

# Ohio

## Cleveland and Columbus Nonattainment Areas

### Final Area Designations for the 2015 Ozone National Ambient Air Quality Standards Technical Support Document (TSD)

#### 1.0 Summary

This technical support document (TSD) describes the EPA's final designations for the Cleveland and Columbus areas in Ohio as nonattainment for the 2015 ozone National Ambient Air Quality Standards (NAAQS). The nonattainment designation for the multi-state Cincinnati, Ohio-Kentucky area is addressed in a separate TSD.

On October 1, 2015, the EPA promulgated revised primary and secondary ozone NAAQS (80 FR 65292; October 26, 2015). The EPA strengthened both standards to a level of 0.070 parts per million (ppm). In accordance with Section 107(d) of the Clean Air Act (CAA), whenever the EPA establishes a new or revised NAAQS, the EPA must promulgate designations for all areas of the country for that NAAQS.

Under section 107(d), states were required to submit area designation recommendations to the EPA for the 2015 ozone NAAQS no later than 1 year following promulgation of the standards, i.e., by October 1, 2016. Tribes were also invited to submit area designation recommendations. On September 30, 2016, Ohio recommended that the seven counties in the Cleveland area and four counties in the Columbus area, as identified in Table 1, be designated as nonattainment for the 2015 ozone NAAQS based on 2014-2016 design values.

After considering these recommendations and based on the EPA's technical analysis as described in this TSD, the EPA is not modifying the recommendation made by the State of Ohio for the Cleveland and Columbus areas and is designating the seven counties in the Cleveland area and the four counties in the Columbus as recommended by the State as nonattainment for the 2015 ozone NAAQS. The EPA must designate an area nonattainment if it has an air quality monitor that is violating the standard or if it has sources of emissions that are contributing to a violation of the NAAQS in a nearby area. Detailed descriptions of the nonattainment boundaries for these areas are found in the supporting technical analysis for each area in Section 3.

**Table 1. Ohio’s Recommended Nonattainment Areas and the EPA’s Final Designated Nonattainment Areas for the 2015 Ozone NAAQS**

Area	Ohio’s Recommended Nonattainment Counties	EPA’s Final Nonattainment Counties
Cincinnati, OH-KY-IN*	Butler Clermont Hamilton Warren	Butler Clermont Hamilton Warren
Cleveland, OH	Cuyahoga Geauga Lake Lorain Medina Portage Summit	Cuyahoga Geauga Lake Lorain Medina Portage Summit
Columbus, OH	Delaware Fairfield Franklin Licking	Delaware Fairfield Franklin Licking

\*Cincinnati is a multi-state area composed of counties and/or partial counties in Ohio and Kentucky. The technical analysis for this multi-state area is discussed in a separate TSD.

On November 6, 2017 (82 FR 54232; November 16, 2017), the EPA signed a final rule designating most of the areas the State did not recommend for designation as nonattainment as attainment/unclassifiable.<sup>1</sup> EPA explains in section 2.0 the approach it is now taking to designate the remaining areas in the State.

## 2.0 Nonattainment Area Analyses and Boundary Determination

The EPA evaluated and determined the boundaries for each nonattainment area on a case-by-case basis, considering the specific facts and circumstances of the area. In accordance with the CAA section 107(d), the EPA is designating as nonattainment the areas with the monitors that is are violating the 2015 ozone NAAQS and nearby areas with emissions sources (i.e., stationary, mobile, and/or area sources) that contribute to the violations. As described in the EPA’s designations guidance for the 2015 NAAQS

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<sup>1</sup> In previous ozone designations and in the designation guidance for the 2015 ozone NAAQS, the EPA used the designation category label Unclassifiable/Attainment to identify both areas that were monitoring attainment and areas that did not have monitors but for which the EPA had reason to believe were likely attainment and were not contributing to a violation in a nearby area. The EPA is now reversing the order of the label to be Attainment/Unclassifiable so that the category is more clearly distinguished from the separate Unclassifiable category.

(hereafter referred to as the “ozone designations guidance”<sup>2</sup> after identifying each monitor indicating a violation of the ozone NAAQS in an area, the EPA analyzed those nearby areas with emissions potentially contributing to the violating area. In guidance issued in February 2016, the EPA provided that using the Core Based Statistical Area (CBSA) or Combined Statistical Area (CSA)<sup>3</sup> as a starting point for the contribution analysis is a reasonable approach to ensure that the nearby areas most likely to contribute to a violating area are evaluated. The area-specific analyses may support nonattainment boundaries that are smaller or larger than the CBSA or CSA.

On November 6, 2017, the EPA issued attainment/unclassifiable designations for approximately 85% of the United States and one unclassifiable area designation.<sup>4</sup> At that time, consistent with statements in the designations guidance regarding the scope of the area the EPA would analyze in determining nonattainment boundaries, EPA deferred designation for any counties in the larger of a CSA or CBSA where one or more counties in the CSA or CBSA was violating the standard and any counties with a violating monitor not located in a CSA or CBSA. In addition, the EPA deferred designation for any other counties adjacent to a county with a violating monitor. The EPA also deferred designation for any county that had incomplete monitoring data, any county in the larger of the CSA or CBSA where such a county was located, and any county located adjacent to a county with incomplete monitoring data.

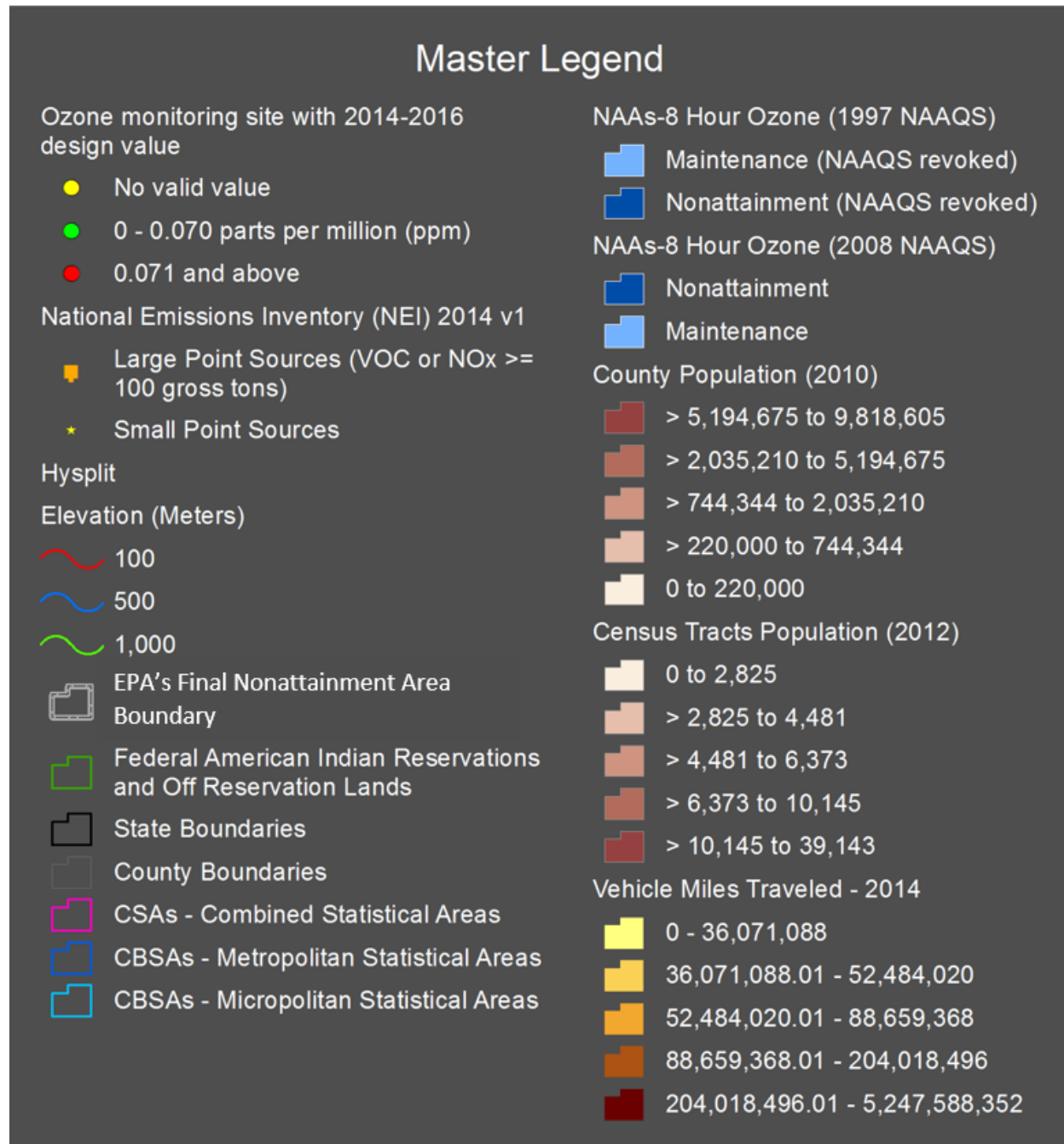
The EPA is proceeding to complete the remaining designations consistent with the designations guidance (and EPA’s past practice) regarding the scope of the area EPA would analyze in determining nonattainment boundaries for the ozone NAAQS as outlined above. For those deferred areas where one or more counties violating the ozone NAAQS or with incomplete data are located in a CSA or CBSA, in most cases the technical analysis for the nonattainment area includes any counties in the larger of the relevant CSA or CBSA. For counties with a violating monitor not located in a CSA or CBSA, EPA explains in the 3.0 Technical Analysis section, its decision whether to consider in the five-factor analysis for each area any other adjacent counties for which EPA previously deferred action. We are designating all counties not included in five-factor analyses for a specific nonattainment or unclassifiable area analyses, as attainment/unclassifiable. These deferred areas are identified in a separate document entitled “Designations for Deferred Counties and County Equivalents Not Addressed in the Technical Analyses.” which is available in the docket.

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<sup>2</sup> The EPA issued guidance on February 25, 2016 that identified important factors that the EPA evaluated in determining appropriate area designations and nonattainment boundaries for the 2015 ozone NAAQS. Available at <https://www.epa.gov/ozone-designations/epa-guidance-area-designations-2015-ozone-naaqs>

<sup>3</sup> Lists of CBSAs and CSAs and their geographic components are provided at [www.census.gov/population/www/metroareas/metrodef.html](http://www.census.gov/population/www/metroareas/metrodef.html). The Office of Management and Budget (OMB) adopts standards for defining statistical areas. The statistical areas are delineated based on U.S. Census Bureau data. The lists are periodically updated by the OMB. The EPA used the most recent July 2015 update (OMB Bulletin No. 15-01), which is based on application of the 2010 OMB standards to the 2010 Census, 2006-2010 American Community Survey, as well as 2013 Population Estimates Program data.

<sup>4</sup> Air Quality Designations for the 2015 Ozone National Ambient Air Quality Standards published on November 16, 2017(82 FR 54232).



Figures in the remainder of this document refer to the master legend above.

### 3.0 Technical Analysis

This technical analysis identifies the areas with monitors that violate the 2015 ozone NAAQS. It also provides EPA's evaluation of these areas and any nearby areas to determine whether those nearby areas have emissions sources that potentially contribute to ambient ozone concentrations at the violating monitors in the area, based on the weight-of-evidence of the five factors recommended in the EPA's

ozone designations guidance and any other relevant information. In developing this technical analysis, the EPA used the latest data and information available to the EPA (and to the states and tribes through the Ozone Designations Mapping Tool and the EPA Ozone Designations Guidance and Data web page).<sup>5</sup> In addition, the EPA considered any additional data or information provided to the EPA by states or tribes.

The five factors recommended in the EPA's guidance are:

1. Air Quality Data (including the design value calculated for each Federal Reference Method (FRM) or Federal Equivalent Method (FEM) monitor);
2. Emissions and Emissions-Related Data (including locations of sources, population, amount of emissions, and urban growth patterns);
3. Meteorology (weather/transport patterns);
4. Geography/Topography (including mountain ranges or other physical features that may influence the fate and transport of emissions and ozone concentrations); and
5. Jurisdictional Boundaries (e.g., counties, air districts, existing nonattainment areas, areas of Indian country, Metropolitan Planning Organizations (MPOs)).

### **3.1 Technical Analysis for the Cleveland, Ohio Area**

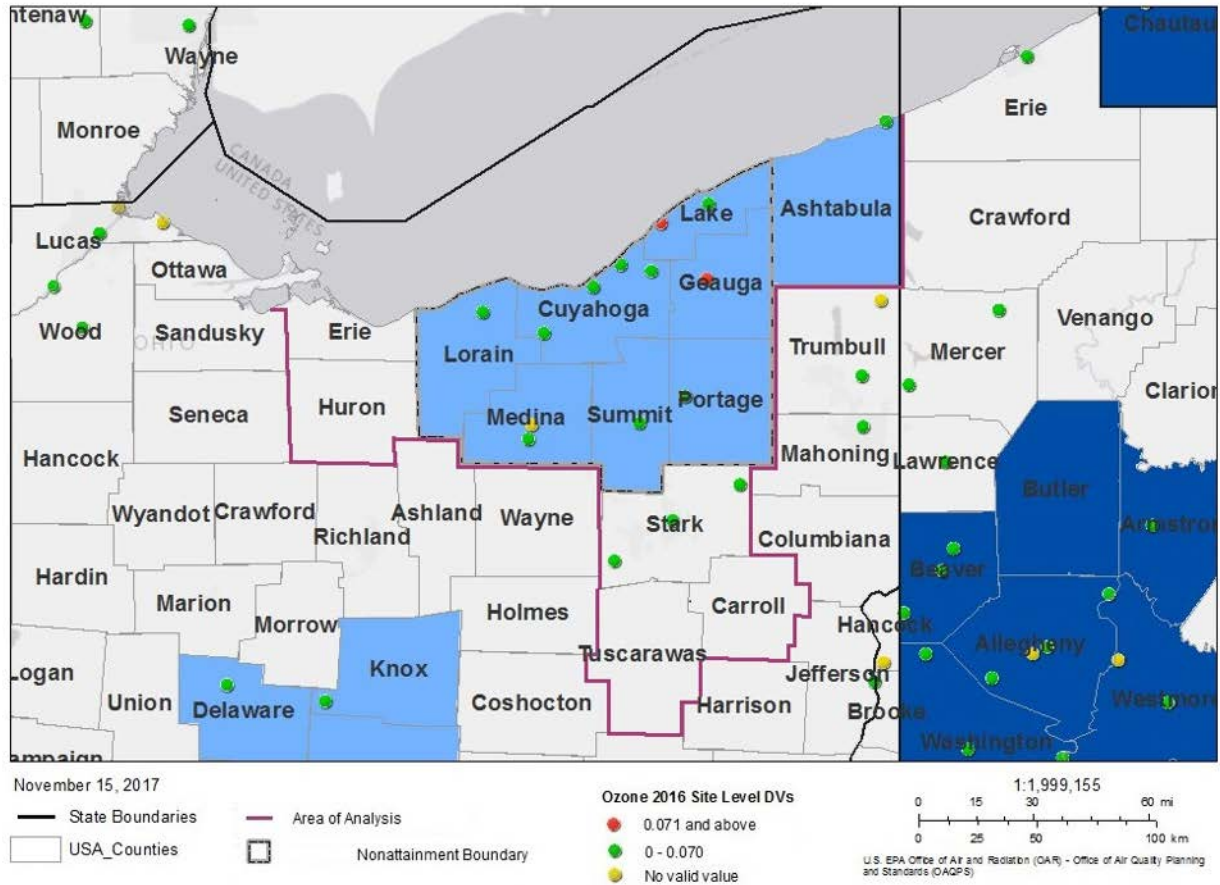
For the Cleveland area, the starting point for the area of analysis is the Cleveland-Akron-Canton, Ohio CSA which includes the following counties: Erie, Huron, Lorain, Medina, Summit, Stark, Carroll, Cuyahoga, Lake, Geauga, Portage, Ashtabula, and Tuscarawas. Figure 1 is a map of the EPA's nonattainment boundary for the Cleveland area. The map shows the location of the ambient air quality monitors; county boundaries; the area of analysis, i.e. the Cleveland-Akron-Canton CSA; and the 2008 ozone NAAQS nonattainment boundary (light blue).

For purposes of the 1997 and 2008 ozone NAAQS, this area was designated nonattainment. The boundary of the nonattainment area for both the 1997 and 2008 ozone NAAQS included eight counties - Ashtabula, Cuyahoga, Geauga, Lake, Lorain, Medina, Portage, and Summit Counties.

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<sup>5</sup> The EPA's Ozone Designations Guidance and Data web page can be found at <https://www.epa.gov/ozone-designations/ozone-designations-guidance-and-data>.

**Figure 1. EPA's Nonattainment Boundaries for the Cleveland Area**



The EPA must designate as nonattainment any area that violates the NAAQS and any nearby areas that contribute to the violation in the violating area. Geauga and Lake Counties have monitors in violation of the 2015 ozone NAAQS, therefore these counties are included in the nonattainment area. The following sections describe the five factor analysis EPA used to evaluate counties in the area of analysis to determine whether to modify the State’s recommendation. While the factors are presented individually, they are not independent. The five factor analysis process carefully considers the interconnections among the different factors and the dependence of each factor on one or more of the others, such as the interaction between emissions and meteorology for the area being evaluated.

## Factor Assessment

### Factor 1: Air Quality Data

The EPA considered 8-hour ozone design values in ppm for air quality monitors in the area of analysis based on data for the 2014-2016 period (i.e., the 2016 design value, or DV). This is the most recent three-year period with fully-certified air quality data. The design value is the 3-year average of the annual 4<sup>th</sup>

highest daily maximum 8-hour average ozone concentration.<sup>6</sup> The 2015 NAAQS are met when the design value is 0.070 ppm or less. Only ozone measurement data collected in accordance with the quality assurance (QA) requirements using approved (FRM/FEM) monitors are used for NAAQS compliance determinations.<sup>7</sup> The EPA uses FRM/FEM measurement data residing in the EPA's Air Quality System (AQS) database to calculate the ozone design values. Individual violations of the 2015 ozone NAAQS that the EPA determines have been caused by an exceptional event that meets the administrative and technical criteria in the Exceptional Events Rule<sup>8</sup> are not included in these calculations. Whenever several monitors are located in a county (or designated nonattainment area), the design value for the county or area is determined by the monitor with the highest valid design value. The presence of one or more violating monitors (i.e. monitors with design values greater than 0.070 ppm) in a county or other geographic area forms the basis for designating that county or area as nonattainment. The remaining four factors are then used as the technical basis for determining the spatial extent of the designated nonattainment area surrounding the violating monitor(s) based on a consideration of what nearby areas are contributing to a violation of the NAAQS.

The EPA identified monitors where the most recent design values violate the NAAQS, and examined historical ozone air quality measurement data (including previous design values) to understand the nature of the ozone ambient air quality problem in the area. Eligible monitors for providing design value data generally include State and Local Air Monitoring Stations (SLAMS) that are operated in accordance with 40 CFR part 58, appendix A, C, D and E and operating with an FRM or FEM monitor. These requirements must be met in order to be acceptable for comparison to the 2015 ozone NAAQS for designation purposes. All data from Special Purpose Monitors (SPMs) using an FRM or FEM are eligible for comparison to the NAAQS, subject to the requirements given in the March 28, 2016 Revision to Ambient Monitoring Quality Assurance and Other Requirements Rule (81 FR 17248).

The 2014-2016 design values for monitors in counties in the area of analysis are shown in Table 2.

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<sup>6</sup> The specific methodology for calculating the ozone design values, including computational formulas and data completeness requirements, is described in 40 CFR part 50, appendix U.

<sup>7</sup> The QA requirements for ozone monitoring data are specified in 40 CFR part 58, appendix A. The performance test requirements for candidate FEMs are provided in 40 CFR part 53, subpart B.

<sup>8</sup> The EPA finalized the rule on the Treatment of Data Influenced by Exceptional Events (81 FR 68513) and the guidance on the Preparation of Exceptional Events Demonstrations for Wildfire Events in September of 2016. For more information, see <https://www.epa.gov/air-quality-analysis/exceptional-events-rule-and-guidance>.

**Table 2. Air Quality Data (all values in ppm)<sup>a</sup>.**

County	State Recommended Nonattainment?	AQS Site ID	2014-2016 DV	2014 4 <sup>th</sup> highest daily max value	2015 4 <sup>th</sup> highest daily max value	2016 4 <sup>th</sup> highest daily max value
Ashtabula	No	39-007-1001	<b>0.070</b>	0.069	0.070	0.072
Carroll	No	No monitor	N/A			
Cuyahoga	Yes	39-035-0034	<b>0.069</b>	0.071	0.068	0.07
		39-035-0060	0.064	0.066	0.063	0.063
		39-035-0064	0.064	0.059	0.066	0.068
		39-035-5002	0.068	0.061	0.072	0.071
Erie	No	No monitor	N/A			
Geauga	Yes	39-055-0004	<b>0.071</b>	0.065	0.073	0.077
Huron	No	No monitor	N/A			
Lake	Yes	39-085-0003	<b>0.075</b>	0.075	0.074	0.076
		39-085-0007	0.067	0.062	0.070	0.069
Lorain	Yes	39-093-0018	<b>0.066</b>	0.067	0.062	0.070
Medina	Yes	39-103-0004	<b>0.064</b>	0.064	0.063	0.066
Portage	Yes	39-133-1001	<b>0.061</b>	0.061	0.064	0.059
Stark	No	39-151-0016	<b>0.069</b>	0.065	0.072	0.072
		39-151-0022	0.064	0.059	0.068	0.067
		39-151-4005	0.066	0.061	0.067	0.071
Summit	Yes	39-153-0020	<b>0.061</b>	0.058	0.065	0.061
Tuscarawas	No	No monitor	N/A			

<sup>a</sup>The highest design value in each county is indicated in bold type.

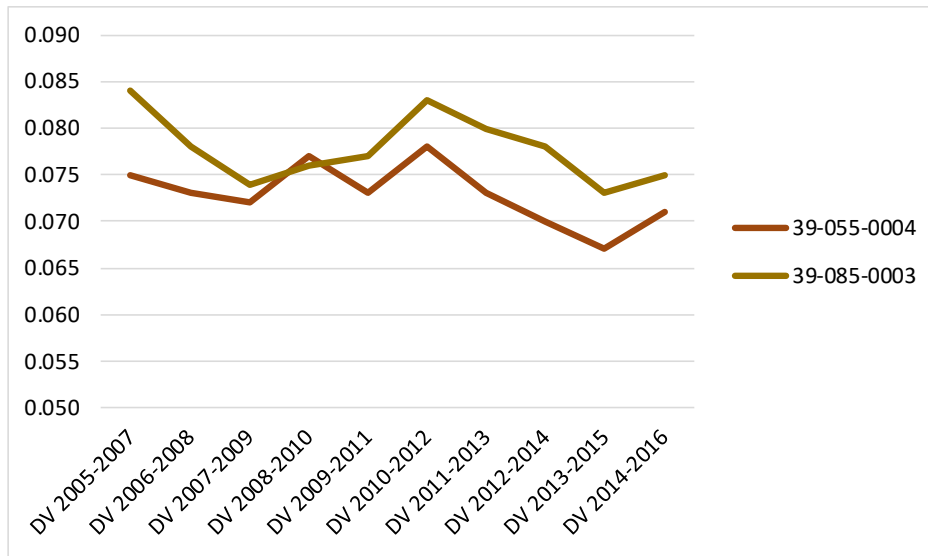
N/A means that the monitor did not meet the completeness criteria described in 40 CFR, part 50, Appendix U, or no data exists for the county.

Geauga and Lake counties show a violation of the 2015 ozone NAAQS, therefore these counties are included in the nonattainment area. A county (or partial county) must also be designated nonattainment if it contributes to a violation in a nearby area. Each county in the area of analysis has been evaluated based on the weight-of-evidence of the five factors and other relevant information to determine whether it contributes to the nearby violation.

Figure 1, shown previously, identifies the Cleveland nonattainment area, the area of analysis and the violating monitors. Table 2 identifies the design values for all monitors in the area of analysis and Figure 2 shows the historical trend of design values for the monitors in the area that are violating the 2015 ozone NAAQS based on 2016 DVs. As indicated on the map, there are two violating monitors that are located in Geauga and Lake Counties. As shown in Figure 2, design values at both of the violating monitors in the area are generally trending downward but have risen over the past two DV periods.



**Figure 2. Three-Year Design Values for Violating Monitors (2007-2016).**



## **Factor 2: Emissions and Emissions-Related Data**

The EPA evaluated ozone precursor emissions of nitrogen oxides (NO<sub>x</sub>) and volatile organic compounds (VOC) and other emissions-related data that provide information on areas contributing to violating monitors.

### **Emissions Data**

The EPA reviewed data from the 2014 National Emissions Inventory (NEI). For each county in the area of analysis, the EPA examined the magnitude of large sources (NO<sub>x</sub> or VOC emissions greater than 100 tons per year), the location of small point sources, and the magnitude of county-level emissions reported in the NEI. These county-level emissions represent the sum of emissions from the following general source categories: point sources, non-point (i.e., area) sources, non-road mobile, on-road mobile, and fires. Emissions levels from sources in a nearby area indicate the potential for the area to contribute to monitored violations.

Table 3 provides a county-level emissions summary of NO<sub>x</sub> and VOC (given in tons per year (tpy)) emissions for the area of analysis considered for inclusion in the Cleveland nonattainment area.

**Table 3. Total County-Level NO<sub>x</sub> and VOC Emissions.**

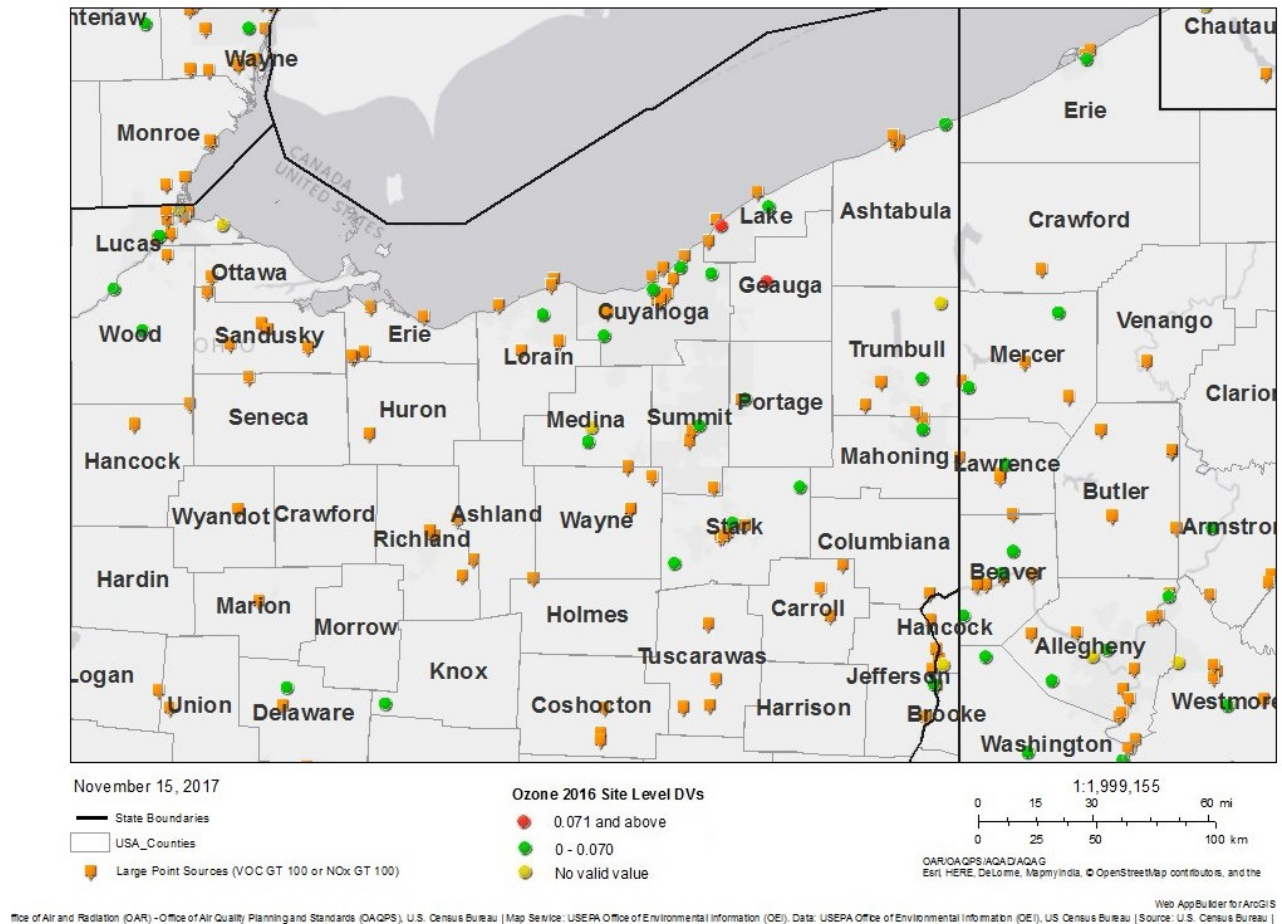
County	State Recommended Nonattainment?	Total NO <sub>x</sub> (tpy)	Total VOC (tpy)
Cuyahoga	Yes	27,676	29,435
Summit	Yes	11,858	12,563
Lorain	Yes	11,307	7,800
Stark	No	9,550	11,257
Lake	Yes	8,782	7,368
Ashtabula	No	4,788	6,791
Erie	No	4,514	4,101
Portage	Yes	4,292	5,449
Medina	Yes	3,750	4,646
Tuscarawas	No	3,255	3,799
Huron	No	2,939	3,300
Carroll	No	2,847	5,966
Geauga	Yes	1,735	3,100
Area wide:		97,293	105,573

In addition to reviewing county-wide emissions of NO<sub>x</sub> and VOC in the area of analysis, the EPA also reviewed emissions from large point sources, i.e., those emitting more than 100 tons per year (tpy) of NO<sub>x</sub> and/or VOC. Table 4 provides a county-level emissions summary of large point source NO<sub>x</sub> and VOC emissions (tpy), based on the 2014 NEI, for the area of analysis. The location of these sources, together with the other factors, can help inform nonattainment boundaries. The locations of the large sources are shown in Figure 3 below.

**Table 4. 2014 NEI County-Level NO<sub>x</sub> and VOC Emissions from Large Point Sources.**

County	Large Point Source NO <sub>x</sub> (tpy)	Large Point Source VOC (tpy)
Lorain	4,199	378
Cuyahoga	3,255	452
Stark	923	412
Carroll	749	203
Ashtabula	678	2,307
Lake	585	29
Tuscarawas	522	414
Huron	519	593
Erie	517	162
Summit	423	39
Portage	-	189
Geauga	-	-
Medina	-	-
Area wide:	12,370	5,177

**Figure 3. Large Point Sources in the Area of Analysis.**



As shown in Table 3, Cuyahoga County stands out with the highest 2014 NEI NO<sub>x</sub> and VOC emissions in the area of analysis, followed by Summit County, which has less than half the emissions of Cuyahoga County. Lorain, Stark, and Lake Counties also have relatively high NO<sub>x</sub> emissions at approximately 41% - 31% of Cuyahoga County NO<sub>x</sub> emissions, followed by Ashtabula, Erie, and Portage Counties, with 17% - 16% of Cuyahoga County NO<sub>x</sub> emissions. Medina, Tuscarawas, Huron, and Carroll Counties have approximately 14% - 10% of Cuyahoga County NO<sub>x</sub> emissions. Geauga County has the least NO<sub>x</sub> emissions in the area of analysis at 6% of Cuyahoga County emissions. With respect to VOC, Stark County also has relatively high emissions with approximately 38% of Cuyahoga County's VOC emissions, followed by Lorain, Lake, Ashtabula, Carroll, and Portage Counties, with approximately 26% - 19% of Cuyahoga County VOC emissions. Medina, Erie, Tuscarawas, Huron, and Geauga Counties have somewhat lower VOC emissions as compared to other counties in the CSA at approximately 16-11% of Cuyahoga County VOC emissions. As shown in Table 4, Cuyahoga and Lorain Counties have a significantly higher portion of the CSA's large point source NO<sub>x</sub> emissions than any of the other counties. Geauga, Portage, and Medina have no large point sources of NO<sub>x</sub>, with the remaining counties making up from 3% to 7% of the CSA's large point source NO<sub>x</sub> emissions. Ashtabula County has approximately 45% of the CSA's large point source VOC emissions. Geauga and Medina County have no

large point sources of VOC and the remaining Counties in the CSA contain from 1% to 11% of the CSA's large point source VOC emissions.

**Population density and degree of urbanization**

In this part of the factor analysis, the EPA evaluated the population and vehicle use characteristics and trends of the area as indicators of the probable location and magnitude of non-point source emissions. These include emissions of NO<sub>x</sub> and VOC from on-road and non-road vehicles and engines, consumer products, residential fuel combustion, and consumer services. Areas of dense population or commercial development are an indicator of area source and mobile source NO<sub>x</sub> and VOC emissions that may contribute to violations of the NAAQS. Table 5 shows the population, population density, and population growth information for each county in the area of analysis. Figure 4 shows the county-level population density for the area of analysis.

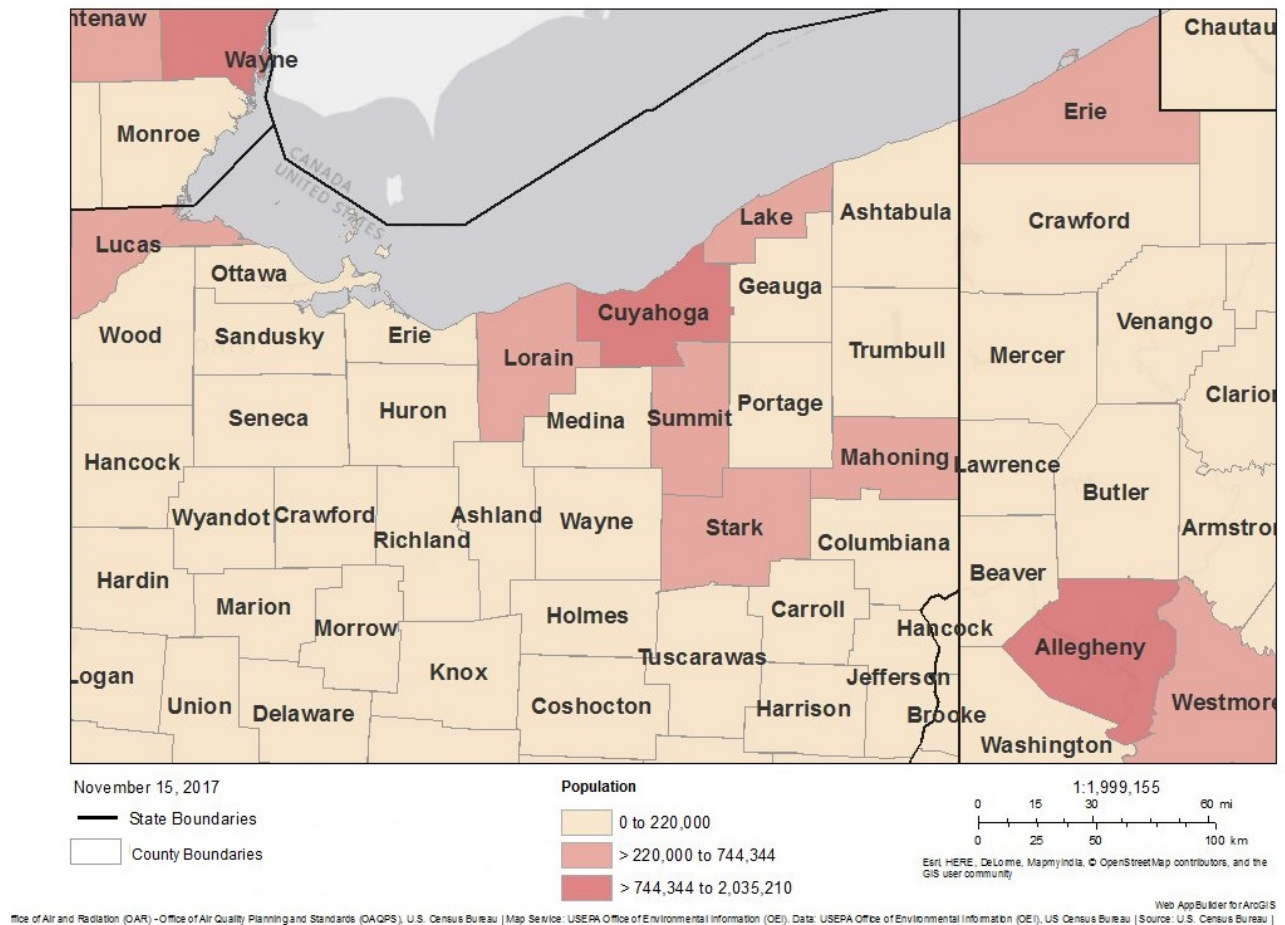
**Table 5. Population and Growth.**

County	State Recommended Nonattainment?	2010 Population	2015 Population	2015 Population Density (per sq. mi.)	Absolute Change in Population (2010-2015)	Population % Change (2010-2015)
Cuyahoga	Yes	1,280,122	1,255,921	2747	-24,201	-2%
Summit	Yes	541,781	541,968	1313	187	0%
Stark	No	375,586	375,165	652	-421	0%
Lorain	Yes	301,356	305,147	621	3,791	1%
Lake	Yes	230,041	229,245	1008	-796	0%
Medina	Yes	172,332	176,395	419	4,063	2%
Portage	Yes	161,419	162,275	333	856	1%
Ashtabula	No	101,497	98,632	141	-2,865	-3%
Geauga	Yes	93,389	94,102	235	713	1%
Tuscarawas	No	92,582	92,916	164	334	0%
Erie	No	77,079	75,550	300	-1,529	-2%
Huron	No	59,626	58,469	119	-1,157	-2%
Carroll	No	28,836	27,811	70	-1,025	-4%
Area wide:		3,515,646	3,493,596	543	-22,050	-1%

\* For state recommended partial counties, the emissions shown are for the entire county.

Source: U.S. Census Bureau population estimates for 2010 and 2015. [www.census.gov/data.html](http://www.census.gov/data.html)

**Figure 4. County-Level Population.**



Evaluation of the population data in Table 5 and Figure 4 shows that Cuyahoga County stands out with the highest population in the area of analysis, followed by Summit County, which has less than half the population of Cuyahoga County. Stark and Lorain Counties have 30% and 24% of the population of Cuyahoga County, respectively, followed by Lake, Medina, and Portage Counties, with 18% to 13% of the population of Cuyahoga County. The remaining counties range from 2% to 8% of the population of Cuyahoga County. Cuyahoga County also has more than twice the population density of Summit or Lake, the next most densely populated counties. Stark and Lorain Counties are somewhat less densely populated at less than a quarter the population density of Cuyahoga, followed by the remaining counties, with steadily declining population densities. No county in the area has experienced more than minor population growth and most areas have seen a small decline.

**Traffic and Vehicle Miles Travelled (VMT)**

The EPA evaluated the commuting patterns of residents, as well as the total vehicle miles traveled (VMT) for each county in the area of analysis. In combination with the population/population density data and the location of main transportation arteries, this information helps identify the probable location of non-point source emissions. A county with high VMT and/or a high number of commuters is generally an integral part of an urban area and high VMT and/or high number of commuters indicates the presence of motor vehicle emissions that may contribute to violations of the NAAQS. Rapid VMT growth in a county

on the urban perimeter may signify increasing integration with the core urban area, and thus could indicate that the associated area source and mobile source emissions may be appropriate to include in the nonattainment area. In addition to VMT, the EPA evaluated worker data collected by the U.S. Census Bureau<sup>9</sup> for the counties in the area of analysis. Table 6 shows the traffic and commuting pattern data, including total VMT for each county, number of residents who work in each county, number of residents that work in counties with violating monitor(s), and the percent of residents working in counties with violating monitor(s). The data in Table 6 are 2014 data.

**Table 6. Traffic and Commuting Patterns.**

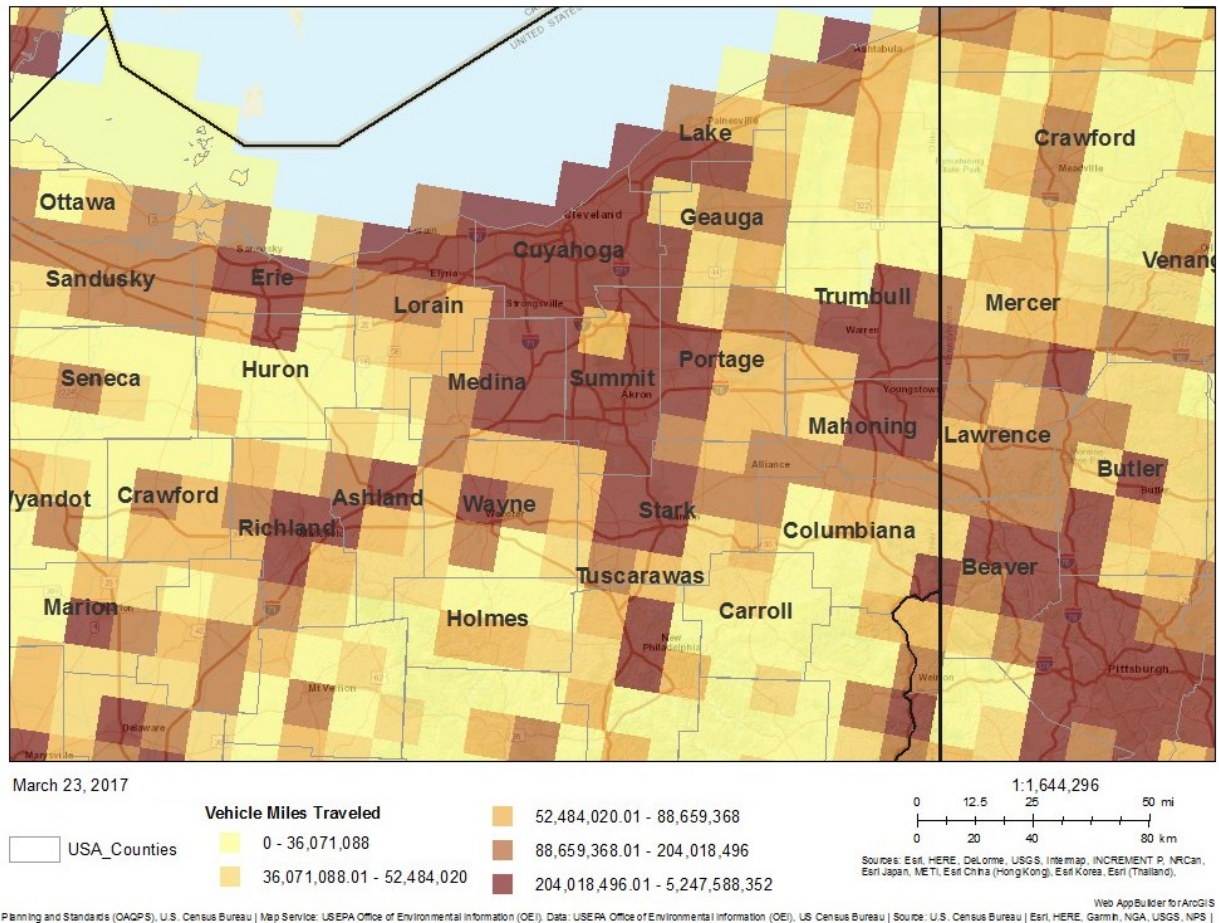
County	State Recommended Nonattainment?	2014 Total VMT (million miles)	Number of County Residents Who Work	Number Commuting to or Within Counties with Violating Monitors	Percentage Commuting to or Within Counties with Violating Monitors
Cuyahoga	Yes	10,536	564,925	20,339	4%
Summit	Yes	5,853	244,635	3,905	2%
Stark	No	3,153	167,589	1,130	1%
Lorain	Yes	2,424	137,212	1,626	1%
<b>Lake</b>	Yes	2,031	115,813	56,545	49%
Portage	Yes	1,758	70,693	3,001	4%
Medina	Yes	1,568	87,433	988	1%
Erie	No	1,150	33,069	124	0.4%
Ashtabula	No	1,005	38,261	6,598	17%
Tuscarawas	No	999	42,214	173	0.4%
<b>Geauga</b>	Yes	746	43,082	17,224	40%
Huron	No	422	26,113	109	0.4%
Carroll	No	243	12,287	95	1%
Total:		31,888.47	1,583,326	111,857	7%

Counties with a monitor(s) violating the NAAQS are indicated in bold.

To show traffic and commuting patterns, Figure 5 overlays twelve-kilometer gridded VMT from the 2014 NEI.

<sup>9</sup> The worker data can be accessed at: <http://onthemap.ces.census.gov/>.

**Figure 5. Twelve Kilometer Gridded VMT (Miles) Overlaid with Transportation Arteries.**



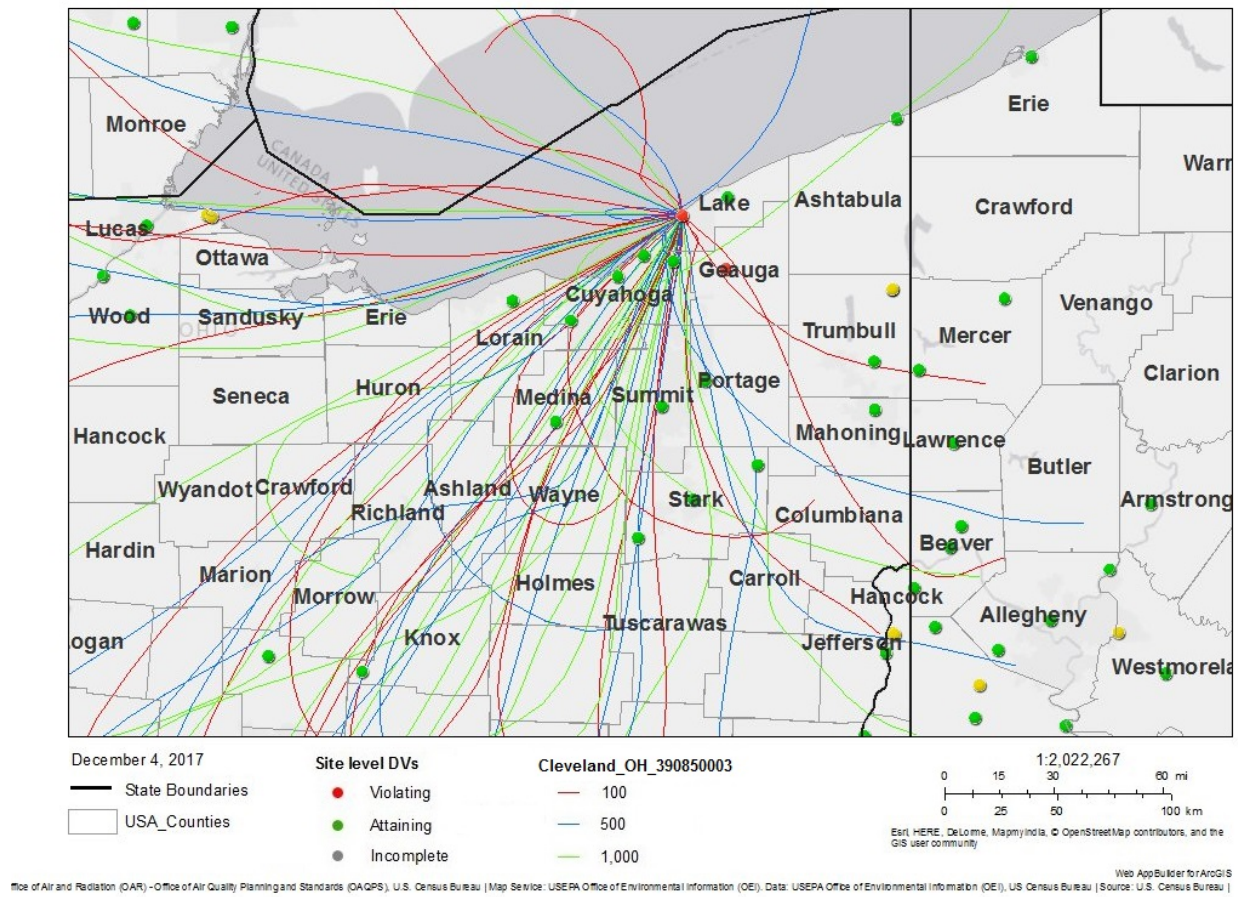
As shown in Table 6, Cuyahoga County has notably higher VMT than the other counties in the area of analysis, followed by Summit County, which has just over half the VMT of Cuyahoga County. Stark and Lorain Counties have 30% and 23% of the VMT of Cuyahoga County, respectively. VMT continues to decline steadily with Lake, Portage, Medina, Erie, Ashtabula, and Tuscarawas Counties having 19% to 9% of Cuyahoga’s VMT. By comparison, Geauga, Huron and Carroll Counties have relatively low VMT with 7% to 2% of that of Cuyahoga County.

The major metropolitan area in the area of analysis is in Cuyahoga County. There is not a violating monitor in Cuyahoga County, so it is not surprising that despite having a large working population, there are few commuters in Cuyahoga County that travel to or within a county with a violating monitor. Also, not surprisingly, the two counties with violating monitors have the highest percentage of commuters traveling to or within a county with a violating monitor – 49% in Lake and 40% in Geauga. With the exception of Ashtabula, with 17%, all of the remaining counties have less than 5%. Stark and Carroll Counties form the Canton-Massillon Metropolitan Statistical Area (MSA) at the southern tip of the area of analysis. Less than 1% of the workers in these counties commute to a county with a violating monitor and less than 5% of the workers commute to Cuyahoga County, where the city of Cleveland is located.

### Factor 3: Meteorology

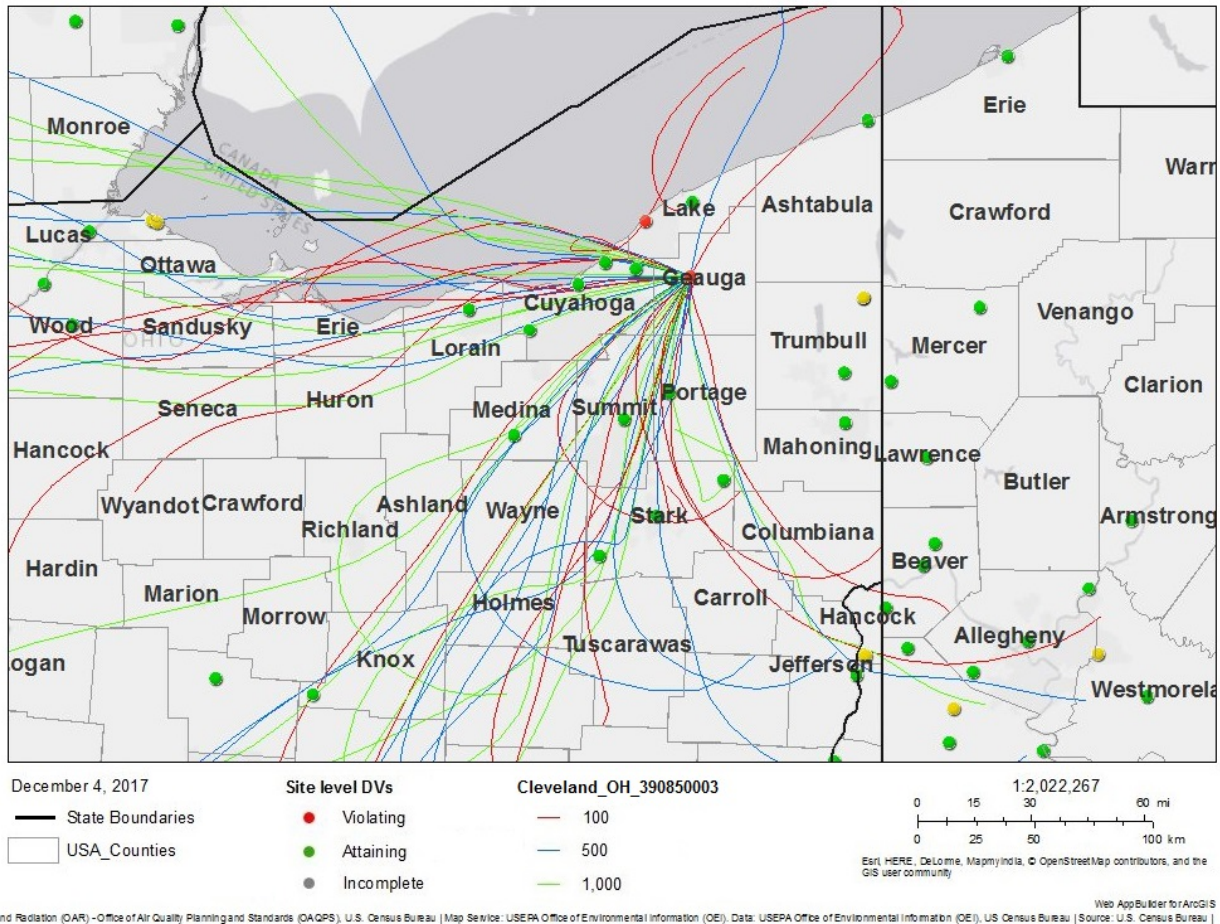
Evaluation of meteorological data helps to assess the fate and transport of emissions contributing to ozone concentrations and to identify areas potentially contributing to the monitored violations. Results of meteorological data analysis may inform the determination of nonattainment area boundaries. In order to determine how meteorological conditions, including, but not limited to, weather, transport patterns, and stagnation conditions, could affect the fate and transport of ozone and precursor emissions from sources in the area., the EPA evaluated 2014-2016 HYSPLIT (HYbrid Single-Particle Lagrangian Integrated Trajectory) trajectories at 100, 500, and 1000 meters above ground level (AGL) that illustrate the three-dimensional paths traveled by air parcels to a violating monitor. Figures 6a and 6b show the 24-hour HYSPLIT back trajectories for each exceedance day (i.e., daily maximum 8 hour values that exceed the 2015 ozone NAAQS) for the violating monitors.

**Figure 6a. HYSPLIT Back Trajectories for Lake County Monitor 39-085-0003.**





**Figure 6b. HYSPLIT Back Trajectories for Geauga County Monitor 39-085-0003.**



The 2014-2016 HYSPLIT back trajectories displayed in Figures 6a and 6b show that transport winds blew predominantly from the west, southwest, and south during times when the violating monitors in the Cleveland area measured exceedances of the 2015 Ozone NAAQS. Together, these figures show a dense pattern of HYSPLIT back trajectories across Cuyahoga, Summit and Medina Counties and portions of Geauga and Portage Counties. Lake County has dense back trajectories to the south and west of the violating monitor and few back trajectories across the remainder of the county. Lorain County has moderately dense HYSPLIT back trajectories, as do portions of Stark County. Erie, Huron, Tuscarawas, and Carroll Counties have less dense back trajectories and Ashtabula has only two, which is the fewest within the area of analysis.

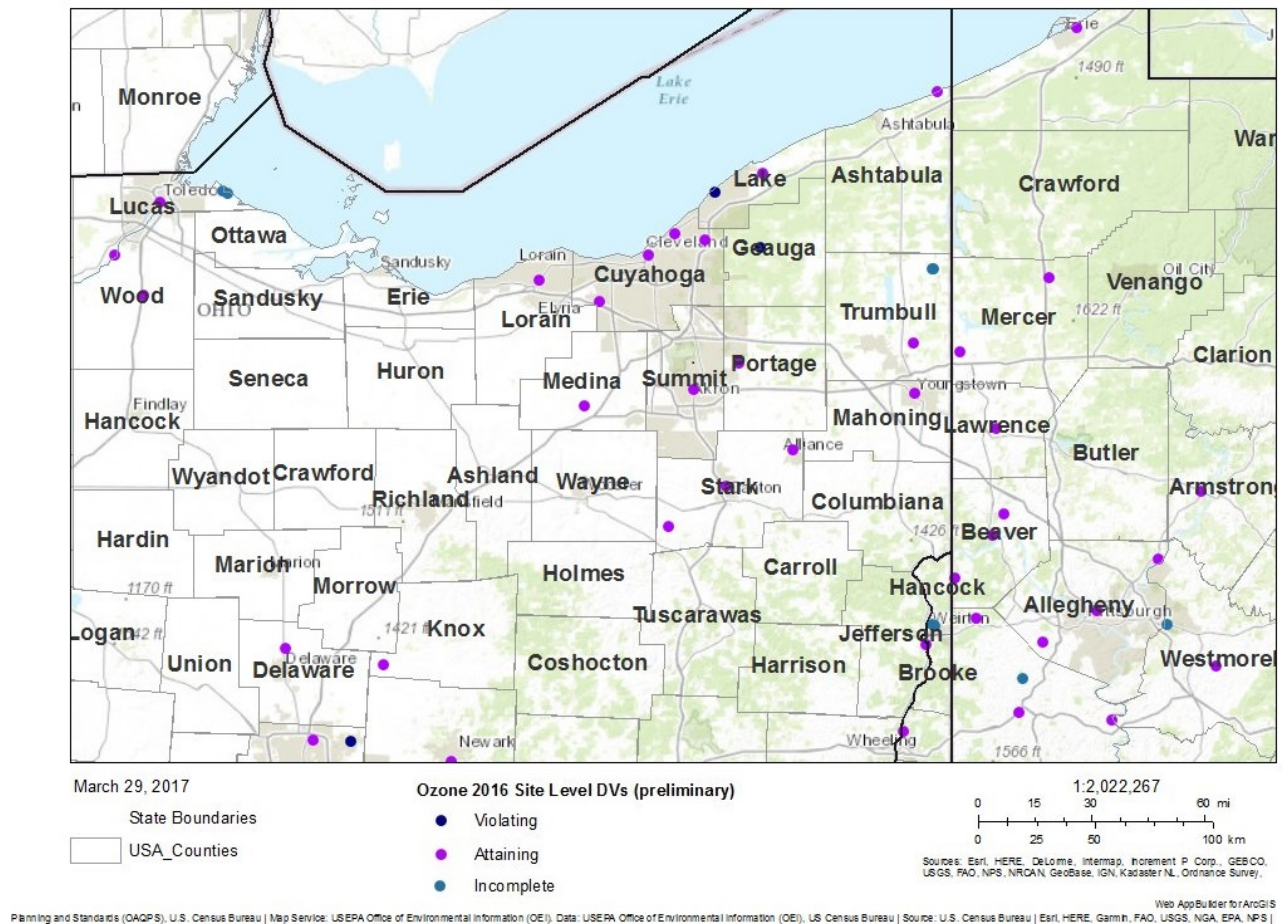
**Factor 4: Geography/topography**

Consideration of geography or topography can provide additional information relevant to defining nonattainment area boundaries. Analyses should examine the physical features of the land that might define the airshed. Mountains or other physical features may influence the fate and transport of emissions

as well as the formation and distribution of ozone concentrations. The absence of any such geographic or topographic features may also be a relevant consideration in selecting boundaries for a given area.

The Cleveland area does not have any geographical or topographical features significantly limiting air pollution transport within its air shed. Therefore, this factor did not play a role in this evaluation.

**Figure 7. Topographic Illustration of the Physical Features.**



**Factor 5: Jurisdictional boundaries**

Once the geographic extent of the violating area and the nearby area contributing to violations is determined, the EPA considered existing jurisdictional boundaries for the purposes of providing a clearly defined legal boundary to carry out the air quality planning and enforcement functions for nonattainment areas. In defining the boundaries of the Cleveland nonattainment area, the EPA considered existing jurisdictional boundaries, which can provide easily identifiable and recognized boundaries for purposes of implementing the NAAQS. Examples of jurisdictional boundaries include, but are not limited to: counties, air districts, areas of Indian country, metropolitan planning organizations, and existing nonattainment areas. If an existing jurisdictional boundary is used to help define the nonattainment area, it must encompass all of the area that has been identified as meeting the nonattainment definition. Where existing jurisdictional boundaries are not adequate or appropriate to describe the nonattainment area, the

EPA considered other clearly defined and permanent landmarks or geographic coordinates for purposes of identifying the boundaries of the designated areas.

The area of analysis for the Cleveland area is the Cleveland-Akron-Canton CSA. This CSA consists of seven CBSAs. The Cleveland-Elyria Metropolitan Statistical Area (MSA), containing the main metropolitan area and both violating monitors, includes Cuyahoga, Geauga, Lake, Lorain, and Medina Counties. The Akron MSA (Summit and Portage Counties), Ashtabula Micropolitan Statistical Area (Ashtabula County), Norwalk Micropolitan Statistical Area (Huron County), and Sandusky Micropolitan Statistical Area (Erie County) are adjacent to the Cleveland-Elyria MSA. The Canton-Massillon MSA (Stark and Carroll Counties) is south of and adjacent to the Akron MSA. The New Philadelphia-Dove Micropolitan Statistical Area (Tuscarawas County) is adjacent to and southwest of the Canton-Massillon MSA.

The Cleveland area has previously established nonattainment boundaries associated with the 1997 and 2008 ozone NAAQS. For both the 1997 and 2008 ozone NAAQS, the nonattainment area included Ashtabula, Cuyahoga, Geauga, Lake, Lorain, Medina, Portage, and Summit Counties. The state has recommended a different boundary for the 2015 ozone NAAQS, which would exclude Ashtabula County but still include Cuyahoga, Geauga, Lake, Lorain, Medina, Portage, and Summit Counties in the nonattainment area.

## **Conclusion for the Cleveland Area**

Based on the assessment of factors described above, the EPA is not modifying Ohio's recommendation that the following seven counties should be included within the boundaries of the nonattainment area: Cuyahoga, Geauga, Lake, Lorain, Medina, Portage, and Summit.

The air quality monitors in Lake and Geauga Counties indicate violations of the 2015 ozone NAAQS based on 2016 design values, therefore these counties are included in the nonattainment area. Cuyahoga County stands out with the highest NO<sub>x</sub> and VOC emissions, population, population density, and VMT in the area of analysis. In addition, the meteorological data indicate that a large number of trajectories pass through Cuyahoga on days that the monitors are exceeding the NAAQS. Summit County ranks second in every factor, with slightly less than half the emissions, population, and population density of Cuyahoga County and a little more than half its VMT. Lorain, Medina, and Portage Counties also rank relatively high for most of the factors. All four of these counties have a significant number of trajectories that pass through the counties on days that the violating monitors are exceeding the NAAQS. Geographically, these counties include the main metropolitan area in the area of analysis (Cleveland, in Cuyahoga County) as well as every county surrounding it.

Erie, Tuscarawas, Huron, and Carroll Counties rank relatively low for all of the factors. While Ashtabula County has moderate emissions as compared to other counties in the area of analysis (17% and 23% of Cuyahoga County's NO<sub>x</sub> and VOC emissions, respectively), the county ranks relatively low in population density and VMT and has only two HYSPLIT trajectories that pass through the county on days that the violating monitors are exceeding the NAAQS. Stark County has approximately a third of Cuyahoga County's emissions, population and VMT, less than a quarter of its population density, and a relatively

less dense pattern of HYSPLIT back trajectories than Cuyahoga, Summit, Medina, Portage and Geauga Counties. Less than 1% of the workers in Stark County commute to a county with a violating monitor, and less than 5% of workers living in Stark County commute to Cuyahoga County, the county containing the main metropolitan area in the area of analysis. Approximately 60% of the workers who live in Stark County work within the Canton-Massillon MSA (Stark and Carroll Counties). This forms the basis for excluding Stark County from the nonattainment boundary. Stark County was not designated as part of the Cleveland area under previous ozone standards. The last time the area was designated as nonattainment, under the 1997 standard, it was designated separately as the Canton area. Ohio contends that because there have not been significant changes in the factors being considered since designations were made under the 1997 and 2008 ozone NAAQS, it is unnecessary to expand the Cleveland area to include the former Canton area.

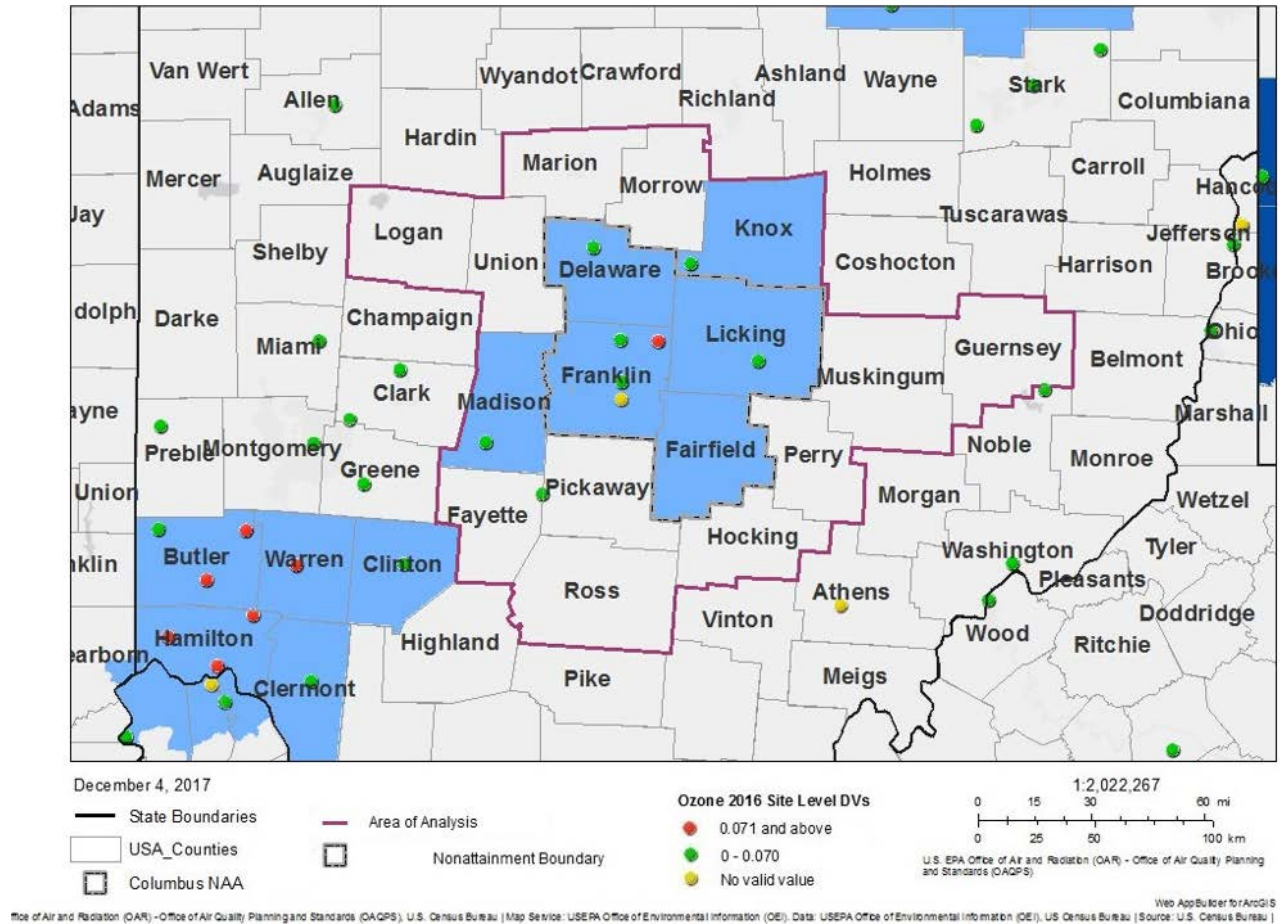
After evaluating the five factors, the EPA is not modifying the State's recommendation and is designating Cuyahoga, Geauga, Lake, Lorain, Medina, Portage, and Summit Counties as the Cleveland nonattainment area for the 2015 ozone NAAQS.

### **3.2 Technical Analysis for the Columbus, Ohio Area**

Franklin County, within the state of Ohio, contains one ozone monitor that shows a violation of the 2015 NAAQS. Franklin County is located within the Columbus-Marion-Zanesville, OH CSA. The area of analysis for this portion of the TSD is the 13 counties that comprise the Columbus-Marion-Zanesville, OH CSA. Figure 8 is a map of the area of analysis along with EPA's nonattainment boundary for the Columbus area. The map also shows the location of the ambient air quality monitors, county boundaries, and the boundary of the Columbus nonattainment area for the 2008 ozone NAAQS.

The boundaries of the Columbus nonattainment area for both the 1997 and 2008 ozone NAAQS included Delaware, Fairfield, Franklin, Knox, Licking, and Madison Counties.

**Figure 8. EPA's Nonattainment Boundaries for the Columbus Area**



The EPA must designate as nonattainment any area that violates the NAAQS and any nearby areas that contribute to the violation in the violating area. Franklin County has a monitor in violation of the 2015 ozone NAAQS, this county is included in the nonattainment area. The EPA state recommended that Delaware, Licking, and Fairfield Counties be included in the nonattainment area based on contribution and EPA is not modifying the State’s recommendation. The following sections describe the five factor analysis EPA used to determine whether to modify the State’s recommendation. While the factors are presented individually, they are not independent. The five factor analysis process carefully considers the interconnections among the different factors and the dependence of each factor on one or more of the others, such as the interaction between emissions and meteorology for the area being evaluated.

## Factor Assessment

### Factor 1: Air Quality Data

The EPA considered 8-hour ozone design values in ppm for air quality monitors in the area of analysis based on data for the 2014-2016 period (i.e., the 2016 design value, or DV). This is the most recent three-year period with fully-certified air quality data. The design value is the 3-year average of the annual 4<sup>th</sup> highest daily maximum 8-hour average ozone concentration. The 2015 NAAQS are met when the design

value is 0.070 ppm or less. Only ozone measurement data collected in accordance with the quality assurance (QA) requirements using approved (FRM/FEM) monitors are used for NAAQS compliance determinations. The EPA uses FRM/FEM measurement data residing in the EPA's Air Quality System (AQS) database to calculate the ozone design values. Individual violations of the 2015 ozone NAAQS that the EPA determines have been caused by an exceptional event that meets the administrative and technical criteria in the Exceptional Events Rule are not included in these calculations. Whenever several monitors are located in a county (or designated nonattainment area), the design value for the county or area is determined by the monitor with the highest valid design value. The presence of one or more violating monitors (i.e. monitors with design values greater than 0.070 ppm) in a county or other geographic area forms the basis for designating that county or area as nonattainment. The remaining four factors are then used as the technical basis for determining the spatial extent of the designated nonattainment area surrounding the violating monitor(s) based on a consideration of what nearby areas are contributing to a violation of the NAAQS.

The EPA identified monitors where the most recent design values violate the NAAQS, and examined historical ozone air quality measurement data (including previous design values) to understand the nature of the ozone ambient air quality problem in the area. Eligible monitors for providing design value data generally include State and Local Air Monitoring Stations (SLAMS) that are operated in accordance with 40 CFR part 58, appendix A, C, D and E and operating with an FRM or FEM monitor. These requirements must be met in order to be acceptable for comparison to the 2015 ozone NAAQS for designation purposes. All data from Special Purpose Monitors (SPMs) using an FRM or FEM are eligible for comparison to the NAAQS, subject to the requirements given in the March 28, 2016 Revision to Ambient Monitoring Quality Assurance and Other Requirements Rule (81 FR 17248).

The 2014-2016 design values for counties in the area of analysis are shown in Table 7.

**Table 7. Air Quality Data (all values in ppm).<sup>a</sup>**

County	State Recommended Nonattainment?	AQS Site ID	2014-2016 DV	2014 4 <sup>th</sup> highest daily max value	2015 4 <sup>th</sup> highest daily max value	2016 4 <sup>th</sup> highest daily max value
Delaware	Yes	39-041-0002	<b>0.067</b>	0.066	0.068	0.067
Fairfield	Yes	No monitor	N/A			
Fayette	No	39-047-9991	<b>0.068</b>	0.069	0.070	0.067
Franklin	Yes	39-049-0029	<b>0.071</b>	0.070	0.071	0.072
		39-049-0037	0.066	0.069	0.064	0.067
		39-049-0081	0.067	0.068	0.063	0.071
Guernsey	No	No monitor	N/A			
Hocking	No	No monitor	N/A			
Knox	No	39-083-0002	<b>0.067</b>	0.066	0.071	0.066
Licking	Yes	39-089-0005	<b>0.067</b>	0.066	0.068	0.067
Logan	No	No monitor	N/A			
Madison	No	39-097-0007	<b>0.068</b>	0.069	0.069	0.068
Marion	No	No monitor	N/A			
Morrow	No	No monitor	N/A			
Muskingum	No	No monitor	N/A			
Perry	No	No monitor	N/A			
Pickaway	No	No monitor	N/A			
Ross	No	No monitor	N/A			
Union	No	No monitor	N/A			

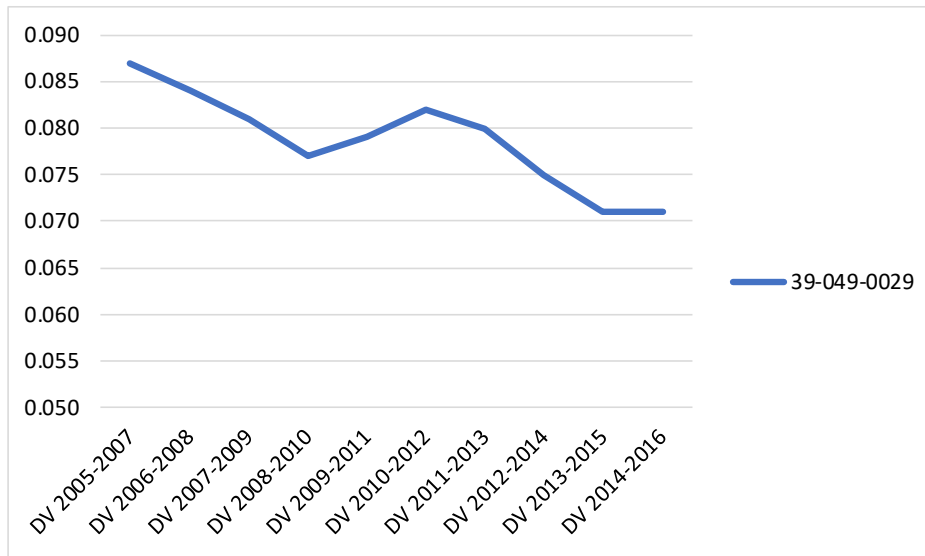
<sup>a</sup> The highest design value in each county is indicated in bold type.

N/A means that the monitor did not meet the completeness criteria described in 40 CFR, part 50, Appendix U, or no data exists for the county.

Franklin County shows a violation of the 2015 ozone NAAQS, therefore this county is included in the nonattainment area. A county (or partial county) must also be designated nonattainment if it contributes to a violation in a nearby area. Each county in the area of analysis has been evaluated based on the weight-of-evidence of the five factors and other relevant information to determine whether it contributes to the nearby violation.

Figure 8, above, identifies the Columbus nonattainment area, the CSA boundary and the violating monitor. Table 7, above, identifies the design values for all monitors in the area of analysis and Figure 9, below, shows the historical trend of design values for the monitors in the area. As indicated on the map, there is one violating monitor that is located in Franklin County. As shown in Figure 9, the design value at this monitor is generally trending downward.

**Figure 9. Three-Year Design Values for Violating Monitor (2007-2016).**



## **Factor 2: Emissions and Emissions-Related Data**

The EPA evaluated ozone precursor emissions of nitrogen oxides (NO<sub>x</sub>) and volatile organic compounds (VOC) and other emissions-related data that provide information on areas contributing to violating monitors.

### **Emissions Data**

The EPA reviewed data from the 2014 National Emissions Inventory (NEI). For each county in the area of analysis, the EPA examined the magnitude of large sources (NO<sub>x</sub> or VOC emissions greater than 100 tons per year), the location of small point sources, and the magnitude of county-level emissions reported in the NEI. These county-level emissions represent the sum of emissions from the following general source categories: point sources, non-point (i.e., area) sources, non-road mobile, on-road mobile, and fires. Significant emissions levels from sources in a nearby area indicate the potential for the area to contribute to monitored violations.

Table 8 provides a county-level emissions summary of NO<sub>x</sub> and VOC (given in tons per year (tpy)) emissions for the area of analysis considered for inclusion in the Columbus nonattainment area.

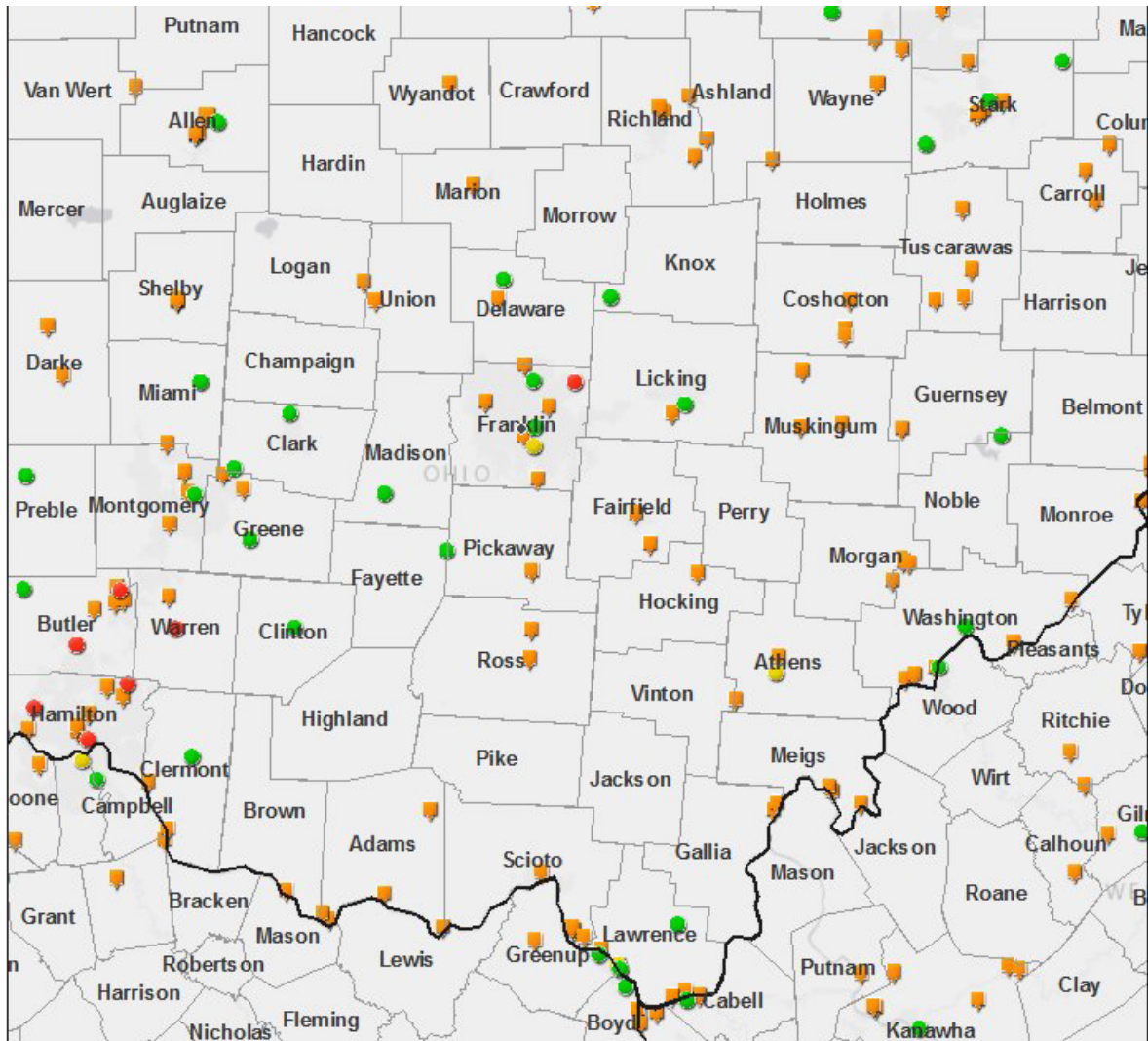


**Table 8. Total County-Level NO<sub>x</sub> and VOC Emissions.**

County	State Recommended Nonattainment?	Total NO <sub>x</sub> (tpy)	Total VOC (tpy)
Franklin	Yes	25,922	25,616
Ross	No	5,035	3,133
Delaware	Yes	4,908	4,838
Fairfield	Yes	4,360	3,741
Licking	Yes	4,285	4,733
Muskingum	No	3,149	3,106
Guernsey	No	2,894	3,602
Marion	No	2,879	2,560
Pickaway	No	2,402	2,044
Madison	No	1,978	1,745
Union	No	1,955	2,872
Logan	No	1,821	2,360
Morrow	No	1,536	1,413
Fayette	No	1,401	1,313
Knox	No	1,400	2,171
Hocking	No	874	1,357
Perry	No	782	1,128
Area wide:		67,580	67,731

In addition to reviewing county-wide emissions of NO<sub>x</sub> and VOC in the area of analysis, the EPA also reviewed emissions from large point sources. The location of these sources, together with the other factors, can help inform nonattainment boundaries. The locations of large point sources are shown in Figure 10 below.

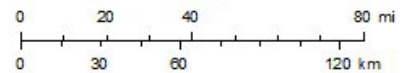
**Figure 10. Large Point Sources in the Area of Analysis.**



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1:2,311,162

- State Boundaries
- USA\_Counties
- Ozone 2016 Site Level DVs
  - No valid value
  - 0 - 0.070
  - 0.071 and above
  - Large Point Sources (VOC GT 100 or NOx GT 100)



OAR/OAQPS/AQAD/AQAG  
 Esri, HERE, DeLorme, MapmyIndia, © OpenStreetMap contributors, and the  
 GIS user community  
 Map Service: USEPA Office of Environmental Information (OEI). Data: U.S.  
 EPA Office of Air and Radiation (OAR) - Office of Air Quality

Web AppBuilder for ArcGIS  
 | Map Service: USEPA Office of Environmental Information (OEI). Data: USEPA Office of Environmental Information (OEI), US Census Bureau | Source: U.S. Census Bureau | Esri, HERE, Garmin, NGA, USGS, NPS |

As shown in Table 8, Franklin County stands out with the highest NOx and VOC emissions in the area of analysis. The remaining counties in the area of analysis have notably lower emissions. Ross and Delaware Counties rank 2<sup>nd</sup> and 3<sup>rd</sup>, respectively, in NOx emissions, each with less than a fifth of Franklin County’s NOx emissions based on the 2014 NEI, followed by Fairfield and Licking Counties, each with

approximately 17% of Franklin County emissions. With respect to VOC emissions, Delaware and Licking Counties rank 2<sup>nd</sup> and 3<sup>rd</sup>, each with less than a fifth of Franklin County's VOC emissions. The remaining counties in the area of analysis follow with 12% or less county-level NO<sub>x</sub> emissions than Franklin County and 15% or less county-level VOC emissions than Franklin County. Perry County had the lowest county-level NO<sub>x</sub> emissions (3% of Franklin County's) and lowest county-level VOC emissions (4% of Franklin County's).

**Population density and degree of urbanization**

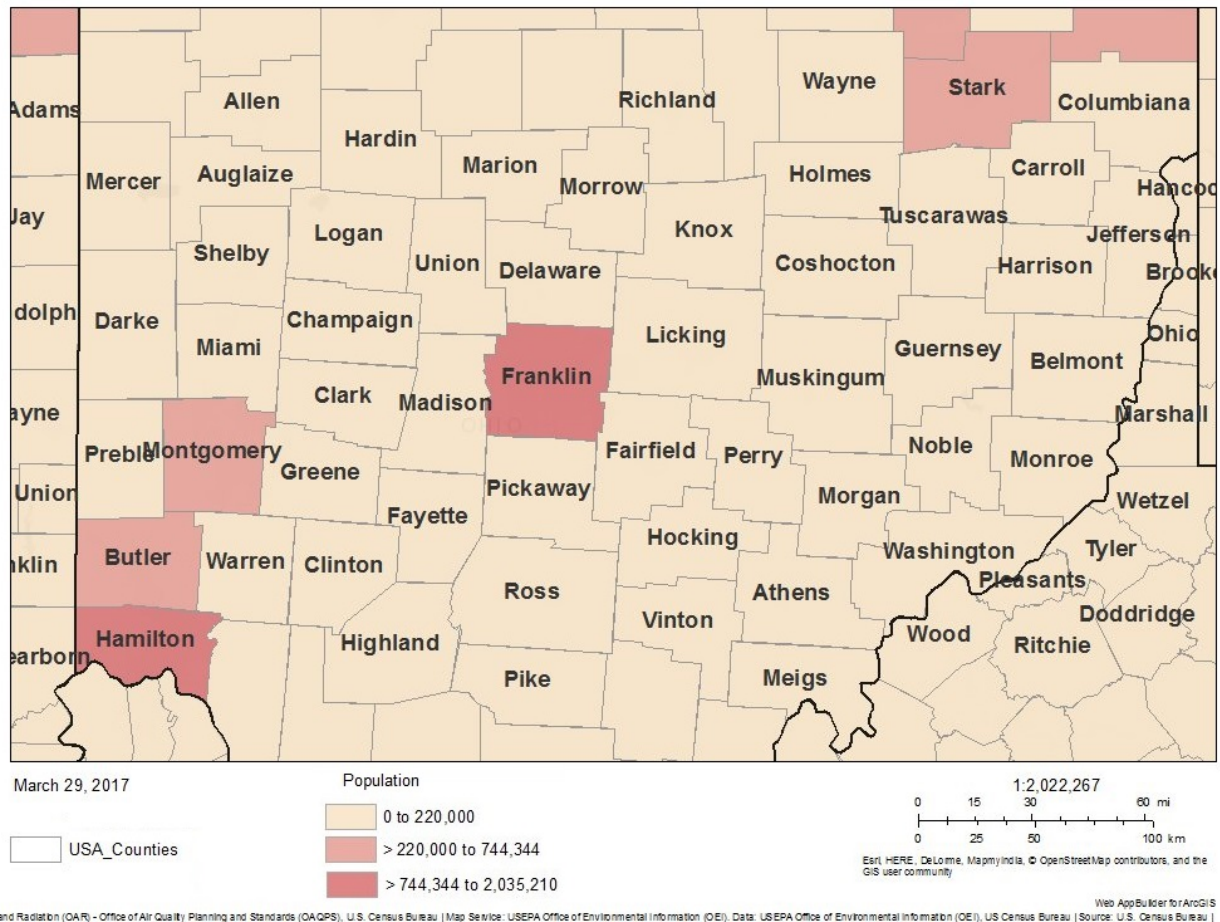
In this part of the factor analysis, the EPA evaluated the population and vehicle use characteristics and trends of the area as indicators of the probable location and magnitude of non-point source emissions. These include emissions of NO<sub>x</sub> and VOC from on-road and non-road vehicles and engines, consumer products, residential fuel combustion, and consumer services. Areas of dense population or commercial development are an indicator of area source and mobile source NO<sub>x</sub> and VOC emissions that may contribute to violations of the NAAQS. Table 9 shows the population, population density, and population growth information for each county in the area of analysis. Figure 11 shows the county-level population density for the area of analysis.

**Table 9. Population and Growth.**

County	State Recommended Nonattainment?	2010 Population	2015 Population	2015 Population Density (per sq. mi.)	Absolute Change in Population (2010-2015)	Population % Change (2010-2015)
Franklin	Yes	1,163,414	1,251,722	2352	88,308	8%
Delaware	Yes	174,214	193,013	436	18,799	11%
Licking	Yes	166,492	170,570	250	4,078	2%
Fairfield	Yes	146,156	151,408	300	5,252	4%
Muskingum	No	86,074	86,290	130	216	0%
Ross	No	78,064	77,170	112	-894	-1%
Marion	No	66,501	65,355	162	-1,146	-2%
Knox	No	60,921	61,061	116	140	0%
Pickaway	No	55,698	56,998	114	1,300	2%
Union	No	52,300	54,277	126	1,977	4%
Logan	No	45,858	45,386	99	-472	-1%
Madison	No	43,435	44,094	95	659	2%
Guernsey	No	40,087	39,258	75	-829	-2%
Perry	No	36,058	35,985	88	-73	0%
Morrow	No	34,827	35,074	86	247	1%
Fayette	No	29,030	28,679	71	-351	-1%
Hocking	No	29,380	28,491	68	-889	-3%
Area wide:		2,308,509	2,424,831	286	116,322	5%

Source: U.S. Census Bureau population estimates for 2010 and 2015. [www.census.gov/data.html](http://www.census.gov/data.html)

**Figure 11. County-Level Population.**



Evaluation of population data in Table 8 shows that Franklin County has, by far, the highest population in the area of analysis. The next most populous counties are Delaware, Licking, and Fairfield Counties, which have 15%, 14%, and 12% of the population of Franklin County, respectively. The remaining counties in the area of analysis are even less populated, ranging from 2% to 7% of Franklin County’s population. Franklin County also has the highest population density in the area of analysis, followed by Delaware, Fairfield, and Licking Counties, with population densities approximately 19%, 13%, and 11% of that of Franklin County, respectively. The population densities of the remaining counties in the area of analysis range from 3% - 7% of that of Franklin County. Most of the counties in the area of analysis did not experience any significant population growth between 2010 and 2015 with growth of about 2 percent or less or with a decrease in population. On the other hand, Delaware and Licking experienced much higher growth of 11% and 8%, respectively. Two counties, Fairfield and Union experienced modest growth of about 4 %.

**Traffic and Vehicle Miles Travelled (VMT)**

The EPA evaluated the commuting patterns of residents, as well as the total vehicle miles traveled (VMT) for each county in the area of analysis. In combination with the population/population density data and the location of main transportation arteries, this information helps identify the probable location of non-point source emissions. A county with high VMT and/or a high number of commuters is generally an

integral part of an urban area and high VMT and/or high number of commuters indicates the presence of motor vehicle emissions that may contribute to violations of the NAAQS. Rapid population or VMT growth in a county on the urban perimeter may signify increasing integration with the core urban area, and thus could indicate that the associated area source and mobile source emissions may be appropriate to include in the nonattainment area. In addition to VMT, the EPA evaluated worker data collected by the U.S. Census Bureau<sup>10</sup> for the in the CSA. Table 10 shows the traffic and commuting pattern data, including total VMT for each county, number of residents who work in each county, number of residents that work in counties with violating monitor(s), and the percent of residents working in counties with violating monitor(s). The data in Table 10 are 2014 data.

**Table 10. Traffic and Commuting Patterns.**

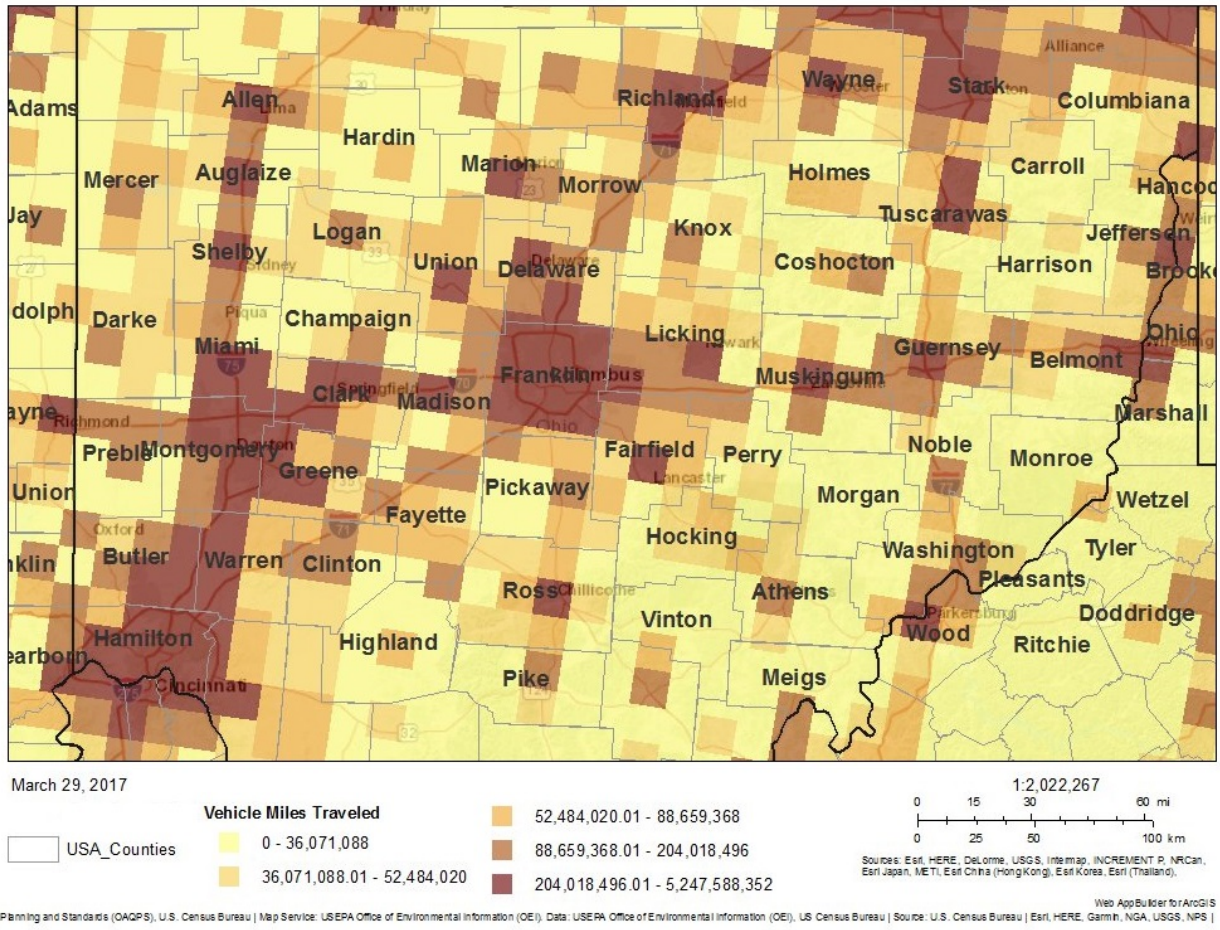
County	State Recommended Nonattainment ?	2014 Total VMT (million miles)	Number of County Residents Who Work	Number Commuting to or Within Counties with Violating Monitors	Percentage Commuting to or Within Counties with Violating Monitors
<b>Franklin</b>	Yes	11,055	569,504	434,683	76%
Delaware	Yes	1,922	89,440	49,813	56%
Licking	Yes	1,874	76,072	28,841	38%
Fairfield	Yes	1,156	66,214	30,946	47%
Muskingum	No	1,064	33,825	4,133	12%
Guernsey	No	852	15,895	335	2%
Ross	No	823	26,764	2,794	10%
Madison	No	716	19,235	8,639	45%
Union	No	680	26,206	9,388	36%
Pickaway	No	656	24,740	11,567	47%
Morrow	No	635	13,445	1,897	14%
Marion	No	629	26,560	3,128	12%
Fayette	No	507	11,112	842	8%
Logan	No	463	20,247	1,266	6%
Knox	No	408	22,543	2,102	9%
Hocking	No	293	10,154	962	9%
Perry	No	261	13,270	1,751	13%
Total:		23,994.79	1,065,226	593,087	56%

Counties with a monitor(s) violating the NAAQS are indicated in bold.

To show traffic and commuting patterns, Figure 12 overlays twelve-kilometer gridded VMT from the 2014 NEI with a map of the transportation arteries.

<sup>10</sup> The worker data can be accessed at: <http://onthemap.ces.census.gov/>.

**Figure 12. Twelve Kilometer Gridded VMT (Miles) Overlaid with Transportation Arteries.**



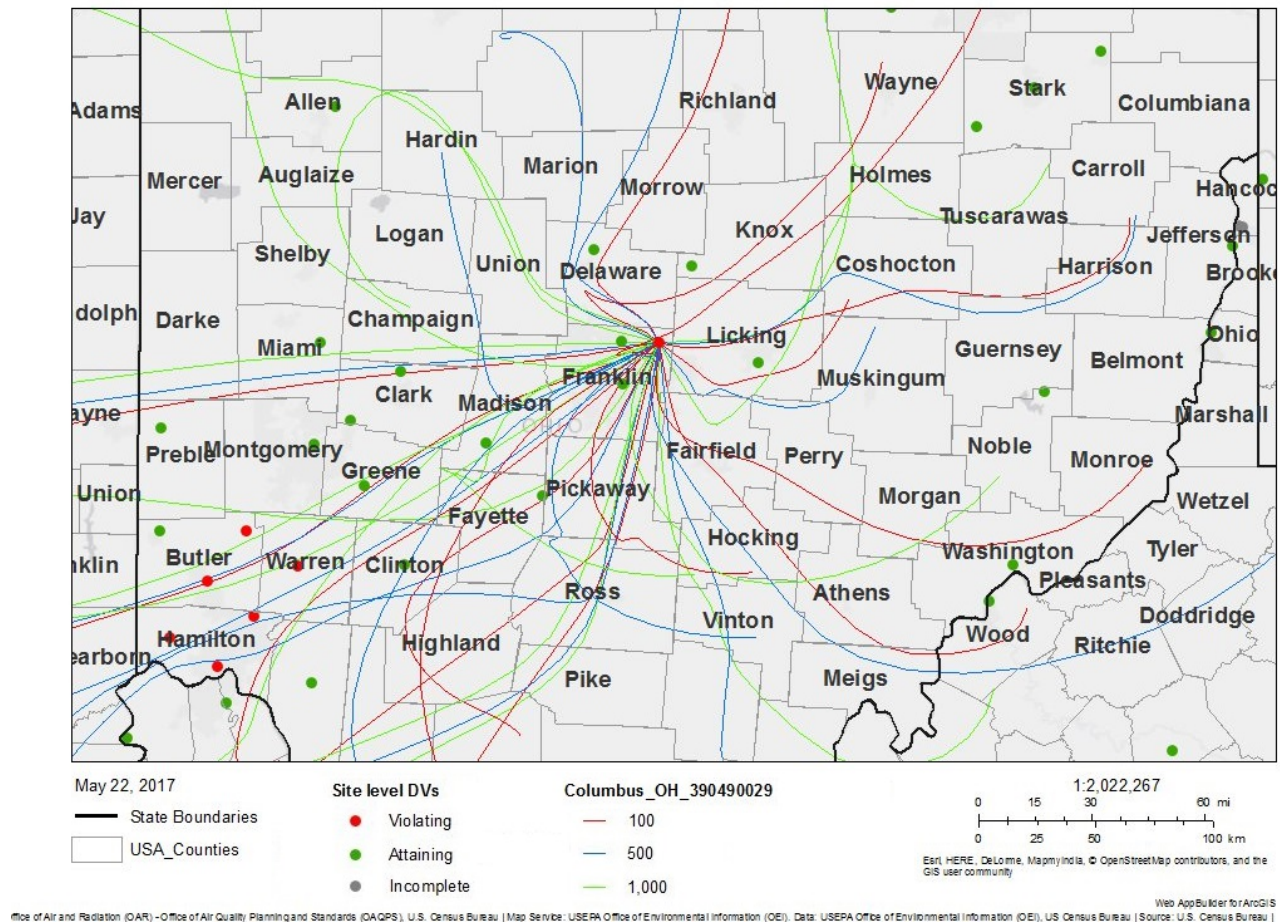
Franklin County has, by far, the highest VMT in the area of analysis. Delaware, Licking, and Fairfield Counties have the next highest VMT, with 16%, 13%, and 12% of the VMT of Franklin County, respectively. The remaining counties in the area of analysis have even less VMT, ranging from 2% to 6% of Franklin County's VMT.

The major metropolitan area in the area of analysis is in Franklin County, which also has the violating monitor. Therefore, it is not surprising that Franklin County has the most commuters traveling to or within a county with a violating monitor. While more than half of the workers in Delaware County commute to Franklin County, the actual number of commuters into Franklin County is only about 11% of the workers commuting within Franklin county. Fairfield and Licking Counties have approximately 7% of the number of workers commuting into Franklin County as there are workers commuting within Franklin County, and the number of workers commuting into Franklin County from the remaining counties are each less than 3% of the number of workers commuting within Franklin County.

### Factor 3: Meteorology

Evaluation of meteorological data helps to assess the fate and transport of emissions contributing to ozone concentrations and to identify areas potentially contributing to the monitored violations. Results of meteorological data analysis may inform the determination of nonattainment area boundaries. In order to determine how meteorological conditions, including, but not limited to, weather, transport patterns, and stagnation conditions, could affect the fate and transport of ozone and precursor emissions from sources in the area., the EPA evaluated 2014-2016 HYSPLIT trajectories at 100, 500, and 1000 meters above ground level (AGL) that illustrate the three-dimensional paths traveled by air parcels to a violating monitor. Figure 13 shows the 24-hour HYSPLIT back trajectories for each exceedance day (i.e., daily maximum 8 hour values that exceed the 2015 ozone NAAQS) for the violating monitor.

**Figure 13. HYSPLIT Back Trajectories for Violating Monitor**



The 2014-2016 HYSPLIT back trajectories displayed in Figure 13 show that transport winds blew predominantly from the west through south during times when the Franklin County monitor measured exceedances of the 2015 Ozone NAAQS, although all of the counties in the area of analysis appear to be upwind of the monitor at some point during the 2014-2016 timeframe. Figure 13 shows a dense pattern of HYSPLIT back trajectories across Franklin County, with a moderately dense pattern of back trajectories to the west through the south of the violating monitor. A notable portion of the back

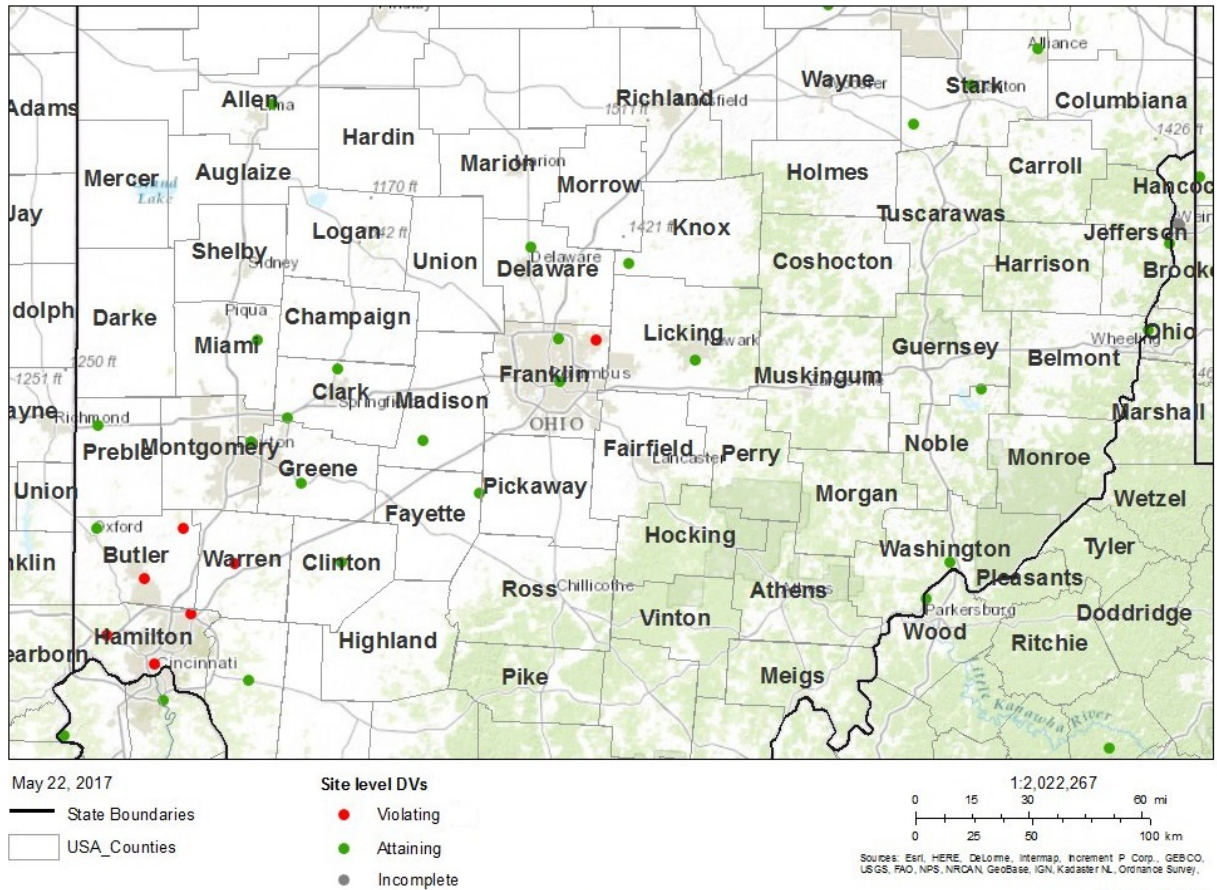
trajectories pass through Delaware, Licking and Fairfield Counties, with less dense trajectories as you move further away from the monitor to the northwest, north, northeast, east and southeast.

**Factor 4: Geography/topography**

Consideration of geography or topography can provide additional information relevant to defining nonattainment area boundaries. Analyses should examine the physical features of the land that might define the airshed. Mountains or other physical features may influence the fate and transport of emissions as well as the formation and distribution of ozone concentrations. The absence of any such geographic or topographic features may also be a relevant consideration in selecting boundaries for a given area.

The area of analysis does not have any geographical or topographical features significantly limiting air pollution transport within its air shed. Therefore, this factor did not play a role in this evaluation.

**Figure 14. Topographic Illustration of the Physical Features.**



May 22, 2017  
 State Boundaries  
 USA\_Countries  
 Site level DVs  
 Violating  
 Attaining  
 Incomplete  
 1:2,022,267  
 0 15 30 60 mi  
 0 25 50 100 km  
 Sources: Esri, HERE, DeLorme, Intermap, Inermap, Inc., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, ...  
 Web AppBuilder for ArcGIS  
 Planning and Standards (OAGPS), U.S. Census Bureau | Map Service: USEPA Office of Environmental Information (OEI), Data: USEPA Office of Environmental Information (OEI), US Census Bureau | Source: U.S. Census Bureau | Esri, HERE, Garmin, FAO, USGS, NGA, EPA, NPS |



## **Factor 5: Jurisdictional boundaries**

Once the geographic extent of the violating area and the nearby area contributing to violations is determined, the EPA considered existing jurisdictional boundaries for the purposes of providing a clearly defined legal boundary to carry out the air quality planning and enforcement functions for nonattainment areas. In defining the boundaries of the Columbus nonattainment area, the EPA considered existing jurisdictional boundaries, which can provide easily identifiable and recognized boundaries for purposes of implementing the NAAQS. Examples of jurisdictional boundaries include, but are not limited to: counties, air districts, areas of Indian country, metropolitan planning organizations, and existing nonattainment areas. If an existing jurisdictional boundary is used to help define the nonattainment area, it must encompass all of the area that has been identified as meeting the nonattainment definition. Where existing jurisdictional boundaries are not adequate or appropriate to describe the nonattainment area, the EPA considered other clearly defined and permanent landmarks or geographic coordinates for purposes of identifying the boundaries of the designated areas.

The area of analysis encompasses previously established nonattainment boundaries associated with the 1997 and 2008 ozone NAAQS. For both the 1997 and 2008 ozone NAAQS, the nonattainment area included Delaware, Fairfield, Franklin, Knox, Licking, and Madison Counties. The state has recommended a different boundary for the 2015 ozone NAAQS, which would exclude Knox and Madison Counties but still include Delaware, Fairfield, Franklin, and Licking Counties in the nonattainment area.

## **Conclusion for Columbus Area**

Based on the assessment of factors described above, the EPA is not modifying Ohio's recommendation that the following four counties should be included within the boundaries of the Columbus nonattainment area: Delaware, Fairfield, Franklin, and Licking.

The air quality monitor in Franklin County indicates a violation of the 2015 ozone NAAQS based on 2016 design values, therefore this county is included in the nonattainment area. Delaware, Fairfield and Licking Counties are nearby counties that do not have violating monitors, but the EPA has concluded that these areas contribute to the ozone concentrations in violation of the 2015 ozone NAAQS through the contribution of emissions from point sources and non-point sources (e.g., vehicles and other small area sources).

In addition to having the violating monitor, Franklin County stands out with the highest NO<sub>x</sub> and VOC emissions, population, population density, VMT, and workers commuting to or within a county with a violating monitor in the area of analysis. In addition, there is a dense pattern of HYSPLIT back trajectories across Franklin County. Delaware, Licking, and Fairfield Counties ranked 3<sup>rd</sup>-5<sup>th</sup> in NO<sub>x</sub> emissions and 2<sup>nd</sup>-4<sup>th</sup> in VOC emissions, population, population density, VMT, and number of workers commuting to or within a county with a violating monitor. Although these counties have fewer HYSPLIT back trajectories than some of the other counties in the area of analysis, they include the majority of back trajectories that don't pass across Franklin County, thus capturing emissions on violating days when Franklin County emissions would be expected to have somewhat less influence.

While some of the remaining counties in the area of analysis are somewhat notable for one or more factors, considering all factors we do not see a reason to modify the State's recommendation. As provided already, Franklin County has significantly higher levels of emissions and VMT, its population is far larger, and it is significantly more densely populated than any other county in the area. While Ross County has the 2<sup>nd</sup> highest level of NO<sub>x</sub> emissions, it has less than a fifth of the NO<sub>x</sub> emissions of Franklin County. It falls in the middle of the counties for most other factors - ranking 6<sup>th</sup> in VOC emissions and population, 7<sup>th</sup> in VMT, and 10<sup>th</sup> in population density and number of workers commuting to or within a county with a violating monitor. However, the trajectories that pass through Ross County travel almost completely through Franklin County before reaching the monitor in northeastern Franklin County.

Similarly, although Pickaway and Madison Counties also have a moderately dense pattern of HYSPLIT back trajectories, those trajectories pass almost completely through Franklin County before reaching the violating monitor. These areas fall into the middle of all of the counties for most factors. They rank 9<sup>th</sup> and 10<sup>th</sup> in NO<sub>x</sub> emissions, 12<sup>th</sup> and 13<sup>th</sup> in VOC emissions, 9<sup>th</sup> and 12<sup>th</sup> in population and population density, 10<sup>th</sup> and 8<sup>th</sup> in VMT, and 5<sup>th</sup> and 7<sup>th</sup> in number of workers commuting to or within a county with a violating monitor, respectively.

Fayette and Hocking Counties are each separated from Franklin County by another county. They rank low for all the emission, population, and traffic and commuting factors: 14<sup>th</sup> and 16<sup>th</sup> for NO<sub>x</sub> emissions; 16<sup>th</sup> and 15<sup>th</sup> for VOC emissions; 16<sup>th</sup> and 17 for population, population density, and VMT; and 16<sup>th</sup> and 15<sup>th</sup> for number of workers commuting to a county with a violating monitor, respectively. Thus, although there are trajectories travelling through those counties the low ranking for the various factors and the fact that the trajectories travel most of the way through Franklin before reaching the monitor support not including these counties.

The remaining counties in the area of analysis (Guernsey, Knox, Logan, Marion, Morrow, Muskingum, Perry, and Union Counties) have very few HYSPLIT back trajectories that pass over the county and do not stand out sufficiently with respect to any of the other factors to support inclusion in the nonattainment area.