average	
County	**Site ID**	**2021**	**2022**	**2023**	**Before EE**	**After EE**
Lucas OH	39-095-0024	8.6	6.6	9.8	8.3	8.0
	39-095-0026	8.4	6.9	9.1	8.1	7.8
	39-095-1003	8.9	8.7	10.5	***9.4***	9.0

Source: U.S. EPA AQS

Insufficient data ***X.X*** Violating monitor

Factor 2: Emissions and Emissions-Related Data

The analysis for factor 2 looks at $PM_{2.5}$-related emissions from areas nearby to an exceeding monitoring site to determine their contribution. Emissions data are derived from the 2022 EMP data[4] which is a modeling platform data set generated from the 2020 National Emissions Inventory (NEI) and projected to 2022. This data set was generated through a collaborative between states and U.S. EPA and is a widely used data set for state implementation purposes. 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 $PM_{2.5}$, the major components of direct $PM_{2.5}$ (organic carbon, elemental carbon, crustal material and/or individual trace metal compounds), primary nitrate and primary sulfate, and precursor gaseous pollutants (e.g., SO_2, NO_x, total VOC and NH_3).

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 2022 EMP 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 monitoring sites and analyzing the total vehicle miles traveled (VMT), may help assess the influence of mobile source emissions in an area.

Data used for population, county trends, degree of urbanization, commuting patterns, and county VMTs was provided by the following sources:

- Ohio populations and county profiles - Ohio Department of Development, County Trends and Profiles for 2022, https://development.ohio.gov/about-us/research/county/county-trends

[4] https://www.epa.gov/air-emissions-modeling/2022v1-emissions-modeling-platform

- Other state populations - U.S. Department of Commerce, Economics and Statistics Administrations, U.S. Census Bureau, 2022 American Community Survey 5-year Estimates https://data.census.gov/table/ACSDP5Y2022.DP05?q=2022%20state%20population
- Ohio VMT data by county - Ohio Department of Transportation, Programs, Technical Services, Traffic Monitoring, Archived DVMT Reports by Year, 2022 data, https://www.dot.state.oh.us/TechnicalServices/Pages/DVMT-Archived-Reports-SC.aspx
- Kentucky VMT data by county - Kentucky Transportation Cabinet, Division of Planning, Roadway Information and Data, Daily Vehicles Miles Traveled (DVMT) and Mileage Reports for 2022, https://transportation.ky.gov/Planning/Pages/Roadway-Information-and-Data.aspx
- Indiana VMT data by county - Indiana Department of Transport, Historic VMT by County (1992-2022), https://www.in.gov/indot/resources/traffic-data/
- West Virginia VMT data by county – provided upon contact with the West Virginia Department of Transportation, Information technology Division, Highway Programming and Analytics Unit (Appendix C)
- Commuter Data - U.S. Department of Commerce, Economics and Statistics Administrations, U.S. Census Bureau, Residence County to Workplace County Commuting Flows for the United States and Puerto Rico Sorted by Workplace Geography: 5-year ACS 2016-2020 https://www.census.gov/data/tables/2020/demo/metro-micro/commuting-flows-2020.html
- All other information – U.S. EPA 2024 $PM_{2.5}$ designations tools

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 for the NWS site. This data may also suggest that emissions in some directions relative to the violation may be more prone to contribute than emissions from other directions.

Wind rose meteorology data included in factor 3 are provided by AERMET surface data and then created using the WRPLOT View application.

HYSPLIT (Hybrid Single-Particle Lagrangian Integrated Trajectory) model density maps (Appendix D) included in factor 3 were provided by U.S. EPA. The density maps, along with a copy of Attachment 4 "Preparing and Running a HYSPLIT Modeling Analysis for Evaluating Nonattainment Area Boundaries for the 2024 Revised Primary Annual $PM_{2.5}$ NAAQS Designations" from the Designations Guidance, can be found at:

> https://www.epa.gov/particle-pollution-designations/particle-pollution-designations-memorandum-and-data-2024-revised

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.

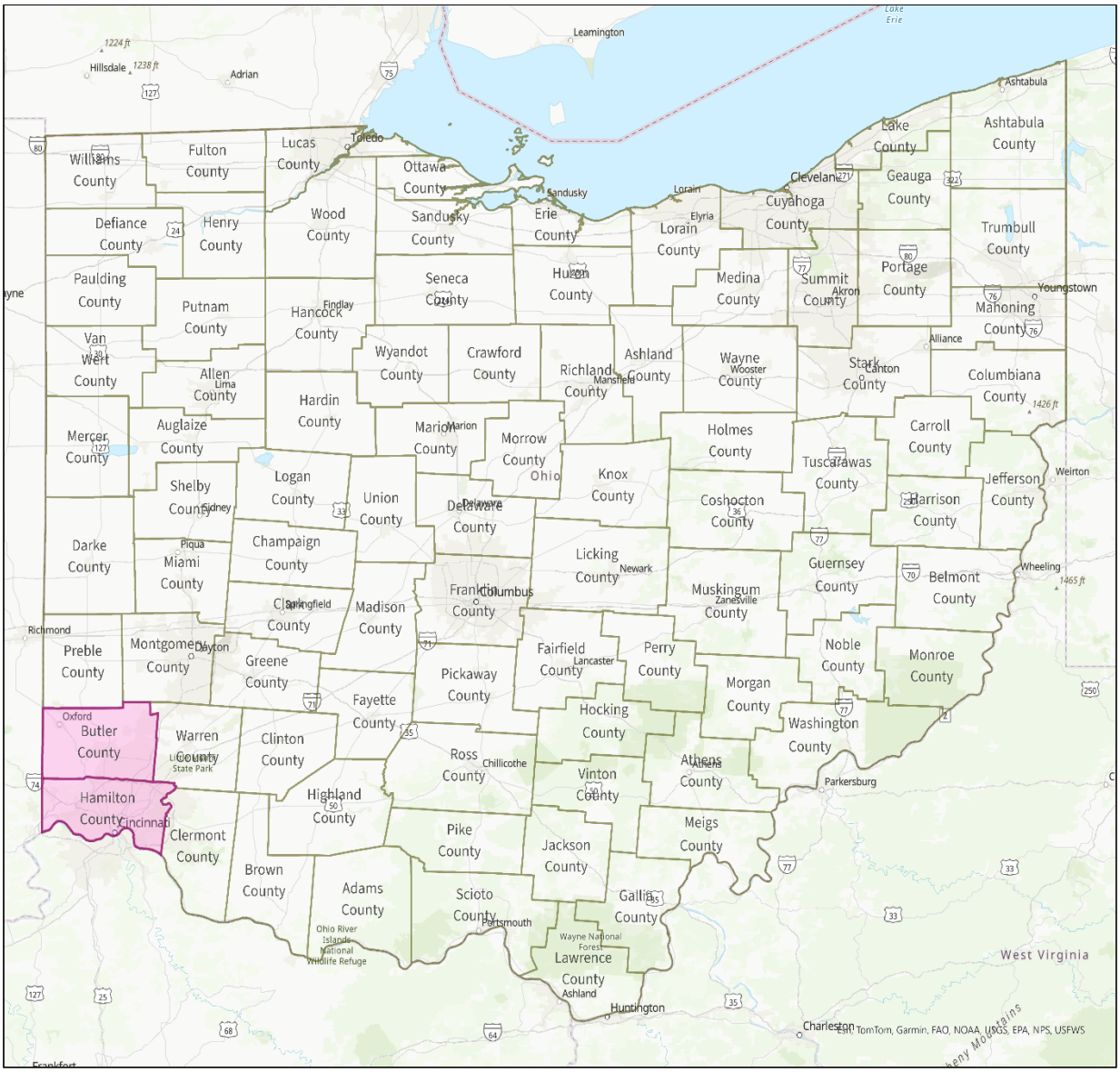
Factor 5: Jurisdictional Boundaries

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 Unclassifiable or Nonattainment Areas

Cincinnati-Wilmington-Maysville OH-KY-IN CSA

Figure 1: Cincinnati-Wilmington-Maysville OH-KY-IN CSA Recommended Nonattainment Area – Ohio Portion Only

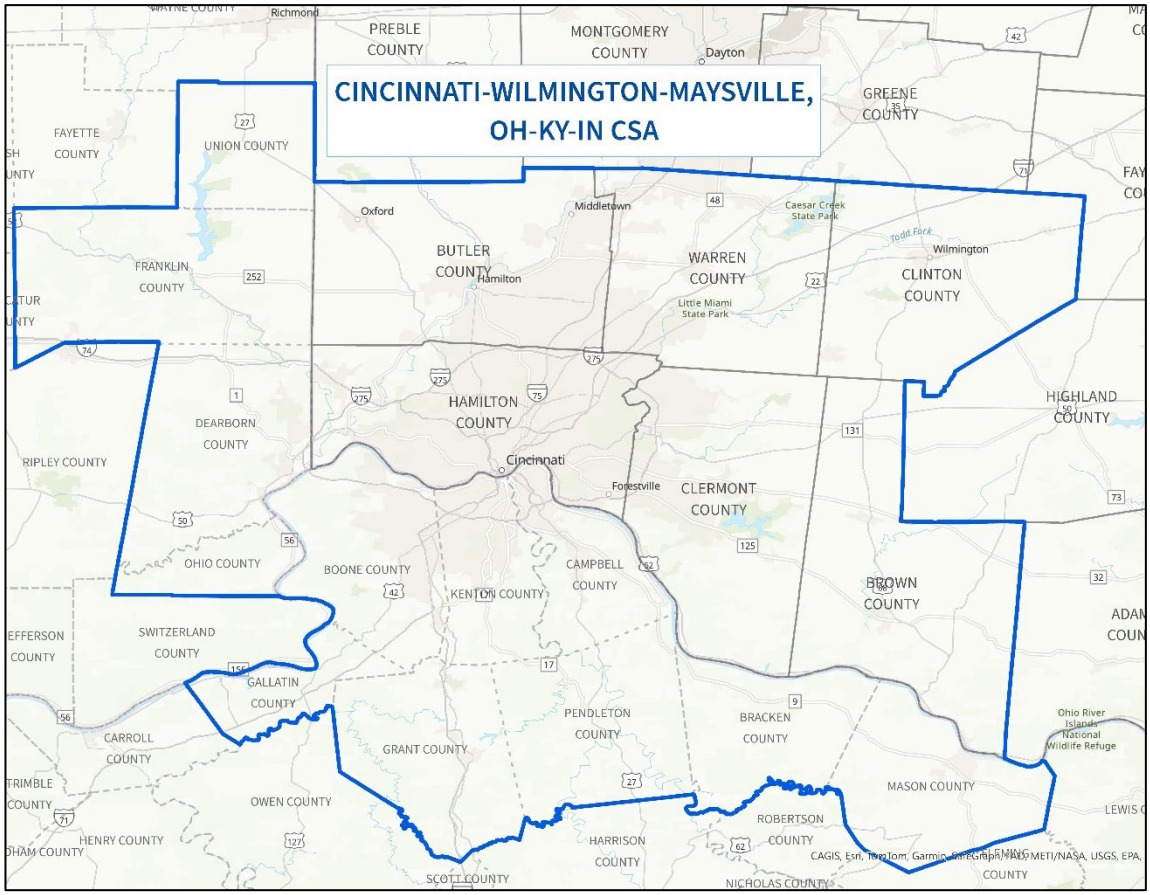


Source: U.S. EPA $PM_{2.5}$ Designations Mapping Tool

DISCUSSION

There are four Ohio counties in this historic 1997 annual $PM_{2.5}$ standard 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 1997 annual $PM_{2.5}$ standard nonattainment area. Ohio EPA recommends designating Butler and Hamilton Counties as nonattainment for the Ohio portion of the Cincinnati-Wilmington-Maysville OH-KY-IN CSA. After considering the five factors, Ohio EPA does not recommend adding any additional contributing Ohio counties to this area.

Figure 2: Cincinnati-Wilmington-Maysville OH-KY-IN CSA



Source: U.S. EPA $PM_{2.5}$ Designations Mapping Tool

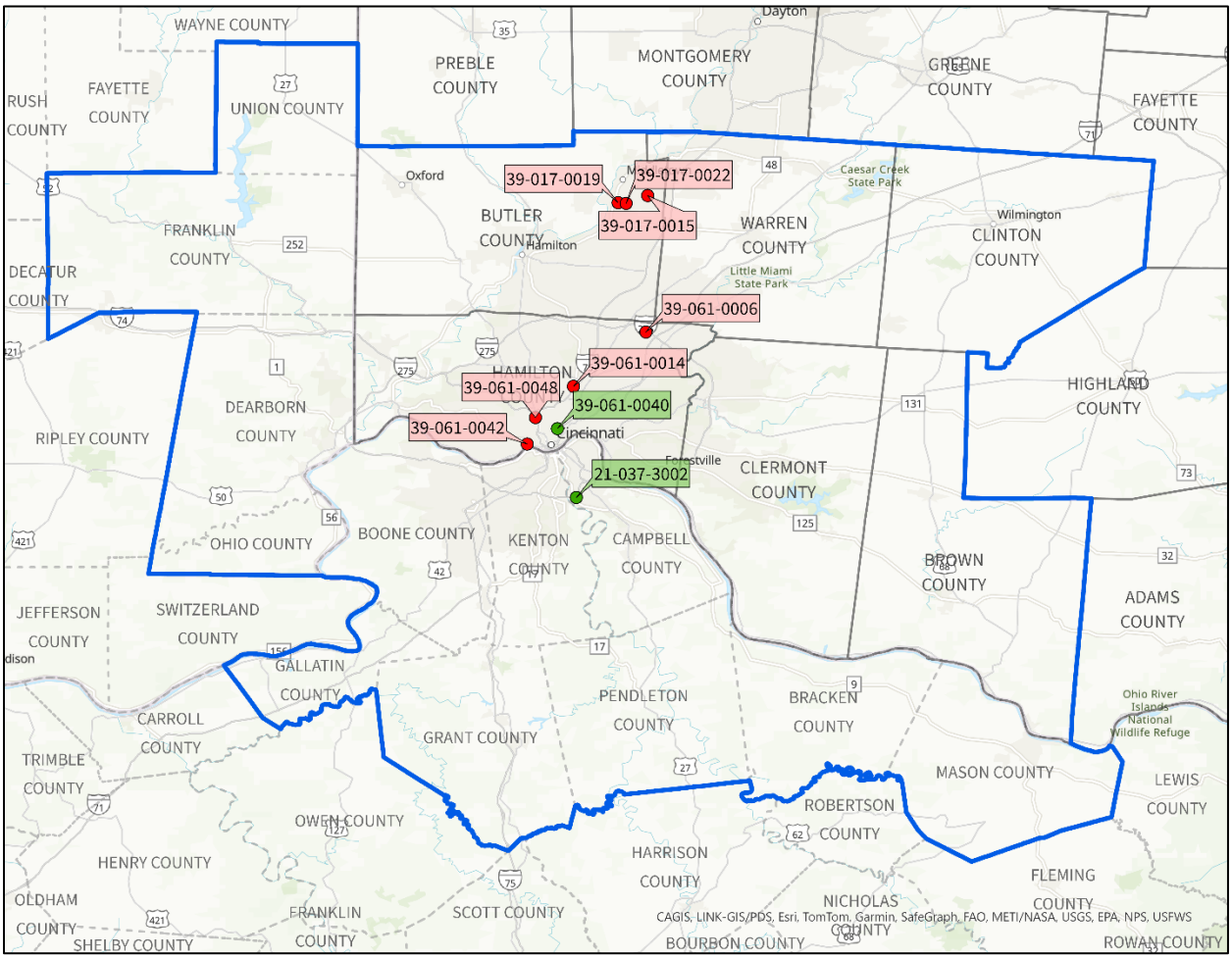
There are three violating monitoring sites in Butler County and four violating monitoring sites in Hamilton County (figure 3). Butler and Hamilton Counties are part of the Cincinnati-Maysville-Wilmington CSA (shown in figure 2 above) and the Cincinnati MSA. The CSA also includes Clermont, Brown, Clinton, and Warren Counties in Ohio; Gallatin, Grant, Pendleton, Boone, Kenton, Mason, Campbell, and Bracken Counties in Kentucky; and Ohio, Dearborn, Franklin, and Union Counties in Indiana.

Ohio EPA will not be analyzing any additional counties adjacent to the CSA counties. Counties to the north are part of the historical Dayton-Springfield $PM_{2.5}$ nonattainment area, which is attaining the newly revised standard. The counties to the east of Brown and Clinton Counties will not be analyzed because historically those counties have been excluded from the nonattainment area. Ohio EPA will analyze Brown and Clinton Counties as part of the Cincinnati-Wilmington-Maysville CSA with respect to the new standard.

AIR QUALITY DATA

For the 2021-2023 period, there are nine Ohio monitoring sites and one Kentucky monitoring site in this area.

Figure 3: Cincinnati-Wilmington-Maysville OH-KY-IN CSA Monitoring Sites



Source: U.S. EPA $PM_{2.5}$ Designations Mapping Tool

As can be seen in table 5, monitoring sites 39-017-0015, 39-017-0019 and 39-017-0022 in Butler County and monitoring sites 39-61-0006, 39-061-0014, 39-061-0042, and 39-061-0048 in

Hamilton County are violating the standard based on 2021-2023 air quality data. The design value for this area is 10.9 µg/m³. As can be seen from tables 1 and 2, air quality trends have historically declined in this area with the exception of 2023 data influenced by wildfire events.

Table 5: Annual Average (µg/m³) for Analysis Area Monitoring Sites (KY and OH)

		Annual Averages			3-year Annual Average
County	**Site ID**	**2021**	**2022**	**2023**	**2021 - 2023**
Butler OH	39-017-0015	9.8	8.4	10.5	***9.6***
	39-017-0019	9.4	8.0	10.1	***9.1***
	39-017-0022	11.0	9.5	12.1	***10.9***
Hamilton OH	39-061-0006	10.2	8.6	8.9	***9.2***
	39-061-0014	10.0	8.7	10.9	***9.9***
	39-061-0040	9.1	7.6	10.0	8.9
	39-061-0042	9.8	8.1	10.1	***9.3***
	39-061-0048	10.8	9.7	9.8	***10.1***
Campbell KY	21-037-3002	7.6	6.7	8.5	7.6

Source: U.S. EPA AQS

Insufficient data ***X.X*** Violating monitor

Ohio monitoring site 39-017-0020 is shown in table 1 above but is not included in the analysis presented in this section. This monitoring site is one of three sites monitoring the Middletown Coke Company facility in Butler County. Previously, Ohio requested in the 2015 Air Monitoring Network Plan (AMNP) to exempt this site from comparison to the annual $PM_{2.5}$ standard. U.S EPA approved this exemption on April 15, 2015 (80 FR 18537). Furthermore, with the installation of a FEM monitor at site 39-017-0020 in 2021, Ohio EPA submitted, and U.S. EPA approved a request to also exclude this site's newly installed FEM monitor from the annual $PM_{2.5}$ standard.[5] Therefore, the data collected by site 39-017-0020 will not be used to inform a decision regarding attainment or nonattainment of the newly revised annual $PM_{2.5}$ standard.

[5] A copy of Ohio EPA's correspondence with the Region 5 U.S. EPA office regarding the aforementioned exclusion can be found in appendix E attached to this document

As can be seen in table 6, there is one speciation monitor located in Hamilton County, co-located at site 39-061-0040.

Table 6: Cincinnati Area Speciation Monitoring Sites

Site ID	Annual Averages	Speciation Monitor SANDWICH Mass					Site Design Value
		Sulfate	Nitrate	Organic Carbon	Elemental Carbon	Crustal	
39-061-0040 Hamilton County	2020	1.23	1.17	1.90	0.59	0.40	8.6
	2021	1.32	1.37	2.29	0.67	0.43	9.1
	2022	1.09	1.24	1.75	0.79	0.45	7.6
	2020-2022 3-year average	1.21	1.26	1.98	0.69	0.43	8.5

Source: CSN speciation data (SANDWICHED) from https://www.epa.gov/particle-pollution-designations/particle-pollution-designations-memorandum-and-data-2024-revised#A

Organic carbon dominates at the monitoring site with a fairly equal amount of sulfate and nitrate that also has a significant presence. Historically sulfate was more dominant than nitrate.[6] This may be an indication of the significant shutdown of coal fired power plants in the area.

[6] https://dam.assets.ohio.gov/image/upload/epa.ohio.gov/Portals/27/sip/Designations_2012_PM2.5_standard_Final.pdf

The 2021-2023 urban increments (UI) in table 7 have also been calculated for the three of the violating monitoring sites.

Table 7: Cincinnati-Wilmington-Maysville CSA Urban Increments

2021-2023 Averages		Organic Carbon UI	Elemental Carbon UI	Nitrates UI	Sulfates UI	Crustal UI
Butler 39-017-0015	Quarter 1	1.05	0.44	1.52	0.29	0.06
	Quarter 2	1.64	0.76	0.00	0.12	0.00
	Quarter 3	1.61	0.72	0.00	-0.20	0.06
	Quarter 4	1.08	0.64	0.32	0.06	0.19
	Annual	1.34	0.65	0.45	0.06	0.08
Butler 39-017-0019	Quarter 1	1.05	0.44	1.52	0.29	0.06
	Quarter 2	1.64	0.76	0.00	0.12	0.00
	Quarter 3	1.61	0.72	0.00	-0.20	0.06
	Quarter 4	1.08	0.64	0.32	0.06	0.19
	Annual	1.34	0.65	0.45	0.06	0.08
Butler 39-017-0022	Quarter 1	1.05	0.44	1.52	0.29	0.06
	Quarter 2	1.64	0.76	0.00	0.12	0.00
	Quarter 3	1.61	0.72	0.00	-0.20	0.06
	Quarter 4	1.08	0.64	0.32	0.06	0.19
	Annual	1.34	0.65	0.45	0.06	0.08
Hamilton 39-061-0014	Quarter 1	1.24	0.44	1.33	0.14	0.01
	Quarter 2	0.88	0.49	0.00	0.16	-0.03
	Quarter 3	1.53	0.57	0.00	0.04	0.04
	Quarter 4	1.42	0.52	0.42	0.12	0.09
	Annual	1.27	0.49	0.45	0.12	0.03
Hamilton 39-061-0040	Quarter 1	1.24	0.40	1.33	0.14	0.01
	Quarter 2	0.88	0.49	0.00	0.16	-0.03
	Quarter 3	1.53	0.57	0.00	0.04	0.04
	Quarter 4	1.42	0.52	0.42	0.12	0.09
	Annual	1.27	0.49	0.45	0.12	0.03
Hamilton 39-061-0042	Quarter 1	1.24	0.40	1.33	0.14	0.01
	Quarter 2	0.88	0.49	0.00	0.16	-0.03
	Quarter 3	1.53	0.57	0.00	0.04	0.04
	Quarter 4	1.42	0.52	0.42	0.12	0.09
	Annual	1.27	0.49	0.45	0.12	0.03
Hamilton 39-061-0048	Quarter 1	1.24	0.40	1.33	0.14	0.01
	Quarter 2	0.88	0.49	0.00	0.16	-0.03
	Quarter 3	1.53	0.57	0.00	0.04	0.04
	Quarter 4	1.42	0.52	0.42	0.12	0.09
	Annual	1.27	0.49	0.45	0.12	0.03

Source: https://www.epa.gov/particle-pollution-designations/particle-pollution-designations-memorandum-and-data-2024-revised

Organic carbon UI is high throughout the year, much higher than the other species, at all monitoring sites. There is a higher nitrates UI at all monitoring sites in quarter 1. Crustal UI is higher during quarter 3 across all monitoring sites. For elemental carbon, the UI is higher in quarter 2 for the Butler County monitoring sites, but higher in quarter 3 for the Hamilton County monitoring sites. Sulfates UI is higher in quarter 1 for the Butler County monitoring sites and higher in quarter 2 for the Hamilton County monitoring sites.

EMISSIONS AND EMISSIONS RELATED DATA

Emission trends

Table 8 presents emissions data for the Cincinnati-Wilmington-Maysville OH-KY-IN CSA. The most significant emissions in the Cincinnati-Wilmington-Maysville OH-KY-IN CSA emanate from Hamilton County and then from Clermont and Butler Counties. Together, Hamilton, Butler, and Clermont Counties emissions account for 44% of the analysis area's total emissions: 46% of $PM_{2.5}$, 51% of NO_X, 38% of NH_3, 77% of SO_2, and 32% of VOC emissions. For each pollutant listed, Hamilton County is the top emitter of all the counties in the analysis area, responsible for 24% of the total area emissions. Clermont County is the second highest emitter, followed closely by Butler County. Clermont County is located to the east of Hamilton County and the violating monitoring sites.

All counties have relatively high VOC emissions dominated by the non-point source sectors which are primarily biogenics and then, consumer solvents.

Setting aside VOC emissions dominated by biogenics, Kentucky and Indiana have low emissions with the exception of high SO_2 and NO_X emissions from Mason (KY) County. The remaining Ohio counties emissions are relatively lower than Butler, Hamilton, and Clermont Counties.

Warren County located to the northeast of the violating monitoring sites, has low emissions, except for NO_x, which is largely on road emissions.

In Hamilton County, the majority of $PM_{2.5}$ emissions are from non-point sources, especially from the construction and paved road dust sectors. In Butler County, the majority of $PM_{2.5}$ emissions are also from non-point sources especially from residential wood fuel and then paved road dust sectors. In Clermont County, the majority of $PM_{2.5}$ emissions are from non-point sources especially from residential wood fuel and then waste disposal sectors.

In Hamilton, Butler and Clermont Counties, the majority of NO_x and SO_2 emissions are from point sources as will be discussed below. As noted above, Warren County NO_x emissions are most significantly from on road emissions and SO_2 emissions are very low.

Table 8: Cincinnati-Wilmington-Maysville OH-KY-IN CSA Counties 2022 Emissions Data (TPY)

Hamilton	**PM2.5**	***OC***	***EC***	***Sulfate***	***Nitrate***	***Other***	**NOx**	**NH3**	**SO2**	**VOC**
Point	871.25	67.61	40.15	87.00	2.49	674.00	8,301.18	50.98	17,122.98	682.30
Nonpoint	3,230.94	1,020.25	106.50	40.45	6.15	2,057.60	2,270.18	542.21	61.20	13,803.83
Non-Road	150.44	60.78	41.94	4.10	0.92	42.65	1,484.50	4.78	1.98	1,470.59
On Road	144.42	40.23	51.52	5.61	0.25	46.81	4,186.38	466.50	19.25	2,399.74
Total	4,397.05	1,188.87	240.11	137.16	9.81	2,821.06	16,242.25	1,064.47	17,205.40	18,356.47
Butler	**PM2.5**	***OC***	***EC***	***Sulfate***	***Nitrate***	***Other***	**NOx**	**NH3**	**SO2**	**VOC**
Point	591.24	169.78	24.44	115.71	6.82	274.49	2,648.77	121.49	2,014.86	626.94
Nonpoint	1,769.25	620.56	75.32	19.28	5.61	1,048.48	1,438.09	491.15	39.71	9,157.16
Non-Road	53.68	22.31	13.60	1.22	0.28	16.26	483.79	1.48	0.62	581.58
On Road	52.61	14.78	19.34	1.84	0.09	16.57	1,445.83	161.49	6.75	1,004.00
Total	2,466.79	827.43	132.70	138.05	12.80	1,355.80	6,016.47	775.61	2,061.94	11,369.68
Clermont	**PM2.5**	***OC***	***EC***	***Sulfate***	***Nitrate***	***Other***	**NOx**	**NH3**	**SO2**	**VOC**
Point	324.64	12.36	13.71	32.31	0.25	266.00	3,695.41	1.97	6,286.08	111.51
Nonpoint	1,322.16	450.68	60.45	12.38	3.29	795.35	599.06	233.33	34.33	9,552.87
Non-Road	31.99	13.25	8.31	0.75	0.18	9.49	307.54	0.89	0.36	401.41
On Road	32.41	9.17	12.39	1.13	0.06	9.66	907.30	99.03	4.17	594.99
Total	1,711.19	485.46	94.86	46.57	3.78	1,080.50	5,509.32	335.22	6,324.93	10,660.77
Warren	**PM2.5**	***OC***	***EC***	***Sulfate***	***Nitrate***	***Other***	**NOx**	**NH3**	**SO2**	**VOC**
Point	113.29	11.67	1.77	11.86	1.59	86.40	612.09	1.38	22.69	357.12
Nonpoint	1,379.43	469.15	64.03	14.63	3.38	828.25	753.25	274.77	38.94	8,898.91
Non-Road	40.42	16.09	11.97	1.20	0.27	10.88	442.14	1.29	0.52	437.55
On Road	41.84	11.91	16.63	1.87	0.08	11.35	1,351.63	130.61	5.63	695.42
Total	1,574.99	508.82	94.40	29.56	5.32	936.88	3,159.11	408.06	67.78	10,388.99
Clinton	**PM2.5**	***OC***	***EC***	***Sulfate***	***Nitrate***	***Other***	**NOx**	**NH3**	**SO2**	**VOC**
Point	42.07	4.72	1.00	1.41	0.14	34.80	99.62	0.00	10.62	183.92
Nonpoint	605.89	116.40	13.98	4.44	1.59	469.49	444.17	450.81	6.26	5,316.60
Non-Road	12.77	4.66	4.79	0.52	0.12	2.67	176.57	0.35	0.15	112.88
On Road	15.13	4.32	6.77	0.78	0.03	3.22	577.27	38.45	1.65	201.76
Total	675.85	130.10	26.54	7.15	1.88	510.18	1,297.62	489.61	18.68	5,815.17
Brown	**PM2.5**	***OC***	***EC***	***Sulfate***	***Nitrate***	***Other***	**NOx**	**NH3**	**SO2**	**VOC**
Point	11.33	2.92	0.59	0.71	0.14	6.97	20.39	0.30	22.93	16.37

Nonpoint	676.77	164.85	21.70	5.77	4.17	480.28	387.03	178.40	9.86	8,272.40
Non-Road	9.10	3.30	3.55	0.39	0.09	1.77	138.64	0.29	0.11	93.11
On Road	9.12	2.63	4.01	0.35	0.02	2.11	295.21	23.64	0.98	164.84
Total	706.32	173.70	29.85	7.22	4.42	491.13	841.27	202.63	33.87	8,546.73
Kenton KY	**PM2.5**	***OC***	***EC***	***Sulfate***	***Nitrate***	***Other***	**NOx**	**NH3**	**SO2**	**VOC**
Point	24.56	30.21	3.24	6.16	0.11	48.24	98.36	0.00	0.51	234.90
Nonpoint	820.52	234.78	26.75	5.99	2.42	441.61	633.51	144.05	21.14	4,385.20
Non-Road	21.72	11.64	8.45	0.81	0.19	7.86	172.31	0.58	0.23	249.52
On Road	40.36	10.71	17.48	2.14	0.08	9.94	1,321.77	94.19	4.24	491.85
Total	907.16	287.34	55.92	15.10	2.80	507.65	2,225.95	238.82	26.12	5,361.46
Boone KY	**PM2.5**	***OC***	***EC***	***Sulfate***	***Nitrate***	***Other***	**NOx**	**NH3**	**SO2**	**VOC**
Point	269.90	60.06	11.83	25.84	0.85	253.83	3,203.33	8.11	1,937.64	1,257.28
Nonpoint	887.84	245.70	29.89	7.28	3.51	462.99	673.37	204.70	26.69	5,696.37
Non-Road	28.99	19.88	10.56	1.69	0.20	17.73	207.62	0.67	0.29	420.00
On Road	43.58	11.60	19.42	2.55	0.09	9.92	1,528.12	100.69	4.63	474.54
Total	1,230.30	337.24	71.70	37.36	4.65	744.47	5,612.43	314.17	1,969.24	7,848.19
Campbell KY	**PM2.5**	***OC***	***EC***	***Sulfate***	***Nitrate***	***Other***	**NOx**	**NH3**	**SO2**	**VOC**
Point	105.06	40.12	5.76	20.77	1.60	65.49	95.92	0.00	1.66	282.24
Nonpoint	571.84	166.74	21.04	4.46	2.36	319.82	404.80	124.43	15.16	4,106.52
Non-Road	9.53	5.46	4.67	0.48	0.11	3.43	104.92	0.31	0.12	129.35
On Road	20.50	5.59	8.99	1.01	0.04	4.87	655.91	49.39	2.21	271.11
Total	706.93	217.91	40.46	26.72	4.11	393.61	1,261.54	174.13	19.16	4,789.22
Grant KY	**PM2.5**	***OC***	***EC***	***Sulfate***	***Nitrate***	***Other***	**NOx**	**NH3**	**SO2**	**VOC**
Point	6.71	4.45	0.50	1.31	0.02	10.03	11.57	0.00	0.80	21.79
Nonpoint	336.38	70.03	9.80	2.96	2.85	212.29	422.93	144.37	6.16	5,179.28
Non-Road	3.27	3.23	3.42	0.37	0.09	1.75	27.82	0.08	0.03	61.89
On Road	18.87	5.16	9.96	1.05	0.05	2.66	741.92	33.09	1.58	149.99
Total	365.23	82.87	23.68	5.69	3.01	226.73	1,204.23	177.54	8.56	5,412.95
Mason KY	**PM2.5**	***OC***	***EC***	***Sulfate***	***Nitrate***	***Other***	**NOx**	**NH3**	**SO2**	**VOC**
Point	190.17	8.17	5.92	32.56	0.16	150.03	3,977.13	5.50	3,959.82	224.34
Nonpoint	408.18	62.88	8.08	4.00	5.96	265.01	362.65	251.97	6.26	3,475.39
Non-Road	3.08	3.01	3.14	0.40	0.08	1.89	48.47	0.11	0.05	46.86
On Road	5.44	1.52	2.48	0.22	0.01	1.20	169.19	11.29	0.48	75.59

Total	606.86	75.58	19.62	37.18	6.21	418.13	4,557.44	268.87	3,966.61	3,822.17
Pendleton KY	**PM2.5**	***OC***	***EC***	***Sulfate***	***Nitrate***	***Other***	**NOx**	**NH3**	**SO2**	**VOC**
Point	85.03	9.52	1.79	9.65	0.44	83.95	1,087.39	0.00	666.40	176.97
Nonpoint	329.31	50.16	6.97	2.19	2.37	171.19	289.57	115.17	8.29	4,823.20
Non-Road	1.67	1.63	1.77	0.21	0.05	0.94	20.70	0.05	0.02	18.67
On Road	2.86	0.81	1.34	0.11	0.01	0.59	88.89	5.41	0.24	53.35
Total	418.88	62.12	11.87	12.16	2.87	256.67	1,486.56	120.63	674.94	5,072.20
Bracken KY	**PM2.5**	***OC***	***EC***	***Sulfate***	***Nitrate***	***Other***	**NOx**	**NH3**	**SO2**	**VOC**
Point	11.76	3.37	0.20	0.21	0.01	10.32	3.72	0.00	0.02	15.84
Nonpoint	201.57	35.25	4.75	2.09	2.97	145.43	247.04	141.25	1.95	3,881.42
Non-Road	2.31	1.93	2.22	0.25	0.06	0.98	37.48	0.09	0.03	38.85
On Road	2.66	0.79	1.31	0.09	0.01	0.47	90.97	5.33	0.22	45.25
Total	218.30	41.34	8.48	2.64	3.05	157.20	379.21	146.67	2.22	3,981.36
Gallatin KY	**PM2.5**	***OC***	***EC***	***Sulfate***	***Nitrate***	***Other***	**NOx**	**NH3**	**SO2**	**VOC**
Point	984.50	42.94	6.68	62.00	2.99	887.43	815.50	0.00	426.74	113.39
Nonpoint	239.67	32.62	5.07	1.44	1.24	107.36	212.29	61.16	6.56	2,856.25
Non-Road	1.37	1.66	1.90	0.21	0.05	0.84	25.59	0.05	0.02	37.03
On Road	9.81	2.70	5.18	0.56	0.03	1.35	391.84	17.78	0.84	69.14
Total	1,235.35	79.92	18.83	64.21	4.31	996.98	1,445.23	79.00	434.17	3,075.81
Dearborn IN	**PM2.5**	***OC***	***EC***	***Sulfate***	***Nitrate***	***Other***	**NOx**	**NH3**	**SO2**	**VOC**
Point	133.27	40.87	6.11	27.86	2.16	56.27	792.77	59.78	96.07	3,357.65
Nonpoint	497.04	164.37	22.95	4.67	1.87	303.17	362.66	109.21	98.53	5,516.84
Non-Road	7.81	3.10	2.36	0.24	0.05	2.06	85.00	0.24	0.09	75.02
On Road	16.65	4.67	7.24	0.82	0.03	3.88	587.22	42.65	1.83	244.73
Total	654.76	213.01	38.66	33.59	4.11	365.38	1,827.66	211.87	196.53	9,194.25
Franklin IN	**PM2.5**	***OC***	***EC***	***Sulfate***	***Nitrate***	***Other***	**NOx**	**NH3**	**SO2**	**VOC**
Point	0.10	0.04	0.01	0.01	0.00	0.05	0.09	0.00	0.02	0.20
Nonpoint	360.85	101.55	14.08	3.34	2.90	238.98	315.15	319.20	42.93	6,370.41
Non-Road	9.11	3.48	3.11	0.32	0.08	2.12	118.76	0.25	0.10	85.70
On Road	5.63	1.61	2.46	0.25	0.01	1.30	189.99	14.06	0.60	99.98
Total	375.69	106.68	19.66	3.92	2.99	242.45	624.00	333.52	43.65	6,556.30
Ohio IN	**PM2.5**	***OC***	***EC***	***Sulfate***	***Nitrate***	***Other***	**NOx**	**NH3**	**SO2**	**VOC**
Point	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

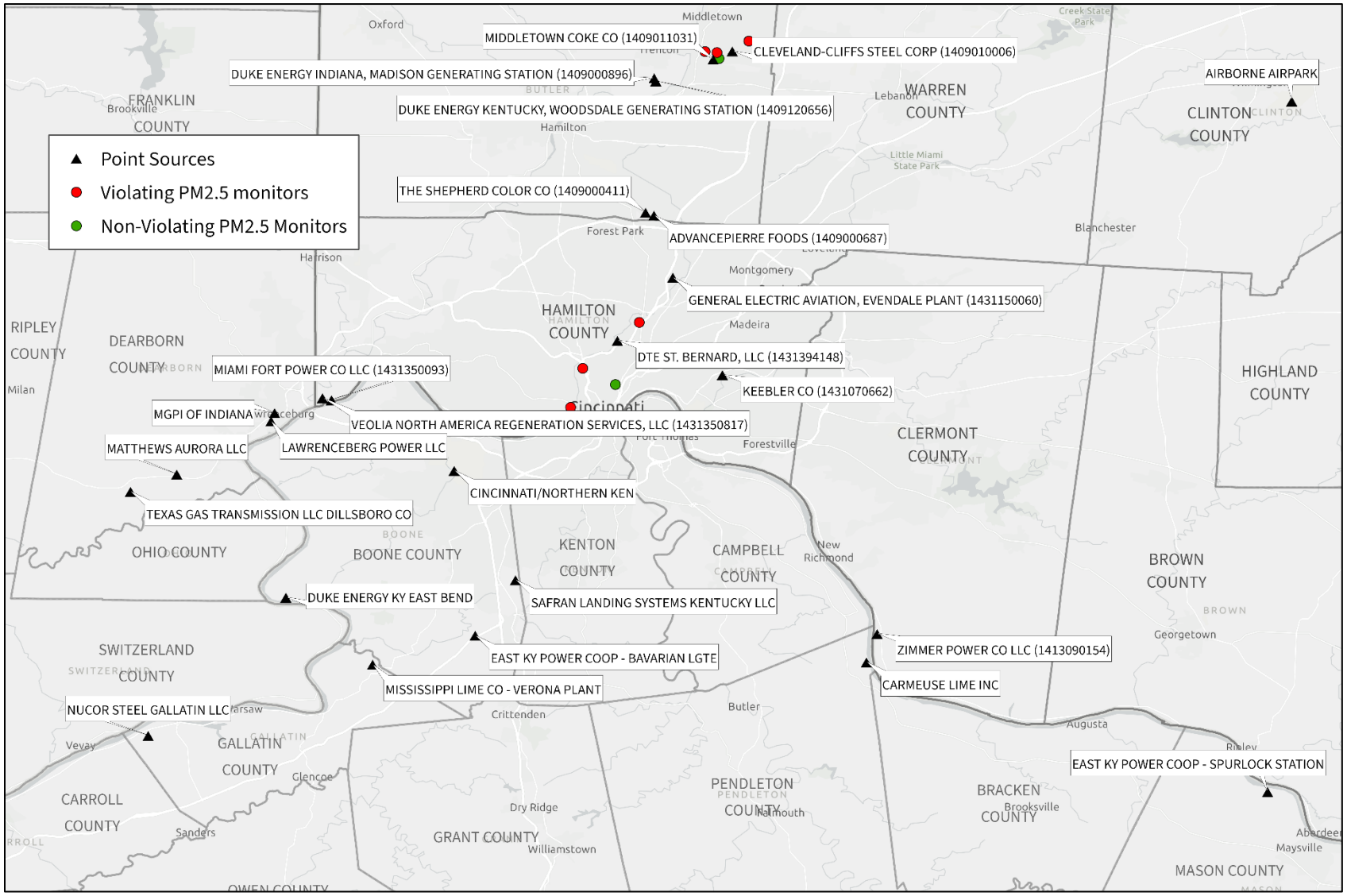
Nonpoint	100.24	36.74	4.51	0.85	0.72	57.43	91.01	203.61	4.74	2,603.40
Non-Road	1.34	0.52	0.44	0.04	0.01	0.32	16.22	0.04	0.01	12.64
On Road	1.00	0.29	0.43	0.04	0.00	0.24	30.99	2.41	0.10	22.76
Total	102.58	37.55	5.38	0.93	0.73	57.99	138.21	206.06	4.86	2,638.80
Union IN	**PM2.5**	***OC***	***EC***	***Sulfate***	***Nitrate***	***Other***	**NOx**	**NH3**	**SO2**	**VOC**
Point	1.73	0.36	0.01	0.00	0.00	1.36	0.00	0.00	0.00	24.38
Nonpoint	147.95	31.91	4.43	1.04	0.71	109.86	214.78	125.64	12.85	2,753.89
Non-Road	4.91	1.87	1.71	0.18	0.04	1.11	66.48	0.14	0.05	64.59
On Road	1.69	0.49	0.74	0.07	0.00	0.38	56.40	4.39	0.19	29.51
Total	156.27	34.63	6.89	1.29	0.75	112.71	337.67	130.18	13.09	2,872.36

TOTALS	**PM2.5**	***OC***	***EC***	***Sulfate***	***Nitrate***	***Other***	**NOx**	**NH3**	**SO2**	**VOC**
Hamilton	4,397.05	1,188.87	240.11	137.16	9.81	2,821.06	16,242.25	1,064.47	17,205.40	18,356.47
Butler	2,466.79	827.43	132.70	138.05	12.80	1,355.80	6,016.47	775.61	2,061.94	11,369.68
Clermont	1,711.19	485.46	94.86	46.57	3.78	1,080.50	5,509.32	335.22	6,324.93	10,660.77
Warren	1,574.99	508.82	94.40	29.56	5.32	936.88	3,159.11	408.06	67.78	10,388.99
Clinton	675.85	130.10	26.54	7.15	1.88	510.18	1,297.62	489.61	18.68	5,815.17
Brown	706.32	173.70	29.85	7.22	4.42	491.13	841.27	202.63	33.87	8,546.73
Kenton KY	907.16	287.34	55.92	15.10	2.80	507.65	2,225.95	238.82	26.12	5,361.46
Boone KY	1,230.30	337.24	71.70	37.36	4.65	744.47	5,612.43	314.17	1,969.24	7,848.19
Campbell KY	706.93	217.91	40.46	26.72	4.11	393.61	1,261.54	174.13	19.16	4,789.22
Grant KY	365.23	82.87	23.68	5.69	3.01	226.73	1,204.23	177.54	8.56	5,412.95
Mason KY	606.86	75.58	19.62	37.18	6.21	418.13	4,557.44	268.87	3,966.61	3,822.17
Pendleton KY	418.88	62.12	11.87	12.16	2.87	256.67	1,486.56	120.63	674.94	5,072.20
Bracken KY	218.30	41.34	8.48	2.64	3.05	157.20	379.21	146.67	2.22	3,981.36
Gallatin KY	1,235.35	79.92	18.83	64.21	4.31	996.98	1,445.23	79.00	434.17	3,075.81
Dearborn IN	654.76	213.01	38.66	33.59	4.11	365.38	1,827.66	211.87	196.53	9,194.25
Franklin IN	375.69	106.68	19.66	3.92	2.99	242.45	624.00	333.52	43.65	6,556.30
Ohio IN	102.58	37.55	5.38	0.93	0.73	57.99	138.21	206.06	4.86	2,638.80
Union IN	156.27	34.63	6.89	1.29	0.75	112.71	337.67	130.18	13.09	2,872.36

Source: 2022 EMP from https://www.epa.gov/air-emissions-modeling/2022v1-emissions-modeling-platform

The following figure 4 and table 9 show the higher emitting point sources in the area.

Figure 4: Location of Cincinnati-Wilmington-Maysville OH-KY-IN CSA Point Sources



Source: 2022 EMP from https://www.epa.gov/air-emissions-modeling/2022v1-emissions-modeling-platform

As seen in table 9 below, the most significant $PM_{2.5}$ emissions come from Nucor Steel in Gallatin (KY) and Miami Fort Power in Hamilton Counties. Miami Fort Power also has the highest NO_X and SO_2 emissions, followed by Zimmer Power in Clermont County and East KY Power Coop in Mason (KY). Miami Fort Power is located to the west-southwest of the violating sites in Hamilton County and is located to the southwest of all the violating sites (shown in figure 4 above). Considering all the point sources from the counties in the analysis area, Lawrenceberg Power in Dearborn (IN) County has the most significant NH_3 emissions and MGPI of Indiana in Dearborn (IN) County has the most significant VOC emissions. Both of these sources are located to the east-southeast of the violating Ohio monitoring sites.

Table 9: Cincinnati-Wilmington-Maysville OH-KY-IN CSA Point Source Emissions for 2022 (TPY)

PM2.5		
Gallatin Co KY	Nucor Steel Gallatin LLC	863.72
Hamilton Co OH	Miami Fort Power Company LLC (1431350093)	699.96
Butler Co OH	Cleveland-Cliffs Steel Company (1409010006)	406.84
Clermont Co OH	Zimmer Power Company LLC (1413090154)	321.63
Mason Co KY	East KY Power Coop – Spurlock Station	138.70
Gallatin Co KY	Mississippi Lime Co – Verona Plant	114.14
Boone Co KY	Duke Energy KY East Bend	112.32
NOx		
Hamilton Co OH	Miami Fort Power Company LLC (1431350093)	7,412.79
Clermont Co OH	Zimmer Power Company LLC (1413090154)	3,691.71
Mason Co KY	East KY Power Coop – Spurlock Station	3,220.65
Boone Co KY	Duke Energy KY East Bend	2,176.13
Butler Co OH	Cleveland-Cliffs Steel Company (1409010006)	1,771.97
Pendleton Co KY	Carmeuse Lime Inc	993.72
Boone Co KY	Cincinnati/Northern Ken	779.50
Gallatin Co KY	Nucor Steel Gallatin LLC	507.19
Warren Co OH	Eastern Gas Transmission and Storage – Lebanon Station (1483000144)	400.90
Gallatin Co KY	Mississippi Lime Co – Verona Plant	300.83
Dearborn Co IN	Lawrenceberg Power LLC	293.54
Dearborn Co IN	Texas Gas Transmission LLC Dillsboro Co	266.75
Butler Co OH	Middletown Coke Company (1409011031)	238.05
Dearborn Co IN	MGPI of Indiana	159.23
Hamilton Co OH	General Electric Aviation, Evendale Plant (1431150060)	151.56
Butler Co OH	Duke Energy Indiana, Madison Generating Station (1409000896)	147.75
Warren Co OH	Texas Eastern Transmission – Lebanon (1483060328)	147.70
Butler Co OH	Duke Energy Kentucky, Woodsdale Generating Station (1409120656)	129.05
Boone Co KY	East KY Power Coop - Bavarian LGTE	114.18
Hamilton Co OH	DTE St Bernard LLC (1431394148)	111.56

NH3		
Dearborn Co IN	Lawrenceberg Power LLC	57.79
Butler Co OH	The Shepherd Color Company (1409000411)	48.40
Butler Co OH	Duke Energy Indiana, Madison Generating Station (1409000896)	27.03
Butler Co OH	AdvancePierre Foods (1409000687)	21.72
Hamilton Co OH	Keebler Company (1431070662)	20.43
SO2		
Hamilton Co OH	Miami Fort Power Company LLC (1431350093)	16,958.69
Clermont Co OH	Zimmer Power Company LLC (1413090154)	6,285.67
Mason Co KY	East KY Power Coop – Spurlock Station	3,852.78
Boone Co KY	Duke Energy KY East Bend	1,822.88
Butler Co OH	Cleveland-Cliffs Steel Company (1409010006)	1,191.29
Butler Co OH	Middletown Coke Company (1409011031)	798.63
Pendleton Co KY	Carmeuse Lime Inc	634.22
Gallatin Co KY	Nucor Steel Gallatin LLC	384.46
Hamilton Co OH	Veolia North America Regeneration Services LLC (1431350817)	129.38
VOC		
Dearborn Co IN	MGPI of Indiana	3,170.64
Butler Co OH	Cleveland-Cliffs Steel Company (1409010006)	307.37
Clinton Co OH	Airborne Airpark	168.88
Boone Co KY	Cincinnati/Northern Ken	161.70
Dearborn Co IN	Matthews Aurora LLC	132.85
Boone Co KY	Safran Landing Systems Kentucky LLC	115.58
Gallatin Co KY	Nucor Steel Gallatin LLC	112.98

Source: 2022 EMP from https://www.epa.gov/air-emissions-modeling/2022v1-emissions- modeling-platform

Level of control of emission sources

In the Ohio portion of the Cincinnati-Wilmington-Maysville OH-KY-IN CSA, the emission reduction programs which have had or will have the greatest 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
- Various Cross-State Air Pollution Rules (CSAPR)
- Ohio Clean Diesel Initiatives
- Mercury and Air Toxics Standards (MATS)
- Good Neighbor Plan (stayed)
- NSPS for Oil and Gas Production

- Ohio Administrative Code 3745-112 “Consumer Products”
- Ohio Administrative Code 3745-113 “Architectural and Industrial Maintenance (AIM) Coatings”
- Ohio Administrative Code 3745-110 “Nitrogen Oxides – Reasonably Available Control Technology”
- Ohio Administrative Code 3745-21 “Carbon Monoxide, Photochemically Reactive Materials, Hydrocarbons, and Related Materials Standards”
- Ohio Administrative Code 3745-17 “Particulate Matter Standards”

The CSAPR, Good Neighbor Plan, and MATS regulate electric generating units (electric generating units (EGUs), or power plants). The CSAPR program replaced the Clean Air Interstate Rule (CAIR) but has the same objective of reducing power plant emissions that cross state lines to improve air quality. CSAPR was revised and updated in 2017 (replacing the original rule promulgated in 2015) to further reduce summertime NO_x emissions from power plants. The Good Neighbor Plan extends the regulations of CSAPR and CAIR to not only EGUs but also for non-EGU stationary sources beginning in 2026. However, this rule was stayed by the Supreme Court in July of 2024. CAIR and CSAPR have brought about the largest reductions in precursor or primary emissions of $PM_{2.5}$ and its species (sulfates, nitrates, organic carbon, elemental carbon and crustal) and will continue to bring additional reductions. Compliance with the MATS rule also leads to additional reductions in precursor species - in particular, sulfates.

The New Source Performance Standards (NSPS) for Oil and Gas production was promulgated March 8, 2024, by the U.S. EPA, and sets new requirements for crude oil and natural gas production sources to regarding greenhouse gas (specifically methane), VOC, and SO_2 emissions. All large oil and gas industrial source owners have to March 2029 to comply with new state requirements created under this ruling. Compliance with this rule will lead to reduction in methane, VOC, and SO_2 emissions.

Ohio Administrative Code (OAC) Chapter 3745-112[7] contain requirements for the content of VOCs in consumer products sold, supplied, offered for sale, or manufactured for use in the state of Ohio. These rules were initially promulgated in 2007 as part of Ohio’s strategy to attain the 1997 ozone standard by adopting the standards in the model rule developed by the Ozone Transport Commission (OTC). The OTC develops model rules for states to consider when adopting consumer products regulations. This rule was last reviewed and updated in 2022 to

[7] The current, effective copy of this rule can be found here: https://epa.ohio.gov/divisions-and-offices/air-pollution-control/regulations/effective-rules/dapc-effective-rules

strengthen the VOC content requirements consistent with more recent OTC model rules. This update was to assist with attaining and maintaining the 2015 ozone standard.

The rules in OAC Chapter 3745-113[8] contain requirements for the content of VOCs in AIM coatings. These rules were initially promulgated in 2007 as part of Ohio's strategy to attain the 1997 ozone standard by adopting the standards in the model rule developed by the OTC. This rule was last reviewed and updated in 2022 to strengthen the VOC content requirements consistent with more recent OTC model rules. This update was to assist with attaining and maintaining the 2015 ozone standard.

On March 30, 2022, Ohio submitted revisions to the previously submitted SIP for the 2015 ozone standard.[9] These revisions addressed Reasonably Available Control Technology (RACT) requirements for the 2015 ozone standard with respect to one nonattainment area that was bumped-up to moderate nonattainment: the Cleveland OH area (Cuyahoga, Geauga, Lake, Lorain, Medina, Portage and Summit Counties); one maintenance area: the Ohio portion of the Cincinnati OH-KY 2015 ozone area (Butler, Clermont, Hamilton and Warren Counties). For certain source categories, Ohio EPA submitted regulations that establish new or more stringent RACT controls in OAC Chapters 3745-21 (VOC) and 3745-110 (NO_X). The rules in OAC Chapter 3745-110[10] limit the emissions of NO_X from stationary industrial sources such as, but not limited to, boilers, combustion turbines and internal combustion engines. The rules in OAC Chapter 3745-21[11] establish requirements for the control of emissions of VOCs and carbon monoxide (CO) from stationary emission sources. Ohio submitted a request for redesignation of the Cincinnati OH-KY area which was approved by the U.S. EPA June 9, 2022 (87 FR 35104). Therefore, Ohio was not required to implement RACT measures for the Cincinnati area but still implemented the controls to help ensure that the Cincinnati area would maintain the 2015 ozone standard.

OAC Chapter 3745-17[12] regulates particulate matter and established RACT for stationary sources under the historical PM_{10} standard.

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[8] The current, effective copy of this rule can be found here: https://epa.ohio.gov/divisions-and-offices/air-pollution-control/regulations/effective-rules/dapc-effective-rules

[9] This revision and all related documents to Ohio's 2015 8-hour ozone standard SIP can be found on Ohio EPA's website, https://epa.ohio.gov/divisions-and-offices/air-pollution-control/state-implementation-plans/division-of-air-pollution-control-sip-2015

[10] The current, effective copy of this rule can be found here: https://epa.ohio.gov/divisions-and-offices/air-pollution-control/regulations/effective-rules/dapc-effective-rules

[11] The current, effective copy of this rule can be found here: https://epa.ohio.gov/divisions-and-offices/air-pollution-control/regulations/effective-rules/dapc-effective-rules

[12] The current, effective copy of this rule can be found here: https://epa.ohio.gov/divisions-and-offices/air-pollution-control/regulations/effective-rules/dapc-effective-rules

With respect to the Ohio utilities, additional reductions have occurred since previous nonattainment designations and will be continuing into the future. Miami Fort Power Company LLC (facility ID 1431350093) is a power station located in Hamilton County. Miami Fort Power has two coal-fired boiler units each with a design capacity of 5,025 MMBtu/hr, both outfitted with NO_x and SO_2 control equipment. On July 9, 2021, Ohio EPA issued Director's Final Findings and Orders (DFFOs) requiring the permanent shutdown of all coal-fired burning activities at Miami Fort by January 1, 2028. This date falls well before the likely attainment date for the 2024 annual $PM_{2.5}$ standard. In addition, on November 13, 2023, Ohio EPA modified said DFFOs to include NO_x RACT requirements limiting NO_x emissions from the facility to 0.24 lb NO_x/MMBtu (30-day average) and 0.30 lb NO_x/MMBtu (annual limit). As can be seen from table 9 and table 10 above, the most significant NO_x and SO_2 emissions within the area are attributable to Miami Fort.

Zimmer Power Company LLC (facility ID 1413090154) is a power station located in Clermont County. Zimmer Power had two gas-fired boilers with design capacities of 635 MMBtu/hr and one coal-fired boiler (1,426 MW) that were all shutdown December 31, 2022. Zimmer Power also had three emergency diesel generators (4,801 horsepower) that shutdown December 31, 2023. As can be seen from table 9 and table 10 above, the second most significant NO_X and SO_2 emissions within the area are attributable to Zimmer Power.

Also, a larger point-source non-utility contributor, Cleveland-Cliffs Steel Company (facility ID 1409010006) is a steel plant located in Butler County. Cleveland-Cliffs Steel has four gas-fired boilers each with a design capacity of 211 MMBtu/hr, four slab furnaces (design capacity of 598 MMBtu/hr) with waste heat boilers (design capacity of 320 MMBtu/hr), and four combined, indirect gas-fired batch process furnaces (with design capacities of 63 MMBtu/hr, 34MMBtu/hr, 85 MMBtu/hr, and 136 MMBtu/hr). There is currently no significant control equipment implemented for these boiler and furnace units. Ohio EPA is currently working with this facility to review controls and determine if NO_X RACT requirements will be necessary.

Urbanization, population, and commuting trends

The following table 10 provides a summary of the 2022 population and VMT for each of the counties discussed in this section.

Table 10: Cincinnati-Wilmington-Maysville OH-KY-IN CSA County Level VMT, Population, Land Area, and Population Density

County	VMT	Population	Land Area (sq. miles)	Population Density (1,000 per sq. miles)
Hamilton OH	20,791,970	825,037	407	2.03
Butler OH	7,746,600	388,710	467	0.83
Warren OH	6,881,680	249,778	400	0.62
Clermont OH	4,538,620	210,805	452	0.47
Brown OH	1,131,770	43,680	492	0.09
Clinton OH	1,659,430	41,964	411	0.10
Kenton KY	397,500	170,313	164	1.04
Boone KY	441,300	139,093	257	0.54
Campbell KY	208,000	93,300	159	0.59
Grant KY	147,500	25,502	261	0.10
Mason KY	50,300	17,068	240	0.07
Pendleton KY	28,400	14,638	282	0.05
Bracken KY	24,700	8,420	209	0.04
Gallatin KY	78,500	8,720	105	0.08
Franklin IN	621,000	23,028	391	0.06
Dearborn IN	1,838,000	51,138	307	0.17
Ohio IN	109,000	5,974	88	0.07
Union IN	200,000	7,041	165	0.04
Total for All Counties	45,184,540	2,265,177	4,606	0.49

Source: Ohio Department of Transportation (Ohio 2022 VMT data only)
Ohio Department of Development, County Trends and Profiles for 2022 (Ohio populations only)
U.S. Department of Commerce Economics and Statistics Administrations, U.S. Census Bureau, 2022 American Community Survey 5-year Estimates (Kentucky and Indiana populations only)
Indiana Department of Transport, Historic VMT by County (1992-2022) (Indiana 2022 VMT data only)
Kentucky Transportation Cabinet, Division of Planning, Roadway Information and Data, Daily Vehicles Miles Traveled (DVMT) and Mileage Reports for 2022 (Kentucky VMT data only)
All other data: U.S. EPA Particle Pollution Designations Memo and Data, https://www.epa.gov/particle-pollution-designations/particle-pollution-designations-memorandum-and-data-2024-revised#A

Degrees of urbanization and population trends

As seen in table 10 above, the majority of the population resides in Hamilton County and then Kenton County (KY) followed by Butler County. Warren and Brown Counties also have higher population while the remaining counties have very low density. As seen in figure 5 below, the population in both Hamilton, Butler, and Warren Counties is expected to increase whereas the population of Brown County is expected to decrease.

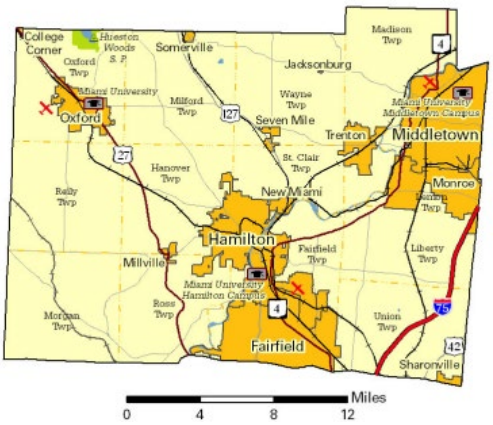
The most urbanized areas in Ohio are within Hamilton and Butler County. Their population and population densities are significantly higher than the surrounding Ohio counties, indicating that population-related emissions may be high in these areas. This is supported by table 8 above, which indicates these counties have the highest non-point and roadway emissions compared to others. Kenton County (KY) also has a high population and population density compared to the other counties but has low emissions compared to Hamilton and Butler Counties.

Brown and Clinton Counties have a low population and population density whereas Warren and Clermont Counties had mid-range populations and population densities. However, Clermont County has higher emissions than Warren, Brown, Butler, and Clinton Counties, but with the shutdown of Zimmer, that will significantly change.

Figure 5: Cincinnati-Wilmington-Maysville OH-KY-IN CSA Ohio County Profiles

Hamilton County

Hamilton County is 40% developed – low intensity, 30% forest, and 19% developed – high intensity. Cincinnati city is the largest major urban area, and where all the Hamilton County violating monitoring sites are located. The 2020 county population was 830,639 and decreased to 825,037 in 2022. The population is expected to increase to an estimated population of 835,109 by 2030.



Butler County

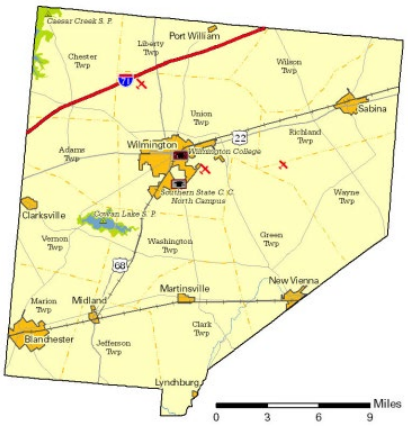
Butler County is 24% developed – low intensity, 23% pasture, and 21% cropland. Hamilton city is the largest major urban area. All of the Butler County violating monitoring sites are located in Middletown city. The 2020 county population was 390,357 and decreased to 388,420 in 2022. The population is expected to increase to an estimated population of 394,365 by 2030.

Clermont County

Clermont County is 46% forest, 16% developed – low intensity, and 16% cropland. Union township is the largest major urban area. The 2020 county population was 208,601 and increased to 210,805 in 2022. The population is expected to continually increase to an estimated population of 218,456 by 2030.

Warren County

Warren County is 28% forest, 24% cropland, and 20% developed – low intensity. Deerfield township is the largest major urban area. The 2020 county population was 242,337 and increased to 249,778 in 2022. The population is expected to continually increase to an estimated population of 262,869 by 2030.



Clinton County

Clinton County is 69% cropland, 14% forest, and 7% pasture. Wilmington city is the largest major urban area. The 2020 county population was 42,018 and decreased to 41,964 in 2022. The population is expected to continually decline to an estimated population of 40,595 by 2030.

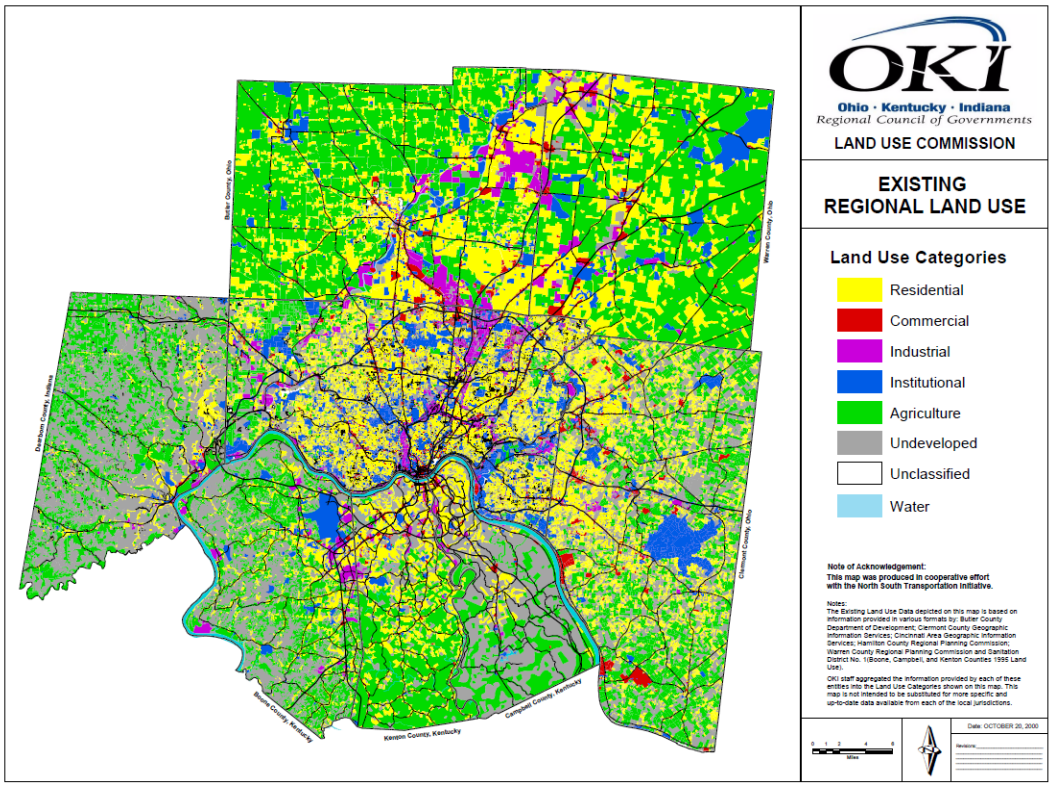
Brown County

Brown County is 35% cropland, 35% forest, and 20% pasture. Georgetown village is the largest major urban area. The 2020 county population was 43,676 and increased to 43,680 in 2022. The population is expected to decline to an estimated population of 42,278 by 2030.

Source: County profile information and maps found at Ohio Department of Development, Research, County Trends, https://development.ohio.gov/about-us/research/county/county-trends

As can be seen in figure 6 below, for the Indiana and Kentucky counties immediately surrounding the greater Cincinnati area, the majority of those areas are undeveloped or agriculture lands. However, there is a larger urban component concentrated near the Cincinnati area.

Figure 6: Cincinnati 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 10, the majority of VMT occurs in Hamilton County, and to a lesser extent Butler, Kenton (KY), Warren, Clermont and Dearborn (IN) Counties. Table 11 below looks at commuter travel in and out of the two counties in this analysis area with violating monitoring sites, Hamilton and Butler. The majority of Hamilton County's workforce also lives in Hamilton County, with only 19% of county residents working in a different county and 37% of county workers living in a different county but commuting into Hamilton County. About 10% of Hamilton residents commute north to Butler, Warren, and Montgomery Counties for work, and 6% commute south to Kentucky counties (Boone, Kenton, Campbell) for work. Only 2% commute east to Clermont County for work. The majority 15% of those commuting to Hamilton County for work are coming from the north (Butler, Warren, Montgomery, Clinton, and Greene Counties) and only 8% commuting from the east (Clermont and Brown Counties).

More of Butler County's workforce live in a different county than Butler County residents working in a different county: 34% of Butler County workers live in a different county whereas 43% of county residents work in a different county. About 27% of residents commute to counties south (Hamilton, Boone (KY), and Clermont) of Butler for work. 10% commute east to Warren County and only about 4% commute north to Montgomery and Greene Counties for work. Again, the majority of Butler County's workforce (18%) commutes from the south (Hamilton, Clermont, and Kenton (KY) Counties) to work in Butler. 7% commutes from the east (Warren County) and 4% commutes from the north (Montgomery and Preble Counties) to work in Butler County.

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 Dearborn (IN) 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 that are part of this analysis, do not significantly contribute to commuter travel in and out of these nonattainment counties.

Table 11: Commuter Travel In and Out of Hamilton and Butler Counties

Hamilton	% workers live in Hamilton work outside Hamilton Co				19.3%
	% workers work in Hamilton live outside Hamilton Co				37.2%
# workers living in Hamilton		401,680	# workers working in Hamilton		515,783
Place of Work	**#**	**%**	**Place of Residence**	**#**	**%**
Butler County	23,293	5.8%	Butler County	46,299	9.0%
Warren County	13,769	3.4%	Clermont County	38,952	7.6%
Boone County (KY)	12,457	3.1%	Warren County	27,275	5.3%
Clermont County	8,461	2.1%	Brown County	3,444	0.7%
Kenton County (KY)	7,402	1.8%	Montgomery County	3,340	0.6%
Campbell County (KY)	4,052	1.0%	Clinton County	1,242	0.2%
Montgomery County	1,659	0.4%	Greene County	1,077	0.2%

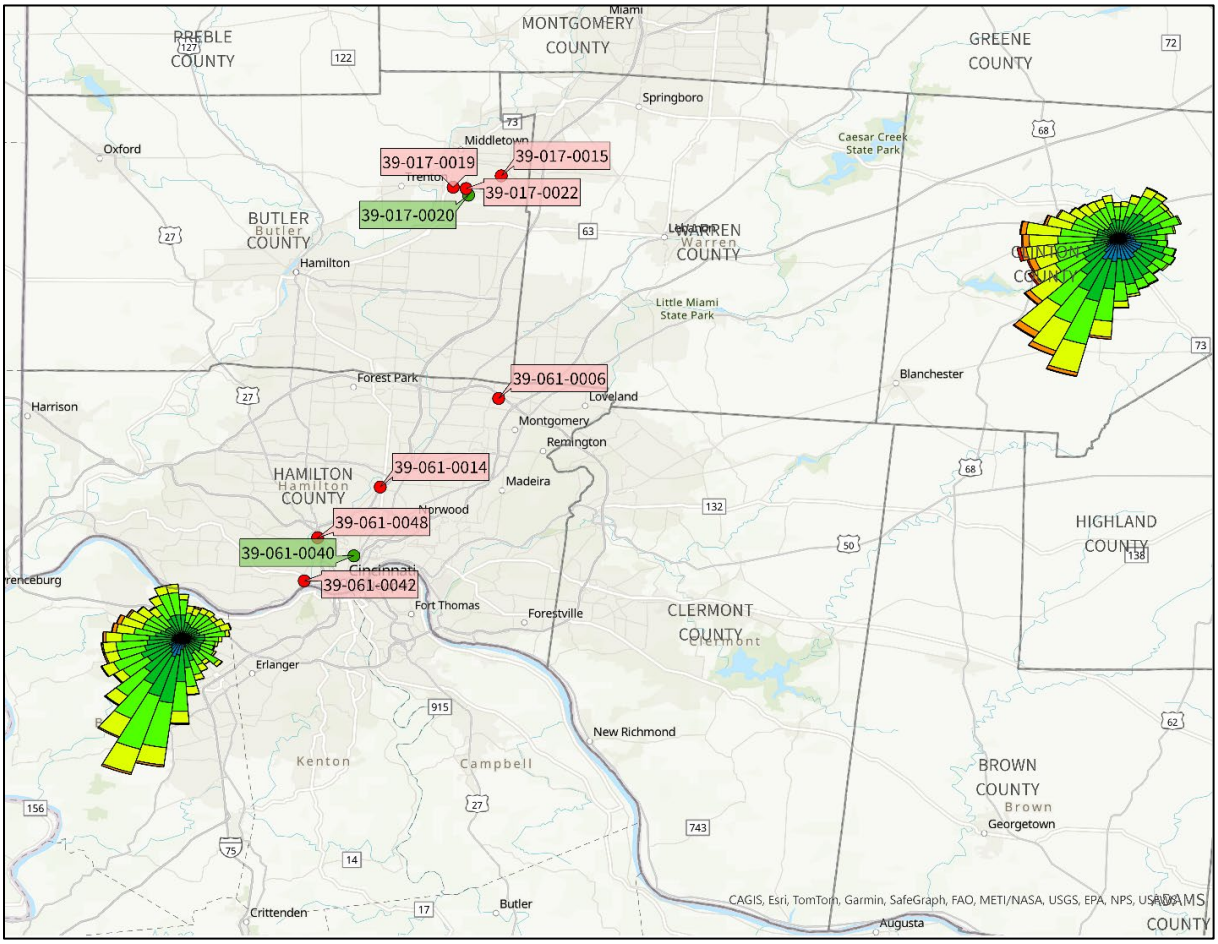
Butler	% workers live in Butler work outside Butler Co				42.6%
	% workers work in Butler live outside Butler Co				34.2%
# workers living in Butler		181,791	# workers working in Butler		158,441
Place of Work	**#**	**%**	**Place of Residence**	**#**	**%**
Hamilton County	46,299	25.5%	Hamilton County	23,293	14.7%
Warren County	17,701	9.7%	Warren County	11,344	7.2%
Montgomery County	5,631	3.1%	Montgomery County	4,616	2.9%
Clermont County	1,244	0.7%	Clermont County	4,302	2.7%
Boone County (KY)	1,035	0.6%	Preble County	2,213	1.4%
Greene County	1,029	0.6%	Kenton County (KY)	939	0.6%

Source: U.S. Department of Commerce Economics and Statistics Administrations, U.S. Census Bureau, Residence County to Workplace County Commuting Flows for the United States and Puerto Rico Sorted by Workplace Geography: 5-year ACS 2016-2020, Residence County to Workplace County Commuting Flows for the United States and Puerto Rico Sorted by Residence Geography: 5-Year ACS 2016-2020

METEOROLOGY

The following wind roses in figure 7 represent this area.

Figure 7: 2021-2023 Wind Roses for the Cincinnati-Wilmington-Maysville OH-KY-IN CSA



Source: AERMET Surface data (Wind Rose data only), U.S. EPA $PM_{2.5}$ Designations Mapping Tool (monitoring sites)

Winds from the south-southwest (the southwest quadrant) are prevalent near the Hamilton and Butler County violating monitoring sites. This indicates that sources of emissions from the southwest quadrant may be contributing to violations at these monitoring sites. However, in both counties, there are violating monitoring sites that are to the southwest of a non-violating monitoring site. This may indicate a component of the violation may be localized to the violating monitoring sites.

The HYSPLIT density maps for the Ohio violating monitoring sites in the Cincinnati-Wilmington-Maysville area (Appendix D pp.2-16) show that most of the air parcels that originate in this area do not tend to travel a large distance over 24 hours, and actually stay in the surrounding counties and area near the violating monitoring sites. This may indicate that any pollutants

emitted in the air near or at the violating sites tend to stay in the area. This further supports that localized sources near the violating monitoring sites could be a component of the violations.

GEOGRAPHY/TOPOGRAPHICAL

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.

JURISDICITONAL BOUNDARIES

Butler, Warren, Clermont, Hamilton, Boone (KY), Kenton (KY), Campbell (KY), and partial Dearborn (IN) Counties were designated as nonattainment for the 1997 annual $PM_{2.5}$ 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 designated nonattainment. Under the 2015 ozone standard, the same counties in Ohio and Kentucky (partial again) were designated as nonattainment; however, Dearborn (IN) County was excluded. This area has since been redesignated to attainment for all these standards. No other counties a part of this analysis have been designated nonattainment for $PM_{2.5}$ or other urban-scale pollutants.

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

COUNCLUSION

Butler, Warren, Clermont, and Hamilton Counties in Ohio have historically been a part of the nonattainment area. Based on 2022 projected emissions, Hamilton and Clermont Counties have higher emissions than Warren and Butler Counties. Overall, the most significant emissions in the analysis area emanate from Hamilton County, then Clermont County, Butler County, and Boone County (KY). Considering all the counties in the analysis area, these four counties account for 53% of $PM_{2.5}$, 62% of NO_X, 44% of NH_3, 83% of SO_2, and 38% of VOC emissions. The largest concentration of larger point sources resides in Hamilton, Clermont, Boone (KY),

Dearborn (IN), and Butler Counties. Miami Fort Power in Hamilton County, Zimmer Power in Clermont County, and Cleveland-Cliffs Steel in Butler County have the highest SO_2, NO_X, and $PM_{2.5}$ emissions of the point sources in Ohio. Also, Duke Energy in Boone County, KY and East KY Power Coop – Spurlock Station in Mason County, KY both had high SO_2, NO_X, and $PM_{2.5}$ emissions. As noted above, the most significant source of emission in Clermont County was Zimmer Power, accounting for 19% of $PM_{2.5}$, 67% of NO_X, and 99% of SO_2 in Clermont County. With the full shutdown of Zimmer Power, after this emissions inventory was created, the most significant emissions from Clermont County are non-point for $PM_{2.5}$ and on-road for NO_x. While Clermont County does have a moderate population compared to the more rural counties in this analysis area and there is moderate commuting between Clermont County and the counties with violating monitoring sites, Ohio EPA does not believe those factors alone warrant including Clermont County in the nonattainment designations. With the full shutdown of Zimmer Power, Ohio EPA does not believe there is justification for inclusion of Clermont County in the nonattainment designations.

Warren County only accounts for 9% of $PM_{2.5}$, 6% of NO_X, 7% of NH_3, 0.2% of SO_2, and 8% of VOC emissions considering all counties in the analysis area. There is only one large point source of NO_X emissions (401 TPY) in Warren County, and it is east and northeast of any of the violating monitoring sites. Therefore, based upon meteorology, likely not a significant contributor. The majority of Warren County emissions are from non-point and on-road 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.

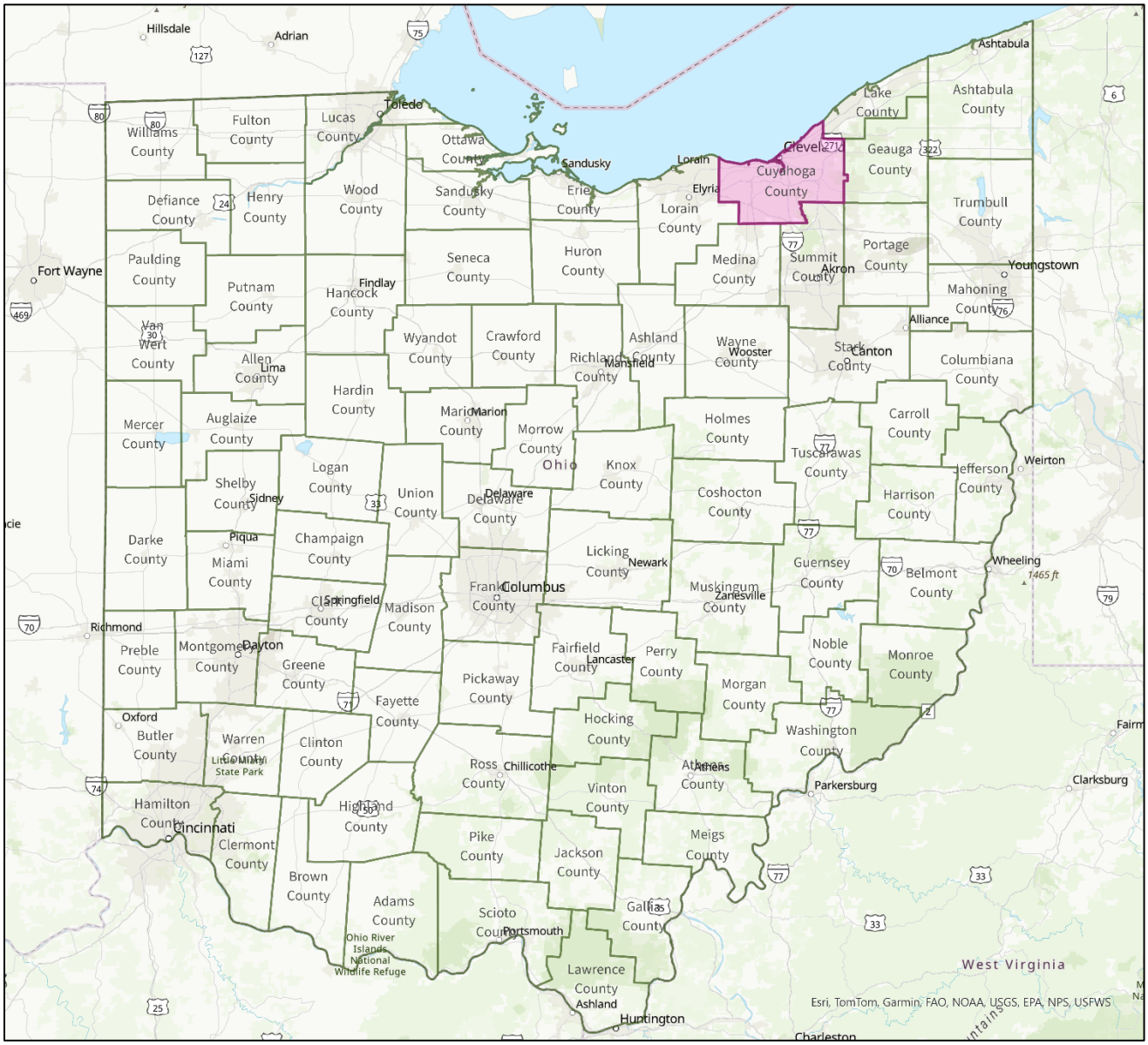
SO_2 and NO_X emissions dominate in the counties with violating monitoring sites and organic carbon dominates at the violating monitors. Accounting for the shutdown of Zimmer Power, Clermont and Warren Counties contribute very little to NO_X and SO_2 emissions in the area.

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

Ohio EPA recommends Hamilton and Butler Counties be designated nonattainment.

Cleveland-Akron-Canton OH CSA

Figure 8: Cleveland-Akron-Canton OH CSA Recommended Nonattainment Area

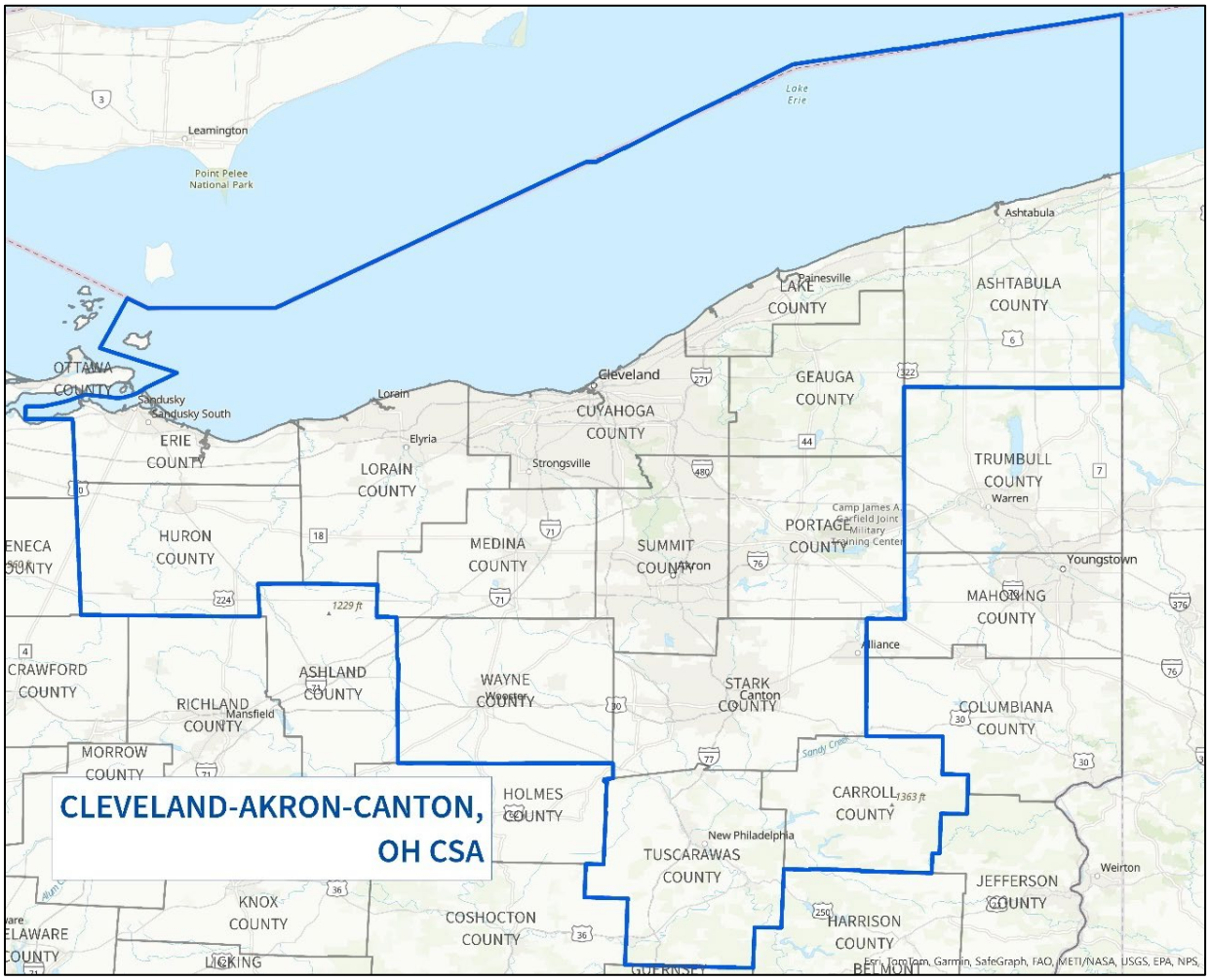


Source: U.S. EPA $PM_{2.5}$ Designations Mapping Tool

DISCUSSION

There are seven counties in this historic 1997 annual $PM_{2.5}$ standard nonattainment area: Ashtabula (partial), Cuyahoga, Lake, Lorain, Medina, Portage, and Summit Counties. These counties, excluding the partial area of Ashtabula County, were part of the 2006 24-hour $PM_{2.5}$ standard nonattainment area. Only Cuyahoga and Lorain Counties were part of the 2012 annual $PM_{2.5}$ standard nonattainment area. Ohio EPA recommends designating Cuyahoga County as nonattainment for the Cleveland-Akron-Canton OH CSA. After considering the five factors, Ohio EPA does not recommend including any other contributing counties in this area.

Figure 9: Cleveland-Akron-Canton OH CSA



Source: U.S. EPA $PM_{2.5}$ Designations Mapping Tool

For the 2021-2023 period, there are twelve monitoring sites in this area of which seven are in Cuyahoga County, two in Summit County, one in Lake County, one in Lorain County and one in Medina County (figure 11). Three of the Cuyahoga County monitoring sites (sites 39-035-0038, -

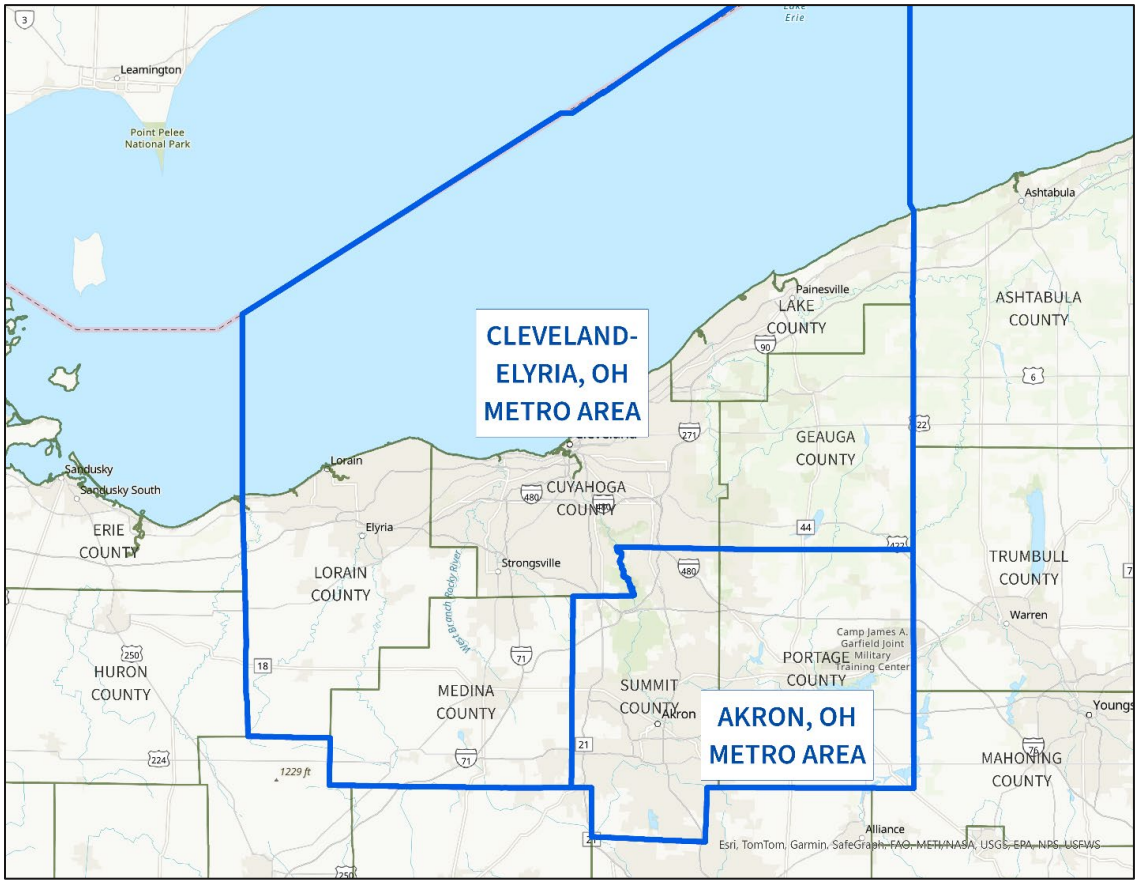
0060, -0065) are violating the revised annual standard. Cuyahoga County is part of the Cleveland-Akron-Canton CSA (figure 9) and Cleveland-Elyria MSA (figure 10) along with Medina, Lorain, Geauga, and Lake Counties. The CSA also includes Summit, Portage, Ashtabula, Stark, Caroll, Wayne, Huron, Erie and Tuscarawas Counties. Summit and Portage Counties are also a part of the Akron MSA (figure 10).

Stark County, along with Caroll, Wayne, and Tuscarawas Counties, have historically been evaluated for nonattainment as a separate area from Cleveland. Therefore, consistent with past practice, Ohio EPA, is analyzing these counties and the Canton-Massillon MSA separately in this document.

Ohio EPA will not be analyzing any additional counties adjacent to the CSA counties because historically those counties have been excluded from the nonattainment area.

Therefore, for the remainder of this analysis area, Ohio EPA will be referring to the Cleveland-Elyria-Akron area, comprised of the Cleveland-Elyria MSA and Akron MSA (figure 10).

Figure 10: Cleveland-Elyria-Akron Analysis Area

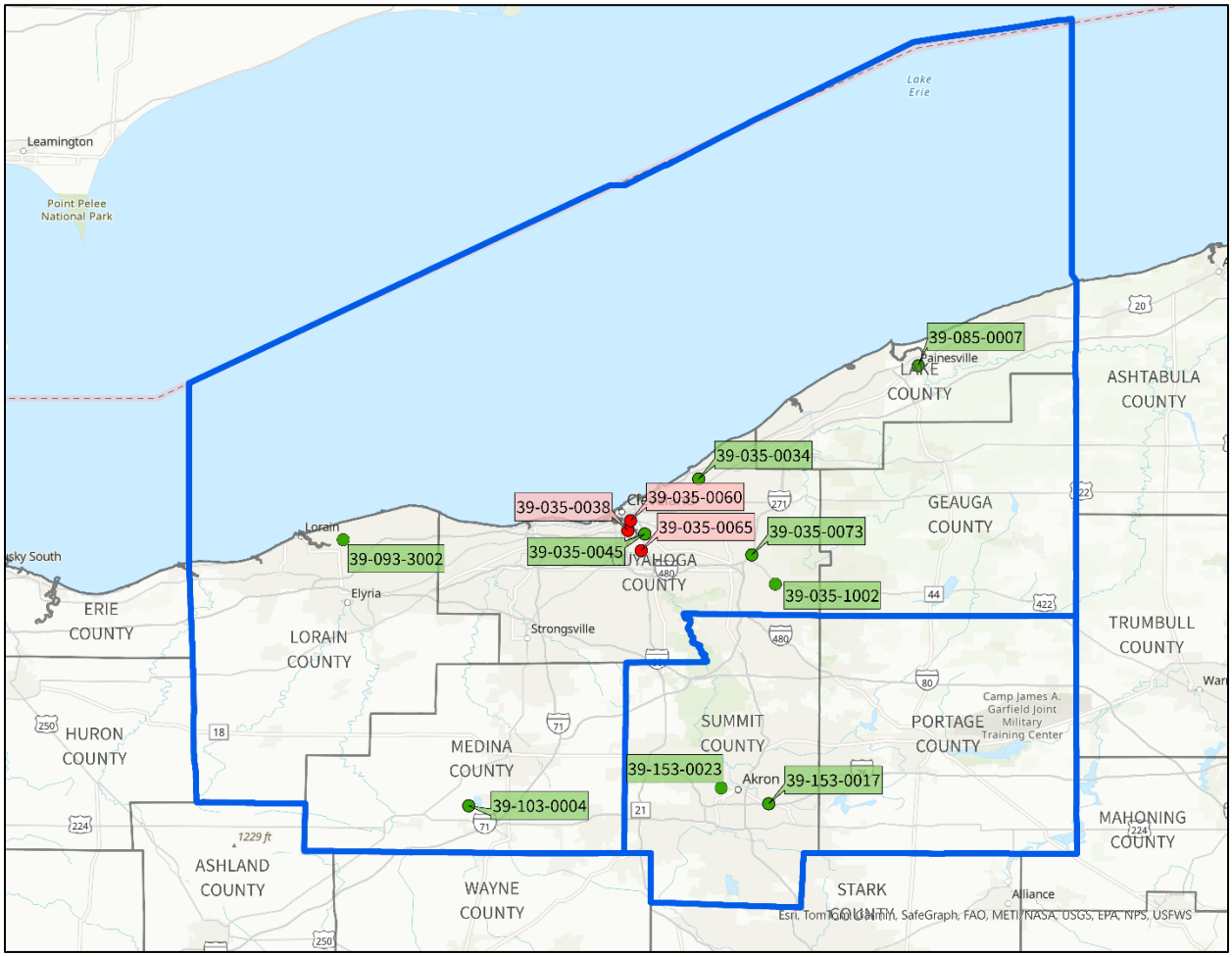


Source: U.S. EPA $PM_{2.5}$ Designations Mapping Tool

AIR QUALITY DATA

For the 2021-2023 period, there were twelve monitoring sites in the Cleveland-Elyria-Akron area.

Figure 11: Cleveland-Elyria-Akron Analysis Area Monitoring Sites



Source: U.S. EPA $PM_{2.5}$ Designations Mapping Tool

As can be seen in table 12, monitoring sites 39-035-0038, -035-0060, and -035-0065 are violating the standard based on 2021-2023 air quality data. The design value for this area is 12.2 µg/m^3.

Monitoring sites 39-035-0038, -0060, and -0065 are located in Cuyahoga County in the central Cleveland area, an industrialized area. As can be seen from tables 1 and 2, air quality trends have declined historically in this area with the exception of 2023 data influenced by wildfire events.

Table 12: Annual Average (µg/m³) for Analysis Area Monitoring Sites

		Annual Averages			3-year Annual Average
County	**Site**	**2021**	**2022**	**2023**	**2021 - 2023**
Cuyahoga	39-035-0034	7.5	6.7	8.4	7.5
	39-035-0038	9.8	8.9	11.2	***10.0***
	39-035-0045	9.9	8.2	8.9	9.0
	39-035-0060	9.7	8.8	11.9	***10.2***
	39-035-0065	12.7	11.0	12.8	***12.2***
	39-035-0073	8.8	7.6	9.1	8.5
	39-035-1002[13]	7.5	6.5		7.0
Lake	39-085-0007	6.9	6.2	8.5	7.2
Lorain	39-093-3002[14]	7.6			7.6
Medina	39-103-0004	6.9	6.3	9.1	7.4
Summit	39-153-0017	8.6	7.9	9.3	8.6
	39-153-0023	8.7	6.8	11.2	8.9

Source: U.S. EPA AQS

Insufficient data ***X.X*** Violating monitor

[13] Site discontinued December 31, 2022

[14] Site discontinued December 16, 2021

As can be seen in table 13, there are six speciation monitoring sites in the Cleveland-Elyria-Akron area being analyzed: four in Cuyahoga County, one in Lorain County, and one in Summit County. Three of the four Cuyahoga County are co-located with the violating monitoring sites.

Table 13: Cleveland-Elyria-Akron Area Speciation Monitors

Site ID	Annual Average	Speciation Monitor SANDWHICH Mass					Site Design Value
		Sulfates	Nitrates	Organic Carbon	Elemental Carbon	Crustal	
39-035-0038 Cuyahoga County	2020	0.88	1.11	1.53	0.56	0.89	8.8
	2021	1.29	1.62	2.05	0.70	1.45	9.8
	2022	1.07	1.27	1.78	0.71	1.53	8.9
	2020-2022 3-year annual average	1.08	1.33	1.79	0.66	1.29	9.2
39-035-0060 Cuyahoga County	2020	1.06	1.17	0.91	1.94	0.78	7.9
	2021	1.25	1.53	2.03	0.72	1.05	9.7
	2022	0.99	1.14	1.84	0.80	1.28	8.8
	2020-2022 3-year annual average	1.10	1.28	1.94	0.77	1.08	8.8
39-035-0065 Cuyahoga County	2020	0.87	1.08	2.69	1.39	0.93	10.4
	2021	1.29	1.55	2.13	0.82	3.67	12.7
	2022	1.06	1.20	1.96	0.68	2.41	11.0
	2020-2022 3-year annual average	1.07	1.28	2.92	1.83	0.81	11.4
39-035-0076[15] Cuyahoga County	2020	0.24	0.58	0.36	0.14	0.13	
	2021	0.83	0.68	0.39	0.16	0.47	
	2022	0.91	1.05	1.68	0.58	0.75	
	2020-2022 3-year annual average	0.66	0.77	0.45	0.81	0.29	
39-093-3002[16] Lorain County	2020	0.66	0.78	1.24	0.36	0.17	6.7
	2021	0.90	0.92	1.47	0.36	0.31	7.6
	2022						
	2020-2022 3-year annual average	0.52	0.57	0.90	0.24	0.16	7.2

Source: CSN speciation data (SANWICHED) from https://www.epa.gov/particle-pollution-designations/particle-pollution-designations-memorandum-and-data-2024-revised#A

Organic carbon tends to dominate at these monitoring sites. The violating monitoring sites in the Cleveland area have a higher fraction of organic carbon whereas the other Cuyahoga County speciation monitoring tends to dominate in elemental carbon and sulfates. Historically,

[15] $PM_{2.5}$ speciation only site

[16] Site discontinued December 16, 2021

sulfate[17] was more dominant than other species. This may be an indication of the significant shutdown of coal fired power plants in the area. Further, site 39-035-0076 has a very low concentrations compared to the other sites, especially the violating sites in Cuyahoga County in the industrialized area. This site is a newer speciation site that was installed south of the Cleveland are violating monitors specifically to act as a background site to the Cleveland industrialized area.

The 2021-2023 urban increments (UI) in table 14 have also been calculated for the three violating monitoring sites.

Table 14: Cleveland-Elyria-Akron Area Urban Increments

2021-2023 Averages		Organic Carbon UI	Elemental Carbon UI	Nitrates UI	Sulfates UI	Crustal UI
Cuyahoga 39-035-0038	Quarter 1	0.80	0.32	1.07	0.46	0.83
	Quarter 2	0.19	0.51	0.00	0.03	1.20
	Quarter 3	1.94	0.46	0.00	-0.11	0.77
	Quarter 4	1.44	0.39	0.53	0.44	1.22
	Annual	1.10	0.42	0.39	0.21	1.01
Cuyahoga 39-035-0060	Quarter 1	1.68	0.34	0.96	0.16	0.41
	Quarter 2	1.62	0.50	0.02	0.10	1.06
	Quarter 3	2.25	0.52	0.00	-0.13	0.87
	Quarter 4	2.15	0.44	0.52	0.30	0.83
	Annual	1.93	0.45	0.36	0.11	0.80
Cuyahoga 39-035-0065	Quarter 1	0.80	0.32	1.07	0.46	0.83
	Quarter 2	0.19	0.51	0.00	0.03	1.20
	Quarter 3	1.94	0.46	0.00	-0.11	0.77
	Quarter 4	1.44	0.39	0.53	0.44	1.22
	Annual	1.10	0.42	0.39	0.21	1.01

Source: https://www.epa.gov/particle-pollution-designations/particle-pollution-designations-memorandum-and-data-2024-revised

Organic carbon UI is higher in quarters 3 and 4 at all monitoring sites. This UI tends to dominate at monitoring site 39-035-0060, higher than the other $PM_{2.5}$ species for all quarters and the annual. There is a significantly higher nitrates UI at all monitoring sites during quarter 1. Quarter 2 tends to have a higher elemental carbon UI for monitoring sites 39-035-0038 and 39-035-0065, whereas quarter 3 has a higher elemental carbon UI for monitoring site 39-035-0060. Quarter 2 has a higher sulfates UI for monitoring sites 39-035-0038 and 39-035-005, whereas quarter 4 has a higher sulfates UI for monitoring site 39-065-0060. Crustal UI is higher in quarter

[17] https://dam.assets.ohio.gov/image/upload/epa.ohio.gov/Portals/27/sip/Designations_2012_PM2.5_standard_Final.pdf

3 at monitoring sites 39-035-0038 and 39-035-0060, and higher in quarter 2 at monitoring site 39-035-0060.

EMISSIONS AND EMISSIONS RELATED DATA

Emission trends

Table 15 presents emissions data for the Cleveland-Elyria-Akron analysis area. The most significant emissions in the analysis area emanates from Cuyahoga County. Cuyahoga County emissions accounts for 25% of the Cleveland-Elyria-Akron analysis area total emissions. Considering all counties in the Cleveland-Elyria-Akron area, Cuyahoga County accounts for 26% of $PM_{2.5}$, 33% of NO_x, 22% of NH_3, 28% of SO_2, and 22% of VOC emissions. The most significant emissions in the analysis area come from Cuyahoga, Summit, and Lorain Counties; although the vast majority of Summit County emissions is non-point emissions whereas Cuyahoga and Lorain Counties are predominantly point emissions. Not as significant are emissions from Lake, Medina, Portage, Geauga and Ashtabula Counties. Huron and Erie Counties do not have significant emissions compared to the above counties. Cuyahoga County has the highest $PM_{2.5}$, NO_x, SO_2, and VOC emissions in the area and is the only county with any violating monitors.

Even though Summit County has the second highest total emissions in the analysis area, both monitoring sites (39-153-0017 and 39-153-0020) are meeting the standard. Summit County is located south-southeast of Cuyahoga County. The non-violating Summit County monitoring sites are located in suburban, residential areas whereas the violating Cuyahoga County monitoring sites are located in urban, commercial/industrial areas.

In Cuyahoga County, the major non-point source sectors for VOC emissions are consumer solvents followed by biogenics. For the rest of the counties in the analysis area, the biogenics sector is the number one non-point source of VOC emissions, followed by the biogenics sector (except for Ashtabula County where the oil and gas production sector is second).

The number one non-point source sector for $PM_{2.5}$ emissions in Cuyahoga County is the commercial cooking sector, followed by the residential wood fuel sector. In Summit County, the residential wood fuel sector has the highest non-point $PM_{2.5}$ emissions, followed by paved road dust. Most of the non-point sources have residential fuel wood as one of the top two sectors for $PM_{2.5}$ emissions in the Cleveland-Elyria-Akron area.

Major on-road sources of NO_x emissions come from heavy duty diesel vehicles (except for Huron County, where it is non-diesel light duty vehicles) in the Cleveland-Elyria-Akron area.

As can be seen in figure 11, two of the violating Cuyahoga County monitors (39-035-0038 and -0060) are located right next to major highways and are also in the industrial area surrounded by the steel industry. The other violating monitor in Cuyahoga County (39-035-0065) is located in the same industrial area dominated by the steel industry. As can be seen in table 16,

Cleveland Cliffs steel facility is the highest point source emitter and Charter Steel facility is the third highest emitter in Cuyahoga County. Together, these two point sources account for 56% of Cuyahoga County's total point source emissions (2,474 TPY out of 4,379 TPY). Lorain County emissions are also dominated by a point source, Avon Lake Power Plant. As will be discussed below, this facility has permanently shut down.

Table 15: Cleveland-Elyria-Akron Area Counties 2022 Emissions Data (TPY)

Cuyahoga	**PM2.5**	***OC***	***EC***	***Sulfate***	***Nitrate***	***Other***	**NOx**	**NH3**	**SO2**	**VOC**
Point	693.59	172.87	34.17	109.18	8.76	368.62	1,971.38	32.91	791.43	889.79
Nonpoint	3,329.23	1,204.42	106.69	42.85	6.79	1,968.48	4,230.05	498.24	63.42	17,174.11
Non-Road	253.68	107.99	57.89	4.74	1.11	81.84	2,122.40	6.82	2.91	2,880.63
On Road	203.35	53.90	73.90	7.66	0.34	67.54	5,233.61	587.23	25.79	2,635.17
Total	4,479.85	1,539.18	272.65	164.43	17.00	2,486.48	13,557.44	1,125.20	883.55	23,579.70
Lorain	**PM2.5**	***OC***	***EC***	***Sulfate***	***Nitrate***	***Other***	**NOx**	**NH3**	**SO2**	**VOC**
Point	318.69	41.83	13.58	40.59	1.88	220.81	1,273.51	2.01	1,582.75	337.54
Nonpoint	1,617.08	531.88	70.56	16.04	4.46	994.15	1,610.77	352.00	37.99	8,710.96
Non-Road	57.03	23.55	14.71	1.32	0.31	17.12	625.78	1.65	0.74	711.75
On Road	47.45	13.10	18.40	1.84	0.08	14.02	1,259.61	139.20	6.27	693.04
Total	2,040.24	610.36	117.25	59.79	6.73	1,246.10	4,769.66	494.84	1,627.74	10,453.30
Lake	**PM2.5**	***OC***	***EC***	***Sulfate***	***Nitrate***	***Other***	**NOx**	**NH3**	**SO2**	**VOC**
Point	70.08	9.90	5.56	11.90	0.48	42.24	584.05	1.41	92.59	303.77
Nonpoint	1,113.89	395.86	50.09	13.15	2.33	652.47	1,170.05	215.62	32.18	5,575.67
Non-Road	46.91	18.87	13.17	1.29	0.29	13.28	634.63	1.67	0.75	574.38
On Road	41.38	11.24	16.27	1.69	0.07	12.10	1,147.18	117.71	5.33	544.07
Total	1,272.27	435.87	85.09	28.03	3.17	720.09	3,535.91	336.41	130.85	6,997.90
Medina	**PM2.5**	***OC***	***EC***	***Sulfate***	***Nitrate***	***Other***	**NOx**	**NH3**	**SO2**	**VOC**
Point	59.43	23.02	1.97	0.99	0.09	33.37	105.94	0.49	147.09	142.93
Nonpoint	1,419.96	422.66	57.14	14.70	4.31	921.15	838.25	313.50	38.58	8,024.94
Non-Road	36.29	14.84	9.86	0.92	0.21	10.44	335.97	1.00	0.40	422.33
On Road	36.11	9.76	15.39	1.73	0.07	9.16	1,106.10	91.72	4.35	448.53
Total	1,551.80	470.28	84.36	18.34	4.68	974.12	2,386.26	406.71	190.42	9,038.72
Summit	**PM2.5**	***OC***	***EC***	***Sulfate***	***Nitrate***	***Other***	**NOx**	**NH3**	**SO2**	**VOC**
Point	39.14	10.34	1.94	2.62	0.35	23.89	171.47	1.63	4.82	379.65
Nonpoint	2,026.38	773.67	82.16	22.86	4.27	1,143.42	1,849.65	394.81	51.16	11,849.79
Non-Road	78.97	33.04	19.20	1.69	0.39	24.62	732.11	2.33	1.00	1,011.94
On Road	92.41	25.50	34.46	3.77	0.16	28.51	2,561.75	287.58	12.57	1,269.89
Total	2,236.90	842.55	137.76	30.94	5.17	1,220.44	5,314.98	686.35	69.55	14,511.26
Portage	**PM2.5**	***OC***	***EC***	***Sulfate***	***Nitrate***	***Other***	**NOx**	**NH3**	**SO2**	**VOC**
Point	168.54	24.81	2.10	9.19	1.02	131.42	117.01	6.78	24.71	407.97

Nonpoint	1,295.17	397.88	56.45	15.54	4.02	821.28	1,126.92	273.37	50.04	8,703.01
Non-Road	35.14	14.91	8.21	0.68	0.16	11.17	360.06	1.01	0.42	650.87
On Road	33.04	9.08	13.80	1.59	0.06	8.50	1,040.47	90.33	4.16	405.24
Total	1,531.90	446.68	80.56	27.00	5.26	972.37	2,644.46	371.50	79.34	10,167.08
Geauga	**PM2.5**	***OC***	***EC***	***Sulfate***	***Nitrate***	***Other***	**NOx**	**NH3**	**SO2**	**VOC**
Point	5.82	1.34	0.33	0.12	0.02	4.01	9.84	0.21	18.95	43.61
Nonpoint	1,123.17	330.68	46.19	11.97	3.09	731.25	423.72	282.35	31.14	5,810.90
Non-Road	37.42	16.09	8.30	0.64	0.16	12.22	288.04	0.89	0.37	516.43
On Road	16.29	4.54	6.57	0.60	0.03	4.55	415.25	42.35	1.97	233.66
Total	1,182.69	352.65	61.39	13.33	3.30	752.03	1,136.85	325.80	52.42	6,604.60
Ashtabula	**PM2.5**	***OC***	***EC***	***Sulfate***	***Nitrate***	***Other***	**NOx**	**NH3**	**SO2**	**VOC**
Point	77.22	15.82	2.48	5.38	0.86	52.68	294.91	4.91	21.33	2,330.62
Nonpoint	1,041.87	291.63	41.68	11.34	4.34	692.78	1,163.55	274.18	30.75	9,413.71
Non-Road	25.47	10.17	7.47	0.72	0.17	6.94	442.04	0.94	0.43	530.77
On Road	24.75	7.02	10.94	1.10	0.05	5.64	878.47	60.66	2.57	368.04
Total	1,169.32	324.64	62.57	18.54	5.42	758.04	2,778.97	340.68	55.08	12,643.15
Huron	**PM2.5**	***OC***	***EC***	***Sulfate***	***Nitrate***	***Other***	**NOx**	**NH3**	**SO2**	**VOC**
Point	24.40	4.37	1.81	1.24	0.16	16.82	211.26	2.59	0.79	1,088.64
Nonpoint	804.01	177.20	28.15	7.87	4.01	586.79	987.08	820.98	14.62	6,230.34
Non-Road	24.18	8.94	8.81	0.96	0.22	5.24	312.05	0.72	0.30	205.88
On Road	10.43	3.01	4.03	0.33	0.02	3.05	298.91	26.99	1.09	216.26
Total	863.02	193.52	42.80	10.40	4.41	611.90	1,809.30	851.28	16.80	7,741.13
Erie	**PM2.5**	***OC***	***EC***	***Sulfate***	***Nitrate***	***Other***	**NOx**	**NH3**	**SO2**	**VOC**
Point	71.03	19.58	7.05	4.07	0.45	39.88	414.22	0.61	59.32	349.20
Nonpoint	667.57	176.58	26.07	6.45	1.97	456.51	1,042.96	122.20	10.88	4,219.92
Non-Road	29.14	12.22	7.27	0.61	0.15	8.88	674.65	1.34	0.61	935.16
On Road	26.05	7.24	11.55	1.32	0.05	5.88	926.73	72.73	3.25	303.97
Total	793.79	215.62	51.94	12.45	2.62	511.15	3,058.56	196.87	74.06	5,808.24

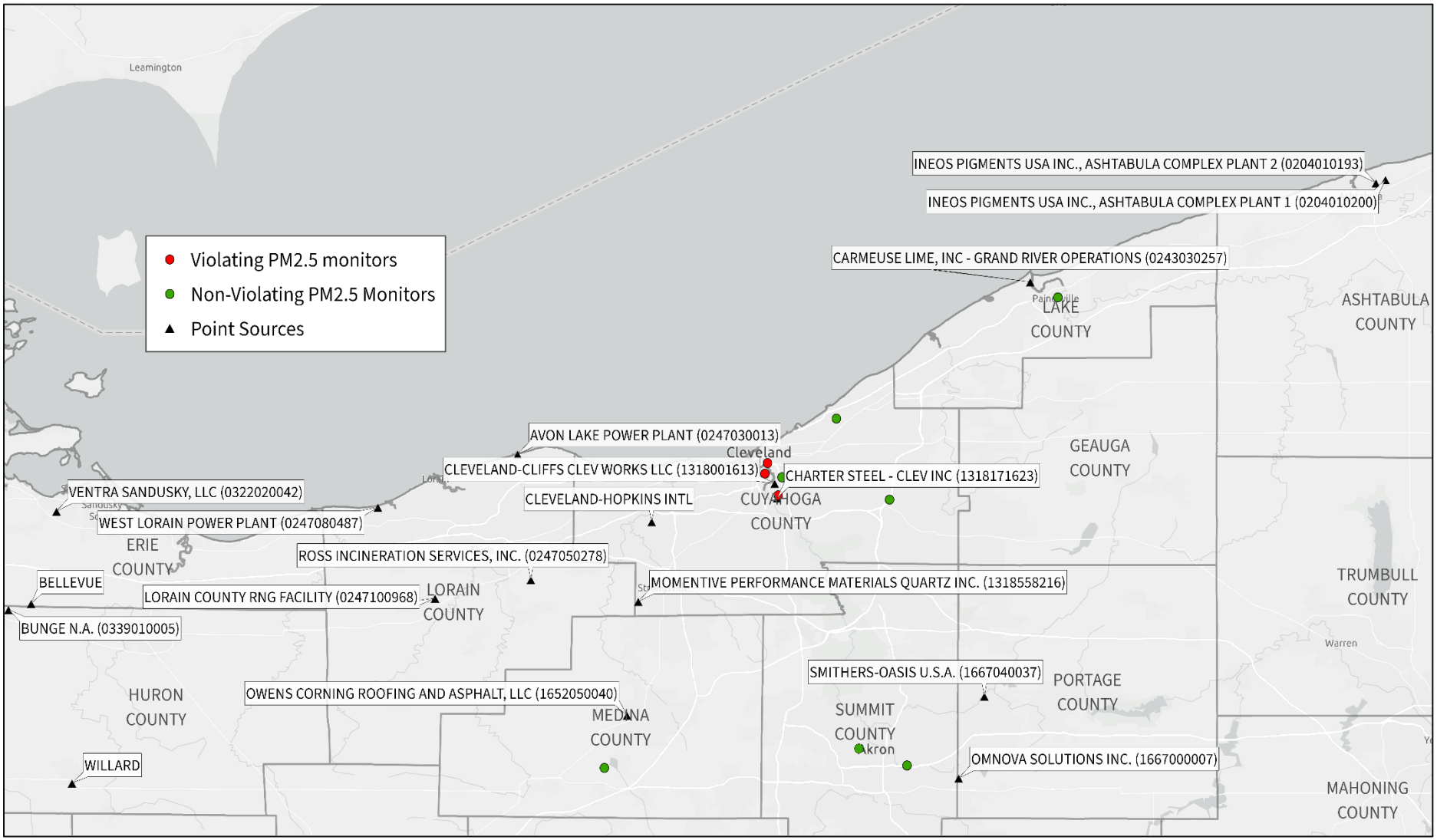
TOTALS	**PM2.5**	***OC***	***EC***	***Sulfate***	***Nitrate***	***Other***	**NOx**	**NH3**	**SO2**	**VOC**
Cuyahoga	4,479.85	1,539.18	272.65	164.43	17.00	2,486.48	13,557.44	1,125.20	883.55	23,579.70
Lorain	2,040.24	610.36	117.25	59.79	6.73	1,246.10	4,769.66	494.84	1,627.74	10,453.30

Lake	1,272.27	435.87	85.09	28.03	3.17	720.09	3,535.91	336.41	130.85	6,997.90
Medina	1,551.80	470.28	84.36	18.34	4.68	974.12	2,386.26	406.71	190.42	9,038.72
Summit	2,236.90	842.55	137.76	30.94	5.17	1,220.44	5,314.98	686.35	69.55	14,511.26
Portage	1,531.90	446.68	80.56	27.00	5.26	972.37	2,644.46	371.50	79.34	10,167.08
Geauga	1,182.69	352.65	61.39	13.33	3.30	752.03	1,136.85	325.80	52.42	6,604.60
Ashtabula	1,169.32	324.64	62.57	18.54	5.42	758.04	2,778.97	340.68	55.08	12,643.15
Huron	863.02	193.52	42.80	10.40	4.41	611.90	1,809.30	851.28	16.80	7,741.13
Erie	793.79	215.62	51.94	12.45	2.62	511.15	3,058.56	196.87	74.06	5,808.24

Source: 2022 EMP from https://www.epa.gov/air-emissions-modeling/2022v1-emissions-modeling-platform

The following figure 12 and table 16 show the higher emitting point sources in the area.

Figure 12: Location of Cleveland-Elyria-Akron Analysis Area Point Sources



Source: 2022 EMP from https://www.epa.gov/air-emissions-modeling/2022v1-emissions-modeling-platform

As can be seen in table 16 below, the point source with the most significant emissions of $PM_{2.5}$, NO_X, and NH_3 is Cleveland-Cliffs Cleveland Works located in Cuyahoga County. Avon Lake Power Company located in Lorain County has the highest emissions of SO_2 in the area, followed by Cleveland-Cliffs Cleveland Works. Cleveland-Cliffs is located between the three violating monitoring sites – south of two sites and north of the other site. Avon Lake Power is located to the west of the violating sites. INEOS Pigments Plant 2 in Ashtabula County has the highest VOC emissions in the analysis area and is located to the northwest of the violating sites. As can be seen in figure 12 above, most of the large point sources are concentrated in and around Cuyahoga County.

Table 16: Cleveland-Elyria-Akron Analysis Area Point Source Emissions for 2022 (TPY)

PM2.5		
Cuyahoga County	Cleveland-Cliffs Cleveland Works LLC (1318001613)	439.27
Lorain County	Avon Lake Power Plant (0247030013)	181.02
Cuyahoga County	Momentive Performance Materials Quartz Inc (1318558216)	94.08
NOx		
Cuyahoga County	Cleveland-Cliffs Cleveland Works LLC (1318001613)	1,032.22
Lorain County	Avon Lake Power Plant (0247030013)	672.00
Lake County	Carmeuse Lime Inc – Grand River Operations (0243030257)	420.12
Cuyahoga County	Cleveland Hopkins Intl	344.71
Erie County	BELLEVUE	298.04
Ashtabula County	INEOS Pigments USA Inc, Ashtabula Complex Plant 2 (0204010193)	215.06
Lorain County	Ross Incineration Services Inc (0247050278)	180.20
Lorain County	West Lorain Power Plant (0247080487)	135.97
Lorain County	Lorain County LFG Power Station (0247100968)	127.44
Huron County	WILLARD	120.29
Cuyahoga County	Charter Manufacturing Company Inc (1318171623)	108.95
NH3		
Cuyahoga County	Cleveland-Cliffs Cleveland Works LLC (1318001613)	13.64
Cuyahoga County	Momentive Performance Materials Quartz Inc (1318558216)	8.07
Portage County	OMNOVA Solutions Inc. (1667000007)	3.22
SO2		
Lorain County	Avon Lake Power Plant (0247030013)	1,550.41
Cuyahoga County	Cleveland-Cliffs Cleveland Works LLC (1318001613)	628.62
Medina County	Owens Corning Roofing and Asphalt LLC (16520550040)	141.79
Cuyahoga County	Charter Manufacturing Company, Inc. (131817623)	63.43
Lake County	Carmeuse Lime Inc – Grand River Operations (0243030257)	55.96
VOC		
Ashtabula County	INEOS Pigments USA Inc, Ashtabula Complex Plant 2 (0204010193)	1,573.28
Huron County	Bunge N.A. (0339010005)	896.51
Ashtabula County	INEOS Pigments USA Inc, Ashtabula Complex Plant 1 (0204010200)	586.47
Portage County	Smithers-Oasis USA (1667040037)	164.86
Erie County	Ventra Sandusky, LLC (0322020042)	101.41

Cuyahoga County	Cleveland-Cliffs Cleveland Works LLC (1318001613)	92.95

Source: 2022 EMP from https://www.epa.gov/air-emissions-modeling/2022v1-emissions-modeling-platform

Level of control of emissions sources

In the Cleveland-Elyria-Akron area, the emission reduction programs which have had or will have the greatest 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
- Various Cross-State Air Pollution Rules (CSAPR)
- Ohio Clean Diesel Initiatives
- Mercury and Air Toxics Standards (MATS)
- Good Neighbor Plan (stayed)
- NSPS for Oil and Gas Production
- Ohio Administrative Code 3745-112 "Consumer Products"
- Ohio Administrative Code 3745-113 "Architectural and Industrial Maintenance (AIM) Coatings"
- Ohio Administrative Code 3745-110 "Nitrogen Oxides – Reasonably Available Control Technology"
- Ohio Administrative Code 3745-21 "Carbon Monoxide, Photochemically Reactive Materials, Hydrocarbons, and Related Materials Standards"
- Ohio Administrative Code 3745-17 "Particulate Matter Standards"

The CSAPR, Good Neighbor Plan, and MATS regulate EGUs, or power plants. The CSAPR program replaced CAIR but has the same objective of reducing power plant emissions that cross state lines to improve air quality. CSAPR was revised and updated in 2017 (replacing the original rule promulgated in 2015) to further reduce summertime NO_x emissions from power plants. The Good Neighbor Plan extends the regulations of CSAPR and CAIR to not only EGUs but also for non-EGU stationary sources beginning in 2026. However, this rule was stayed by the Supreme Court in July of 2024. CAIR and CSAPR have brought about the largest reductions in precursor or primary emissions of $PM_{2.5}$ and its species (sulfates, nitrates, organic carbon, elemental carbon and crustal) and will continue to bring additional reductions. Compliance with the MATS rule also leads to additional reductions in precursor species - in particular, sulfates.

The NSPS for Oil and Gas production was promulgated March 8, 2024, by U.S. EPA, and sets new requirements for crude oil and natural gas production sources to regarding greenhouse gas

(specifically methane), VOC, and SO_2 emissions. All large oil and gas industrial source owners have to March 2029 to comply with new state requirements created under this ruling. Compliance with this rule will lead to reduction in methane, VOC, and SO_2 emissions.

OAC Chapter 3745-112[18] contain requirements for the content of VOCs in consumer products sold, supplied, offered for sale, or manufactured for use in the state of Ohio. These rules were initially promulgated in 2007 as part of Ohio's strategy to attain the 1997 ozone standard by adopting the standards in the model rule developed by the Ozone Transport Commission (OTC). The OTC develops model rules for states to consider when adopting consumer products regulations. This rule was last reviewed and updated in 2022 to strengthen the VOC content requirements consistent with more recent OTC model rules. This update was to assist with attaining and maintaining the 2015 ozone standard.

The rules in OAC Chapter 3745-113[19] contain requirements for the content of VOCs in AIM coatings. These rules were initially promulgated in 2007 as part of Ohio's strategy to attain the 1997 ozone standard by adopting the standards in the model rule developed by the OTC. This rule was last reviewed and updated in 2022 to strengthen the VOC content requirements consistent with more recent OTC model rules. This update was to assist with attaining and maintaining the 2015 ozone standard.

On March 30, 2022, Ohio submitted revisions to the previously submitted SIP for the 2015 ozone standard.[20] These revisions addressed Reasonably Available Control Technology (RACT) requirements for the 2015 ozone standard with respect to one nonattainment area that was bumped-up to moderate nonattainment: the Cleveland OH area (Cuyahoga, Geauga, Lake, Lorain, Medina, Portage and Summit Counties); and one maintenance area: the Ohio portion of the Cincinnati OH-KY area (Butler, Clermont, Hamilton and Warren Counties). For certain source categories, Ohio EPA submitted regulations that establish new or more stringent RACT controls in OAC Chapters 3745-21 (VOC) and 3745-110 (NO_X). The rules in OAC Chapter 3745-110[21] limit the emissions of NO_X from stationary industrial sources such as, but not limited to, boilers, combustion turbines and internal combustion engines. The rules in OAC Chapter 3745-21[22]

[18] The current, effective copy of this rule can be found here: https://epa.ohio.gov/divisions-and-offices/air-pollution-control/regulations/effective-rules/dapc-effective-rules

[19] The current, effective copy of this rule can be found here: https://epa.ohio.gov/divisions-and-offices/air-pollution-control/regulations/effective-rules/dapc-effective-rules

[20] This revision and all related documents to Ohio's 2015 8-hour ozone standard SIP can be found on Ohio EPA's website, https://epa.ohio.gov/divisions-and-offices/air-pollution-control/state-implementation-plans/division-of-air-pollution-control-sip-2015

[21] The current, effective copy of this rule can be found here: https://epa.ohio.gov/divisions-and-offices/air-pollution-control/regulations/effective-rules/dapc-effective-rules

[22] The current, effective copy of this rule can be found here: https://epa.ohio.gov/divisions-and-offices/air-pollution-control/regulations/effective-rules/dapc-effective-rules

establish requirements for the control of emissions of VOCs and carbon monoxide (CO) from stationary emission sources. NO_X and VOC emissions are both precursor pollutants that lead to the formation of ozone. Ohio EPA is currently in the process of further strengthening our RACT rules for the Cleveland area due to the impending bump-up to serious nonattainment.

OAC Chapter 3745-17[23] regulates particulate matter and established RACT for stationary sources under the historical PM_{10} standard. In Cuyahoga County, additional restrictions are in place requiring contingency plan requirements (OAC rule 3745-17-14) and more stringent requirements for select sources (OAC rule 3745-17-12).

With respect to the Ohio utilities, Avon Lake Power Plant (facility ID 0247030013) was an EGU facility located in Lorain County that was permanently shut down April 1, 2022. Prior to the facility's shutdown, it had one coal-fired boiler unit with a design capacity of 6,040 MMBtu/hr. As can be seen from table 15 and table 16 above, the most significant SO_2 emissions and second most significant NO_x and $PM_{2.5}$ emissions from point sources within the area were attributable to Avon Lake Power Plant.

Also, a larger point-source non-utility contributor, Cleveland-Cliffs Cleveland Works LLC (facility ID 1318001613) is an iron and steel mill located in Cuyahoga County. This mill has seven boiler units (three with 336 MMBtu/hr design capacities, one with 467 MMBtu/hr design capacity, one with 388 MMBtu/hr design capacity, and two with 237.5 MMBtu/hr design capacities) currently operating. The 467MMBtu/hr boiler and 388 MMBtu/hr boiler both have PM control equipment (installed 1974 and in 1976, respectively). The three 336 MMBtu boiler units and the 388 MMBtu/hr boiler unit have constant emissions monitoring (installed along with the units). This facility also has three reheat furnaces with no implemented controls; two blast furnaces both with VOC (installed 1943), PM (installed 1972), and CO (installed 1943) control equipment; and two basic oxygen furnaces (with two vessels per furnace) with PM control equipment (installed 1961). Ohio EPA is currently working with this facility to review controls and determine if NO_x RACT requirements will be necessary. As can be seen from table 15 and table 16 above, the most significant $PM_{2.5}$, NO_x, and NH_3 emissions and second most significant SO_2 emissions from point sources within the area are attributable to Cleveland-Cliffs Cleveland Works.

Urbanization, population, and commuting trends

The following table 17 provides a summary of the 2022 population and VMT for each of the counties discussed in this section.

[23] The current, effective copy of this rule can be found here: https://epa.ohio.gov/divisions-and-offices/air-pollution-control/regulations/effective-rules/dapc-effective-rules

Table 17: Cleveland-Elyria-Akron Area 2022 County Level VMT, Population, Land Area, and Population Density

County	VMT	Population	Land Area (sq. miles)	Population Density (1,000 per sq. miles)
Cuyahoga	27,022,350	1,263,667	459	2.75
Lorain	7,392,150	316,268	494	0.64
Lake	5,598,480	231,842	231	1.00
Medina	4,830,98	183,512	423	0.43
Geauga	2,394,490	95,469	408	0.23
Cleveland-Elyria MSA Total	42,407,470	2,090,758	2,015	1.04
Summit	14,431,060	535,882	420	1.28
Portage	4,599,260	161,745	504	0.32
Akron MSA Total	19,030,320	697,627	924	0.76
Ashtabula	2,717,630	97,014	709	0.14
Erie	3,504,490	74,501	255	0.29
Huron	1,215,220	58,218	496	0.12
Total for All Counties	68,875,130	3,018,118	4,399	0.69

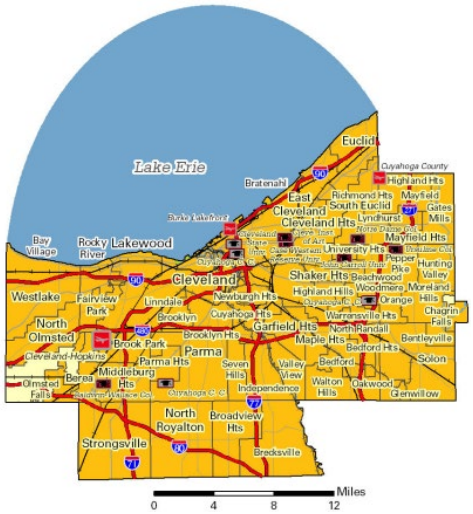
Source: Ohio Department of Transportation (Ohio 2022 VMT data only)
Ohio Department of Development, County Trends and Profiles for 2022 (Ohio populations only)
All other data: U.S. EPA Particle Pollution Designations Memo and Data, https://www.epa.gov/particle-pollution-designations/particle-pollution-designations-memorandum-and-data-2024-revised#A

Degrees of urbanization and population trends

As seen in table 17 above, the majority of the population for this analysis area resides in Cuyahoga County and then next in Summit County. Other more populated counties include Lorain and Lake Counties. Cuyahoga County also has a very high population density; therefore, population related emissions are expected to be high. Summit and Lake Counties also have higher population densities than the other counties in the analysis area. As can be seen in figure 13, the majority of the counties in this area are expected to have declines in population, including Cuyahoga County.

The most urbanized areas are within Cuyahoga and Summit Counties. Their population and population densities are significantly higher than the other counties in the analysis area indicating that population-related emissions in these counties may be high. This is supported by table 15 above, which indicates that these two counties have the highest mobile and non-point emissions compared to the others. Lorain County mobile and non-point emissions are not as high.

Figure 13: Cleveland-Elyria-Akron Analysis Area Ohio County Profiles

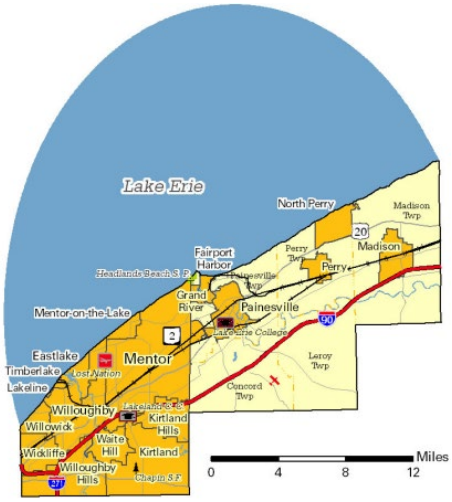


Cuyahoga County

Cuyahoga County is 31% developed - high intensity, 48% developed - low intensity, and 18% forest. Cleveland city is the largest major urban area, and where two of three the violating monitoring sites are located. The other violating monitoring site is located in Newburgh Heights, located 5 miles south of downtown Cleveland. The 2020 county population was 1,264,817 and declined to 1,236,041 in 2022. The population is expected to continually decline in the future to an estimated population of 1,210,921 by 2030.

Lorain County

Lorain County is 30% cropland, 21% forest, and 20% developed - high intensity. Lorain city is the largest major urban area. The 2020 county population was 312,964 and increased to 316,268 in 2022. The population is expected to continually increase in the future to an estimated population of 316,704 by 2030.



Lake County

Lake County is 38% developed - low intensity, 33% forest, and 12% developed - high intensity. Mentor city is the largest major urban area. The 2020 county population was 232,603 and declined to 231,842 in 2022. The population is expected to continually decline in the future to an estimated population of 226,501 by 2030.

Medina County

Medina County is 30% forest, 23% shrub/grasslands, and 20% cropland. Brunswick city is the largest major urban area. The 2020 county population was 182,470 and increased to 183,512 in 2022. The population is expected to continually increase in the future to an estimated population of 186,744 by 2030.

Summit County

Summit County is 41% developed – low intensity, 28% forest, and 16% developed – high intensity. Akron city is the largest major urban area. The 2020 county population was 540,428 and declined to 535,882 in 2022. The population is expected to continually decline in the future to an estimated population of 519,874 by 2030.

Portage County

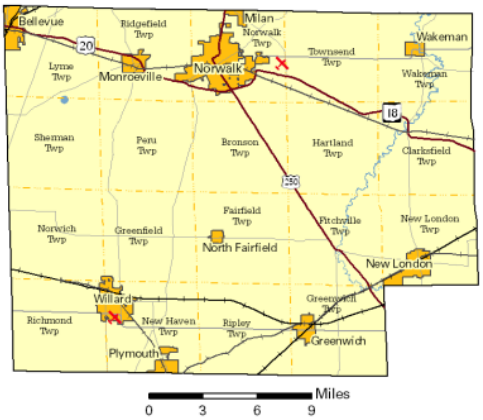
Portage County is 38% forest, 21% pasture, and 16% developed – low intensity. Kent city is the largest major urban area. The 2020 county population was 161,791 and decreased slightly to 161,745 in 2022. The population is expected to continually decline to an estimated population of 153,249 by 2030.

Geauga County

Geauga County is 49% forest, 20% pasture, and 17% developed – low intensity. Bainbridge township is the largest major urban area. The 2020 county population was 95,397 and increased slightly to 95,469 in 2022. The population is expected to continually increase to an estimated population of 96,327 by 2030.

Ashtabula County

Ashtabula County is 41% forest, 18% pasture, and 15% cropland. Ashtabula city is the largest major urban area. The 2020 county population was 97,574 and decreased to 97,014 in 2022. The population is expected to continually decline to an estimated population of 93,604 by 2030.



Huron County

Huron County is 66% cropland, 16% forest, and 7% developed – low intensity. Norwalk city is the largest major urban area. The 2020 county population was 58,565 and decreased slightly to 58,218 in 2022. The population is expected to continually decline to an estimated population of 56,144 by 2030.

Erie County

Erie County is 51% cropland, 18% forest, and 12% developed – low intensity. Sandusky city is the largest major urban area. The 2020 county population was 75,622 and decreased to 74,501 in 2022. The population is expected to continually decline to an estimated population of 70,426 by 2030.

Source: County profile information and maps found at Ohio Department of Development, Research, County Trends, https://development.ohio.gov/about-us/research/county/county-trends

Commuting trends

As seen can be seen in table 17, the majority of VMT occurs in Cuyahoga County and then Summit County, followed by Stark, Lake, and Lorain Counties. Table 18 below looks at commuter travel in and out of the Cuyahoga County, where the violating monitoring sites are located. Only 11% of workers who reside in Cuyahoga County commute to a different county for work. In turn, about 27% of workers who work in Cuyahoga County live in an outside county. Of the Cuyahoga County residents, the greatest percentage commutes south to Summit County (3.1%), northeast to Lake County (2.3%), and west to Lorain County (2%). Of the non-residents who commute into Cuyahoga County for work, the majority comes from Lorain County (6.2%), Summit County (4.9%) and Lake County (4.9%). Overall, the most significant commuter travel in and out of these counties occurs between Cuyahoga, Summit, Lorain, and Lake Counties.

Table 18: Commuter Travel In and Out of Cuyahoga County

Cuyahoga	**% workers live in Cuyahoga work outside Cuyahoga Co**				11.0%
	% workers work in Cuyahoga live outside Cuyahoga Co				26.8%
# workers living in Cuyahoga		582,120	**# workers working in Cuyahoga**		708,092
Place of Work	**#**	**%**	**Place of Residence**	**#**	**%**
Summit County	18,029	3.1%	Lorain County	44,058	6.2%
Lake County	13,326	2.3%	Summit County	35,608	4.9%
Lorain County	11,538	2.0%	Lake County	34,882	4.9%
Medina County	6,457	1.1%	Medina County	26,801	3.8%
Geauga County	3,597	0.6%	Geauga County	14,611	2.1%
Portage County	2,927	0.5%	Portage County	10,507	1.5%
Stark County	786	0.14%	Stark County	3,198	0.5%

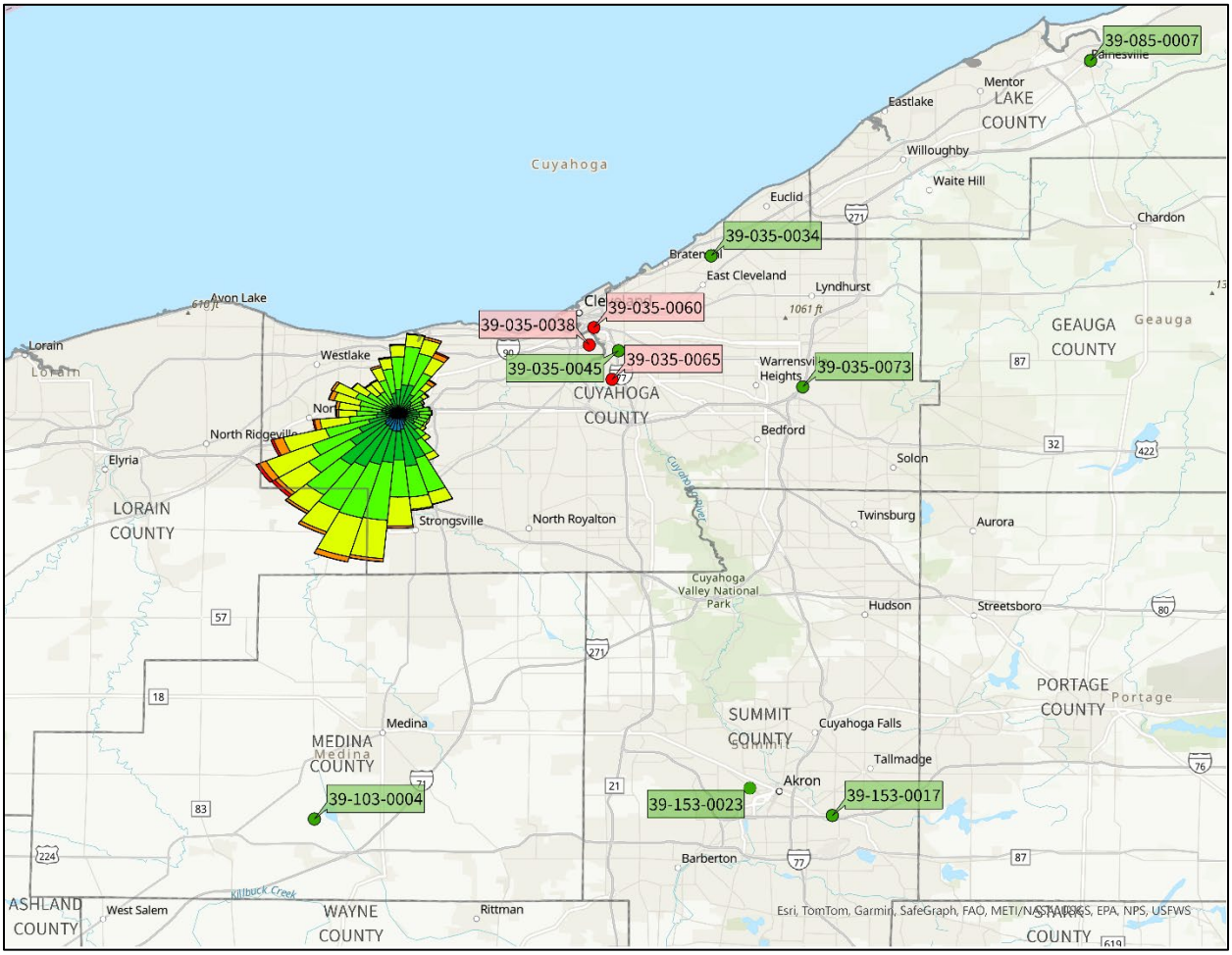
Source: U.S. Department of Commerce Economics and Statistics Administrations, U.S. Census Bureau, Residence County to Workplace County Commuting Flows for the United States and Puerto Rico Sorted by Workplace Geography: 5-year ACS 2016-

2020, Residence County to Workplace County Commuting Flows for the United States and Puerto Rico Sorted by Residence Geography: 5-Year ACS 2016-2020

METEOROLOGY

The following wind rose in figure 14 represents this area.

Figure 14: 2021-2023 Wind Roses for the Cleveland-Elyria-Akron Analysis Area



Source: AERMET Surface data (Wind Rose data only), U.S. EPA $PM_{2.5}$ Designations Mapping Tool (monitoring sites)

Winds from the southwest quadrant are prevalent near the Cleveland-Elyria-Akron area monitoring sites. However, given the nature of the location of the violating monitors in close proximity to the industrialized steel area in Cleveland, Ohio EPA anticipates very localized impacts.

The HSYPLIT density maps for the violating monitoring sites in the Cleveland-Elyria-Akron area (Appendix D pp.17-23) show that most of the air parcels that originate in this area do not tend to travel a large distance over 24 hours, and actually stay in the surrounding counties and area near the violating monitoring sites. This may indicate that any pollutants emitted in the air near

or at the violating sites tend to stay in the area. This further supports that localized sources near the violating monitoring sites could be a component of the violations.

GEOGRAPHY/TOPOGRAPHICAL

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.

JURISDICTIONAL BOUNDARIES

Cuyahoga and Lorain Counties were designated as nonattainment for the 2012 annual $PM_{2.5}$ standard. Lake, Lorain, Cuyahoga, Medina, Summit, and Portage Counties were designated as nonattainment for the 2006 24-hour $PM_{2.5}$ standard. Lake, Lorain, Cuyahoga, Medina, Summit, and Portage Counties, and a partial area of Ashtabula County were designated as nonattainment under the 1997 annual $PM_{2.5}$ standard. With respect to the 1997 and 2008 ozone standards, Lake, Lorain, Cuyahoga, Medina, Summit, Portage, Ashtabula, and Geauga Counties were designated as nonattainment. These areas have been redesignated to attainment for the 1997 annual and 2006 24-hour $PM_{2.5}$ standards and 1997 ozone standards. For the most recent 2015 ozone standard, Lake, Lorain, Cuyahoga, Medina, Summit, Portage, and Geauga Counties were designated nonattainment as part of the Cleveland OH nonattainment area and have not yet been redesignated to attainment. No other counties a part of this analysis have been designated nonattainment for $PM_{2.5}$ or other urban-scale pollutants.

Cuyahoga County is part of the Cleveland-Akron-Canton CSA which is comprised of the Cleveland-Elyria MSA (Cuyahoga, Lake, Lorain, Medina, and Geauga Counties), the Akron MSA (Summit and Portage Counties), the Canton-Massillon MSA (Stark and Carroll Counties) and Ashtabula, Tuscarawas, Wayne, Erie, and Huron Counties.

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 for the 1997 annual and 2006 24-hour $PM_{2.5}$ standards. For the most recent 2012 annual $PM_{2.5}$ standard, only Cuyahoga and Lorain Counties were nonattainment.

Ashtabula County was a part of the designations of nonattainment under the 1997 annual $PM_{2.5}$ standard but not the 2006 24-hour or 2012 annual $PM_{2.5}$ standard. Under the 1997 annual $PM_{2.5}$

standard, a coal-fired power plant existed in Ashtabula County but since shutdown. Now, emissions in Ashtabula County are dominated by nonpoint emissions. It is unlikely these emissions have any impact on the violating monitoring in Cuyahoga County, given the significant distance and predominant wind pattern being in the opposite direction.

As was the case with the 1997 annual, 2006 24-hour, and 2012 annual $PM_{2.5}$ 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. It is unlikely these emissions have any impact on the violating monitoring in Cuyahoga County, given the distance and predominant wind pattern being in the opposite direction.

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

The remaining counties include Cuyahoga (three violating monitoring sites in Cleveland), Lorain (non-violating monitoring site), Lake (non-violating monitoring site), Medina (non-violating monitoring site), Summit (two non-violating monitoring sites) and Portage (no monitoring sites) Counties. These counties were designated as nonattainment as part of the 2006 24-hour $PM_{2.5}$ standard but only Cuyahoga and Lorain Counties as a part of the 2012 annual $PM_{2.5}$ standard. Although emissions and commuter travel from Lake, Medina, Summit and Portage Counties is larger than those from Huron and Erie Counties, they are not significant enough to warrant inclusion in the nonattainment area, just as was the case under the 2012 annual $PM_{2.5}$ standard.

Just as under the 2012 annual $PM_{2.5}$ standard, only Cuyahoga County contains monitoring sites not attaining the revised annual standard. As identified in the Cleveland-Elyria-Akron's analysis above, these monitoring sites are all located geographically in the heart of the Cleveland metropolitan/industrial area. Figure 12 demonstrates the significant amount of point source emissions condensed nearby the violating monitoring sites. Cuyahoga County has by far the highest population in the area, although projected to steadily decline in the future, and the highest VMT.

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

Cuyahoga County has the highest emissions in the analysis area compared to the other counties, followed by Lorain County. Most of Lorain County's emissions come from non-point sources and then to a lesser extent point sources.

For the 2012 annual $PM_{2.5}$ standard, U.S. EPA recommended Lorain County as part of the Cleveland nonattainment area due to Lorain County's high emissions. Avon Lake Power Plant, located in Lorain County, had the second largest point source emissions in the area and contributed significantly to Lorain County's emissions. It was also noted that since Lorain County was southwest of Cleveland, Lorain County was considered a "considerable contributor to the violating monitoring sites in Cleveland".[24] Lorain County emissions have decreased significantly (from 59,215 TPY in 2014 to 19,386 TPY in 2022), and Avon Lake Power Plant shut down April 1, 2022. Although emissions from Avon Lake are included in the emissions data presented in this document, Ohio EPA expects significant reductions in Lorain County point emissions due to the full shutdown. While Lorain County commuter travel into Cuyahoga is the highest at 6.2%, Ohio EPA does not believe the sole reason for inclusion of Lorain County should be based upon limited commuter travel.

As discussed above, the speciation data for the Cuyahoga County monitoring sites indicate a large organic carbon component, which tends to be from local sources. Historically sulfate was more dominant than other species. This may be an indication of the significant shutdown of coal fired power plants in the area. Further, site 39-035-0076 has a very low concentrations compared to the other sites, especially the violating sites in Cuyahoga County in the industrialized area. This site is a newer speciation site that was installed south of Cleveland specifically to act as a background site to the Cleveland industrialized area.

Ohio EPA continues to believe this revised annual $PM_{2.5}$ nonattainment area should be limited to Cuyahoga County.

[24] U.S. EPA's (120-day) response to Ohio's Recommended Nonattainment Area Designations for the 2012 PM2.5 Annual Standard, https://dam.assets.ohio.gov/image/upload/epa.ohio.gov/Portals/27/sip/05_OH_120resp_8-19-14.pdf

Canton-Massillon OH MSA

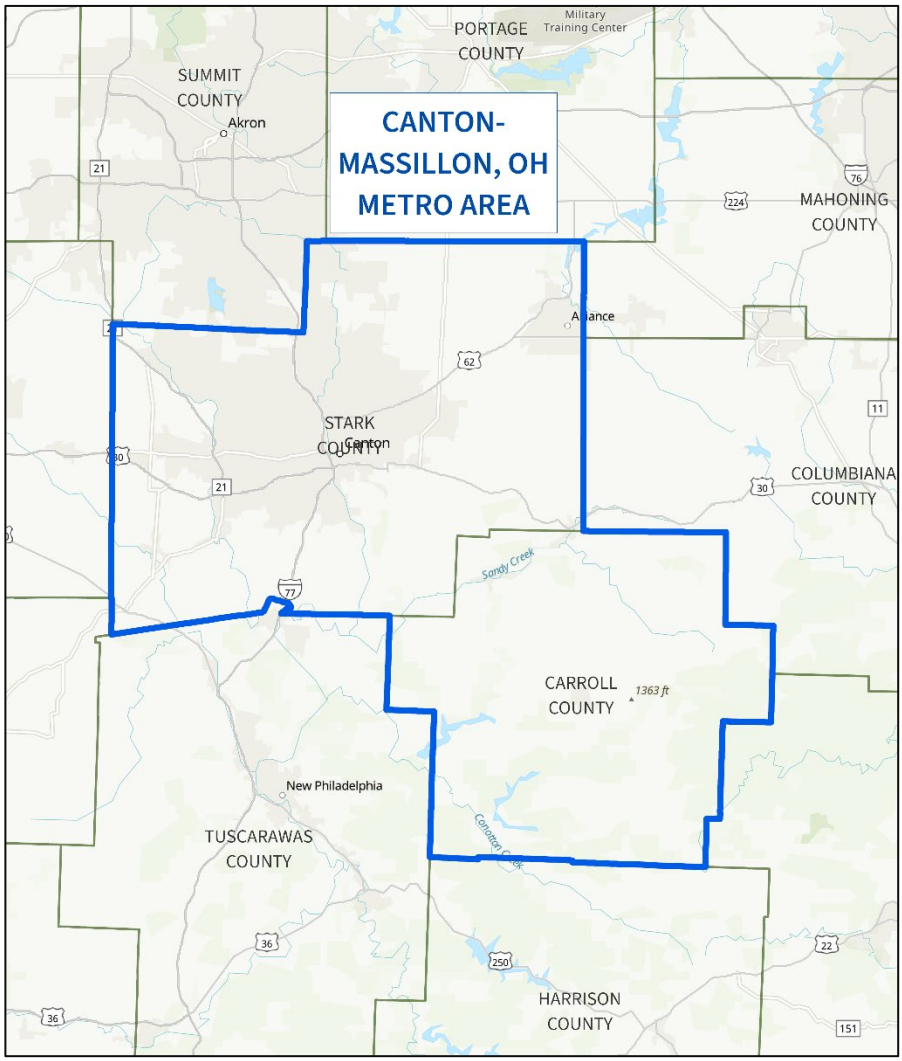
Figure 15: Canton-Massillon OH MSA Recommended Unclassifiable Area

Source: U.S. EPA $PM_{2.5}$ Designations Mapping Tool

DISCUSSION

There is one county in this historic 1997 annual and 2006 24-hour $PM_{2.5}$ nonattainment area: Stark County. Ohio EPA cannot make a recommendation regarding attainment or nonattainment for the Canton-Massillon area with the available 2021-2023 air quality data. Therefore, Ohio EPA is recommending Stark County as unclassifiable. After considering the five factors, Ohio EPA does not recommend adding any contributing counties to this area.

Figure 16 Canton-Massillon OH MSA



Source: U.S. EPA $PM_{2.5}$ Designations Mapping Tool

As seen in figure 17, Stark County contains two monitoring sites, both of which are violating the annual revised standard (site 39-151-0017 and 39-151-0020). Stark County is part of the Canton-Massillon, OH MSA along with Carroll County (figure 16).

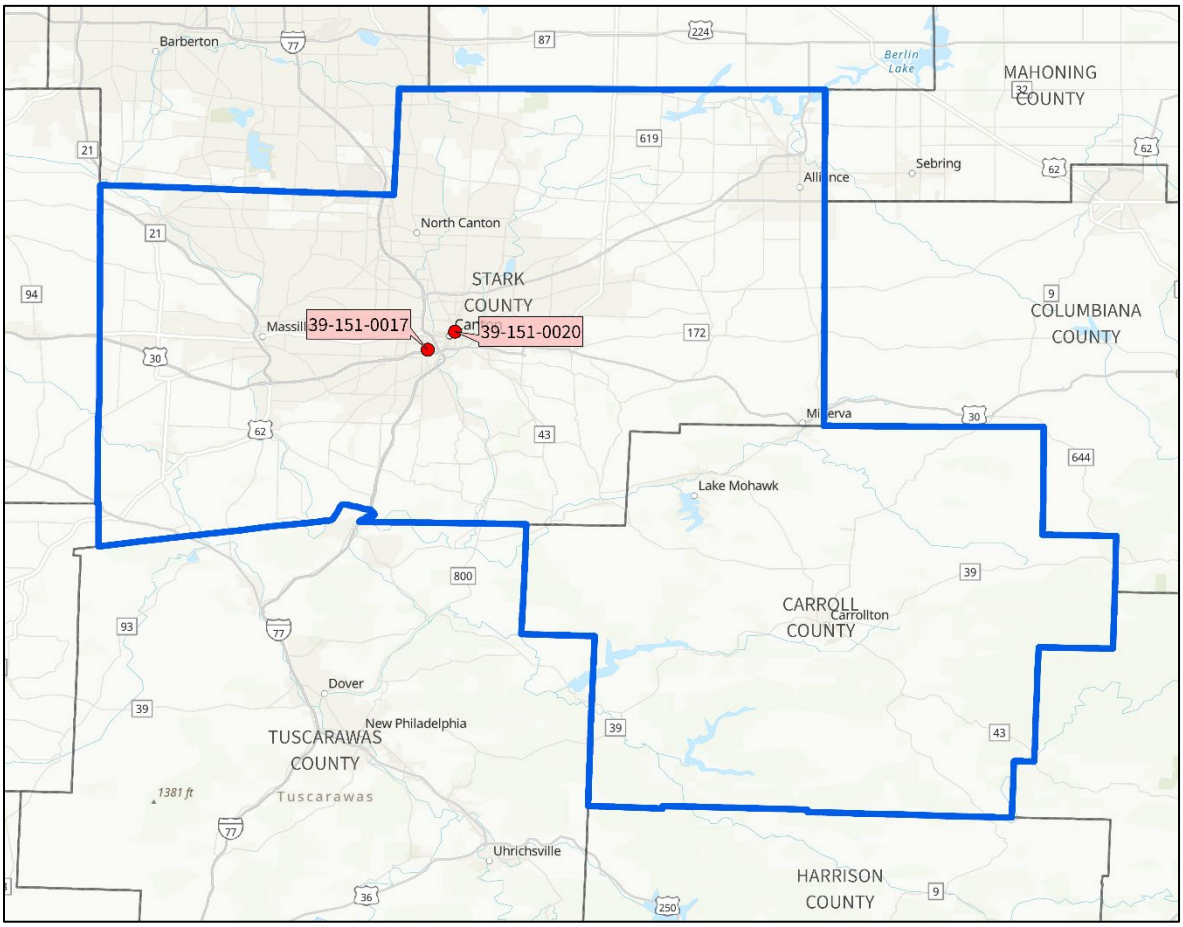
There are nine counties adjacent to the Canton-Massillon, OH MSA: Wayne, Holmes, Tuscarawas, Harrison, Jefferson, Columbiana, Mahoning, Portage, and Summit Counties.

Portage and Summit Counties are discussed in the Cleveland-Akron-Elyria area analysis while Jefferson and Harrison Counties are discussed in the Steubenville-Weirton area analysis.

AIR QUALITY DATA

For the 2021-2023 period, there are two Ohio monitoring sites in this area.

Figure 17: Canton-Massillon OH MSA Monitoring Sites



Source: U.S. EPA $PM_{2.5}$ Mapping Designations Tool

As can be seen in table 19, monitoring sites 39-151-0017 and 39-151-0020 in Stark County are both violating the standard based on 2021-2023 air quality data. The design value for the area is 9.5 µg/m^3. As can be seen from tables 1 and 2, air quality trends have historically declined in this area with the exception of 2023 data influenced by wildfire events.

On January x, 2025, Ohio EPA submitted to U.S. EPA an exceptional events demonstration for both monitoring sites requesting the exclusion of certain daily $PM_{2.5}$ values affected by regulatorily significant summer 2023 Canadian wildfire smoke events discussed above. These sites experienced high daily $PM_{2.5}$ values during these events leading to higher design values and based on the discussion below, will have regulatory significance with respect to these

recommended designations. As can be seen in table 19, approved requests for the exclusion of seven daily $PM_{2.5}$ values at site 39-151-0017 and ten daily $PM_{2.5}$ values at site 39-151-0020 due to impacts from regulatorily significant wildfire smoke-driven $PM_{2.5}$ episodes would result in site 39-151-0020 having a new 2021-2023 annual design value of 8.7 µg/m³, indicating attainment, and site 39-151-0017 having a new 2021-2023 annual design value of 9.0 µg/m³, although the design value would be invalid and therefore ineligible for comparison against the 2024 $PM_{2.5}$ annual NAAQS since it does not meet the data completeness criteria and cannot use the data substitution test per 40 CFR 50, Appendix N, Paragraph 4.1(c)(ii).

Table 19: Annual Average (µg/m³) for Analysis Area Monitoring Sites

		Annual Averages			2021-2023 3-year Annual Average	
County	**Site ID**	**2021**	**2022**	**2023**	**Before EE**	**After EE**
Stark OH	39-151-0017	9.4	8.2	11.0	***9.5***	9.0
	39-151-0020	9.4	7.9	10.3	***9.2***	8.7

Source: U.S. EPA AQS

Insufficient data ***X.X*** Violating monitor

Site 39-151-0017 currently has a valid 2021-2023 $PM_{2.5}$ annual design value but does not meet the completeness criteria for the 2021 annual average, as the first quarter of data year 2021 had ten creditable samples, representing less than 50% data capture. When applying the data substitution test for the first quarter of data year 2021, per 40 CFR Part 50, Appendix N, Paragraph 4.1(c)(i), the test design value passes the data substitution test, so the valid design value of 9.5 µg/m³ is maintained. Ohio EPA then recalculated the $PM_{2.5}$ annual design value for site 39-151-0017 without the seven $PM_{2.5}$ daily values affected by wildfire smoke events that will be requested for exclusion in an exceptional events demonstration, resulting in a new 2021-2023 $PM_{2.5}$ annual design value of 9.0 µg/m³. However, per 40 CFR Part 50, Appendix N, Paragraph 4.1(c)(ii), the data substitution test can only be used to validate a calculated design value at or below the level of the standard if every quarter has at least 50% data capture, and the first quarter of data year 2021 does not meet this data completeness threshold. The new 2021-2023 $PM_{2.5}$ annual design value of 9.0 µg/m³ for site 39-151-0017 is therefore deemed invalid to use for regulatory purposes. These details will be provided in Ohio's exceptional events demonstration, which is being worked on concurrently with this document.

It should be noted, when 2024 data is complete and a 2022-2024 annual design value is available for this site, it is expected that the design value will be valid with the removal of the incomplete 1st quarter 2021 data. Furthermore, based on 2022 data, 2023 data with Ohio's approved exceptional events demonstration, 2024 data collected to date, and considering historical data during non-wildfire event periods, Ohio EPA believes the 2022-2024 design value will meet the revised annual $PM_{2.5}$ standard.

As can be seen in table 20, there is one speciated $PM_{2.5}$ monitoring site in this area. It is co-located with the violating monitoring site 39-151-0017.

Table 20: Canton-Massillon Area Speciation Monitoring Sites

Site ID	Annual Averages	Speciation Monitor SANDWICH Mass					Site Design Value
		Sulfate	Nitrate	Organic Carbon	Elemental Carbon	Crustal	
39-151-0017 Stark County	2020	0.26	0.48	0.36	0.16	0.12	8.3
	2021	0.89	0.63	1.98	0.61	0.65	9.4
	2022	0.97	1.01	1.98	0.72	0.90	8.2
	2020-2022 3-year average	0.71	0.71	1.44	0.50	0.55	8.6

Source: CSN speciation data (SANDWICHED) from https://www.epa.gov/particle-pollution-designations/particle-pollution-designations-memorandum-and-data-2024-revised#A

Organic carbon dominates at this monitoring site. Sulfate and nitrate both also have a strong presence.

The 2021-2023 urban increments (UI) in table 21 have also been calculated for one of the violating monitoring sites.

Table 21: Canton-Massillon Area Urban Increments

2021-2023 Averages		Organic Carbon UI	Elemental Carbon UI	Nitrates UI	Sulfates UI	Crustal UI
Stark 39-151-0017	Quarter 1	2.69	0.37	0.81	0.08	0.55
	Quarter 2	4.14	0.71	0.00	0.09	0.39
	Quarter 3	3.22	0.59	0.00	-0.25	0.50
	Quarter 4	2.53	0.52	0.28	0.06	0.49
	Annual	3.18	0.56	0.23	-0.01	0.48
Stark 39-151-0020	Quarter 1	2.69	0.37	0.81	0.08	0.55
	Quarter 2	4.14	0.71	0.00	0.09	0.39
	Quarter 3	3.22	0.59	0.00	-0.25	0.50
	Quarter 4	2.53	0.52	0.28	0.06	0.49
	Annual	3.18	0.56	0.23	-0.01	0.48

Source: https://www.epa.gov/particle-pollution-designations/particle-pollution-designations-memorandum-and-data-2024-revised

Organic carbon UI tends to dominate throughout all quarters at both monitoring sites, peaking in quarter 2 along with the elemental carbon UI and sulfates UI. Nitrates UI and crustal UI are the highest in quarter 1 at both monitoring sites.

EMISSIONS AND EMISSIONS RELATED DATA

Emission trends

Table 22 presents emissions data for the Canton-Massillon MSA. Overall, the most significant emissions in the Canton-Massillon analysis area emanate from Stark County. Considering all the counties in the analysis area, Stark County accounts for 21% of the Canton-Massillon total area emissions: 27% of $PM_{2.5}$, 27% of NO_X, 10% of NH_3, 11% of SO_2, and 20% of VOC emissions. Stark County has the highest $PM_{2.5}$, NO_X, and VOC emissions in the area.

Tuscarawas County, located to the south of the violating monitoring sites, has the second highest emissions in the Canton-Massillon area, with the highest (51%) SO_2 emissions and second highest (16%) VOC emissions. Wayne County, located to the west of the violating monitoring sites, also has high emissions compared to the other counties in the area and has the highest (34%) NH_3 emissions. The majority of emissions in Wayne and Tuscarawas County come from point and nonpoint sources.

Mahoning County also has high emissions compared to the other counties but is located to the east of the violating monitoring sites. The one monitoring site located in Mahoning County is also meeting the standard.

In the Canton-Massillon analysis area, the biggest non-point sector for VOC emissions is biogenics followed by oil and gas production, except for Stark and Mahoning Counties where commercial solvents are second to biogenics. Most of the non-point sources has biogenics as one of the top two sectors for NO_X emissions in the Canton-Massillon analysis area (Mahoning County is the only outlier in this conclusion). The number one non-point source sector for $PM_{2.5}$ emissions in Stark County is the residential wood fuel sector, followed by paved road dust. In Carroll County, the crops and livestock dust have the highest non-point $PM_{2.5}$ emissions, followed by residential wood fuel. All of the non-point sources in the analysis area have residential fuel wood as one of the top two sectors for $PM_{2.5}$ emissions. The biggest non-point sector for NH_3 emissions is livestock waste for all analysis counties.

Table 22: Canton-Massillon MSA Counties 2022 Emissions Data (TPY)

Stark	**PM2.5**	***OC***	***EC***	***Sulfate***	***Nitrate***	***Other***	**NOx**	**NH3**	**SO2**	**VOC**
Point	385.65	49.27	14.39	48.48	2.75	270.76	971.98	24.09	536.92	607.53
Nonpoint	2,187.87	706.10	87.19	26.85	8.00	1,359.72	1,612.13	681.23	79.28	11,467.79
Non-Road	105.58	44.23	25.90	2.26	0.53	32.62	869.20	2.74	1.15	1,124.38
On Road	56.17	15.77	21.13	1.97	0.10	17.21	1,535.01	162.96	6.91	1,048.14
Total	2,735.28	815.37	148.61	79.56	11.38	1,680.31	4,988.32	871.02	624.25	14,247.84
Carroll	**PM2.5**	***OC***	***EC***	***Sulfate***	***Nitrate***	***Other***	**NOx**	**NH3**	**SO2**	**VOC**
Point	164.63	74.16	11.23	15.90	3.98	59.37	727.65	169.37	19.91	324.92
Nonpoint	463.20	117.18	15.24	6.18	3.84	320.77	476.77	209.27	646.21	7,559.81
Non-Road	8.35	3.35	2.44	0.23	0.06	2.27	106.03	0.23	0.09	136.29
On Road	5.36	1.52	2.36	0.20	0.01	1.26	164.72	11.84	0.51	100.26
Total	641.54	196.21	31.27	22.51	7.89	383.67	1,475.17	390.71	666.71	8,121.29
Wayne	**PM2.5**	***OC***	***EC***	***Sulfate***	***Nitrate***	***Other***	**NOx**	**NH3**	**SO2**	**VOC**
Point	203.91	20.24	4.70	45.94	1.20	131.84	416.02	13.40	924.88	317.76
Nonpoint	1,461.00	354.43	49.21	20.16	16.22	1,020.98	922.10	2,930.92	34.66	8,553.61
Non-Road	36.93	13.65	13.44	1.47	0.34	8.03	468.29	1.09	0.46	238.76
On Road	23.21	6.88	9.90	0.91	0.05	5.47	790.82	64.15	2.65	408.42
Total	1,725.05	395.20	77.25	68.48	17.81	1,166.32	2,597.24	3,009.56	962.66	9,518.56
Holmes	**PM2.5**	***OC***	***EC***	***Sulfate***	***Nitrate***	***Other***	**NOx**	**NH3**	**SO2**	**VOC**
Point	30.48	10.35	2.75	1.19	0.19	16.00	281.63	3.31	12.73	564.43
Nonpoint	754.08	195.12	27.59	11.97	10.04	509.36	451.10	1,907.36	22.71	8,061.57
Non-Road	17.49	6.39	6.59	0.72	0.17	3.61	230.84	0.47	0.20	123.67
On Road	7.67	2.19	3.26	0.26	0.02	1.94	235.11	17.34	0.73	116.02
Total	809.72	214.05	40.19	14.14	10.42	530.91	1,198.68	1,928.48	36.36	8,865.69
Tuscarawas	**PM2.5**	***OC***	***EC***	***Sulfate***	***Nitrate***	***Other***	**NOx**	**NH3**	**SO2**	**VOC**
Point	120.94	33.87	6.66	10.79	1.91	67.70	959.72	11.51	2,950.42	651.67
Nonpoint	951.77	273.94	34.52	12.47	7.38	623.48	659.22	951.00	23.76	10,338.68
Non-Road	16.43	6.41	5.09	0.52	0.12	4.30	207.87	0.49	0.22	180.98
On Road	22.41	6.49	9.75	0.98	0.05	5.15	791.29	58.08	2.45	370.14
Total	1,111.55	320.71	56.02	24.76	9.46	700.63	2,618.10	1,021.09	2,976.86	11,541.47
Columbiana	**PM2.5**	***OC***	***EC***	***Sulfate***	***Nitrate***	***Other***	**NOx**	**NH3**	**SO2**	**VOC**
Point	239.11	86.85	13.30	23.54	4.69	110.73	292.76	70.01	22.20	112.69

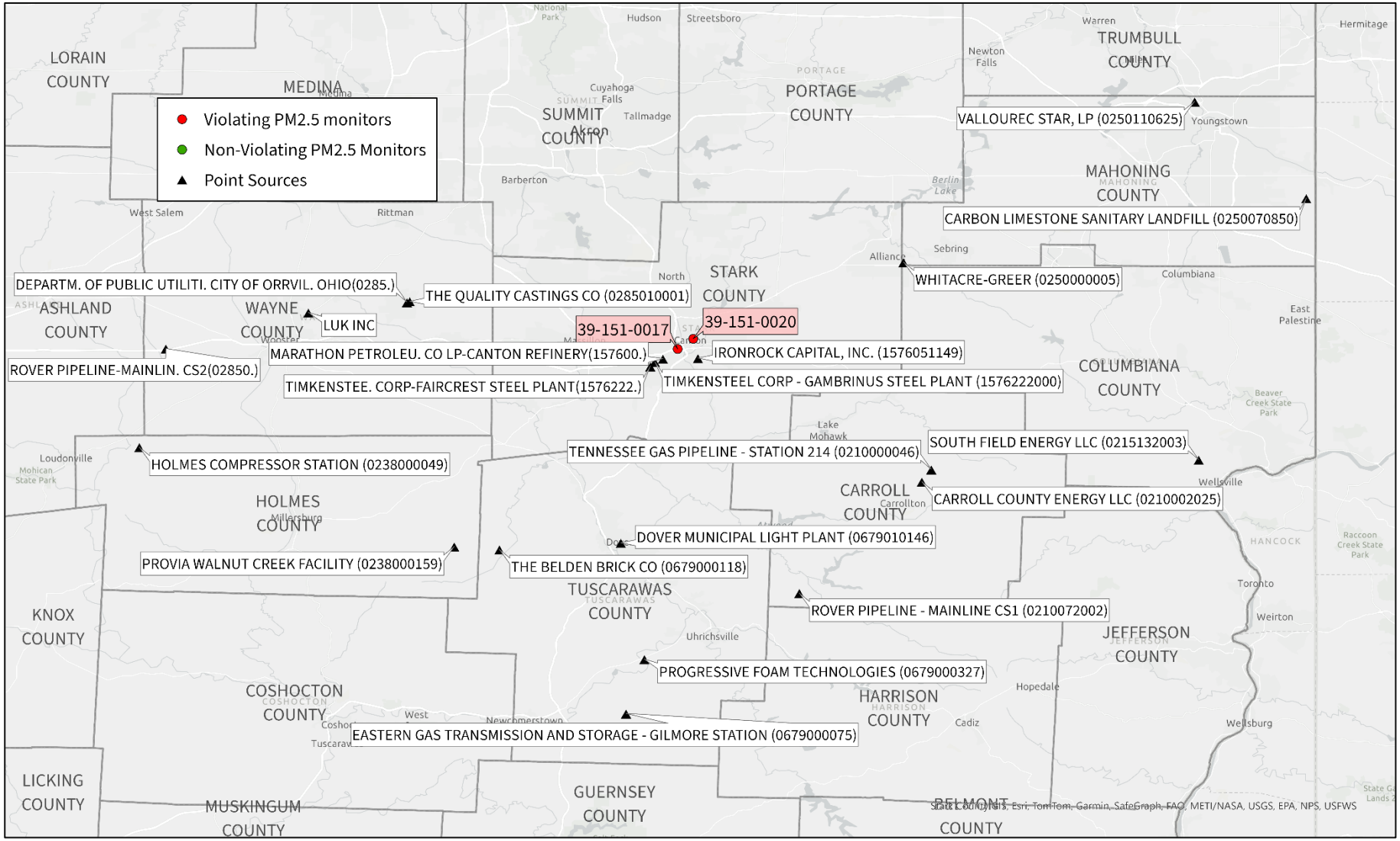
Nonpoint	1,005.47	308.19	43.20	11.68	6.48	635.92	1,026.57	937.07	159.82	8,217.13
Non-Road	20.77	8.11	6.52	0.66	0.15	5.31	241.33	0.62	0.26	264.83
On Road	16.55	4.86	6.40	0.52	0.03	4.74	479.99	45.10	1.81	355.11
Total	1,281.89	408.01	69.42	36.40	11.35	756.70	2,040.65	1,052.80	184.10	8,949.77
Mahoning	**PM2.5**	***OC***	***EC***	***Sulfate***	***Nitrate***	***Other***	**NOx**	**NH3**	**SO2**	**VOC**
Point	259.55	35.17	6.57	25.38	1.50	190.93	431.81	0.33	314.80	395.03
Nonpoint	1,415.76	479.75	56.40	14.73	4.91	859.97	1,133.35	577.53	38.34	8,489.69
Non-Road	32.90	13.49	8.80	0.81	0.19	9.59	357.44	1.01	0.42	451.94
On Road	43.51	12.00	16.59	1.84	0.08	13.01	1,324.71	125.39	5.36	684.65
Total	1,751.72	540.41	88.36	42.76	6.68	1,073.50	3,247.30	704.25	358.92	10,021.31

TOTALS	**PM2.5**	***OC***	***EC***	***Sulfate***	***Nitrate***	***Other***	**NOx**	**NH3**	**SO2**	**VOC**
Stark	2,735.28	815.37	148.61	79.56	11.38	1,680.31	4,988.32	871.02	624.25	14,247.84
Carroll	641.54	196.21	31.27	22.51	7.89	383.67	1,475.17	390.71	666.71	8,121.29
Wayne	1,725.05	395.20	77.25	68.48	17.81	1,166.32	2,597.24	3,009.56	962.66	9,518.56
Holmes	809.72	214.05	40.19	14.14	10.42	530.91	1,198.68	1,928.48	36.36	8,865.69
Tuscarawas	1,111.55	320.71	56.02	24.76	9.46	700.63	2,618.10	1,021.09	2,976.86	11,541.47
Columbiana	1,281.89	408.01	69.42	36.40	11.35	756.70	2,040.65	1,052.80	184.10	8,949.77
Mahoning	1,751.72	540.41	88.36	42.76	6.68	1,073.50	3,247.30	704.25	358.92	10,021.31

Source: 2022 EMP from https://www.epa.gov/air-emissions-modeling/2022v1-emissions-modeling-platform

The following figure 18 and table 23 show the higher emitting point sources in the area.

Figure 18: Location of Canton-Massillon Analysis Area Point Sources



Source: 2022 EMP from https://www.epa.gov/air-emissions-modeling/2022v1-emissions-modeling-platform

As shown in table 23 below, South Field Energy in Columbiana County and Carroll County Energy in Carroll County have the most significant $PM_{2.5}$ emissions in the analysis area. Both of these sources are located southeast of the violating sites. The Eastern Gas Gilmore Station in Tuscarawas County has the highest NO_X emissions in the area and is located south of the violating monitoring sites. Carroll County Energy also has the highest NH_3 emissions. Dover Municipal Light Plant in Tuscarawas County has the highest SO_2 emissions in the analysis area and is located south of the violating sites. ProVia Walnut Creek Facility in Holmes County has the highest VOC emissions and is located to the southwest of the violating sites. As can be seen in figure 13 above, most of the higher emitting point sources are located in Tuscarawas, Carroll, Stark, and Wayne Counties.

Table 23: Canton-Massillon Analysis Area Point Source Emissions for 2022 (TPY)

PM2.5		
Columbiana County	South Field Energy LLC (0215132003)	189.01
Carroll County	Carroll County Energy LLC (0210002025)	136.40
Mahoning County	Vallourec Star, LP (0250110625)	122.47
Wayne County	The Quality Castings Company (0285010001)	121.51
NOx		
Tuscarawas County	Eastern Gas Transmission and Storage - Gilmore Station (0679000075)	465.15
Carroll County	Tennessee Gas Pipeline - Station 214 (0210000046)	367.03
Tuscarawas County	Dover Municipal Light Plant (0679010146)	300.28
Stark County	Marathon Petroleum Company LP - Canton Refinery (1576002006)	299.72
Holmes County	Holmes Compressor Station (0238000049)	192.67
Columbiana County	South Field Energy LLC (0215132003)	174.14
Carroll County	Rover Pipeline - Mainline CS1 (0210072002)	156.56
Wayne County	Department of Public Utilities, City of Orrville, Ohio (0285010188)	154.28
Stark County	TimkenSteel Corporation - Faircrest Steel Plant (1576222001)	135.82
Mahoning County	Vallourec Star, LP (0250110625)	128.68
Wayne County	Rover Pipeline - Mainline CS2 (0285032017)	127.17
Mahoning County	Carbon Limestone LFG engine plant (0250050996)	124.06
Stark County	TimkenSteel Corporation - Gambrinus Steel Plant (1576222000)	121.43
Carroll County	Carroll County Energy LLC (0210002025)	113.55
NH3		
Carroll County	Carroll County Energy LLC (0210002025)	169.37
Columbiana County	South Field Energy LLC (0215132003)	70.01
Wayne County	Luk Inc	10.81
SO2		
Tuscarawas County	Dover Municipal Light Plant (0679010146)	2,092.02
Wayne County	Department of Public Utilities, City of Orrville, Ohio (0285010188)	920.78
Tuscarawas County	The Belden Brick Company (0679000118)	718.95
Mahoning County	Whitacre-Greer (0250000005)	219.80

Stark County	Ironrock Capital, Inc. (1576051149)	183.12
Stark County	TimkenSteel Corporation - Faircrest Steel Plant (1576222001)	132.70
Tuscarawas County	Belden Brick Plant 3 (0679005018)	119.00
Stark County	Marathon Petroleum Company LP - Canton Refinery (1576002006)	105.78
VOC		
Holmes County	ProVia Walnut Creek Facility (0238000159)	206.98
Mahoning County	DATCO Manufacturing LLC (0250110856)	146.57
Tuscarawas County	Progressive Foam Technologies (0679000327)	143.07
Stark County	Marathon Petroleum Company LP - Canton Refinery (1576002006)	98.89

Source: 2022 EMP from https://www.epa.gov/air-emissions-modeling/2022v1-emissions-modeling-platform

Level of control of emission sources

In the Canton-Massillon area, the emission reduction programs which have had or will have the greatest 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
- Various Cross-State Air Pollution Rules (CSAPR)
- Ohio Clean Diesel Initiatives
- Mercury and Air Toxics Standards (MATS)
- Good Neighbor Plan (stayed)
- NSPS for Oil and Gas Production
- Ohio Administrative Code 3745-112 “Consumer Products”
- Ohio Administrative Code 3745-113 “Architectural and Industrial Maintenance (AIM) Coatings”
- Ohio Administrative Code 3745-17 “Particulate Matter Standards”

The CSAPR, Good Neighbor Plan, and MATS regulate EGUs. The CSAPR program replaced CAIR but has the same objective of reducing power plant emissions that cross state lines to improve air quality. CSAPR was revised and updated in 2017 (replacing the original rule promulgated in 2015) to further reduce summertime NO_x emissions from power plants. The Good Neighbor Plan extends the regulations of CSAPR and CAIR to not only EGUs but also for non-EGU stationary sources beginning in 2026. However, this rule was stayed by the Supreme Court in July of 2024. CAIR and CSAPR have brought about the largest reductions in precursor or primary emissions of $PM_{2.5}$ and its species (sulfates, nitrates, organic carbon, elemental carbon and crustal) and will continue to bring additional reductions. Compliance with the MATS rule also leads to additional reductions in precursor species - in particular, sulfates.

The NSPS for Oil and Gas production was promulgated March 8, 2024, by U.S. EPA, and sets new requirements for crude oil and natural gas production sources to regarding greenhouse gas (specifically methane), VOC, and SO_2 emissions. All large oil and gas industrial source owners have to March 2029 to comply with new state requirements created under this ruling. Compliance with this rule will lead to reduction in methane, VOC, and SO_2 emissions.

OAC Chapter 3745-112[25] contain requirements for the content of VOCs in consumer products sold, supplied, offered for sale, or manufactured for use in the state of Ohio. These rules were initially promulgated in 2007 as part of Ohio's strategy to attain the 1997 ozone standard by adopting the standards in the model rule developed by the OTC. This rule was last reviewed and updated in 2022 to strengthen the VOC content requirements consistent with more recent OTC model rules. This update was to assist with attaining and maintaining the 2015 ozone standard.

The rules in OAC Chapter 3745-113[26] contains requirements for the content of VOCs in AIM coatings. These rules were initially promulgated in 2007 as part of Ohio's strategy to attain the 1997 ozone standard by adopting the standards in the model rule developed by the OTC. This rule was last reviewed and updated in 2022 to strengthen the VOC content requirements consistent with more recent OTC model rules. This update was to assist with attaining and maintaining the 2015 ozone standard.

OAC Chapter 3745-17[27] regulates particulate matter and established RACT for stationary sources under the historical PM_{10} standard.

With respect to the Ohio utilities, Dover Municipal Light (facility ID 0679010146) is the most notable significant point source and an EGU facility located in Tuscarawas County. Dover Municipal Light has one coal-fired boiler with a design capacity of 247 MMBtu/hr. This boiler has PM control equipment that has been operating since December 2007.

Urbanization, population, and commuting trends

The following table 24 provides a summary of the 2022 population and VMT for each of the counties discussed in this section.

[25] The current, effective copy of this rule can be found here: https://epa.ohio.gov/divisions-and-offices/air-pollution-control/regulations/effective-rules/dapc-effective-rules

[26] The current, effective copy of this rule can be found here: https://epa.ohio.gov/divisions-and-offices/air-pollution-control/regulations/effective-rules/dapc-effective-rules

[27] The current, effective copy of this rule can be found here: https://epa.ohio.gov/divisions-and-offices/air-pollution-control/regulations/effective-rules/dapc-effective-rules

Table 24: Canton-Massillon Analysis Area 2022 County Level VMT, Population, Land Area, and Population Density

County	VMT	Population	Land Area (sq. miles)	Population Density (1,000 per sq. miles)
Stark	778,601	372,657	576	0.57
Carroll	613,430	26,659	395	0.07
MSA Total	1,392,031	354,316	975	0.36
Wayne	299,928	116,559	555	0.21
Holmes	80,540	44,390	423	0.10
Tuscarawas	263,990	91,937	568	0.16
Columbiana	185,620	100,511	533	0.19
Mahoning	563,827	225,636	415	0.54
Total for All Counties	4,177,967	1,332,665	4,440	0.30

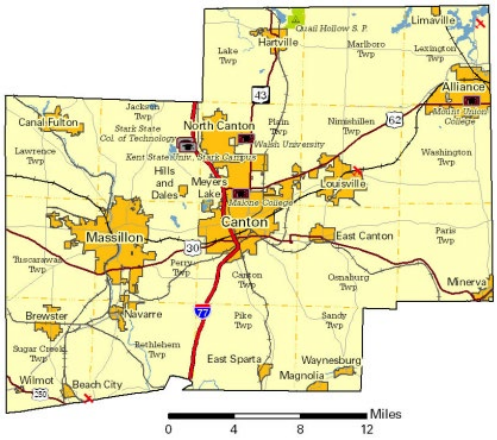
Source: Ohio Department of Transportation (Ohio 2022 VMT data only)
Ohio Department of Development, County Trends and Profiles for 2022 (Ohio populations only)
All other data: U.S. EPA Particle Pollution Designations Memo and Data, https://www.epa.gov/particle-pollution-designations/particle-pollution-designations-memorandum-and-data-2024-revised#A

Degree of urbanization and population trends

As seen in table 24 above, the majority of the population resides in the Canton-Massillon MSA and most notably Stark County, followed by Mahoning County. However, as can be seen in figure 19, the population of these counties have declined since 2020 and are expected to continually decline.

The most urbanized areas are within Stark and Mahoning Counties. Their population and population densities are significantly higher than the other counties in the area, indicating that population-related emissions may be high. Table 24 above supports this conclusion for Stark County, as it has the highest mobile and non-point source emissions out of the analysis area. However, Mahoning County is only the third highest in regard to mobile and non-point source emissions, being beat by Wayne County's mobile and non-point source emissions.

Figure 19: Canton-Massillon OH Analysis Area County Profiles

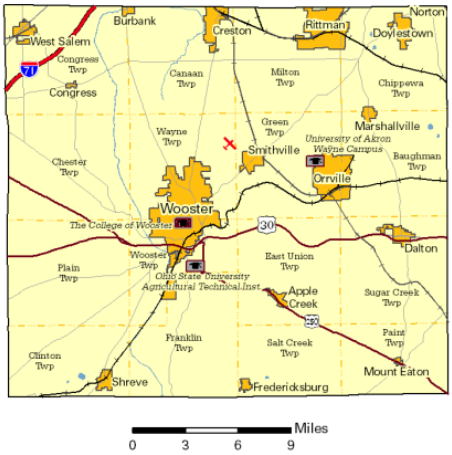


Stark County

Stark County is 24% developed – low intensity, 23% forest, and 22% forest. Canton city is the largest major urban area, and where both violating monitoring sites are located. The 2020 county population was 374,853 and decreased to 372,657 in 2022. The population is expected to continually decline to an estimated population of 358,580 by 2030.

Carroll County

Carroll County is 54% forest, 29% pasture, and 8% developed – low intensity. Brown Township is the largest major urban area. The 2020 county population was 26,721 and declined slightly to 26,659 in 2022. The population is expected to continually decline in the future to an estimated population of 25,297 by 2030.



Wayne County

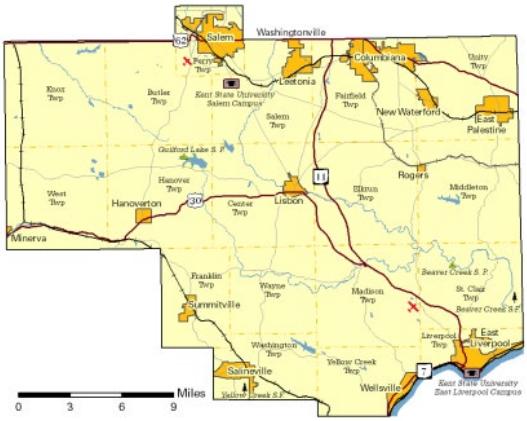
Wayne County is 39% cropland, 26% pasture, and 17% forest. Wooster city is the largest major urban area. The 2020 county population was 116,894 and decreased to 116,559 in 2022. The population is expected to continually decline to an estimated population of 114,490 by 2030.

Holmes County

Holmes County is 39% forest, 38% pasture, and 13% cropland. Salt Creek township is the largest major urban area. The 2020 county population was 44,223 and increased to 44,390 in 2022. The population is expected to continually increase to an estimated population of 44,888 by 2030.

Tuscarawas County

Tuscarawas County is 52% forest, 23% pasture, and 9% developed – low intensity. New Philadelphia city is the largest major urban area. The 2020 county population was 93,263 and decreased to 91,937 in 2022. The population is expected to continually decline to an estimated population of 90,206 by 2030.



Columbiana County

Columbiana County is 44% forest, 24% pasture, and 14% cropland. Salem city is the major urban area in the county. The 2020 county population was 101,788 and declined to 100,511 in 2022. The population is expected to continually decline in the future with an estimated population of 93,544 by 2030.

Mahoning County

Mahoning County is 31% forest, 23% developed – low intensity, and 18% pasture. Youngstown city (partial) is the largest major urban area. The 2020 county population was 228,614 and decreased to 225,636 in 2022. The population is expected to continually decline to an estimated population of 212,996 by 2030.

Source: County profile information and maps found at Ohio Department of Development, Research, County Trends, https://development.ohio.gov/about-us/research/county/county-trends

Commuting trends

As can be seen in table 24, the majority of VMT occurs in Stark, Carroll and Mahoning Counties. Table 25 below looks at commuter travel in and out of the analysis area counties and in and out of Stark County, the only county with violating monitoring sites. Only 24% of workers living in Stark County work in a different county, and only 20% of workers that work in Stark County live in a different county and commute into Stark County. Of the Stark County residents commuting to other counties for work, the greatest percentage (18%) commutes north to Summit, Cuyahoga, Mahoning, and Portage Counties. To a lesser extent, only 2% of Stark County residents commute south to Carroll and Tuscarawas Counties, and only 2% commute west to Wayne County. The greatest percentage (9%) of workers who commute to Stark County for work live in Summit and Portage Counties. Only 5% of Stark County workers commute from Tuscarawas and Carrol Counties, 3% commute from Columbiana and Mahoning Counties, and only 1% (less than 2,000 workers) commute from Wayne County. The majority of Stary County's workforce resides and works in Stark County.

Table 25: Commuter Travel In and Out of Stark and Carroll Counties

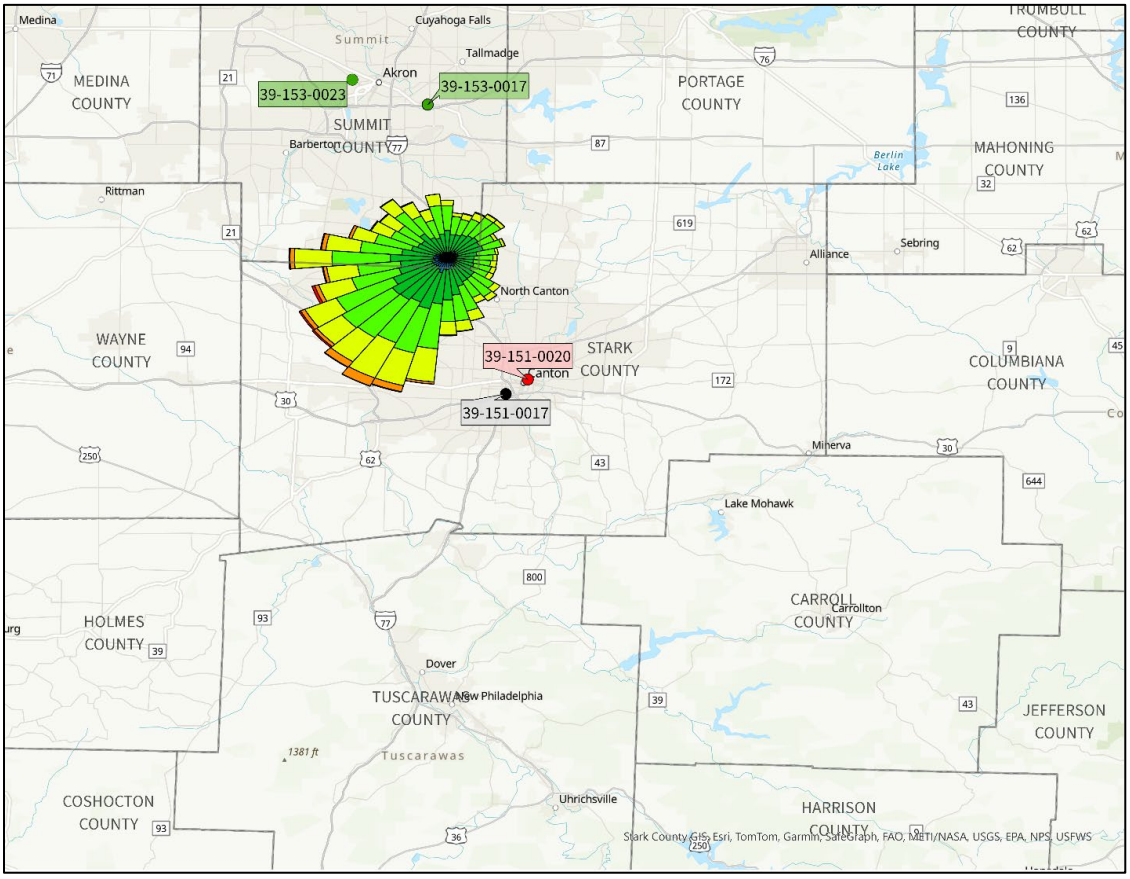
Stark	% workers live in Stark work outside Stark Co				24.4%
	% workers work in Stark live outside Stark Co				20.4%
# workers living in Stark Co		173,892	# workers working in Stark Co		165,144
Place of Work	**#**	**%**	**Place of Residence**	**#**	**%**
Summit County	23,861	14%	Summit County	10,822	6.6%
Wayne County	3,285	1.9%	Tuscarawas County	5,084	3.1%
Cuyahoga County	3,198	1.8%	Carroll County	3,419	2.1%
Tuscarawas County	2,994	1.7%	Columbiana County	3,039	1.8%
Portage County	2,562	1.5%	Portage County	2,848	1.7%
Carroll County	1,099	0.63%	Mahoning County	2,197	1.3%
Mahoning County	1,005	0.58%	Wayne County	1,936	1.2%

Source: U.S. Department of Commerce Economics and Statistics Administrations, U.S. Census Bureau, Residence County to Workplace County Commuting Flows for the United States and Puerto Rico Sorted by Workplace Geography: 5-year ACS 2016-2020, Residence County to Workplace County Commuting Flows for the United States and Puerto Rico Sorted by Residence Geography: 5-Year ACS 2016-2020

METEOROLOGY

The following wind rose in figure 20 represents this area.

Figure 20: 2021-2023 Wind Roses for the Canton-Massillon OH MSA



Source: AERMET Surface data (Wind Rose data only), U.S. EPA $PM_{2.5}$ Designations Mapping Tool (monitoring sites)

Winds from the southwest quadrant are prevalent in the Canton-Massillon area monitoring sites. This indicates that sources of emissions from the southwest may be contributing to violations at these monitoring sites.

The HYSPLIT density maps for the violating monitoring sites in Canton-Massillon area (Appendix D pp.24-28) show that most of the air parcels that originate in this area do not tend to travel a large distance over 24 hours, and actually stay in the surrounding counties and area near the violating monitoring sites. This may indicate that any pollutants emitted in the air near or at the violating sites tend to stay in the area. This further supports that localized sources near the violating monitoring sites could be a component of the violations

GEOGRAPHY/TOPOGRAPHICAL

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.

JURISDICTIONAL BOUNDARIES

Stark County was designated as a nonattainment county for 1997 annual and 2006 24-hour $PM_{2.5}$ 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. All of these areas have been redesignated to attainment. No other counties a part of this analysis area have been designated nonattainment for $PM_{2.5}$ or other urban-scale pollutants.

The Canton-Massillon MSA includes Stark and Carroll Counties and the principal cities of Canton and Massillon. The Canton-Massillon MSA is part of the larger Cleveland-Akron-Canton CSA.

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-Elyria-Akron area analysis. Jefferson and Harrison Counties are 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. Organic carbon dominates at the violating monitoring sites, which may be an indication of local source contributions.

The most significant emissions of SO_2 are from Tuscarawas County, most likely a result of the Dover Municipal Light Plant located in that county. The facility is located almost directly south of the violating monitoring sites. However, sulfates do not dominate at the violating monitoring sites, and therefore, it is highly unlikely these emissions are impacting the violating monitoring sites. There is also little commuter travel between Stark and Tuscarawas Counties.

The most significant emissions of NH_3 are from Wayne County, but it is highly unlikely these are impacting the Stark County violating monitoring site. The higher emissions of NH_3 are likely due to the large percentage of cropland in Wayne County. There is also very little commuter travel between Stark and Wayne Counties.

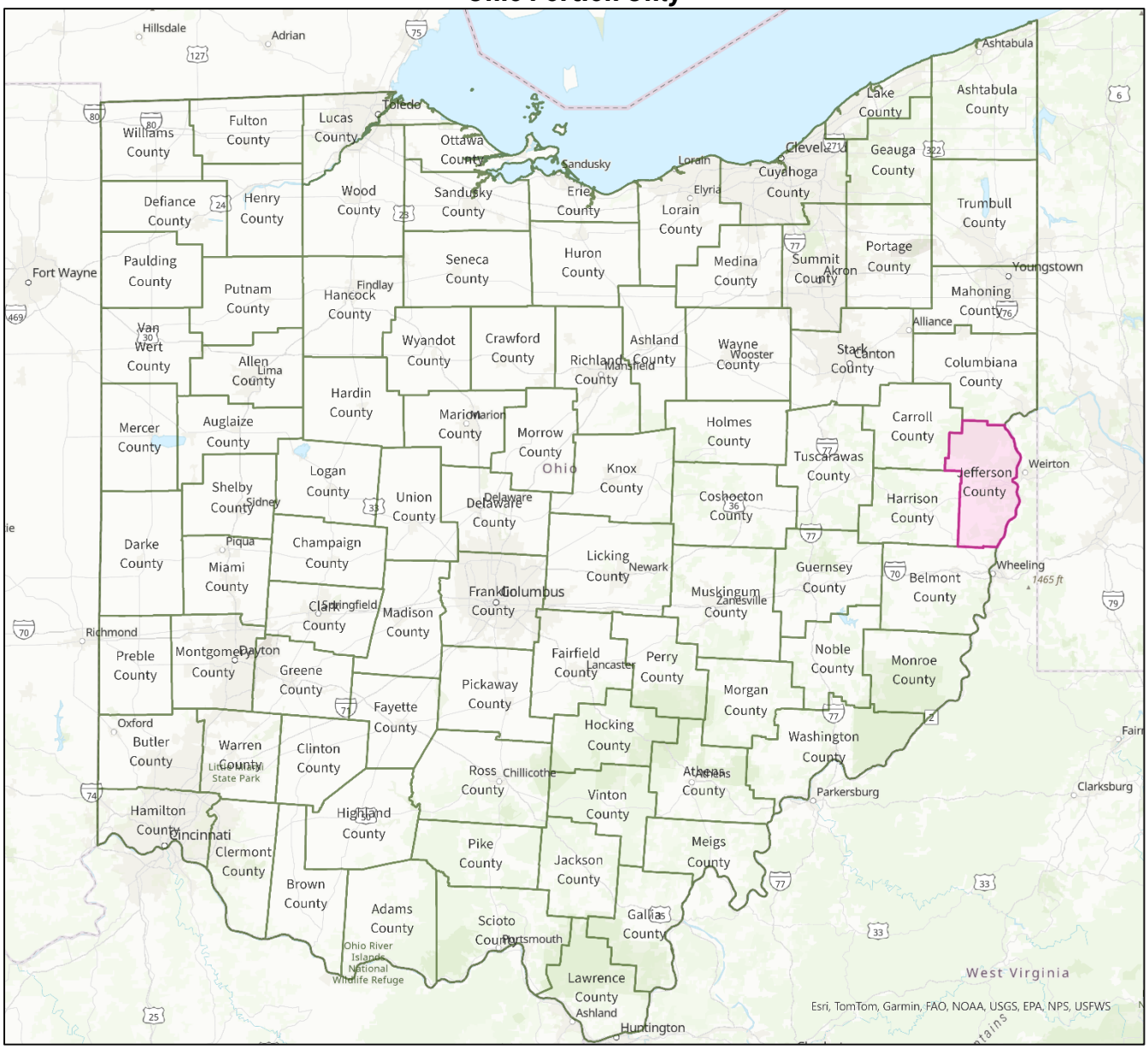
Columbiana and Mahoning Counties also have high emissions compared to other counties in the analysis area but have historically been analyzed as part of the Youngstown-Warren OH-PA area. There is one monitoring site located in Mahoning County (see tables 1 and 2) and is indicating attainment of the standard. 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 monitoring sites.

Holmes County has significantly lower emissions, VMT and commuter travel and is likely not a significant impact on the violating monitoring sites. 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 part of the designation area. No other factors warrant inclusion of any of the other counties included in the analysis of this area, except Stark County. However, since the exceptional events demonstration for site 39-151-0020 would result in attainment and for site 39-151-0017, an invalid 2021-2023 annual design value, Ohio EPA cannot make a recommendation for Stark County regarding attainment or nonattainment. Until more air quality data is available for a valid three-year annual design value (i.e. the 2022-2024 annual $PM_{2.5}$ design values), Ohio EPA's final classification for Stark County is recommended as unclassifiable. If the 2022-2024 annual design value is consistent with historical monitoring data, Ohio EPA projects that Stark County will be in attainment by the time of final recommendations.

Pittsburgh-New Castle-Weirton PA-OH-WV CSA

Figure 21: Pittsburgh-New Castle-Weirton PA-OH-WV CSA Recommended Nonattainment Area – Ohio Portion Only

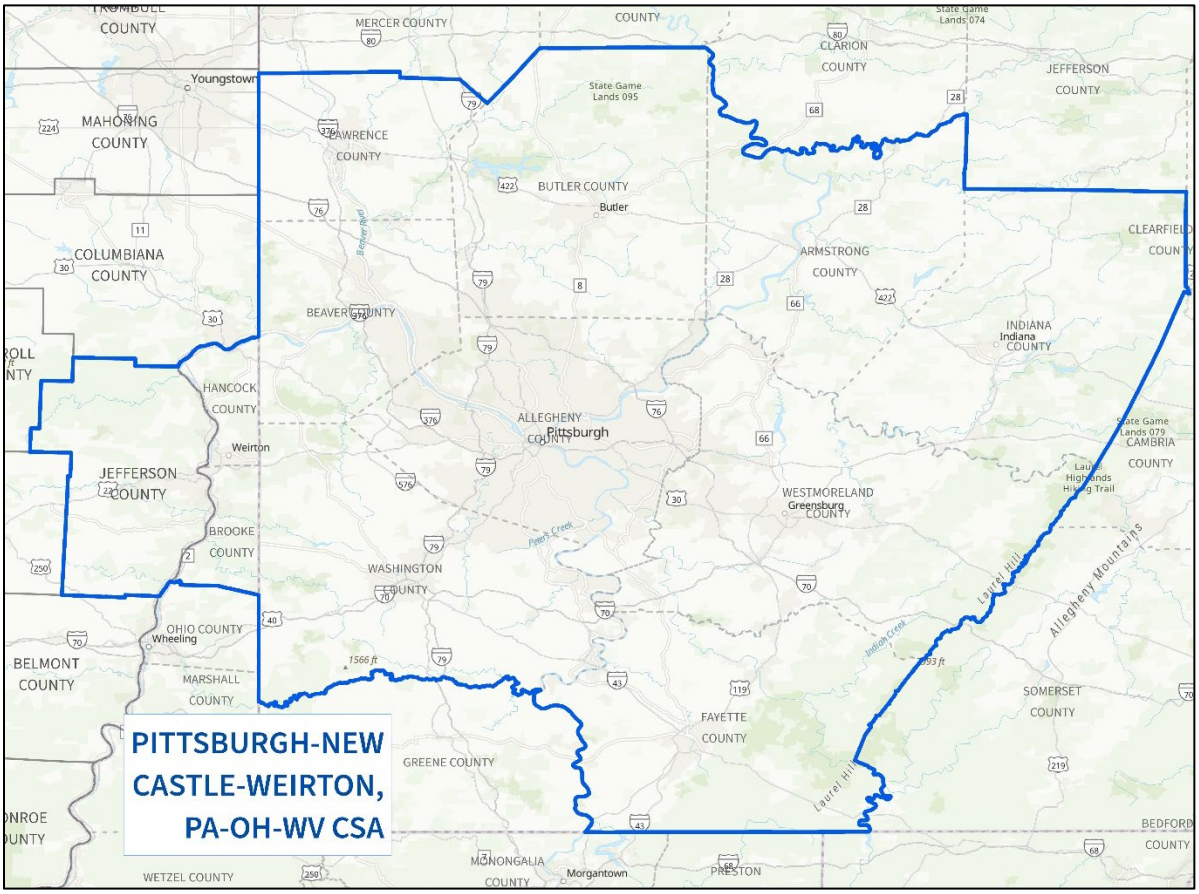


Source: U.S. EPA $PM_{2.5}$ Designations Mapping Tool

DISCUSSION

For Pittsburgh-New Castle-Weirton PA-OH-WV CSA, there is one Ohio county in this historic 1997 annual and 2006 24-hour $PM_{2.5}$ nonattainment area: Jefferson County. In addition to Ohio counties, Hancock and Brooke Counties in West Virginia were a part of this 1997 annual $PM_{2.5}$ standard nonattainment area. Ohio EPA recommends designating Jefferson County as nonattainment for this area. After considering the five factors, Ohio EPA does not recommend adding any contributing counties to this area.

Figure 22: Pittsburgh-New Castle-Weirton PA-OH-WV CSA



Source: U.S EPA $PM_{2.5}$ Designations Mapping Tool

As can be seen in figure 22, the Pittsburgh-New Castle-Weirton PA-OH-WV CSA includes Jefferson, Hancock (WV), Brooke (WV), Washington (PA), Beaver (PA), Allegheny (PA), Lawrence (PA), Armstrong (PA), Indiana (PA), Westmoreland (PA), Fayette (PA), and Butler (PA) Counties. This CSA is comprised of the Weirton-Steubenville OH-WV MSA and the Pittsburgh PA MSA. The Pittsburgh PA MSA has historically been analyzed separately and Ohio will not consider data from Pennsylvania in this analysis. In addition to those two MSAs, the Wheeling WV-OH MSA is comprised of Belmont, Ohio (WV) and Marshall (WV) Counties and they have also been analyzed

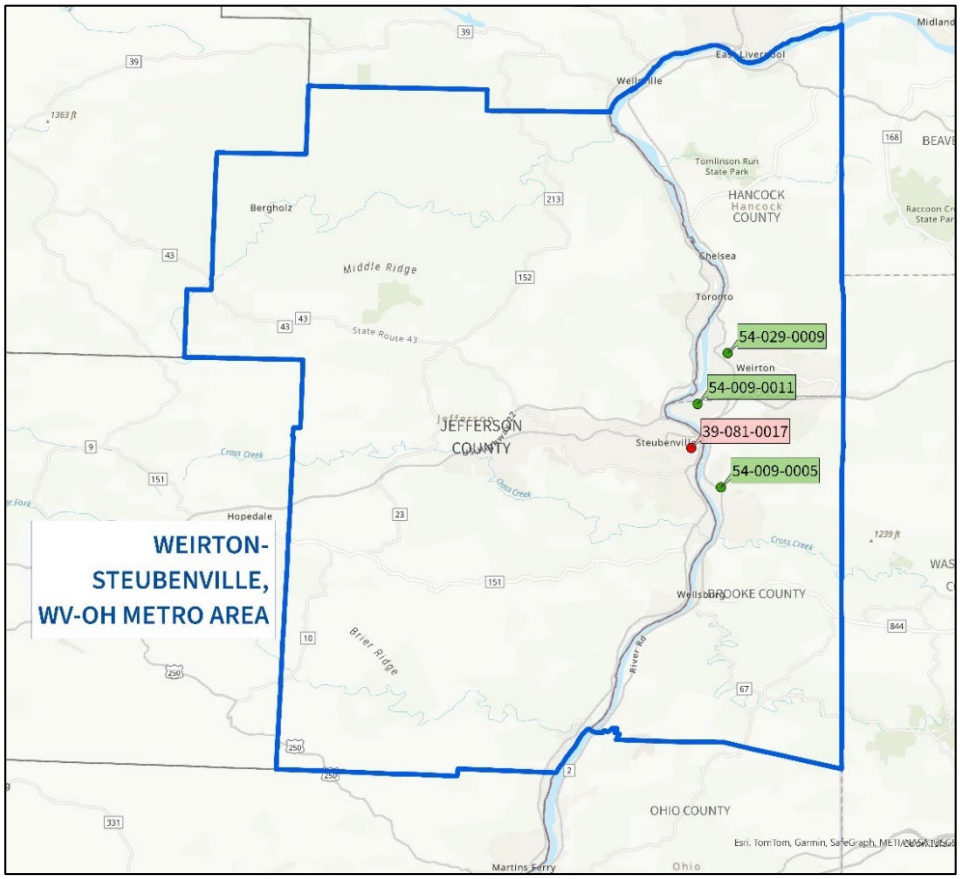
separately. These counties were designated as a nonattainment area for the 1997 annual $PM_{2.5}$ standard. However, as can be seen from table 1 and table 2, Belmont County is monitoring attainment. Ohio EPA will not be analyzing any additional counties adjacent to the CSA counties because historically those counties have been excluded from the nonattainment area. Therefore, for the remainder of this analysis area, Ohio EPA will be referring to the Weirton-Steubenville MSA.

As can be seen in figure 23, Jefferson County has one monitoring site, which is violating the annual revised standard (site 39-081-0017). Jefferson County is part of the Weirton-Steubenville MSA along with Hancock County (WV) and Brooke County (WV).

AIR QUALITY DATA

For the 2021-2023 period, there are four monitoring sites in this area, one of which is in Ohio and three in West Virginia.

Figure 23 Weirton-Steubenville OH-WV MSA Monitoring Sites



Source: U.S. EPA PM2.5 Designations Mapping Tool

As can be seen in table 26, the Jefferson County monitoring site 39-081-0017 is violating the standard based on 2021-2023 air quality data. The design value for this monitoring site is 10.0 µg/m³. As can be seen in tables 1 and 2, air quality trends have declined historically in this area with the exception of 2023 data influenced by wildfire events.

Table 26: Annual Average (µg/m³) for Analysis Area Monitoring Sites (WV and OH)

		Annual Averages			3-year Annual Average
County	**Site ID**	**2021**	**2022**	**2023**	**2021-2023**
Jefferson OH	39-081-0017	11.1	9.1	9.8	***10.0***
Brooke WV	54-009-0005	9.7	7.6	8.7	8.7
	54-009-0011	9.1	7.2	8.8	8.4
Hancock WV	54-029-0009	8.9	7.4	8.5	8.3

Source: U.S. EPA AQS

Insufficient data ***X.X*** Violating monitor

As can be seen in table 27, there is one speciation monitoring site in this area. It is co-located with the violating Ohio monitor.

Table 27: Weirton-Steubenville Area Speciation Monitoring Sites

Site ID	Annual Averages	Speciation Monitor SANDWICH Mass					Site Design Value
		Sulfate	Nitrate	Organic Carbon	Elemental Carbon	Crustal	
39-081-0017 Jefferson County	2020	0.75	0.41	1.13	0.43	0.25	8.9
	2021	1.55	1.17	2.31	0.82	0.67	11.1
	2022	0.67	0.19	1.08	0.36	0.44	9.1
	2020-2022 3-year average	0.99	0.59	1.51	0.54	0.45	9.7

Source: CSN speciation data (SANDWICHED) from https://www.epa.gov/particle-pollution-designations/particle-pollution-designations-memorandum-and-data-2024-revised#A

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

The 2021-2023 urban increments (UI) in table 28 have also been calculated for the violating monitoring site.

Table 28: Weirton-Steubenville Area Urban Increments

2021-2023 Averages		Organic Carbon UI	Elemental Carbon UI	Nitrates UI	Sulfates UI	Crustal UI
Jefferson 39-081-0017	Quarter 1	1.28	0.45	0.87	0.73	0.44
	Quarter 2	4.24	0.66	0.00	0.37	0.32
	Quarter 3	2.43	0.39	0.00	0.02	0.30
	Quarter 4	2.12	0.53	0.10	0.57	0.51
	Annual	2.61	0.51	0.19	0.39	0.39

Source: https://www.epa.gov/particle-pollution-designations/particle-pollution-designations-memorandum-and-data-2024-revised

Organic carbon UI tends to dominate throughout the year at this monitoring site, peaking in quarter 2 along with the elemental carbon UI. Sulfates UI and nitrates UI are the highest in quarter 1, and crustal UI is the highest in quarter 2.

EMISSIONS AND EMISSIONS RELATED DATA

Emission trends

Table 29 presents emissions data for the Weirton-Steubenville analysis area. Overall, the most significant emissions in the Weirton-Steubenville analysis area emanates from Jefferson County. Considering all counties in the analysis area, Jefferson County accounts for 77% of total area emissions; 74% of $PM_{2.5}$, 87% of NO_x, 73% of NH_3, 99% of SO_2, and 50% of VOC emissions. Jefferson County has the highest $PM_{2.5}$, NO_X, and SO_2 emissions. Most of the emissions relate to point sources. However, there have been significant reductions in recent years from point source emissions in Jefferson County.

Comparatively, Brooke (WV) and Hancock (WV) Counties both have low emissions, accounting for the remaining 23% of the total area's emissions.

The biggest non-point sector for VOC emissions is biogenics followed by oil and gas production in all Ohio counties in the Weirton-Steubenville area. For $PM_{2.5}$ emissions, the top two non-point source sectors are residential wood fuel and crops and livestock dust.

Table 29: Weirton-Steubenville OH-WV MSA Counties 2022 Emissions Data (TPY)

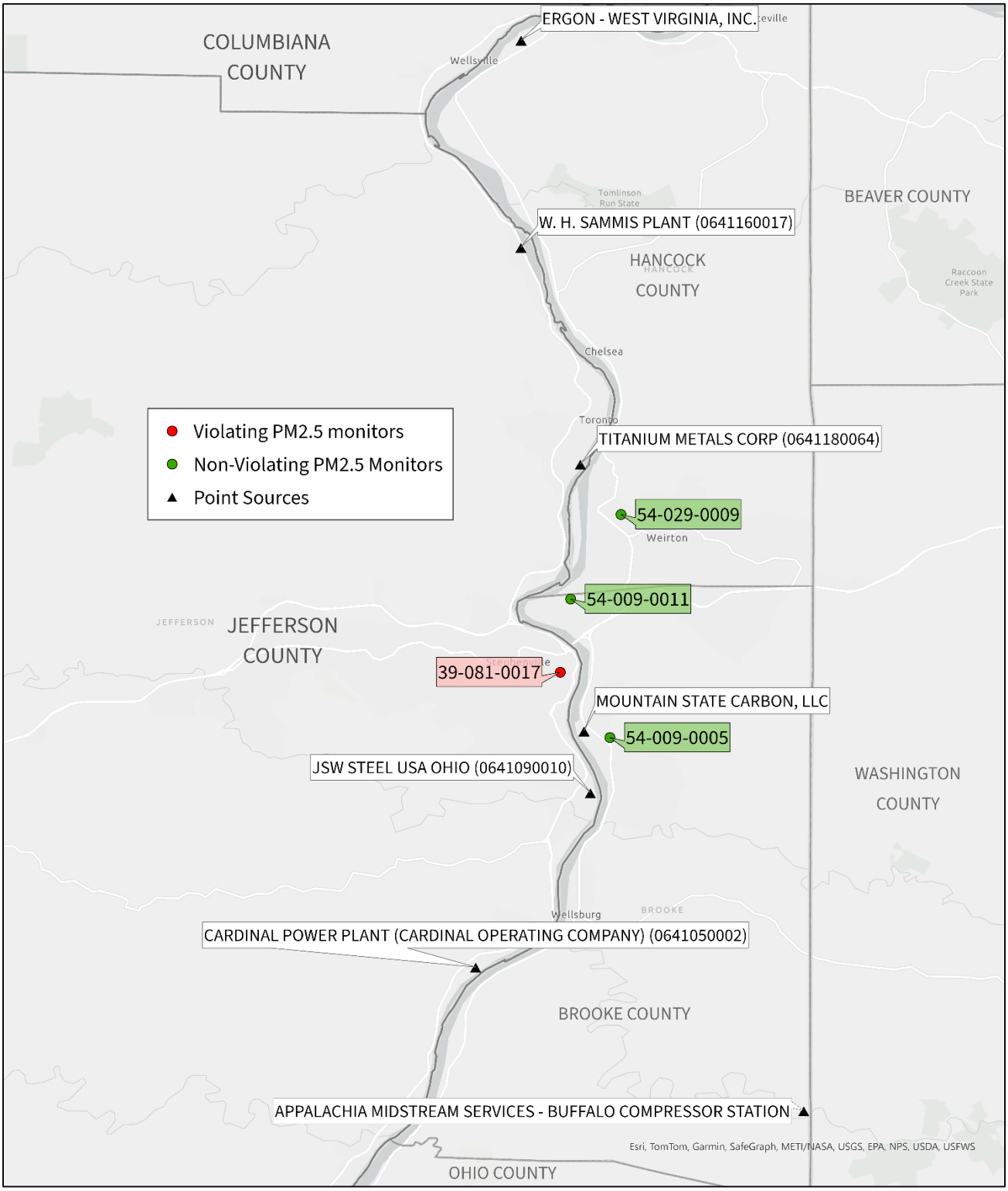
Jefferson OH	**PM2.5**	**OC**	**EC**	**Sulfate**	**Nitrate**	**Other**	**NOx**	**NH3**	**SO2**	**VOC**
Point	915.52	32.23	37.68	91.49	0.74	753.38	6,800.96	5.79	14,283.19	260.63
Nonpoint	620.35	208.40	28.91	7.16	3.12	372.76	585.97	195.94	185.61	6,629.50
Non-Road	10.27	4.12	2.96	0.29	0.07	2.84	108.93	0.32	0.13	130.12
On Road	9.81	2.98	3.78	0.30	0.02	2.73	298.83	30.71	1.20	221.11
Total	1,555.94	247.73	73.33	99.24	3.95	1,131.71	7,794.69	232.75	14,470.13	7,241.36
Brooke WV	**PM2.5**	**OC**	**EC**	**Sulfate**	**Nitrate**	**Other**	**NOx**	**NH3**	**SO2**	**VOC**
Point	42.16	6.05	1.28	3.49	0.33	9.52	293.53	1.26	78.45	259.19
Nonpoint	249.26	90.11	10.33	1.76	0.67	96.90	289.57	36.28	79.66	4,035.73
Non-Road	3.50	1.86	1.82	0.20	0.05	1.15	52.54	0.12	0.08	37.55
On Road	3.01	0.88	1.21	0.08	0.01	0.95	75.32	8.33	0.35	54.96
Total	297.93	98.90	14.64	5.53	1.06	108.52	710.97	45.99	158.54	4,387.43
Hancock WV	**PM2.5**	**OC**	**EC**	**Sulfate**	**Nitrate**	**Other**	**NOx**	**NH3**	**SO2**	**VOC**
Point	26.84	4.75	1.82	4.13	0.23	29.13	196.04	4.59	25.62	102.40
Nonpoint	206.36	77.46	9.65	1.63	0.95	99.52	196.81	27.39	5.48	2,605.76
Non-Road	2.09	2.13	2.10	0.23	0.05	1.36	35.95	0.08	0.05	44.97
On Road	3.13	0.86	1.12	0.09	0.01	0.93	72.42	6.92	0.31	70.81
Total	238.42	85.20	14.69	6.08	1.24	130.94	501.23	38.99	31.46	2,823.95

TOTALS	**PM2.5**	**OC**	**EC**	**Sulfate**	**Nitrate**	**Other**	**NOx**	**NH3**	**SO2**	**VOC**
Jefferson	1,555.94	247.73	73.33	99.24	3.95	1,131.71	7,794.69	232.75	14,470.13	7,241.36
Brooke WV	297.93	98.90	14.64	5.53	1.06	108.52	710.97	45.99	158.54	4,387.43
Hancock WV	238.42	85.20	14.69	6.08	1.24	130.94	501.23	38.99	31.46	2,823.95

Source: 2022 EMP from https://www.epa.gov/air-emissions-modeling/2022v1-emissions-modeling-platform

The following figure 24 and table 30 show the higher emitting point sources in the area.

Figure 24: Location of Weirton-Steubenville Analysis Area Point Sources



Source: 2022 EMP from https://www.epa.gov/air-emissions-modeling/2022v1-emissions-modeling-platform

As shown in table 30 below, the most significant point source emissions come from Cardinal Power Plant and W.H Sammis Plant both located in Jefferson County. These two facilities have the highest $PM_{2.5}$, NO_X, and SO_2 emissions in the analysis area. Cardinal Power has the highest VOC emissions, followed by Ergon in Hancock County (WV). Ergon also has the highest NH_3 emissions in the area, though NH_3 point source emissions for the area are overall miniscule. Cardinal Power is located to the south of the violating site and W.H. Sammis is located to the north. As can be seen in figure 24 above, most of these point sources are located on the Ohio-West Virginia border.

Table 30: Weirton-Steubenville Analysis Area Point Source Emissions for 2022 (TPY)

PM2.5		
Jefferson Co OH	Cardinal Power Plant (Cardinal Operating Company) (0641050002)	507.80
Jefferson Co OH	W. H. Sammis Plant (0641160017)	346.87
Brooke Co WV	Mountain State Carbon LLC	37.30
Jefferson Co OH	JSW Steel USA Ohio (0641090010)	33.83
NOx		
Jefferson Co OH	Cardinal Power Plant (Cardinal Operating Company) (0641050002)	3,767.50
Jefferson Co OH	W. H. Sammis Plant (0641160017)	2,678.72
Jefferson Co OH	Titanium Metals Corporation (0641180064)	248.25
Brooke Co WV	Mountain State Carbon LLC	147.97
Hancock Co WV	Ergon – West Virginia Inc	101.50
NH3		
Hancock Co WV	Ergon – West Virginia Inc	4.59
Jefferson Co OH	W. H. Sammis Plant (0641160017)	2.87
Jefferson Co OH	Cardinal Power Plant (Cardinal Operating Company) (0641050002)	2.11
Brooke Co WV	Mountain State Carbon LLC	1.09
SO2		
Jefferson Co OH	Cardinal Power Plant (Cardinal Operating Company) (0641050002)	11,069.18
Jefferson Co OH	W. H. Sammis Plant (0641160017)	3,136.30
Brooke Co WV	Mountain State Carbon LLC	77.43
Jefferson Co OH	JSW Steel USA Ohio (0641090010)	70.57
VOC		
Jefferson Co OH	Cardinal Power Plant (Cardinal Operating Company) (0641050002)	127.16
Hancock Co WV	Ergon – West Virginia Inc	93.84
Brooke Co WV	Appalachian Midstream Services – Buffalo Compressor Station	85.94
Jefferson Co OH	W. H. Sammis Plant (0641160017)	69.85

Source: 2022 EMP from https://www.epa.gov/air-emissions-modeling/2022v1-emissions-modeling-platform

Level of control of emission sources

In the Weirton-Steubenville area, the emission reduction programs which have had or will have the greatest 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
- Various Cross-State Air Pollution Rules (CSAPR)
- Ohio Clean Diesel Initiatives
- Mercury and Air Toxics Standards (MATS)
- Good Neighbor Plan (stayed)
- NSPS for Oil and Gas Production
- Ohio Administrative Code 3745-112 "Consumer Products"
- Ohio Administrative Code 3745-113 "Architectural and Industrial Maintenance (AIM) Coatings"
- Ohio Administrative Code 3745-17 "Particulate Matter Standards"

The CSAPR, Good Neighbor Plan, and MATS regulate electric generating units EGUs. The CSAPR program replaced CAIR but has the same objective of reducing power plant emissions that cross state lines to improve air quality. CSAPR was revised and updated in 2017 (replacing the original rule promulgated in 2015) to further reduce summertime NO_x emissions from power plants. The Good Neighbor Plan extends the regulations of CSAPR and CAIR to not only EGUs but also for non-EGU stationary sources beginning in 2026. However, this rule was stayed by the Supreme Court in July of 2024. CAIR and CSAPR have brought about the largest reductions in precursor or primary emissions of $PM_{2.5}$ and its species (sulfates, nitrates, organic carbon, elemental carbon and crustal) and will continue to bring additional reductions. Compliance with the MATS rule also leads to additional reductions in precursor species - in particular, sulfates.

The NSPS for Oil and Gas production was promulgated March 8, 2024, by U.S. EPA, and sets new requirements for crude oil and natural gas production sources to regarding greenhouse gas (specifically methane), VOC, and SO_2 emissions. All large oil and gas industrial source owners have to March 2029 to comply with new state requirements created under this ruling. Compliance with this rule will lead to reduction in methane, VOC, and SO_2 emissions.

OAC Chapter 3745-112[28] contain requirements for the content of VOCs in consumer products sold, supplied, offered for sale, or manufactured for use in the state of Ohio. These rules were initially promulgated in 2007 as part of Ohio's strategy to attain the 1997 ozone standard by adopting the standards in the model rule developed by the OTC. The OTC develops model rules for states to consider when adopting consumer products regulations. This rule was last reviewed and updated in 2022 to strengthen the VOC content requirements consistent with more recent OTC model rules. This update was to assist with attaining and maintaining the 2015 ozone standard.

OAC Chapter 3745-113[29] contains requirements for the content of VOCs in AIM coatings. These rules were initially promulgated in 2007 as part of Ohio's strategy to attain the 1997 ozone standard by adopting the standards in the model rule developed by the OTC. This rule was last reviewed and updated in 2022 to strengthen the VOC content requirements consistent with more recent OTC model rules. This update was to assist with attaining and maintaining the 2015 ozone standard.

OAC Chapter 3745-17[30] regulates particulate matter and established RACT for stationary sources under the historical PM_{10} standard. In Jefferson County, additional restrictions are in place requiring contingency plan requirements (OAC rule 3745-17-14) and more stringent requirements for select sources (OAC rule 3745-17-13).

With respect to the Ohio utilities, Cardinal Power Plant (facility ID 0641050002) is an EGU facility located in Jefferson County. Cardinal Power has three coal-fired boilers all with a design capacity of 5,275 MMBtu/hr. All three boiler units have NO_x and SO_2 control equipment installed. The NO_x control equipment was installed in 2003. The SO_2 control equipment for two of the units were installed in late 2007/early 2008. The SO_2 control equipment was installed December 2011 for the other boiler unit. On June 25, 2019, Ohio submitted a supplement of the 2010 1-hour SO_2 standard attainment demonstration for the Steubenville OH-WV SO_2 nonattainment area. This supplement contained amended rules of OAC Chapter 3745-18, establishing a revised SO_2 emission limit for the coal-fired boilers at Cardinal Power to ensure the attainment and maintenance of the Steubenville nonattainment area with the 2010 1-hour SO_2 standard (84 FR 56385). Ohio requested this SO_2 emission limit be approved into the Regional Haze SIP for the

[28] The current, effective copy of this rule can be found here: https://epa.ohio.gov/divisions-and-offices/air-pollution-control/regulations/effective-rules/dapc-effective-rules

[29] The current, effective copy of this rule can be found here: https://epa.ohio.gov/divisions-and-offices/air-pollution-control/regulations/effective-rules/dapc-effective-rules

[30] The current, effective copy of this rule can be found here: https://epa.ohio.gov/divisions-and-offices/air-pollution-control/regulations/effective-rules/dapc-effective-rules

Second Implementation Period, to ensure maintenance and reasonable progress towards visibility goals, in a supplement submitted to U.S. EPA August 6, 2024. Cardinal Power Plant is the top point source emitter in Jefferson County and is located south of the violating monitoring site; however, it's worth noting that two non-violating monitors are between Cardinal Power Plan and the violating monitor.

The W.H. Sammis Plant (facility ID 0641160017) is another EGU facility located in Jefferson County. W.H. Sammis had three coal-fired boiler units: one with a design capacity of 3,000 MMBtu/hr and two with a design capacity of 6,066 MMBtu/hr. W.H. Sammis Plant was the second highest point source emitter in Jefferson County and is located north of the violating monitoring site. All of these boiler units were permanently shut down at the end of May 2023. This shut down will greatly reduce emissions in this county.

Also worth noting, Mountain State Carbon in West Virginia, located directly east of the violating monitor also permanently shut down all operation by March 31, 2022. Although not as a significant emitter, this source was much closer in proximity than either power plant to the violating monitoring site.

Urbanization, population, and commuting trends

The following table 31 provides a summary of the 2022 population and VMT for each of the counties discussed in this section.

Table 31: Weirton-Steubenville Analysis Area 2022 County Level VMT, Population, Land Area, and Population Density

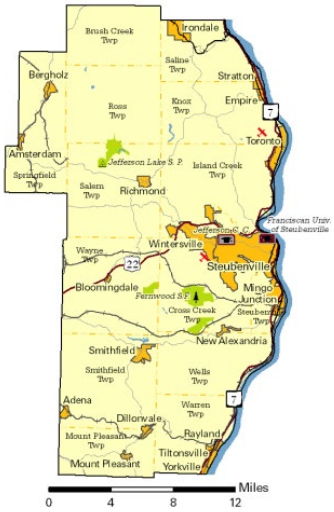
County	VMT	Population	Land Area (sq. miles)	Population Density (1,000 per sq. miles)
Jefferson OH	1,322,380	64,330	411	0.16
Brooke WV	499,234	22,349	93	0.24
Hancock WV	348,850	28,907	88	0.33
Total for All Counties	2,170,464	115,586	580	0.20

Source: Ohio Department of Transportation (Ohio 2022 VMT data only)
Ohio Department of Development, County Trends and Profiles for 2022 (Ohio populations only)
U.S. Department of Commerce Economics and Statistics Administrations, U.S. Census Bureau, 2022 American Community Survey 5-year Estimates (West Virginia populations only)
All other data: U.S. EPA Particle Pollution Designations Memo and Data, https://www.epa.gov/particle-pollution-designations/particle-pollution-designations-memorandum-and-data-2024-revised#A

Degrees of urbanization and population trends

As seen in table 31 above, the majority of the population resides in Jefferson County although the population densities are higher in Brooke (WV) and Hancock (WV) Counties. However, as can be seen in figure 25, the population of Jefferson County has declined since 2020 and are expected to continually decline.

Figure 25: Weirton-Steubenville Analysis Area Ohio County Profiles



Jefferson County

Jefferson County is 64% forest, 20% pasture, and 9% developed – low intensity. Steubenville city is the major urban area of the county, and where the violating monitoring site is located. The 2020 county population was 65,249 and declined to 64,330 in 2022. The population is expected to continually decline in the future with an estimated population of 59,792 by 2030.

Source: County profile information and maps found at Ohio Department of Development, Research, County Trends, https://development.ohio.gov/about-us/research/county/county-trends

Commuting trends

As can be seen in table 31, the majority of VMT occurs in Jefferson County, and to a lesser extent Brooke (WV) and Hancock (WV) Counties. Table 32 below looks at commuter travel in and out of the county in this analysis area with the violating monitoring site, Jefferson County. A significant amount of workers living in Jefferson County work in a different county (37%) whereas only 25% of those working in Jefferson County live in an outside county and commute into Jefferson County. Of the Jefferson County residents commuting to other counties, the greatest percentage commutes east to Allegheny (PA) (6.7%), Brooke (WV) (5.9%), and Belmont (5.6%) Counties. The greatest percentage of workers who commute to Jefferson County for work live in Columbiana (4.3%) County.

Table 32: Commuter Travel In and Out of Jefferson County

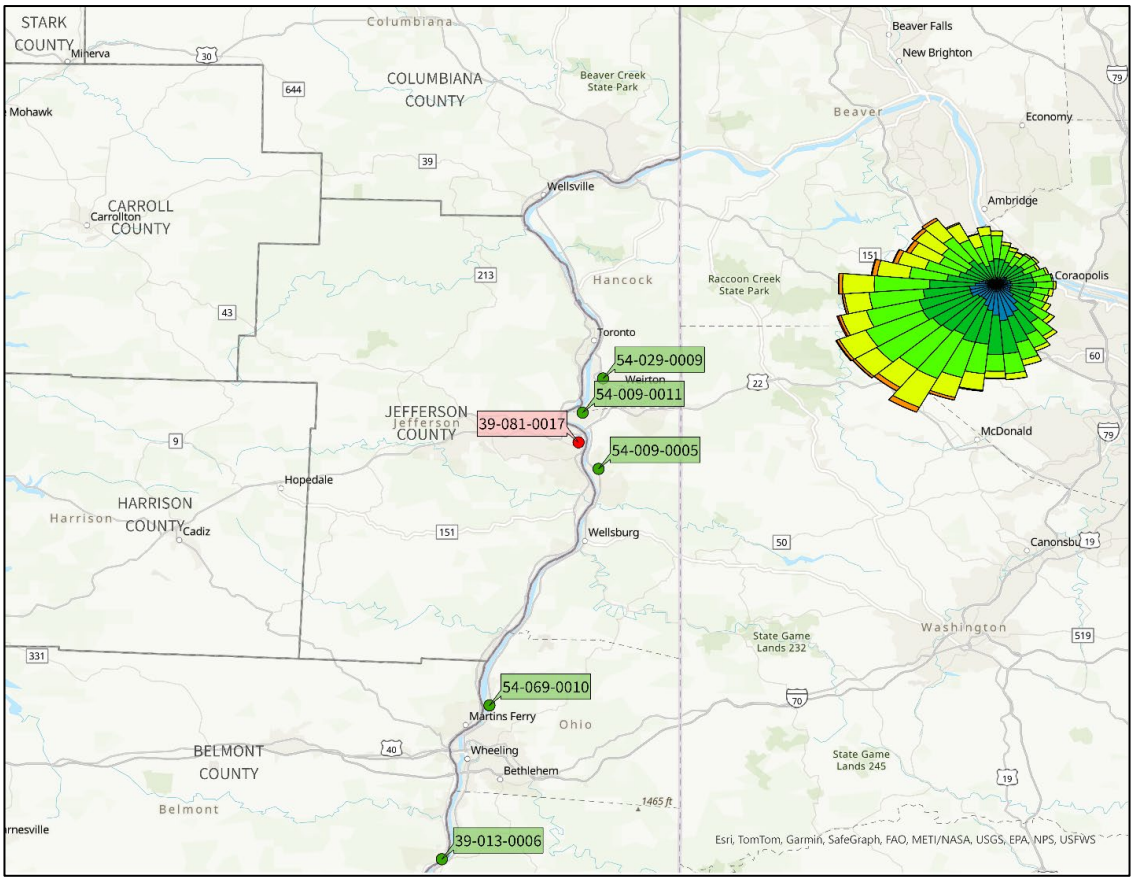
Jefferson	% of workers living in county work outside county				37.0%
	% of workers living outside of county work in county				25.1%
# workers living in Jefferson		27,652	# workers working in Jefferson		23,274
Place of Work	**#**	**%**	**Place of Residence**	**#**	**%**
Allegheny County (PA)	1,845	6.7%	Columbiana County	998	4.3%
Brooke County (WV)	1,626	5.9%	Brooke County (WV)	917	3.9%
Belmont County	1,543	5.6%	Hancock County (WV)	829	3.6%
Ohio County (WV)	1,361	4.9%	Harrison County	788	3.4%
Harrison County	559	2.0%	Belmont County	704	3.0%
Columbiana County	476	1.7%	Carroll County	305	1.3%

Source: U.S. Department of Commerce Economics and Statistics Administrations, U.S. Census Bureau, Residence County to Workplace County Commuting Flows for the United States and Puerto Rico Sorted by Workplace Geography: 5-year ACS 2016-2020, Residence County to Workplace County Commuting Flows for the United States and Puerto Rico Sorted by Residence Geography: 5-Year ACS 2016-2020

METEOROLOGY

The following wind rose in figure 26 represents this area.

Figure 26: 2021-2023 Wind Roses for the Weirton-Steubenville OH MSA



Source: AERMET Surface data (Wind Rose data only), U.S. EPA $PM_{2.5}$ Designations Mapping Tool (monitoring sites)

Winds from the southwest quadrant are prevalent near the Weirton-Steubenville area monitoring sites. This indicates that sources of emissions from the southwest may be contributing to violations at this monitoring site. It may be more likely that the source of these violations is local considering the two larger power plants are directly north and south of the violating monitor yet have non-violating monitors between them and the violating monitor.

The HYSPLIT density maps for the violating monitoring sites in the Weirton-Steubenville area (Appendix D pp.29-31) show that most of the air parcels that originate in this area do not tend to travel a large distance over 24 hours, and actually stay in the surrounding counties and area near the violating monitoring sites. This may indicate that any pollutants emitted in the air near or at the violating sites tend to stay in the area. This further supports that localized sources near the violating monitoring sites could be a component of the violations.

GEOGRAPHY/TOPOGRAPHICAL

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.

JURISDICTIONAL BOUNDARIES

Jefferson, Hancock (WV) and Brooke (WV) Counties was designated as a nonattainment for the 1997 annual $PM_{2.5}$ standard and while only Jefferson County was nonattainment for the 2006 24-hour $PM_{2.5}$ standard (both as part of the Steubenville- Weirton OH-WV nonattainment area). Jefferson, Brooke (WV) and Hancock (WV) Counties were designated as nonattainment under the 1997 ozone standard. These areas have been redesignated to attainment for all standards. No other counties a part of this analysis have been designated nonattainment for $PM_{2.5}$ or other urban-scale pollutants.

Jefferson County and the Weirton-Steubenville WV-OH MSA is part of the larger Pittsburgh-New Castle-Weirton PA-OH-WV CSA.

CONCLUSION

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

The most significant emissions of $PM_{2.5}$ and its precursors are from Jefferson County, predominantly from power plants to the north, W. H. Sammis Plant, and south, Cardinal Power Plant, of the violating monitoring site. The violating monitoring site shows a high presence of organic carbon and then, nitrates. As demonstrated above, significant reductions, including the permanent shut down of W. H. Sammis Plant in May 2023, have occurred during and after the time these inventories were created. As a result, we will continue to see a decline in power plant related emissions.

Also noted above, although not a significant emissions source for 2022 emissions but a source in close proximity to the violating monitoring site, Mountain State Carbon (WV) also shut down all operations by March 31, 2022. Under the 2010 1-hour SO_2 standard, Ohio submitted an attainment demonstration for the Steubenville OH-WV SO_2 nonattainment area (submitted to U.S. EPA June 25, 2019). The analysis showed Mountain State Carbon was a large contributor to SO_2 violations in the Steubenville OH-WV SO_2 nonattainment area. As can be seen from table 1,

for the violating monitor, for the 3-year design value period of 2021-2023, 2021 had the most significant annual average of 11.1 µg/m^3– a period of time when Mountain State Carbon was still operating. 2022 and 2023 annual design values were 9.1 and 9.8 µg/m^3, respectively. Even with wildfire impacts, the 2023 design value was below the 2021 design value. Therefore, it's likely Mountain State Carbon was impacting the violating monitoring site.

Although W.H. Sammis is a much greater distance to the north, it is also likely that their 2023 shut down will lead to additional declining annual design values at the violating monitoring site. Although the fact that non-violating monitors exist between the violating monitor and W. H. Sammis lends to the question of how much local sources are leading to exceedances at the violating monitor. This is further corroborated by the fact that there also non-violating monitors between Cardinal Power Plant and the violating monitor.

The majority of the population and VMT for this analysis area are in Jefferson County. While populations are lower, the population densities of Brooke and Hancock Counties (WV) are significantly higher than Jefferson County.

There is some commuter travel between Jefferson County and the other counties in the analysis area. The majority of commuting occurs between Jefferson and Brooke (WV) Counties. Ohio EPA does not believe the sole reason for inclusion of any neighboring counties should be based upon limited commuter travel.

Ohio EPA is recommending only Jefferson County be designated nonattainment with respect to the Ohio portion of the Weirton-Steubenville OH-WV area.