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

Summary

The table below identifies the areas in Ohio that EPA is designating as "nonattainment" for the 2008 8-hour ozone National Ambient Air Quality Standard (NAAQS)[1] as part of the Columbus, Ohio (OH) nonattainment area. In accordance with section 107(d) of the Clean Air Act (CAA), EPA must designate an area (county or part of a county) as "nonattainment" if it is violating the 2008 8-hour ozone NAAQS or if it is contributing to a violation of the 2008 ozone NAAQS in a nearby area. The technical analysis supporting the boundary for this ozone nonattainment area is provided below.

Table 1. Areas in Ohio Included in the Columbus, OH Ozone Nonattainment Area

Area	Ohio Recommended Nonattainment Counties	EPA's Nonattainment Counties
Columbus, OH	Delaware Fairfield Franklin Knox Licking Madison	Delaware Fairfield Franklin Knox Licking Madison

EPA is designating as "unclassifiable/attainment" for the 2008 8-hour ozone NAAQS the remaining counties in Ohio that are not included in the table above or in the Cincinnati, OH-KY-IN or Cleveland-Akron-Lorain, OH nonattainment areas (see separate Technical Support Documents for these areas).

The analysis below provides the basis for the Columbus, OH nonattainment area boundary. 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] The primary 8-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.

[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.

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, 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.

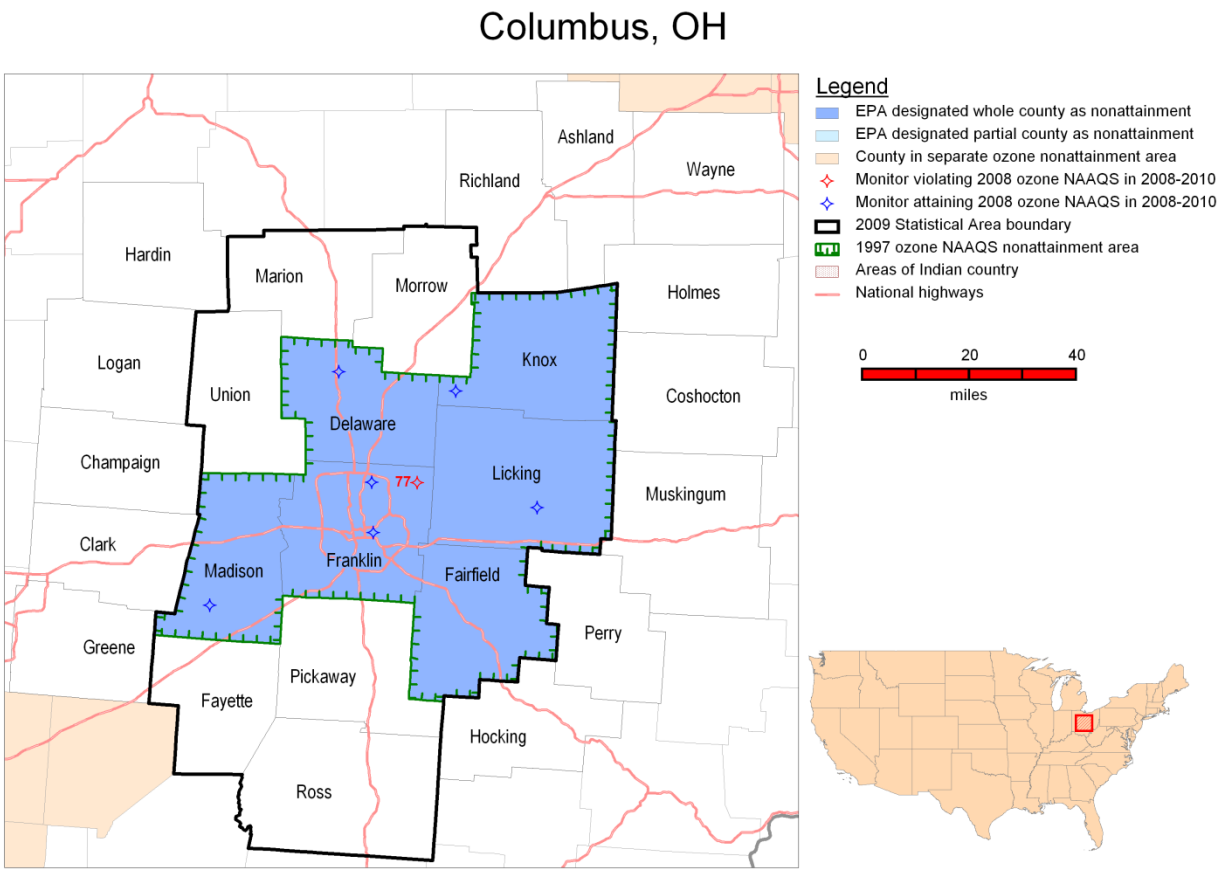
Technical Analysis for Columbus-Marion-Chillicothe, OH

Figure 1 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.

[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).

Figure 1. Columbus, 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 is designating the same 6 counties in Ohio (identified in Table 2 below) as "nonattainment" for the 2008 ozone NAAQS as part of the Columbus, OH nonattainment area.

Table 2. EPA's Selected Nonattainment Counties for the Columbus, OH Ozone Nonattainment Area

State-Recommended Nonattainment Counties in Columbus, Ohio	EPA Intended Nonattainment Counties in Columbus, 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 3.

Table 3. Ozone Air Quality Data for the Columbus-Marion-Chillicothe, OH CSA

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 3, 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 4 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 4. Total 2008 VOC and NOx Emissions (tons/year) in the Columbus-Marion-Chillicothe, 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 4, 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. In addition, the VOC and NOx emissions in Delaware, Fairfield, and Licking Counties are moderately high, which, coupled with the proximity of these counties to the violating ozone monitoring site, favors the inclusion of these counties in the ozone nonattainment area.

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

Table 5. 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 comparatively 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 6 shows the traffic levels, 2008 VMT, in each county in the Columbus-Marion-Chillicothe, OH CSA.

Table 6. 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.

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 7 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 7. 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.

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 have selected 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 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.

The results of our factor review above 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.

We note that the State of Ohio has also recommended the inclusion of Knox and Madison Counties in the ozone nonattainment area for the 2008 ozone NAAQS. We accept the State's recommendation and have included these counties in the ozone nonattainment area.