

US EPA ARCHIVE DOCUMENT

**Cleveland-Akron-Lorain, 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 Cleveland-Akron-Lorain, 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 Cleveland-Akron-Lorain, OH Ozone Nonattainment Area

Area	Ohio Recommended Nonattainment Counties	EPA’s Nonattainment Counties
Cleveland-Akron-Lorain, OH	Ashtabula Cuyahoga Geauga Lake Lorain Medina Portage Summit	Ashtabula Cuyahoga Geauga Lake Lorain Medina Portage Summit

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 Columbus, OH nonattainment areas (see separate Technical Support Documents for these areas).

The analysis below provides the basis for the Cleveland-Akron-Lorain, 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

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 (NO_x) and Volatile Organic Compounds (VOC) in the presence of sunlight.³ Because NO_x 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 Cleveland-Akron-Lorain, OH

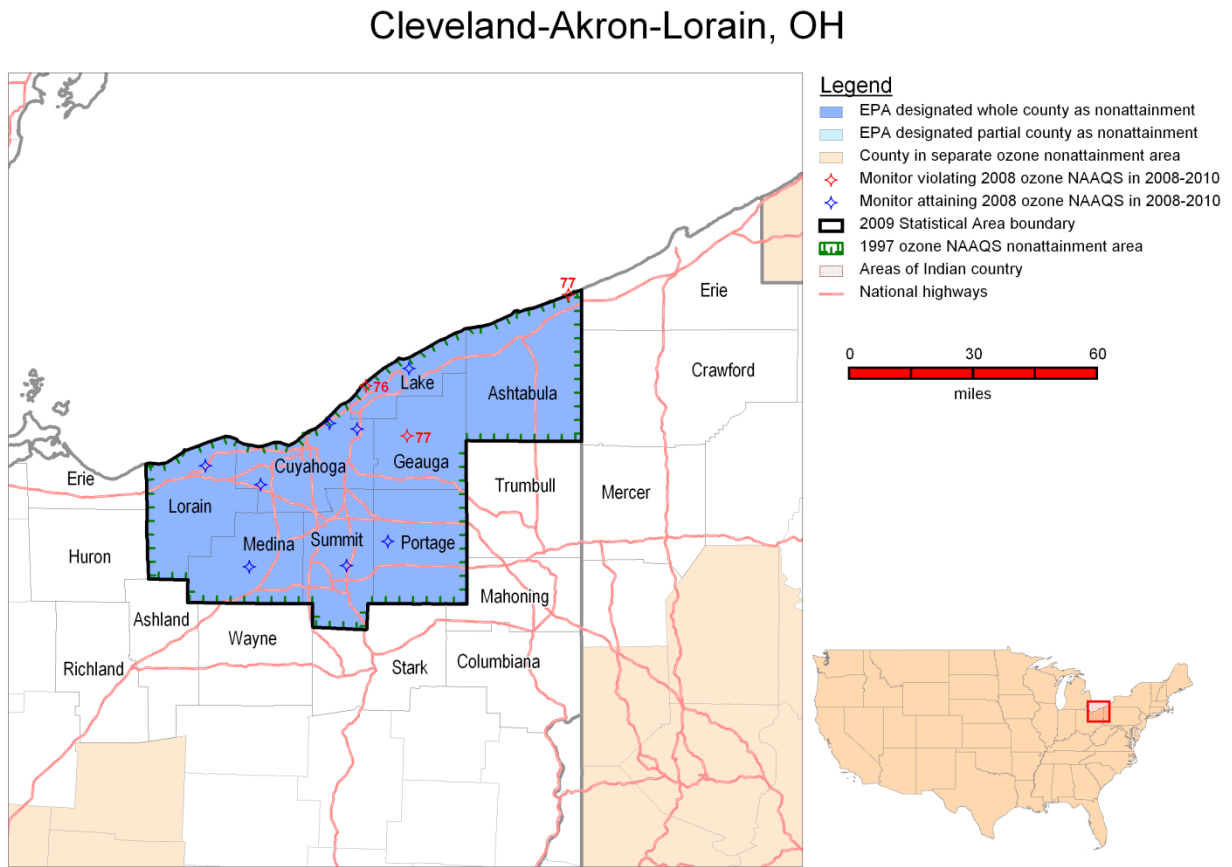
Figure 1 is a map of the Cleveland-Akron-Lorain, OH ozone nonattainment area for the 2008 ozone NAAQS. The map provides other relevant information, including the locations and ozone design values of air quality monitors recording violations of the 2008 ozone NAAQS, county and other jurisdictional boundaries, existing maintenance boundary for the 1997 ozone NAAQS, Cleveland-Akron-Elyria, OH CSA boundary and major transportation arteries.

emissions-related factors together under the heading of "Emissions-Related Data," which results in 5 categories of factors.

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. Cleveland-Akron-Lorain, OH 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 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 is designating the same 8 counties in Ohio (identified in Table 9 below) as “nonattainment” for the 2008 ozone NAAQS for the Cleveland-Akron-Lorain, OH nonattainment area.

Factor Assessment

Factor 1: Air Quality Data

For this factor, we considered 8-hour ozone design values 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 is attaining 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 2.

Table 2. 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 2, 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 3 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 3. 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 3, 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 including 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-Lorain, OH nonattainment 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 4 shows the 2010 population, population density, and population growth information for each county in the Cleveland-Akron-Elyria, OH CSA.

Table 4. 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.STO5&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-Lorain, OH ozone nonattainment area.

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

Table 5. 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-Lorain, OH ozone nonattainment 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 NO_x 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-Lorain, 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 6 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 6. 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.

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 concluded that the following Ohio counties should be included in the Cleveland-Akron-Lorain, 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.

The results in the factor analysis above show that all counties in the Cleveland-Akron-Elyria, OH CSA should be included in the Cleveland-Akron-Lorain, 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-Lorain, OH nonattainment area for the 2008 ozone NAAQS.