

Commonwealth of Pennsylvania



pennsylvania

DEPARTMENT OF ENVIRONMENTAL PROTECTION

**PROPOSED
DESIGNATION RECOMMENDATIONS
FOR THE 2015 EIGHT-HOUR OZONE
NATIONAL AMBIENT AIR QUALITY STANDARDS**

AUGUST 2016

Bureau of Air Quality
Pennsylvania Department of Environmental Protection
P.O. Box 8468
Harrisburg, PA 17105-8468
717-787-9495

www.dep.pa.gov

Patrick McDonnell
Acting Secretary

Tom Wolf
Governor

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Designation Recommendations For the 2015 Eight-Hour Ozone National Ambient Air Quality Standards

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What is this document?

Section 107 of the Clean Air Act (CAA), 42 U.S.C.A. § 7407, provides a mechanism for states to make recommendations to the United States Environmental Protection Agency (EPA) on the designation of areas attaining and not attaining the National Ambient Air Quality Standards (NAAQS).

In this document, the Commonwealth of Pennsylvania (Commonwealth) is making recommendations to EPA concerning the designation of Unclassifiable/Attainment and Nonattainment areas in Pennsylvania for the primary and secondary 8-hour ozone NAAQS revised by EPA on October 1, 2015 (80 FR 65292; October 26, 2015). The designation recommendations are based on air quality monitoring data for 2013-2015 and other available information, including ozone-forming emissions and emissions-related data, meteorological data, geography and topography and jurisdictional boundaries. In addition, the Commonwealth may use other factors as part of a weight-of-evidence approach in recommending attainment and nonattainment areas. A full list of the recommendations by area and county and a map are contained in Appendix A.

Since EPA anticipates making final designations by October 1, 2017, using air quality monitoring data that may include 2016, the Pennsylvania Department of Environmental Protection (DEP) will continue to work with EPA during the designation process leading to the promulgation of the final designations.

What is ground-level ozone?

Ozone is not emitted directly to the atmosphere, but is formed by photochemical reactions between volatile organic compounds (VOCs) and oxides of nitrogen (NO_x) in the presence of sunlight. The long, hot, humid days of summer are particularly conducive to ozone formation, so ozone levels are of concern primarily during the months of April through September.

The primary sources of anthropogenic VOCs and NO_x, the ozone precursors, are the evaporation of fuels and solvents (gasoline and consumer products), the combustion of fuels (motor vehicles, power plants and non-road engines), and industrial processes. Biogenic sources of emissions also contribute to ozone formation.

Health effects. Repeated exposure to ozone pollution may cause permanent damage to the lungs. Even when ozone is present in low levels, inhaling it triggers a variety of health problems including chest pains, coughing, nausea, throat irritation, and congestion. Exposure to ozone can also worsen symptoms of bronchitis, heart disease, emphysema, and asthma, and reduce lung capacity. Asthma is a significant and growing health threat to children and adults. Ozone can aggravate asthma, causing more asthma attacks, increased use of medication, more medical treatment and more frequent visits to hospital emergency clinics.

Healthy people also experience difficulty in breathing when exposed to ozone pollution. Because ozone pollution usually forms in hot weather, normally healthy individuals who spend time outdoors in the summer may be affected, particularly children, mature adults, considered individuals older than 64 years of age, outdoor workers and people exercising. Children are most at risk from exposure to ozone because they are active outside, playing and exercising, during the summertime, when ozone concentrations are at their highest. Several million Pennsylvanians live in areas and near areas where the ozone health-based standards are exceeded.

EPA estimates that revising the primary NAAQS for ozone will yield national public health benefits valued between \$2.9 billion and \$5.9 billion versus an estimated cost to comply with the regulation of \$1.4 billion. These national benefits and costs exclude the State of California. Benefits include preventing cases of bronchitis, aggravated asthma, hospital and emergency room visits, nonfatal heart attacks and premature death, among others.

Welfare effects. Ground-level ozone damages plant life and is responsible for hundreds of millions of dollars in reduced crop production in the United States each year. Ozone interferes with the ability of plants to produce and store food, making them more susceptible to disease, insects, other pollutants, and harsh weather. It also damages the foliage of trees and other plants, ruining the landscape of cities, parks and forests, and recreation areas. One of the key components of ozone, NO_x, contributes to fish kills and algae blooms in sensitive waterways, such as the Chesapeake Bay.

What is the NAAQS for ozone?

EPA sets the primary and secondary NAAQS based on its review of existing scientific knowledge about the adverse health and welfare effects of a pollutant. Section 109(d) of the CAA (42 U.S.C.A. 7409(d)) requires EPA to review and periodically update, if necessary, the NAAQS to “protect public health with an adequate margin of safety” based on the latest, best-available science.

An ozone standard averaged over eight hours (8-hour standard) was first established in 1997, replacing a 1-hour standard established in 1979 to account for health impacts over longer periods of daily ozone exposure (62 FR 38856, July 18,1997). The 1997 standard, set at 0.08 parts per million (ppm), effectively became 0.084 ppm because of rounding methods. In 2008, the EPA revised the primary and secondary ozone NAAQS to 0.075 ppm or equivalent to 75 parts per billion (ppb) (73 FR 16436, March 27, 2008).

After evaluating the results of scientific studies available for the 2015 ozone NAAQS review, which included epidemiological, controlled human exposure, and animal toxicological studies, EPA concluded that ozone causes adverse health effects at levels below the primary 2008 ozone NAAQS. Moreover, the human exposure studies were performed with healthy individuals, which means those with existing respiratory illness are even more affected by higher levels of ozone. The more protective 2015 primary

(health-based) NAAQS is set at 0.070 ppm or 70 ppb. EPA also strengthened the secondary (welfare-based) ozone NAAQS to the level of 70 ppb, making it identical in all respects to the revised primary ozone standard.

What is the process for designating areas?

Section 107(d)(1)(B) of the CAA (42 U.S.C. § 7407 (d)(1)(B)) requires EPA to designate areas as nonattainment, attainment or unclassifiable after promulgating a new or revised NAAQS under Section 109 of the CAA (42 U.S.C. 7409). Following promulgation of new or revised air NAAQS, governors are given the opportunity under Section 107(d)(1) of the CAA to submit recommendations for the designation of attainment and nonattainment areas, supported by the most recent quality-assured monitoring data. EPA provides criteria for states' recommendations for designating areas.

EPA has requested that governors' recommendations for ozone attainment and nonattainment designations be submitted by October 1, 2016, one year after the promulgation of the revised primary and secondary NAAQS. EPA may make modifications and promulgate all or part of a Governor's recommendations. If EPA determines that a modification to the recommendation is necessary, EPA will notify the state no later than 120 days prior to promulgating the designation, and must give the state an opportunity to demonstrate why the potential modification is inappropriate.

The CAA requires EPA to make final ozone designations within two years of promulgation of a new or revised NAAQS unless there is insufficient information. Therefore, EPA anticipates promulgating designations by October 1, 2017, based on the most recent quality-assured data available at the time.

The anticipated schedule for the recommendations of designation and development of SIPs is as follows:

September 2, 2016	Close comment period on ozone designation recommendations
October 1, 2016	State recommendations due to EPA
June 3, 2017	EPA notifies Pennsylvania if EPA intends to modify recommendations
July 3, 2017	EPA public comment period on draft designations
August 2, 2017	Deadline for states to submit additional information
October 1, 2017	EPA's final designations

The DEP held public informational meetings in the DEP regional offices in Harrisburg on August 24, 2016 in Harrisburg, in Norristown on August 25, 2016 and in Pittsburgh on August 25, 2016 to explain the proposed ozone designation recommendations. DEP accepted public comment on the proposed ozone designation recommendations through September 2, 2016. Notice of the public meetings and the opportunity for public comment was published in the Pennsylvania Bulletin on August 19, 2016.

The ozone State Implementation Plan (SIP) revisions, outlining how each nonattainment area will reduce pollution to meet the 2015 8-hour ozone NAAQS, will be due to the EPA in October 1, 2020, three years after final designations are expected to be effective. The EPA is expected to classify areas in accordance with CAA § 107(d)(3)(E) at the same time it makes final designations; requirements and attainment dates may vary based on the severity of the problem in the area, as indicated by the area's classification.

What would be the effects of designation as nonattainment?

The CAA contains different regulatory requirements for new or modified stationary sources in areas designated as nonattainment for a NAAQS. In addition, the "conformity" provisions of the CAA apply only in nonattainment and maintenance areas; transportation plans and federally funded actions and projects must conform to the SIP in order not to interfere with NAAQS attainment and maintenance.

However, because ground-level ozone and ozone precursor emissions are pervasive and easily transported, Congress established an Ozone Transport Region (OTR), consisting of 13 states and the District of Columbia, stretching from Northern Virginia to Maine. As a result of Pennsylvania's inclusion in the OTR, the entire Commonwealth is considered a "moderate" nonattainment area for purposes of regulating stationary sources and for the specific requirements in the OTR-related portions of the CAA. Pennsylvania has already fulfilled these requirements in its development of the SIPs for the 1979 1-hour ozone NAAQS and the 1997 8-hour ozone NAAQS. Pennsylvania has also adopted many regulations that are in effect at both the local and state level that ensure attainment and maintenance both within its borders and to help reduce its contribution to ozone pollution in downwind areas. The Commonwealth is also included in the Cross State Air Pollution Rule (CSAPR) currently being administered by EPA. According to EPA, CSAPR will reduce emissions of ozone precursors by 54 percent from 2005 levels in the eastern United States. The Commonwealth has developed maintenance plans for most of those counties that were designated as nonattainment under, and subsequently attained, the 1997 primary and secondary ozone NAAQS¹; these maintenance plans include specific permanent and enforceable control measures. Most measures in effect in an area designated as nonattainment of a prior ozone NAAQS will continue to stay in effect even if the area has attained the prior ozone NAAQS or is designated as attainment for the 2015 ozone NAAQS. For the 2008 ozone NAAQS, five areas (Figure A-2) in the Commonwealth were designated nonattainment. Three of those areas have received clean data determinations for the 2008 ozone NAAQS from EPA, while two areas, the Pittsburgh-Beaver Valley Area and the Philadelphia Area, have received 1-year extensions to attain the NAAQS.

To the extent additional state measures are required to attain the revised primary and secondary 2015 8-hour ozone NAAQS, new measures will be developed by Pennsylvania

¹ These counties are Erie, Mercer, Cambria, Blair, Centre, Lancaster, Berks, Tioga, Franklin; the Harrisburg-Lebanon-Carlisle area including Cumberland, Dauphin, Lebanon and Perry; the York area including Adams and York; the Allentown-Bethlehem-Easton area including Lehigh, Northampton and Carbon; the Scranton-Wilkes-Barre area including Wyoming, Luzerne, Lackawanna and Monroe.

through a public process as the implementation plan is developed. The Commonwealth will also work with states in areas that affect and are affected by Pennsylvania's air quality to develop cost-effective measures that will not disadvantage Pennsylvania economically.

Pennsylvania's Ozone Designation Recommendations

EPA guidance for ozone designation boundaries. On February 25, 2016, Janet McCabe, Acting Assistant Administrator for the EPA's Office of Air Radiation, issued a general guidance memorandum entitled, "Area Designations for the 2015 Ozone National Ambient Air Quality Standards." The guidance memorandum describes criteria that EPA suggests states should examine when determining their recommended nonattainment area boundaries.

EPA recommends that a state use the statistical areas defined by the U.S. Office of Management and Budget (OMB) as a starting point for its recommendations. In addition, EPA recommends analysis of five factors for area-specific recommendations (some of which are similar to the criteria OMB uses to establish statistical areas), particularly if the state is recommending deviations from the boundaries of the statistical areas. The five factors are:

- Air quality data
- Emissions data and emissions-related data
- Meteorology
- Geography and topography
- Jurisdictional boundaries, including political boundaries, transportation planning organizations and existing nonattainment areas

The EPA recommended nine factors for the 2008 ozone NAAQS designations. The four factors previously recommended by EPA that have not been included as part of the five factors for the 2015 ozone NAAQS are population density and degree of urbanization, traffic and commuting patterns, population growth rates and patterns, and level of control on emissions sources. EPA still includes population and degree of urbanization and traffic commuting patterns under one of the five factors: emissions and emissions-related data. States may still consider other relevant data to determine nonattainment boundaries for the 2015 8-hour ozone NAAQS designations. Pennsylvania will still consider other factors outside of the five factors.

Pennsylvania will consider population growth rates, population density, emissions density and other factors in addition to the five factors given by EPA in order to establish similarities and differences between neighboring counties and multi-county areas. This will allow Pennsylvania to determine the appropriateness of including a county or area with another area for the purpose of developing recommendations for ozone designations.

Discussion about statistical areas. Section 107(d)(1) of the CAA defines an area as nonattainment if it is violating the NAAQS or if it is contributing to a violation in a nearby area. 42 U.S.C. § 7407(d)(1). Ozone and ozone precursors are readily

transported, so EPA believes it is important to examine emissions across a relatively broad geographic area. EPA recommends using the Core-Based Statistical Area (CBSA) where appropriate or Combined Statistical Area (CSA) (which includes two or more adjacent CBSAs) associated with the violating monitor(s) as a starting point. A CBSA consists of a county or counties containing at least one urban core plus adjacent counties that have a high degree of social and economic integration with the urban core as measured by commuting ties. If a violating monitor is not located in a CBSA or CSA, EPA recommends using the boundary of the county as the starting point for defining a nonattainment area. EPA used the same conceptual approach in the designation process for the 1997 and 2008 ozone NAAQS.

The OMB defines statistical areas. The criteria on which statistical areas are based are contained in a notice of decision, *Standards for Defining Metropolitan and Micropolitan Statistical Areas* (75 FR 37246, June 28, 2010). DEP based its nonattainment area boundary recommendations in this document on OMB Bulletin No. 13-01 (February 2013), *Revised Delineations of Metropolitan Statistical Areas, Micropolitan Statistical Areas, and Combined Statistical Areas, and Guidance and Uses of These Areas*, containing the lists of counties in each statistical area. The updated list of statistical areas is available at the following website: <http://www.census.gov/population/metro/>.

A metropolitan statistical area is a CBSA that has an urban area with a population of at least 50,000. It may or may not include outlying counties. A micropolitan statistical area is a CBSA that has an urban area with a population of at least 10,000, but less than 50,000 (with or without outlying counties). A map of relevant CBSAs can be found in Appendix B, Figure B-6. CSAs are formed automatically if two or more adjacent CBSAs have an employment interchange of 25 percent. A map of relevant CSAs can be found in Appendix B, Figure B-7. If the employment interchange is between 15 percent and 25 percent between two or more adjacent CBSAs, a CSA could be formed if local opinion favors the idea. Counties or groups of counties form metropolitan divisions if they have a core population of at least 2.5 million and have commuting ties to adjacent counties.

A county may appear in only one CBSA. If a county is a central county in one CBSA and an outlying county in another, it falls within the CBSA where it is a central county. If a county is an outlying county in two or more CBSAs, the county falls in the CBSA where it has the greatest employment interchange measure.

Example of a Pennsylvania statistical area. The Harrisburg-York-Lebanon CSA is comprised of four metropolitan statistical areas (MSA). Dauphin, Cumberland, and Perry counties comprise one MSA, Harrisburg-Carlisle. All three counties have very strong economic and commuting links with each other so that the area comprises both an MSA and a CBSA. Lebanon County is also one MSA. It is a stand-alone adjacent county that has a core and a separate CBSA. Lebanon County is not as integrated with Dauphin, Cumberland, and Perry Counties as they are with each other. Also, York-Hanover is an MSA within the Harrisburg-York-Lebanon CSA. The Gettysburg MSA is the fourth MSA in the Harrisburg-York-Lebanon CSA. A map of the OMB core-based statistical areas is provided as Figure B-6 in Appendix B.

Discussion by factor. DEP, on behalf of the Commonwealth, and per EPA guidance, has considered these five factors in order to determine Pennsylvania's designation recommendations for the 2015 ozone NAAQS:

Air Quality

The Commonwealth's recommendations are based on the 2015 ozone design values (using the 2013, 2014, and 2015 quality assured ozone monitor data). Figure B-1 in Appendix B is a map of the 2015 ozone design values for all of the ozone monitors. The monitors exceeding the 70 ppb standard are displayed in red. Two areas that were designated nonattainment for the 2008 ozone NAAQS in 2010, specifically the Pittsburgh-Beaver Valley Area and the Philadelphia-Wilmington-Atlantic City, PA-NJ-MD-DE Area, have monitors that still exceed the revised 2015 ozone NAAQS. The Allentown-Bethlehem-Easton Area, Lancaster Area, and the Reading Area were designated nonattainment for the 2008 ozone NAAQS, but are now monitoring attainment for the 2015 ozone NAAQS. The Harrisburg-York-Lebanon Area was designated attainment for the 2008 ozone NAAQS, but a portion of this area is monitoring nonattainment for the 2015 NAAQS. Counties in which the ozone monitors do not exceed the 2015 ozone NAAQS are Adams, Beaver, Berks, Blair, Bradford, Cambria, Centre, Clearfield, Dauphin, Elk, Erie, Franklin, Greene, Lackawanna, Lancaster, Lawrence, Lehigh, Lycoming, Luzerne, Mercer, Monroe, Northampton, Somerset, Tioga, Washington, Westmoreland, and York,.

Emissions and Emissions-Related Data

An emission inventory is an estimate of the emissions from sources in a particular area. The inventory consists of sources in five sectors: stationary point sources, stationary area sources, highway vehicle sources, nonroad sources and biogenic sources.

Table 2 in Appendix B shows the ozone precursor emissions of NO_x and VOC by county. Figures B-2, B-3 and Table 2 in Appendix B show the tons of emissions of NO_x and VOC emitted per square mile. These emissions come from the following sources:

- “Stationary sources” (or “point” sources), which are sources for which the DEP collects individual emissions-related information. Generally, stationary sources are “major” stationary sources for purposes of permitting, but may also include some smaller stationary sources.
- “Stationary area sources,” which are industrial, commercial, and residential sources too small or too numerous to be handled individually, such as commercial and residential open burning, architectural and industrial maintenance coatings application and clean-up, consumer product use, and vehicle refueling at service stations.

- “Highway vehicles,” which include passenger cars and light-duty trucks, other trucks, buses and motorcycles.
- “Nonroad sources,” which include a diverse collection of engines and vehicles, including outdoor power equipment, recreational vehicles, farm and construction machinery, lawn and garden equipment, industrial equipment, recreational marine vessels, commercial marine vessels, locomotives, ships, aircraft and many other engines and vehicles.
- “Biogenic Source,” include mostly VOC emissions from natural sources such as plants, crops, and trees.

As recommended by EPA in its guidance memorandum, these emissions are based on the last complete three-year National Emissions Inventory (NEI) available, which is the 2011 NEI version 2. Emissions for the 2014 NEI version 1, which was submitted by Pennsylvania to EPA in December 2015 and under EPA review, are significantly less than the emissions in the 2011 NEI version 2.

Population, Urbanization, Traffic, Commuting, and Growth

Population, urbanization, traffic, commuting, and growth are related factors that are the primary determinates of the OMB’s designation of metropolitan and micropolitan statistical areas; therefore, consideration of the statistical area boundary associated with the violating monitor as a starting point for the nonattainment area boundary inherently includes consideration of these factors. This approach is consistent with EPA’s guidance memorandum and with the approach used in the designation process for the ozone standard.

Although the factor of population growth is considered in this analysis, a high rate of growth does not necessarily mean a high absolute increase in emissions. For example, while Pike County has a high rate of growth, its population is small when compared to the New York City area and, therefore, emissions from Pike County are expected to remain an insignificant contribution to the New York City area. Therefore, Pike County should be designated Unclassifiable/Attainment.

Commuting patterns were obtained from the U.S. Census, U.S. Census Bureau, OnTheMap Application and LEHD Origin-Destination Employment Statistics (Beginning of Quarter Employment, 2nd Quarter of 2002-2014). In a county-by-county breakdown, the commuting patterns data indicate both the percentage of people who reside inside a specified county who commute to another county and what percentage of the people who reside outside a specified county commute to the specified county. Updated commuting patterns were examined to determine the relative strength of the commuting patterns between counties within a MSA or CSA.

Meteorology

Ozone is a photochemical pollutant, which means sunlight is needed in order to start the chemical transformation of VOCs and NO_x into ozone. For this reason, meteorology plays a very important factor in the formation of ozone. Significant reductions in the monitored ozone values have occurred from when the 1997 8-hour ozone designations were made in 2004 until today. This reduction in ozone levels is due to many factors which include the reduction in transport of NO_x emissions from upwind point sources, and lower sulfur levels in transportation fuels along with better emission controls on highway vehicles and nonroad equipment. This region-wide reduction in NO_x has helped to limit the level of NO_x transported into the Commonwealth from other states. This can be seen in monitoring data recorded at the Methodist Hill and Tioga monitors (high elevation monitors), which measure ozone values well below the 2015 revised ozone standard. However, ozone transport from other states is still occurring (see the 24-hour Hybrid Single-Particle Lagrangian Integrated Trajectory (HYSPLIT) back trajectories) at the monitors in the Pittsburgh-Beaver Valley area, Indiana County, Lebanon County and Philadelphia area. General wind flow through the entire Commonwealth is from west to east. Wind flow across the eastern portion of the Commonwealth is generally from southwest to northeast. Therefore, the Commonwealth continues to see transport of ozone and its precursors primarily from states to Pennsylvania's south and west.

Topography and Geography

Pennsylvania contains numerous topographically and geographically distinct regions, most of which form a series of curved bands that run from the northeastern to the southwestern portion of the state. Starting from the eastern part of the state, a narrow coastal zone belt that is slightly above sea level occupies the southeastern portion of the state. Next, a zone of rolling hills defines the Piedmont Plateau. Going west, some of the regions are the Great Valley, Pocono Plateau, Appalachian Mountains, Allegheny High Plateau, and the Erie Plain. Intermixed within these regions, a few small topographical regions exist. All of these regions exert its own specific influence on the formation of ozone. The topography of the region will be considered when metropolitan and micropolitan statistical areas are combined to form one ozone Unclassifiable/Attainment or Nonattainment Areas. A discussion of the topography and geography will be included in each recommendation.

Jurisdictional Boundaries Including Political Boundaries, Transportation Planning Organizations and Existing Nonattainment Areas

Following county boundaries has a natural advantage in that county boundaries are also used by the Commonwealth's regional transportation planning organizations (which are often economic planning organizations, as well). Inventory data for non-point sources is more readily available on the county level and is more accurate because county populations are easily obtained and estimated. When a monitor is not located in a CBSA or CSA, the EPA intends to review relevant information associated with the county containing the monitor and, if appropriate, other adjacent nearby counties. The EPA

indicates that it will determine the nonattainment area boundaries through a weight-of-evidence analysis for the area based on the five-factor analysis. Regional transportation planning organizations (metropolitan and rural planning organizations) established in Pennsylvania often, but do not always, follow OMB's statistical area framework. Continuity of planning for ozone nonattainment areas may provide an important factor for planning, but keeping nonattainment areas constant is probably less important currently since the Commonwealth has no maintenance plans for the 2008 ozone NAAQS, the 1997 NAAQS is now almost 20 years old and second 10-year maintenance plans for the 1997 NAAQS will not be required to be submitted to EPA. This will allow the possibility for the Commonwealth to form new nonattainment areas that correspond to relevant criteria associated with current transport of ozone precursors and other data examined in the five factor analysis.

Other Areas that Pennsylvania Will Consider

Because of the pervasive nature of ozone and the effects of transport of ozone and its precursors into and out of the Commonwealth, Pennsylvania will consider the current level of emission controls, which will likely keep some areas attaining the 2015 revised ozone standard. Most emission controls in Pennsylvania have been adopted for areas larger than single nonattainment areas. There are exceptions, though, primarily for the Pittsburgh-Beaver Valley nonattainment area² and the Philadelphia nonattainment area³. Level of emission control is a factor for recommending nonattainment boundaries primarily in those two areas.

Highway and nonroad emissions of NO_x and VOC have been declining and will continue to decline as national and state controls on new highway vehicles, and national controls on nonroad equipment and motor vehicle fuels, come into effect, and as older vehicles are replaced.

Starting in 1997, Pennsylvania and other states adopted regional NO_x control programs in the form of regulations for large industrial boilers, internal combustion engines, electric generating units, and cement plants. The Federal CSAPR Program governs large electric generating units in the Commonwealth. CSAPR requires reductions in NO_x emissions from these electric generating units. The federal and state New Source Review programs and standards for hazardous air pollutants also reduce emissions to provide continued improvements. Pennsylvania has also adopted statewide controls for emissions of VOCs from sources such as consumer products, adhesives, solvent degreasing, printing, large appliances and metal furniture finishing, and architectural and industrial maintenance coatings. Finally, the low cost of natural gas has provided incentive for utility companies to shutdown older, more polluting, coal-fired power plants.

Additional discussion of the five factors is included below.

² Recommended to include Allegheny, Armstrong, Beaver, Butler, Fayette, Washington and Westmoreland counties.

³ Recommended to include Bucks, Chester, Delaware, Montgomery and Philadelphia Counties.

Discussion by Area.

Recommended Nonattainment Areas

The Commonwealth is making the following ozone nonattainment area designation recommendations based upon air quality monitoring data for 2013-2015, the other information described immediately above regarding the five factors in the EPA's guidance memorandum, and any additional information described below. Please see Appendix A, Figure A-1 for a full list of 2015 ozone designation recommendations for each Pennsylvania county.

Southwest Pennsylvania:

This region of Pennsylvania is dominated by relatively high terrain cut by numerous river valleys. These valleys tend to trap the precursor pollutants necessary to form ozone. During an ozone generating event, the sun begins to heat the surface in the late morning. With an abundance of NO_x and VOC due to the local traffic and regional source production, the sun reacts well with the air mass over the region to form ozone.

Pittsburgh-Beaver Valley Nonattainment Area:

The Pittsburgh-Beaver Valley Nonattainment Area for the 2008 ozone NAAQS consists of Allegheny, Armstrong, Beaver, Butler, Fayette, Washington and Westmoreland Counties. Two monitors in the Pittsburgh-Beaver Valley Area have monitored a 2015 design value above the 2015 ozone NAAQS at 72 ppb and 73 ppb. The Commonwealth recommends that the Pittsburgh-Beaver Valley nonattainment area for the 2015 ozone NAAQS be comprised of the same seven counties listed above.

These seven counties have historically been part of the same MSA as they are today. The seven counties have been grouped together for the purposes of air quality planning, emission control programs, state implementation plans, and area designations for many years. The relatively low population growth and types of economic activity that the seven counties experience are similar (Appendix B, Figures B-4 and B-5). In addition, commuting patterns shown in Appendix D indicate that between 35 to 40 percent of commuters in the six counties surrounding Allegheny County travel to workplace destinations inside the seven county area. Finally, in the Pittsburgh-Beaver Valley Area and in nearby upwind states, natural gas prices have either led to the shutdown of coal-fired power plants or the conversion of these power plants to natural gas. Consequently, ozone forming pollutants and ozone concentrations have been greatly reduced in the area and beyond.

The 24-hour HYSPLIT trajectory analysis for the Pittsburgh-Beaver Valley Area, Appendix D, for the calendar years 2013 through 2015 years shows that the same problems affect the area as was the case a decade ago, such as ozone transport, although transport is not coming from as far away on average. Also, exceedances of the ozone standards for 2013 through 2015 occur less often when compared to ozone exceedances

from 2003 through 2005. Regional transport of pollution from states to the south and west of Pennsylvania into the Pittsburgh-Beaver Valley Area still occurs. Slightly over half of the ozone exceedances resulted from regional transport during calendar years 2013 through 2015. The rest of the ozone exceedances appear to be a result of more local sources.

All of these elements taken together indicate why it is appropriate to designate the 7-county Pittsburgh-Beaver Valley Area as one nonattainment area.

Indiana County Nonattainment Area:

DEP recommends that Indiana County be designated as a standalone nonattainment area for the 2015 ozone NAAQS. The Pittsburgh-New Castle-Weirton PA-OH-WV, CSA includes Indiana County, which is a single county micropolitan statistical area adjacent to the 7-county Pittsburgh-Beaver Valley Area. The ozone monitor located in Strongstown, Indiana County measures a 2015 design value of 71 ppb. Although Indiana County is part of the larger Pittsburgh-New Castle-Weirton CSA, Indiana County does not share some other important factors with the Pittsburgh-Beaver Valley Area. For instance, only about 25 percent of all Indiana County residents commute to the 7-county Pittsburgh-Beaver Valley area while upward of 40 percent of residents in counties in the 7-county Pittsburgh-Beaver Valley Area commute to other counties in the area. In addition, Indiana County has never been included in the Pittsburgh-Beaver Valley Region, and thus, has never been included in the larger region for air quality planning or regional emission control planning.

One relevant factor could indicate that Indiana County should be grouped with the Pittsburgh-Beaver Valley Area. The HYSPLIT back trajectories which can represent wind speed and direction before an ozone exceedance indicate that 7 out of 10 24-hour HYSPLIT scenarios analyzed local pollution sources in the 7-county Pittsburgh-Beaver Valley Area probably had a role in affecting air quality in Indiana County. The 7 back trajectories indicate that the ozone transport started closer to Indiana County from either within the 7-county Pittsburgh-Beaver Valley Area or just across the border in Ohio, West Virginia, or Maryland, but because the DEP is recommending that both Indiana County and the Pittsburgh-Beaver Valley Area be designated nonattainment, the DEP sees no reason or air quality benefit to include Indiana County in the larger Pittsburgh-Beaver Valley Area.

All of these elements taken together indicate why it is appropriate to designate Indiana County as a single nonattainment area.

Southcentral Pennsylvania:

This region of Pennsylvania is comprised of the Piedmont Plateau and the Great Valley. The region lies south of Blue Mountain, a mountain that marks the southern border of the Allegheny Mountains. This physical boundary influences regional wind patterns and often poses a barrier to maritime air masses originating from the Atlantic Ocean. Several

broad valleys stretch across the region comprising the topography feature called the Great Valley, mainly aligned from east to west. These valleys are separated by a mountain range to the north and west. Population, population density and population growth are higher than in other areas in the Commonwealth and relatively consistent across the region.

Lebanon Nonattainment Area:

All monitors in the southcentral region, except the Lebanon monitor, are meeting the ozone standard. The 2015 ozone design value for the Lebanon monitor is 71 ppb. The DEP recommends that Lebanon County be designated as a single nonattainment area for the 2015 ozone NAAQS.

Cumberland, Dauphin, Perry, and Lebanon Counties were designated as one nonattainment area for the 1997 ozone NAAQS and a maintenance plan for the area is in place. All four of these counties were designated attainment for the 2008 NAAQS. Circumstances have changed since the 1997 and 2008 ozone NAAQS designations in that most, but not all, of the area is meeting the revised 2015 ozone standard consistently.

Cumberland, Dauphin, and Perry Counties comprise the Harrisburg-Carlisle MSA. Lebanon County by itself comprises the Lebanon MSA. York County comprises the York-Hanover MSA. Adams County comprises the Gettysburg MSA. These four MSAs comprise the Harrisburg-York-Lebanon Combined Statistical Area.

The 24-hour HYSPLIT back trajectories shown in Appendix C indicate that the wind patterns at 500 meters altitude transport pollution toward the Lebanon monitor from all directions.

Consequently, DEP recommends that Lebanon County be designated as a nonattainment area for the 2015 ozone NAAQS.

Cumberland, Dauphin, and Perry Counties:

The Commonwealth recommends that Cumberland, Dauphin and Perry Counties be designated Unclassifiable/Attainment. Although Cumberland County does not have an ozone monitor, the county is surrounded by other counties (Adams, Franklin, Dauphin and York) that do have ozone monitors, and all of those monitors in those counties are meeting the 2015 ozone NAAQS. The examination of commuting patterns in Appendix D illustrates that Cumberland County does not have many commuters who travel to Lebanon County for work. Unlike Cumberland County, Dauphin County has two ozone monitors, each of which is attaining the 2015 ozone NAAQS. As with Cumberland County, a small percentage (about 2%) of Dauphin County residents travels to Lebanon County for work. Perry County neither contains any significant sources of industrial emissions nor produces much in the way of highway emissions that contribute to ozone concentrations at the Lebanon monitor. Vehicles in Perry County contribute a very small percentage of the vehicle miles travelled within its MSA, about 7 percent. In addition,

commuting volumes, found in Appendix D, indicate that vehicle traffic between Perry County and the other five counties in the CSA are low. For these reasons, the Commonwealth recommends that Cumberland, Dauphin and Perry Counties be designated Unclassifiable/Attainment.

York County:

The Commonwealth recommends that York County be designated Unclassifiable/Attainment. York County is considered part of the Harrisburg-York-Lebanon CSA because these counties have established economic and commuting ties with each other. Regardless, York County has two ozone monitors, each of which is meeting the 2015 ozone NAAQS. All of these counties have higher population growth rates (See Figure B-5) on average than most other areas of the Commonwealth and similar population densities (Figure B-4). Although York County has the highest NO_x emission density of any county in the Harrisburg-York-Lebanon CSA, NO_x emissions within York County are anticipated to continue to decline greatly over the next several years. Pennsylvania's implementation of the Additional Reasonably achievable Requirements for Major Sources of NO_x and VOCs rule (*Pa Code*, Title 25, § 129.96) will greatly lower emissions from large sources of emissions in York County and across the Commonwealth. Also, with the changing landscape in the price of fossil fuels, (currently, it is cheaper to produce electricity by combusting natural gas than coal), the forecast is for electric utilities to use natural gas, which produces less NO_x than coal; a major NO_x emitter in York County, Talen Energy's Brunner Island, is expected to produce much less NO_x, which contributes to ozone formation. In addition, commuting patterns, illustrated in Appendix D, show that only slightly more than 2 percent of York County residents travel to Lebanon County for work. The same patterns hold for those commuters traveling from Lebanon County to York County.

Adams County:

The Commonwealth recommends that Adams County be designated Unclassifiable /Attainment. Adams County is part of the Harrisburg-York-Lebanon CSA and the Gettysburg MSA, but Adams County's economic association with other counties in the Harrisburg-York-Lebanon CSA has always been the weakest of all of the counties in the CSA. Furthermore, the NO_x emissions density (Figure B-2) of Adams County is lower than that of all the other counties in the region. Also, population density and population growth are lower than the other counties in the CSA (Figure B-4 and B-5). In addition, ozone monitors in Adams County measure design values of 51 ppb and 65 ppb and no major industrial sources of pollution exist in Adams County. For these reasons, the Commonwealth recommends that Adams County be designated Unclassifiable /Attainment.

Eastern Pennsylvania

Philadelphia Nonattainment Area:

The Pennsylvania portion of the existing 2008 ozone NAAQS nonattainment area consists of Bucks, Chester, Delaware, Montgomery and Philadelphia Counties. The Commonwealth is recommending that these five counties be designated as nonattainment for the 2015 ozone NAAQS. The monitor with the highest design value in the 5-county area is located in Bucks County and has a 2015 design value of 75 ppb.

There are no major topographic features to restrict airflow present in this region of the state as this region of the state is in a band of coastal zone. Some small hills separate this region from the Lehigh Valley area to the north. Emissions and population density are, with the exception of Philadelphia County, relatively uniform across the 5-county area and eastward into New Jersey.

All of these five counties are included in the interstate Philadelphia-Reading-Camden CSA. The transportation planning agency for the area covers the five Pennsylvania counties as well as a number of counties in New Jersey. The nonattainment area includes the DEP's Southeast Air Basins, as defined in 25 *Pa. Code* § 121.1. These five counties have been included in a Philadelphia multi-state nonattainment area since ozone designations were first made under the CAA. The Commonwealth has no objection to these five counties being included in the same interstate nonattainment area as in the past.

Population density throughout the 5-county area is high but shows a relatively homogenous growth increase within the five counties that ranges from 0.9 percent to 2.7 percent between the years 2010 and 2015. Philadelphia has reversed a long-term trend of losing population to become the fastest growing county in the 5-county area. As indicated by the area's MSA status, commuting and economic ties throughout the area are strong. According to U.S. Census data, Appendix D, about one-third of all commuters from these counties travel from their home county to another county within the 5-county area.

There are a number of emission control strategies that differentiate the 5-county area from other surrounding nonattainment areas, including Berks and Lancaster Counties. These primarily arise from the area's former designation as "severe" under the 1979 1-hour ozone standard and include:

- a more stringent major source definition for new source review and permitting;
- a requirement for federal reformulated gasoline, as mandated by federal statute;
- a requirement for Stage II gasoline pumps;
- requirements for NO_x controls on smaller sources not required in other areas; and
- a more stringent vehicle emission inspection/maintenance program

Additional Areas Recommended As Unclassifiable/Attainment

Pike County:

The area does not have a monitor, but is part of the New York City CSA. Historically, the county has not been included as part of the New York City nonattainment area. While population in Pike County is growing, population is still very low. Pike County is now, and is likely to remain, an insignificant contributor to New York City ozone nonattainment. The Commonwealth, therefore, recommends that Pike County remain designated as attainment and not be included in any designation for the New York City area as nonattainment for the revised 2015 ozone NAAQS.

Scranton-Wilkes-Barre Area:

The Commonwealth is recommending designation of Lackawanna, Luzerne, and Wyoming Counties as attainment for the 2015 ozone NAAQS. The Scranton-Wilkes-Barre metropolitan area consists of Lackawanna, Luzerne, and Wyoming Counties. The three monitors in these counties are both measuring ozone levels that meet the 2015 ozone NAAQS at design values of 63, 64 and 65 ppb.

Allentown-Bethlehem-Easton Area:

The Commonwealth recommends designating Carbon, Lehigh and Northampton Counties as attainment area for the 2015 ozone NAAQS. The highest design value monitored in the area is 68 ppb. The Allentown-Bethlehem-Easton area historically has strong planning and economic ties and is designated by OMB as an MSA.

The region shares a common topography and geography. The region is bounded on the north by Blue Mountain, providing a significant physical barrier. A broad valley runs from east to west connecting both Lehigh and Northampton Counties.

Lehigh and Northampton Counties are covered by a single metropolitan transportation planning organization, while Carbon County is part of a 5-county rural planning organization.

The Allentown-Bethlehem-Easton Air Basin defined in *25 Pa. Code* § 121.1 covers portions of Lehigh and Northampton Counties.

Lancaster County:

The Commonwealth recommends that Lancaster County be designated attainment for the 2015 ozone NAAQS. Monitors in the Lancaster Area are measuring attainment for the 2015 ozone NAAQS with the highest design value of any monitor certified at 67 ppb. Although the HYSPLIT back trajectories show that ozone plumes travel over western Lancaster County on their way to the Lebanon monitor, Lancaster County has a lower NO_x emission density than surrounding counties and no major point sources of NO_x.

emissions that can contribute significantly to ozone exceedances at the Lebanon monitor. In addition, Lancaster County is not part of the Harrisburg-York-Lebanon MSA and has traditionally been separate from all other surrounding MSAs and has remained its own distinct area. While there are some commuting ties to other MSAs in Southcentral Pennsylvania, Lancaster County has a political and cultural identity of its own.

Lawrence County:

The Commonwealth recommends designating Lawrence County Unclassifiable/Attainment and not including Lawrence County in the Pittsburgh-Beaver Valley nonattainment area (discussed above). Although included in the larger Pittsburgh-New Castle CSA, Lawrence County is a single county micropolitan statistical area. Lawrence County has traditionally been a stand-alone planning area. The monitor located in New Castle indicates ambient air quality that attains the standard with a design value of 68 ppb, and Lawrence County's micropolitan statistical area status indicates a lower level of social and economic ties to the Pittsburgh metropolitan area counties than the ties of the counties included in the MSA.

Reading Nonattainment Area:

The Commonwealth recommends that Berks County be designated as an Unclassifiable/Attainment area for the 2015 ozone NAAQS based on current ozone monitoring data.

The OMB defines a Reading MSA that consists of only Berks County. Although the OMB added Berks County to the Philadelphia CSA in 2006 because of increasing commuting ties to the larger area, Berks traditionally has its own planning functions, including its own metropolitan planning organization. In addition, the Reading Air Basin is defined in *25 Pa. Code* §121.1 as including portions of Berks County and no other county.

Berks County has a lower VOC and NO_x emissions density than any of the other five counties in the Philadelphia area. As shown in Figures B-4 and B-5, Berks County has a relatively lower population density and lower population growth than the five counties in the Philadelphia area. In addition, Berks County commuting patterns, shown in Appendix D, with the Philadelphia area are not as linked as the commuting patterns in the counties within the 5-county Philadelphia region.

Finally, Berks County was designated as a single nonattainment area for the 2008 ozone NAAQS; it subsequently attained the standard, and currently, the highest design for an ozone monitor in Berks County is below the 2015 standard at 69 ppb.

Additional Information

Appendix A includes a table and a map that describe the recommendations for the 2015 ozone NAAQS nonattainment areas, and a map of the designations for the 2008 ozone

NAAQS. The list of nonattainment and attainment areas in Table 1 includes all 67 Pennsylvania counties.

Appendices B and C include documenting data and material that address the EPA's five factor designation criteria pertaining to air quality, emissions and population factors, a map of the OMB statistical areas in Pennsylvania, and the HYSPLIT back trajectories.

Appendix D includes commuting patterns of residents in counties relevant to this analysis.

ACRONYMS AND TERMS

CAA	Clean Air Act
CSA	Combined Statistical Area
CSAPR	Cross State Air Pollution Rule
DEP	Department of Environmental Protection (Pennsylvania)
EPA	Environmental Protection Agency (United States)
HYSPLIT	Hybrid Single-Particle Lagrangian Integrated Trajectory
NAAQS	National Ambient Air Quality Standards
NEI	National Emission Inventory
NO _x	oxides of nitrogen
OMB	Office of Management and Budget (United States)
PM	particulate matter
ppb	parts per billion
ppm	parts per million
SIP	State Implementation Plan
VOC	volatile organic compounds

References

EPA, Final Rule, “*National Ambient Air Quality Standards for Ozone*,” for 2015, *Federal Register*, Volume 80, Number 206, October 26, 2015

Area Designations for the 2015 Ozone National Ambient Air Quality Standard, Janet G. McGabe, Acting Assistant Administrator, U.S. Environmental Protection Agency, February 25, 2016

EPA, Air Quality Designations for the 2008 Ozone National Ambient Air Quality Standards, Volume 77, Number 98, May 21, 2012.

EPA, 2011 National Emissions Inventory, <https://www.epa.gov/ai-emissions-inventories/naional-emissions-inventory>.

U.S. Census Bureau, OnTheMap Application and LEHD Origin-Destination Employment Statistics (Beginning of Quarter Employment, 2nd Quarter of 2002-2014).

U.S. Census Bureau, Annual Estimates of the Resident Population for the Counties: April 1, 2010 to July 1, 2015, <https://factfinder.census.gov>.

U.S. Census Bureau, <https://www.census.gov>, USA Counties Data File Downloads, Land Area Worksheet, Land Area in Square miles for 2010 column.

Office of Management and Budget, Notice of Decision, “*Standards for Defining Metropolitan and Micropolitan Statistical Areas*,” (65 FR 82228, December 27, 2010).

Stein, A.F., Draxler, R.R., Rolph, G.D., Stunder, B.J.B., Cohen, M.D., and Ngan, F., (2015). NOAA's HYSPLIT atmospheric transport and dispersion modeling system, *Bull. Amer. Meteor. Soc.*, **96**, 2059-2077, <http://dx.doi.org/10.1175/BAMS-D-14-00110.1> □

Rolph, G.D. (2016). Real-time Environmental Applications and Display sYstem (READY) Website (<http://www.ready.noaa.gov>). NOAA Air Resources Laboratory, College Park, MD.

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