# Cincinnati, OH-KY-IN

# 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 designation for the Cincinnati area as nonattainment for the 2015 ozone National Ambient Air Quality Standards (NAAQS). As described in this document, the Cincinnati area is comprised of portions of Ohio, Kentucky, and Indiana. The EPA's final designations with respect to the remainder of Ohio, Kentucky, and Indiana are contained in separate TSDs.

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 submitted its designation recommendations for all areas within the state. For the Cincinnati area, Ohio recommended that the Ohio counties identified in Table 1 be designated as nonattainment for the 2015 ozone NAAQS based on certified air quality data from 2013-2015 and preliminary air quality data from 2016. Ohio's recommendations and the EPA's final designations with respect to the rest of the state are contained in a separate Ohio TSD. On September 16, 2016, Indiana recommended that the entire state be designated as attainment or unclassifiable for the 2015 ozone NAAQS based on air quality data from 2013-2015. The EPA explains its final designations for other areas within the state of Indiana in separate TSDs for the Chicago, IL-IN-WI and Louisville, KY-IN areas. On September 30, 2016, Kentucky recommended that the portions of three counties, as identified in Table 1, be designated as nonattainment and all other areas in the Commonwealth were recommended to be designated as unclassifiable/attainment for the 2015 ozone NAAQS based on air quality data from 2013-2015. Campbell County, KY violated the 2015 ozone NAAQS based on 2013-2015 ozone monitoring data but does not violate the 2015 ozone NAAQS with 2014-2016 ozone monitoring data. A discussion of the EPA's final designation for another area in Kentucky, the Louisville, Kentucky-Indiana area, is contained in a separate TSD. On November 6, 2017 (82 FR 5423), the EPA designated all of Ohio except for counties in the Cincinnati area, the Cleveland-Akron-Canton, OH Combined Statistical Area (CSA), and the Columbus-Marion-Zanesville, OH CSA; all of Indiana except for counties in the Cincinnati area, the Chicago-Naperville, IL-IN-WI CSA, the Louisville/Jefferson County—Elizabethtown—Madison, KY-IN CSA, and the South Bend-Elkhart-Mishawaka, IN-MI CSA; and all of Kentucky except for counties in the Cincinnati area and the Louisville/Jefferson County—Elizabethtown—Mishawaka, KY-IN CSA as attainment/unclassifiable for the 2015 ozone NAAQS.

After considering these recommendations and based on the EPA's technical analysis as described in this TSD, the EPA is designating the areas listed in Table 1 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. A detailed description of the

nonattainment boundary for the Cincinnati area is found in the supporting technical analysis for the area in Section 3.

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

| Area | State/Commonwealth's Recommended Nonattainment Counties | EPA's Final Nonattainment Counties [or Areas of Indian Country] |
|---|---|---|
| Cincinnati (IN)* | None | None |
| Cincinnati (KY)* | Boone (partial)<br>Campbell (partial)<br>Kenton (partial) | Boone (partial)**<br>Campbell (partial)**<br>Kenton (partial)** |
| Cincinnati (OH)* | Butler<br>Clermont<br>Hamilton<br>Warren | Butler<br>Clermont<br>Hamilton<br>Warren |

* There are additional TSDs for the rest of the state/commonwealth for Ohio, Kentucky and Indiana.
****** The EPA's partial boundary is the same as the Commonwealth's recommended boundary.

## 2.0 Nonattainment Area Analyses and Final Boundary Determination

The EPA evaluated and determined the final 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 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 (hereafter referred to as the "ozone designations guidance"[1] 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)[2] 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.

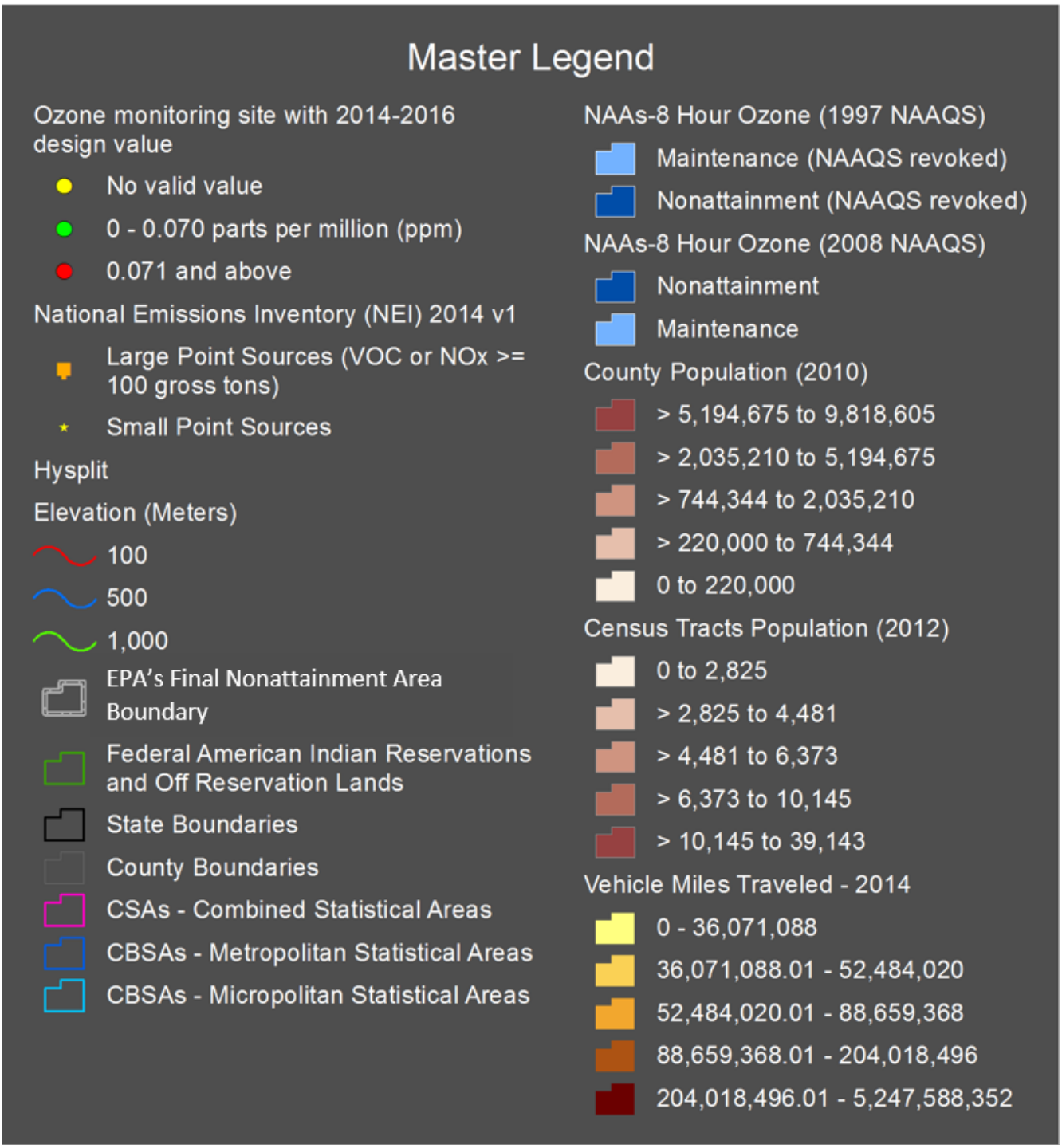
[1] The EPA issued guidance on February 25, 2016 that identified important factors that the EPA intends to evaluate in determining appropriate area designations and nonattainment boundaries for the 2015 ozone NAAQS. Available at *https://www.epa.gov/ozone-designations/epa-guidance-area-designations-2015-ozone-naaqs*

[2] Lists of CBSAs and CSAs and their geographic components are provided at 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.

On November 6, 2017, the EPA issued attainment/unclassifiable designations for approximately 85% of the United States and one unclassifiable area designation.[3] 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.

[3] 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 for the Cincinnati Area

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 the Cincinnati area, Butler, Hamilton, and Warren Counties in Ohio have monitors

in violation of the 2015 ozone NAAQS, based on 2014-2016 data, therefore nearby areas must be evaluated for contribution. For the Cincinnati area, the starting point for the analysis (the area of analysis), is the Cincinnati-Wilmington-Maysville, OH-KY-IN CSA, which includes all of the counties with violating monitors. In developing this technical analysis, the EPA used the latest data and information available to the EPA (and to the states, Commonwealth and tribes through the Ozone Designations Mapping Tool and the EPA Ozone Designations Guidance and Data web page).[4] In addition, the EPA considered any additional data or information provided to the EPA by states or tribes.

The Cincinnati-Wilmington-Maysville, OH-KY-IN CSA includes the following counties: Dearborn County (IN), Ohio County (IN), Union County (IN), Boone County (KY), Bracken County (KY), Campbell County (KY), Gallatin County (KY), Grant County (KY), Kenton County (KY), Mason County (KY), Pendleton County (KY), Brown County (OH), Butler County (OH), Clermont County (OH), Clinton County (OH), Hamilton County (OH), and Warren County (OH). The EPA applied the five factors recommended in its guidance to the area of analysis to determine the nonattainment boundary.

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

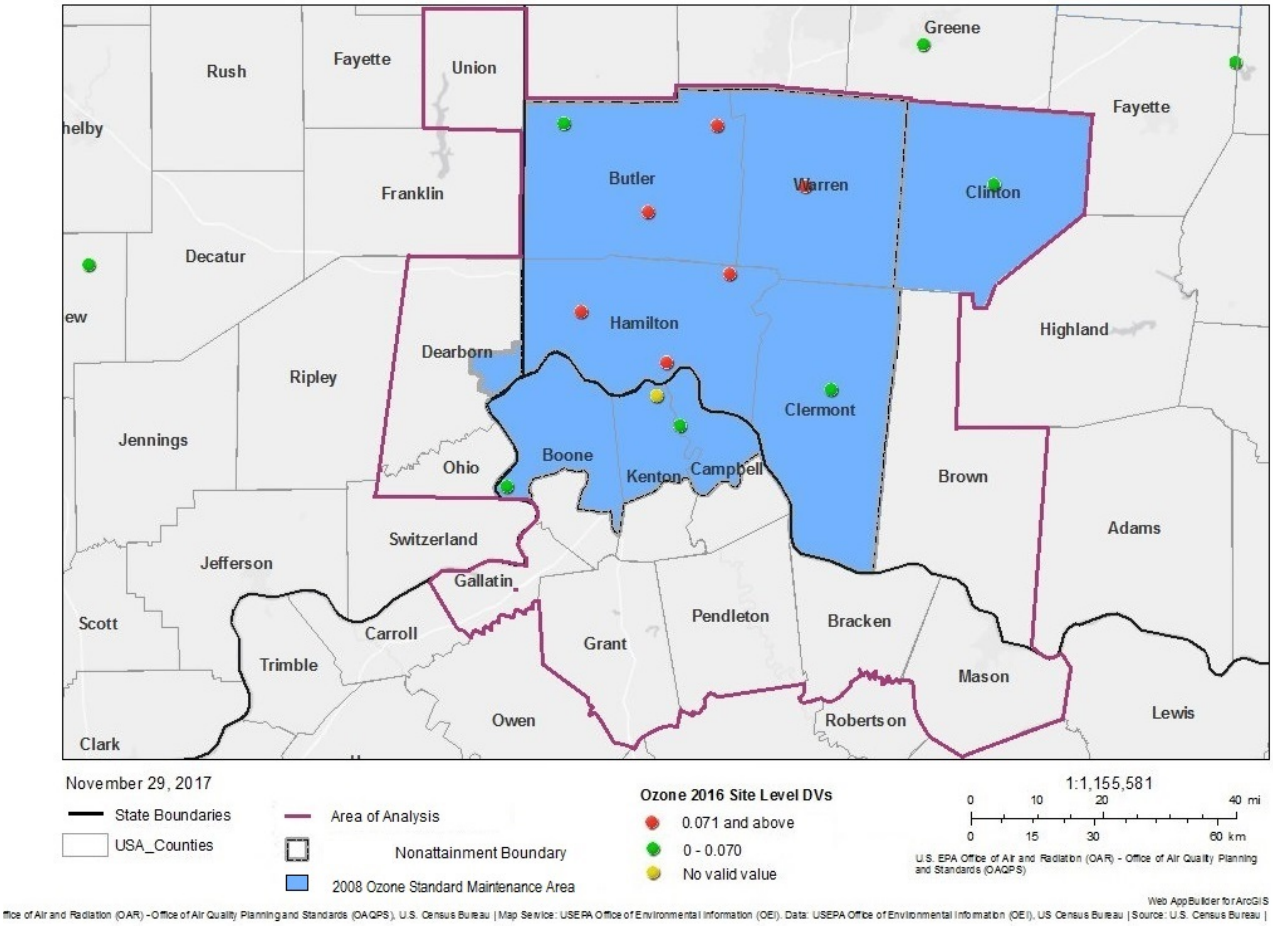
1. Air Quality Data (including the design value calculated for each Federal Reference Method (FRM) or Federal Equivalent Method (FEM) monitor;
2. Emissions and Emissions-Related Data (including locations of sources, population, amount of emissions, and urban growth patterns);
3. Meteorology (weather/transport 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)).

Figure 1 is a map of the EPA's final nonattainment boundary for the Cincinnati area for the 2015 ozone NAAQS. The map shows the approximate locations of the ambient air quality monitors, county, and other jurisdictional boundaries.

For purposes of both the 1997 ozone NAAQS and the 2008 ozone NAAQS, portions of this area were designated nonattainment. The boundary for the nonattainment area for the 1997 ozone NAAQS included the entire counties of Butler, Clermont, Clinton, Hamilton and Warren in Ohio, the entire counties of Boone, Campbell and Kenton in Kentucky and part of Dearborn County in Indiana. The boundary for the nonattainment area for the 2008 ozone NAAQS included the entire counties of Butler, Clermont, Clinton, Hamilton and Warren in Ohio, parts of Boone, Campbell and Kenton Counties in Kentucky and part of Dearborn County in Indiana.

[4] 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. The EPA's Nonattainment Boundaries for the Cincinnati Area for the 2015 Ozone NAAQS**




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. Butler, Hamilton, and Warren Counties in Ohio have monitors in violation of the 2015 ozone NAAQS, therefore these counties are included in the final nonattainment area. In addition, based on the five factor analysis discussed below, the EPA determined that Clermont County, Ohio and Boone, Kenton and Campbell Counties in Kentucky in whole or in part should also be included in the nonattainment area due to contribution to the violating monitors. The following sections describe the five factor analysis. 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 Cincinnati-Wilmington-Maysville, OH-KY-IN CSA 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 4th highest daily maximum 8-hour average ozone concentration.[5] 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.[6] 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[7] 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 within counties in the Cincinnati-Wilmington-Maysville, OH-KY-IN CSA are shown in Table 2.

[5] 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.

[6] 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.

[7] 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)[a].**

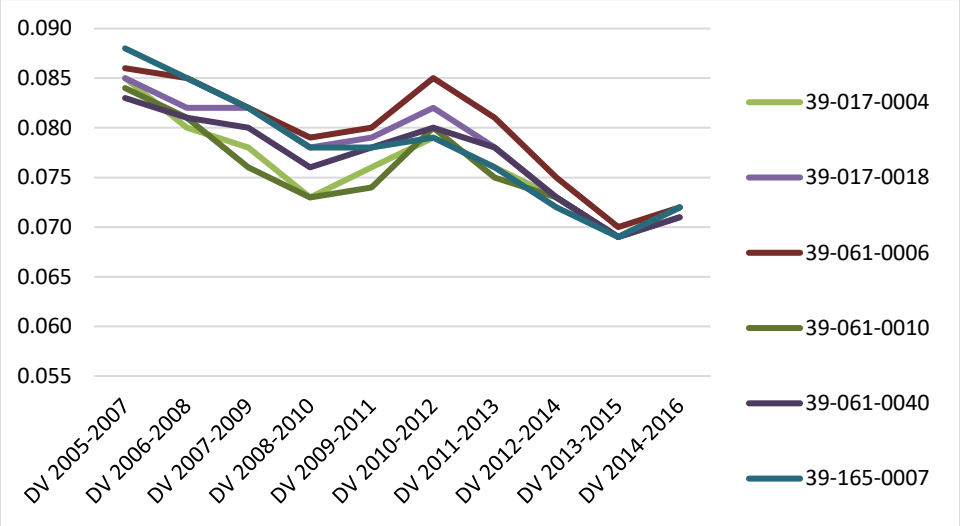
| County, State | State Recommended Nonattainment? | AQS Site ID | 2014-2016 DV | 2014 4th highest daily max value | 2015 4th highest daily max value | 2016 4th highest daily max value |
|---|---|---|---|---|---|---|
| Dearborn, IN | No | No monitor | N/A | | | |
| Ohio, IN | No | No monitor | N/A | | | |
| Union, IN | No | No monitor | N/A | | | |
| Boone, KY | Yes (partial) | 21-015-0003 | **0.063** | 0.062 | 0.062 | 0.065 |
| Bracken, KY | No | No monitor | N/A | | | |
| Campbell, KY | Yes (partial) | 21-037-3002 | **0.070** | 0.071 | 0.071 | 0.069 |
| Gallatin, KY | No | No monitor | N/A | | | |
| Grant, KY | No | No monitor | N/A | | | |
| Kenton, KY | Yes (partial) | No monitor | N/A | | | |
| Mason, KY | No | No monitor | N/A | | | |
| Pendleton, KY | No | No monitor | N/A | | | |
| Brown, OH | No | No monitor | N/A | | | |
| Butler, OH | Yes | 39-017-0004 | **0.072** | 0.070 | 0.070 | 0.076 |
| | | 39-017-0018 | 0.071 | 0.069 | 0.070 | 0.074 |
| | | 39-017-9991 | 0.069 | 0.069 | 0.068 | 0.072 |
| Clermont, OH | Yes | 39-025-0022 | **0.070** | 0.068 | 0.070 | 0.073 |
| Clinton, OH | No | 39-027-1002 | **0.070** | 0.070 | 0.070 | 0.071 |
| Hamilton, OH | Yes | 39-061-0006 | **0.072** | 0.071 | 0.072 | 0.075 |
| | | 39-061-0010 | **0.072** | 0.073 | 0.070 | 0.073 |
| | | 39-061-0040 | 0.071 | 0.069 | 0.071 | 0.073 |
| Warren, OH | Yes | 39-165-0007 | **0.072** | 0.071 | 0.071 | 0.074 |

[a] 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.

Butler, Hamilton, and Warren Counties in Ohio show violations 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.

Figure 1, above, identifies the Cincinnati, nonattainment area, the Cincinnati-Wilmington-Maysville, OH-KY-IN CSA boundary and the violating monitors. Table 2, above, identifies the design values for all monitors in the area of analysis and Figure 2, below, shows the historical trend of design values for the violating monitors in the CSA. As indicated on the map, using 2014-2016 monitoring data, there are six total violating monitors that are located in Butler, Hamilton and Warren counties in Ohio. As shown in Figure 2, all violating monitors in the Cincinnati Area show a general downward trend in design values, with a slight increase in the 2016 design value.

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




Hamilton, Butler and Warren Counties in Ohio 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 within the area of analysis has been evaluated, as discussed below, based on the weight-of-evidence of the five factors to determine whether it contributes to the nearby violation.

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

The EPA evaluated ozone precursor emissions of nitrogen oxides (NOx) 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 (NOx 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 NOx and VOC emissions (given in tons per year (tpy)), based on the 2014 NEI, for the area of analysis considered for inclusion in the Cincinnati nonattainment area.

**Table 3. 2014 NEI Total County-Level $NO_x$ and VOC Emissions.**

| County | State Recommended Nonattainment? | Total NOx (tpy) | Total VOC (tpy) |
|---|---|---|---|
| Hamilton, OH | Yes | 26,305 | 19,866 |
| Clermont, OH[2] | Yes | 15,307 | 5,046 |
| Butler, OH | Yes | 12,090 | 10,296 |
| Boone, KY[1] | Yes (partial) | 9,555 | 5,928 |
| Mason, KY | No | 6,073 | 753 |
| Warren, OH | Yes | 4,874 | 5,766 |
| Kenton, KY[1] | Yes (partial) | 4,172 | 3,417 |
| Campbell, KY[1] | Yes (partial) | 2,620 | 2,046 |
| Dearborn, IN[3] | No | 2,359 | 3,345 |
| Gallatin, KY | No | 2,174 | 521 |
| Grant, KY | No | 1,997 | 974 |
| Clinton, OH | No | 1,561 | 1,713 |
| Pendleton, KY | No | 1,413 | 555 |
| Brown, OH | No | 1,091 | 1,320 |
| Bracken, KY | No | 771 | 362 |
| Union, IN | No | 327 | 417 |
| Ohio, IN | No | 148 | 221 |
| | Area wide: | 92,835 | 62,542 |

[1]For commonwealth recommended partial counties, the emissions shown are for the entire county.

[2]Clermont County emissions were adjusted to remove emissions from the Walter C. Beckjord power station which was permanently shut down October 2014.

[3]Dearborn County emissions were adjusted to remove emissions from the Tanners Creek power station which was permanently shut down May 2015.

In addition to reviewing county-wide emissions of NOx and VOC in the area of analysis, the EPA also reviewed emissions from large point sources, i.e., those emitting more than 100 tpy of NOx and/or VOC. Table 4 provides a county-level emissions summary of large point source NOx and VOC emissions (given in tons per year (tpy)), based on the 2014 NEI, for the area of analysis considered for inclusion in the Cincinnati nonattainment area. The location of these sources, together with the other factors, can help inform nonattainment boundaries. The locations of large and small point sources are shown in Figure 3 below.

**Table 4. 2014 NEI County-Level $NO_x$ and VOC Emissions from Large Point Sources.**

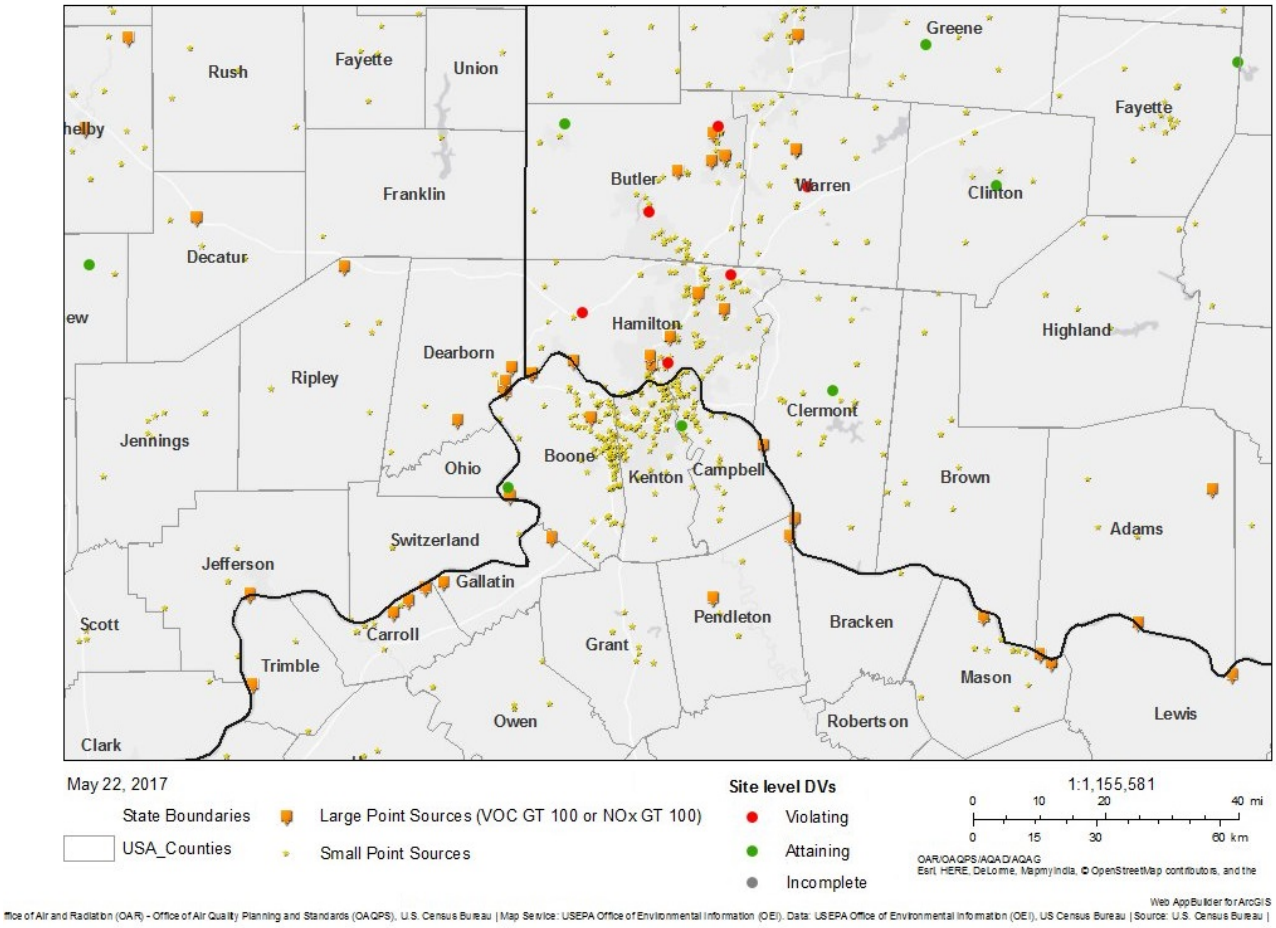
| County | NOx | VOC |
|---|---|---|
| Clermont, OH[2] | 11,318 | 61 |
| Hamilton, OH | 7,974 | 306 |
| Mason, KY | 5,089 | 102 |
| Boone, KY[1] | 4,811 | 215 |
| Butler, OH | 3,779 | 884 |
| Pendleton, KY | 796 | 102 |
| Gallatin, KY | 659 | 84 |
| Dearborn, IN[3] | 501 | 1,966 |
| Warren, OH | 269 | 40 |
| Bracken, KY | - | - |
| Brown, OH | - | - |
| Campbell, KY[1] | - | - |
| Clinton, OH | - | - |
| Grant, KY | - | - |
| Kenton, KY[1] | - | - |
| Ohio, IN | - | - |
| Union, IN | - | - |
| Area wide: | 35,197 | 3,759 |

[1]For commonwealth recommended partial counties, the emissions shown are for the entire county.

[2]Clermont County emissions were adjusted to remove emissions from the Walter C. Beckjord power station which was permanently shut down October 2014.

[3]Dearborn County emissions were adjusted to remove emissions from the Tanners Creek power station which was permanently shut down May 2015.

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




*Emissions Observations for each State/Commonwealth*

**Ohio:** The EPA's evaluation of 2014 NEI county-level emissions from Table 3 shows that Hamilton, Clermont and Butler Counties have the highest NOx emissions in the area of analysis, with Warren County ranking 6th out of 17 counties in the area of analysis. Hamilton and Butler Counties also had the highest total VOC emissions (in tpy) for that year, with Warren and Clermont ranking 4th and 5th, respectively. Together, these counties account for 63 percent of the NOx emissions and 66 percent of the VOC emissions in the CSA. NOx and VOC emissions from Clinton and Brown counties are substantially less, ranking 12th and 14th, respectively, for NOx and 9th and 10th, respectively, for VOC. Clermont, Hamilton and Butler Counties also contain a substantial portion of the large point source in the CSA, with approximately 66 percent of the CSA's large point source NOx emissions and 33 percent of the large point source VOC emissions. Warren County contains approximately 1 percent of the CSA's large NOx and VOC point source emissions. Clinton and Brown counties contain no large point sources.

**Indiana:** The 2014 NEI emissions data in Table 3 shows that Dearborn County ranks 7th for VOC emissions and 9th for NOx emissions in the 17 county area of analysis. NOx and VOC emissions in Dearborn County are notably lower than emissions from Hamilton, Clermont, and Butler Counties in Ohio. NOx emissions for Boone and Mason Counties in Kentucky are also higher than emissions in Dearborn. Dearborn County emissions represent approximately 3 percent of the VOC emissions and 5 percent of the NOx emissions in the area of analysis. Emissions in Dearborn County are most similar to emissions in Kenton and Campbell Counties in Kentucky, though NOx emissions are somewhat lower than those in Kenton County and VOC emissions are

somewhat higher than those in Campbell County. When considering emissions from large point sources, Dearborn County alone contains approximately 52 percent of the large point source VOC emissions in the CSA and 1 percent of the large point source NOx emissions. All but one of the large point sources in Dearborn County are contained within Lawrenceburg Township. Union and Ohio County emissions are substantially lower, ranking 16th and 17th, respectively, for NOx, and 15th and 17th, respectively, for VOC. Together, these counties represent approximately 1 percent of the CSA's NOx and VOC emissions. Union and Ohio Counties contain no large point sources.

**Kentucky:** Boone County shows a relatively high ranking for VOC and $NO_X$ emissions in the area of analysis, ranking 3rd and 4th, respectively. Based on the 2014 NEI, Boone County represents approximately 9 percent of the CSA's VOC emissions and 10 percent of the CSA's NOx emissions. Kenton County is ranked 6th for VOC and 7th for NOx. Kenton County represents approximately 5 percent of the CSA's VOC and 4 percent of the CSA's $NO_X$ emissions. Campbell County is ranked 8th for both VOC and NOx. Campbell County represents approximately 3 percent of both the CSA's VOC and the CSA's NOx emissions. Boone, Kenton and Campbell Counties in Kentucky have a large concentration of small point sources located in the northern portion of these counties. There is 1 large point source located in the northeastern portion of Boone County in Kentucky.

**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 $NO_x$ 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 NOx 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, while Figure 5 shows population density by census tract.

**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) |
|---|---|---|---|---|---|---|
| Hamilton, OH | Yes | 802,374 | 807,598 | 1,990 | 5,224 | 1% |
| Butler, OH | Yes | 368,130 | 376,353 | 806 | 8,223 | 2% |
| Warren, OH | Yes | 212,693 | 224,469 | 559 | 11,776 | 6% |
| Clermont, OH | Yes | 197,363 | 201,973 | 447 | 4,610 | 2% |
| Kenton, KY | Yes (partial) | 159,720 | 165,012 | 1,030 | 5,292 | 3% |
| Boone, KY | Yes (partial) | 118,811 | 127,712 | 518 | 8,901 | 7% |
| Campbell, KY | Yes (partial) | 90,336 | 92,066 | 608 | 1,730 | 2% |
| Dearborn, IN | No | 50,047 | 49,455 | 162 | -592 | -1% |
| Brown, OH | No | 44,846 | 43,839 | 89 | -1,007 | -2% |
| Clinton, OH | No | 42,040 | 41,917 | 103 | -123 | 0% |
| Grant, KY | No | 24,662 | 24,757 | 96 | 95 | 0% |
| Mason, KY | No | 17,490 | 17,099 | 71 | -391 | -2% |
| Pendleton, KY | No | 14,877 | 14,408 | 52 | -469 | -3% |
| Gallatin, KY | No | 8,589 | 8,636 | 85 | 47 | 1% |
| Bracken, KY | No | 8,488 | 8,321 | 40 | -167 | -2% |
| Union, IN | No | 7,516 | 7,182 | 45 | -334 | -4% |
| Ohio, IN | No | 6,128 | 5,938 | 69 | -190 | -3% |
| | Area wide: | 2,174,110 | 2,216,735 | 460 | 42,625 | 2% |

* For state/commonwealth 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

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

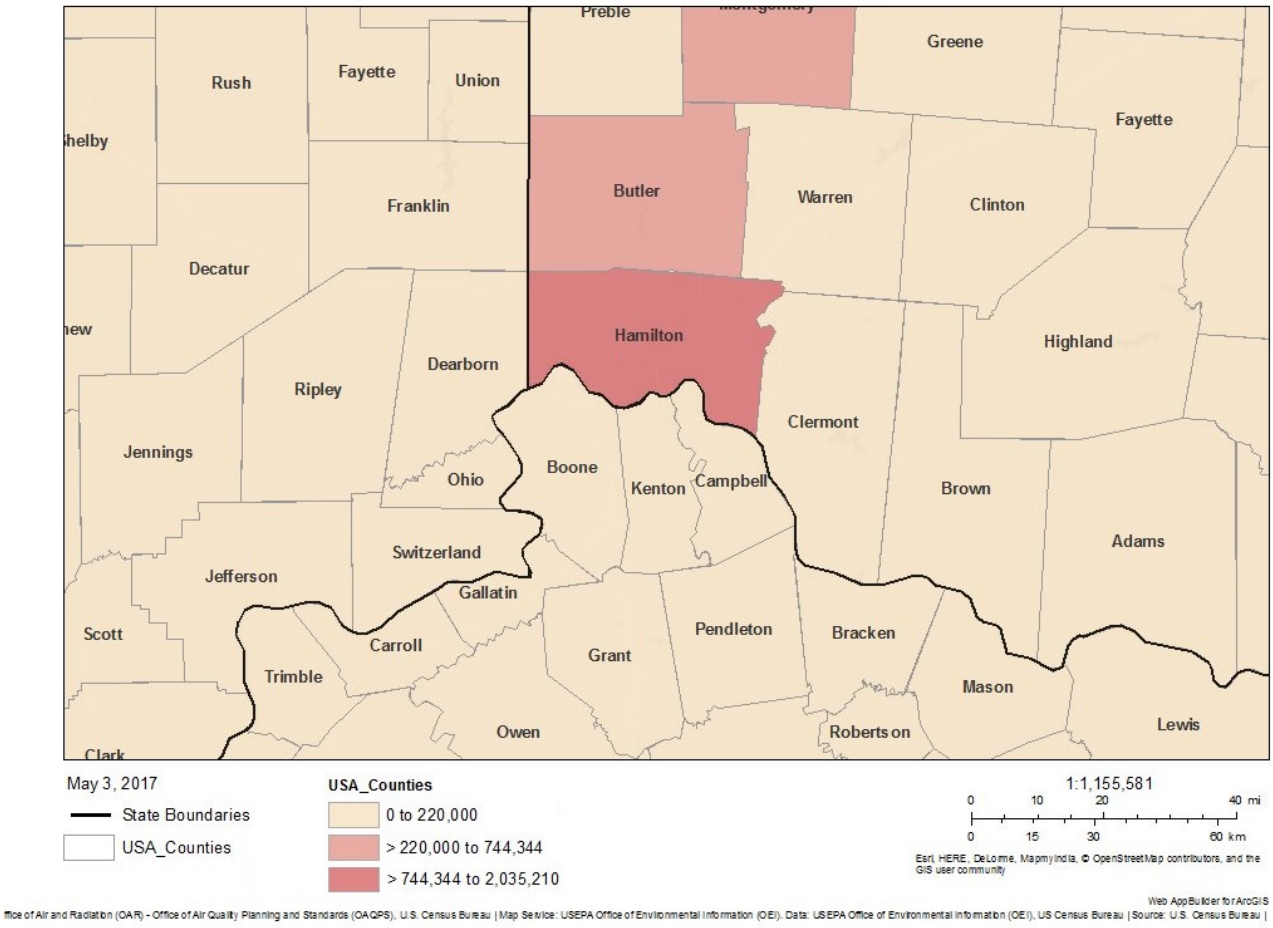
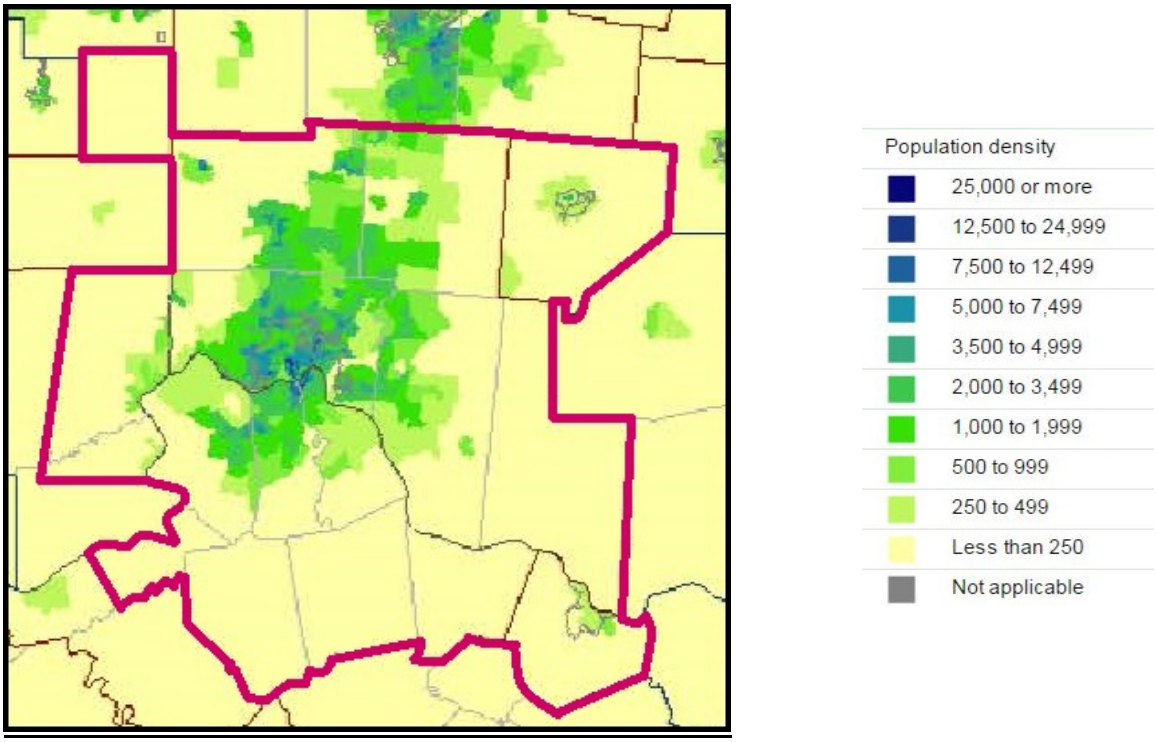


**Figure 5. 2010 Population Density by Census Tract.**




Source: U.S. Census Bureau population density by census tract: 2010
https://www.census.gov/population/metro/data/thematic_maps.html

**Ohio**: Hamilton County has the largest 2015 population in the area of analysis with slightly over twice as many people as Butler County, which ranks second, and almost four times the population of Warren County and Clermont County, which rank 3rd and 4th. Together, these counties account for 73 percent of the total CSA population. Brown and Clinton counties ranking 9th and 10th in population respectively, each have about 5 percent of the population in Hamilton County. With respect to 2015 population density, Hamilton County is almost twice as densely populated as Kenton County, which ranks 2nd. Butler, Warren, and Clermont Counties rank 3rd, 5th, and 7th, respectively, with population densities between 22 and 41 percent that of Hamilton County. Clinton and Brown counties are significantly less densely populated, ranking 9th and 11th, with about 10 percent the density of Hamilton County. Warren County had the second highest percentage increase in population between 2010 and 2015 at 6%. Clermont, Butler, and Hamilton Counties rank 4th, 5th, and 7th, respectively, with increases ranging from 1 to 2 percent. The remaining counties in Ohio decreased in population between 2010 and 2015.

**Kentucky**: Boone, Campbell, and Kenton Counties have relatively high populations and population densities when compared to the rest of the CSA. With respect to the 2015 population in the CSA, Kenton, Boone, Campbell rank 5th, 6th, and 7th, respectively. Boone, Campbell and Kenton Counties' combined population makes up 17% of the entire area of analysis and approximately half that of Hamilton County, OH. Kenton, Campbell and Boone Counties rank 2nd, 3rd and 5th, respectively, with the population densities between 26 and 52 percent that of Hamilton County, OH. Boone, Campbell and Kenton Counties are highly developed in the northern portions of the counties near the Ohio border with high population density in these portions of the counties. Bracken, Gallatin, Grant, Mason and Pendleton Counties' population densities are between 2 to 5 percent that of Hamilton County, OH. Boone County at 7 percent had the highest percentage of population growth for any of the counties listed as part of the CSA. The remaining CSA counties had population growth ranging from a loss of over 4 percent population to an increase of up to 6 percent population growth.

**Indiana**: Dearborn County ranks 8th in 2015 population as compared to other counties in the CSA. Union and Ohio Counties have the lowest 2015 populations in the CSA (ranking 16th and 17th, respectively). Dearborn, Ohio and Union Counties have relatively low 2015 population densities as compared to other counties in the CSA. With a 2015 population density of approximately 450 per square mile[8], Lawrenceburg Township is substantially more densely populated than the majority of Dearborn County. The population density of Lawrenceburg Township is similar to that of Clermont County, OH. Between 2010 and 2015, population in Dearborn County decreased 1%. Ohio and Union County population decreased from 3 to 4 percent.

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

The EPA evaluated the commuting patterns of residents, as well as the total 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[9] for the counties in the CSA. 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.

[8]Source of 2015 township population: https://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ACS_15_SPT_B01003&prodType=table

[9] The worker data can be accessed at: http://onthemap.ces.census.gov/.

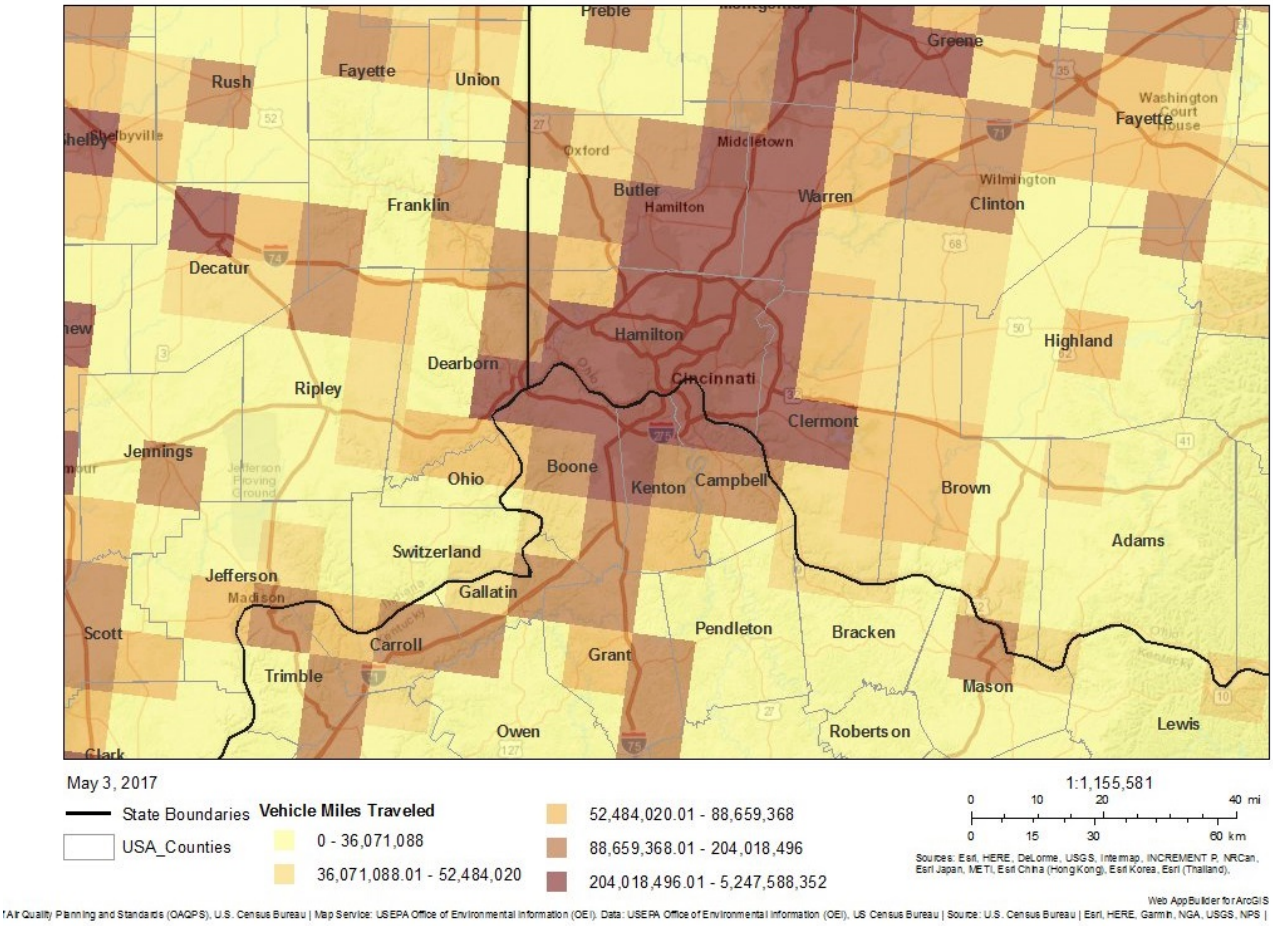
**Table 6. Traffic and Commuting Patterns.**

| 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 |
|---|---|---|---|---|---|
| **Hamilton, OH** | Yes | 8,530 | 372,836 | 295,507 | 79% |
| **Butler, OH** | Yes | 3,035 | 169,161 | 134,693 | 80% |
| **Warren, OH** | Yes | 1,932 | 102,393 | 69,230 | 68% |
| Clermont, OH | Yes | 1,661 | 94,732 | 52,503 | 55% |
| Kenton, KY | Yes (partial) | 1,660 | 79,496 | 20,135 | 25% |
| Boone, KY | Yes (partial) | 1,616 | 60,353 | 11,107 | 18% |
| Campbell, KY | Yes (partial) | 861 | 44,816 | 15,065 | 34% |
| Dearborn, IN | No | 689 | 24,184 | 7,789 | 32% |
| Clinton, OH | No | 632 | 17,707 | 3,839 | 22% |
| Grant, KY | No | 466 | 10,678 | 871 | 8% |
| Brown, OH | No | 412 | 18,030 | 5,706 | 32% |
| Gallatin, KY | No | 293 | 3,708 | 286 | 8% |
| Mason, KY | No | 189 | 6,460 | 107 | 2% |
| Pendleton, KY | No | 95 | 6,037 | 840 | 14% |
| Bracken, KY | No | 88 | 2,535 | 51 | 2% |
| Union, IN | No | 78 | 3,477 | 887 | 26% |
| Ohio, IN | No | 55 | 3,066 | 522 | 17% |
| | Total: | 22,291 | 1,019,669 | 619,138 | 61% |

* For state/commonwealth recommended partial counties, the data provided are for the entire county.
Counties with a monitor(s) violating the NAAQS are indicated in bold.

To show traffic and commuting patterns, Figure 6 overlays twelve-kilometer gridded VMT from the 2014 NEI with a map of the transportation arteries.

**Figure 6. Twelve Kilometer Gridded VMT (Miles) Overlaid with Transportation Arteries**




**Ohio**: Hamilton County has the highest VMT in the area of analysis with almost three times the VMT of Butler County, which ranks second, and more than four times the VMT of Warren County and five times the VMT of Clermont County, which rank 3rd and 4th. Together, they account for 65 percent of the total VMT in the area of analysis. Clinton and Brown Counties have less VMT, accounting for less than 3 percent and 2 percent of VMT in the area of analysis, respectively. The three counties with violating monitors - Hamilton, Butler, Warren have the highest percentage of commuters commuting to or within a county with a violating monitor. The percentage for Clermont County is also relatively high at over 50 percent. Because these counties are also among the most populous, they also account for a high percentage of the total workers in the area of analysis that are commuting to or within counties with violating monitors, accounting for approximately 89 percent of the total number of workers in the area of analysis. Clinton and Brown Counties have 22 percent and 32 percent commuting to a county with a violating monitor, but because they have relatively low populations, the two counties together only account for approximately 0.7 percent of the CSA total.

**Kentucky**:

Boone, Campbell, and Kenton Counties had more VMT than Bracken, Gallatin, Grant, Mason and Pendleton Counties. Cumulatively, Boone, Campbell and Kenton make up 19 percent of the total VMT for the Cincinnati, OH-KY-IN CSA. Kenton County's VMT makes up 7 percent of the total VMT for the area of analysis. Boone County also makes up 7 percent of the total VMT and Campbell County's VMT makes up 4 percent of the total VMT for the area of analysis. Kenton, Boone and Campbell are ranked 5th, 6th and 7th, respectively for VMT in

the area of analysis. The VMT for the remaining counties in Kentucky rank amongst the bottom half of the CSA.

**Indiana**: Dearborn County has relatively low 2014 VMT. In comparison, Hamilton County, Ohio has more than 12 times the VMT of Dearborn County. Union and Ohio Counties have the lowest VMT in the CSA, together accounting for less than 2 percent of the VMT of Hamilton County, Ohio. Dearborn County has 32 percent of its workers commuting to a county with a violating monitor. However, because population is relatively low, this accounts for a little over 1 percent of the CSA total. Similarly, although 26 percent and 17 percent of workers in Union and Ohio Counties, respectively, commute to a county with a violating monitor, this accounts for only 0.2 percent of the CSA total.

**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 1,000 meters above ground level (AGL) that illustrate the three-dimensional paths traveled by air parcels to a violating monitor. Figures 7a through 7g 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 monitor.

**Figure 7a. HYSPLIT Back Trajectories for Butler County Monitor 39-017-0004.**

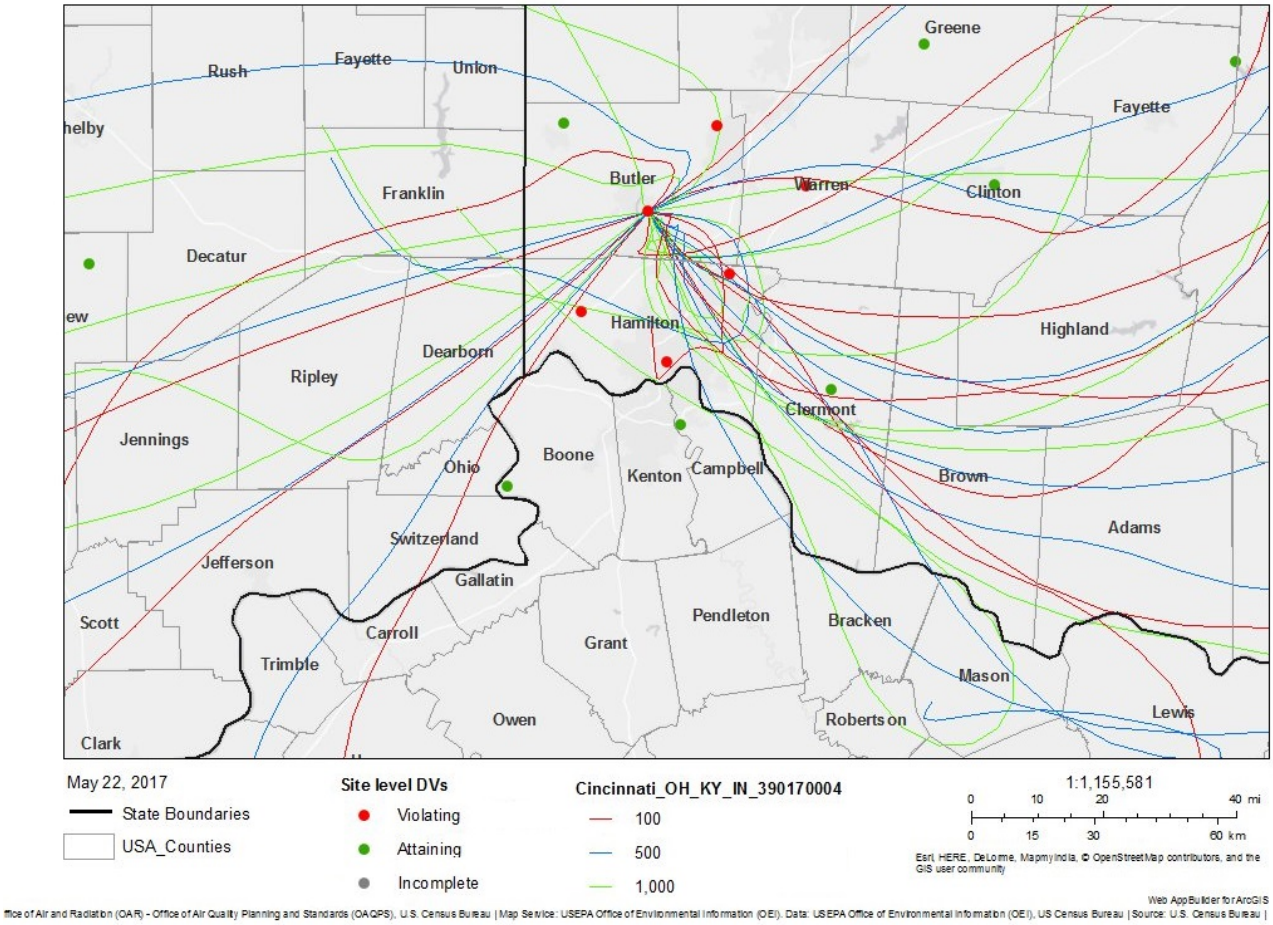


**Figure 7b. HYSPLIT Back Trajectories for Butler County Monitor 39-017-0018.**

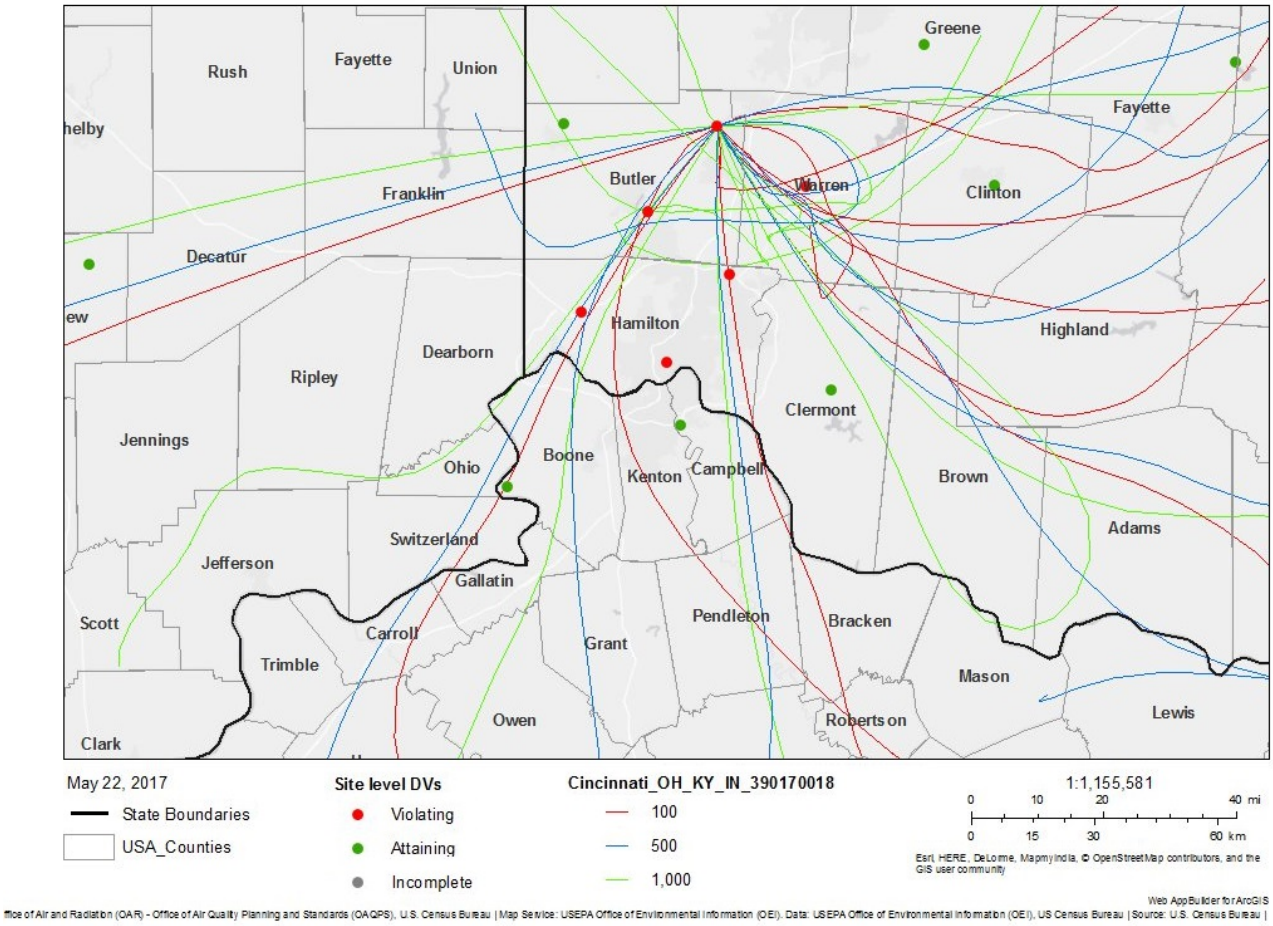


**Figure 7c. HYSPLIT Back Trajectories for Hamilton County Monitor 39-061-0006.**

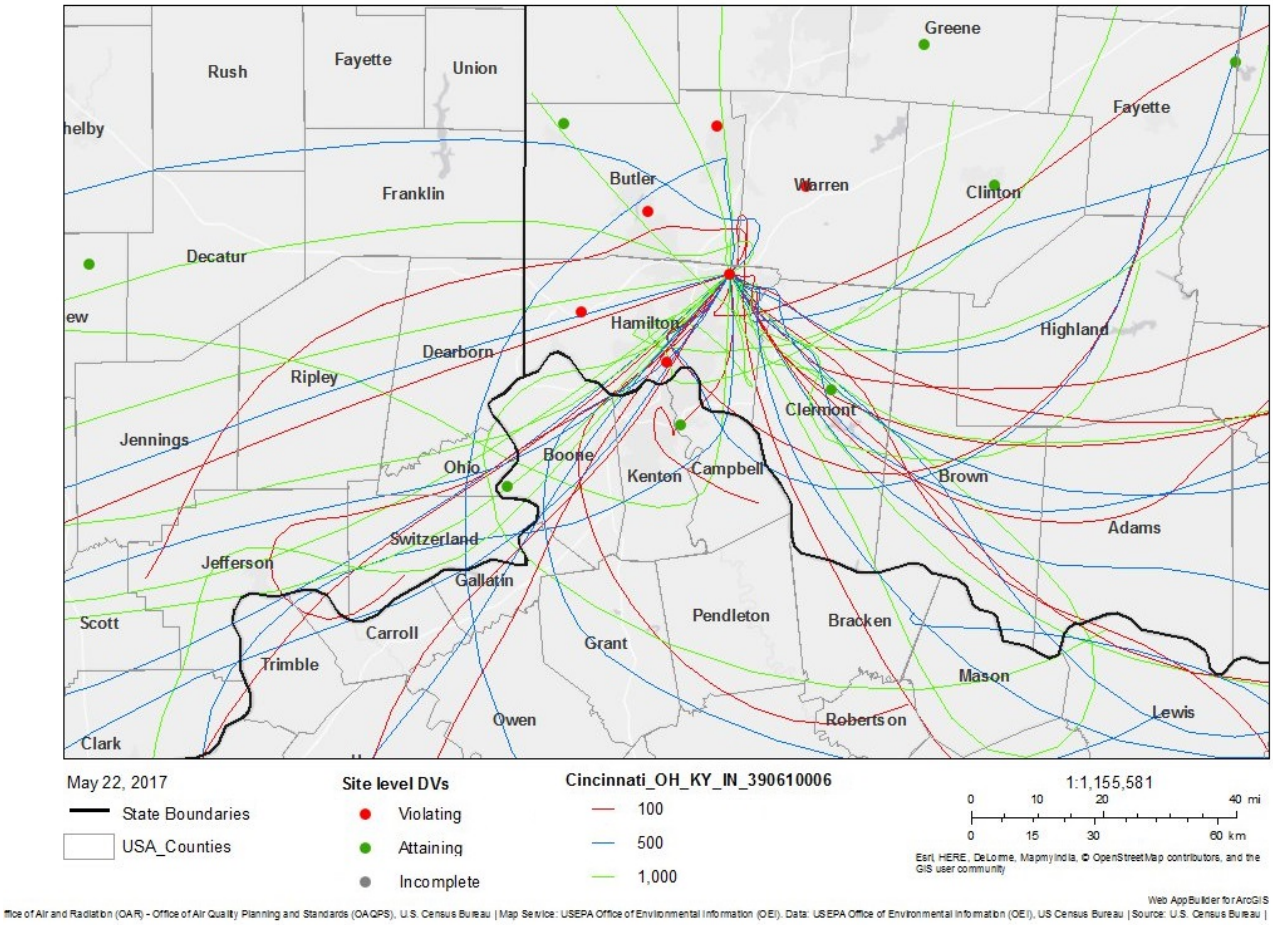


**Figure 7d. HYSPLIT Back Trajectories for Hamilton County Monitor 39-061-0010.**

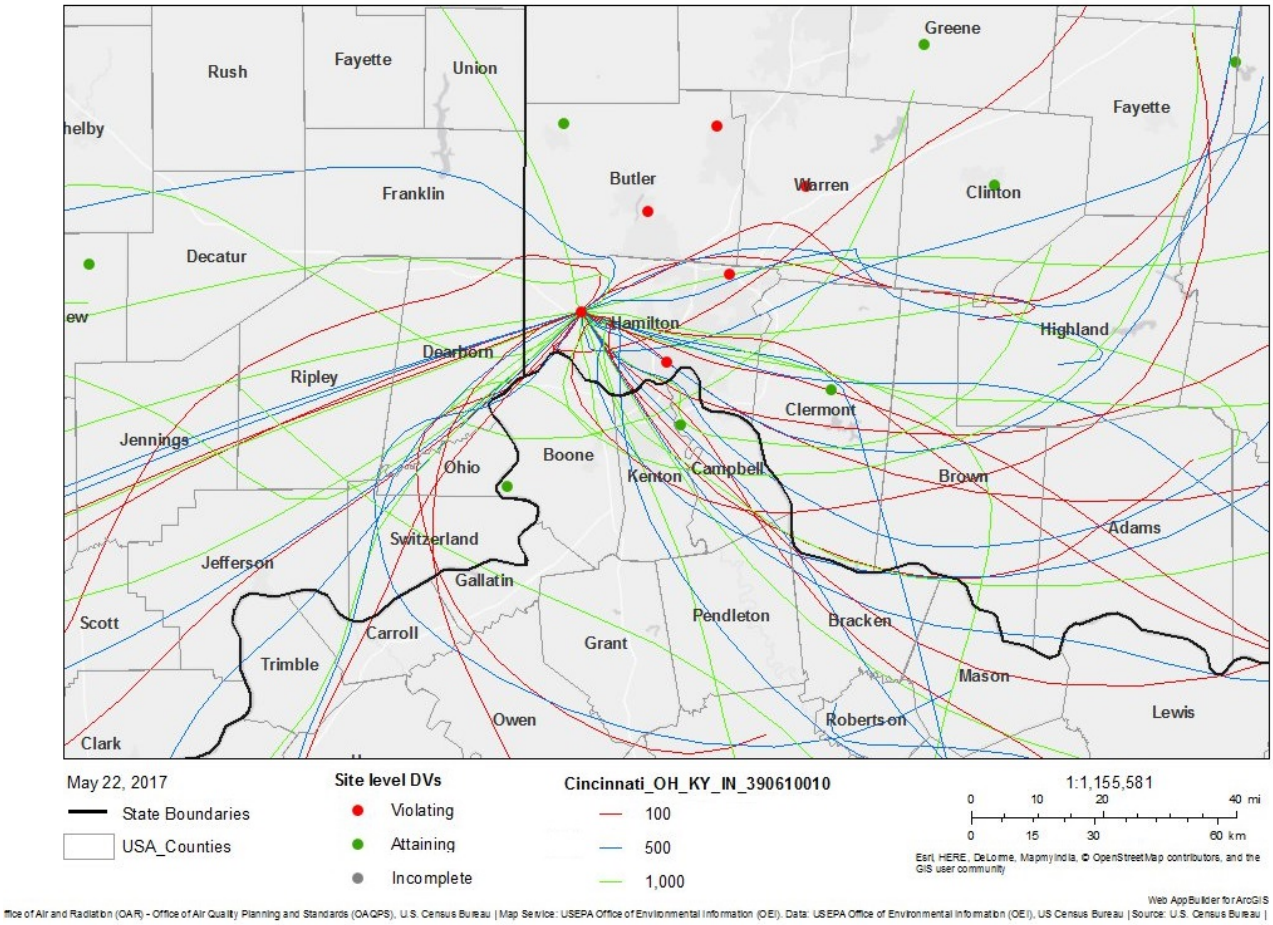


**Figure 7e. HYSPLIT Back Trajectories for Hamilton County Monitor 39-061-0040.**

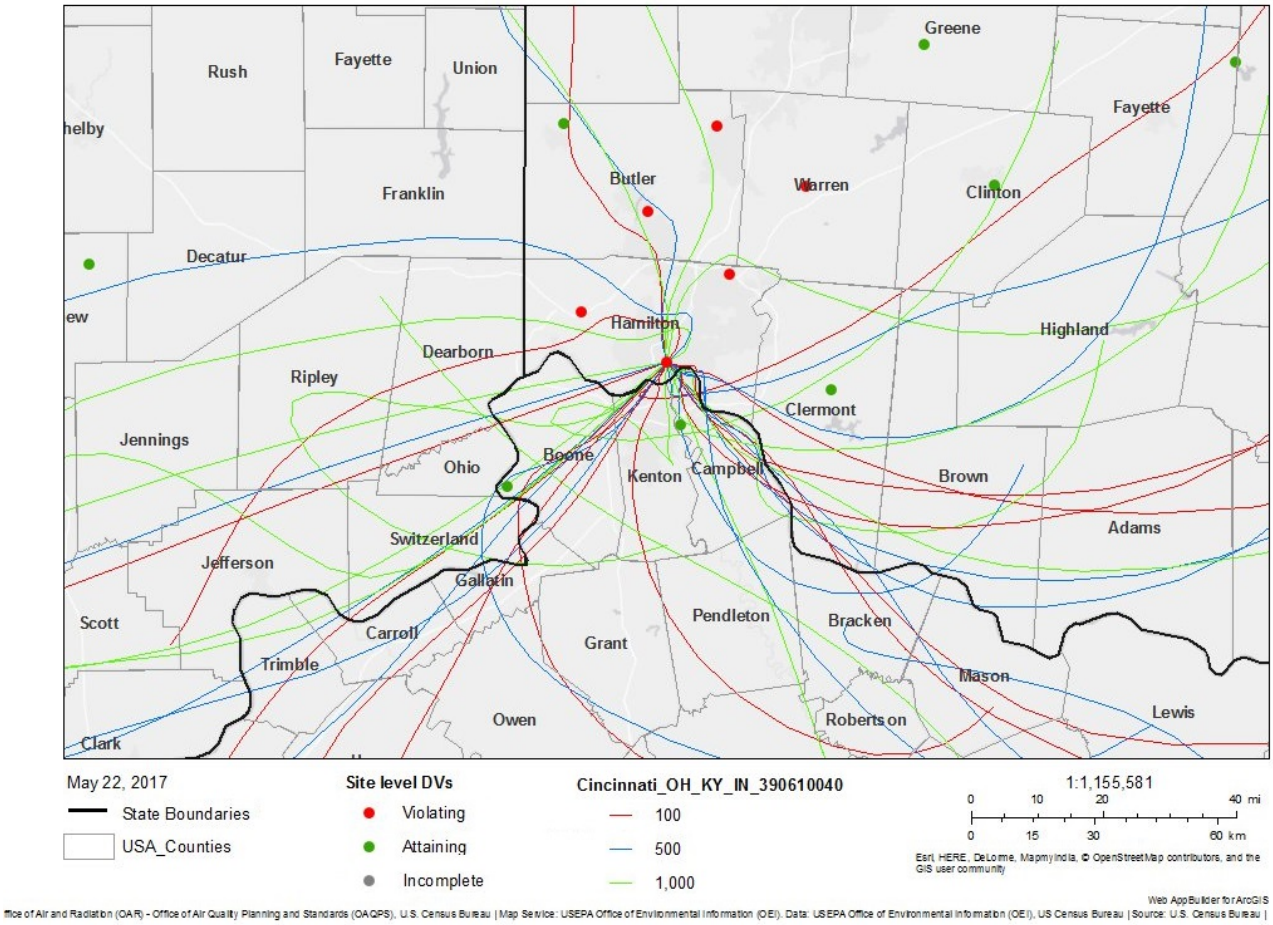
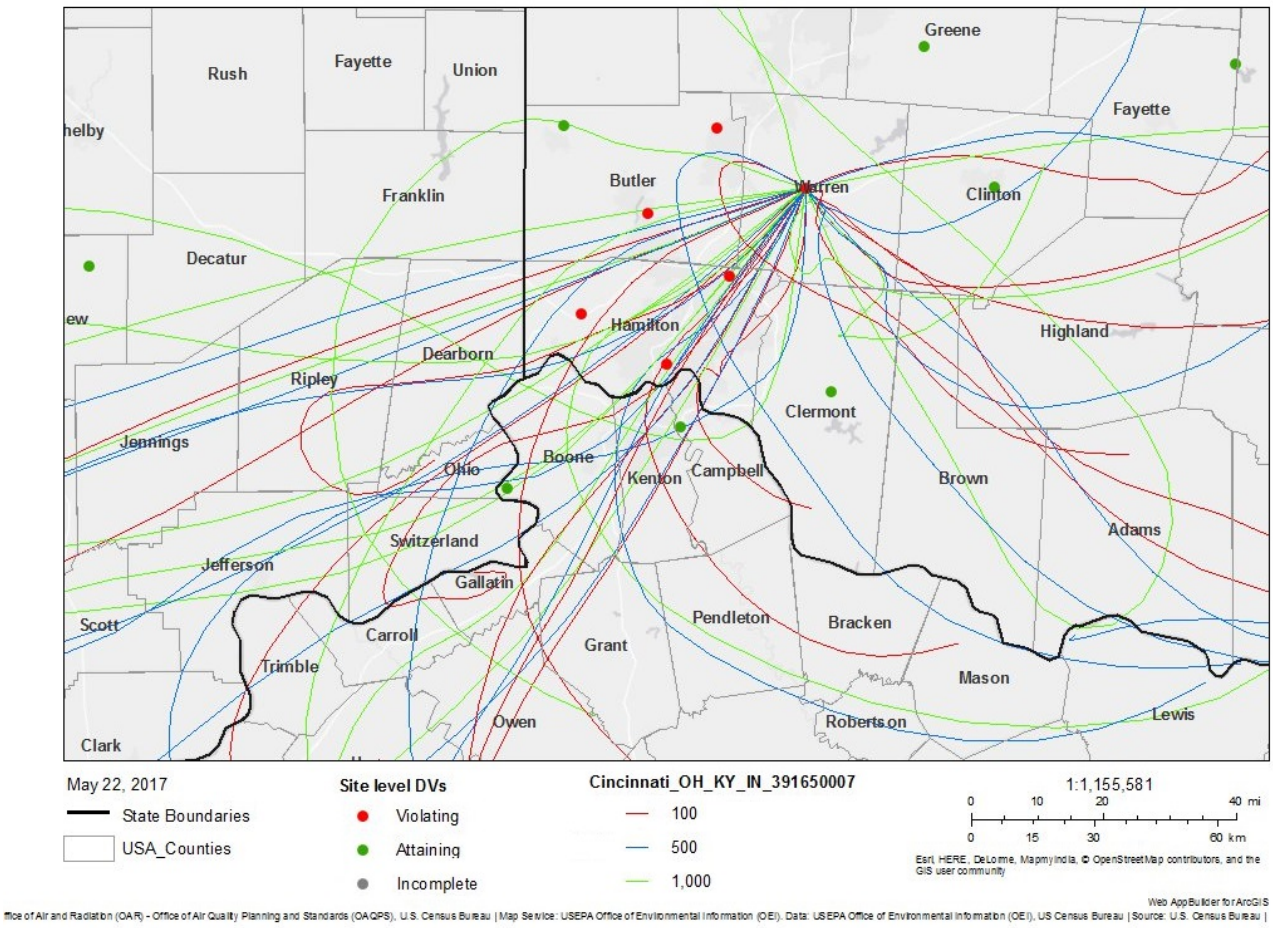


**Figure 7f. HYSPLIT Back Trajectories for Warren County Monitor 39-165-0007.**




The 2014-2016 HYSPLIT back trajectories displayed in Figures 7a through 7f show that transport winds blew predominantly from the west southwest, southwest, southeast and east directions during times when the violating monitors in the Cincinnati area measured exceedances of the 2015 Ozone NAAQS. Together, these figures show a dense pattern of HYSPLIT back trajectories across Hamilton, Butler, Warren, and Clermont Counties, in Ohio; the northern portions of Boone, Kenton, and Campbell Counties in Kentucky; as well as Ohio County and portions of Dearborn County in Indiana. Brown County, Ohio and the southern portions of Boone, Kenton, and Campbell Counties in Kentucky have a moderately dense pattern of HYSPLIT back trajectories. Clinton County, Ohio; Bracken, Pendleton, and Mason Counties in Kentucky; and northern Dearborn County, Indiana have a less dense pattern of back trajectories. Union County, Indiana and Grant County, Kentucky have few back trajectories.

The Indiana Department of Environmental Management (IDEM) provided a summary of photochemical modeling[10] analyzing the impacts of ozone precursor emissions from Dearborn County. For this analysis, IDEM performed several photochemical modeling simulations with the Comprehensive Air Quality Model with Extensions (CAMx)[11] version 6.3 for the period of June 15 – August 4 using EPA's 2011 modeling platform with 2023e1 emissions. The CAMx simulations included one case which used emissions from EPA's 2023el emissions platform[12] and several cases where a portion of 2023 emissions in Dearborn County were removed ("zeroed-out"). IDEM then compared the model-predicted ozone concentrations from each zero-out scenario back to model-predicted ozone concentrations from the base 2023el scenario with unperturbed 2023 emissions. In one scenario, IDEM zeroed-out point source VOC emissions in Dearborn County; in a second scenario IDEM zeroed out both VOC and NOx point source emissions in Dearborn County. The model showed changes to maximum daily 8-hour average ozone concentrations in the Cincinnati area of up to 0.1 ppb when both NOx and VOC point source emissions were zeroed out and of up to 0.001 ppb for when only VOC point source emissions were zeroed out. These impacts are minor.

Ideally IDEM would have modeled 2011 or a recent year rather than a projected 2023 emissions case since designations are based on an assessment of current conditions rather than future conditions.[13] In addition, due to an expansion at MPGI, the largest VOC point source in Dearborn County, which was not accounted for in the 2023 emissions projection, the 2023 VOC emissions attributed to that source were substantially underestimated. Further, it would have presented a more complete case if Indiana had zeroed-out all anthropogenic emissions in Dearborn County rather than just point sources. Nevertheless, given the very small impacts on ozone predicted by the zero-out simulations, modifications to the simulation reflecting these changes would not likely have more than a negligible impact on the minor impacts demonstrated by the modeling submitted by the state. In addition, the negligible impact from VOC reductions alone suggests that the Cincinnati area is NOx-limited and that underestimates of 2023 Dearborn County VOC emissions are unlikely to impact model-predicted ozone levels in the Cincinnati area.

**Factor 4: Geography/topography**

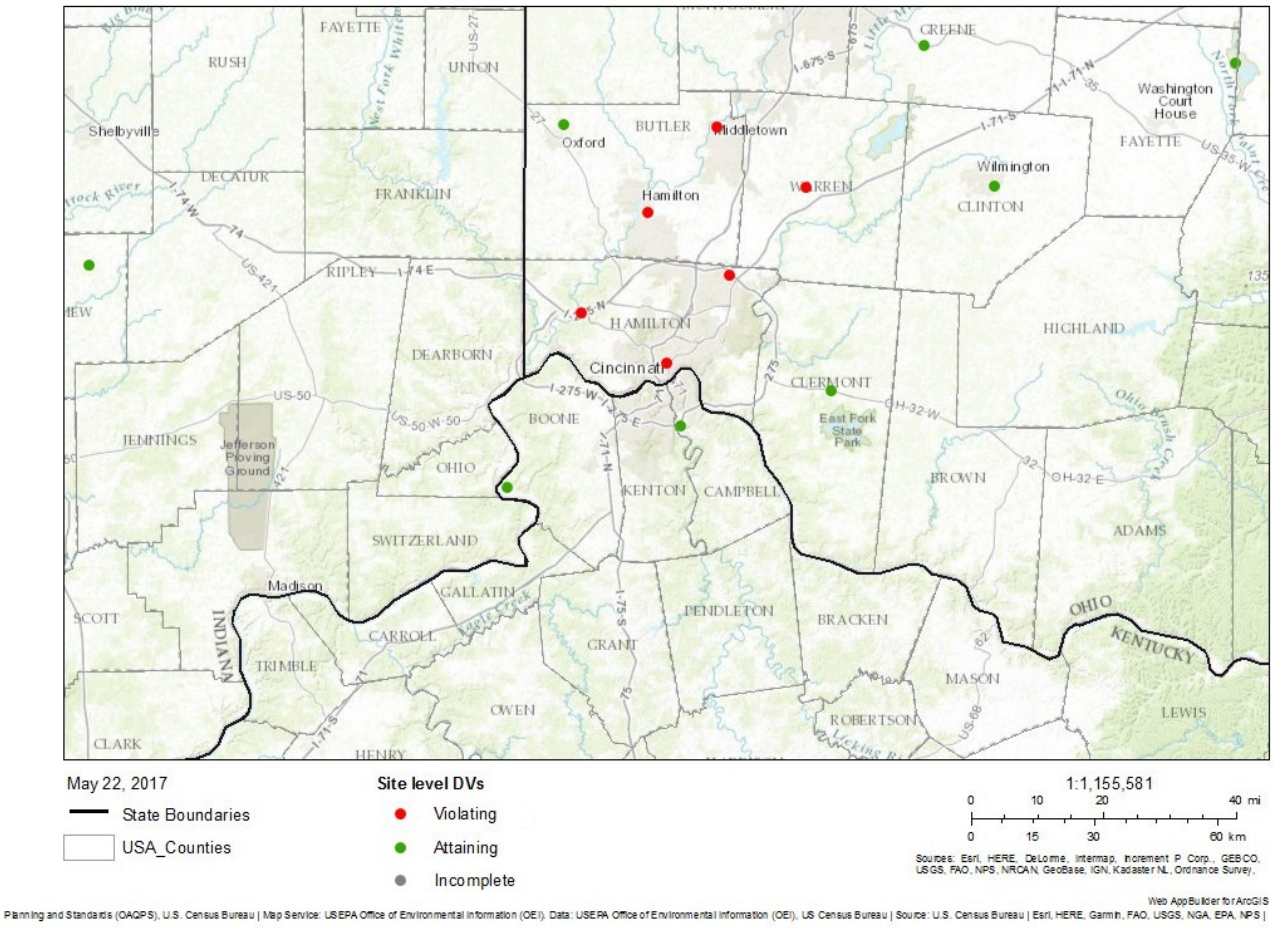
Consideration of geography or topography can provide additional information relevant to defining nonattainment area boundaries. Analyses should examine the physical features of the land that might define the air shed. Mountains or other physical features may influence the fate and transport of emissions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

[10] See February 16, 2018 letter from Bruno L.Pigott, Commissioner, Indiana Department of Environmental Management to Cathy Stepp, Regional Administrator, USEPA Region 5 (docket document ID number EPA-HQ-OAR-2017-0548-0292).
[11] Model documentation and download available at http://www.camx.com/
[12] These emissions are documented as part of EPA's 2011 Version 6.3 Air Emissions Modeling Platform available at https://www.epa.gov/air-emissions-modeling/2011-version-63-platform
[13] Section 107(d)(1)(A) of the Clean Air Act uses the present tense rather than the future tense, requiring the Governor of each State to submit lists for each area that "does not meet", "meets", or "cannot be classified…as meeting nor not meeting" the NAAQS.

The EPA used geography/topography analysis to evaluate the physical features of the land that might affect the air shed and, therefore, the distribution of ozone over the area.

The Cincinnati-Wilmington-Maysville CSA does not have major geographical or topographical features significantly limiting air pollution transport within its air shed. The Ohio River separates the Counties in Kentucky from those in Ohio.

**Figure 8. 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 Cincinnati 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, MPOs, 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 Cincinnati area has previously established nonattainment boundaries associated with the 2008 ozone NAAQS. This boundary included the entire counties of Butler, Clermont, Clinton, Hamilton and Warren in Ohio, parts of Boone, Campbell and Kenton Counties in Kentucky, and Lawrenceburg Township in Dearborn County, Indiana. Kentucky has recommended the same parts of Boone, Campbell and Kenton Counties be included in the nonattainment area for the 2015 ozone NAAQS. Ohio has recommended that Butler, Clermont, Hamilton and Warren Counties be included in the nonattainment area for the 2015 ozone NAAQS, but that Clinton County not be included in the area. Indiana has recommended not including any part of Dearborn County in the nonattainment area for the 2015 ozone NAAQS.

## Conclusion for the Cincinnati Area

The EPA is not modifying the states' recommendations for nonattainment boundaries. Based on the assessment of factors described above, the EPA has concluded that the following counties or portions of counties meet the CAA criteria for inclusion in the Cincinnati nonattainment area: Butler, Clermont, Hamilton and Warren in Ohio and the parts of Boone, Campbell and Kenton Counties in Kentucky identified in Kentucky's recommendation.[14] These counties and partial counties were all included in the Cincinnati, OH-KY-IN nonattainment area for the 2008 ozone NAAQS.

The air quality monitors in Butler, Hamilton, and Warren Counties in Ohio indicate violations of the 2015 ozone NAAQS based on the 2016 design values, therefore these counties are included in the nonattainment area.

When considering 2014 NEI emissions presented in Table 3, above, Hamilton County, Ohio has the highest NOx and VOC emissions in the area of analysis. Hamilton, Butler, Clermont and Warren Counties in Ohio and Boone, Kenton, and Campbell Counties in Kentucky seven of the eight highest NOx and VOC emissions in the area of analysis. Hamilton County, Ohio has by far the highest population in the area of analysis, followed by Butler, Warren, and Clermont Counties in Ohio, Kenton, Boone, and Campbell Counties in Kentucky. When looking at population density, Hamilton County, Ohio has the highest population density, followed by Kenton (KY), Butler (OH), Campbell (KY), Warren (OH), Boone (KY), and Clermont (KY) Counties. When considering VMT, again, Hamilton County, Ohio has by far the highest total VMT, followed by Butler County, Ohio. Warren and Clermont Counties in Ohio and Kenton and Boone Counties in Kentucky are ranked 3rd through 6th, respectively, with relatively similar VMT. Campbell County, Kentucky has significantly lower VMT; however, approximately 34 percent of workers in the counties commute to counties with violating monitors, suggesting a high level of integration with one or more of the counties with a violating monitor. Ohio and Union Counties in Indiana, Bracken, Gallatin, Grant, Mason and Pendleton Counties in Kentucky, and Brown and Clinton Counties in Ohio rank amongst the bottom half of the CSA for VMT and population. This would support the exclusion of these counties from the nonattainment area for the 2015 8-hour ozone NAAQS. Further, HYSPLIT back trajectories provide support for concluding that emissions in Hamilton, Butler, Warren and Clermont Counties, in Ohio; Boone, Kenton, and Campbell Counties in Kentucky; and Dearborn County in Indiana potentially contribute to the monitored violations.

[14] The partial county boundary for Boone County is all of Boone County with the exception of 2010 US Census Tracts 706.01 and 706.04 which are being designated attainment/unclassifiable. The partial county boundary for Campbell County is all of Campbell County with the exception of 2010 US Census tracts 520.01 and 520.02 which are being designated attainment/unclassifiable. The partial county boundary for Kenton County is all of Kenton County with the exception of 2010 US Census tracts 637.01 and 637.02 which are being designated attainment/unclassifiable. On April 12, 2018 Kentucky submitted a letter to the EPA clarifying the boundaries for Boone, Campbell and Kenton Counties.

As noted above, data indicate that the northern portions of Kenton, Boone, and Campbell Counties in Kentucky are the appropriate portions of these counties to include in the Cincinnati nonattainment area. The northern portions of Boone, Campbell and Kenton counties are in close proximity and have easy access to the core of the Cincinnati area. Boone, Campbell, and Kenton Counties are ranked amongst the highest in population and population densities when compared to the rest of the area of analysis. These three counties are densely populated within the partial boundary. Boone, Campbell and Kenton also have a large concentration of small point sources in the northern part of these counties.

While some of the remaining counties in the area of analysis are notable for one or more factors, the totality of the factors for each area does not support a decision to modify the states' recommendations. Dearborn County contains approximately 52 percent of the large point source VOC emissions in the area of analysis and 1 percent of the large point source NOx emissions, and all but one of these sources are contained within Lawrenceburg Township. In addition, Lawrenceburg Township is more densely populated than the majority of Dearborn County, and has relatively dense HYSPLIT back trajectories. However, photochemical modeling provided by Indiana indicates that the control of emissions from Dearborn County is unlikely to reduce maximum daily 8-hour average ozone concentrations in the Cincinnati area. Mason County has relatively high NOx emissions, ranking 5$^{th}$, but relatively low VOC emissions, ranking 12$^{th}$; relatively low population and VMT; and a relatively less dense pattern of HYSPLIT back trajectories as compared to other counties in the area of analysis. While Brown County, Ohio has moderately dense HYSPLIT back trajectories, it has relatively low NOx and VOC emissions, relatively low population and population density, and relatively low VMT. While Ohio County, Indiana has relatively dense HYSPLIT back trajectories, both VOC and NOx emissions are relatively low, population and population density are relatively low, and VMT is relatively low. Grant County, Kentucky has relatively low VOC and NOx emissions, relatively low population and population density, relatively low VMT, and few HYSPLIT back trajectories. Clinton County, Ohio and Gallatin, Pendleton, and Bracken Counties in Kentucky have relatively low NOx and VOC emissions, population, population density, and VMT, and all but Ohio have less dense HYSPLIT back trajectories than the counties the EPA is designating as nonattainment. Union County, Indiana has relatively low NOx and VOC emissions, relatively low population and population density, relatively low VMT, and few HYSPLIT back trajectories.