Ohio
Area Designations for the
2008 Ozone National Ambient Air Quality Standards

SUMMARY

The table below identifies the areas and associated counties in Ohio that EPA intends to designate as nonattainment for the 2008 ozone National Ambient Air Quality Standards (NAAQS).[1] In accordance with section 107(d) of the CAA, EPA must designate an area (county or part of a county) as "nonattainment" if it is violating the 2008 ozone NAAQS or if it is contributing to a violation of the 2008 ozone NAAQS in a nearby area. The technical analyses supporting the boundaries for the nonattainment areas are provided below.

Table 1. Intended Ozone Nonattainment Areas in Ohio

Area	Ohio Recommended Nonattainment Counties	EPA's Intended Nonattainment Counties
Nonattainment Areas †		
Cincinnati-Middletown-Wilmington, OH-KY-IN ‡	Butler Clermont Clinton Hamilton Warren	Butler Clermont Clinton Hamilton Warren
Cleveland-Akron-Lorain, OH	Ashtabula Cuyahoga Geauga Lake Lorain Medina Portage Summit	Ashtabula Cuyahoga Geauga Lake Lorain Medina Portage Summit
Columbus, OH	Delaware Fairfield Franklin Knox Licking Madison	Delaware Fairfield Franklin Knox Licking Madison

[1] The primary 8-hour hour ozone standard, set to protect human health, was revised on March 27, 2008 (73 FR 16436) from 0.08 parts per million (ppm) to 0.075 ppm. The secondary ozone standard, set to protect human welfare and the environment, was revised to be consistent with the primary ozone standard in all respects.

† Nonattainment for both primary and secondary 2008 8-hour ozone standards.

‡ Cincinnati-Middletown-Wilmington, OH-KY-IN is a multi-state nonattainment area. Table 2 below identifies the counties in Ohio and in other states that EPA intends to designate as part of the nonattainment area.

EPA intends to designate the remaining counties in Ohio that are not listed in Table 1 above as "unclassifiable/attainment" for the 2008 ozone NAAQS.

The analysis below provides the basis for the intended nonattainment area boundaries. It relies on our analysis of whether and which monitors are recording violations of the 2008 ozone NAAQS, based on certified air quality monitoring data from 2008-2010 and on an evaluation of whether nearby areas are contributing to such violations. EPA has evaluated contributions from nearby areas based on a weight-of-evidence analysis considering the factors identified below. EPA issued guidance on December 4, 2008 that identified these factors as ones EPA would consider in determining nonattainment area boundaries, and recommended that states consider these factors in making their designation recommendations to EPA.[2]

1. Air quality data (including the ozone design value calculated for each Federal Reference Method (FRM) or Federal Equivalent Method (FEM) monitor in the area);

2. Emissions and emissions-related data (including location of sources, population, amount of emissions and emission controls, and growth patterns);

3. Meteorology (weather/transport patterns);

4. Geography and topography (mountain ranges and other basin boundaries affecting ozone levels and ozone precursor transport); and,

5. Jurisdictional boundaries (e.g. counties, air districts, existing ozone nonattainment areas, Indian country,

[2] The December 4, 2008 guidance memorandum, "Area Designations for the 2008 Revised Ozone National Ambient Air Quality Standards," refers to 9 factors. In this technical support document, we have grouped the emissions-related factors together under the heading of "Emissions-Related Data," which results in 5 categories of factors.

Metropolitan Planning Organization (MPOs) and their covered area).

Ground-level ozone is generally not emitted directly into the air, but is created by chemical reactions involving Nitrogen Oxides (NOx) and Volatile Organic Compounds (VOC) in the presence of sunlight.[3] Because NOx and VOC emissions from a broad range of sources over a wide area typically contribute to violations of the ozone standards, EPA believes it is important to consider whether there are contributing emissions from a broad geographic area. Accordingly, EPA chose to examine the 5 factors with respect to the larger of the Combined Statistical Area (CSA) or Core Based Statistical Area (CBSA) associated with the violating monitor(s).[4] All data and information used by EPA in this evaluation are the latest available to EPA and/or provided to EPA by states or tribes.

In EPA's designations guidance for the 2008 ozone NAAQS, EPA recommended examining CSA/CBSAs because certain factors used to establish CSAs and CBSAs are similar to the factors EPA is using in this technical analysis to determine if a nearby area is contributing to a violation of the 2008 ozone NAAQS. Congress required a similar approach in 1990 for areas classified as serious and above for the 1-hour ozone standard and EPA used the same approach in the designation process for the 1997 ozone NAAQS. Where a violating monitor is not located in a CSA or CBSA, EPA's September 4, 2008 guidance recommends using the boundary of the county containing the violating monitor as the starting point for considering the nonattainment area's boundary.

Technical Analysis for Cincinnati-Middletown-Wilmington, OH-KY-IN

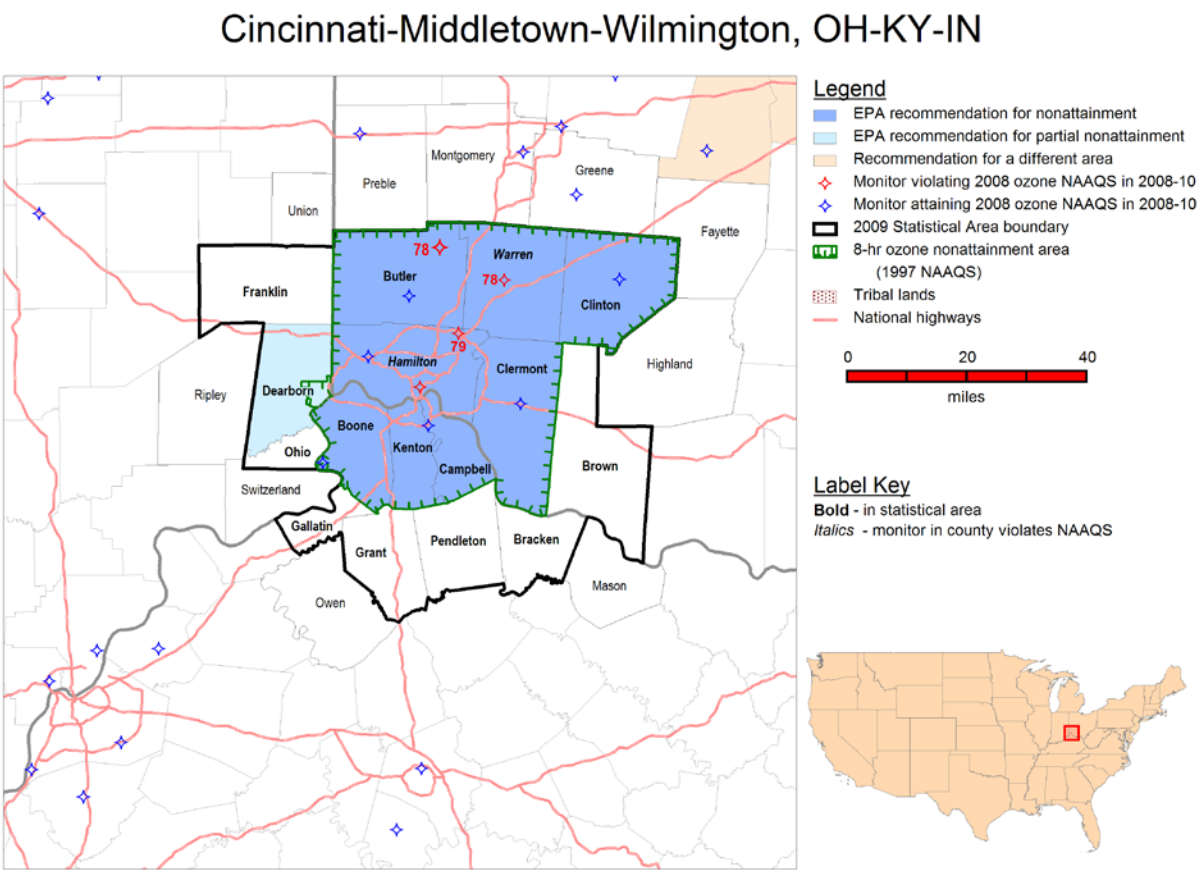
Figure 1 is a map of the Cincinnati-Middletown-Wilmington, OH-KY-IN intended nonattainment area. The map provides other relevant information, including the locations and ozone design values (violating monitors only) of air quality monitors, county and other jurisdictional boundaries, existing maintenance boundary for the 1997 ozone NAAQS, Cincinnati-Middletown-

[3] Peak ozone concentrations generally occur downwind of source areas on relatively sunny days with high temperatures and relatively low wind speeds.

[4] Lists of CBSAs and CSAs and their geographic components are provided at www.census.gov/population/www/metroareas/metrodef.html. The lists are periodically updated by the Office of Management and Budget. EPA used the most recent update, based on 2008 population estimates, issued on December 1, 2009 (OMB Bulletin No. 10-02).

Wilmington, OH-KY-IN CSA boundary, and major transportation arteries.

Figure 1. Cincinnati-Middletown-Wilmington, OH-KY-IN Area



For purposes of the 1997 ozone NAAQS, as noted in Figure 1, portions of this area were designated nonattainment and subsequently redesignated to attainment (maintenance). The boundary for the nonattainment area for the 1997 ozone NAAQS included the entire counties of Butler, Clermont, Clinton, Hamilton, and Warren in Ohio and Boone, Campbell, and Kenton in Kentucky and part of Dearborn County (Lawrenceburg Township) in Indiana.

In March 2009, Ohio recommended that Butler, Clermont, Clinton, Hamilton, and Warren Counties be designated as “nonattainment” for the 2008 ozone NAAQS based on air quality data from 2006-2008. In March 2009, Kentucky recommended that Boone, Campbell, and Kenton Counties be designated as nonattainment for the 2008 ozone NAAQS based on air quality data from 2006-2008.

Additionally, Indiana, in March 2009, recommended that each county in the Indiana portion of the Cincinnati-Middletown-Wilmington, OH-KY-IN CSA be designated as "attainment" for the 2008 ozone NAAQS. In October 2011, Kentucky submitted an update to their 2009 recommendation, and revised their recommendation to "attainment" designations for each county in the State.[5]

The ozone data reflected in Figure 1 and summarized below are from FEM monitors sited and operated in accordance with 40 CFR part 58.

After considering these recommendations and based on EPA's technical analysis described below, EPA intends to designate the counties in Ohio and Kentucky and the partial county in Indiana identified in Table 2 below as "nonattainment" for the 2008 ozone NAAQS as part of the Cincinnati-Middletown-Wilmington, OH-KY-IN nonattainment area.

Table 2. EPA's Intended Nonattainment Counties for the Cincinnati-Middletown-Wilmington, OH-KY-IN Ozone Nonattainment Area

Cincinnati-Middletown-Wilmington, OH-KY-IN	State-Recommended Nonattainment Counties	EPA Intended Nonattainment Counties
Indiana	None	Dearborn-Partial
Kentucky	None	Boone Campbell Kenton
Ohio	Butler Clermont Clinton Hamilton Warren	Butler Clermont Clinton Hamilton Warren

Factor Assessment

Factor 1: Air Quality Data

[5] Letters from Leonard K, Peters, Kentucky Energy and Environmental Cabinet Secretary to A. Stanley Meiburg and Gwendolyn Keyes Fleming regarding the initial and updated nonattainment boundary recommendations for the 2008 8-hour ozone standard for Kentucky(October 13, 2011 and March 12, 2009, respectively); Letter from Chris Korleski, Director, State of Ohio Environmental Protection Agency, to Lynn Buhl, Regional Administrator, U.S. Environmental Protection Agency, Region 5, regarding initial nonattainment boundary recommendations for Ohio for the 2008 ozone NAAQS (March 9, 2009); Letter from Thomas W. Easterly, Commissioner, Indiana Department of Environmental Management, to Bharat Mathur, Deputy Regional Administrator, U.S. Environmental Protection Agency, Region 5, regarding the initial nonattainment boundary recommendations for the 2008 ozone NAAQS for Indiana.

For this factor, we considered 8-hour ozone design values (in ppm) for air quality monitors in counties in the Cincinnati-Middleton-Wilmington, OH-KY-IN CSA based on data for the 2008-2010 period, which are the most recent years with fully-certified air quality data. A monitor's design value is the metric or statistic that indicates whether that monitor attains a specified air quality standard. The 2008 ozone NAAQS are met at a monitor when the annual fourth-highest daily maximum 8-hour ozone concentrations, averaged over 3 years is 0.075 ppm or less. A design values is valid only if minimum data completeness requirements are met. See 40 CFR part 50 Appendix P. Where several monitors are located in a county (or a designated nonattainment area or maintenance area), the design value for the county or area is determined by the monitor with the highest individual design value.

Note: Monitors that are eligible for providing design value data generally include State and Local Air Monitoring Stations (SLAMS) that are sited in accordance with 40 CFR Part 58, Appendix D (Section 4.1) and operating with a Federal Reference Method (FRM) or Federal Equivalent Method (FEM) monitor that meets the requirements of 40 CFR Part 58, Appendix A. All data from a Special Purpose Monitor (SPM) using an FRM or FEM which has operated for more than 24 months is eligible for comparison to the NAAQS unless the monitoring agency demonstrates that the data came from a particular period during which the requirements of Appendix A (quality assurance requirements) or Appendix E (probe and monitoring path siting criteria) were not met.

The 2008-2010 ozone design values for monitors and counties in the Cincinnati-Middletown-Wilmington, OH-KY-IN CSA are shown in Table 3.

Table 3. Ozone Air Quality Data for the Cincinnati-Middletown-Wilmington, OH-KY-IN CSA

State/County	Site Number	2008-2010 8-hour Ozone Design Values (ppm)
Ohio:		
Butler	390170018	**0.078†**
Butler	390170004	0.073
Clermont	390250022	0.071
Clinton	390271002	0.074
Hamilton	390610040	**0.076†**
Hamilton	390610010	0.073

Hamilton	390610006	**0.079†**
Warren	391650007	**0.078†**
Kentucky:		
Boone	210150003	0.065
Campbell	210373002	0.072

† Monitored violation of the 2008 ozone NAAQS.

Butler, Hamilton, and Warren Counties in Ohio show violations of the 2008 ozone NAAQS. Therefore, these counties are included in the intended ozone nonattainment area. A county (or partial county) must also be designated nonattainment if it contributes to a violation in a nearby area. Each county without a violating monitor that is located near a county with a violating monitor 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.

Please note that the state of Ohio, in its March 9, 2009 area designation recommendations and accompanying technical support documentation, based its recommendations on 2006-2008 ozone data. Since these data no longer cover the most recent 3-year period with quality-assured, state-certified data and have been supplanted by the more current 2008-2010 ozone data, we are not reviewing the older ozone data covered by the state of Ohio.

Factor 2: Emissions and Emissions-Related Data

EPA evaluated emissions for ozone precursors (VOC and NOx) and other emissions-related data that provide information on area contributions to ozone standard violations.

Emissions Data

EPA evaluated county-level emission data for NOx and VOC derived from the 2008 National Emissions Inventory (NEI), version 1.5. These are the most recently available NEI emissions data. (See http://www.epa.gov/ttn/chief/net/2008inventory.html) Significant emission levels in a nearby area indicate the potential for the area to contribute to the observed ozone standard violation.

Table 4 shows the 2008 emissions of VOC and NOx (tons per year (tpy)) for all counties in the Cincinnati-Middletown-Wilmington, OH-KY-IN CSA. This table also indicates which of the counties were recommended to be nonattainment for the 2008 ozone NAAQS by their respective states.

Table 4. Total 2008 VOC and NOx Emissions (tons/year) in the Cincinnati-Middletown-Wilmington, OH-KY-IN CSA

State/County	State Recommended Nonattainment?	VOC Emissions (tpy)	NOx Emissions (tpy)
Indiana:			
Dearborn	No	3,572	11,637
Franklin	No	1,097	862
Ohio	No	210	259
Kentucky:			
Boone	No	4,332	8,848
Bracken	No	361	760
Campbell	No	2,260	2,697
Gallatin	No	671	1,634
Grant	No	1,148	1,623
Kenton	No	3,901	4,095
Pendleton	No	608	1,394
Ohio:			
Brown	No	1,720	1,430
Butler	Yes	10,813	12,600
Clermont	Yes	5,809	28,461
Clinton	Yes	2,618	2,941
Hamilton	Yes	26,816	38,664
Warren	Yes	5,618	6,027
CSA Total		71,554	123,933

Emissions Observations By State

Ohio:

From the Ohio emissions data in Table 4, it can be seen that comparatively high 2008 VOC and NOx emissions in the vicinity of the violating counties originate in the following counties: Butler, Clermont, Hamilton, and Warren. Emissions from these counties in 2008 account for 68.6 percent of the VOC emissions and 69.2 percent of the NOx emissions for the entire Cincinnati-Middletown-Wilmington, OH-KY-IN CSA.

The VOC and NOx emissions from Brown and Clinton Counties, Ohio are significantly smaller than those originating in the higher emitting counties elsewhere in the Cincinnati-Middletown-Wilmington, OH-KY-IN CSA. This supports the exclusion of Brown County from the recommended ozone nonattainment area for the 2008 8-hour ozone NAAQS, but not the exclusion of Clinton County based on consideration of jurisdictional boundaries (see the discussion of Factor 5 below).

Indiana:

From the Indiana emissions data in Table 4, it can be seen that comparatively high 2008 VOC and NOx emissions in the vicinity of the violating counties originate from Dearborn County. Emissions from this county in 2008 account for 5.0 percent of the VOC emissions and 9.4 percent of the NOx emissions for the entire Cincinnati-Middletown-Wilmington, OH-KY-IN CSA. The majority of these emissions come from the American Electric Power (AEP) - Tanner's Creek Generating Station located in the Lawrenceburg Township, adjacent to the recommended nonattainment area.

The VOC and NOx emissions from Franklin and Ohio Counties in Indiana are comparatively smaller than those originating in the higher emitting counties elsewhere in the Cincinnati-Middletown-Wilmington, OH-KY-IN CSA. This supports the exclusion of these counties from the recommended ozone nonattainment area for the 2008 8-hour ozone NAAQS.

Kentucky:

Based on the 2008 NEI, 62 percent of Boone County's NOx emissions are from point sources, and 21 percent of Boone County's NOx emissions from mobile sources. Less than 5 percent of Campbell County's NOx emissions are from point sources, and 57 percent of Campbell County's NOX emissions are from mobile sources. Kenton County also has less than 5 percent of its NOx emission from point sources, but 63 percent of Kenton County's NOX emissions are from mobile sources. Boone County has 29 percent of its VOC emission coming from area sources and 23 percent of its VOC emissions from mobile sources. Campbell County has 35 percent of its VOC emissions coming from area sources and 43 percent of VOC emissions from mobile sources. Kenton County has 38 percent of its VOC emission coming from area sources and 41 percent of its VOC emissions from mobile sources.

The VOC and NOx emissions from Bracken, Gallatin, Grant, and Pendleton Counties, Kentucky are considerably less than those originating in the higher emitting counties elsewhere in the Cincinnati-Middletown-Wilmington, OH-KY-IN CSA. This would support the exclusion of these counties from the recommended ozone nonattainment area for the 2008 8-hour ozone NAAQS.

Population, Population Density, and Degree of Urbanization

EPA evaluated the population and vehicle use characteristics and population trends of the area as indicators of the probable

location and magnitude of non-point source emissions. These include ozone-creating emissions from on-road and off-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 violating ozone monitors. Rapid population or Vehicle Miles Traveled (VMT) growth in a county on the urban perimeter signifies increasing integration with the urban core area, and indicates that it may be appropriate to include this county in the ozone nonattainment area, particularly if this county already has moderate or higher VOC and/or NOx emissions. Table 5 shows the 2010 population, population density, and population growth information for each county in the Cincinnati-Middletown-Wilmington, OH-KY-IN CSA.

Table 5. Population and Population Growth in the Cincinnati-Middletown-Wilmington, OH-KY-IN CSA

State/County	State Recommended Nonattainment	2010 Population	2010 Population Density (1,000 per square mile)	Change in Population (2000-2010)	Population Percent Change (2000-2010)
Indiana:					
Dearborn	No	50,047	0.16	3,702	+8
Franklin	No	23,087	0.06	866	+4
Ohio	No	6,128	0.07	492	+9
Kentucky:					
Boone	No	118,811	0.46	31,811	+37
Bracken	No	8,488	0.04	211	+3
Campbell	No	90,336	0.57	1,680	+2
Gallatin	No	8,589	0.08	705	+9
Grant	No	24,662	0.09	2,115	+9
Kenton	No	159,720	0.97	8,032	+5
Pendleton	No	14,877	0.05	389	+3
Ohio:					
Brown	No	44,846	0.09	2,263	+5
Butler	Yes	368,130	0.78	34,447	+10
Clermont	Yes	197,363	0.43	18,733	+10
Clinton	Yes	42,040	0.10	1,378	+3
Hamilton	Yes	802,374	1.94	-41,916	-5
Warren	Yes	212,693	0.52	52,006	+32
Area-wide		2,172,191	0.45	116,914	+6

Sources: U.S. Census Bureau population estimates for 2010 as of August 4, 2011. (http://factfinder2.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=DEC_10_PL_GCTPL2.ST05&prodType=table)

Population Observations By State

Ohio:

For Ohio, the population data show that Butler, Clermont, Hamilton, and Warren Counties have comparatively large populations and population densities and are densely populated. This implies that the population-related VOC and NOx emissions in these counties are relatively high. In addition, the population change percentages in Butler, Clermont, and Warren Counties between 2000 and 2010 exceed the population change percentage for the entire Cincinnati-Middletown-Wilmington, OH-KY-IN area, implying that the population-related emission contributions from these counties are increasing compared to those from other counties in the Cincinnati-Middletown-Wilmington, OH-KY-IN area.

Indiana:

The populations of the Indiana counties in the Cincinnati-Middletown-Wilmington, OH-KY-IN CSA are smaller than those of the Ohio counties and larger Kentucky counties in this CSA, but Dearborn County has a moderate population implying moderate population-related VOC and NOx emissions. In addition, the population change percentage change from 2000 to 2010 in Dearborn County is greater than the population change percentage for the entire Cincinnati-Middletown-Wilmington, OH-KY-IN CSA, implying that the population-related emission contribution from this county may be increasing relative to those from other counties in the Cincinnati-Middletown-Wilmington, OH-KY-IN area. Ohio County, Indiana also has a greater population change percentage as well, but the lower population in this county causes this change to be less significant.

Kentucky:

For Kentucky, Boone, Campbell, and Kenton Counties have relatively high populations and population densities when compared to the rest of the CSA. Bracken, Gallatin, Grant and Pendleton Counties are smaller when compared to the counties included in the non-attainment recommendation. Boone County at 37 percent growth and Warren County at 32 percent growth had the highest percentage of population growth for any of the counties in the Cincinnati-Middletown-Wilmington CSA. Other counties in this CSA did not have as large of a population percentage change, with their growth rates ranging from a 2 to 10 percent

increase. Hamilton County population decreased by 5 percent from 2000-2010.

Traffic and Commuting Patterns

EPA evaluated the total VMT for each county in the Cincinnati-Middletown-Wilmington, OH-KY-IN CSA. In combination with the population/population density data and the location of main transportation arteries (see above area map), this information helps identify the probable location of non-point source emissions. A county with high VMT is generally an integral part of an urban area and indicates the presence of relatively high motor vehicle emissions that may significantly contribute to ozone formation and transport that contributes to nonattainment in the urban area. Rapid population or VMT growth in a county on the urban perimeter signifies increasing integration with the core urban area, and suggests that this county should be included in the ozone nonattainment area, particularly if the VOC and/or NOx emissions in this county are a significant portion of the total emissions in the nonattainment area.

Table 6 shows the traffic levels, total 2008 VMT, in each county in the Cincinnati-Middletown-Wilmington, OH-KY-IN CSA.

Table 6. Traffic Levels in the Cincinnati-Middletown-Wilmington, OH-KY-IN CSA

State/County	State Recommended Nonattainment	2008 VMT* (million miles)
Indiana:		
Dearborn	No	904
Franklin	No	316
Ohio	No	63
Kentucky:		
Boone	No	1,095
Bracken	No	89
Campbell	No	1,005
Gallatin	No	278
Grant	No	432
Kenton	No	1,669
Pendleton	No	182
Ohio:		
Brown	No	413
Butler	Yes	2,469
Clermont	Yes	1,464
Clinton	Yes	655
Hamilton	Yes	7,391
Warren	Yes	1,640

Area-wide	20,063

* MOBILE model VMT are those input into the NEI version 1.5 use to compute the mobile source portion of the NEI emissions summarized above in Table 4.

VMT Observations By State

Ohio:

For Ohio, the VMT data show that VMT levels in Butler, Clermont, Hamilton, and Warren Counties are comparatively higher than those in Brown and Clinton Counties and, accumulatively, are a significant portion of the total VMT for the Cincinnati-Middletown-Wilmington, OH-KY-IN CSA.

Indiana:

For Indiana, the data show that VMT level in Dearborn County is a comparatively high portion of the total VMT for the Cincinnati-Middletown-Wilmington, OH-KY-IN CSA.

Kentucky:

The VMT data show that VMT levels in Boone, Campbell, and Kenton Counties are larger than those in Bracken, Gallatin, Grant, and Pendleton Counties and, accumulatively, are a large portion of the total VMT for the Cincinnati-Middletown-Wilmington, OH-KY-IN CSA.

Additional Emissions-Related Data Discussed in Ohio's March 9, 2009 Designation Recommendation Submittal

The State of Ohio, through the Ohio Environmental Protection Agency (OEPA), has provided a detailed discussion of the county-specific VOC and NOx emissions, populations, and traffic and commuting patterns for the Ohio counties in the Cincinnati-Middletown-Wilmington, OH-KY-IN CSA. These data support our conclusions discussed above, but also allow us to further refine our decisions for Factor 2 for the Ohio portion of the CSA. This is particularly true for growth in county populations and traffic levels and the inter-county impact of commuter traffic.

With regard to emissions, Ohio clearly shows that both VOC and NOx daily emissions in Brown County are considerably lower than many other counties in the Cincinnati-Middletown-Wilmington, OH-KY-IN CSA. This confirms our conclusions that Brown County

emissions are relatively low and would not support inclusion of this county in the ozone nonattainment area.

Ohio has projected county-populations through 2030. These population projections show that populations in Clinton and Brown Counties will remain comparatively low through 2030. Whereas, the populations of Butler, Clermont, Hamilton, and Warren Counties will either significantly increase or will remain relatively high through 2030.

Estimated daily VMT in Brown County are shown to be largely unchanged beginning in 2001 through 2007, and daily VMT in Hamilton County are estimated to be similarly unchanged between 1990 and 2007. In contrast, daily VMT levels have shown significant growth trends in Butler, Clinton, Clermont, and Warren Counties between 1990 and 2007.

The State of Ohio notes that the vast majority of workers traveling out of county from Butler, Warren, and Clermont Counties commute to Hamilton County. This conclusion is supported by tabulated inter-county commuter numbers and percentages in Ohio' March 9, 2009 submittal. It is also noted that approximately 15 percent of the Hamilton County workers commute outside of the county, with the majority traveling to Butler County, with significant numbers of commuters also traveling from Hamilton County to Warren and Clermont Counties. The commuter numbers for Brown County show a much smaller number commuters traveling to or from other counties in the Cincinnati-Middletown-Wilmington, OH-KY-IN CSA.

Considering all of the information provided by the State of Ohio supports the conclusion that there is strong urban integration of Butler, Clermont, Hamilton, and Warren Counties. In contrast, Clinton and Brown Counties are not significantly integrated with the Cincinnati urban area. This favors the exclusion of Brown County from the Cincinnati-Middletown-Wilmington, OH-KY-IN ozone nonattainment area for the 2008 ozone NAAQS. Clinton County, however, cannot be excluded from the ozone nonattainment area due to jurisdictional boundary considerations, as discussed for Factor 5 below.

Factor 3: Meteorology (Weather/Transport Patterns)

EPA evaluated available meteorological data to help determine how meteorological conditions, particularly transport conditions, affect the fate and transport of ozone and ozone precursors contributing to ozone formation in the Cincinnati-

Middletown-Wilmington, OH-KY-IN CSA. The wind direction percentages show that there is no "preferred" wind direction during the summertime. Transport winds can and do blow from all directions into the counties with the recorded violations of the 2008 ozone NAAQS. There is, however, an indication that winds from south-southwest and west-southwest (collectively, the southwest quadrant) may be more prevalent than winds from other wind directions during the summertime in all three ozone standard violation counties.

Factor 4: Geography/Topography (Mountain Ranges or Other Air Basin Boundaries)

The geography/topography analysis evaluates the physical features of the land that might affect the airshed and, therefore, the distribution of ozone over the area.

The Cincinnati-Middletown-Wilmington, OH-KY-IN CSA does not have any geographical or topographical barriers significantly limiting air pollution transport within its air shed. Therefore, this factor did not play a significant role in this evaluation.

Factor 5: Jurisdictional Boundaries

Once we identified the general area that we anticipated we would recommend as nonattainment for the 2008 ozone NAAQS, we then considered existing jurisdictional boundaries for the purposes of providing a clearly defined legal boundary and to help identify the area appropriate for carrying out the air quality planning and enforcement functions for an ozone nonattainment area. Examples of jurisdictional boundaries include existing/prior nonattainment boundaries for ozone or other urban-scale pollutants, county boundaries, air district boundaries, township boundaries, areas covered by metropolitan planning organizations, state lines, and Reservation boundaries. Where existing jurisdictional boundaries are not adequate or appropriate to describe the nonattainment area, other clearly defined and permanent landmarks or geographic coordinates may be considered.

The Cincinnati-Middletown-Wilmington, OH-KY-IN area has previously established nonattainment boundaries associated with the both the 1-hour ozone and 1997 8-hour ozone NAAQS. The Cincinnati nonattainment boundary for the 1-hour ozone NAAQS included Boone, Campbell and Kenton Counties in their entireties in Kentucky; Butler, Clermont, Hamilton and Warren Counties in

their entireties in Ohio. Whereas the Cincinnati nonattainment boundary for the 1997 8-hour ozone NAAQS included Boone, Campbell and Kenton Counties in their entireties in Kentucky, Butler, Clermont, Clinton, Hamilton and Warren Counties in their entireties in Ohio, and a portion of Dearborn County (Lawrenceburg Township) in Indiana. Kentucky and Indiana have recommended a different nonattainment boundary for the 2008 ozone NAAQS for their portion of this area. Ohio recommended the same boundary as the 1997 ozone NAAQS nonattainment boundary for their portion of this area. With the exception of those counties (and partial county) that comprise the 1997 8-hour ozone boundary for this area, we believe that the remainder of the counties in the CSA do not contribute to the violations at the monitors in this area and, therefore, are not necessary for consideration as part of the nonattainment area.

Conclusion

Ohio:

Based on the assessment of factors described above, EPA has preliminarily concluded that the following Ohio counties should be included in the Cincinnati-Middletown-Wilmington, OH-KY-IN ozone nonattainment area because they are either violating the 2008 ozone NAAQS or contributing to a violation of the 2008 ozone NAAQS within this preliminary nonattainment area: Butler; Clermont; Clinton; Hamilton; and, Warren.

Table 8a summarizes which factors, discussed above, support the inclusion of each Ohio county in the intended nonattainment area for the 2008 ozone NAAQS. Note that Table 8a covers all Ohio counties in the Cincinnati-Middletown-Wilmington, OH-KY-IN CSA, but that not all of these counties are included in the preliminary nonattainment area for the 2008 ozone NAAQS.

Table 8a. Factors Supporting Inclusion of Ohio Counties in the Cincinnati-Middletown-Wilmington, OH-KY-IN Ozone Nonattainment Area for the 2008 Ozone NAAQS

County	Violates Ozone Standard	High Emissions Population and Traffic Levels	Meteorology Favors Emissions Impact on Violating Monitor	Geography Favors High Ozone or Emissions Impact on Violating Monitor	Jurisdictional Basis for Inclusion In Nonattainment Area
Butler	X	X	X	NA	X
Clermont		X	X	NA	X

Clinton			X	NA	X
Hamilton	X	X	X	NA	X
Warren	X	X	X	NA	X

The results in the above table show that Butler, Hamilton, and Warren Counties, at minimum, should be included in the ozone nonattainment area based on air quality data. In addition, these counties also have comparatively high VOC and NOx emissions, populations (high population-related emissions), and traffic levels (traffic-related emissions), which favor their inclusion in the ozone nonattainment area.

Clermont County has comparatively high VOC and NOx emissions and relatively high populations and traffic levels, which, based on meteorological considerations, can also contribute to the monitored ozone standard violations in EPA's intended ozone nonattainment area. Therefore, Clermont County should also be included in the preliminary ozone nonattainment area.

Clinton County has no monitored ozone standard violations and generally lacks the higher VOC and NOx emissions and high population and traffic levels of the other Ohio counties discussed above. Therefore, these factors do not favor the inclusion of Clinton County in the intended ozone nonattainment area. However, it is noted that Clinton County has historically been included in the Cincinnati ozone nonattainment area for the 1997 ozone NAAQS. In addition, the State of Ohio, in its March 9, 2009 ozone designation submittal, has recommended that Clinton County should be included in the ozone nonattainment area for the 2008 ozone NAAQS. Based on the jurisdictional factor and the State's recommendation, we are including Clinton County in the intended, preliminary Cincinnati-Middletown-Wilmington, OH-KY-IN ozone nonattainment area for the 2008 ozone NAAQS.

Finally, it is noted Brown County lacks ozone standard violations, and the comparatively high emissions, populations, and traffic levels of other Ohio counties in the Cincinnati-Middletown-Wilmington, OH-KY-IN CSA. In addition, this county was not included in the nonattainment area for the 1997 ozone NAAQS and Ohio has not recommended the inclusion of this county in the ozone nonattainment area for the 2008 ozone NAAQS. Based on all of these factors and facts, we are not including Brown County in the intended Cincinnati-Middletown-Wilmington, OH-KY-IN ozone nonattainment area for the 2008 ozone NAAQS.

Indiana:

Based on the assessment of factors described above, EPA has preliminarily concluded that the following Indiana county should be included in the Cincinnati-Middletown-Wilmington, OH-KY-IN ozone nonattainment area because they are either violating the 2008 ozone NAAQS or contributing to a violation of the 2008 ozone NAAQS within this preliminary nonattainment area: Lawrence Township in Dearborn County.

Table 8b summarizes which factors, discussed above, support the inclusion of each Indiana county in the intended nonattainment area for the 2008 ozone NAAQS. Note that Table 8b covers all Indiana counties in the Cincinnati-Middletown-Wilmington, OH-KY-IN CSA, but that not all of these counties are included in the preliminary nonattainment area for the 2008 ozone NAAQS.

Table 8b. Factors Supporting Inclusion of Indiana Counties in the Cincinnati-Middletown-Wilmington, OH-KY-IN Ozone Nonattainment Area for the 2008 Ozone NAAQS

County	Monitored Violation for Ozone Standard	High Emissions Population and Traffic Levels	Meteorology Favors Emissions Impact on Violating Monitor	Geography Favors High Ozone or Emissions Impact on Violating Monitor	Jurisdictional Basis for Inclusion In Nonattainment Area
Dearborn - Partial		X	X	NA	X

EPA has preliminarily concluded that Franklin and Ohio Counties are not expected to contribute to the ozone standard violations in the recommended Cincinnati-Middletown-Wilmington, OH-KY-IN ozone nonattainment area. The areas are mostly rural with no point source emissions and minimal amounts of nonpoint source and mobile emissions. Franklin and Ohio Counties were not included in the Cincinnati ozone nonattainment area for the 1997 ozone NAAQS. EPA has preliminarily concluded that Franklin and Ohio Counties are to be excluded from the proposed nonattainment area.

Lawrenceburg Township in Dearborn County contains the American Electric Power (AEP) – Tanner's Creek Generating Station and has high NOx and VOC emissions. Dearborn County also has the potential to have moderate mobile source and population related VOC and NOx emissions. The inclusion of Lawrenceburg Township in the Cincinnati-Middletown-Wilmington, OH-KY-IN ozone nonattainment area would be consistent with the ozone nonattainment area for the 1997 ozone NAAQS. Lawrenceburg Township contains the only major stationary source in the Indiana portion of Cincinnati-Middletown-Wilmington, OH-KY-IN CSA and accounts for the majority of the VOC and NOx emissions

in the Indiana portion of this area. The remainder of Dearborn County is fairly rural and is similar to Franklin and Ohio Counties. The inclusion of the Lawrenceburg Township portion of Dearborn County, Indiana in the intended Cincinnati-Middletown-Wilmington, OH-KY-IN nonattainment area for the 2008 ozone NAAQS is sufficient to account for the contribution of this county.

Kentucky:

Table 8c summarizes which factors discussed above support the inclusion of Kentucky counties in the intended nonattainment area for the 2008 ozone NAAQS. Note that Table 8c covers all Kentucky counties in the Cincinnati-Middletown-Wilmington, OH-KY-IN CSA, but that not all of these counties are included in the preliminary nonattainment area for the 2008 ozone NAAQS.

Table 8c. Factors Supporting Inclusion of Kentucky Counties in the Cincinnati-Middletown-Wilmington, OH-KY-IN Ozone Nonattainment Area for the 2008 Ozone NAAQS

County	Monitored Violation for Ozone Standard	High Emissions Population and Traffic Levels	Meteorology Favors Emissions Impact on Violating Monitor	Geography Favors High Ozone or Emissions Impact on Violating Monitor	Jurisdictional Basis for Inclusion In Nonattainment Area
Boone		X	X	NA	X
Campbell		X	X	NA	X
Kenton		X	X	NA	X

For Kentucky, based on the assessment of factors described above, EPA has preliminarily concluded that the following counties, Boone, Campbell and Kenton, should be included as part of the Cincinnati-Middletown-Wilmington nonattainment area because they are contributing to a violation in a nearby area. Source category emissions data indicate that mobile sources and area sources are not the primary contributors of NOx to ozone formation in the Cincinnati-Middletown -Wilmington area. The analysis reveals that mobile emissions make up approximately 28 percent of the total NOx in the Cincinnati-Middletown-Wilmington area, and area sources make up approximately 12 percent of the total NOx emissions in the Cincinnati-Middletown -Wilmington area. The total of mobile sources and area sources make up approximately 40 percent of the total NOx emissions in the Cincinnati area. However, VOC emissions in Cincinnati-Middletown-Wilmington area are high for area and mobile sources. The analysis reveals that mobile emissions make up approximately 37 percent of the total VOC in the Cincinnati-Middletown-Wilmington area, and area sources make up approximately 38 percent of the total VOC emissions in the Cincinnati area. The

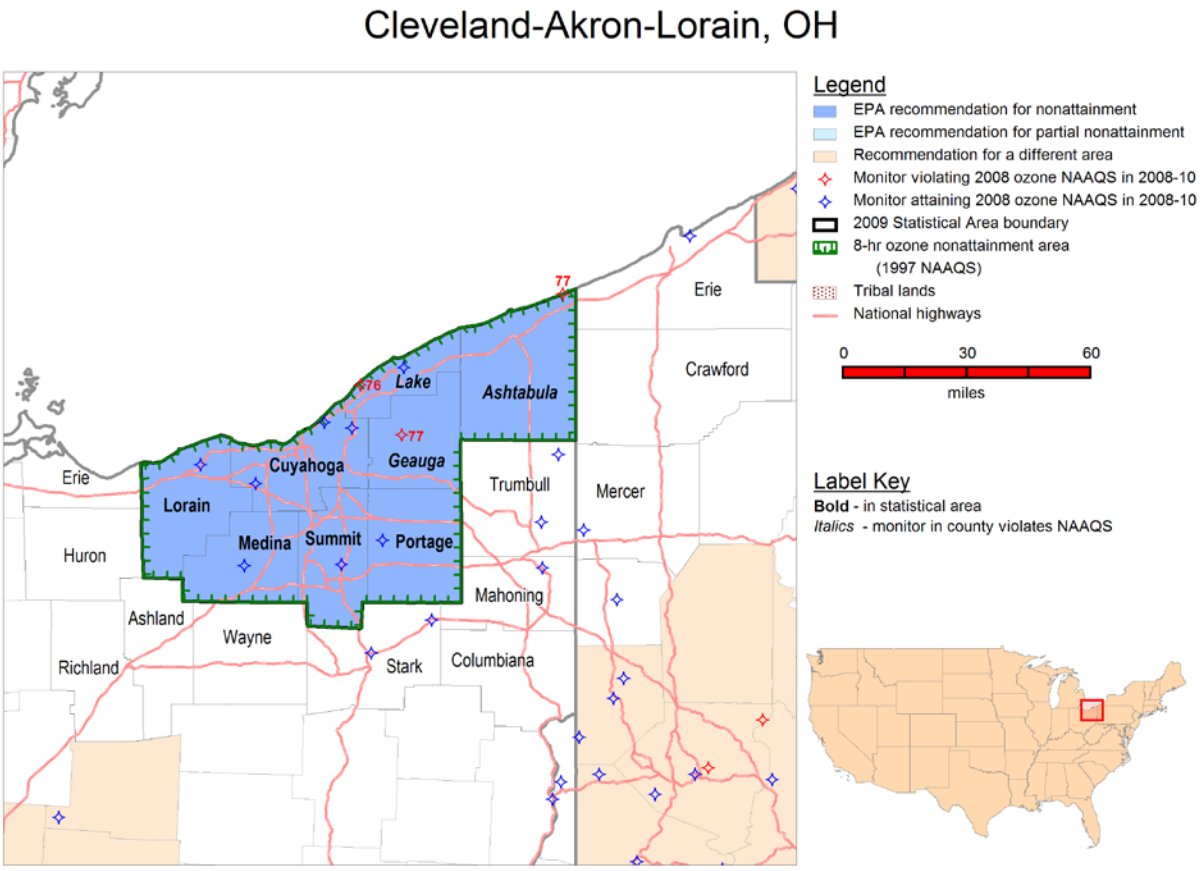
total of mobile sources and area sources make up approximately 75 percent of the total VOC emissions in the Cincinnati-Middletown-Wilmington area. Point sources in the area make up approximately 50 percent of the total NOx emissions and approximatley10 percent of the total VOC emissions in the Cincinnati-Middletown-Wilmington Area.

Boone, Campbell, and Kenton counties' NOx and VOC precursor emissions, high VMT along with population growth suggest that these counties should be considered for inclusion in the Cincinnati-Middletown-Wilmington, OH-KY-IN ozone nonattainment area.

Technical Analysis for Cleveland-Akron-Elyria, OH

Figure 2 is a map of the intended Cleveland-Akron-Elyria, OH ozone nonattainment area for the 2008 ozone NAAQS. The map provides other relevant information, including the locations and ozone design values of air quality monitors recording violations of the 2008 ozone NAAQS, county and other jurisdictional boundaries, existing maintenance boundary for the 1997 ozone NAAQS, Cleveland-Akron-Elyria, OH CSA boundary and major transportation arteries.

Figure 2. Cleveland-Akron-Elyria, OH Area



For purposes of the 1997 ozone NAAQS, as noted in Figure 2, portions of this area were designated nonattainment and subsequently redesignated to attainment (maintenance). The boundary for the nonattainment area for the 1997 ozone NAAQS included all Ohio counties in the Cleveland-Akron-Elyria, OH CSA. In March 2009, Ohio recommended that the same counties in Ohio be designated as nonattainment for the 2008 ozone NAAQS based on air quality data from 2006-2008. These data are from monitors sited and operated in accordance with 40 CFR part 58.

After considering these recommendations and based on EPA's technical analysis described below, EPA intends to designate the same 8 counties in Ohio (identified in Table 9 below) as "nonattainment" for the 2008 ozone NAAQS for the Cleveland-Akron-Elyria, OH nonattainment area.

Table 9. EPA's Intended Nonattainment Counties for the Cleveland-Akron-Elyria, OH Ozone Nonattainment Area

State-Recommended Nonattainment	EPA Intended Nonattainment Counties

Counties in Ohio	in Ohio
Ashtabula	Ashtabula
Cuyahoga	Cuyahoga
Geauga	Geauga
Lake	Lake
Lorain	Lorain
Medina	Medina
Portage	Portage
Summit	Summit

Factor Assessment

Factor 1: Air Quality Data

For this factor, we considered 8-hour ozone design values (in ppm) for air quality monitors in counties in the Cleveland-Akron-Elyria, OH CSA based on data for the 2008-2010 period, which are the most recent years with fully-certified air quality data. As discussed above, a monitor's design value is the metric or statistic that indicates whether that monitor attains a specified air quality standard. The 2008 ozone NAAQS are met at a monitor when the annual fourth-highest daily maximum 8-hour ozone concentrations, averaged over 3 years is 0.075 ppm or less. A design value is valid only if minimum data completeness requirements are met. See 40 CFR part 50 Appendix P. Where several monitors are located in a county (or a designated nonattainment area or maintenance area), the design value for the county or area is determined by the monitor with the highest individual design value.

The 2008-2010 ozone design values for ozone monitors in the Cleveland-Akron-Elyria, OH CSA are shown in Table 10.

Table 10. Ozone Air Quality Data for the Cleveland-Akron-Elyria, OH CSA

County	Site Number	2008-2010 8-Hour Ozone Design Values (ppm)
Ashtabula	390071001	**0.077**†
Cuyahoga	390350064	0.068
Cuyahoga	390350034	0.075
Cuyahoga	390355002	0.075
Geauga	390550004	**0.077**†
Lake	390850003	**0.076**†
Lorain	390930018	0.070
Medina	391030004	0.070

Portage	391331001	0.067
Summit	391530020	0.075

† Monitored violation of the 2008 ozone NAAQS.

From Table 10, it can be seen that Ashtabula, Geauga, and Lake Counties in Ohio show violations of the 2008 ozone NAAQS for the period of 2008-2010. Therefore, these counties must be included in the ozone nonattainment area. As noted above, a county (or partial county) must also be designated nonattainment if it contributes to an air quality standard violation in a nearby area. Each county in the Cleveland-Akron-Elyria, OH CSA has been evaluated, as discussed below, based on the five factors summarized above and other relevant information to determine whether it contributed to the violations of the 2008 ozone NAAQS in Ashtabula, Geauga, and Lake Counties.

Please note that the State of Ohio, in its March 9, 2009 area designation recommendations and accompanying technical support documentation, based its area recommendations on 2006-2008 ozone data. Since these data no longer cover the most recent 3-year period with quality-assured, state-certified data and have been supplanted by the more current 2008-2010 ozone data, we are not reviewing the older ozone data covered by the state of Ohio.

Factor 2: Emissions and Emissions-Related Data

EPA evaluated emissions for VOC and NOx and other emissions-related data (primarily county population, population density, and traffic levels, and projected growth rates for county populations) that provide information on area contributions to local ozone standard violations.

Emissions Data

EPA evaluated county-level emission data for NOx and VOC derived from the 2008 NEI, version 1.5. These are the most recently available NEI emissions data. (See http://www.epa.gov/ttn/chief/net/2008inventory.html) Significant emission levels in a nearby area indicate the potential for the area to contribute to the observed ozone standard violation.

Table 11 shows the 2008 emissions of NOx and VOC (tons per year) for all counties in the Cleveland-Akron-Elyria, OH CSA. This table also indicates which of the counties were recommended to be nonattainment for the 2008 ozone NAAQS by the State of Ohio.

Table 11. Total 2008 VOC and NOx Emissions (tons/year) in the Cleveland-Akron-Elyria, OH CSA

State/County	State Recommended Nonattainment?	VOC Emissions (tpy)	NOx Emissions (tpy)
Ohio:			
Ashtabula	Yes	10,411	9,860
Cuyahoga	Yes	42,981	38,698
Geauga	Yes	3,891	2,237
Lake	Yes	10,382	19,286
Lorain	Yes	11,646	15,261
Medina	Yes	5,918	5,101
Portage	Yes	6,137	5,656
Summit	Yes	18,699	14,924
CSA Total		110,065	111,022

From the emissions data in Table 11, it can be seen that comparatively high 2008 VOC and NOx emissions in the vicinity of the violating counties originate in the following counties: Ashtabula, Cuyahoga, Lake, Lorain, and Summit. Emissions from these counties in 2008 account for 85.5 percent of the VOC emissions and 88.3 percent of NOx emissions for the entire Cleveland-Akron-Elyria, OH CSA.

The VOC and NOx emissions from Geauga, Medina, and Portage Counties are significantly smaller than those originating in the higher emitting counties within the Cleveland-Akron-Elyria, OH CSA. Note, however, that the collective emissions from these "lower emission" counties does constitute 12 to 15 percent of the CSA total emissions. So, even though individual VOC and NOx emissions are relatively low in the low emissions counties, their collective emission levels are equivalent to the emission levels for counties we are intending to include in the nonattainment area for the 2008 ozone NAAQS. On this basis, we conclude that these counties may have the potential to contribute to ozone standard violations in the Cleveland-Akron-Elyria, OH area.

Population, Population Density, and Degree of Urbanizaion

EPA evaluated the population and vehicle use characteristics and population trends of the area as indicators of the probable location and magnitude of non-point source emissions. These include ozone-creating emission from on-road and off-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, which can contribute to local and downwind high ozone concentrations. Rapid population

or VMT growth in a county on the urban perimeter signifies increasing integration with the urban core area, and indicates that it may be appropriate to include this county in the ozone nonattainment area, particularly if this county already has moderate or higher VOC and/or NOx emissions.

Table 12 shows the 2010 population, population density, and population growth information for each county in the Cleveland-Akron-Elyria, OH CSA.

Table 12. Population and Population Growth in the Cleveland-Akron-Elyria, OH CSA

State/County	State Recommended Nonattainment?	2010 Population	2010 Population Density (1,000 per square mile)	Change in Population (2000-2010)	Population Percent Change (2000-2010)
Ohio:					
Ashtabula	Yes	101,497	0.14	-1,249	-1
Cuyahoga	Yes	1,280,122	2.79	-111,989	-8
Geauga	Yes	93,389	0.23	2,180	2
Lake	Yes	230,041	0.99	2,385	1
Lorain	Yes	301,356	0.61	16,224	6
Medina	Yes	172,332	0.41	20,496	13
Portage	Yes	161,419	0.32	9,036	6
Summit	Yes	541,781	1.29	-1,797	0
Area Totals		**2,881,937**	**0.79**	**-64,714**	**-2**

Sources: U.S. Census Bureau population estimates for 2010 as of August 4, 2011. (http://factfinder2.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=DEC_10_PL_GCTPL2.ST05&proType=table)

The population data show that Cuyahoga, Lake, Lorain, Medina, Portage, and Summit Counties have comparatively high populations and population densities. This implies that these counties are generally urbanized and relatively integrated with the urban core of the Cleveland-Akron-Elyria, OH CSA. It also implies that the population-related VOC and NOx emissions in these counties are comparatively high and contribute to the ozone standard violations in the Cleveland-Akron-Elyria, OH CSA.

The counties that experienced the largest population growth for the 2000-2010 period are Lorain and Medina. As noted above, this implies an increasing integration of these counties with the urban core of the Cleveland-Akron-Elyria, OH CSA, and favors the inclusion of these counties in the ozone nonattainment area.

Although some counties, to the contrary are experiencing population declines (Cuyahoga and Summit Counties), their base populations remain high, implying that they should not be excluded from the ozone nonattainment area.

Traffic and Commuting Patterns

EPA evaluated the total VMT for each county in the Cleveland-Akron-Elyria, OH CSA. In combination with the county-specific population/population density data and the locations of the main transportation arteries (see above), this information helps identify the probable locations of non-point source emissions. A county with high VMT is generally an integral part of an urban area and indicates the presence of relatively high motor vehicle emissions that may significantly contribute to ozone formation and transport that contributes to ozone standard violations in or downwind of the urban area. Rapid population or VMT growth in a county on the urban perimeter signifies increasing integration with the urban core area, and indicates that this county should be included in the ozone nonattainment area, particularly if the VOC and/or NOx emissions in this county are a significant portion of the total emissions in the nonattainment area.

Table 13 show the traffic levels, 2008 VMT, in each county in the Cleveland-Akron-Elyria, OH CSA.

Table 13. Traffic Levels in the Cleveland-Akron-Elyria, OH CSA

State/County	State Recommended Nonattainment?	2008 VMT (million miles)
Ohio:		
Ashtabula	Yes	1,039
Cuyahoga	Yes	10,148
Geauga	Yes	736
Lake	Yes	2,111
Lorain	Yes	2,359
Medina	Yes	1,532
Portage	Yes	1,651
Summit	Yes	5,471
Area Total		25,048

The VMT data show that VMT levels in all counties, with the exception of Geauga County, are relatively high. This implies that mobile source emissions in these counties are comparatively high and contribute to ozone standard violations in the Cleveland-Akron-Elyria, OH area.

VMT in Geauga County are comparatively lower than those in other counties in this area. This, however, does not imply that this county should be excluded from the ozone nonattainment area since this county has a monitored violation of the 2008 ozone NAAQS.

Additional Emissions-Related Data Discussed in Ohio's March 9, 2009 Designation Recommendation Submittal

OEPA has provided typical daily, county-specific total VOC and NOx emissions for 2005 and 2009 for each of the counties in the Cleveland-Akron-Elyria, OH CSA. These data confirm the conclusions we have drawn above using county-specific annual emissions.

OEPA has provided population projections through 2030 for each of the counties in the CSA. These data show significant population growth trends in Geauga, Lake, Lorain, Medina, Portage, and Wayne Counties. Populations are projected to be substantially unchanged in Ashtabula and Summit Counties through 2030. Populations are projected to decline over time in Cuyahoga County, however, the population in this county is projected to remain above 1 million through 2030.

OEPA provided graphs of daily VMT levels plotted for the period of 1990-2007 for each of the counties in the CSA. This visual VMT trend information shows that daily VMT grew moderately during the 1990-2007 period for Ashtabula, Cuyahoga, Geauga, Lake, Lorain, Medina, Portage, and Summit Counties.

OEPA provided inter-county commuter numbers and percentages for each of the counties in the Cleveland-Akron-Elyria, OH CSA. These numbers show a strong inter-county commuting pattern throughout the CSA.

Collectively, the OEPA-supplied population and traffic data support the conclusion that all of the counties in the Cleveland-Akron-Elyria, OH CSA, with the exception of Ashtabula County, are relatively integrated with the urban, industrial core of this area. Therefore, these data support including Cuyahoga, Geauga, Lake, Lorain, Medina, Portage, and Summit Counties in the Cleveland-Akron-Elyria, OH ozone nonattainment area. As noted elsewhere in this technical review, Ashtabula County must be included in this ozone nonattainment area as the result of its monitored violation of the 2008 ozone NAAQS.

Factor 3: Meteorology (Weather/Transport Patterns)

EPA evaluated available meteorological data to help determine how meteorological conditions, particularly transport conditions, affect the fate and transport of ozone and ozone precursors contributing to ozone formation in the Cleveland-Akron-Elyria, OH CSA. EPA examined the frequency distribution of wind directions for the four seasons of the year by averaging National Weather Service direction-sorted wind directions for each county for a 30 year period. To apply the results of this data analysis to the Cleveland-Akron-Elyria, OH CSA, we have considered the wind direction (direction from which winds are blowing, reflecting directions to potential source areas) frequencies during the summer months (June-August) for the three Ohio counties with recorded violations of the 2008 ozone NAAQS (See Table 10). Therefore, we have considered wind direction distributions for Ashtabula, Cuyahoga, and Geauga Counties in Ohio.

Table 14 shows the summertime 30-year averaged percentages of wind directions (winds blowing into the subject county from the specified wind direction sector) for the three ozone standard violation counties in the Cleveland-Akron-Elyria, OH CSA.

Table 14. Averaged Summertime Wind Direction Percentages for Ozone Standard Violation Counties in the Cleveland-Akron-Elyria, OH CSA

Wind Direction	Ashtabula County	Geauga County	Lake County
North-Northeast	10.1	13.4	14.8
East-Northeast	7.1	6.1	5.5
East-Southeast	8.5	8.3	6.9
South-Southeast	10.1	9.5	9.7
South-Southwest	25.1	24.8	26.8
West-Southwest	15.8	16.6	16.2
West-Northwest	13.2	10.9	10.2
North-Northwest	10.1	10.3	10.0

The wind direction percentages show that there is no single “preferred” wind direction during the summertime, when the highest ozone concentrations are generally monitored. Transport winds can and do blow from all directions in the counties with the recorded violations of the 2008 ozone NAAQS. There is, however, an indication that winds from the south-southwest and west-southwest may be more prevalent than winds from other wind directions during the summertime in all three ozone standard violation counties.

Unfortunately, EPA's wind direction percentage data do little to shed light on which counties in the Cleveland-Akron-Elyria, OH CSA are the most important from an ozone and ozone precursor transport standpoint. The wind directions considered have not been sorted based on peak ozone concentrations or specifically for high ozone days, the timing of peak ozone concentrations, wind speeds, or other factors that could have been used to isolate the most critical ozone precursor source areas.

Factor 4: Geography/Topography (Mountain Ranges or Other Air Basin Boundaries)

The geography/topography analysis evaluates the physical features of the land that might affect the airshed and, therefore, the distribution of ozone over the area.

The Cleveland-Akron-Elyria, OH CSA does not have any geographical or topographical barriers significantly limiting air pollution transport within its air shed. Therefore, this factor did not play a significant role in this evaluation.

Factor 5: Jurisdictional Boundaries

Once we identified the general area that we anticipated we would recommend as nonattainment for the 2008 ozone NAAQS, we then considered existing jurisdictional boundaries for the purposes of providing a clearly defined legal boundary and to help identify the area appropriate for carrying out the air quality planning and enforcement functions for an ozone nonattainment area. Examples of jurisdictional boundaries include existing/prior nonattainment boundaries for ozone or other urban-scale pollutants, county boundaries, air district boundaries, township boundaries, areas covered by metropolitan planning organizations, state lines, and Reservation boundaries. Where existing jurisdictional boundaries are not adequate or appropriate to describe the nonattainment area, other clearly defined and permanent landmarks or geographic coordinates may be considered.

The portion of the Cleveland-Akron-Elyria, OH CSA that we are considering as designating as nonattainment for the 2008 ozone NAAQS has a previously established nonattainment boundary associated with the 1997 8-hour ozone NAAQS. The State of Ohio has recommended the same counties (as included in the 1997 8-hour ozone nonattainment area) in Ohio to be included in the boundary of the nonattainment area for the 2008 ozone NAAQS. The prior inclusion of these counties in the ozone nonattainment

area for the 1997 ozone NAAQS forms the primary jurisdictional basis for the inclusion of these counties in the nonattainment area for the 2008 ozone NAAQS.

Conclusion

Based on the assessment of factors described above, EPA has preliminarily concluded that the following Ohio counties should be included in the Cleveland-Akron-Elyria, OH ozone nonattainment area because they are either violating the 2008 ozone NAAQS or are contributing to a violation of the 2008 ozone NAAQS within this preliminary nonattainment area: Ashtabula; Cuyahoga; Geauga; Lake; Lorain; Medina; Portage; and, Summit.

Table 15 summarizes which factors discussed above support the inclusion of each Ohio county in the preliminary nonattainment area for the 2008 ozone NAAQS.

Table 15. Factors Supporting Inclusion of Ohio Counties in the Cleveland-Akron-Elyria, OH Ozone Nonattainment Area for the 2008 Ozone NAAQS

County	Violates Ozone Standard	High Emissions Population and Traffic Levels	Meteorology Favors Emissions Impact on Violating Monitor	Geography Favors High Ozone or Emissions Impact on Violating Monitor	Jurisdictional Basis for Inclusion In Nonattainment Area
Ashtabula	X	X	X	NA	X
Cuyahoga		X	X	NA	X
Geauga	X		X	NA	X
Lake	X	X	X	NA	X
Lorain		X	X	NA	X
Medina		X	X	NA	X
Portage		X	X	NA	X
Summit		X	X	NA	X

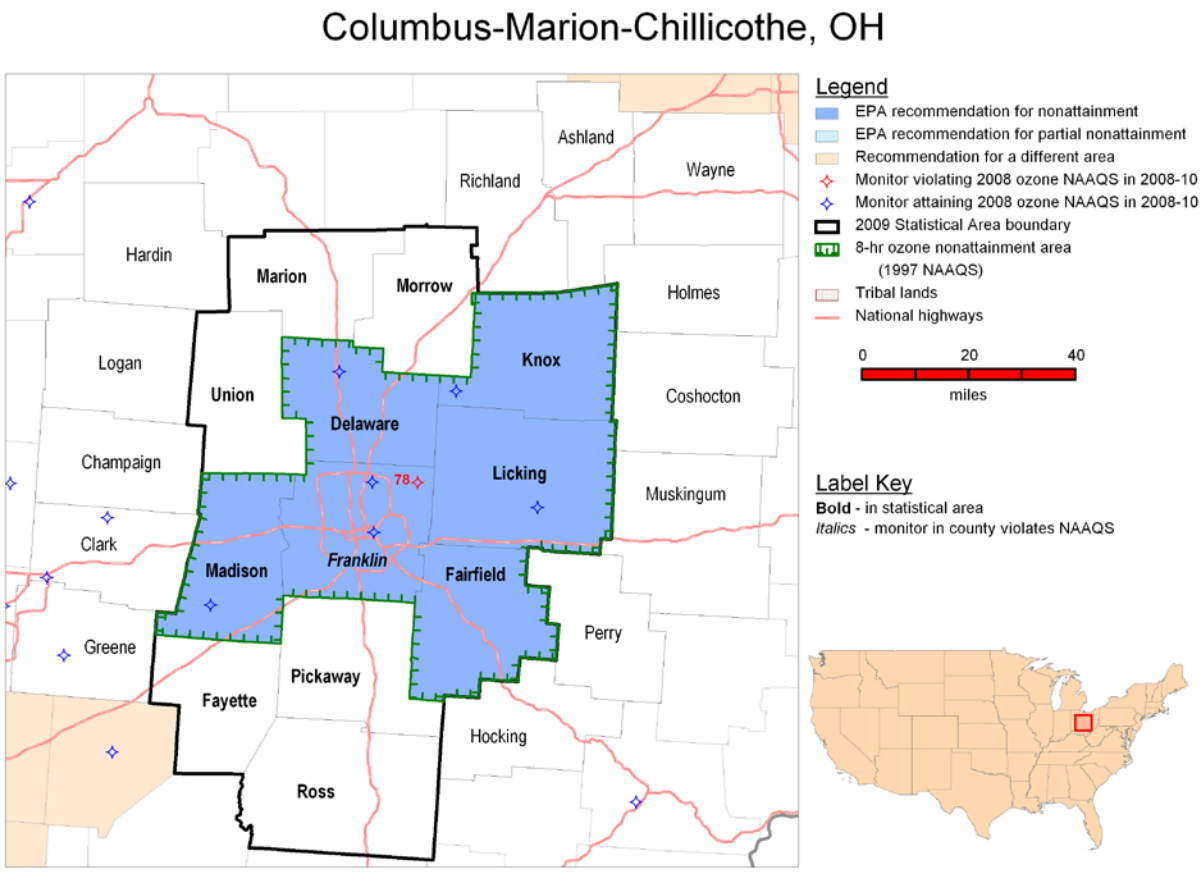
The results in the above table show that all counties in the Cleveland-Akron-Elyria, OH CSA should be included in the Cleveland-Akron-Elyria, OH nonattainment area for the 2008 ozone NAAQS. Ashtabula, Geauga, and Lake Counties have monitored violations of the 2008 ozone NAAQS. All counties, except Geauga County, have high emissions or emissions-related data (population, population growth, and/or traffic levels) that support inclusion in the nonattainment area. Finally, all of these counties are recommended for inclusion in the ozone nonattainment area by the State of Ohio and were included in the ozone nonattainment area for the 1997 ozone NAAQS.

Based on these factors, we conclude that the entire Cleveland-Akron-Elyria, OH CSA should be included in the Cleveland-Akron-Elyria, OH nonattainment area for the 2008 ozone NAAQS.

Technical Analysis for Columbus-Marion-Chillicothe, OH

Figure 3 is a map of the intended Columbus, OH ozone nonattainment area for the 2008 ozone NAAQS. The map provides other relevant information, including the locations and ozone design values of air quality monitors recording violations of the 2008 ozone NAAQS, county and other jurisdictional boundaries, existing maintenance boundary for the 1997 ozone NAAQS, Columbus-Marion-Chillicothe, OH CSA boundary and major transportation arteries.

Figure 3. Columbus-Marion-Chillicothe, OH Area



For purposes of the 1997 ozone NAAQS, as noted in Figure 3, portions of this area were designated nonattainment and subsequently redesignated to attainment (maintenance). The

boundary for the nonattainment area for the 1997 ozone NAAQS included only a portion of the Columbus-Marion-Chillicothe, OH CSA. In March 2009, Ohio recommended that the same counties (the same counties included in the nonattainment area for the 1997 ozone NAAQS) in Ohio be designated as nonattainment for the 2008 ozone NAAQS based on air quality data from 2006-2008 and other considerations. The 2006-2008 ozone data are from monitors sited and operated in accordance with 40 CFR part 58.

After considering these recommendations and based on EPA's technical analysis described below, EPA intends to designate the same 6 counties in Ohio (identified in Table 16 below) as "nonattainment" for the 2008 ozone NAAQS as part of the Columbus, OH nonattainment area.

Table 16. EPA's Intended Designated Nonattainment Counties for the Columbus, OH Ozone Nonattainment Area

State-Recommended Nonattainment Counties in Ohio	EPA Intended Nonattainment Counties in Ohio
Delaware	Delaware
Fairfield	Fairfield
Franklin	Franklin
Knox	Knox
Licking	Licking
Madison	Madison

Factor Assessment

Factor 1: Air Quality Data

For this factor, we considered 8-hour ozone design values (in ppm) for air quality monitors in counties in the Columbus-Marion-Chillicothe, OH CSA based on data for the 2008-2010 period, which are the most recent years with fully-certified air quality data. As discussed above, a monitor's design value is the metric or statistic that indicates whether that monitor attains a specified air quality standard. The 2008 ozone NAAQS are met at a monitor when the annual fourth-highest daily maximum 8-hour ozone concentrations, averaged over 3 years is 0.075 ppm or less. A design value is valid only if minimum data completeness requirements are met. See 40 CFR part 50 Appendix P. Where several monitors are located in a county or area (or a designated nonattainment area or maintenance area), the design value for the county or area is determined by the monitor with the highest individual design value.

The ozone design values for ozone monitors in the Columbus-Marion-Chillicothe, OH CSA are shown in Table 17.

Table 17. Ozone Air Quality Data for the Columbus-Marion-Chillicothe, OH CSA

State/County	Site Number	2008-2010 8-Hour Ozone Design Values (ppm)
Delaware	390410002	0.073
Franklin	390490081	0.069
Franklin	390490037	0.071
Franklin	390490029	**0.078**†
Knox	390830002	0.071
Licking	390890005	0.072
Madison	390970007	0.070

† Monitored violation of the 2008 ozone NAAQS.

From Table 17, it can be seen that Franklin County is the only county in the Columbus-Marion-Chillicothe, OH CSA with a monitored violation of the 2008 ozone NAAQS for the period of 2008-2010. Therefore, at minimum, Franklin County must be included in the ozone nonattainment area. As noted above, a county (or partial county) must also be designated nonattainment if it contributes to an air quality violation in a nearby area (to the violation of the 2008 ozone NAAQS recorded in Franklin County). Each county in the Columbus-Marion-Chillicothe, OH CSA has been evaluated, as discussed below, based on the five factors discussed above and other relevant information to determine whether it contributed to the violation of the 2008 ozone NAAQS in Franklin County.

Please note that the State of Ohio, in its March 9, 2009 area designation recommendations and accompanying technical support documentation, based its area recommendations on 2006-2008 ozone data. Since these data no longer cover the most recent 3-year period with quality-assured, state-certified data and have been supplanted by the more current 2008-2010 ozone data, we are not reviewing the older ozone data covered by the state of Ohio.

Factor 2: Emissions and Emissions-Related Data

EPA evaluated emissions for VOC and NOx and other emissions-related data (primarily county population, population density, and traffic levels, and projected growth rates for these emissions-related data) that provide information on area contributions to local ozone standard violations.

EPA's Accumulated Emissions and Emissions-Related Data

Emissions Data

EPA evaluated county-level emission data for NOx and VOC derived from the 2008 NEI, version 1.5. These are the most recently available NEI emissions data. (See http://www.epa.gov/ttn/chief/net/2008inventory.html) Significant emission levels in a nearby area (in a county near to a county with a violating ozone monitor) indicate the potential for the area to contribute to the observed ozone standard violation.

Table 18 shows the 2008 emissions of NOx and VOC (in tons per year) for all counties in the Columbus-Marion-Chillicothe, OH CSA. This table also indicates which of the counties were recommended to be nonattainment for the 2008 ozone NAAQS by the State of Ohio.

Table 18. Total 2008 VOC and NOx Emissions (tons/year) in the Cleveland-Akron-Elyria, OH CSA

State/County	State Recommended Nonattainment?	VOC Emissions (tpy)	NOx Emissions (tpy)
Ohio:			
Delaware	Yes	5,686	5,655
Fairfield	Yes	4,459	4,915
Fayette	No	1,887	1,981
Franklin	Yes	38,690	32,092
Knox	Yes	2,324	1,539
Licking	Yes	7,016	6,008
Madison	Yes	2,373	2,809
Marion	No	3,588	3,509
Morrow	No	1,983	2,190
Pickaway	No	2,969	3,919
Ross	No	3,292	5,010
Union	No	3,404	2,413
CSA Total		77,671	72,041

From the emissions data in Table 18, it can be seen that the VOC and NOx emissions in the Columbus-Marion-Chillicothe, OH CSA are dominated by those in Franklin County. The VOC emissions in Franklin County are 49.8 percent of the CSA total, and the NOx emissions in Franklin County are 44.5 percent of the CSA total. All other counties in this CSA have significantly lower and similar (to each other) VOC and NOx emissions. However, the accumulative VOC and NOx emissions in these remaining counties is a significant portion of the total VOC and NOx emissions in the CSA.

The high emissions in Franklin County, along with the monitored violation of the 2008 ozone NAAQS in this county, implies that Franklin County should be part of the nonattainment area for the 2008 ozone NAAQS. The VOC and NOx emissions for the remaining counties in the Columbus-Marion-Chillicothe, OH CSA do not provide a definitive basis for inclusion or exclusion from the nonattainment area. Note that the counties Ohio is recommending for exclusion from the nonattainment area have similar VOC and NOx emissions to many of the Ohio-recommended nonattainment counties in the Columbus-Marion-Chillicothe, OH CSA.

Population, Population Density, and Degree of Urbanization

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 ozone-creating emissions from on-road and off-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, which can contribute to local and downwind high ozone concentrations. Rapid population or VMT growth in a county on the urban perimeter signifies increasing integration with the urban core area, and indicates that it may be appropriate to include this county in the ozone nonattainment area, particularly if this county already has moderate or higher VOC and/or NOx emissions.

Table 19 shows the 2010 population, population density, and population growth information for each county in the Columbus-Marion-Chillicothe, OH CSA.

Table 19. Population and Population Growth in the Columbus-Marion-Chillicothe, OH CSA

State/County	State Recommended Nonattainment?	2010 Population	2010 Population Density (1,000 per square mile)	Change in Population (2000-2010)	Population Percent Change (2000-2010)
Ohio:					
Delaware	Yes	174,214	0.38	62,504	56
Fairfield	Yes	146,156	0.29	22,736	18
Fayette	No	29,030	0.07	595	2
Franklin	Yes	1,163,414	2.14	91,127	8
Knox	Yes	60,921	0.12	6,278	11
Licking	Yes	166,492	0.24	20,421	14
Madison	Yes	43,435	0.09	3,223	8

Marion	No	66,501	0.16	351	1
Morrow	No	34,827	0.09	3,033	10
Pickaway	No	55,698	0.11	2,882	5
Ross	No	78,064	0.11	4,614	6
Union	No	52.300	0.12	11,105	27
CSA Totals		2,071,052	0.34	228,869	12

Sources: U.S. Census Bureau population estimates for 2010 as of August 4, 2011. (http://factfinder2.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=DEC_10_PL_GCTPL2.STO5&proType=table)

The population data show that half of the 2010 population and almost half of the 2000-2010 population growth in the Columbus-Marion-Chillicothe, OH CSA can be found in Franklin County. Comparatively large 2010 populations and 2000-2010 population growths can also be found in Delaware, Fairfield, and Licking Counties. The 2010 populations in the remaining counties in the CSA are comparatively smaller. Union County has a comparativley high population growth percentage, however, its 2010 population is small compared to those of Delaware, Fairfield, Franklin, and Licking Counties. Finally, the 2010 populations and 2000-2010 population growths of Fayette and Marion Counties are comparatively lower than those of other counties in the Columbus-Marion-Chillicothe, OH CSA.

Traffic and Commuting Patterns

EPA evaluated the commuting patterns of residents in the Columbus-Marion-Chillicothe, OH CSA. In combination with the county-specific population/population density data and the locations of the main transportation arteries (see above), this information helps identify the probable locations 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 indicates the presence of relatively high motor vehicle emissions that may significantly contribute to ozone standard violations in or downwind of the urban area. Rapid population or VMT growth in a county on the urban perimeter signifies increasing integration with the urban core area, and indicates that this county should be included in the ozone nonattainment area, particularly if the VOC and/or NOx emissions in this county are a significant portion of the total emissions in the nonattainment area.

Table 20 shows the traffic levels, 2008 VMT, in each county in the Columbus-Marion-Chillicothe, OH CSA.

Table 20. Traffic Levels in the Columbus-Marion-Chillicothe, OH CSA

State/County	State Recommended Nonattainment?	2008 VMT (million miles)
Ohio:		
Delaware	Yes	1,530
Fairfield	Yes	1,035
Fayette	No	505
Franklin	Yes	10,645
Knox	Yes	397
Licking	Yes	1,780
Madison	Yes	704
Marion	No	629
Morrow	No	605
Pickaway	No	648
Ross	No	772
Union	No	630
CSA Total		19,881

The VMT data show that county-specific VMT levels are the highest in Delaware, Franklin, Fairfield, and Licking Counties. These VMT account for 75.4 percent of the total VMT in the Columbus-Marion-Chillicothe, OH CSA.

The VMT data plus the population data in Table 19 indicate that Delaware, Fairfield, Franklin, and Licking Counties are relatively urbanized with significant population- and traffic-related emissions that contributed to the ozone standard violation in Franklin County. This contribution is much smaller for the remaining counties in the Columbus-Marion-Chillicothe, OH CSA.

Additional Emissions-Related Data Discussed in Ohio's March 9, 2009 Designation Recommendation Submittal

OEPA has provided typical daily, county-specific total VOC and NOx emissions for 2005 and 2009 for each of the counties in the Columbus-Marion-Chillicothe, OH CSA. These data confirm the conclusions we have drawn above using county-specific annual emissions.

OEPA has provided population projections through 2030 for each of the counties in the CSA. Populations are projected to increase significantly in Delaware, Fairfield, Franklin, Licking, Medina, Morrow, Pickaway, Ross, and Union Counties. Populations are projected to increase moderately in Fayette and Marion Counties. Populations are expected to decline in Knox County.

OEPA provided graphs of daily VMT levels plotted for the period of 1990-2007 for each of the counties in the CSA. This visual VMT trend information shows that daily VMT grew significantly during the 1990-2007 period for Delaware, Fairfield, Franklin, Licking and Morrow Counties. The VMT trend information shows that daily VMT grew moderately during the 1990-2007 period for Knox, Marion, Pickaway (VMT levels remained substantially unchanged after 1999 in this county), and Ross Counties.

OEPA provided inter-county commuter numbers and percentages for each of the counties in the Columbus-Marion-Chillicothe, OH CSA. These numbers show a moderate to high inter-county commuting pattern between Franklin County and other counties (with the exceptions of Fayette, Knox, Ross, Marion, and Morrow Counties) in the Columbus-Marion-Chillicothe, OH CSA. Inter-county commuter numbers between other counties (other than Franklin County) in the CSA are moderate to small.

Collectively, the OEPA-supplied population and traffic/commuter data show moderate integration between Franklin, Delaware, Fairfield, Licking, Medina, Morrow, Pickaway, Ross, and Union Counties. Less integration is apparent between Franklin, Fayette, Knox, and Marion Counties. This implies that, from an emissions standpoint, the Columbus, OH ozone nonattainment area should include Delaware, Fairfield, Franklin, Licking, Medina, Morrow, Pickaway, Ross, and Union Counties. Remaining counties in the CSA could be excluded on the basis that their emissions are not significant contributors to the monitored violations of the 2008 ozone NAAQS in Franklin County.

Factor 3: Meteorology (Weather/Transport Patterns)

EPA's Accumulated Meteorological Data

EPA evaluated available meteorological data to help determine how meteorological conditions, particularly transport conditions, affect the fate and transport of ozone and ozone precursors contributing to ozone formation in the Columbus-Mario-Chillicothe, OH CSA. EPA examined the frequency distribution of wind directions for the four seasons of the year by averaging National Weather Service direction-sorted wind directions for each county for a 30-year period. To apply the results of this data analysis to the Columbus-Marion-Chillicothe, OH CSA, we have considered the wind direction (direction from which winds are blowing, reflecting directions to potential source areas) frequencies during the summer months (June-August) for Franklin County, which is the only county in

the CSA with a monitored violation of the 2008 ozone NAAQS (See Table 17).

Table 21 shows the summertime 30-year averaged percentages of wind directions (winds blowing into the subject county from the specified wind direction sector) for Franklin County.

Table 21. Averaged Summertime Wind Direction Percentages For Franklin County

Wind Direction	Franklin County
North-Northeast	15.3
East-Northeast	9.6
East-Southeast	11.4
South-Southeast	12.0
South-Southwest	22.0
West-Southwest	11.0
West-Northwest	9.7
North-Northwest	9.0

The wind direction percentages show that there is no single "preferred" wind direction during the summertime, when the highest ozone concentrations are generally monitored. Winds from south-southwest may be more prevalent than the winds from other wind directions during the summertime.

Unfortunately, EPA's wind direction percentage data do little to shed light on which counties in the Columbus-Marion-Chillicothe, OH CSA are the most important from an ozone and ozone precursor transport standpoint. The wind directions considered have not been sorted based on peak ozone concentrations or specifically for high ozone days, the timing of peak ozone concentrations, wind speeds, or other factors that could have been used to isolate the most critical ozone precursor source areas.

Factor 4: Geography/Topography (Mountain Ranges or Other Air Basin Boundaries)

The geography/topography analysis evaluates the physical features of the land that might affect the airshed and, therefore, the distribution of ozone over the area.

The Columbus-Marion-Chillicothe, OH CSA does not have any geographical or topographical barriers significantly limiting air pollution transport within its air shed. Therefore, this factor did not play a significant role in this evaluation.

Factor 5: Jurisdictional Boundaries

Once we identified the general area that we anticipated we would recommend as nonattainment for the 2008 ozone NAAQS, we then considered existing jurisdictional boundaries for the purposes of providing a clearly defined legal boundary and to help identify the area appropriate for carrying out the air quality planning and enforcement functions for an ozone nonattainment area. Examples of jurisdictional boundaries include existing/prior nonattainment boundaries for ozone or other urban-scale pollutants, county boundaries, air district boundaries, township boundaries, areas covered by metropolitan planning organizations, state lines, and Reservation boundaries. Where existing jurisdictional boundaries are not adequate or appropriate to describe the nonattainment area, other clearly defined and permanent landmarks or geographic coordinates may be considered.

The portion of the Columbus-Marion-Chillicothe, OH CSA that we are considering for designation as nonattainment for the 2008 ozone NAAQS has a previously established nonattainment boundary associated with the 1997 8-hour ozone NAAQS. The State of Ohio has recommended the same counties (as included in the 1997 8-hour ozone nonattainment area) in Ohio be included in the boundary of the nonattainment area for the 2008 ozone NAAQS. The prior inclusion of these counties in the ozone nonattainment area for the 1997 ozone NAAQS forms the primary jurisdictional basis for the inclusion of these counties in the nonattainment area for the 2008 ozone NAAQS.

Conclusion

Based on the assessment of factors described above, EPA has preliminarily concluded that the following Ohio counties should be included in the Columbus, OH ozone nonattainment area because they are either violating the 2008 ozone NAAQS or are contributing to a violation of the 2008 ozone NAAQS within this intended ozone nonattainment area: Delaware; Fairfield; Franklin; Knox; Licking; and, Madison.

Table 22 summarizes which factors discussed above support the inclusion of each Ohio county in the Columbus, OH preliminary nonattainment area for the 2008 ozone NAAQS.

Table 22. Factors Supporting Inclusion of Ohio Counties in the Columbus, OH Ozone Nonattainment Area for the 2008 Ozone NAAQS

County	Violates	High	Meteorology	Geography	Jurisdictional

	Ozone Standard	Emissions Population and Traffic Levels	Favors Emissions Impact on Violating Monitor	Favors High Ozone or Emissions Impact on Violating Monitor	Basis for Inclusion In Nonattainment Area
Delaware		X	X	NA	X
Fairfield		X	X	NA	X
Franklin	X	X	X	NA	X
Knox			X	NA	X
Licking		X	X	NA	X
Madison			X	NA	X

The results in the above table show that Delaware, Fairfield, Franklin and Licking Counties should be included in the Columbus, OH ozone nonattainment area on the bases of a violation of the 2008 ozone NAAQS and/or significant emissions that contribute to the violation of the 2008 ozone NAAQS.

The issue is less clear for Knox and Madison Counties due to the lack of a monitored ozone standard violation and relatively low VOC and NOx emissions, populations, and traffic levels in these counties. The only bases for including these counties in the intended, preliminary ozone nonattainment area for the 2008 ozone NAAQS are the facts that the State of Ohio has recommended their inclusion in the nonattainment area and that these counties were included in the nonattainment area for the 2007 ozone NAAQS. Based on these facts, we agree with the State of Ohio that these counties should also be included in the Columbus, OH nonattainment area.