Kentucky Division for Air Quality
2018 Annual Report

Commonwealth of Kentucky
Energy and Environment Cabinet
Department for Environmental Protection
Division for Air Quality
air.ky.gov

Kentucky Division for Air Quality
Annual Report
Fiscal Year 2018

Governor Matt Bevin **Secretary Charles G. Snavely**

This Annual Report is intended to provide a concise set of facts and measurements to support environmental decision-making. We welcome your questions and comments to the contacts below:

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The 2018 DAQ Annual Report was edited by Roberta Burnes and Shauna Switzer. We gratefully acknowledge the contributions of the following staff and management of the Division for Air Quality in the production of this report.

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Permit Review	Clay Thompson, Shawn Hokanson, Ben Cordes
Technical Services	Jennifer Miller, Shauna Switzer

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FROM THE DIRECTOR

Dear Reader,

On behalf of the Division for Air Quality, I want to thank you for taking the time to review the Division's 2018 Annual Report. This report highlights key accomplishments and activities that enable us to carry out and fulfill our statutory obligations. Within these pages, you will find information related to the following activities:

· Air program planning and implementation;
· Regulatory updates;
· Facility compliance inspections;
· Air quality permitting;
· Ambient air monitoring;
· Source sampling; and
· Education and outreach

In addition, the annual report details metrics on air quality complaints; emissions of regulated air pollutants; and most importantly, significant improvements in Kentucky's air quality as measured by our ambient air monitoring network.

The data in this report reveal a positive and impressive story.

For example, the Division's Emissions Inventory Section surveys nearly 1,200 facilities in Kentucky each year to determine actual emissions. Once again, emissions of regulated air pollutants emitted from stationary sources located in Kentucky have declined from the previous year.

The results from the Division's ambient air monitoring network confirm the downward trends for all criteria pollutants. Some pollutants, such as sulfur dioxide (SO_2) and nitrogen oxides (NO_x), have seen dramatic declines over the past decade. These air quality improvements reflect the installation and operation of air pollution controls, especially at electric generating plants.

Air pollution reductions greatly enhance Kentucky's environment and provide for opportunities of economic growth and development. As of 2018, ambient air monitoring data demonstrate that all areas of Kentucky are meeting the National Ambient Air Quality Standards (NAAQS) for SO_2, NO_x, and particulate matter.

With the exception of two areas, the Commonwealth currently meets the ozone NAAQS. On April 30, 2018, EPA designated two areas in Kentucky as not meeting the more stringent NAAQS for ozone established in 2015. The areas designated as "nonattainment" for the 2015 Ozone NAAQS are the Louisville area (Jefferson and Bullitt counties) and the Northern Kentucky area (northern portions of Boone, Campbell, and Kenton counties). Rest assured, Division staff are working diligently, along with our partners at the Louisville Metro Air Pollution Control District, on Kentucky's State Implementation Plan to identify strategies for reducing ozone concentrations in these areas.

Again, thank you for your interest in Kentucky's air quality and the Division. Clean air is a precious resource for everyone, and each of us performs a vital role in protecting it. Please consider your neighbors, your community, and your environment when carrying out your daily activities.

If you have questions, comments, or request additional information, please contact us at your convenience.

Many thanks,

Sean Alteri
Director

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SELECTED FIGURES

Welcome to the FY 2018 Annual Report of the Kentucky Division for Air Quality (DAQ). This report details DAQ's accomplishments from July 1, 2017 through June 30, 2018.

Our mission:

To protect human health and the environment by achieving and maintaining acceptable air quality through:

- Operation of a comprehensive air monitoring network;
- Creating effective partnerships with air pollution sources and the public;
- Timely dissemination of accurate and useful information;
- The judicious use of program resources; and
- Maintenance of a reasonable and effective compliance assurance program.

Who we are:

- A team of environmental professionals dedicated to protecting Kentucky's air quality
- 150 funded positions located in Frankfort and throughout the state in 8 Regional field offices
- Third largest division in the Dept. for Environmental Protection

What we do:

- Air monitoring
- Regulation development
- Permitting regulated facilities
- Ensure compliance with National Ambient Air Quality Standards (NAAQS)
- Education & outreach

The Clean Air Act: Federal and State Roles in Protecting Clean Air

During the first half of the 20th century, air pollution control was handled at the state and local level. Poor air quality in many urban areas was becoming a major health concern.

In 1952, the Kentucky legislature passed KRS chapter 77, which authorized the creation of county-level air pollution control districts. That same year, the Air Pollution Control District of Jefferson County was formed to tackle the problem of air pollution in the Louisville area. Kentucky's first state-wide air pollution control program was created in 1966, when the Kentucky General Assembly enacted KRS 224.20-100:

> *"The Kentucky General Assembly hereby finds it necessary to the health and welfare of the citizens of Kentucky that there be maintained at all times both now and in the future a reasonable degree of purity of the air resources of this Commonwealth consistent with maximum employment and full industrial development necessary for the protection of the public health, the general welfare, and the property and people in this Commonwealth; and foster the comfort and convenience of its inhabitants and facilitate the enjoyment of the natural attractions of the state."*

Originally operating out of the state health department, the Kentucky Air Pollution Control Commission eventually moved to the Department for Environmental Protection where it became known as the Division for Air Quality. Today, as in its beginning, air pollution control is divided among a hierarchy of state, federal, and local programs.

Federal Authority

The Clean Air Act (CAA), codified as 42 U.S.C. 7401 *et seq.*, was first enacted by Congress in 1963 with major revisions in 1970, 1977, and 1990. The Act requires the U.S. Environmental Protection Agency (EPA) to establish health-based standards for ambient (outdoor) air quality, providing deadlines and requirements for meeting those standards by state and local governments. The Act establishes federal standards for hazardous air pollutants, for ozone-depleting chemicals, and for emissions that contribute to acid rain. In addition, the Clean Air Act establishes a permitting system for major sources of air pollution.

Local Authority

KRS 224 recognizes the right of counties to develop their own air pollution control districts as provided for in KRS 77. The Louisville Metro Air Pollution Control District)LMAPCD) maintains a local air pollution control program, while activities in the rest of Kentucky's counties are covered by the Division for Air Quality. The LMAPCD may choose to make subtle changes or be more stringent than state and federal regulations, but it must be at least as stringent as the state and federal programs.

Air monitoring in Kentucky, then and now. Photo credits: LMAPCD and DAQ

Division staff participate in several regional and national organizations.

DAQ's participation in these organizations enables the Division to stay connected to regional and national policy issues and gain valuable professional development opportunities. Often, Division staff assume leadership roles within the organizations and are members of various committees and groups. The most notable organizations that the Division routinely engages are below:

AAPCA: The Association of Air Pollution Control Agencies was formed in 2012, representing 20 states. AAPCA is a consensus-driven organization focused on assisting air quality agencies and personnel with implementation and technical issues associated with the federal Clean Air Act (CAA). DAQ director Sean Alteri served as AAPCA's Past President during FY 2018, and DAQ staff chaired two AAPCA committees as well.

ECOS: The Environmental Council of the States is the national non-profit, non-partisan association of state and territorial environmental agency leaders. The purpose of ECOS is to improve the capability of state environmental agencies and their leaders to protect and improve human health and the environment of the United States of America.

KAEE: The Kentucky Association for Environmental Education is one of the nation's oldest professional associations supporting environmental and sustainability education. KAEE promotes environmental education as a tool to increase public awareness and knowledge about environmental issues and provide the skills to make informed decisions and take responsible actions. The Division is an Institutional Member of KAEE.

KAGC: The Kentucky Association of Governmental Communicators supports Kentucky professionals whose primary jobs involve communicating with media, the public, legislatures and others. DAQ education specialist Roberta Burnes served on KAGC's board of directors in 2017.

KCFC: The Kentucky Clean Fuels Coalition is a non-profit organization whose mission is to link providers and users of fuels across Kentucky to the best information and education available about clean energy technologies. DAQ administers DEP's participation in KCFC's Green Fleets of the Bluegrass program.

SEDC: The Southeast Diesel Collaborative is a voluntary, public-private partnership involving leaders from federal, state and local government, the private sector and other stakeholders throughout the southeast working to reduce diesel emissions. The Southeast Diesel Collaborative is part of the EPA's National Clean Diesel Campaign.

SESARM: Southeastern States Air Resource Managers Inc. is a non-profit corporation formed by the state air pollution control agencies located in the southeastern states of Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, Tennessee, West Virginia, and Virginia. SESARM exists to support and supplement the work of member agencies.

UIEK: The Utility Information Exchange of Kentucky is a group comprised of utilities with electric generation and transmission facilities located in Kentucky. Among other things, UIEK encourages exchange of information about environmental regulatory developments and requirements among its members.

STAKEHOLDER OUTREACH

During FY 2018, the Division's Stakeholder Outreach Program reached 4,054 people in 20 counties.

DAQ's Stakeholder Outreach Program continues to reach thousands of Kentuckians each year. DAQ staff provide presentations on outdoor and indoor air quality, transportation and idle reduction, health and environmental impacts of air pollution, energy conservation, and Kentucky's open burning regulation.

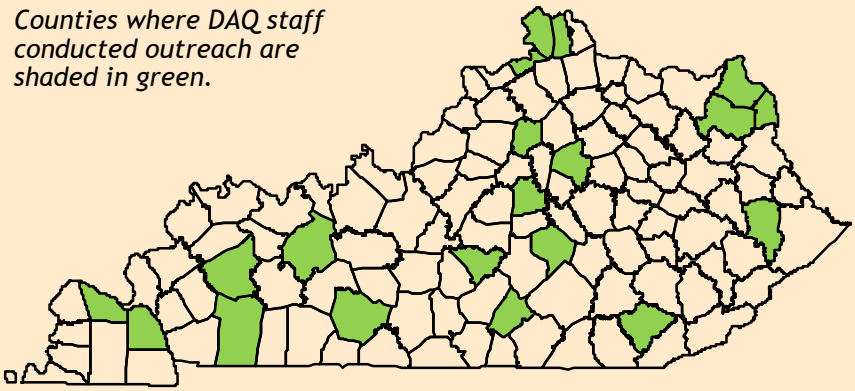
Environmental education is an essential tool in promoting environmental stewardship. DAQ's Stakeholder Outreach program reaches a diverse audience across the Commonwealth including students, teachers, firefighters, businesses, solid waste coordinators, and the general public.

Figure 1 shows the numbers for each major audience reached by DAQ's outreach program. School programs drew the largest audience (2,619) as DAQ staff participated in several school-wide science and technology fairs, as well as several environmental field days at regional parks and 4-H camps. The majority of these students received direct, face-to-face contact with DAQ staff presenting educational programs about air quality, energy, and careers in science.

Public programs drew the second-largest audience (580). These numbers reflect a decrease in public programs over last year due to several annual festivals being canceled due to inclement weather.

DAQ staff conducted educational outreach in the following counties during FY 2018:

Counties where DAQ staff conducted outreach are shaded in green.



Boone
Boyd
Carter
Christian
Fayette
Floyd
Franklin
Gallatin
Greenup
Hopkins
Kenton
Knox
Lincoln
Marshall
McCracken
Mercer
Ohio
Russell
Taylor
Warren

Air Quality Awareness Week

The first week in May is National Air Quality Awareness Week. This year, the Division again distributed daily air quality articles and quizzes through email and social media. In addition, the Division worked with the Energy and Environment Cabinet's Office of Communications to produce a video and article about ozone season.

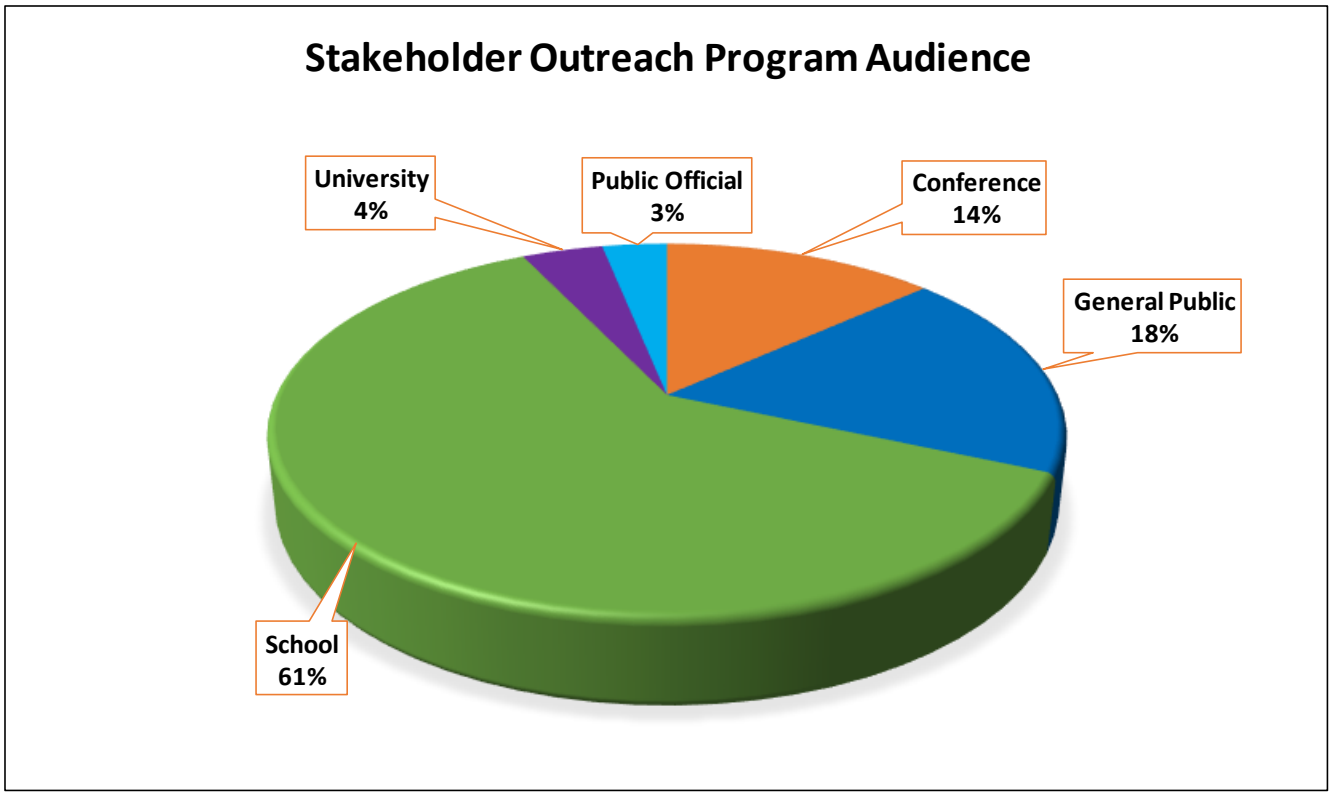
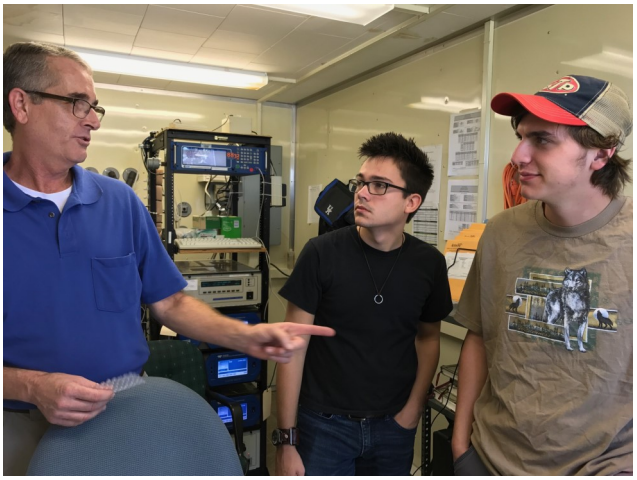


Figure 1: The Division for Air Quality's outreach programs reached 4,054 people during FY 2018.

University of Kentucky Collaboration

During the fall of 2017, the Division collaborated with a University of Kentucky writing class. Titled "Communicating Technical and Scientific Information", the class gave students real-world experience in communicating about air quality — a subject of which none of them had prior knowledge.

According to Professor Lauren Cagle, the purpose of the course was to give students a simulated experience of working with a client to produce deliverable communication products, while honing their skills at interpreting complex scientific information.



DAQ Environmental Scientist Chris Juilfs talks about air monitoring with Austin Clemons and Drake Boling during a student field trip to Lexington's air monitoring station. (Photo: Lauren Cagle)

To kick off the course, the students learned about air quality and the Division's work. Visits to DAQ's Frankfort headquarters and an air monitoring station helped put their knowledge in context. Course texts included the Division's Annual Report as well as the AAPCA report "The Greatest Story Seldom Told".

Over the course of 3 months, students produced PowerPoints, brochures, table displays, and videos to communicate air quality to a variety of audiences and for a variety of purposes. Regular visits and feedback from DAQ's education/outreach specialist helped keep students on track.

At the end of the course, DAQ received all student projects with rights to edit and/or use any or all of the material. Plans are in the works to collaborate again with a new class of students when the course is offered again.

DAQ's Roberta Burnes talks with students about the video they produced. (Photo: DAQ)

Examples of some of the student work produced in the DAQ-UK collaboration included an open burning brochure targeting U.K. students and a banner about the health effects of open burning.

Open Burning

Illegal open burning continues to be a serious health concern in Kentucky. The Division promotes open burning awareness in the following ways:

- DAQ's open burning brochure is the Division's primary educational tool, summarizing Kentucky's open burning regulation in easy-to-understand language. First responders often carry DAQ's open burning brochures in their vehicles so they can distribute the information as the need arises.
- The Division's open burning web page (air.ky.gov/Pages/OpenBurning.aspx) provides a variety of educational links and resources including a PowerPoint presentation, posters, and PDFs of the open burning brochure in English and Spanish.
- DAQ provided trainings on the open burning regulation to 135 fire fighters and public officials during FY 2018.

Posters and brochures educate about Kentucky's open burning regulation.

Air Quality Flag Program

Last fall, George Rogers Clark Elementary School in Paducah became Kentucky's first school to join EPA's Air Quality Flag Program. The program uses brightly colored flags based on the Air Quality Index (AQI) to notify the public about air quality conditions. Each day, participating organizations raise a flag that corresponds to the AQI color of the local air quality forecast.

DAQ's outreach specialist Roberta Burnes worked with teacher Debbie Stewart and her 4th and 5th grade leadership classes to provide flags and introduce the program to the school. Students produced educational videos and Burnes visited every 3rd and 4th grade class at Clark Elementary to teach about air quality and the program.

In addition to Clark Elementary, more than 60 other Kentucky schools and organizations joined the Air Quality Flag Program in the spring of 2018. All received free flag sets from EPA.

Students at George Rogers Clark Elementary in Paducah hold air quality flags with DAQ's education specialist Roberta Burnes. (Photo: DAQ)

FIELD OPERATIONS

The Field Operations Branch (FOB) is the largest branch of the Division and is currently staffed by 62 employees. The majority of FOB field staff is located in eight regional offices and have the following primary duties:

- Complete unannounced inspections to ensure that permitted facilities and non-permitted entities maintain compliance with federal and/or state air quality regulations;
- Operate and maintain 28 air monitoring stations scattered throughout the state to measure ambient air quality and determine whether pollutant concentrations remain within EPA established limits; and
- Investigate air quality complaints received from the general public.

For a map of DAQ's regional offices, see Page 81 of this report.

Inspections

In calendar year 2017, FOB staff completed 3,560 compliance inspections of various types at mostly permitted sources (major Title V, minor); 85 percent of inspected sources were found to be compliant (Figure 2). Types of inspections included full compliance evaluations, partial compliance evaluations, records reviews, compliance demonstrations (stack tests), asbestos inspections, follow-up inspections of documented violations, and self-initiated inspections of suspected violators.

The regional offices with more inspections for major facilities (Figure 4) are located in areas of the state with a higher number of major permitted facilities, which include power plants, manufacturing facilities and chemical processing plants. The regional offices with more inspections for minor sources tend to be located in areas of the state with a smaller population base, leading to a higher percentage of minor pollution sources, such as auto body/paint shops, non-coal mineral processing facilities, and coal-mining related activities (Figure 5).

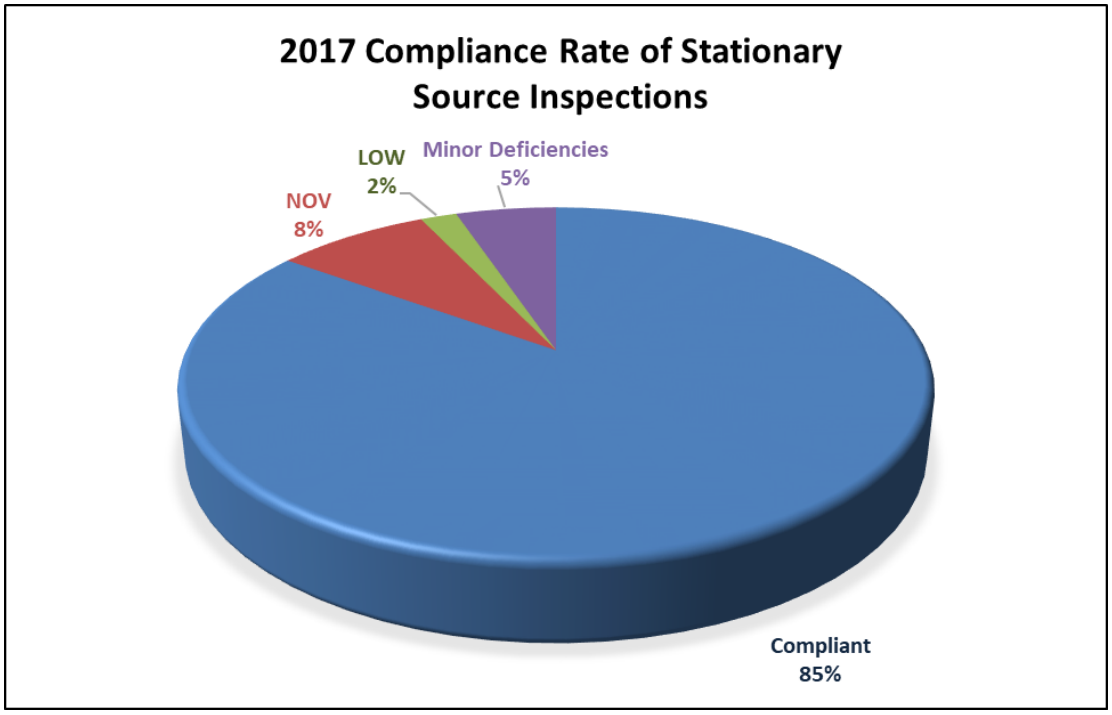


Figure 2: The compliance rate of regulated stationary sources inspected by field office staff in 2017 was 85 percent. Notices of Violation (NOV) were issued to 8 percent of Kentucky's stationary sources, while Letters of Warning (LOW) were below 1 percent. About 5 percent of violations were considered non-recurrent minor violations or violations that were quickly corrected, eliminating the need for any formal enforcement action.

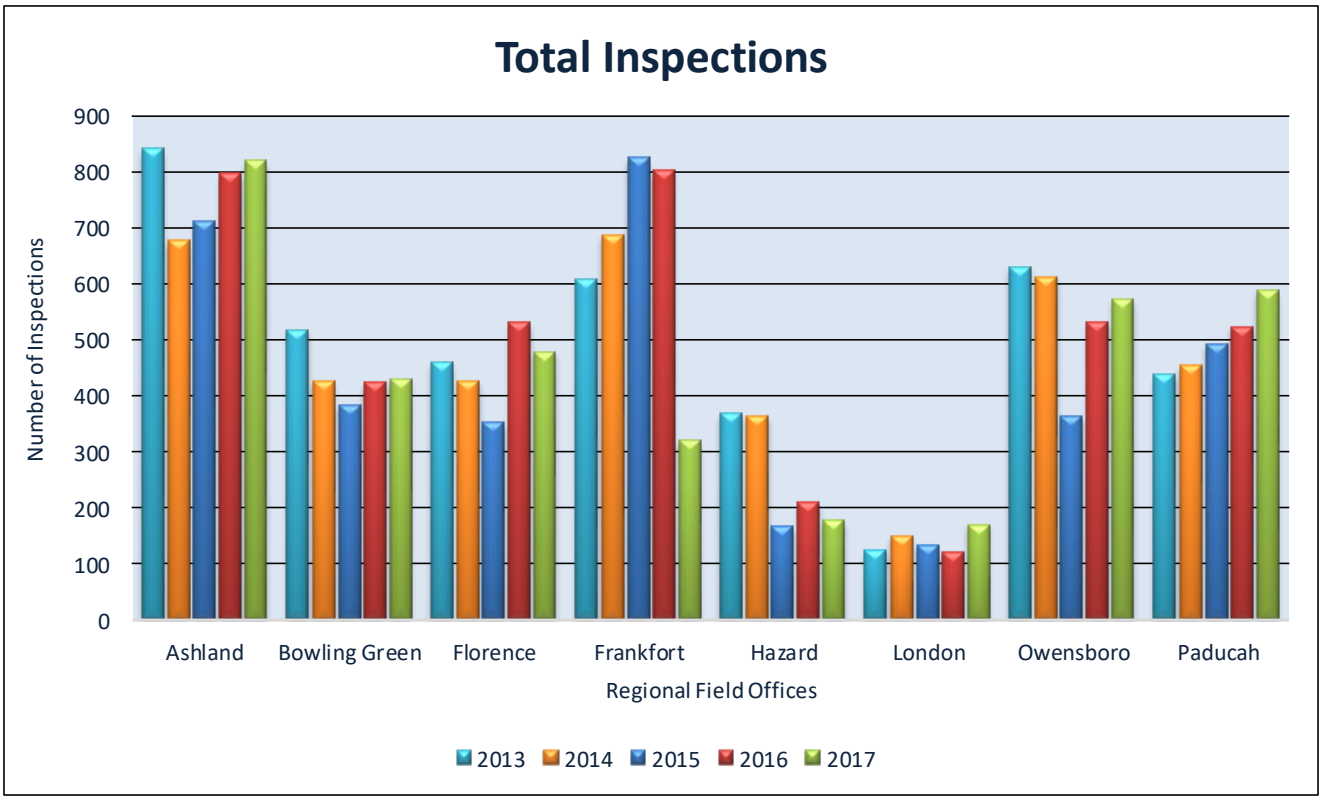


Figure 3: The total number of inspections at regulated facilities.

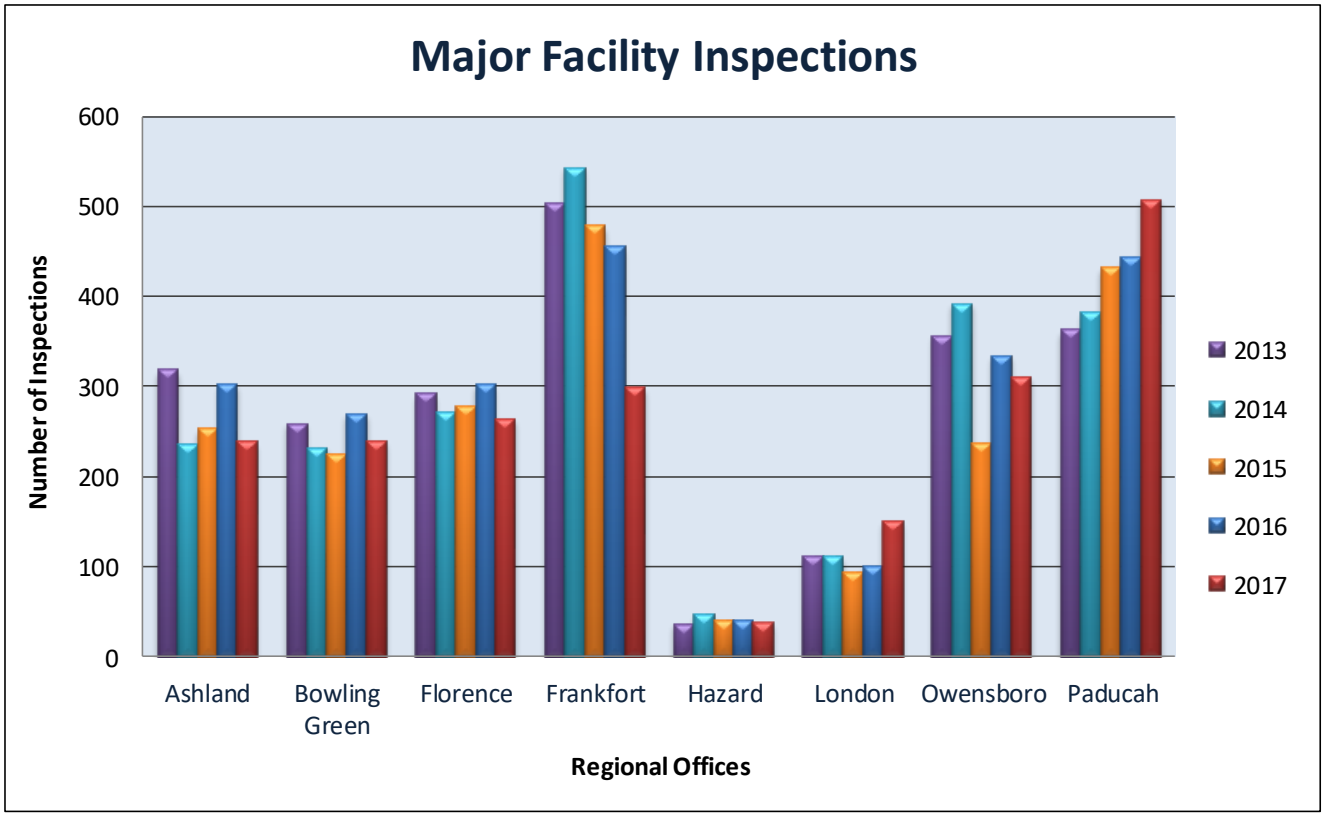


Figure 4: Number of major stationary facility inspections in Kentucky. The regional offices with more inspections are located in areas of the state with more major permitted facilities. Major permitted facilities include power plants, manufacturing facilities and chemical processing plants.

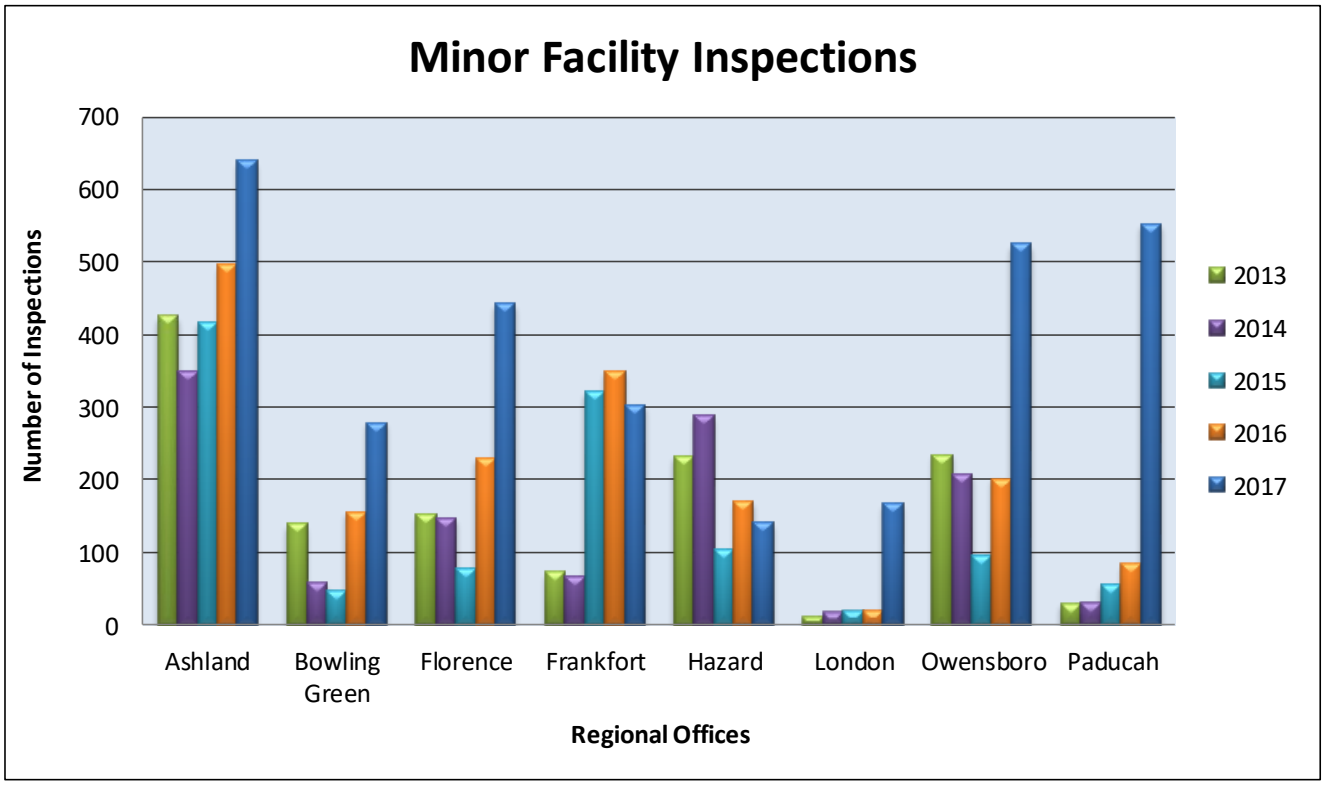


Figure 5: Number of minor stationary source inspections. Minor pollution sources include auto body paint shops, dry cleaners, and both coal and non-coal mineral processing facilities.

Complaint Investigations

Investigating complaints consumes a significant portion of field staff time. In 2017, DAQ received a total of 1,215 complaints (Figure 6). Numbers of complaints and violations resulting from investigations are included in Figures 7 - 10. The majority of complaints were about open burning, fugitive emissions, and odor.

In general, an air quality complaint represents a single incident about which one or more calls have been received. For example, a single incident of tire burning may generate several citizen calls to DAQ. Those calls are counted collectively as a single complaint, since they refer to a single incident.

Open burning is the outdoor burning of any material without an approved burn chamber, stack, or chimney with control devices approved by KY DAQ. Open burning in Kentucky is regulated under 401 KAR 63:005.

The Division received 648 complaints about open burning in calendar year 2017. 38 percent of these complaints resulted in Notices of Violation (NOV) of the open burning regulation (Figure 7). Kentucky does not have a statewide open burn permit program, so the total number of actual open burns is unknown.

Fugitive emissions are pollutants released into the air, usually by human activity — but not from smokestacks, chimneys, or ducts. Common fugitive emissions include dust released during land clearing, heavy construction operations, mining and quarrying activities, storage and transport of dusty materials and transportation on unpaved roads. In Kentucky, fugitive emissions are regulated under 401 KAR 63:010.

Fugitive emissions complaints and violations (Figure 8) are related to yearly precipitation patterns. During periods of prolonged drought, both the number of complaints and violations generally increases. This is especially true when a drought occurs in the summer months when the heat from the sun dries up surfaces more quickly and people tend to be out doing activities that create more dust.

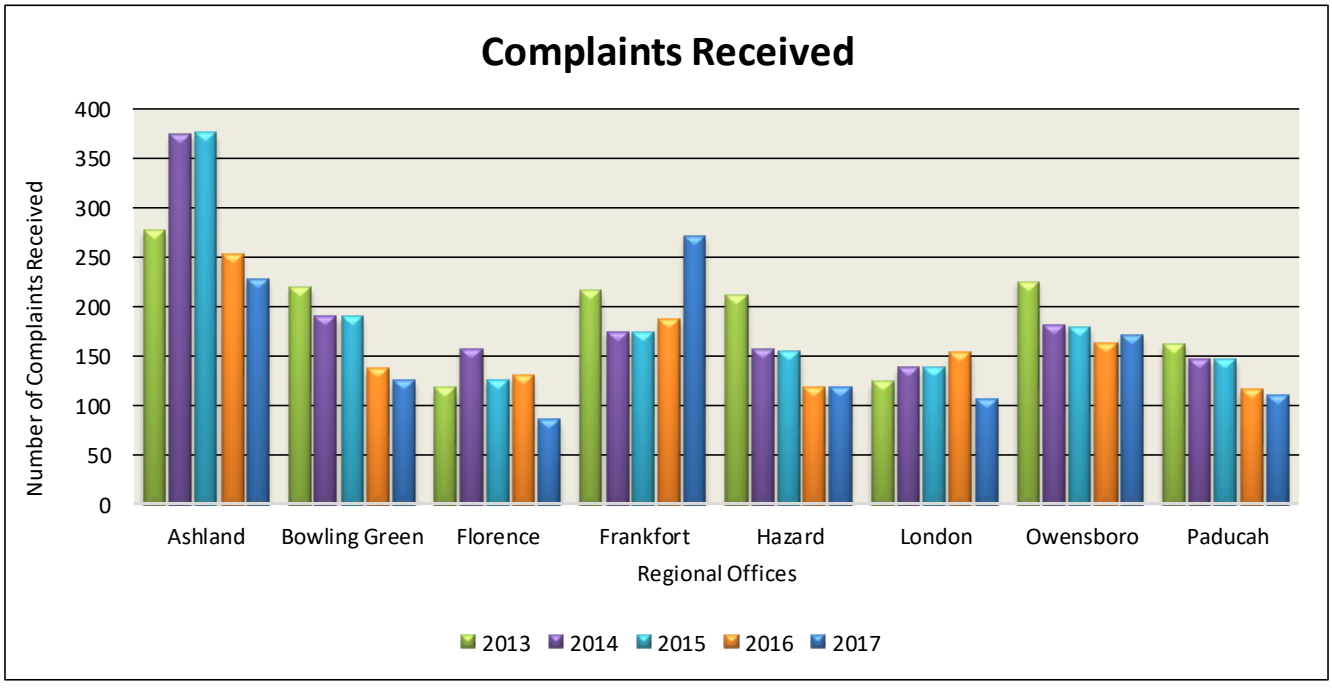


Figure 6: The numbers of complaints received during the last five years including open burning, fugitive emissions, odor, and asbestos complaints.

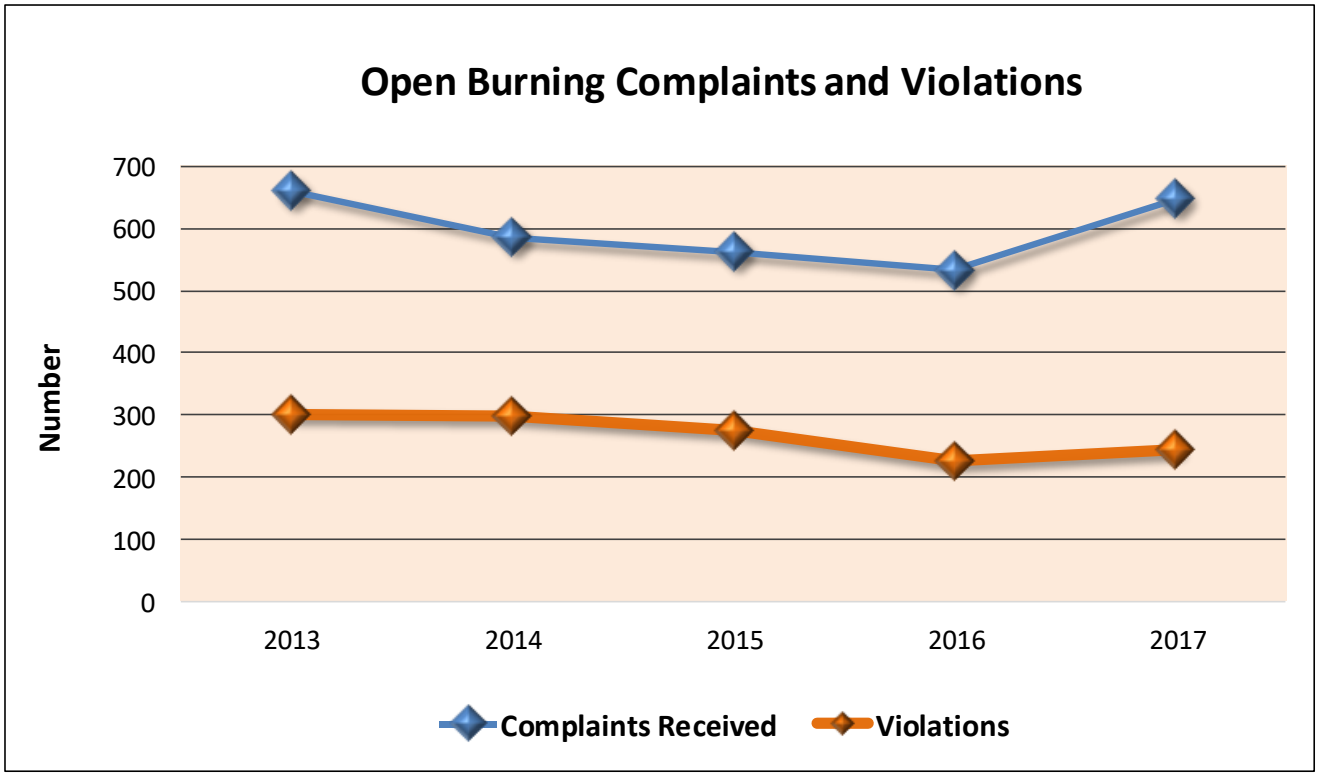


Figure 7: Complaints received about open burning and violations cited after investigation. Even though 2017 saw an increase in complaints from 2016, the number of violations were still trending downward with only 38 percent of complaints resulting in violations.

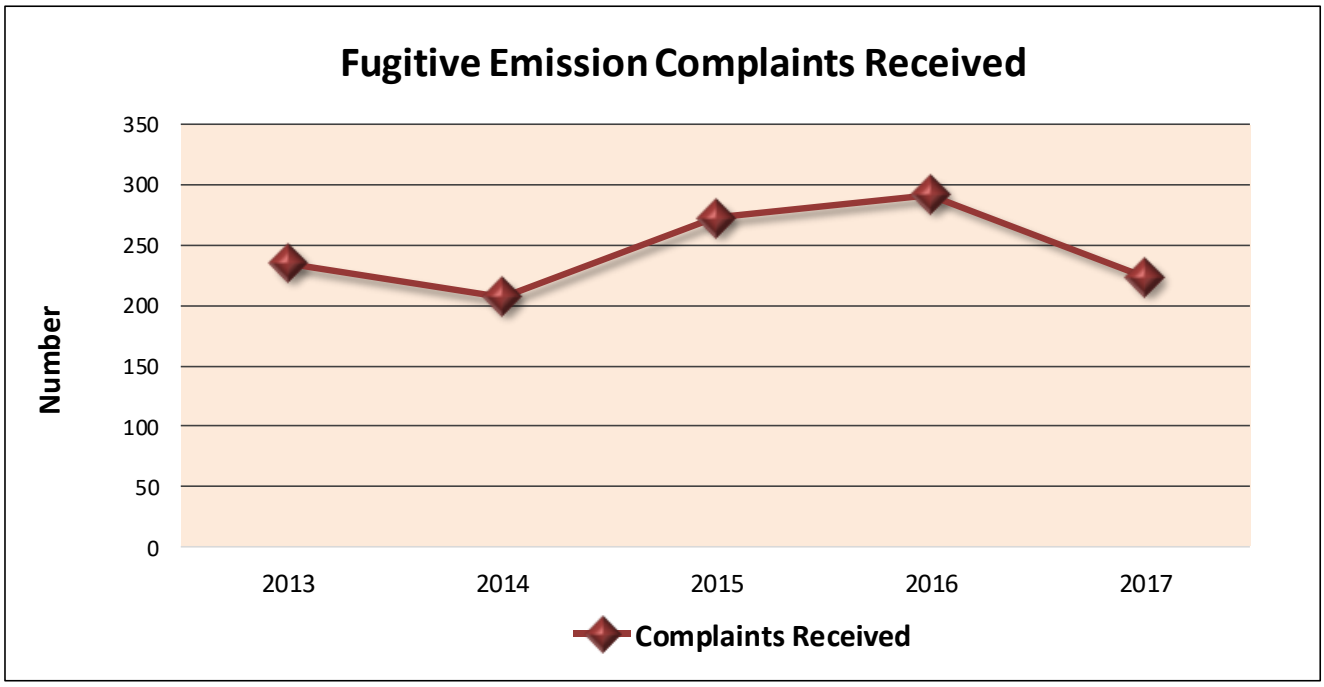


Figure 8: Complaints received about fugitive emissions. Fugitive emissions are those that do not come from a stack. Common fugitive emissions are dust from haul roads, quarries, conveyor systems, etc.

Odor complaints are regulated under 401 KAR 401 53:010. DAQ receives complaints concerning odor on a regular basis (Figure 9). Odor violations are documented when an inspector can smell the odor through a sniffing device known as a Nasal Ranger or Scentometer, which dilutes the ambient air at a ratio of seven to one.

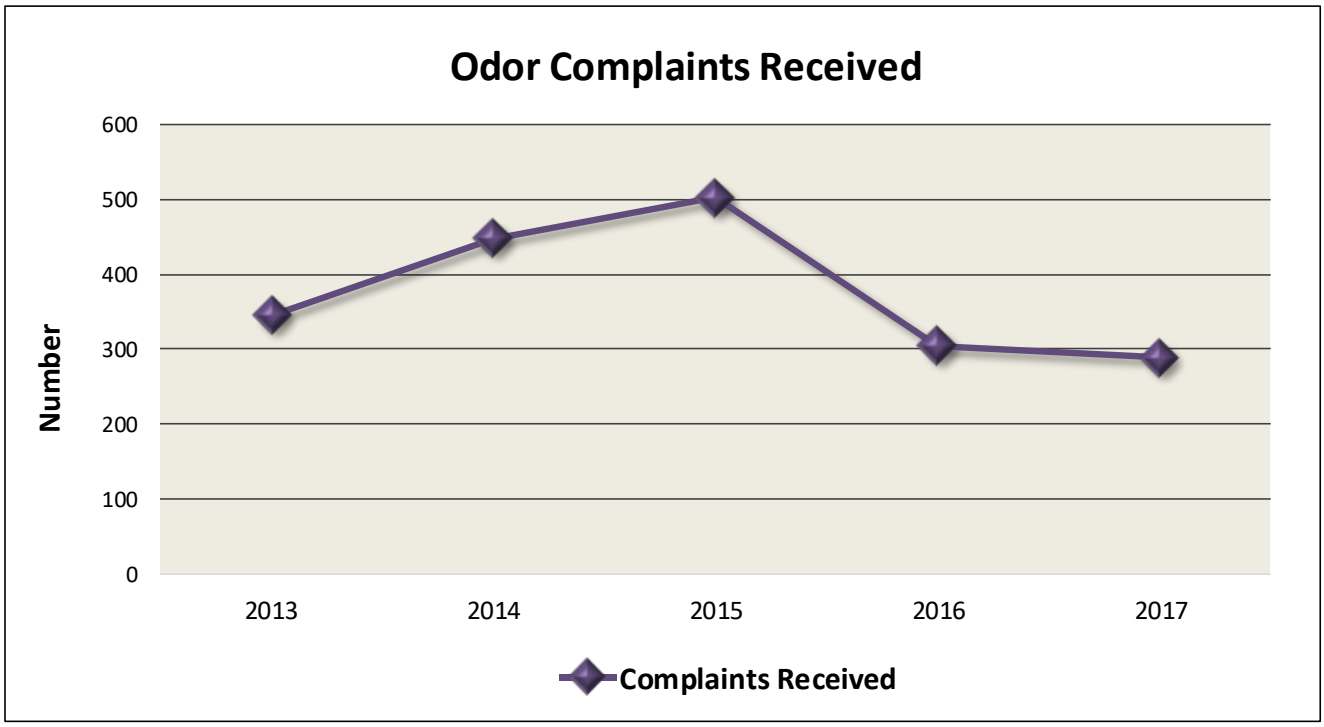


Figure 9: Odor Complaints Received. Note that a "complaint" may represent multiple calls about a single odor incident. Complaints in 2016 went down significantly after resolution of violations at one odor source.

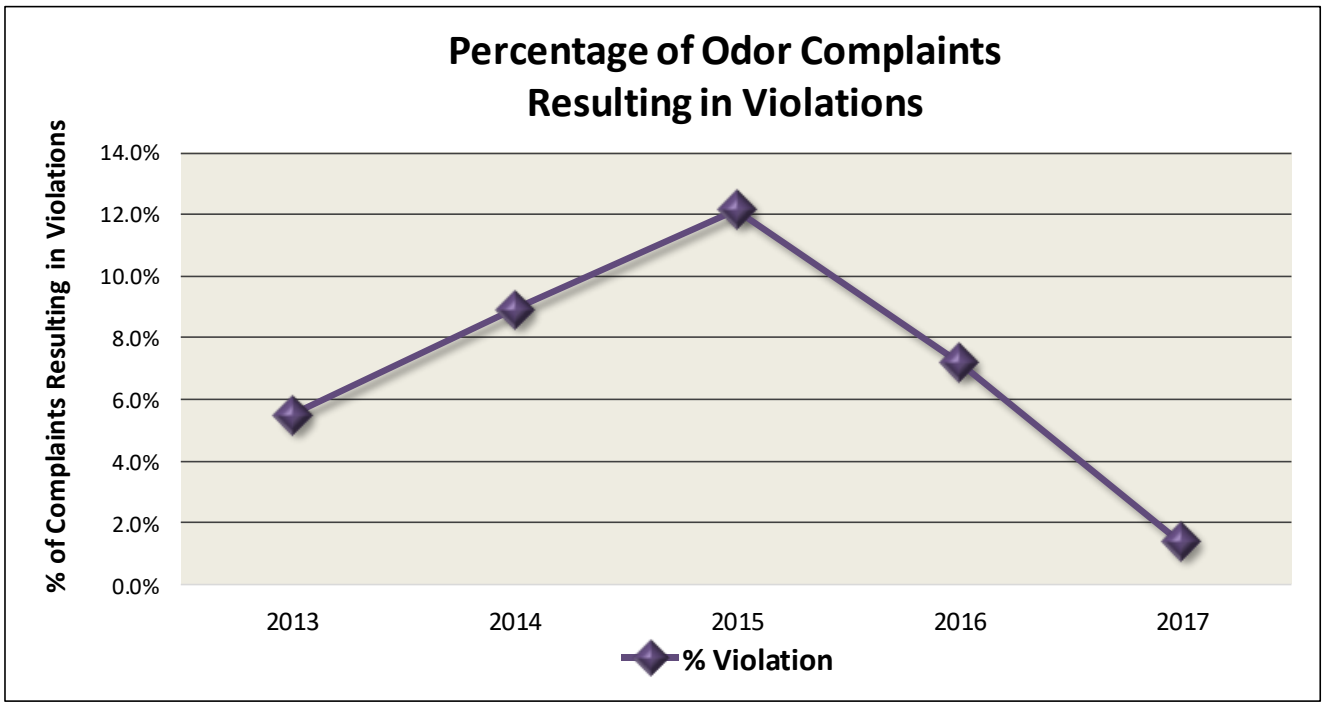


Figure 10: Percentage of Odor Complaints Resulting in Violations. Major corrective actions at one odor source in 2015 -2016 reduced the percentage of complaints resulting in violations down to more historical levels in 2016. 2017 saw the lowest number of odor complaints and violations in 5 years.

DAQ's Asbestos Inspection Program

Asbestos removals associated with renovations and demolitions are regulated by the Division under the National Emission Standards for Hazardous Air Pollutants (NESHAP). Increased awareness within the regulated community has improved the notification process for inspections and removals. Educational outreach to the general public has also improved the complaint process to report potential violations of the regulatory program.

Federal regulations also require schools to have their buildings thoroughly surveyed for asbestos under the Asbestos Hazard Emergency Response Act (AHERA). The results must be documented in a management plan that describes how asbestos containing building materials in the school buildings will be managed safely. The Division's compliance oversight strategy for AHERA inspections has evolved from a records review approach to an actual site inspection/records verification process.

Measures tracked by the Division to evaluate the asbestos program's success (Figure 11) are as follows:
· Number of asbestos NESHAP and AHERA inspections conducted;
· Number of asbestos complaint investigations conducted; and
· Compliance rate of NESHAP and AHERA related inspections and investigations.

Compliance with all asbestos regulations is overseen by the Field Support Section and inspectors from the regional offices. In 2017, the compliance rate for the asbestos NESHAP was 82 percent (Figure 12) and the compliance rate for AHERA was 80 percent (Figure 13).

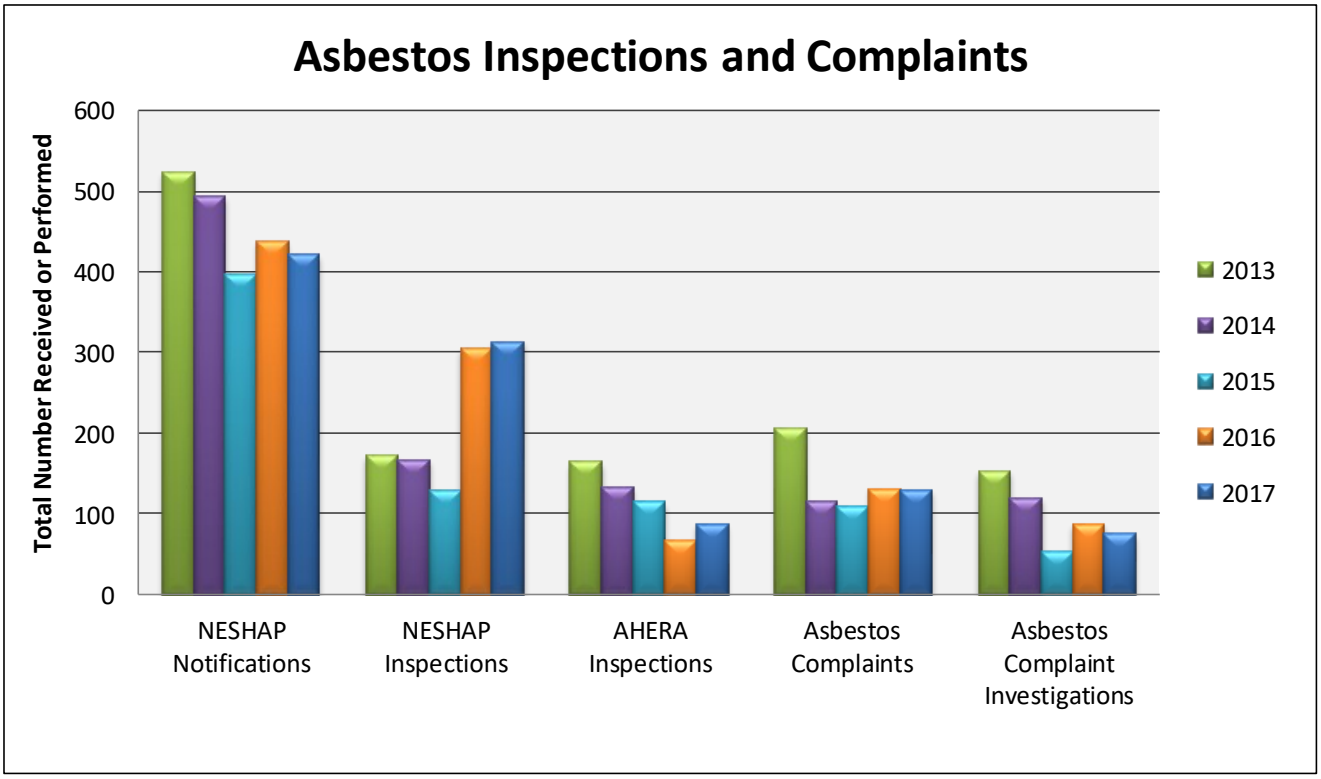


Figure 11: NESHAP notifications and inspections and AHERA inspections, complaints, and investigations.

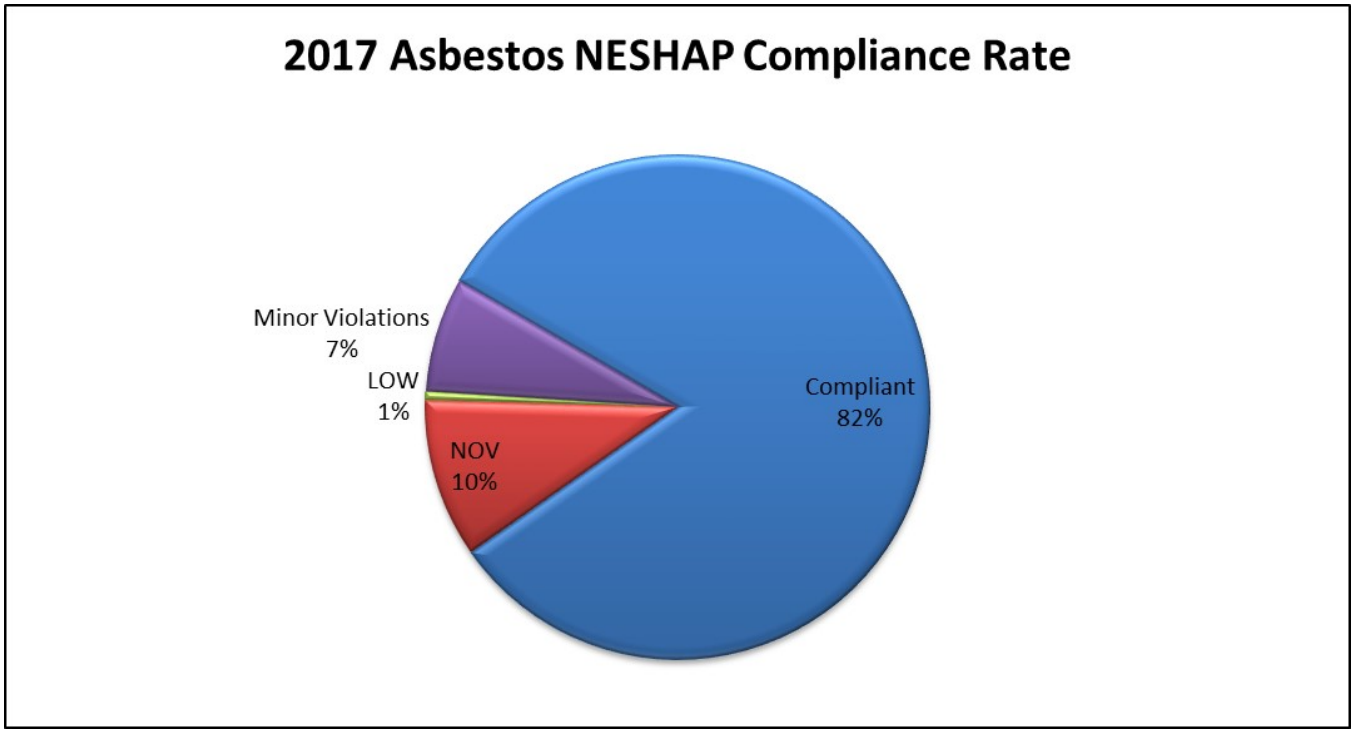


Figure 12: Compliance rate of asbestos removal and/or demolition operations regulated under the National Emission Standards for Hazardous Air Pollutants (NESHAP). "LOW" refers to Letters of Warning, while "NOV" refers to Notices of Violation.

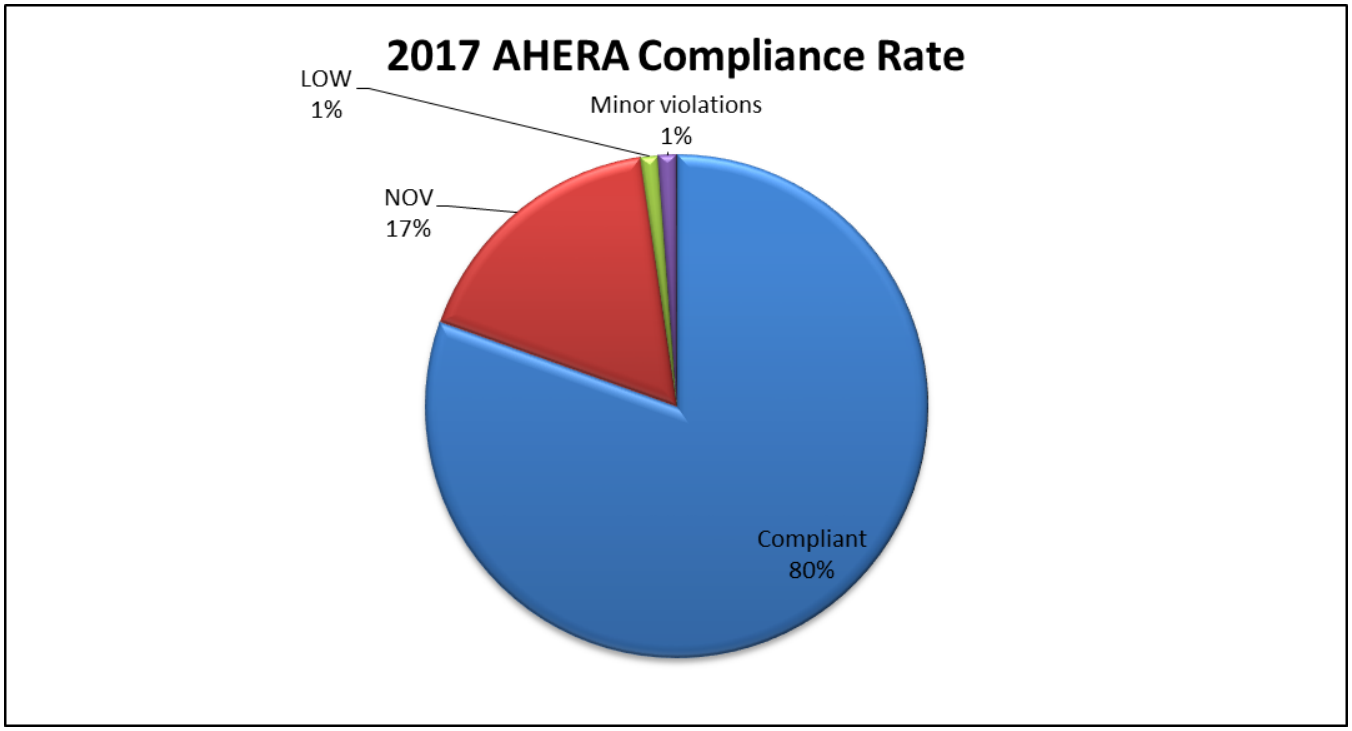


Figure 13: Compliance rate of school inspections for asbestos under the Asbestos Hazard Emergency Response Act (AHERA).

PERMIT REVIEW

The Permit Review Branch (PRB) issues air permits in compliance with federal and Kentucky regulations, which include the requirements and enforceable conditions an owner or operator must follow to comply with applicable air standards. The branch is divided into the following specialized sections:

- Air Dispersion Modeling - helps permitting engineers and the Division to analyze the effects of toxic air pollutants and hazardous air pollutants, and models emissions for SIP planning.
- Chemical Section – issues permits for chemical, petrochemical, plastic, resin, carbon and graphite industries.
- Combustion Section - issues permits for power plants, distilleries, wood drying, food drying, charcoal, landfill-gas-to-energy and bakeries.
- Metallurgy Section - issues permits for primary, secondary and miscellaneous metal production (copper smelting, iron foundries, steel industry, aluminum, etc.) and landfills.
- Minerals Section - issues permits for nonmetallic minerals, coal, asphalt, concrete, lime and grain plants.
- Surface Coating Section - issues permits for industries that use surface coating processes such as automobile and light duty trucks, large appliances, printing and publishing, metal furniture, paper, plastic parts and products, and wood and shipbuilding.
- Permit Support – reviews permits and permit applications for completeness, enters pollutants of concern data, and ensures public notices are sent out, public hearings are scheduled and permitting packages are submitted to the source and the EPA, as required.

In FY 2018, PRB issued 440 permits. Six of these were considered major economic development projects on which the Division and the Cabinet for Economic Development worked together to successfully complete.

At the close of FY 2018, PRB had 214 pending applications in-house. Of those applications, 53 were beyond regulatory timeframe. Figure 14 shows the number of permits issued by section for FY 2014-2018.

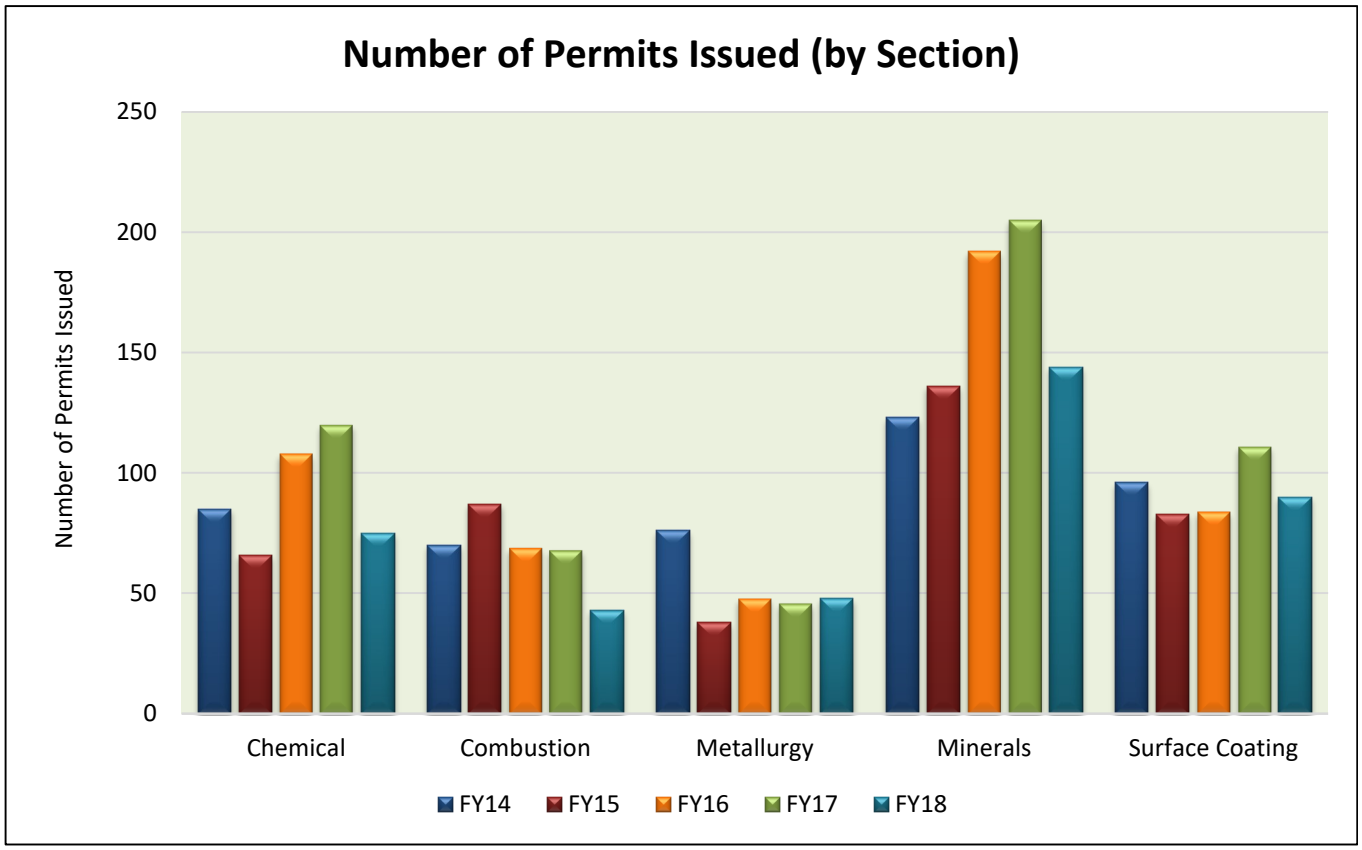


Figure 14: This chart shows the number of permits issued by section category in fiscal years 2014-2018.

On average, PRB receives over 800 permitting actions per year. These actions include new permit applications, permit renewals, permit revisions and changes, and registrations. Figure 15 shows new permit applications received compared to completed reviews for major and minor sources within Kentucky. Major sources are issued permits pursuant to 401 KAR 52:020 (Title V) and 401 KAR 52:030 (Federally Enforceable – FESOP). Minor sources that fall below the regulatory threshold are issued a State Origin Permit under 401 KAR 52:040, a registration under 401 KAR 52:070, or are determined to be an area or insignificant source.

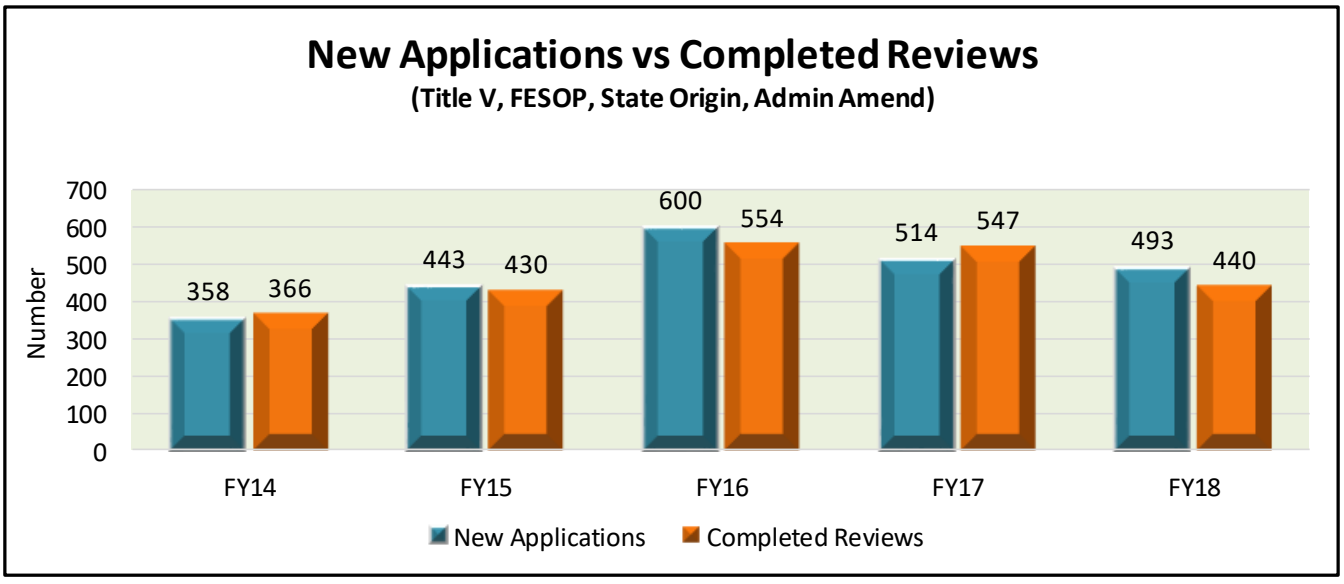


Figure 15: Major and Minor Source completed permits versus new applications in fiscal years 2014-2018.

Within the Major and Minor Source category, small changes often fall under the category of 502(b)10 or an Off-Permit Change. Figure 16 details these types of actions.

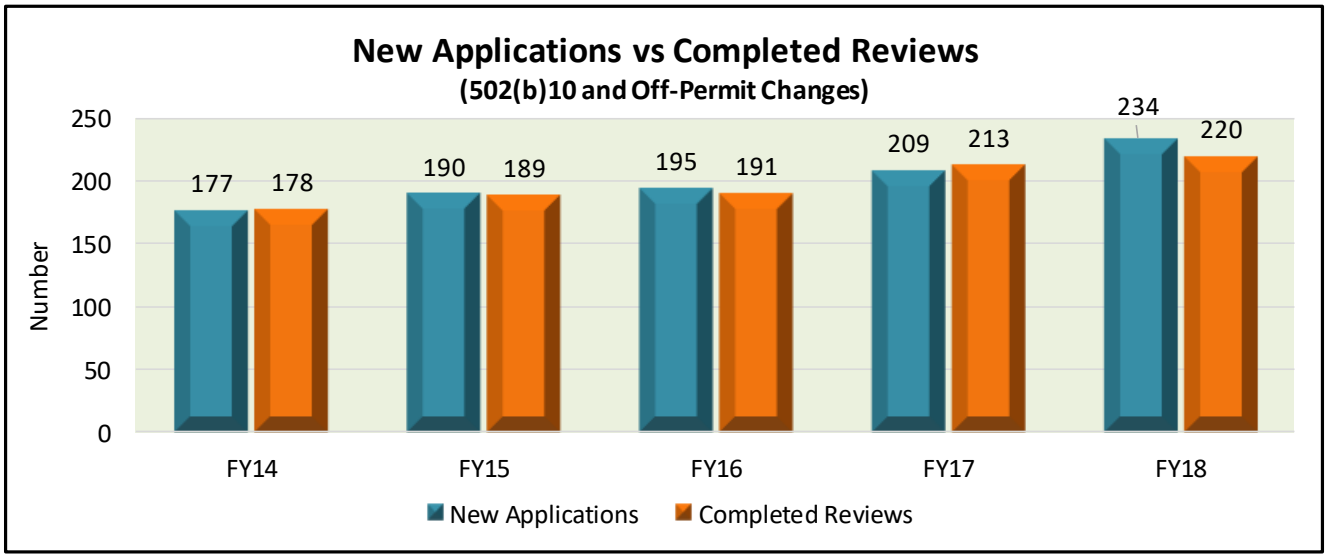


Figure 16: 502(b)10 and Off-Permit changes new applications compared to completed reviews for fiscal years 2014-2018.

Registrations comprise the final category of actions processed by the Permit Review Branch. Registered sources are sources that emit or have the potential to emit more than a baseline amount but less than the thresholds for Major and Minor permits (401 KAR 52:070).

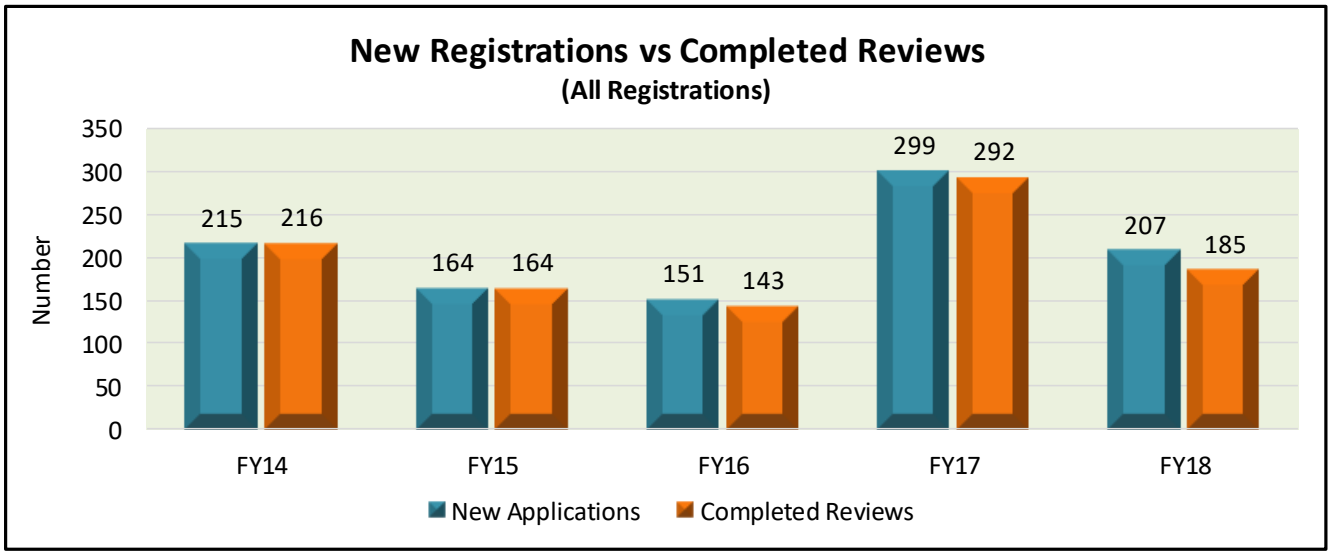


Figure 17: Numbers of completed registrations versus new applications in fiscal years 2014-2018.

The Division has significantly reduced the permit backlog and the number of permit applications that are beyond the allotted time for the complete permitting process, also known as the Regulatory Time Frame (RTF). The current number of pending applications represents a 70% reduction from 2006, and a decrease from the percentage of permits exceeding the RTF from 73% in 2006 to 25% in June 2018.

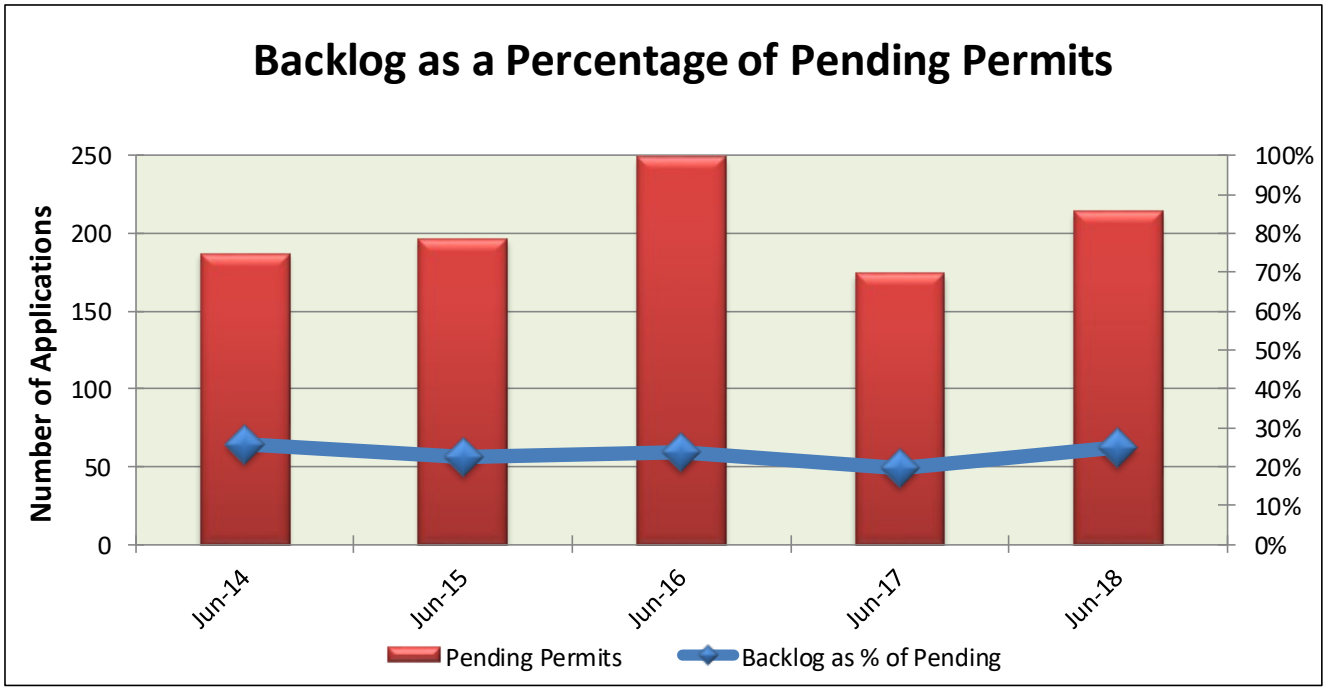


Figure 18: The Division tracks the number of permits that are in process as well as those beyond the Regulatory Time Frame (RTF). Over the past five years, the number of permits beyond the RTF has consistently hovered in the 22-25% range.

Air Dispersion Modeling

In FY 2018, the Air Dispersion Modeling Section performed a review of modeling or refined modeling for 3 criteria pollutant assessments and 44 air toxic assessments.

The section frequently uses modeling to refine the initial estimates from the screening analyses performed by the Permit Review Branch. These refined modeling runs have yielded data that has been used to verify, adjust, or establish limits in permits, justify permit conditions, and protect public health and air quality.

In addition to the modeling analyses and review, the Section also provides support to the Director's Office and Program Planning Branch in SIP-related matters. The Modeling Section reviewed and provided feedback for photochemical grid modeling that was required by the "good neighbor" provision of the 2008 Ozone NAAQS. The demonstration was included in Kentucky's Interstate Transport SIP submittal, and subsequently approved by the EPA.

FY 2018 also ushered in the organizational phase for the development of the revised Regional Haze SIP. The Air Dispersion Modeling Section participates in committee efforts through the Visibility Improvement State and Tribal Association of the Southeast (VISTAS) planning organizations. The Modeling Section worked with other southeastern states to select an appropriate contractor to perform the photochemical grid modeling required by the Regional Haze program.

PROGRAM PLANNING & ADMINISTRATION

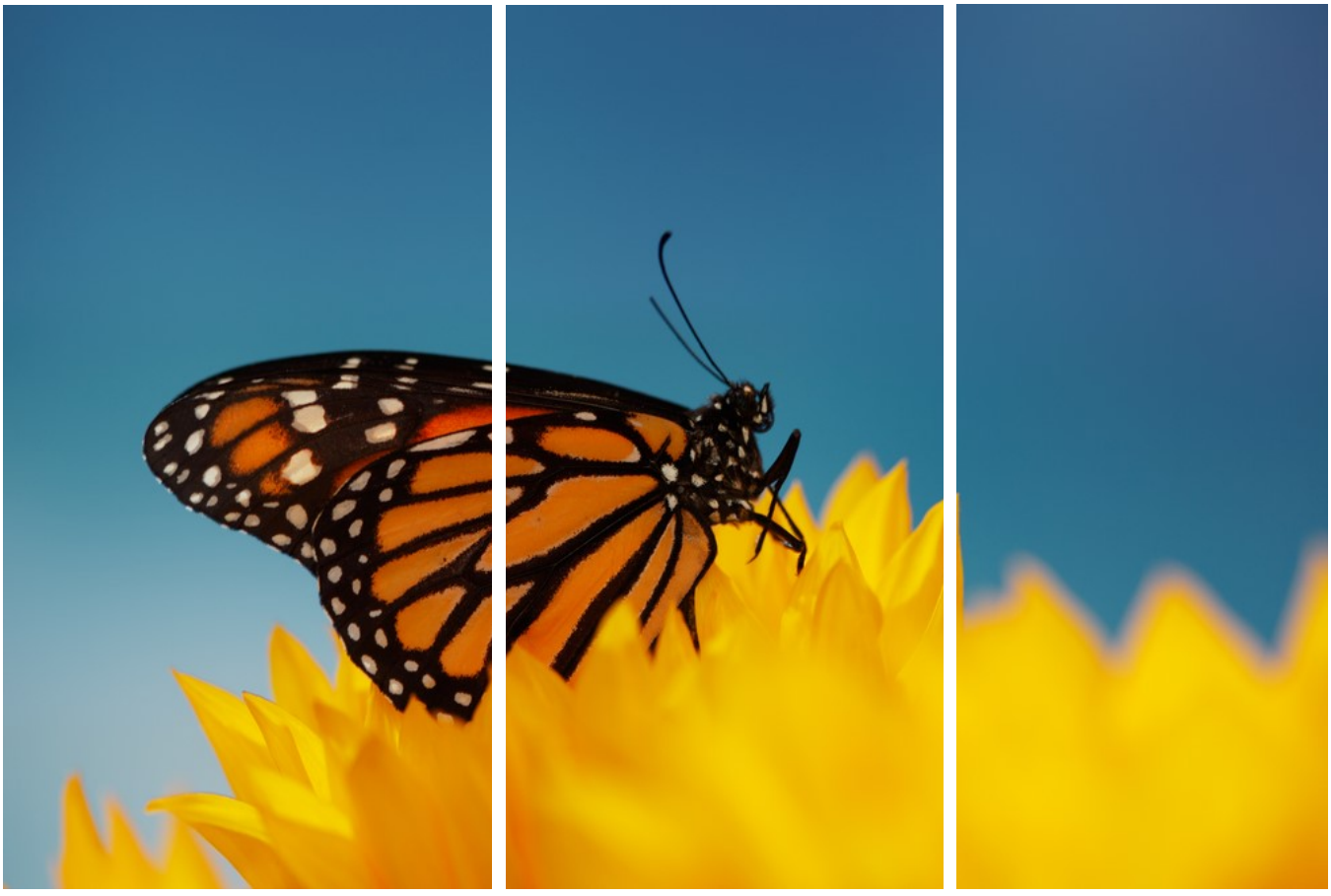
The Program Planning and Administration Branch (PPAB) is the planning and implementation cornerstone of the Division. This branch is responsible for:

- Fiscal management
- Emissions inventory
- Regulation development
- State implementation plan

Fiscal Management

The Division operates primarily on Title V emissions fees and federal grant funds. Funding under the Title V program (mandated by the Clean Air Act) is through air pollutant emission fees assessed to permitted air pollution sources in the state that meet specific criteria. Further authorized in Kentucky by state statute, the Division is mandated to charge fees sufficient to cover the cost of implementing and carrying out the requirements of the Title V program.

The Division surveys permitted sources subject to the Title V fee program each year. Once the agency has determined the overall cost of the program for the fiscal year, the number of tons of pollutants emitted in Kentucky are divided into the projected operating costs to develop a per ton cost. Each source, subject to air emission fees, will then be issued a bill based on that per ton cost. Concurrently, the Environmental Protection Agency (EPA) determines a minimum cost per ton of pollutant that an agency should charge to fund the Title V permitting program. This is referred to as the *presumptive minimum*. Figure 19 shows the comparison between the EPA presumptive minimum and the actual cost per ton that the Division has charged.



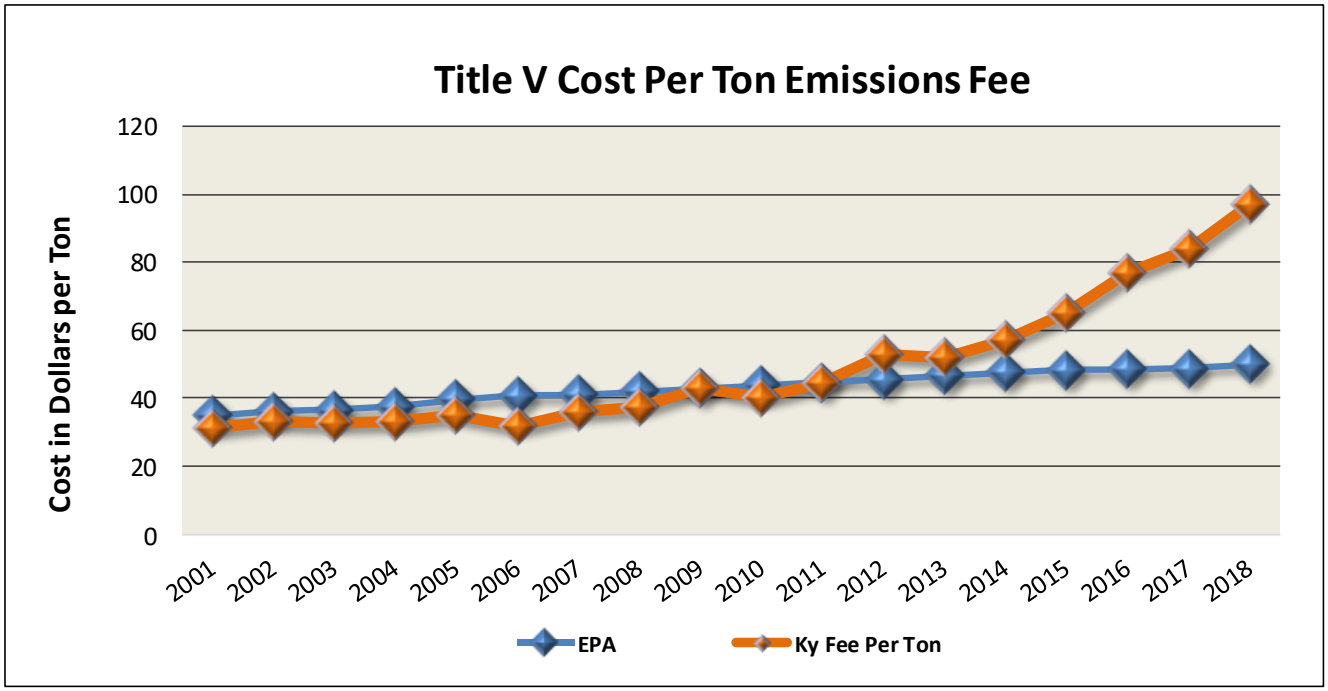


Figure 19: Title V Emission Fees Collected. This chart compares Kentucky's actual fees with EPA's "Presumptive Minimum," which is a suggested minimum fee per ton that states should charge.

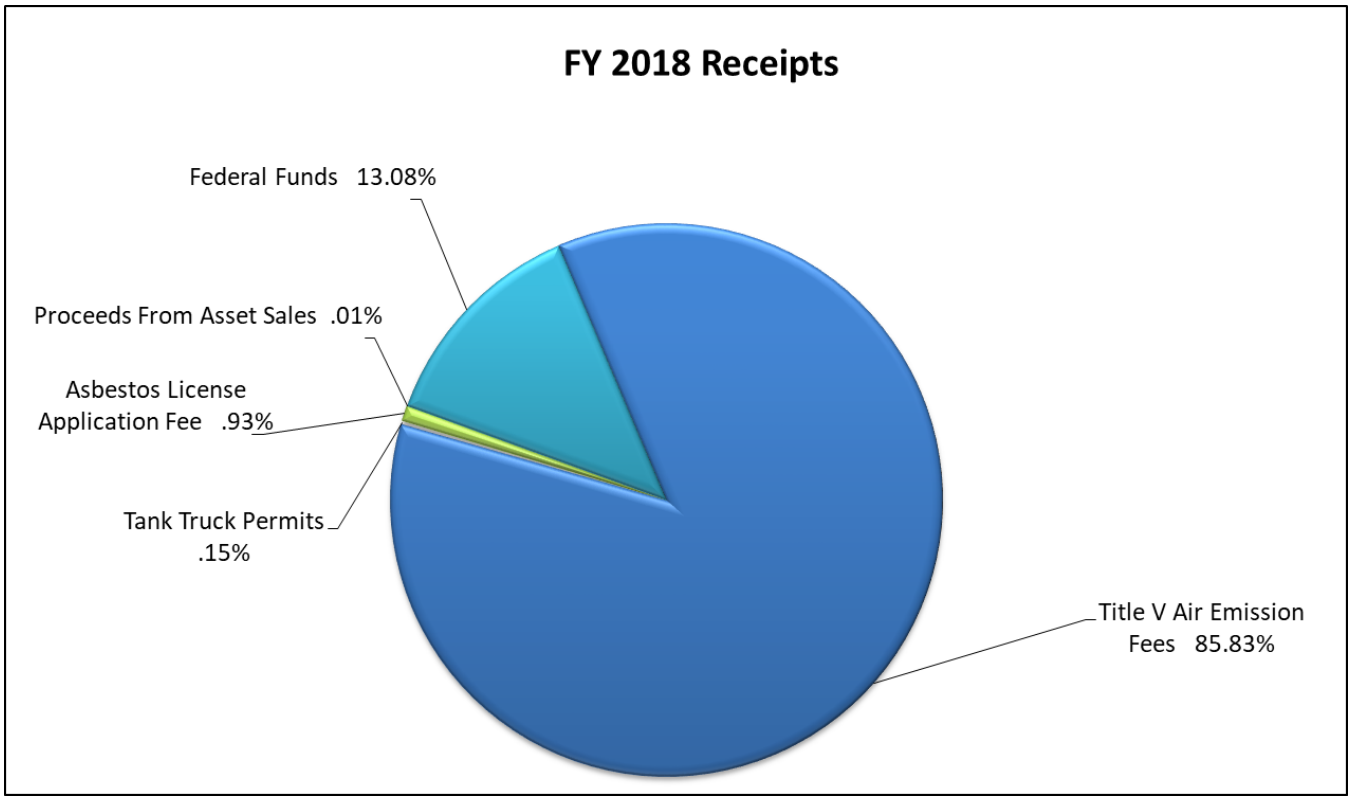


Figure 20: Division for Air Quality FY 2018 Receipts. The Division operates primarily on Title V emission fees and federal grant funds. Other funds are derived from non-state insurance recovery, proceeds from recyclable sales, and proceeds from asset sales.

A breakdown of the Division's revenue for FY 2018 is provided in Figure 20. In addition to Title V air emission fees, the Division receives funds from:

- Federal grant programs
- Tank truck permits
- Asbestos license and inspection fees

Emissions Inventory

The emissions inventory system is designed to document and track actual and potential air pollutant emissions. The data is then used to develop air quality improvement programs. In its most basic form, an emissions inventory is a list of sources of air pollutants, and for each source or source type, the amount of each pollutant emitted, or has the potential to be emitted.

Kentucky's point source emissions inventory is maintained by the Emissions Inventory Section. The main function of this section is to continue to improve the comprehensiveness and accuracy of point source emissions information, and ensure the information is current and useable by the Administration Section for billing calculations; the Program Evaluation Section for developing and evaluating emissions control programs; and the Permit Review Branch for permitting and modeling sources within a given geographic area.

The Emissions Inventory Section surveys nearly 1,200 plants per year to determine actual air pollutant emissions for the previous calendar year. Figure 21 shows the emissions inventory for 2016; at the time of

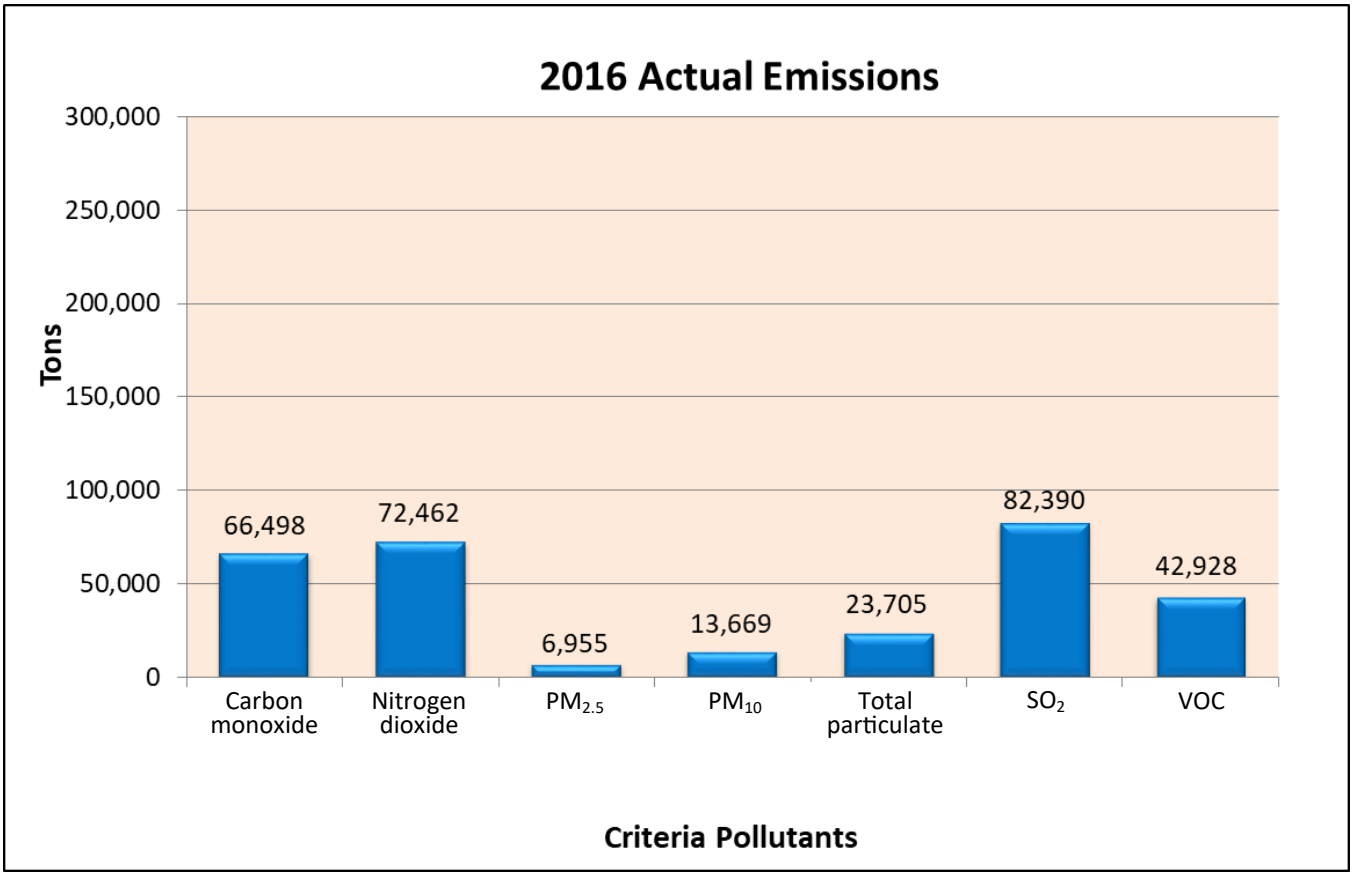


Figure 21: Actual tons of pollutants emitted by surveyed, regulated entities in Kentucky for the calendar year 2016. Although DAQ receives inventory emission data at the beginning of each calendar year, it takes approximately nine months to verify and complete the inventory.

publication of this report, data for calendar year 2017 was still being verified. It takes approximately nine months to verify and complete the inventory for the previous year.

Greenhouse Gas Emissions

EPA's Greenhouse Gas Reporting Rule requires mandatory reporting of greenhouse gases (GHGs) from sources that in general emit 25,000 metric tons or more of carbon dioxide equivalent (CO2e) per year in the U.S. Most small businesses fall below the 25,000 metric ton threshold and are not required to report GHG emissions to EPA.

Greenhouse Gas	2012 Actual Emissions (tons)	2013 Actual Emissions (tons)	2014 Actual Emissions (tons)	2015 Actual Emissions (tons)	2016 Actual Emissions (tons)
Carbon Dioxide	106,395,292	96,288,161	100,438,102	92,176,908	86,531,345
Methane	51,417	112,528	100,197	88,373	89,313
Nitrous Oxide	4,001	3,736	3,810	3,519	3,891
CO2e (metric tonnes)	98,624,914	90,545,487	94,096,177	86,712,303*	81,703,900
CO2e (tons)	108,715,363	99,809,319	103,723,251	95,583,925*	90,063,137

*Figure 22: Kentucky greenhouse gas emissions, 2012-2016. Landfills have always emitted methane but those emissions were not tracked until 2013. Emissions of GHGs are typically expressed in a common metric (CO2e) so that their impacts can be directly compared, as some gases have a higher warming potential than others. * The CO2e figures for 2015 utilize the IPCC's updated GWP factors. http://ghginstitute.org/2010/06/28/what-is-a-global-warming-potential/*

Though DAQ is not required to report GHG emissions on behalf of facilities, DAQ's Emissions Inventory section collects GHG data when available. Figure 22 above shows GHG emissions data from 2012 through 2016 calendar years.

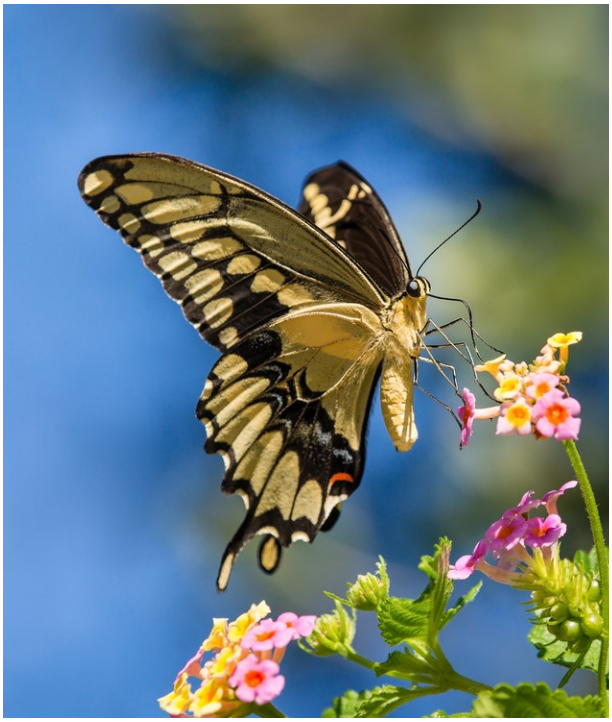
Regulation Development

The Regulation Development Section drafts and adopts regulations to control air pollution in the state. Regulations can be drafted in response to:

- Federal mandates to control air pollution or specific air pollution sources;
- A state mandate, made by either the governor or the legislature, to control air pollution within the Commonwealth; or
- An action identified by the Energy and Environment Cabinet (Cabinet) as necessary to protect human health and the environment.

Regulations can be adopted for specific controls to address specific air quality concerns within the state. While the agency receives its authority to draft and adopt air quality regulations under Kentucky Revised

Statute (KRS) Chapter 224, it is also governed on the drafting of those regulations by KRS 13A, which specifies regulatory drafting procedures as well as public participation in the regulatory promulgation process.



From July 2017 through June 2018, the Regulatory Development Section filed the following administrative regulations:

- December 15, 2017, 401 Kentucky Administrative Regulation (KAR) 59:015. *New indirect heat exchangers*; filed the Statement of Consideration and Amended After Comments version;
- December 15, 2017, 401 KAR 61:015. *Existing indirect heat exchangers*; filed the Statement of Consideration and Amended After Comments version;
- March 13, 2018, 401 KAR 51:240. *Cross State Air Pollution Rule (CSAPR) NO_X annual trading program*; filed the Statement of Consideration and Amended After Comments version;
- March 13, 2018, 401 KAR 51:250. *CSAPR NO_X ozone season group 2 trading program*; filed the Statement of Consideration and Amended After Comments version; and
- March 13, 2018, 401 KAR 51:260. *CSAPR SO_2 group 1 trading program*; filed the Statement of Consideration and Amended After Comments version.

On January 12, 2018, the Division submitted comments on the proposed rule, "Repeal of Carbon Dioxide Emission Guidelines for Existing Stationary Sources: Electric Utility Generating Units". Federal Registers relevant to the activities of the Division were reviewed and comments were compiled and submitted to EPA on this and other major federal regulatory proposed actions.

Finally, the Regulatory Development Section also conducted multiple research projects involving various topics designed to protect air quality throughout the Commonwealth of Kentucky, including but not limited to: granting concurrence to the regulations adopted by the Louisville-Metro Air Pollution Control District (LMAPCD); emissions trading; and several other research projects that will have a positive effect on air quality throughout the Commonwealth.

State Implementation Plan

The State Implementation Plan (SIP) is a state-specific plan to ensure attainment and maintenance of the various National Ambient Air Quality Standards (NAAQS) within a state or region. Once regulations or programs are adopted into the SIP, they become federally-enforceable. Overall, the framework and components of the SIP are designed to ensure that states continue to move forward in achieving air quality that meets the national standards, and once achieved, that air quality continues to maintain those standards. In short, the SIP is the mechanism for air resource management.

Air resource management begins with:

- A determination of existing conditions – air quality, meteorological conditions, and an inventory of emissions;

- Development of goals or objectives for an area (typically air quality standards that must be met or maintained); and
- Development of control strategies that may include emission reduction measures or measures to ensure no further degradation of air quality occurs.

A key component of air resource management, or SIP development, is coordination with the local communities that have a stake in how a plan is to be implemented.

The following section summarizes recent NAAQS revisions, area designations, and control strategies for each of the six criteria pollutants covered by the NAAQS. For a complete listing of the current NAAQS, see Appendix F beginning on Page 85.

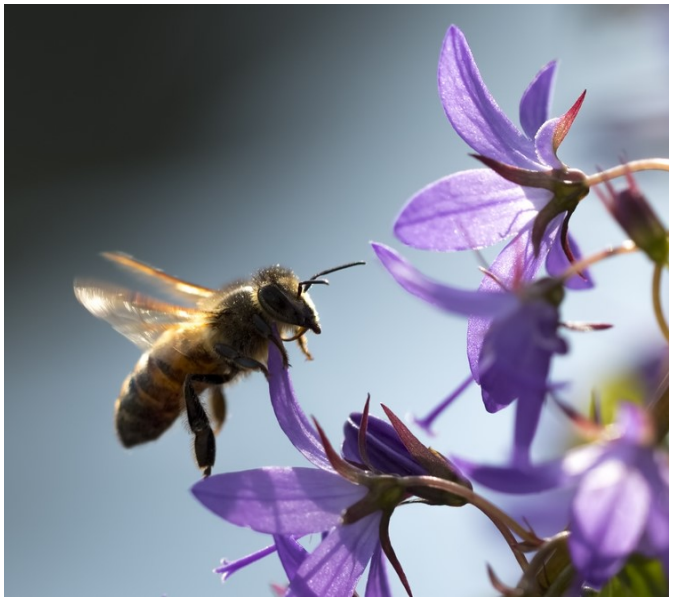
Ozone (O_3)

Ground-level ozone is a secondary pollutant that is formed when volatile organic compounds (VOCs) and nitrogen oxides (NO_x) combine in the presence of heat and strong sunlight.

On October 26, 2015, the EPA published *National Ambient Air Quality Standards for Ozone: Final Rule* in the Federal Register. The final rule revises the level of the primary Ozone NAAQS from the current level of 0.075 ppm to 0.070 ppm. On April 30, 2018, EPA designated portions of the Northern Kentucky counties of Boone, Campbell, and Kenton, and the counties of Bullitt, Jefferson, and Oldham as nonattainment (marginal) for the 2015 ozone standard. All remaining counties in Kentucky are designated attainment/unclassifiable.

On May 10, 2018, the Division prepared, and the Cabinet submitted, a final SIP revision addressing CAA Section 110(a)(2)(D)(i)(I) for the 2008 ozone NAAQS, known as the "good neighbor provisions" to the EPA. The Cabinet requested that the EPA approve this revision to the Kentucky SIP and find that Kentucky is not required to make any further reductions, beyond those required by the CSAPR Update, to address Kentucky's statutory obligation under CAA Section 110(a)(2)(D)(i)(I) for the 2008 ozone NAAQS. The EPA approved the SIP revision and the EPA administrator signed the final rule on June 28, 2018 (with an effective date of August 16, 2018).

Fine Particulate Matter (PM_{10} and $PM_{2.5}$)



Effective March 18, 2013, the EPA finalized the change in the annual $PM_{2.5}$ standard from 15 $\mu g/m^3$ to 12.0 $\mu g/m^3$, as calculated on an annual average. In a letter to the EPA, dated December 5, 2013, the Cabinet recommended all counties with certified air monitoring data be designated as attainment and those counties without certified monitoring data (the remaining portion of the state) be designated as attainment/unclassifiable.

On April 7, 2015, the EPA published a corrected designation of unclassifiable for the Louisville, KY-IN area for the 2012 annual $PM_{2.5}$ NAAQS. A May 4, 2018 letter from the Cabinet and the LMAPCD, submitted to the EPA, noted that sufficient, quality-assured ambient air monitoring data had been submitted to EPA's Air Quality System (AQS), and demonstrated that the area achieved the 2012 annual $PM_{2.5}$ NAAQS. The Cabinet requested that Jefferson and Bullitt (partial) counties in Kentucky be redesignated from unclassifiable to unclassifiable/attainment for the 2012 annual $PM_{2.5}$ NAAQS. The EPA approved the redesignation request and the EPA Administrator signed the final rule on August 8, 2018.

On February 8, 2016, the Cabinet submitted a final SIP certification letter to EPA, certifying that Kentucky's existing SIP contains the provisions of Section 110 of the CAA that address the requirements for purposes of implementing the 2012 $PM_{2.5}$ NAAQS. On August 8, 2017, the EPA approved portions of the submittal. The EPA did not take action on 110(a)(2)(D)(i)(I) prongs 1, 2, or 4, which covers interstate transport and visibility, and also did not take action on 110(a)(2)(C), which covers the minor source program requirements.

Nitrogen Dioxide (NO_2)

On February 9, 2010, the EPA strengthened the standard for NO_2. The new standard is set at a 1-hour level of 100 parts per billion (ppb). A February 17, 2012 Federal Register designated all areas in Kentucky as unclassifiable/attainment.

Sulfur Dioxide (SO_2)

On June 22, 2010, the EPA strengthened the NAAQS for SO_2. This standard had not been changed since 1971 and the EPA was required under a judicial consent decree to review the primary standard. On July 13, 2011, the EPA announced the proposed secondary standard, which addresses public welfare. The rule was finalized on April 3, 2012.

Effective October 4, 2013, a portion of Campbell County and a portion of Jefferson County were designated nonattainment for the 2010 SO_2 NAAQS. Campbell County was redesignated from nonattainment to attainment by EPA on March 10, 2017. The Division and LMAPCD prepared, and the Cabinet submitted, a nonattainment SIP revision to EPA on June 23, 2017, to address the Jefferson County nonattainment area. At the time of this publication, EPA had not taken action on the submittal.

As required by the 2010 SO_2 Data Requirements Rule (DRR), on January 6, 2017, the Division submitted documentation identifying the methods selected to characterize the air quality around the 16 sources within Kentucky to which the DRR applies. One facility selected to monitor emissions rather than model, and a new monitor was added to the Ambient Network Plan. This site was operational by the January 1, 2017 deadline.

Lead

The EPA revised the NAAQS for lead to 0.15 µg/m^3 in November of 2008. In an action final on December 27, 2011, the EPA also lowered the monitoring threshold from 1.0 tpy to 0.5 tpy.

Kentucky has been monitoring for lead as required, and all areas are in compliance.

On January 5, 2015, the EPA proposed to retain the current lead NAAQS of 0.15 µg/m^3. Effective November 17, 2016, EPA issued a final rule to retain the current NAAQS for lead.

Visibility

Regional haze is pollution that impairs natural visibility over a large region, including national parks, forests, and wilderness areas (known as "Class I" areas). As part of the CAA Amendments and further regulations adopted by the EPA, states must develop plans to restore natural visibility conditions in the 156 Class I areas throughout the nation by the year 2064. Kentucky's Mammoth Cave National Park is included in the list of areas.

Regional haze is typically caused by sources and activities emitting fine particles and their precursors, often transported over large regions. Particles affect visibility through the scattering and absorption of light. Reducing fine particles in the atmosphere is an effective method of improving visibility.

As required by the CAA and Regional Haze Rule, the Division submitted a final SIP revision that included Kentucky's Regional Haze 5-Year Periodic Report to the EPA for approval. As of the publication of this report, the EPA had not taken any action on Kentucky's submittal.

Reformulated Gasoline SIP Revision

On April 18, 2017, EEC Secretary Charles Snavely submitted a petition letter to the EPA administrator requesting to opt-out of the federal reformulated gasoline (RFG) program in the Northern Kentucky area. The signed petition letter met the requirements of 40 CFR 80.72(b). On September 13, 2017, the Cabinet submitted a final SIP revision to the EPA, requesting to opt-out of the federal RFG program. In accordance with CAA Section 110(l), Kentucky provided a non-interference demonstration. The demonstration concluded that opting-out of the federal RFG program in Boone, Campbell, and Kenton counties would not interfere with any applicable requirements concerning attainment or reasonable further progress in nonattainment or maintenance areas.

The SIP revision included updated on-road and non-road source emissions inventories reflecting the removal of RFG as a control measure for the Northern Kentucky area, and replaced those emissions inventories previously submitted with the redesignation request for the 2008 8-hour Ozone NAAQS. On April 2, 2018, the EPA Administrator approved the SIP revision and approved the Cabinet's petition to opt-out of the federal RFG program effective July 1, 2018.

TECHNICAL SERVICES

The Technical Services Branch (TSB) oversees three essential functions of the Division:

- Source sampling to ensure compliance with emission limits
- Operation and maintenance of a state-wide ambient air monitoring network
- Data analysis and quality assurance of ambient air monitoring data

Source Sampling

Facilities throughout the Commonwealth are required by federal regulations, state regulations and permits to sample the emissions being released from identified point sources. Samples must be collected and analyzed in accordance with federally promulgated test procedures and methods.

The Source Sampling Section, in conjunction with the Field Operations Branch and Permit Review Branch, reviews test protocols prior to the test to ensure proper procedures and methods will be followed. The Source Sampling Section also makes every effort to observe scheduled source tests throughout the Commonwealth. Following a test, a report is submitted to the Division where it is reviewed for accuracy and completeness. The compliance status of the facility is also determined based on the approved reported test results. Source tests are then reported to EPA's ICIS-Air database based upon data entered into the state-operated TEMPO database by the Source Sampling Section.

In 2017, the Source Sampling Section received 352 Compliance and Relative Accuracy Test Audit (RATA) test protocols by Kentucky facilities. 207 of these tests were scheduled compliance tests and 145 were scheduled RATA tests. The section reviewed all protocols for compliance tests that were received. The section received 28 cancellations during 2017 resulting in a total of 324 tests scheduled, as seen in Figure 23. The section observed 153 (74 percent) of the 208 scheduled compliance tests that were performed. Additionally, the Source Sampling Section received 343 RATA and Compliance test reports and completed 358 technical reviews of test reports, as seen in Figure 24.

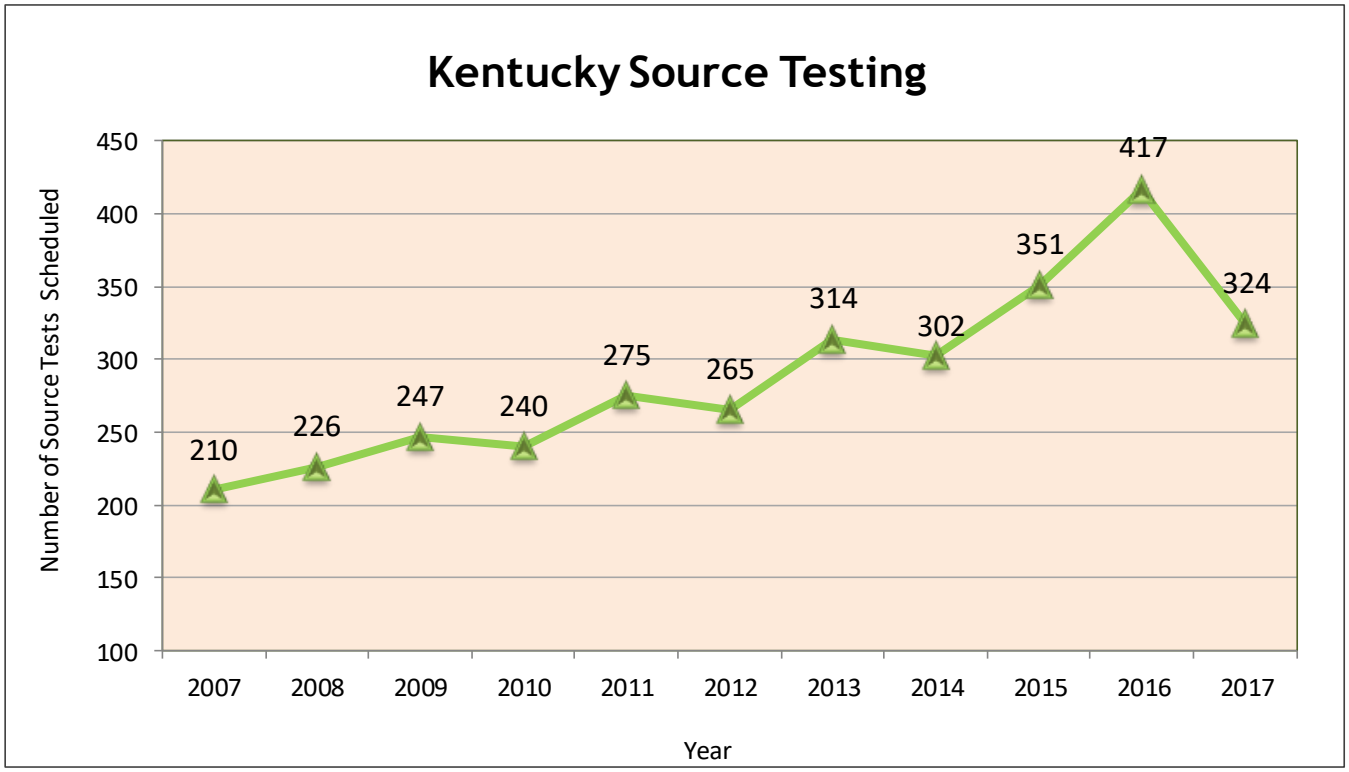


Figure 23: The last ten years have shown an overall increase in source testing throughout the state.

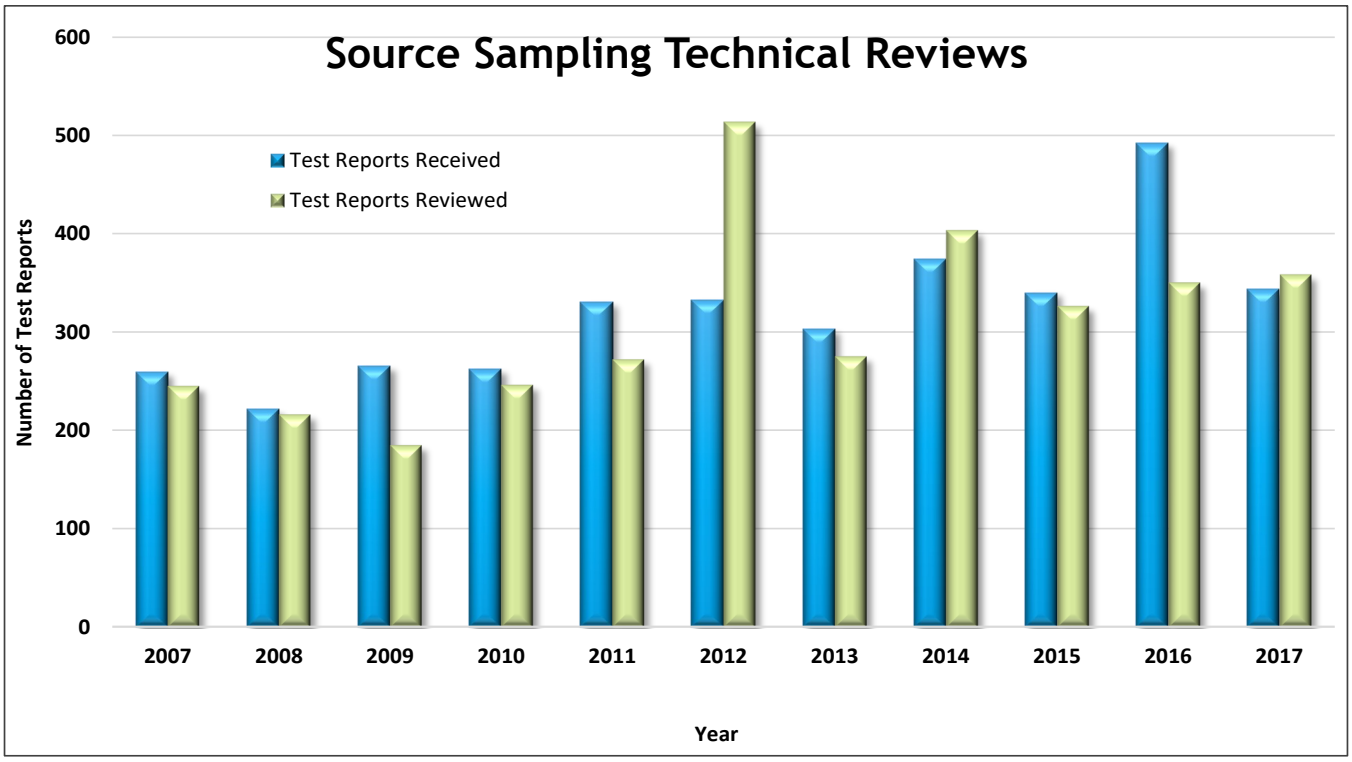


Figure 24: The Source Sampling Section successfully completed 358 technical reviews of source test report data in 2017.

Ambient Air Monitoring Network

Particulate matter sampler. (Photo: DAQ)

Kentucky has operated an ambient air monitoring network since 1967. The 2017 network included 35 monitoring stations in 26 counties; this total includes monitors operated by the Louisville Metro Air Pollution Control District (LMAPCD) and the National Park Service (NPS) at Mammoth Cave.

Locations of ambient air monitoring stations are selected in accordance with EPA regulations (40 CFR 58, Appendix D). In general, monitors are placed in densely populated areas or near sources of pollution, whether it's a busy highway or a stationary source with a smokestack. The site locations are reviewed annually to ensure that adequate coverage is being provided and regulatory requirements are met.

Each year, the Division is required to submit an annual Ambient Air Monitoring Network Plan, which describes the ambient air monitoring network in detail. The 2017 plan was submitted to the EPA by the July 1 regulatory deadline after undergoing a 30-day public comment period. The Ambient Air Monitoring Network Plan is available for review on the Division's website at http://air.ky.gov/Pages/DivisionReports.aspx.

Pages 34-71 of this Annual Report contain tables and graphs that summarize the concentrations of pollutants measured in Kentucky during the 2017 calendar year, as well as 2017 design values. A **design value** is a calculated metric that is used to determine compliance with each particular NAAQS. For many pollutants, a design value is calculated for each year and then averaged over a three-year period before being compared to a standard. However, some design values use alternate intervals of time for the calculation. For example, lead uses a 3-month rolling average and one of the two primary NAAQS for nitrogen dioxide uses an annual average.

The actual number of sites in operation in a calendar year may differ slightly from the network represented in the Network Plan. The network map on Page 32 is representative of the network, as submitted to the EPA. However, the maps of each individual pollutant network represent all monitors that collected data within the calendar year, which may differ from the network submitted to the EPA in the 2017 Ambient Air Monitoring Network Plan.

It is important to note that an *exceedance* of a particular pollutant is not the same as a *violation* of the NAAQS for that pollutant. Violations are determined according to the formula for each standard and involve the average of multiple measured values over a specified amount of time.

Gas chromatograph. (Photo: DAQ)

For specific information on criteria pollutant health effects, sampling, and analysis, see Appendix B: Criteria Pollutants beginning on Page 75. For a complete listing of the current NAAQS, see Appendix F beginning on Page 85.

Any data contained in this report is subject to change. The most current quality assured dataset can be obtained through a Kentucky Open Records Act request. Instructions for requesting data can be found at http://eec.ky.gov/Pages/OpenRecords.aspx.

Data Quality Assurance

TSB validates all ambient data collected by the monitors and samplers in the network. Upon completing its review of 2017 data, the Division submitted its annual data certification request to EPA prior to the May 1 regulatory deadline. This data certification package includes reports that summarize all the hours of valid data collected and the quality control measures taken to ensure the accuracy of the data, as well as the number of annual performance evaluations completed.

TSB maintains a library of Quality Assurance Project Plans (QAPPs) and Standard Operating Procedures (SOPs) for each instrument operated in the monitoring network. Overall, there are three active and current QAPPs, as well as 18 active SOPs, in the DAQ library.

In 2017, personnel within the TSB conducted a total of 362 performance audits of air monitoring equipment throughout Kentucky; this number includes performance audits conducted on monitors operated by Mammoth Cave National Park and the Louisville Metro Air Pollution Control District. Such audits are crucial to ensuring data quality and verifying instrument function. Additionally, a total of 30 technical systems audits were performed to ensure that operational procedures at each site were followed.

TSB staff also completed a total of 220 instrument service trips in the field and repaired an additional 110 monitors in-house in 2017. Acceptance testing was conducted on 14 newly purchased instruments, in order to ensure that stated specifications were met by the manufacturer.

TSB provides oversight for the contract laboratories utilized for analysis of ambient air monitoring samples. Particulate matter filters are sent to a contract laboratory for gravimetric analysis, which is conducted in accordance with EPA-approved methods. Similarly, lead filters and air toxics samples are sent to a contract laboratory for chemical analysis. The results of all analysis outsourced to contract laboratories are returned to the TSB for final review prior to use by decision-makers.

TSB staff participated in several trainings in 2017-18. (Photo: DAQ)

TSB continues to implement a robust training program, which focuses on providing Division air monitoring staff with the foundation necessary to collect and analyze ambient air data. TSB staff continue to participate in a number of local and national workgroups. Staff presented at several conferences and meetings during the year.

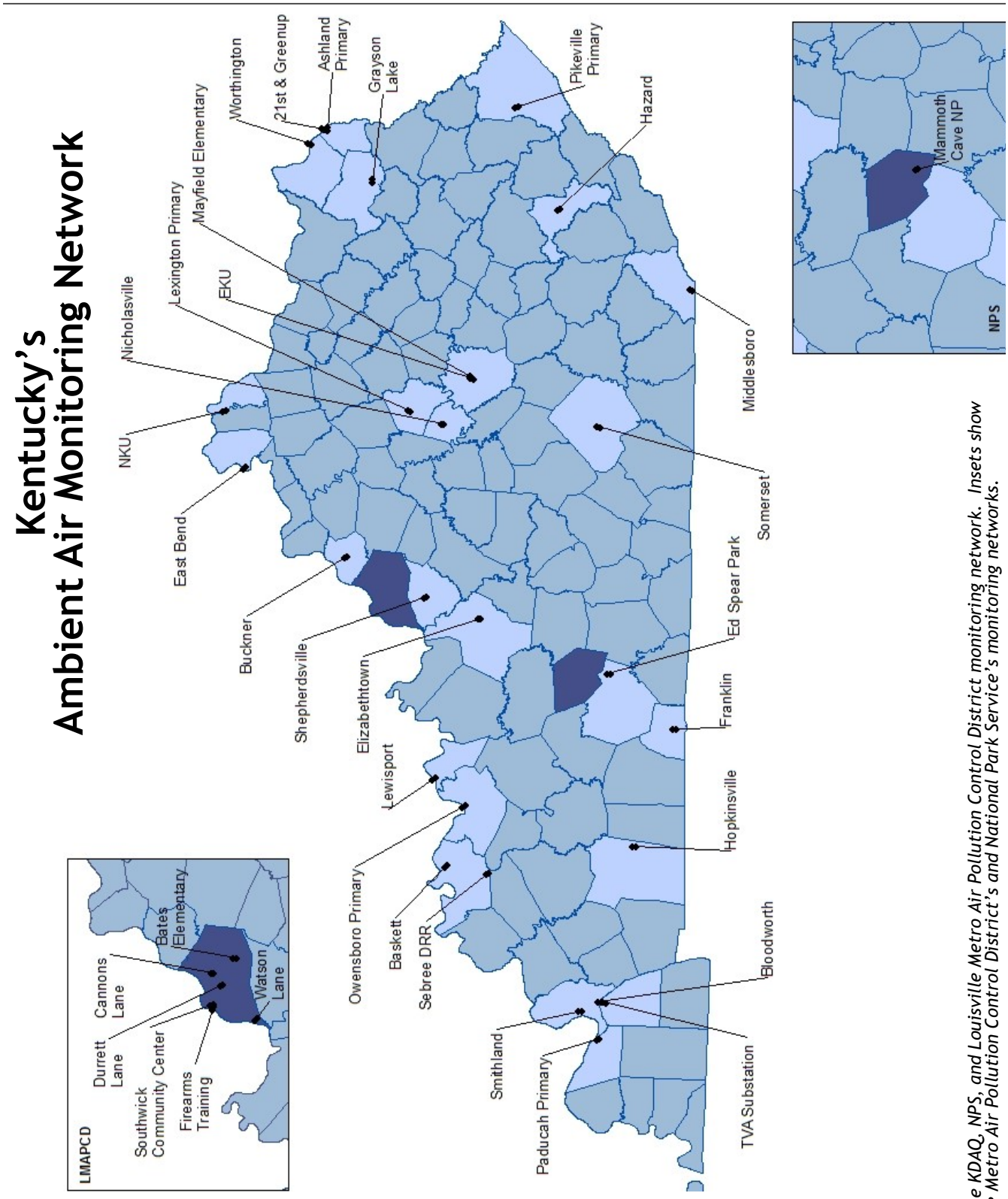


Figure 25: The KDAQ, NPS, and Louisville Metro Air Pollution Control District monitoring network. Insets show the Louisville Metro Air Pollution Control District's and National Park Service's monitoring networks.

Metropolitan Statistical Area	Site Count	$PM_{2.5}$	Continuous $PM_{2.5}$	PM10	Continuous PM_{10}	SO_2	NO2	NO_y	CO	O_3	Pb	VOC	Car-bonyl	PAH	$PM_{2.5}$ Speciation	Carbon Speciation	RadNet	Met
Bowling Green, KY	2	2^{C}	2^{i}			1		1	1	$2^{i, Max}$								1
Cincinnati-Middletown, OH-KY-IN (AQI) (PWEI)	2	1	1^{i}			1^{i}	1^{i}			2^{i}								1
Clarksville, TN-KY	1	1^{X}								1								1
Elizabethtown, KY	1	2^{C}	1							1^{Max}								
Evansville, IN-KY (PWEI)	2	1	1	1^{m}		2 DRR				1^{Max}								
Huntington-Ashland, WV-KY-OH (AQI) (PWEI)	3	1	$1^{i,S}$	$2^{C,m}$		2^{i}	1^{i}			$2^{i, Max}$		1						1
Lexington-Fayette, KY (AQI) (PWEI)	2	1	1^{i}	1^{m}		2^{i}	$1^{r40,i}$			$2^{i, Max}$							1	1
Louisville-Jefferson County, KY-IN (AQI) (PWEI)	8	$5^{n,C}$	$3^{i,B,*}$		$2^{i,,B}$	3^{i}	$2^{n,i}$	1	2^{ni}	$5^{i, Max}$					1^{U}	1^{U}	1	6^{n}
Owensboro, KY	2	1	$1^{i,S}$			1^{i}	1^{i}			$2^{i, Max}$								1
Micropolitan Statistical Area																		
Paducah, KY-IL (PWEI)	3	1	$1^{i,S}$	2^{m}		1^{i}	1^{i}			2^{i}		1					1	1
Somerset, KY	1	1								1								
Middlesboro, KY	1	1								1								1
Richmond-Berea, KY	2	1									3							
Not in a CBSA																		
Carter County	1	1^{X}		$2^{C,m}$						1		2^{D}	2^{D}	1				1
Marshall County	2											2^{C}						
Perry County	1	1	1							1								1
Pike County	1	2^{C}	1^{i}							1^{i}								
Simpson County	1									1								1
KDAQ Totals	28	18	10	8	0	9	5	0	0	22	3	6	2	1	0	0	2	11
LMAPCD Totals	6	5	3	0	2	3	2	1	2	3	0	0	0	0	1	1	1	5
NPS Totals	1	0	1	0	0	1	0	1	1	1	0	0	0	0	0	0	0	1
Total 2017 Network	**35**	**23**	**14**	**8**	**2**	**13**	**7**	**2**	**3**	**26**	**3**	**6**	**2**	**1**	**1**	**1**	**3**	**17**

Tallies are equal to the actual number of monitors present. Superscripts represent additional information about the network. PWEI= PWEI SO2 Monitoring Required in MSA; r40=RA-40 Monitor; Max= Maximum O3 Concentration Site; n=Near-Road Monitor; X= Regional PM2.5 Transport or Background Monitor; B=Continuous BAM; *=BAM Eligible for NAAQS Comparisons; AQI=AQI Monitoring Required in CBSA; i=AQI Reported; m= PM10 Filter Analyzed for Metals; Lead=PM10 Filter Analyzed for Lead; C=Collocated Monitors ; D= Duplicate Channels; DRR= SO2 Data Requirements Rule Monitor; S= Continuous PM T640; NO_y= Total Reactive Nitrogen

2017 Carbon Monoxide Ambient Air Monitoring Network
(Louisville Metro Air Pollution Control District and National Park Service)

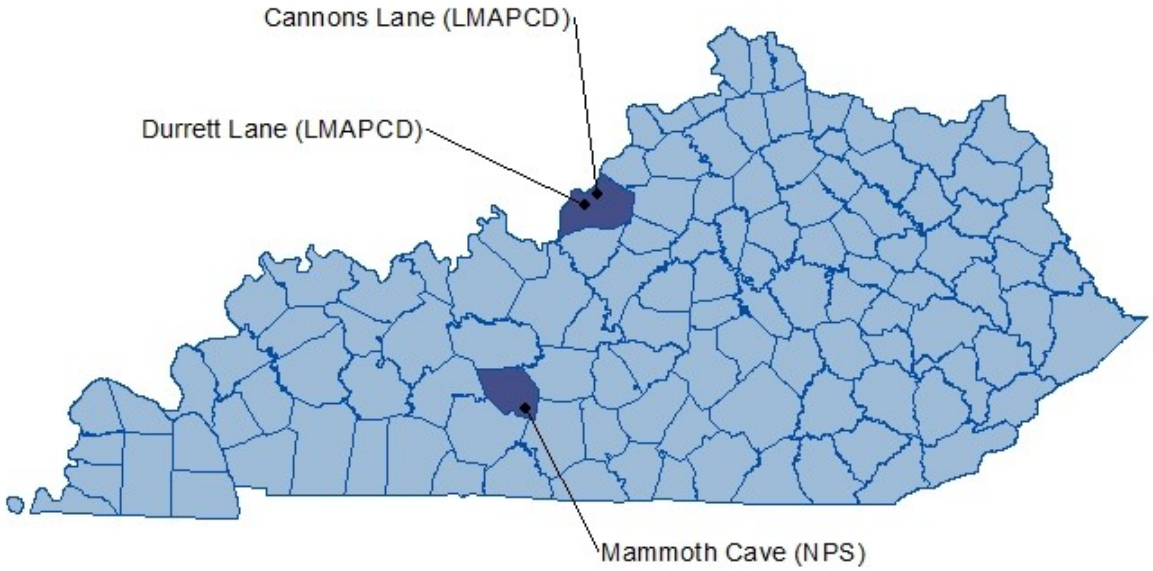


Figure 26: Carbon monoxide monitoring in Kentucky is currently only conducted by the Louisville Metro Air Pollution Control District and the National Park Service. Jefferson County historically has had higher levels of CO than elsewhere in the state, perhaps due to the high levels of vehicle traffic in the area.

Statewide Averages for Carbon Monoxide

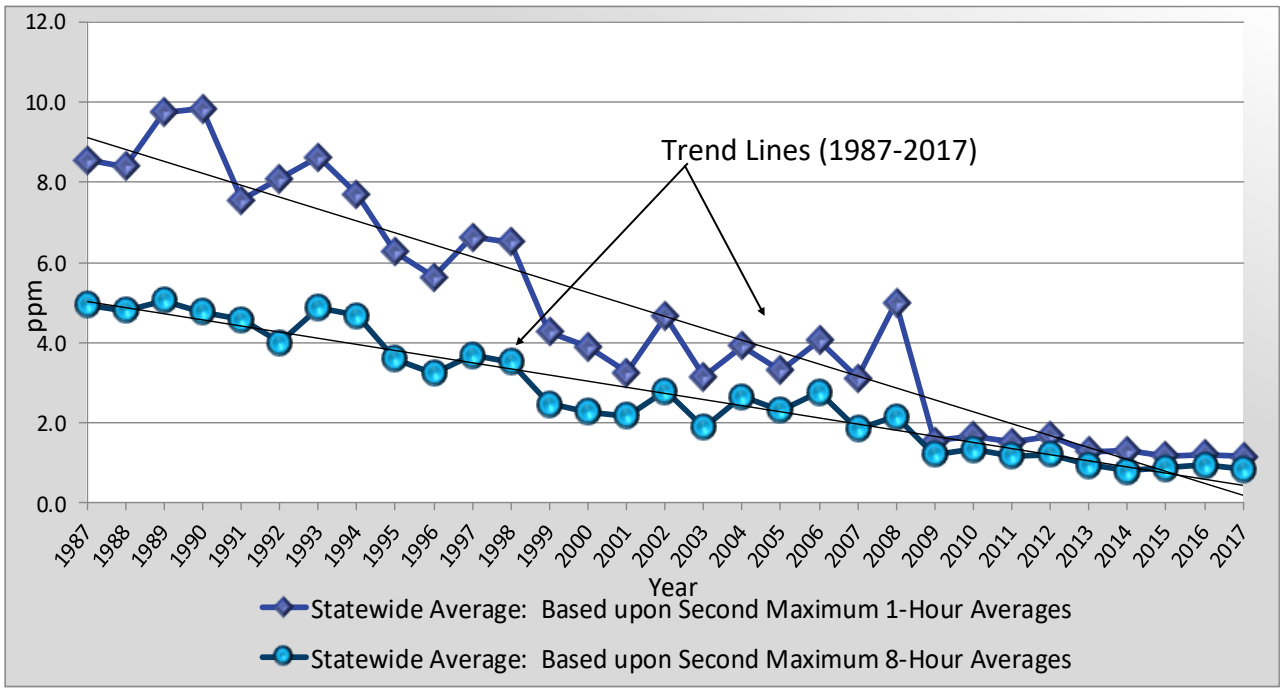


Figure 27: Statewide averages for CO monitoring indicate pollution reductions.

Carbon Monoxide Results

There were no exceedances of the CO standards in 2017. The last exceedance of a standard occurred on Jan. 7, 1998, in Ashland when an 8-hour average of 11.7 ppm was recorded. All Kentucky counties are currently in attainment of the standards for carbon monoxide. In 2017, the Louisville Metro Air Pollution Control District operated two CO monitors, while the National Park Service operated one CO monitor at Mammoth Cave National Park.

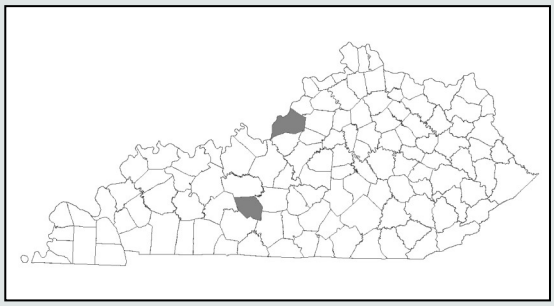
Statewide and regional carbon monoxide levels have declined substantially since 1980, primarily due to improved emission controls on motor vehicles. Due to the substantial drop in monitored levels, carbon monoxide monitoring was discontinued statewide in 2003, except for Jefferson County. The 2003 statewide discontinuation of CO monitors accounts for the uptrend from 2003 to 2008, as seen in Figure 26, because the annual average had been based on data only from Jefferson County. Jefferson County has historically had higher CO levels than the rest of the state. In 2009, another dramatic shift, this time downward, can be attributed to the establishment of monitoring at Mammoth Cave, a rural area with fewer mobile sources.

National Ambient Air Quality Standards for Carbon Monoxide

Primary NAAQS:	8-hour average not to exceed 9 ppm more than once per year 1-hour average not to exceed 35 ppm more than once per year
Secondary NAAQS:	None

Criteria Pollutant Summary Report - 2017

Pollutant: **Carbon Monoxide**
Method: Instrumental/Non-Dispersive Infrared Photometry
Data Interval: Hourly
Units: Parts-per-million (ppm)



County	Site Address	AQS-ID	# Obs	1-Hr Averages			8-Hr Averages		
				1st max	2nd max	Obs> 35.0	1st max	2nd max	Obs> 9
Edmonson[1]	Alfred Cook Rd Mammoth Cave	21-061-0501	7763	0.53	0.31	0	0.3	0.3	0
Jefferson[2]	2730 Cannons Ln Louisville	21-111-0067	8069	1.78	1.35	0	1.1	0.9	0
Jefferson[2]	1517 Durrett Lane Louisville	21-111-0075	8249	1.80	1.79	0	1.6	1.3	0

[1] Monitor operated by the National Park Service.
[2] Monitor operated by the Louisville Metro Air Pollution Control District.

2017 Lead Ambient Air Monitoring Network

Figure 28: Lead monitoring locations in Kentucky.

Three-Month Rolling Averages for Lead

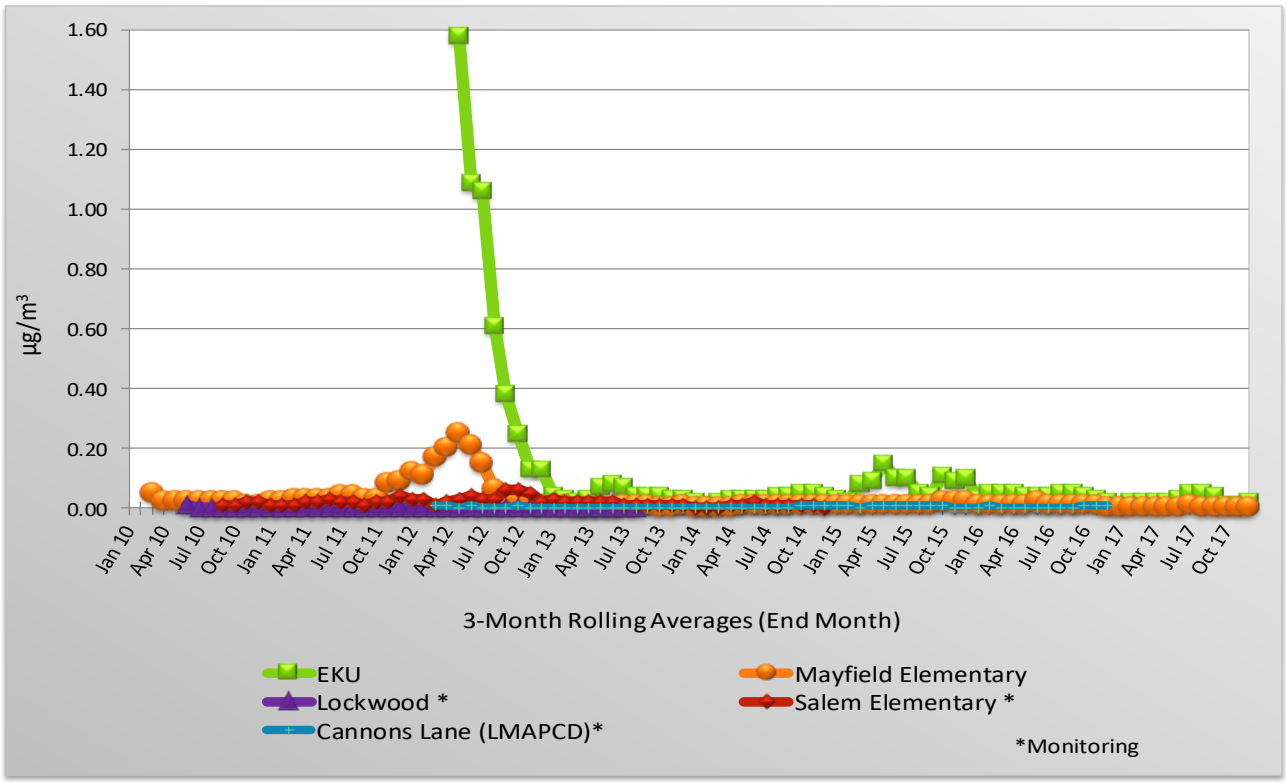


Figure 29: Three-month rolling averages for lead for each site in operation since 2010. Each three-month average is plotted on the month that the three-month period ended. Monitoring data is only available for 2010-2017.

Lead Results

In 2012, the Mayfield Elementary and Eastern Kentucky University sites in Richmond were affected by a compliance issue with a single stationary source. Lead monitors at the two sites registered multiple three-month rolling averages above the 0.15 µg/m^3 NAAQS standard. The compliance issue was resolved, and monitoring data shows that lead concentrations have steadily decreased since that time. There were no exceedances of the three-month rolling NAAQS in 2017.

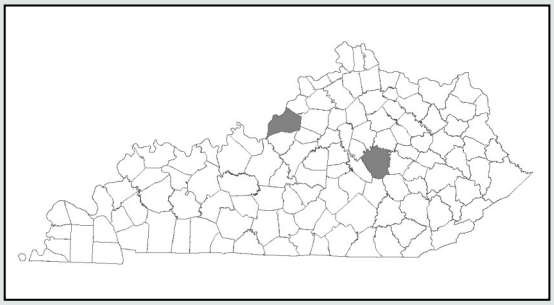
National Ambient Air Quality Standards for Lead

Primary NAAQS: Rolling 3-month average not to exceed 0.15 µg/m^3

Secondary NAAQS: Same as primary standard

Criteria Pollutant Summary Report - 2017

Pollutant: **Lead**
Method: High volume sampler; Inductively Coupled Plasma-Mass Spectroscopy
Data Interval: 24-hour
Units: Micrograms per cubic meter (µg/m^3)



County	Site Address	AQS-ID	# Obs	Rolling 3-Month Average				
				1st max	2nd max	3rd max	4th max	Obs > 0.15
Madison	Mayfield Elem, Bond St Richmond	21-151-0003	59	0.01	0.00	0.00	0.00	0
Madison	EKU, Van Hoose Dr Richmond	21-151-0005	61	0.05	0.05	0.04	0.03	0

NITROGEN DIOXIDE (NO_2)

2017 Nitrogen Dioxide Ambient Air Monitoring Network

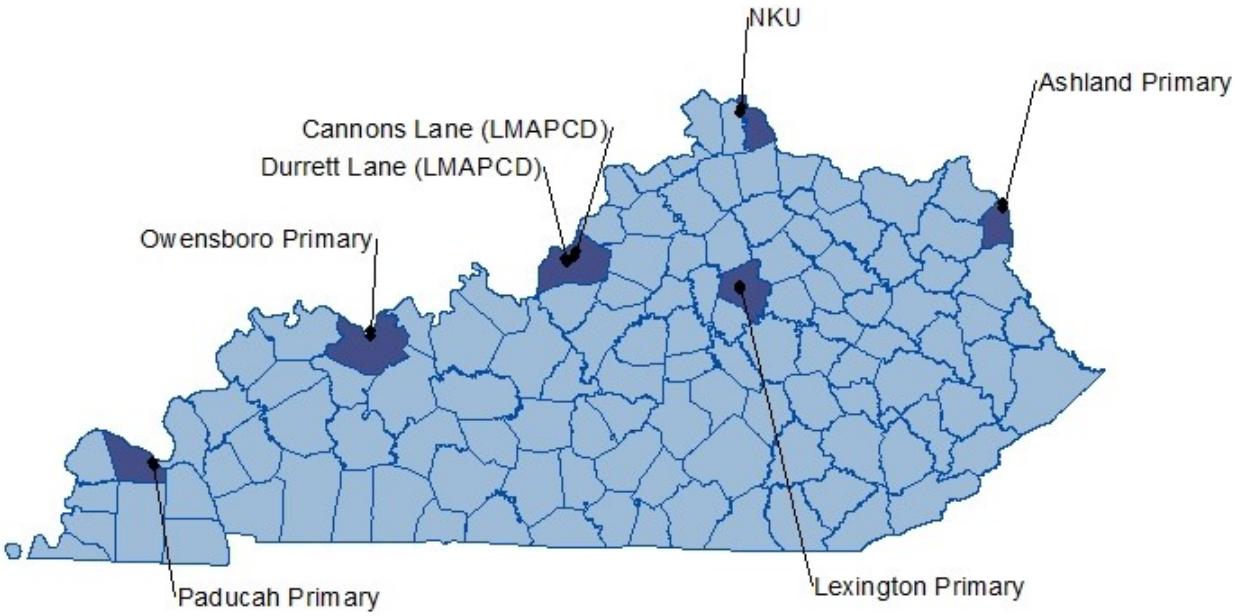


Figure 30: Nitrogen dioxide monitoring locations in Kentucky.

Statewide Averages for Nitrogen Dioxide

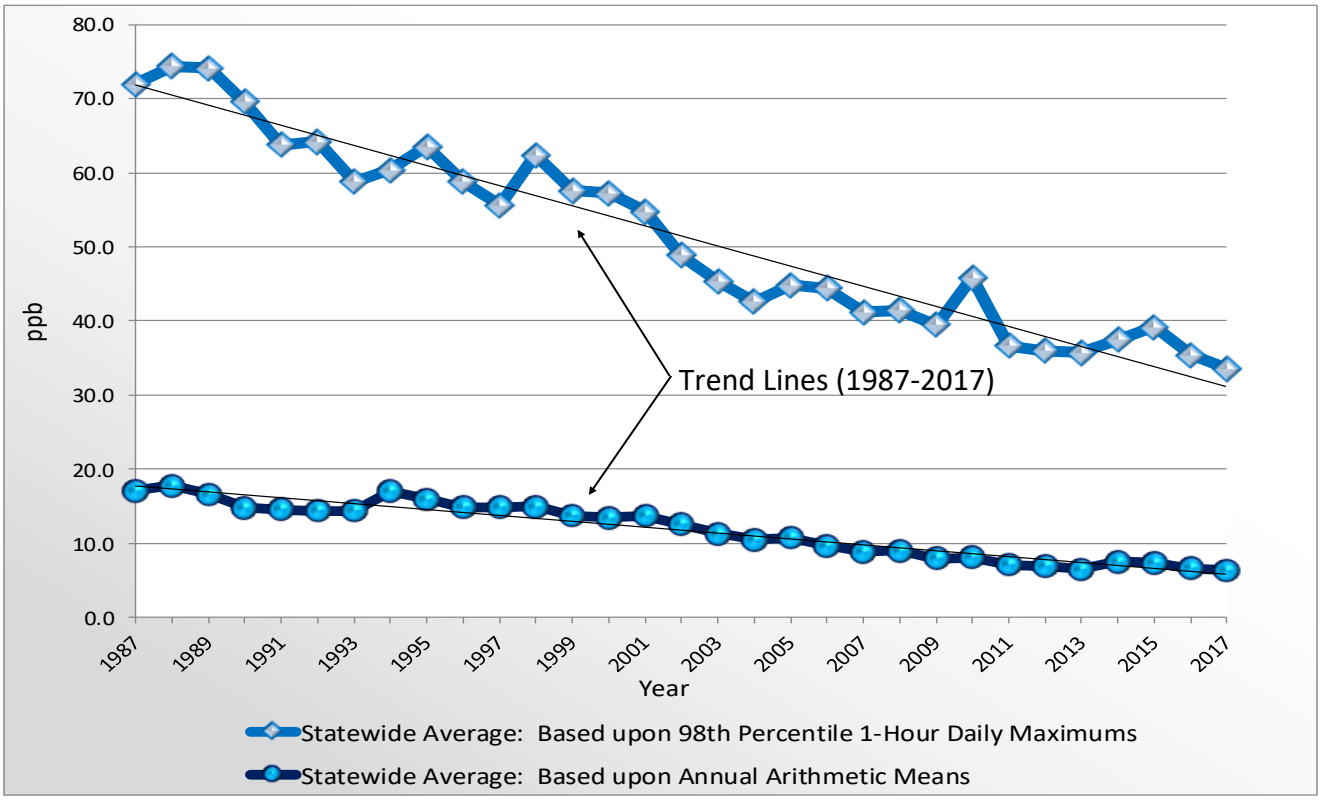


Figure 31: Statewide averages for nitrogen dioxide monitoring indicate pollution reductions.

Nitrogen Dioxide Results

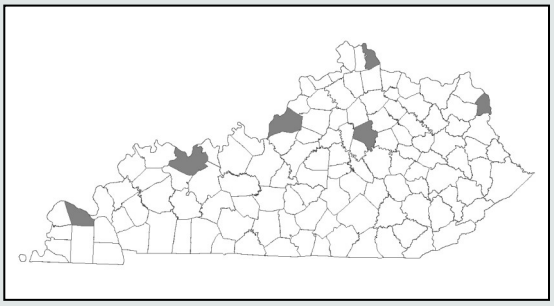
There have been no recorded exceedances of a NO_2 NAAQS since the inception of sampling in 1970. Overall, statewide nitrogen dioxide levels show a steady downward trend, primarily due to the use of pollution control devices on motor vehicles, power plants, and industrial boilers. In 2017, the Division and the LMAPCD operated seven nitrogen dioxide monitors in Kentucky.

National Ambient Air Quality Standards for Nitrogen Dioxide

Primary NAAQS:	Annual arithmetic mean must not exceed 53 ppb 3-year average of the 98th percentile of daily maximum one-hour averages must not exceed 100 ppb
Secondary NAAQS:	Annual arithmetic mean must not exceed 53 ppb

Criteria Pollutant Summary Report – 2017

Pollutant: **Nitrogen Dioxide**
Method: Instrumental/Gas-Phase Chemiluminescence
Data Interval: Hourly
Units: Parts-per-billion (ppb)



County	Site Address	AQS-ID	# Obs	1-Hr Daily Maximum			Annual Mean
				1st max	2nd max	Obs > 100	
Boyd	2924 Holt Street Ashland	21-019-0017	8183	35.0	34.0	0	4.26
Campbell	524A John Hill Rd Highland Heights	21-037-3002	7557	32.0	29.0	0	2.94
Daviess	US60 & Pleasant Valley Rd Owensboro	21-059-0005	7553	30.0	30.0	0	4.23
Fayette	650 Newtown Pike Lexington	21-067-0012	7171	40.0	38.0	0	4.78
Jefferson[1]	2730 Cannons Ln Louisville	21-111-0067	6292	47.5	44.6	0	8.87*
Jefferson[1]	1517 Durrett Ln Louisville	21-111-0075	8367	59.5	55.4	0	14.58
McCracken	2901 Powell Street Paducah	21-145-1024	7581	41.0	38.0	0	4.61

[1] Monitor operated by the Louisville Metro Air Pollution Control District.
* The mean does not satisfy summary criteria.

NO_2 Criteria Pollutant Multi-Year Summary Report – 2017
98th Percentile Daily 1-Hour Maximum, 3-Year Average

County	Site Address	AQS-ID	98th Percentile Daily Maximum 1-Hr Averages				
			2015	2016	2017	3-Yr Avg	Obs > 100
Boyd	2924 Holt Street Ashland	21-019-0017	35.0	29.0	30.0	31	0
Campbell	524A John Hill Road Highland Heights	21-037-3002	32.0	26.0	24.0	27	0
Daviess	US 60 & Pleasant Valley Rd Owensboro	21-059-0005	33.0	29.0	28.0	30	0
Fayette	650 Newtown Pike Lexington	21-067-0012	41.0	43.0	35.0	40	0
Jefferson[1]	2730 Cannons Ln Louisville	21-111-0067	44.0	40.4	39.9	41	0
Jefferson[1]	1517 Durrett Ln Louisville	21-111-0075	50.2	49.2	47.0	49	0
McCracken	2901 Powell Street Paducah	21-145-1024	39.0	31.0	31.0	34	0

[1] Monitor operated by the Louisville Metro Air Pollution Control District.

2017 Ozone Ambient Air Monitoring Network

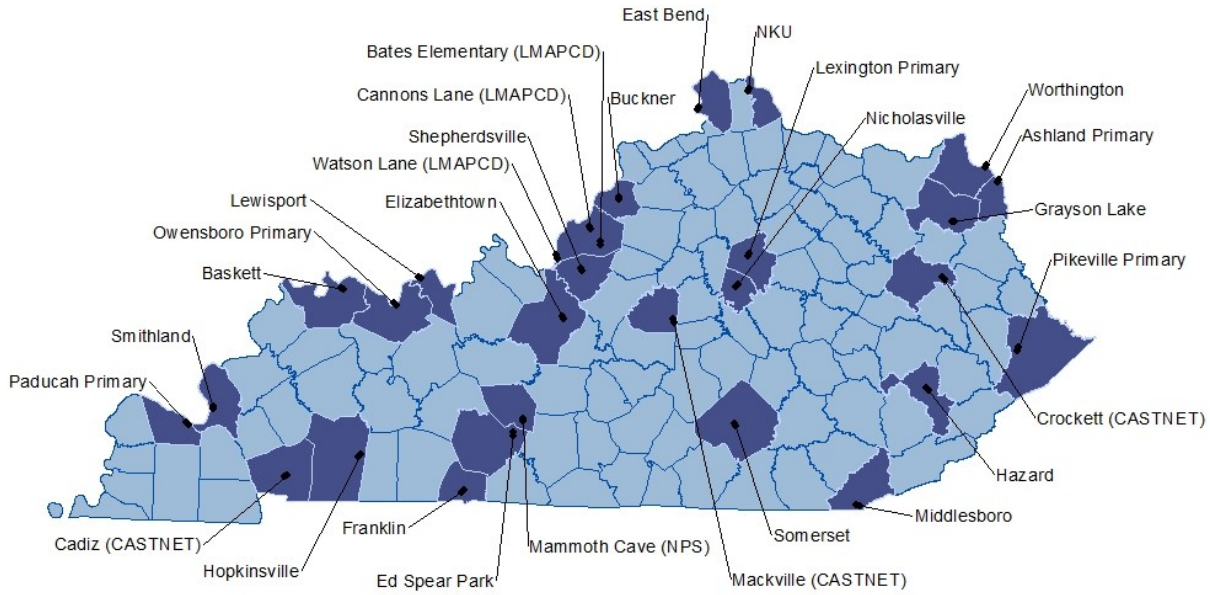


Figure 32: Ozone monitoring locations in Kentucky.

Statewide Averages for Ozone

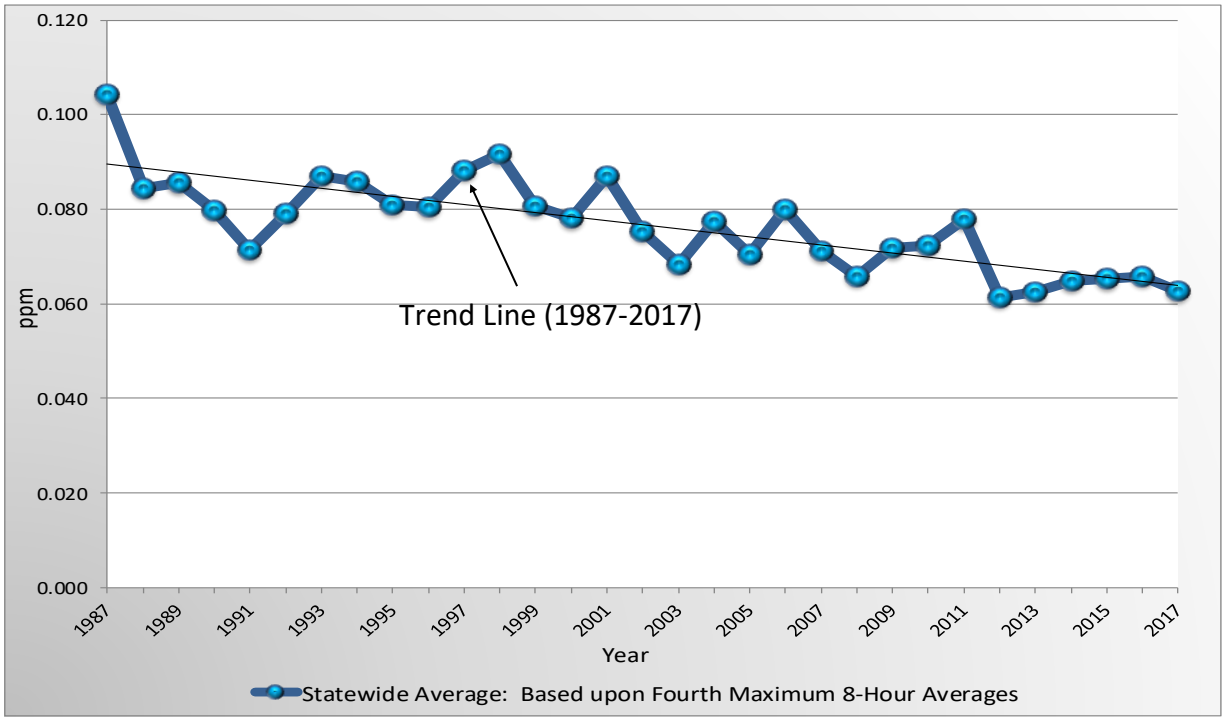


Figure 33: Statewide averages for ozone monitoring indicate pollution reductions.

Ozone Results

In 2017, DAQ, LMAPCD, and the National Park Service at Mammoth Cave operated a total of 26 ozone monitors in Kentucky. The EPA operated an additional three sites as part of an independent network of CASTNET monitors. While ten exceedances were measured at six sites during 2017, only one of those sites recorded a fourth highest daily maximum eight-hour average greater than 0.070 ppm.

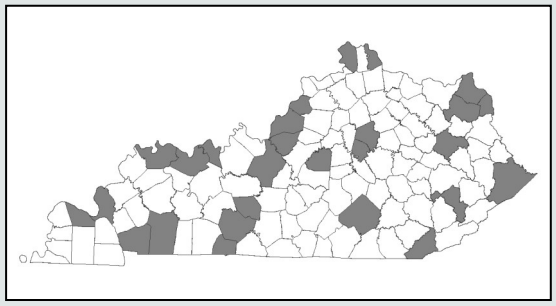
Generally, there has been a decline in ozone levels over the past 25 years. This trend is attributable to emission controls on vehicles and a regional strategy controlling NO_x emissions from large stationary internal combustion engines, large boilers and turbines used in power plants and other industrial applications.

National Ambient Air Quality Standards for Ozone

Primary NAAQS:	**3-year average of the 4th highest daily maximum 8-hr concentration not to exceed 0.070 ppm**
Secondary NAAQS:	**Same as Primary Standard**

Criteria Pollutant Summary Report - 2017

Pollutant: **Ozone**
Method: Ultra-Violet Photometry
Data Interval: Hourly
Units: Parts-per-million (ppm)



County	Site Address	AQS-ID	Valid Days	Daily Maximum 8-Hr Average				
				1st max	2nd max	3rd max	4th max	Obs> 0.070
Bell	34th & Dorchester Middlesboro	21-013-0002	243	.064	.064	.061	.060	0
Boone	KY 338 & Lower River East Bend	21-015-0003	221	.069	.063	.061	.060	0
Boyd	2924 Holt Street Ashland	21-019-0017	243	.066	.066	.065	.062	0
Bullitt	2nd & Carpenter St Shepherdsville	21-029-0006	232	.069	.068	.063	.063	0
Campbell	524A John Hill Rd Highland Heights	21-037-3002	227	.075	.071	.069	.068	2
Carter	Camp Webb Grayson Lake	21-043-0500	243	.063	.063	.063	.061	0
Christian	10800 Pilot Rock Hopkinsville	21-047-0006	233	.061	.061	.060	.060	0
Daviess	US60 & Pleasant Valley, Owensboro	21-059-0005	238	.068	.064	.063	.063	0

Values in red represent an exceedance of the NAAQS.

Ozone Criteria Pollutant Summary Report - 2017 Continued

County	Site Address	AQS-ID	Valid Days	Daily Maximum 8-Hr Average				
				1st max	2nd max	3rd max	4th max	Obs> 0.070
Edmonson[1]	Alfred Cook Rd Mammoth Cave	21-061-0501	243	.066	.064	.064	.064	0
Fayette	650 Newtown Pike Lexington	21-067-0012	242	.069	.066	.064	.064	0
Greenup	Scott & Center St Worthington	21-089-0007	220	.061	.061	.058	.057	0
Hancock	2nd & Caroline Lewisport	21-091-0012	244	.067	.067	.066	.065	0
Hardin	801 North Miles St Elizabethtown	21-093-0006	240	.066	.062	.061	.060	0
Henderson	Baskett Fire Dept. Baskett	21-101-0014	237	.069	.069	.067	.066	0
Jefferson[2]	7601 Bardstown Rd Louisville	21-111-0027	244	.072	.068	.065	.065	1
Jefferson[2]	7201 Watson Lane Louisville	21-111-0051	234	.072	.068	.067	.066	1
Jefferson[2]	2730 Cannons Lane Louisville	21-111-0067	360	.074	.074	.072	.072	4
Jessamine	DOT, Wilson Drive Nicholasville	21-113-0001	243	.070	.067	.064	.062	0
Livingston	DOT, US 60E Smithland	21-139-0003	239	.068	.065	.063	.063	0
McCracken	2901 Powell Street Paducah	21-145-1024	242	.069	.067	.065	.062	0
Morgan[3] CASTNET	State Hwy 437 West Liberty	21-175-9991	235	.068	.066	.066	.064	0
Oldham	DOT, 1601 S Hwy 393 Buckner	21-185-0004	236	.076	.070	.066	.064	1
Perry	Perry Co Horse Park Hazard	21-193-0003	242	.065	.062	.060	.059	0
Pike	101 North Mayo Trail Pikeville	21-195-0002	242	.063	.063	.060	.058	0
Pulaski	Clifty Street Somerset	21-199-0003	244	.063	.063	.060	.059	0
Simpson	DOT, HWY 1008 Franklin	21-213-0004	236	.066	.065	.065	.063	0
Trigg[3] CASTNET	5720 Old Dover Road Cadiz	21-221-9991	232	.066	.063	.062	.062	0
Warren	Ed Spear Park Smiths Grove	21-227-0009	236	.066	.064	.062	.061	0
Washington[3] CASTNET	542 Weasley-Miller Road Harrodsburg	21-229-9991	242	.074	.066	.065	.065	1

[1] Monitor operated by the National Park Service.
[2] Monitor operated by the Louisville Metro Air Pollution Control District.
[3] CASTNET Monitor operated by an EPA contractor and not associated with the State network.
Values in red represent an exceedance of the NAAQS.

Ozone Criteria Pollutant Multi-Year Summary Report – 2017
8-hour 4th Maximum, 3-year Average

County	Site Address	AQS-ID	4th Maximum 8-hr Average			
			2015	2016	2017	3-Yr Avg
Bell	34th & Dorchester Middlesboro	21-013-0002	0.059	0.062	.060	.060
Boone	KY 338 & Lower River Road East Bend	21-015-0003	0.062	0.065	.060	.062
Boyd	2924 Holt Street Ashland	21-019-0017	0.069	0.066	.062	.065
Bullitt	2nd & Carpenter Streets Shepherdsville	21-029-0006	0.067	0.067	.063	.065
Campbell	524A John Hill Highland Heights	21-037-3002	0.071	0.069	.068	.069
Carter	Camp Webb Grayson Lake	21-043-0500	0.060	0.065	.061	.062
Christian	10800 Pilot Rock Road Hopkinsville	21-047-0006	0.062	0.061	.060	.061
Daviess	US 60 & Pleasant Valley Rd Owensboro	21-059-0005	0.065	0.068	.063	.065
Edmonson[1]	Alfred Cook Road Mammoth Cave	21-061-0501	0.063	0.065	.064	.064
Fayette	650 Newtown Pike Lexington	21-067-0012	0.071	0.065	.064	.066
Greenup	Scott & Center Streets Worthington	21-089-0007	0.066	0.063	.057	.062
Hancock	2nd & Caroline Streets Lewisport	21-091-0012	0.071	0.067	.065	.067
Hardin	801 North Miles Street Elizabethtown	21-093-0006	0.066	0.068	.060	.064
Henderson	Baskett Fire Dept Baskett	21-101-0014	0.067	0.072	.066	.068
Jefferson[2]	7601 Bardstown Road Louisville	21-111-0027	0.071	0.073	.065	.069
Jefferson[2]	7201 Watson Lane Louisville	21-111-0051	0.069	0.070	.066	.068
Jefferson[2]	2730 Cannons Lane Louisville	21-111-0067	0.076	0.076	.072	.074
Jessamine	DOT, Etter Drive Nicholasville	21-113-0001	0.066	0.066	.062	.064
Livingston	DOT, 811 US 60 East Smithland	21-139-0003	0.063	0.068	.063	.064

Ozone Criteria Pollutant Multi-Year Summary Report – 2017 Continued
8-hour 4th Maximum, 3-year Average

County	Site Address	AQS-ID	4th Maximum 8-hr Average			
			2015	2016	2017	3-Yr Avg
McCracken	2901 Powell Street Paducah	21-145-1024	0.063	0.063	.062	.062
Morgan[3] CASTNET	State Hwy 437 West Liberty	21-175-9991	0.064	0.066	.064	.064
Oldham	DOT, 1601 S Hwy 393 Buckner	21-185-0004	0.073	0.069	.064	.068
Perry	Perry County Horse Park Hazard	21-193-0003	0.057	0.058	.059	.058
Pike	101 North Mayo Trail Pikeville	21-195-0002	0.058	0.061	.058	.059
Pulaski	Clifty Street Somerset	21-199-0003	0.062	0.063	.059	.061
Simpson	DOT, Hwy 1008 Franklin	21-213-0004	0.067	0.063	.063	.064
Trigg[3] CASTNET	5720 Old Dover Road Cadiz	21-221-9991	0.060	0.063	.062	.061
Warren	Ed Spear Park Smiths Grove	21-227-0009	0.061	0.062	.061	.061
Washington[3] CASTNET	542 Weasley-Miller Road Harrodsburg	21-229-9991	0.064	0.065	.065	.064

[1] Monitor operated by the National Park Service.
[2] Monitor operated by the Louisville Metro Air Pollution Control District.
[3 CASTNET] Monitor operated by an EPA contractor and not associated with the State network.
Values in red represent an exceedance of the NAAQS.

2017 Particulate Matter ($PM_{2.5}$) Ambient Air Monitoring Network

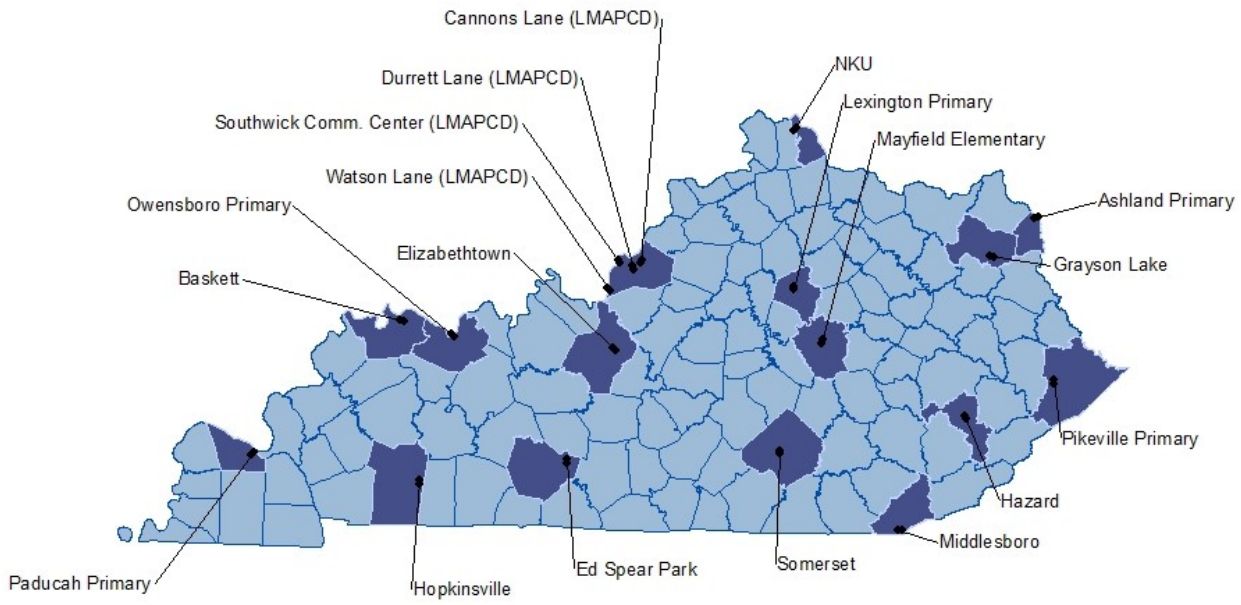


Figure 34: $PM_{2.5}$ monitoring locations in Kentucky.

Statewide Averages for $PM_{2.5}$

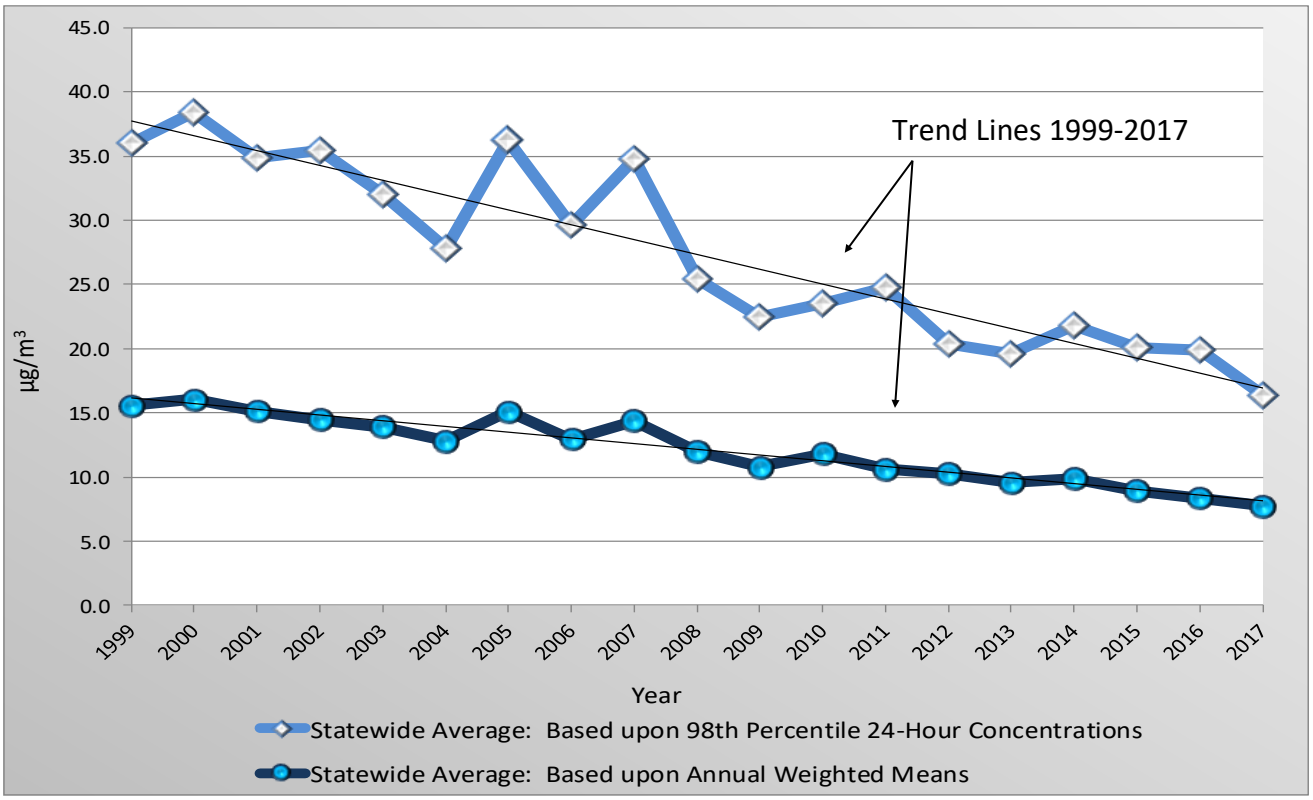


Figure 35: Statewide averages for $PM_{2.5}$ monitoring indicate pollution reductions.

$PM_{2.5}$ Results

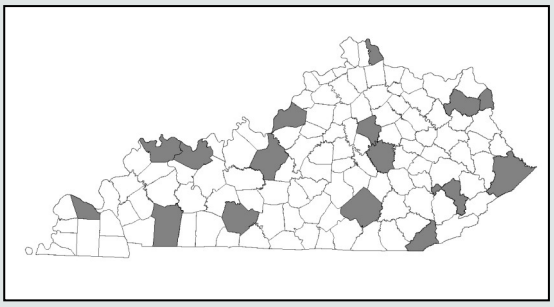
In 2017, DAQ and LMAPCD operated FRM-type samplers for NAAQS comparisons at 19 sites across the Commonwealth. No sampler exceeded either the three-year 24-hour standard or the three-year annual standard during the 2015-2017 averaging period. This is a significant accomplishment. Generally, statewide $PM_{2.5}$ levels declined during the 1999-2017 time period.

National Ambient Air Quality Standards for Particulate Matter $PM_{2.5}$

Primary NAAQS:	3-year average of the annual weighted mean not to exceed 12.0 µg/m^3 3-year average of the 98th percentile of 24-hour concentrations not to exceed 35 µg/m^3
Secondary NAAQS:	3-year average of the annual weighted mean not to exceed 15.0 µg/m^3 3-year average of the 98th percentile of 24-hour concentrations not to exceed 35 µg/m^3

Criteria Pollutant Summary Report - 2017

Pollutant: **Particulate Matter $PM_{2.5}$**
Method: Gravimetric
Data Interval: 24-hour
Units: Micrograms per cubic meter (µg/m^3)



County	Site	AQS-ID	# Obs	24-Hour Average					Wtd-Mean
				1st max	2nd max	3rd max	4th max	Obs> 35	
Bell	34th & Dorchester Middlesboro	21-013-0002	60	19.7	15.5	14.2	13.1	0	7.6
Boyd	2924 Holt Street Ashland	21-019-0017	122	16.8	14.7	14.2	14.1	0	7.4
Campbell	524A John Hill Rd Highland Heights	21-037-3002	122	18.5	17.5	17.4	15.6	0	7.6
Carter	Camp Webb Grayson Lake	21-043-0500	122	14.5	13.7	13.5	12.2	0	6.2
Christian	10800 Pilot Rock Hopkinsville	21-047-0006	113	19.5	17.7	16.5	15.9	0	8.2
Daviess	US60 & Pleasant Valley Rd Owensboro	21-059-0005	118	17.5	17.5	17.2	16.8	0	8.1

$PM_{2.5}$ Criteria Pollutant Summary Report – 2017 Continued

County	Site	AQS-ID	# Obs	24-Hour Average					Wtd-Mean
				1st max	2nd max	3rd max	4th max	Obs> 35	
Fayette	650 Newtown Pike Lexington	21-067-0012	116	20.4	18.5	18.3	16.3	0	7.8
Hardin	801 North Miles Street Elizabethtown	21-093-0006	103	19.2	15.9	15.2	15.2	0	8.2
Henderson	Basket Fire Dept. Baskett	21-101-0014	119	36.5	17.6	17.3	16.1	1	8.4
Jefferson[1]	37th & Southern Avenue Louisville	21-111-0043	121	18.6	17.9	17.8	17.6	0	9.2
Jefferson[1]	7201 Watson Lane Louisville	21-111-0051	116	18.9	17.9	17.7	16.1	0	8.8
Jefferson[1]	2730 Cannons Lane Louisville	21-111-0067	122	23.4	20.2	17.2	16.7	0	8.2
Jefferson[1]	1517 Durrett Lane Louisville	21-111-0075	121	24.4	21.2	20.7	18.4	0	8.9
McCracken	2901 Powell Street Paducah	21-145-1024	112	19.4	19.2	15.3	15.0	0	8.6*
Madison	Mayfield School Richmond	21-151-0003	113	20.7	18.5	15.2	15.1	0	7.5
Perry	Perry County Horse Park Hazard	21-193-0003	60	12.7	12.4	10.8	10.7	0	6.8
Pike	101 North Mayo Trail Pikeville	21-195-0002	121	17.3	16.8	13.7	13.0	0	6.9
Pulaski	305 Clifty Street Somerset	21-199-0003	118	18.6	17.8	16.7	14.9	0	7.5
Warren	Ed Spear Park Smiths Grove	21-227-0009	111	19.1	17.9	17.0	15.6	0	8.0

[1] Monitors operated by the Louisville Metro Air Pollution Control District.
* Incomplete dataset. The mean does not satisfy summary criteria.
Values in red represent an exceedance of the NAAQS.

$PM_{2.5}$ Criteria Pollutant Multi-Year Summary Report – 2017
24-Hour 98th Percentile, 3-Year Average

County	Site	AQS-ID	24-Hour, 98th Percentile			
			2015	2016	2017	3-Yr Avg
Bell	34th & Dorchester Middlesboro	21-013-0002	19.3*	41.3	15.5	25
Boyd	2924 Holt Street Ashland	21-019-0017	23.5	14.8	14.2	18
Campbell	524A John Hill Highland Heights	21-037-3002	22.0*	17.5	17.4	19
Carter	Camp Webb Grayson Lake	21-043-0500	19.8	15.0	13.5	16
Christian	10800 Pilot Rock Road Hopkinsville	21-047-0006	22.2	17.3	16.5	19
Daviess	US60 and Pleasant Valley Rd Owensboro	21-059-0005	21.6	18.0	17.2	19
Fayette	650 Newtown Pike Lexington	21-067-0012	18.6	16.7	18.3	18
Hardin	801 North Miles Street Elizabethtown	21-093-0006	20.5	17.2	15.2	18
Henderson	Baskett Fire Dept Baskett	21-101-0014	20.2	16.7	17.3	18
Jefferson[1]	37th & Southern Avenue Louisville	21-111-0043	22.3	19.2	17.9	20
Jefferson[1]	7201 Watson Lane Louisville	21-111-0051	22.9	16.3	18.9	19
Jefferson[1]	2730 Cannons Lane Louisville	21-111-0067	21.7	18.5	17.6	19
Jefferson[1]	1517 Durrett Lane Louisville	21-111-0075	22.1	18.7	20.7	21
McCracken	2901 Powell Street Paducah	21-145-1024	21.7*	16.4*	15.3*	18
Madison	Mayfield School Richmond	21-151-0003	15.6	21.5*	15.2	17
Perry	Perry County Horse Park Hazard	21-193-0003	16.3	27.8	12.4	19
Pike	101 North Mayo Trail Pikeville	21-195-0002	16.6	29.4	13.7	20
Pulaski	305 Clifty Street Somerset	21-199-0003	18.7	16.4	16.7	17
Warren	Ed Spear Park Smiths Grove	21-227-0009	18.5	16.9	17.0	17

[1] Monitor operated by the Louisville Metro Air Pollution Control District.
* Incomplete dataset. The mean does not satisfy summary criteria.
Values in red represent an exceedance of the NAAQS.

$PM_{2.5}$ Criteria Pollutant Multi-Year Summary Report – 2017
Annual Weighted Mean, 3-Year Average

County	Site	AQS-ID	Annual Weighted Mean			
			2015	2016	2017	3-Yr Avg
Bell	34th & Dorchester Middlesboro	21-013-0002	8.7*	10.1	7.6	8.8
Boyd	2924 Holt Street Ashland	21-019-0017	8.8	7.7	7.4	8.0
Campbell	524A John Hill Highland Heights	21-037-3002	9.4*	8.1	7.6	8.4
Carter	Camp Webb Grayson Lake	21-043-0500	7.3	6.6	6.2	6.7
Christian	10800 Pilot Rock Road Hopkinsville	21-047-0006	9.1	8.3	8.2	8.5
Daviess	US60 and Pleasant Valley Rd Owensboro	21-059-0005	9.7	8.6	8.1	8.8
Fayette	650 Newtown Pike Lexington	21-067-0012	8.6	8.2	7.8	8.2
Hardin	801 North Miles Street Elizabethtown	21-093-0006	9.2	8.2	8.2	8.5
Henderson	Baskett Fire Dept. Baskett	21-101-0014	9.5	8.6	8.4	8.9
Jefferson[1]	37th & Southern Avenue Louisville	21-111-0043	10.4	9.5	9.2	9.7
Jefferson[1]	7201 Watson Lane Louisville	21-111-0051	10.4	8.2	8.8	9.2
Jefferson[1]	2730 Cannons Lane Louisville	21-111-0067	9.5	8.2	8.2	8.6
Jefferson[1]	1517 Durrett Lane Louisville	21-111-0075	10.0	9.2	8.9	9.4
McCracken	2901 Powell Street Paducah	21-145-1024	9.3*	7.9*	8.6*	8.6
Madison	Mayfield School Richmond	21-151-0003	7.6	7.9*	7.5	7.7
Perry	Perry County Horse Park Hazard	21-193-0003	8.4	8.8	6.8	8.0
Pike	101 North Mayo Trail Pikeville	21-195-0002	7.6	7.8	6.9	7.4
Pulaski	305 Clifty Street Somerset	21-199-0003	8.1	8.0	7.5	7.9
Warren	Ed Spear Park Smiths Grove	21-227-0009	8.4	8.3	8.0	8.2

[1] Monitor operated by the Louisville Metro Air Pollution Control District.
* Incomplete dataset. The mean does not satisfy summary criteria.
Values in red represent an exceedance of the NAAQS.

2017 Particulate Matter ($PM_{2.5}$) Speciation Ambient Air Monitoring Network

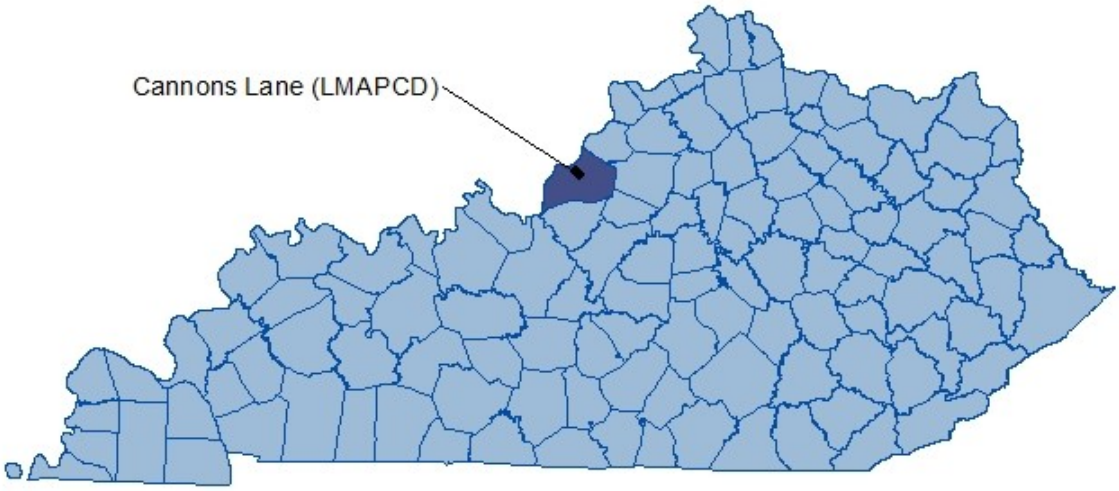


Figure 36: $PM_{2.5}$ speciation monitoring locations in Kentucky.

$PM_{2.5}$ Speciation

Efficient air quality management requires knowing which sources contribute to particle pollution. However, determining $PM_{2.5}$ source contributions is complicated due to the fact that often half or more of the $PM_{2.5}$ mass is comprised of secondarily formed species, therefore hiding their point of origin. In addition, $PM_{2.5}$ may remain in the atmosphere for several days enabling sources several hundred miles away to affect an area.

Realizing this, the EPA established the Speciation Trends Network designed to assist in identifying the compounds associated with fine particulates. Sites were strategically located to address different types of land-uses, ranging from industrial, urban, and rural. The network is used to provide data on a target group of chemical species known to be significant contributors to $PM_{2.5}$ mass. The data provided by the network can be used to support several areas that include:

- Assisting the implementation of the $PM_{2.5}$ standard by using speciated data as input to air quality modeling analyses and as indicators to track progress of controls.
- Aiding the interpretation of health studies by linking health effects to $PM_{2.5}$ constituents.
- Understanding the effect of atmospheric components on visibility impairment.
- Using the speciated particulate data to aid in monitoring network design and siting adjustment.

Speciation Results

In December 2014, the EPA defunded a number of monitors in the network, based upon an assessment that found certain sites to be unnecessary. Ultimately, three DAQ-operated monitors were discontinued in December 2014. As a result, only one $PM_{2.5}$ speciation site was in operation in Kentucky during 2017. That site is operated by the Louisville Metro Air Pollution Control District in Jefferson County.

2017 $PM_{2.5}$ Speciation: Average Concentration of Major Species

The chart below provides a visual representation of the major components of speciation data collected in 2017. The data suggests that particulates identified as sulfates, nitrates, and organic carbon are the primary contributors to $PM_{2.5}$ in Kentucky . Sulfates are formed from sulfur dioxide emissions with the major sources of those emissions being coal-fired power plants. Similarly, nitrates are formed secondarily from nitrogen oxides, which are emitted during fossil fuel combustion. Organic carbon comes from a combination of mobile and stationary combustion sources.

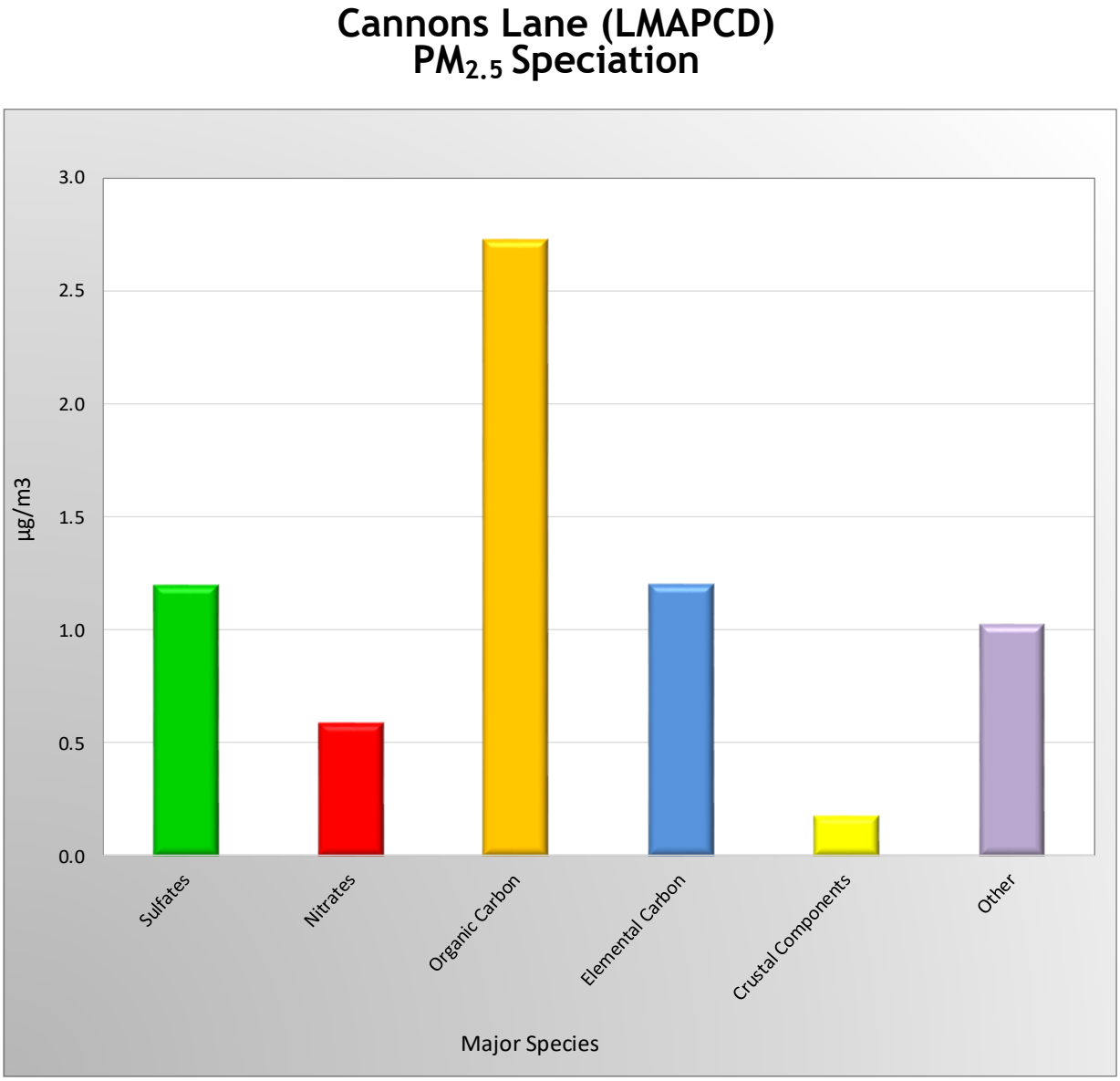


Figure 37: Average species distribution of major elements from the Louisville Metropolitan Air Pollution Control District $PM_{2.5}$ speciation monitor at the Cannons Lane site (AQS I.D.: 21-111-0067). "Other" represents a combination of trace compounds with individual concentrations too small to graphically display, which are not characterized as major elements or crustal components.

2017 Particulate Matter (PM_{10}) Ambient Air Monitoring Network

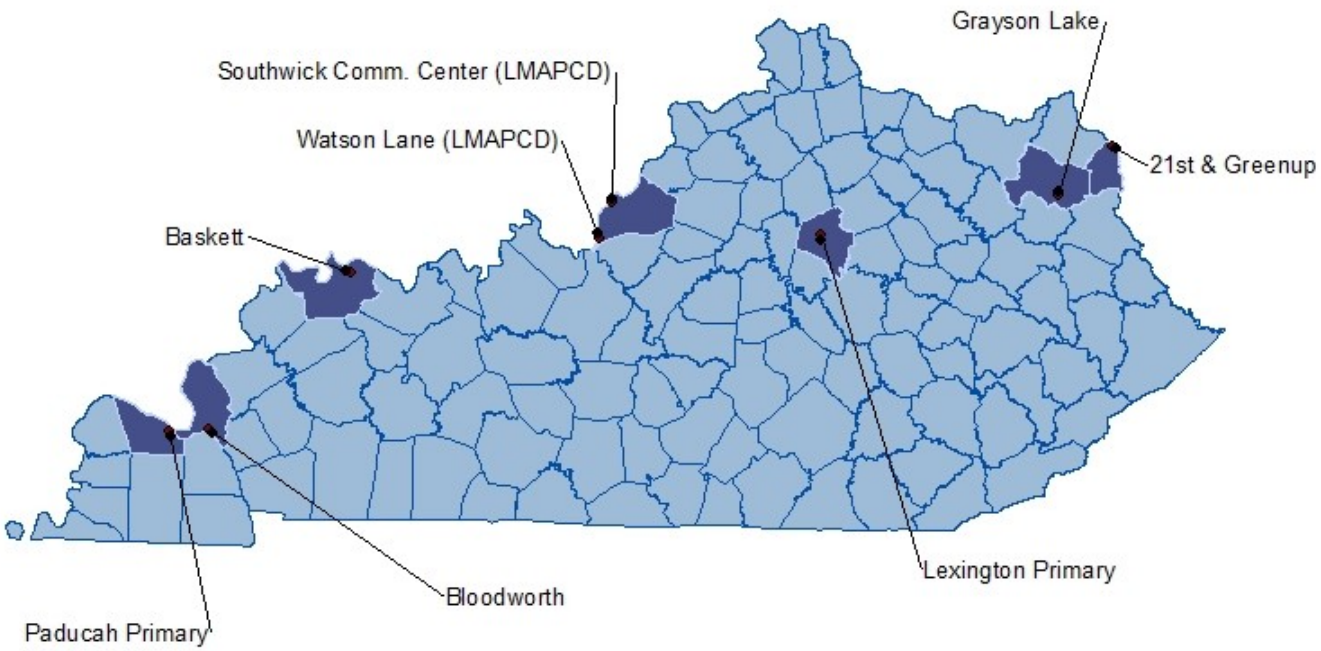


Figure 38: PM_{10} monitoring locations in Kentucky.

Statewide Averages for PM_{10}

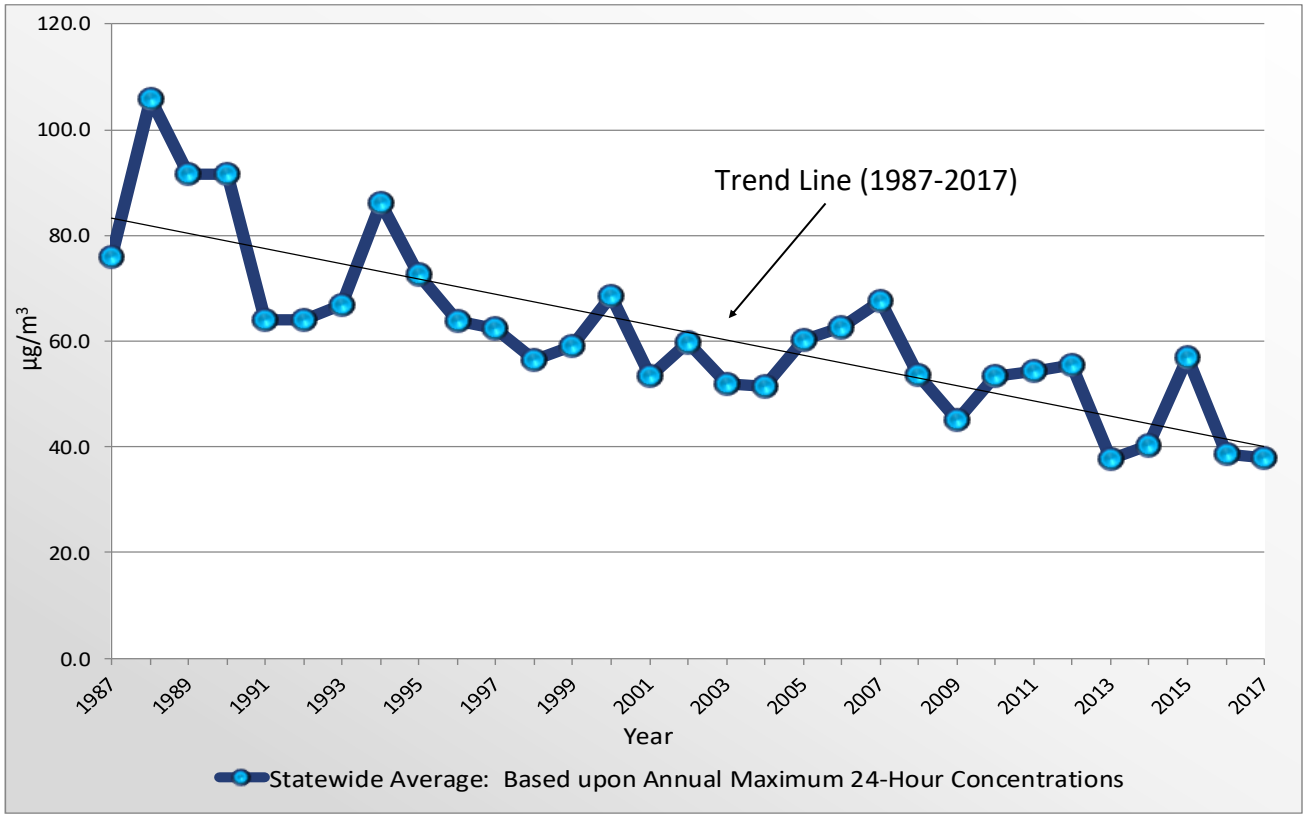


Figure 39: Statewide averages for PM_{10} monitoring indicate pollution reductions.

PM_{10} Results

In 2017, the DAQ and the LMAPCD operated a combined network of eight PM_{10} intermittent and continuous samplers in Kentucky. The annual PM_{10} standard is attained when the expected number of days per year with a 24-hour concentration greater than 150 ug/m^3 is less than or equal to one, when averaged over a three-year period. When a site collects samples everyday, the expected number of exceedances is equal to the number of actual exceedances. However, when the sampling frequency does not occur everyday, the number of days expected to be greater 150 ug/m^3 is obtained via a calculation. Poor data recovery can also impact the expected number of exceedances per year.

There were no exceedances of the annual PM_{10} standard in 2017. The last exceedance of the standard occurred on March 22, 2012, at the Ashland site (21-019-0002), which is located next to a metals recycler. Prior to 2012, only two previous exceedances of the PM_{10} NAAQS have been recorded.

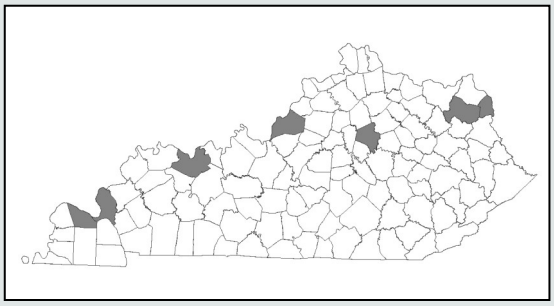
Statewide and regional PM_{10} levels have shown declining trends. This downward trend is the result of controls on industrial sources for particulate matter.

National Ambient Air Quality Standards for Particulate Matter (PM_{10})

Primary NAAQS:	**Expected number of days with a maximum 24-hour concentration greater than 150 µg/m^3 must be less than or equal to one, on average over three years.**
Secondary NAAQS:	**Same as Primary Standard**

Criteria Pollutant Summary Report - 2017

Pollutant: **Particulate Matter PM_{10}**
Method: Gravimetric
Data Interval: 24-hour
Units: Micrograms per cubic meter (µg/m^3) (25°C)



County	Site	AQS-ID	# Obs	24-hour Average				Act Obs > 150	Exp Obs > 150	Mean
				1st Max	2nd Max	3rd Max	4th Max			
Boyd	21st & Greenup Ashland	21-019-0002	58	41	34	33	33	0	0	18.0
Carter	Camp Webb Grayson Lake	21-043-0500	56	17	17	16	16	0	0	9.1
Fayette	650 Newtown Pike Lexington	21-067-0012	59	47	40	29	27	0	0	14.7
Henderson	Baskett Fire Dept. Baskett	21-101-0014	59	55	25	23	23	0	0	14.2
Jefferson[1]	37th & Southern Ave Louisville	21-111-0043	7267	40	35	34	34	0	0	17.4*

PM_{10} Criteria Pollutant Summary Report – 2017 Continued

County	Site	AQS-ID	# Obs	24-hour Average				Act Obs > 150	Exp Obs > 150	Mean
				1st Max	2nd Max	3rd Max	4th Max			
Jefferson[1]	7201 Watson Ln Louisville	21-111-0051	7853	39	39	38	36	0	0	16.1*
Livingston	763 Bloodworth Rd Smithland	21-139-0004	60	37	23	23	23	0	0	14.5
McCracken	2901 Powell St Paducah	21-145-1024	56	27	27	26	26	0	0	15.1

[1] Monitor operated by the Louisville Metro Air Pollution Control District.
* Incomplete dataset. The mean does not satisfy summary criteria.

PM_{10} Criteria Pollutant Summary Report – 2017
Estimated Number of Annual Exceedances, Expected 3-Year Average

County	Site	AQS-ID	Estimated Number of Exceedances			
			2015	2016	2017	Expected 3-Year Avg
Boyd	21st & Greenup Ashland	21-019-0002	0	0	0	0
Carter	Camp Webb Grayson Lake	21-043-0500	0	0	0	0
Fayette	650 Newtown Pike Lexington	21-067-0012	0	0	0	0
Henderson	Baskett Fire Dept Baskett	21-101-0014	0	0	0	0
Jefferson[1]	37th & Southern Ave Louisville	21-111-0043	0	0	0	0
Jefferson[1]	7201 Watson Ln Louisville	21-111-0051	0*	0	0	0*
Livingston	763 Bloodworth Rd Smithland	21-139-0004	0*	0*	0	0*
McCracken	2901 Powell Street Paducah	21-145-1024	0	0	0	0

[1] Monitor operated by the Louisville Metro Air Pollution Control District.
* Incomplete dataset. The mean does not satisfy summary criteria.

2017 Sulfur Dioxide Ambient Air Monitoring Network

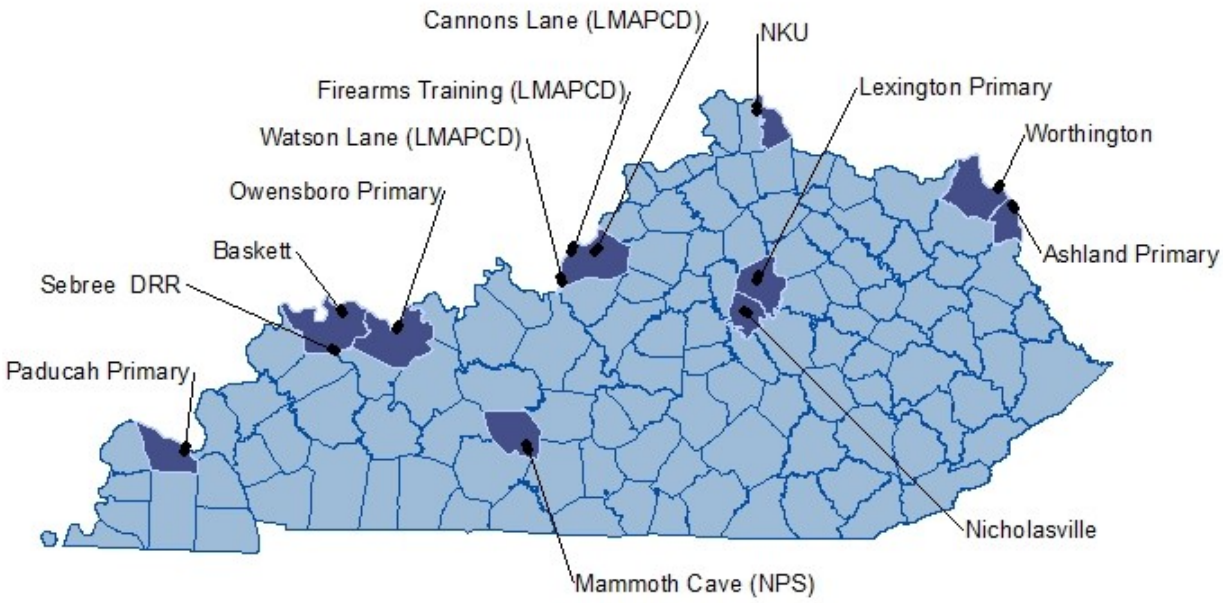


Figure 40: Sulfur dioxide monitoring locations in Kentucky.

Statewide Averages for Sulfur Dioxide

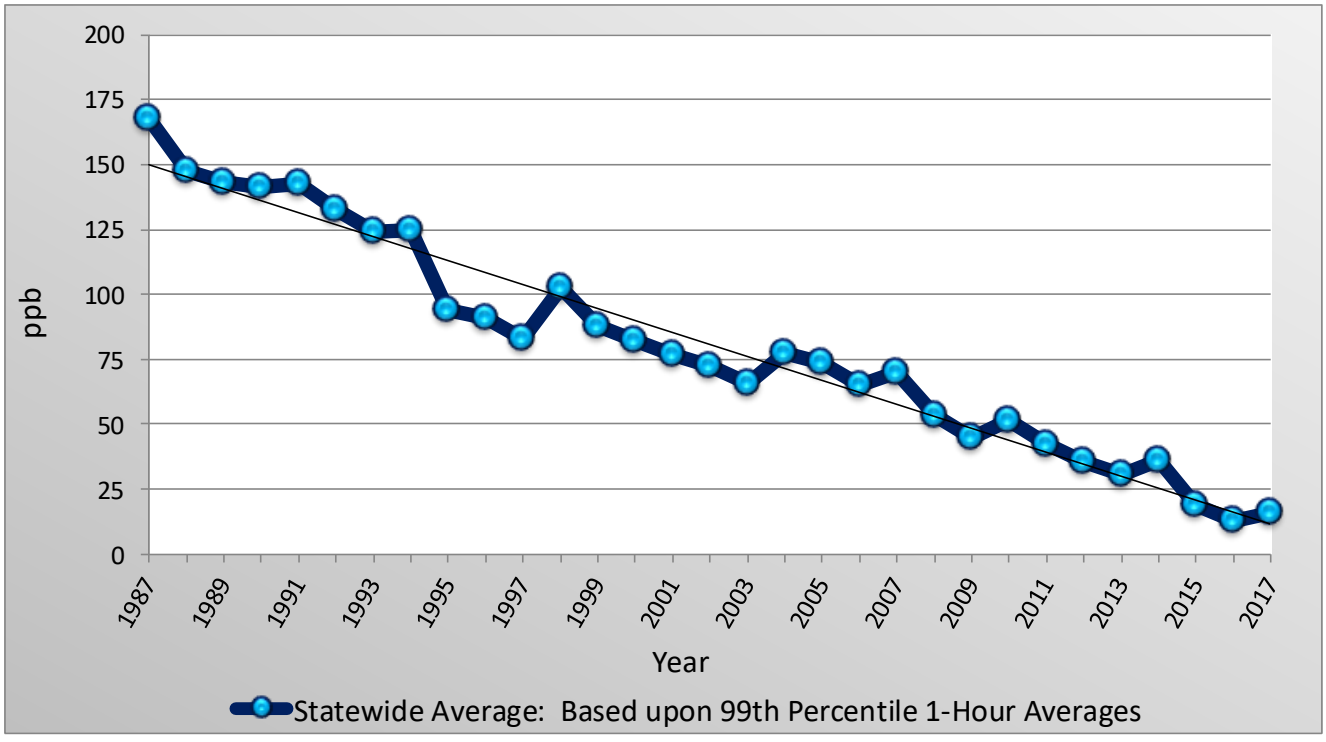


Figure 41: Statewide averages for SO_2 monitoring indicate significant pollution reductions.

Sulfur Dioxide Results

In 2017, the Division, the NPS at Mammoth Cave, and LMAPCD operated 13 SO_2 monitors in Kentucky. During 2017, one site recorded six exceedances of the daily one-hour standard of 75 ppb. That site, located near Sebree, Kentucky, was established to characterize maximum hourly sulfur dioxide concentrations in fulfillment of the EPA's 2015 Data Requirements Rule (DRR). No other exceedances were recorded in the state.

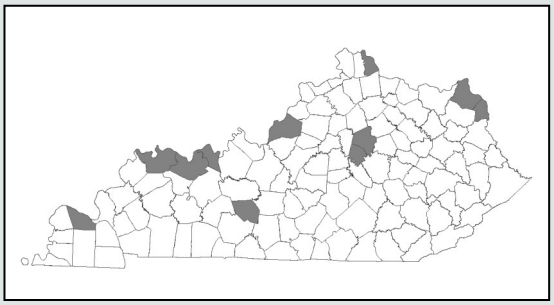
Overall, statewide and regional sulfur dioxide levels have declined over the past twenty years. The SO_2 allowances component of the Acid Rain Program provides an opportunity for electric utilities to participate in a market-based trade of SO_2 emissions. An electric utility that is participating in the trading program is required to continually monitor emissions for SO_2, NO_x, and any other pollutants. The continuous monitoring of the emissions provides compliance data and credibility to the trading program. The trading allowances in the Acid Rain program have directly contributed to the decline in ambient SO_2 concentrations.

National Ambient Air Quality Standards for Sulfur Dioxide

Primary NAAQS:	**3-year average of the 99th percentile of the daily maximum 1-hour concentration not to exceed 75 ppb**
Secondary NAAQS:	**3-hour concentrations not to exceed 0.5 ppm (500 ppb) more than once per year**

Criteria Pollutant Summary Report – 2017

Pollutant: **Sulfur Dioxide**
Method: Instrumental
Ultra-Violet Fluorescence
Data Interval: Hourly
Units: Parts-per-billion (ppb)



County	Site Address	AQS-ID	# Obs	Daily Maximum 1-Hr Avg			Annual Maximum 3-Hr Block Avg		
				1st max	2nd max	Obs > 75	1st max	2nd max	Obs > 500
Boyd	2924 Holt Street Ashland	21-019-0017	8262	17.0	7.0	0	7.6	4.0	0
Campbell	524A John Hill Rd Highland Heights	21-037-3002	8290	23.0	19.0	0	13.6	13.6	0
Daviess	US60 & Pleasant Valley Owensboro	21-059-0005	8347	31.0	27.0	0	17.0	14.6	0
Edmonson[1]	Alfred Cook Road Mammoth Cave	21-061-0501	7942	3.6	3.4	0	3.2	2.8	0

SO_2 Criteria Pollutant Summary Report – 2017 Continued

County	Site Address	AQS-ID	# Obs	Daily Maximum 1-Hr Avg			Annual Maximum 3-Hr Block Avg		
				1st max	2nd max	Obs > 75	1st max	2nd max	Obs > 500
Fayette	650 Newtown Pike Lexington	21-067-0012	8256	5.0	4.0	0	4.0	2.6	0
Greenup	Scott & Center St. Worthington	21-089-0007	8268	12.0	11.0	0	2.7	2.4	0
Henderson	Baskett Fire Dept. Baskett	21-101-0014	8244	28.0	13.0	0	10.6	9.3	0
Henderson	Alcan Aluminum Rd. Robards	21-101-1011	8288	101.0	100.0	6	86.3	83.3	0
Jefferson[2]	7201 Watson Lane Louisville	21-111-0051	8258	18.1	14.0	0	10.7	8.3	0
Jefferson[2]	2730 Cannons Lane Louisville	21-111-0067	8046	11.1	8.4	0	7.4	5.9	0
Jefferson[2]	4201 Algonquin Pkwy Louisville	21-111-1041	8052	27.9	17.8	0	18.1	11.7	0
Jessamine	KYDOT, Etter Drive Nicholasville	21-113-0001	7876	4.0	3.0	0	3.3	2.3	0
McCracken	2901 Powell Street Paducah	21-145-1024	8329	20.0	13.0	0	8.3	8.3	0

[1] Monitor operated by the National Park Service.
[2] Monitor operated by the Louisville Metro Air Pollution Control District.

SO_2 Criteria Pollutant Multi-Year Summary Report – 2017
Daily Maximum 1-hour 99th Percentile, 3-Year Average

County	Site Address	AQS-ID	Daily Maximum 1-Hr Average 99th Percentile			
			2015	2016	2017	3-Year Avg
Boyd	2924 Holt Street Ashland	21-019-0017	12	6	7	8
Campbell	524A John Hill Rd Highland Heights	21-037-3002	18	12	16	15
Daviess	US60 & Pleasant Valley Rd Owensboro	21-059-0005	27*	25	17	23
Edmonson[1]	Alfred Cook Road Mammoth Cave	21-061-0501	7	3*	3	5
Fayette	650 Newtown Pike Lexington	21-067-0012	9	3	4	5
Greenup	Scott & Center Streets Worthington	21-089-0007	13	8	7	9
Henderson	Baskett Fire Dept. Baskett	21-101-0014	19	14	10	14
Henderson	Alcan Aluminum Rd Robards	21-101-1011	- - -	- - -	94	0
Jefferson[2]	7201 Watson Lane Louisville	21-111-0051	54	26	14	31
Jefferson[2]	2730 Cannons Lane Louisville	21-111-0067	19	8	7	11
Jefferson[2]	4201 Algonquin Pkwy Louisville	21-111-1041	25	16	11	17
Jessamine	KYDOT, Etter Drive Nicholasville	21-113-0001	10	5	3	6
McCracken	2901 Powell Street Paducah	21-145-1024	15*	16	12	14

[1] Monitor operated by the National Park Service.
[2] Monitor operated by the Louisville Metro Air Pollution Control District.
* Incomplete dataset. The mean does not satisfy summary criteria.
Values in red represent an exceedance of the NAAQS.
- - - monitoring not conducted/Data not available

2017 Hazardous Air Pollutant Ambient Air Monitoring Network

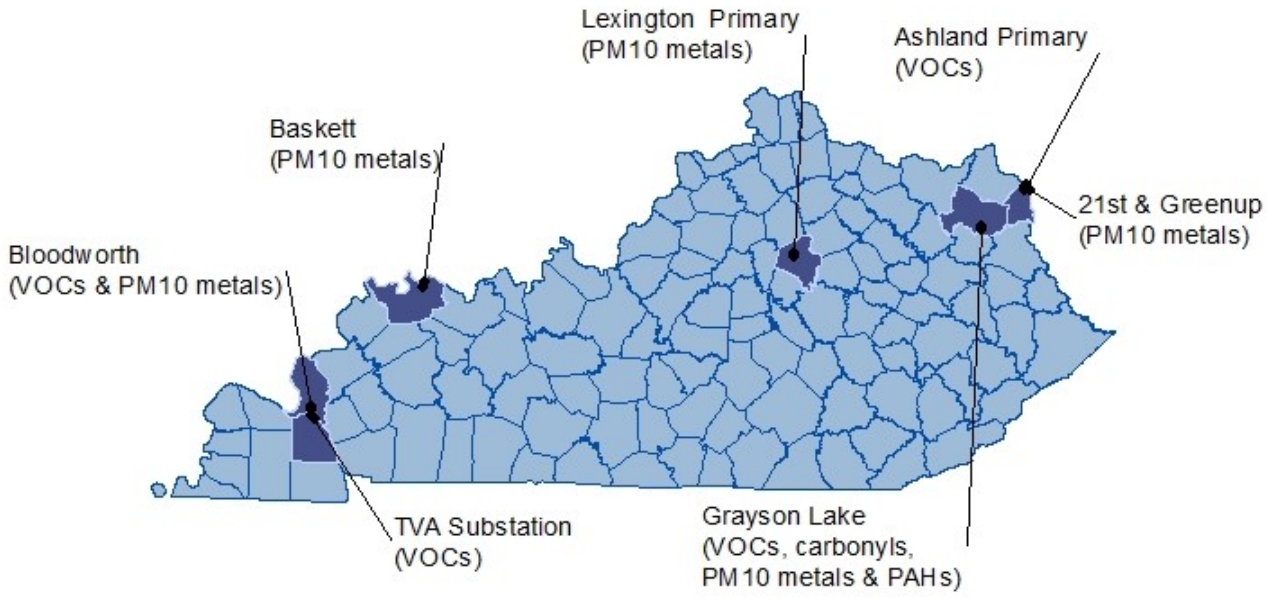


Figure 42: Hazardous air pollutant monitoring locations in Kentucky.

Hazardous air pollutants (HAPs) include 187 substances known or suspected to cause neurological, immunological, reproductive, and respiratory disorders, as well as known or suspected human carcinogens. The ultimate goal of the EPA is to eliminate unacceptable risks of cancer, other significant health problems from exposures to air toxics emissions and to substantially reduce or eliminate adverse effects on our natural environment. To provide a basis for decision-making with respect to these matters, the EPA developed the National Air Toxics Trends Stations (NATTS) monitoring network.

In 2017, the Division operated seven hazardous air pollutant stations throughout the Commonwealth using the NATTS monitoring objectives; however, only samplers operated at Grayson Lake are a part of the NATTS network. The EPA has identified 18 hazardous air pollutants that are required to be monitored in the National Air Toxics Trends study.

HAPS can be subdivided into four monitoring groups: carbonyls, metals, volatile organic compounds (VOC), and polycyclic aromatic hydrocarbons (PAH). The compounds are sampled using the following media:

- Carbonyls: Dinitrophenylhydrazine (DNPH) adsorbent cartridges
- PM_{10} metals: Teflon® filters
- VOCs: 6L Passivated SUMMA canisters
- PAHs: Polyurethane foam (PUF)/XAD-2® sorbent

All samples are sent to a NATTS National Contract laboratory for analysis.

Results

Data collected from the air toxics network indicates that several of the 18 NATTS pollutants of interest are present in Kentucky's ambient air. Potential sources may be large industrial sources in the immediate area, mobile emissions (cars, trucks and school buses), and small local source emissions such as those from fueling stations, body shops/painting, dry cleaners, asphalt plants, etc. The Division continues to collect and analyze the data for trends. For more information about air toxics in Kentucky, see the Permit Review Branch section of this report.

Carbonyls

Air Toxics Summary Report - 2017

Site: Camp Webb-Grayson Lake, Carter County
AQS ID: 21-043-0500
Pollutant: Acetaldehyde
Method: TO-11A; Carbonyl sampler with DPNH cartridges
Data Interval: 24-hour
Units: Parts-per-billion (ppb)

Pollutant	# Obs	1st max	2nd max	3rd max	4th max	Annual Mean
Formaldehyde	61	2.7	2.7	2.6	2.5	1.17
Acetaldehyde	61	1.6	1.2	1.2	1.2	.80
Propionaldehyde	60	.6	.5	.4	.4	.24
Butyraldehyde	60	.296	.264	.232	.232	.14
Isovaleraldehyde	61	.0	.0	.0	.0	0.00
Hexanaldehyde	61	.3	.2	.2	.2	.09
Valeraldehyde	57	.2	.2	.1	.1	.05
Crotonaldehyde	61	2.9	2.6	2.5	2.4	.55
Acetone	61	5.3	4.5	3.3	3.0	1.72
Methyl ethyl ketone	56	.7	.6	.6	.5	.32
Benzaldehyde	61	.3	.1	.1	.1	.09
Isoxylaldehyde	61	0	0	0	0	0.00
Tolualdehydes	54	.6	.5	.3	.3	.16

Metals

Air Toxics Summary Report - 2017

Pollutant: Antimony
Method: IO-3.5; Metals low volume PM_{10} monitor
Data Interval: 24-hour
Units: Nanograms per cubic meter (ng/m^3)

County	Site	AQS-ID	# Obs	1st max	2nd max	3rd max	4th max	Annual Mean
Boyd	21st & Greenup Ashland	21-019-0002	57	71.3	27.2	11.6	11.1	3.87
Carter	Camp Webb Grayson Lake	21-043-0500	56	3.71	2.16	2.07	1.86	.67
Fayette	650 Newtown Pike Lexington	21-067-0012	59	5.76	4.93	4.49	3.49	1.30
Henderson	Baskett Fire Dept. Baskett	21-101-0014	60	1.33	1.27	1.22	1.22	.64
Livingston	763 Bloodworth Rd Smithland	21-139-0004	59	1.90	1.64	1.32	1.14	.57

Air Toxics Summary Report - 2017

Pollutant: Arsenic
Method: IO-3.5; Metals low volume PM_{10} monitor
Data Interval: 24-hour
Units: Nanograms per cubic meter (ng/m^3)

County	Site	AQS-ID	# Obs	1st max	2nd max	3rd max	4th max	Annual Mean
Boyd	21st & Greenup Ashland	21-019-0002	57	9.1	3.6	3.3	3.3	1.16
Carter	Camp Webb Grayson Lake	21-043-0500	56	2.03	1.19	1.05	.98	.47
Fayette	650 Newtown Pike Lexington	21-067-0012	59	5.81	2.71	2.62	2.25	.86
Henderson	Baskett Fire Dept. Baskett	21-101-0014	60	7.74	5.28	2.28	2.27	.98
Livingston	763 Bloodworth Rd Smithland	21-139-0004	59	3.97	1.27	1.21	1.18	.56

Metals

Air Toxics Summary Report - 2017

Pollutant: Beryllium
Method: IO-3.5; Metals low volume PM_{10} monitor
Data Interval: 24-hour
Units: Nanograms per cubic meter (ng/m^3)

County	Site	AQS-ID	# Obs	1st max	2nd max	3rd max	4th max	Annual Mean
Boyd	21st & Greenup Ashland	21-019-0002	57	.1	.0	.0	.0	0.00
Carter	Camp Webb Grayson Lake	21-043-0500	56	.01	.01	.01	.01	.001
Fayette	650 Newtown Pike Lexington	21-067-0012	59	.08	.07	.05	.04	.012
Henderson	Baskett Fire Dept. Baskett	21-101-0014	60	.05	.04	.04	.04	.012
Livingston	763 Bloodworth Rd Smithland	21-139-0004	59	.03	.02	.02	.02	.006

Air Toxics Summary Report - 2017

Pollutant: Cadmium
Method: IO-3.5; Metals low volume PM_{10} monitor
Data Interval: 24-hour
Units: Nanograms per cubic meter (ng/m^3)

County	Site	AQS-ID	# Obs	1st max	2nd max	3rd max	4th max	Annual Mean
Boyd	21st & Greenup Ashland	21-019-0002	57	2.8	1.3	.7	.6	.24
Carter	Camp Webb Grayson Lake	21-043-0500	56	.15	.15	.14	.14	.065
Fayette	650 Newtown Pike Lexington	21-067-0012	59	.31	.23	.21	.12	.071
Henderson	Baskett Fire Dept. Baskett	21-101-0014	60	.44	.34	.23	.16	.091
Livingston	763 Bloodworth Rd Smithland	21-139-0004	59	.40	.23	.22	.18	.079

Metals

Air Toxics Summary Report - 2017

Pollutant: Chromium
Method: IO-3.5; Metals low volume PM_{10} monitor
Data Interval: 24-hour
Units: Nanograms per cubic meter (ng/m^3)

County	Site	AQS-ID	# Obs	1st max	2nd max	3rd max	4th max	Annual Mean
Boyd	21st & Greenup Ashland	21-019-0002	57	22.4	9.4	6.3	6.2	3.86
Carter	Camp Webb Grayson Lake	21-043-0500	56	4.00	3.35	3.13	2.96	1.69
Fayette	650 Newtown Pike Lexington	21-067-0012	59	4.19	3.40	3.13	3.09	2.05
Henderson	Baskett Fire Dept. Baskett	21-101-0014	60	7.23	5.98	4.50	3.49	2.06
Livingston	763 Bloodworth Rd Smithland	21-139-0004	59	9.77	5.60	3.94	3.23	2.11

Air Toxics Summary Report - 2017

Pollutant: Lead
Method: IO-3.5; Metals low volume PM_{10} monitor
Data Interval: 24-hour
Units: Nanograms per cubic meter (ng/m^3)

County	Site	AQS-ID	# Obs	1st max	2nd max	3rd max	4th max	Annual Mean
Boyd	21st & Greenup Ashland	21-019-0002	57	.02	.01	.01	.01	.00
Carter	Camp Webb Grayson Lake	21-043-0500	56	.00	.00	.00	.00	.00
Fayette	650 Newtown Pike Lexington	21-067-0012	59	.01	.00	.00	.00	.00
Henderson	Baskett Fire Dept. Baskett	21-101-0014	60	.00	.00	.00	.00	.00
Livingston	763 Bloodworth Rd Smithland	21-139-0004	59	.00	.00	.00	.00	.00

Metals

Air Toxics Summary Report - 2017

Pollutant: Manganese
Method: IO-3.5; Metals low volume PM_{10} monitor
Data Interval: 24-hour
Units: Nanograms per cubic meter (ng/m^3)

County	Site	AQS-ID	# Obs	1st max	2nd max	3rd max	4th max	Annual Mean
Boyd	21st & Greenup Ashland	21-019-0002	57	49.6	46.9	45.1	42.4	16.7
Carter	Camp Webb Grayson Lake	21-043-0500	56	13.80	6.37	6.06	4.76	2.47
Fayette	650 Newtown Pike Lexington	21-067-0012	59	18.4	17.20	12.90	11.00	5.55
Henderson	Baskett Fire Dept. Baskett	21-101-0014	60	9.51	9.28	7.50	7.47	4.35
Livingston	763 Bloodworth Rd Smithland	21-139-0004	59	34.60	18.20	16.00	15.60	6.31

* Incomplete dataset. The mean does not satisfy summary criteria.
Metals data is only available through September 2016.

Air Toxics Summary Report - 2017

Pollutant: Nickel
Method: IO-3.5; Metals low volume PM_{10} monitor
Data Interval: 24-hour
Units: Nanograms per cubic meter (ng/m^3)

County	Site	AQS-ID	# Obs	1st max	2nd max	3rd max	4th max	Annual Mean
Boyd	21st & Greenup Ashland	21-019-0002	57	13.6	6.7	6.1	4.9	1.70
Carter	Camp Webb Grayson Lake	21-043-0500	56	.86	.52	.50	.45	.25
Fayette	650 Newtown Pike Lexington	21-067-0012	59	1.72	1.49	1.33	1.19	.52
Henderson	Baskett Fire Dept. Baskett	21-101-0014	60	1.46	1.40	1.25	1.25	.54
Livingston	763 Bloodworth Rd Smithland	21-139-0004	59	1.82	1.52	1.48	1.17	.49

* Incomplete dataset. The mean does not satisfy summary criteria.
Metals data is only available through September 2016.

Volatile Organic Compounds

Air Toxics Summary Report - 2017

Pollutant: 1,3-Butadiene
Method: TO-15; Passivated SUMMA Canister
Data Interval: 24-hour
Units: Parts-per-billion (ppb)

County	Site	AQS-ID	# Obs	1st max	2nd max	3rd max	4th max	Annual Mean
Boyd	2924 Holt Street Ashland	21-019-0017	59	.4	.4	.4	.3	.11
Carter	Camp Webb Grayson Lake	21-043-0500	61	.1	.1	.1	.1	.03
Livingston	763 Bloodworth Rd Smithland	21-139-0004	58	.8	.4	.3	.2	.09
Marshall	TVA Substation Calvert City	21-157-0014	58	2.3	1.9	1.6	1.4	.26

Air Toxics Summary Report - 2017

Pollutant: Chloroform
Method: TO-15; Passivated SUMMA Canister
Data Interval: 24-hour
Units: Parts-per-billion (ppb)

County	Site	AQS-ID	# Obs	1st max	2nd max	3rd max	4th max	Annual Mean
Boyd	2924 Holt Street Ashland	21-019-0017	59	.1	.1	.1	.0	.01
Carter	Camp Webb Grayson Lake	21-043-0500	61	.1	.1	.1	.0	0.00
Livingston	763 Bloodworth Rd Smithland	21-139-0004	58	.3	.1	.1	.1	.02
Marshall	TVA Substation Calvert City	21-157-0014	58	.6	.3	.3	.3	.05

Volatile Organic Compounds

Air Toxics Summary Report - 2017

Pollutant: Carbon Tetrachloride
Method: TO-15; Passivated SUMMA Canister
Data Interval: 24-hour
Units: Parts-per-billion (ppb)

County	Site	AQS-ID	# Obs	1st max	2nd max	3rd max	4th max	Annual Mean
Boyd	2924 Holt Street Ashland	21-019-0017	59	.1	.1	.1	.1	.10
Carter	Camp Webb Grayson Lake	21-043-0500	61	.1	.1	.1	.1	.10
Livingston	763 Bloodworth Rd Smithland	21-139-0004	58	.2	.2	.1	.1	.10
Marshall	TVA Substation Calvert City	21-157-0014	58	.5	.5	.3	.3	.13

Air Toxics Summary Report - 2017

Pollutant: Ethylene Dichloride
Method: TO-15; Passivated SUMMA Canister
Data Interval: 24-hour
Units: Parts-per-billion (ppb)

County	Site	AQS-ID	# Obs	1st max	2nd max	3rd max	4th max	Annual Mean
Boyd	2924 Holt Street Ashland	21-019-0017	59	.1	.1	.1	.0	.01
Carter	Camp Webb Grayson Lake	21-043-0500	61	.1	.0	.0	.0	.00
Livingston	763 Bloodworth Rd Smithland	21-139-0004	58	3.5	3.4	2.0	1.7	.51
Marshall	TVA Substation Calvert City	21-157-0014	58	52.6	22.4	18.5	18.2	2.77

* Incomplete dataset. The mean does not satisfy summary criteria.

Volatile Organic Compounds

Air Toxics Summary Report - 2017

Pollutant: Tetrachloroethylene
Method: TO-15; Passivated SUMMA Canister
Data Interval: 24-hour
Units: Parts-per-billion (ppb)

County	Site	AQS-ID	# Obs	1st max	2nd max	3rd max	4th max	Annual Mean
Boyd	2924 Holt Street Ashland	21-019-0017	59	.1	.1	.1	.0	.01
Carter	Camp Webb Grayson Lake	21-043-0500	61	.0	.0	.0	.0	0.00
Livingston	763 Bloodworth Rd Smithland	21-139-0004	58	.1	.0	.0	.0	0.00
Marshall	TVA Substation Calvert City	21-157-0014	58	.2	.1	.0	.0	.01

Air Toxics Summary Report - 2017

Pollutant: 1,1,2,2-Tetrachloroethane
Method: TO-15; Passivated SUMMA Canister
Data Interval: 24-hour
Units: Parts-per-billion (ppb)

County	Site	AQS-ID	# Obs	1st max	2nd max	3rd max	4th max	Annual Mean
Boyd	2924 Holt Street Ashland	21-019-0017	59	.0	.0	.0	.0	0.00
Carter	Camp Webb Grayson Lake	21-043-0500	61	.0	.0	.0	.0	0.00
Livingston	763 Bloodworth Rd Smithland	21-139-0004	58	.0	.0	.0	.0	0.00
Marshall	TVA Substation Calvert City	21-157-0014	58	.0	.0	.0	.0	0.00

* Incomplete dataset. The mean does not satisfy summary criteria.

Volatile Organic Compounds

Air Toxics Summary Report - 2017

Pollutant: Trichloroethylene
Method: TO-15; Passivated SUMMA Canister
Data Interval: 24-hour
Units: Parts-per-billion (ppb)

County	Site	AQS-ID	# Obs	1st max	2nd max	3rd max	4th max	Annual Mean
Boyd	2924 Holt Street Ashland	21-019-0017	59	.0	.0	.0	.0	0.00
Carter	Camp Webb Grayson Lake	21-043-0500	61	.0	.0	.0	.0	0.00
Livingston	763 Bloodworth Rd Smithland	21-139-0004	58	.1	.1	.0	.0	0.00
Marshall	TVA Substation Calvert City	21-157-0014	58	.0	.0	.0	.0	0.00

Air Toxics Summary Report - 2017

Pollutant: Vinyl Chloride
Method: TO-15; Passivated SUMMA Canister
Data Interval: 24-hour

County	Site	AQS-ID	# Obs	1st max	2nd max	3rd max	4th max	Annual Mean
Boyd	2924 Holt Street Ashland	21-019-0017	59	.0	.0	.0	.0	0.00
Carter	Camp Webb Grayson Lake	21-043-0500	61	.0	.0	.0	.0	0.00
Livingston	763 Bloodworth Rd Smithland	21-139-0004	58	.9	.7	.4	.4	.12
Marshall	TVA Substation Calvert City	21-157-0014	58	19.7	2.9	2.9	1.5	.65

* Incomplete dataset. The mean does not satisfy summary criteria.

Volatile Organic Compounds

Air Toxics Summary Report - 2017

Pollutant: Benzene
Method: TO-15; Passivated SUMMA Canister
Data Interval: 24-hour
Units: Parts-per-billion (ppb)

County	Site	AQS-ID	# Obs	1st max	2nd max	3rd max	4th max	Annual Mean
Boyd	2924 Holt Street Ashland	21-019-0017	59	4.8	3.0	2.8	2.4	1.25
Carter	Camp Webb Grayson Lake	21-043-0500	61	1.2	1.1	1.1	1.1	.72
Livingston	763 Bloodworth Rd Smithland	21-139-0004	58	4.2	3.0	2.2	1.8	1.04
Marshall	TVA Substation Calvert City	21-157-0014	58	9.0	4.8	3.8	3.6	1.34

* Incomplete dataset. The mean does not satisfy summary criteria.

Polycyclic Aromatic Hydrocarbons

Air Toxics Summary Report - 2017

Site: Camp Webb-Grayson Lake, Carter County
AQS ID: 21-043-0500
Method: TO-13; PUF-ZAD2 GC-MS
Data Interval: 24-hour
Units: Nanograms per cubic meter (ng/m^3) (25 C)

Pollutant	# Obs	1st max	2nd max	3rd max	4th max	Annual Mean
Napthalene (TSP)	57	31.80	28.80	26.60	24.40	12.26
Acenaphthene (TSP)	57	.69	.57	.53	.51	.20
Acenaphthylene (TSP)	57	.19	.19	.18	.13	.02
Fluorene (TSP)	57	1.29	1.15	1.10	1.10	.61
Phenanthrene (TSP)	57	2.07	1.62	1.55	1.52	.99
Anthracene (TSP)	57	.06	.04	.04	.04	.01
Retene (TSP)	57	.76	.42	.31	.24	.13
Fluoranthene (TSP)	57	.58	.58	.55	.54	.33
Pyrene (TSP)	57	.33	.32	.31	.31	.17
Chrysene (TSP)	57	.27	.22	.20	.18	.06
Coronene (TSP)	57	.13	.10	.09	.07	.02
Perylene (TSP)	57	.03	.03	.02	.01	.00
Benzo (a) anthracene (TSP)	57	.13	.10	.09	.08	.02
Benzo (b) fluoranthene (TSP)	57	.51	.35	.32	.28	.09
Benzo (k) fluoranthene (TSP)	57	.13	.09	.07	.07	.02

APPENDICES

APPENDIX A: AIR QUALITY INDEX (AQI)

Air Quality Index Levels of Health Concern	Numerical Value	Meaning
Good	0-50	Air quality is considered satisfactory, and air pollution poses little or no risk.
Moderate	51-100	Air quality is acceptable; however, for some pollutants there may be a moderate health concern for a very small number of people who are unusually sensitive to air pollution.
Unhealthy for Sensitive Groups	101-150	Members of sensitive groups may experience health effects. The general public is not likely to be affected.
Unhealthy	151-200	Everyone may begin to experience health effects; members of sensitive groups may experience more serious health effects.
Very Unhealthy	201-300	Health alert: everyone may experience more serious health effects.
Hazardous	> 300	Health warnings of emergency conditions. The entire population is more likely to be affected.

What is the AQI?

The AQI is an index for reporting daily air quality. It tells you how clean or polluted your air is, and what associated health effects you may experience within a few hours or days after breathing polluted air. The EPA calculates the AQI for five major air pollutants regulated by the Clean Air Act: ground-level ozone, particle pollution (also known as particulate matter), carbon monoxide, sulfur dioxide, and nitrogen dioxide. For each of these pollutants, EPA has established national air quality standards to protect public health.

How does the AQI work?

Think of the AQI as a yardstick that runs from 0 to 500. The higher the AQI value, the greater the level of air pollution and the greater the health concern. For example, an AQI value of 50 represents good air quality with little potential to affect public health, while a value over 300 signifies hazardous air quality.

An AQI value of 100 generally corresponds to the national air quality standard for the pollutant, which is the level EPA has set to protect public health. AQI values below 100 are generally thought of as satisfactory. When AQI values are above 100, air quality is considered to be unhealthy — at first for certain sensitive groups of people, then for everyone as AQI values get higher.

The Division for Air Quality reports nearly real-time AQI values on our website at air.ky.gov . Forecasted AQI data is generated using a combination of forecasted weather data and known pollution emission values. The division does not forecast for air pollution; however, the Louisville Metro Air Pollution Control District does provide ozone and $PM_{2.5}$ forecasts for residents of Jefferson County. LMAPCD's forecasts can be accessed on their website at www.louisvilleky.gov/APCD.

Nationwide near real-time and forecasted AQI data can be accessed at EPA's airnow.gov.

Carbon Monoxide (CO)

Carbon monoxide is an odorless, colorless, poisonous gas that is produced by the incomplete combustion of carbon containing fuels. The primary source of carbon monoxide is the exhaust from motor vehicles including highway and off-road vehicles, such as construction equipment. Other sources include industrial processes, and kerosene or wood burning stoves in homes.

Current Carbon Monoxide Standard
CO has two standards: an 8-hour primary standard at 9 ppm and a 1-hour primary standard at 35 ppm.

Health and Environmental Impacts
The main health effect of carbon monoxide is its tendency to reduce the oxygen carrying capacity of blood. Carbon monoxide enters the bloodstream in the lungs where it binds chemically with the hemoglobin in red blood cells. Hemoglobin normally carries oxygen to organs and tissues but because CO binds with the hemoglobin over 200 times more readily than oxygen, the amount of oxygen absorbed into the bloodstream is greatly reduced when CO is present.

Depending on the level of exposure, CO can cause fatigue and headaches and can impair vision and reflexes. Unconsciousness and even death may occur at high concentrations. The severity of the effects is related to the length of exposure and concentration level of CO.

How is CO Monitored?
Carbon monoxide is monitored continuously by analyzers that operate using the non-dispersive infrared photometry method. In this method, ambient air is drawn into a sample cell and a beam of infrared light is passed through the sample. Carbon monoxide absorbs infrared light and any decrease in the intensity of the beam is due to the presence of CO. The decrease is directly related to the concentration of CO in the ambient air. A detector measures the difference between the sample cell beam and a duplicate beam passing through a reference cell with no CO present. The difference is translated into a measure of the CO present in the ambient air. Data from the analyzer is transmitted, by telemetry, for entry into an automated data storage system.

Lead (Pb)

Lead is a soft, blue-gray metal that occurs naturally. However, the historical use of lead in gasoline, paint, and plumbing, along with modern use in batteries, bridge paint, and plastic has caused lead to accumulate in the environment. The accumulation of lead in the environment is the reason lead can be found in everyone's body today.

Current Lead Standard
On Nov. 12, 2008, the NAAQS for lead was lowered from 1.5 $\mu g/m^3$ to 0.15 $\mu g/m^3$. Unlike the other NAAQS pollutants that monitor for area-wide impacts, the lead NAAQS required state, tribal, and local agencies to monitor near sources that emit more than one ton of lead per year. The division identified sources that emitted over one ton of lead annually and began monitoring near the sources in 2010. In December 2010, the EPA released an updated set of monitoring requirements, which established lead monitoring near sources that emit more than 0.5 tons per year. While rule revisions orginally required lead monitoring at certain urban NCore sites, the requirement has since been eliminated.

CRITERIA POLLUTANTS, Cont'd.

Health and Environmental Impacts

Ingestion of lead is the first major pathway of exposure. In adults, only about 10 percent of ingested lead is absorbed into the body whereas approximately 30-50 percent of lead ingested by children is absorbed. Children also absorb lead into their system faster than an adult. Inhalation is the second leading pathway of exposure for lead; nearly all of lead inhaled is absorbed into the body.

Lead can accumulate in soil, water, and sediments through deposition from air sources. The accumulation can damage ecosystems through the loss of biodiversity, changes in community composition, and decreased growth and reproductive rates in plants and animals.

Lead contamination can cause nervous system and kidney damage, learning disabilities, poor muscle coordination, decreased bone and muscle growth, and hearing damage in children. Lead can also affect adult nervous systems. However, most adults require a much larger exposure than a child to have a negative health impact.

How is lead monitored?

Lead concentrations are determined from the analysis of suspended particulates collected by federal reference method high volume particulate samplers. These samplers use a brushless motor and a critical flow orifice in order to achieve a sampling flow rate between 1.10 and 1.70 cubic meters per minute (m^3/min) over the course of 24 hours. Samples are collected on 8x10 glass fiber filters. Upon collection, the filters are sent to an EPA-certified laboratory for analysis. The sample filters are cut into strips, acid digested according to 40 CFR Part 50, Appendix G, and analyzed by Inductively Coupled Plasma with Mass Spectroscopy Detection (ICP-MS).

Nitrogen Dioxide (NO_2)

Nitrogen dioxide is a reddish brown gas that is produced during high temperature combustion. During combustion, nitrogen and oxygen combine or *oxidize* to form a family of highly reactive gases called nitrogen oxides (NO_x), which includes nitrogen dioxide (NO_2) and nitrogen oxide (NO). In addition to the NO_2 produced during combustion, the NO produced may, in the presence of sunlight, undergo a photochemical reaction that will also form NO_2. The rate of reaction is dependent upon the intensity of the sunlight. Major combustion or oxidation sources that produce NO_2 include motor vehicles, power plants, incinerators, boilers, and chemical processes.

Current Nitrogen Dioxide Standard

NO_2 has two standards: a 1-hour primary standard set at 100 ppb and an annual primary and secondary combined standard at 53 ppb.

Health and Environmental Impacts

The primary health effect of NO_2 is as a lung irritant, which can cause an increase in respiratory rate, a decrease in lung function, and an increase in the susceptibility of the respiratory system to infection. Nitrogen oxides are also considered detrimental to human health due to their association in the formation of ozone and the resulting health effects caused by that pollutant.

NO_2 is a contributor to the formation of acid precipitation, which can damage plant life, aquatic life, cause the deterioration of stone/masonry-type buildings, and deteriorate statues.

Nitrogen oxides also react with ammonia to form ammonium nitrate, a component of $PM_{2.5}$. Nitrates are a

key component in regional haze that has been attributed to poor visibility in the southeast region of the United States.

How is NO_2 monitored?

Nitrogen dioxide is monitored continuously by analyzers that utilize the principle of photometric detection of the chemiluminescence (light) resulting from the gas phase reaction of nitric oxide (NO) and ozone. When these two gases react, light at a specific wavelength is produced.

In operation, sample air is drawn into the analyzer and split into two streams. The first air stream reacts directly with ozone (which is produced by a generator in the analyzer) and the light energy produced is proportional to the NO in the sample. Since NO_2 does not react with ozone, the second stream of air passes through a catalytic converter that converts the NO_2 in the sample to NO. The second air stream then reacts with ozone, providing a total measurement of nitrogen oxides (NO_x) in the sample.

The assumption is that the majority of the NO_x value is not NO_2. By subtracting the second air stream NO concentration from the first stream NO_x concentration, an NO_2 value is obtained. Data from the analyzer is transmitted into an automated data storage system.

Ozone (O_3)

Ozone is a colorless gas that is not emitted directly into the atmosphere from sources, but rather forms in the atmosphere from a photochemical reaction between volatile organic compounds (VOCs) and nitrogen oxides (NO_x) in the presence of sunlight. Sources of VOCs include motor vehicle exhaust, dry cleaning, paint solvents, and evaporation of gasoline from storage and fuel transfer facilities. Sources of NO_x include emissions from motor vehicles, boilers, and power plants.

Current Ozone Standard

In October 2015, the EPA lowered the eight-hour ozone standard from 0.075 ppm to 0.070 ppm. However, the previous standard of 0.075 ppm remained in effect throughout the 2015 ozone monitoring season. The secondary standard to protect public welfare is the same as the primary.

Health and Environmental Impacts

In the upper atmosphere, naturally occurring stratospheric ozone (commonly called the ozone layer) shields the earth's surface from the sun's harmful ultraviolet rays. However, tropospheric ozone, also known as ground-level ozone, can trigger health problems at low level exposure, cause permanent lung damage after long term exposure, and can damage ecosystems.

How is O_3 monitored?

Ozone is typically monitored from March 1st through Oct. 31st each year, when meteorological conditions are most conducive to the formation of ozone; however, the LMAPCD NCore site collects ozone data year-round. Analyzers, which operate continuously, monitor ozone by using the ultraviolet photometry method. In this method, ambient air is drawn into a sample cell and a beam of ultraviolet light is passed through the cell. Ozone absorbs ultraviolet light and a decrease in the intensity of the light indicates the presence of ozone. The intensity of the light is first measured with no ozone present to determine a reference value. An ambient sample is then introduced and the intensity of the resultant light is measured by an ultraviolet detector. The amount of light absorbed by the sample indicates the level of ozone present. Data from the analyzers are transmitted into an automated data storage system.

Particulate Matter ($PM_{2.5}$)

Particulate matter is a mixture of solid particles and liquid droplets that are 2.5 microns or smaller in size. Sources of $PM_{2.5}$ include power plants, wood burning, industrial processes, and fuel combustion. Fine particulates are also formed in the atmosphere when gases are transformed through chemical reactions. Sulfur dioxide, nitrogen oxides, and VOCs are all examples of gases that can transform by chemical reactions.

Current $PM_{2.5}$ Standard

$PM_{2.5}$ has two primary standards to protect human health: an annual standard set at 12 µg/m^3, and a 24-hour standard set at 35 µg/m^3. The secondary standard to protect public welfare is an annual standard set at 15 µg/m^3.

Health and Environmental Impacts

Particulate matter of 2.5 microns or less has the ability to penetrate into the deepest parts of the lungs, causing chronic respiratory symptoms in sensitive populations and premature deaths in the elderly. $PM_{2.5}$ also affects the environment by reducing visibility (up to 70 percent in some areas of the U.S.) and contributing to acid rain.

How is $PM_{2.5}$ monitored?

The division currently operates manual intermittent Federal Reference Method (FRM) and Federal Equivalent Method (FEM) filter-based samplers, as well as continuous Tapered Element Oscillating Microbalance (TEOM) monitors and FEM continuous T640 broadband spectrometric monitors. However, only the FRM and FEM manual intermittent samplers are used for comparisons to the NAAQS. The TEOM and T640 monitors continuously report $PM_{2.5}$ Air Quality Index (AQI) results. The FRM and FEM manual samplers are used for calculation of the AQI for historic data. LMAPCD also operates FEM Beta Attenuation Monitors (BAM), which are usable for both NAAQS comparisons or reporting of the AQI.

The manual intermittent FRM-type monitors collect a sample over a 24-hour run cycle. While most samplers operate every third day, some samplers operate every sixth day and others operate every twelfth day. These samplers operate by drawing a measured volume of air through a pre-weighed filter. Before reaching the filter, the air passes through an impaction chamber where larger particles fall out of the air stream while particles smaller than 2.5 microns pass on to the sample filter where they are collected.

After completion of the sample run, the filter is removed from the sampler and weighed to determine the mass of the particulates collected.

How is $PM_{2.5}$ composition (speciation) determined?

$PM_{2.5}$ is composed of many different components or *species*. Determining those components is called chemical speciation and it involves both sampling and analysis of various species. The target groups of chemical species include a list of analytes that consist of various cations, anions, carbon species, and trace elements. Because no one sample media is capable of providing the appropriate sample collection for all of the target species, each series of species requires sample collection on the appropriate media and utilization of the appropriate analytical techniques. One instrument collects $PM_{2.5}$ speciation samples on a set of two filters, one comprised of Teflon and one comprised of nylon, over a 24-hour sampling period. A second instrument collects a sample on a quartz filter over a 24-hour sampling period. The quartz filter is used to collect a speciated carbon sample.

$PM_{2.5}$ speciation samples are sent to an EPA contract laboratory for analysis. Listed below are the techniques used to analyze samples for each group of species:

- Trace Elements: X-ray fluorescence and particle induced X-ray emission
- Anion and Cations: Ion chromatography
- Carbon: Controlled-combustion/thermal optical

Once analysis is complete, the species are further separated into several target chemical species. These species in turn can be linked to source categories that ultimately can be used to assist in understanding $PM_{2.5}$ composition and developing control strategies needed to reduce ambient levels.

- Nitrate (total)
- Sulfate
- Ammonium
- Organic Carbon
- Crustal Component (trace elements, fine soil)
- Other ($PM_{2.5}$ mass unaccounted for by analytical methods)

Particulate Matter (PM_{10})

Particulate matter of 10 microns or less in diameter (PM_{10}) is a mixture of solid particles and liquid droplets. Some common sources of PM_{10} are prescribed fires, construction activities, agricultural practices, and smoke-stacks.

Current PM_{10} Standard

The current NAAQS for PM_{10} (both primary and secondary) is a 24-hour standard set at 150 $\mu g/m^3$. The estimated number of exceedances must be equal to or less than one, on average, over 3 years.

Health and Environmental Impacts

Exposure to particulates aggravates respiratory and cardiovascular disease, and high levels can increase the death rates of sufferers. The elderly, children, and people with chronic lung disease are especially sensitive to particulate matter.

Particulate matter can soil and damage a wide range of man-made items such as building surfaces. PM_{10} damages vegetation by interfering with plant photosynthesis due to the formation of a film on leaves that reduces exposure to sunlight. Particulate pollution can also produce haze, which diminishes visibility and the amount of sunlight reaching the earth.

How is PM_{10} monitored?

For PM_{10} NAAQS comparisons, both intermittent and continuous monitor types may be used because they are both FRM or FEM equivalents. Most PM_{10} samplers are the intermittent type that operates for 24 hours, every sixth day. Some intermittent samplers may operate on a more frequent schedule in order to investigate localized concerns. Intermittent samplers operate by drawing a measured volume of air through a pre-weighed filter over a 24-hour period. Before reaching the filter, the air passes through an impaction chamber where larger particles fall out of the air stream while particles smaller than 10 microns pass on to the sample filter where they are collected.

After completion of the sample run, the filter is removed from the sampler and reweighed to determine the mass of the particulates collected. Sample results are entered manually into a data storage system. The network also includes continuously operating PM_{10} samplers that provide results daily. These samplers determine sample weights electronically and transmit results by telemetry into an automated data storage system.

Sulfur Dioxide

Sulfur dioxide is a colorless gas that has a pungent odor at concentrations exceeding 0.5 ppm. SO_2 is produced by the combustion of sulfur containing fuels, ore smelting, petroleum processing, and the manufacture of sulfuric acid. Nationwide, coal-fired power plants are the largest sources of SO_2. Other industrial sources include petroleum refineries and paper mills.

Current SO_2 Standard

The current primary SO_2 standard is a 1-hour average set at 75 ppb. The secondary standard is a 3-hour average set at 0.5 ppm.

Health and Environmental Impacts

The primary health effect of exposure to SO_2 is the aggravation of pre-existing respiratory, cardiovascular, and pulmonary disease. Asthmatics, children, and the elderly are especially susceptible to the effects of SO_2 pollution. SO_2 can also damage the foliage of trees and agricultural crops.

Moisture in the atmosphere combines with SO_2 to form sulfuric acid (H_2SO_4), which is a component of acid precipitation. Acid precipitation causes acidification of soil and water that can deteriorate plant life, animal life, and structural surfaces.

SO_2 may also be converted into sulfates. Sulfates are significant components of $PM_{2.5}$ and regional haze. Regional haze has been attributed to poor visibility at many of the vistas in our national parks, including Mammoth Cave National Park in Kentucky and the Great Smoky Mountains in Tennessee.

How is SO_2 monitored?

Analyzers continuously monitor SO_2 by using the ultraviolet (UV) fluorescence method. Fluorescent analyzers irradiate an ambient air sample with ultraviolet light. SO_2 molecules absorb a portion of this energy and then re-emit the energy at a characteristic wavelength of light. The light energy emitted by the SO_2 molecules is proportional to the concentration of SO_2 present in the sample. A photo-multiplier cell measures the light emitted and converts it to a parts-per-million measurement. Data from the analyzer is transmitted into an automated data storage system.

Division for Air Quality
Regional Office Boundaries

air.ky.gov

Environmental Emergency, 24-hour; (502) 564-2380 or (800) 928-2380
Open burn complaints: (502) 782-6592

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Frankfort Region
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APPENDIX D: GLOSSARY OF ABBREVIATIONS

AHERA Asbestos Hazard Emergency Response Act

AQI Air Quality Index

BACT Best Available Control Technology

CAA Clean Air Act

CO Carbon Monoxide

CO_2 Carbon Dioxide

CPT Cost per Ton

CSAPR Cross-State Air Pollution Rule

DAQ Division for Air Quality

DEP Department for Environmental Protection

DERA Diesel Emissions Reduction Act

EEC Energy and Environment Cabinet

EGU Electric Generating Unit

EPA Environmental Protection Agency

FEM Federal Equivalent Method

FRM Federal Reference Method

GHG Greenhouse Gas

HAP Hazardous Air Pollutant

HPV High Priority Violation

KAR Kentucky Administrative Regulation

KORA Kentucky Open Records Act

KRS Kentucky Revised Statute

LMAPCD Louisville Metropolitan Air Pollution Control District

LOW Letter of Warning

MACT Maximum Achievable Control Technology

NAAQS National Ambient Air Quality Standard

NATTS National Air Toxics Trends Stations

NESHAP National Emission Standard for Hazardous Air Pollutants

NO_x Nitrogen Oxides

NOV Notice of Violation

NPS National Park Service

NSR New Source Review

O_3 Ozone

Pb Lead

PM_{10} Particulate Matter, also known as coarse particles, measure between 2.5-10 microns in diameter

$PM_{2.5}$ Fine Particulate Matter, also known as fine particles, measuring less than 2.5 microns in diameter

PTE Potential to Emit

QAPP Quality Assurance Project Plan

RATA Relative Accuracy Test Audit

RTF Regulatory Time Frame

SEDC Southeast Diesel Collaborative

SIP State Implementation Plan

SO_2 Sulfur Dioxide

SOP Standard Operating Procedure

TEMPO Tools for Environmental Management and Protection Organizations

TPY Tons per year

TRI Toxics Release Inventory

VISTAS Visibility Improvement State and Tribal Association of the Southeast

VOC Volatile Organic Compound

APPENDIX E: GLOSSARY OF TERMS

Analyte A chemical substance that is the subject of chemical analysis.

Anion A negatively-charged particle, having more electrons than protons.

Asbestos Hazard Emergency Response Act AHERA requires schools to inventory their asbestos materials and document strategies for dealing with these materials.

Air Toxics See Toxic Air Pollutant.

Ambient air quality The level of pollution present in the air outside.

Attainment When an area meets the national air quality standard set by the federal EPA for a particular pollutant.

Cation A positively-charged particle, having more protons than electrons.

Chemiluminescence The emission of light by a substance as a result of a chemical reaction that does not involve an increase in its temperature.

Clean Air Act Federal clean air program established by Congress in 1963.

Class I Area Areas of special natural, scenic, or historic importance are known as "Class 1 Areas," and are protected to maintain long distance, panoramic views.

Criteria Pollutant A regulated air pollutant. Currently, there are six criteria pollutants under the Clean Air Act. They are carbon monoxide, lead, ozone, particulate matter, nitrogen oxides and sulfur dioxide.

Emissions Inventory A list of sources of air contaminants, containing for each source the amount of each contaminant emitted.

Exceedance (of NAAQS) One occurrence of a measured or modeled concentration that exceeds the specified concentration level of a NAAQS for the averaging period specified by that standard.

Hazardous Air Pollutant Any pollutant listed in Subsection B of Section 112 of the Clean Air Act.

Inspection A scheduled determination of compliance with an existing regulation.

Investigation A complaint driven determination of compliance with an existing regulation.

Major Source A stationary source that emits and/or has the potential to emit 100 tons per year or more of a regulated air pollutant.

Minor Source A stationary source that emits and/or has the potential to emit less than the major source threshold.

Mobile Source A *moving*, non-stationary source of air pollutants, such as motor vehicles, ships, airplanes, construction equipment, etc.

GLOSSARY, Cont'd.

National Ambient Air Quality Standards (NAAQS) Standards established by the United States Environmental Protection Agency (EPA) under authority of the Clean Air Act (42 U.S.C. 7401 et seq.) that apply to outdoor air throughout the country.

National Emissions Standards for Hazardous Air Pollutants (NESHAP) With respect to asbestos, NESHAP governs renovation and demolition activities and requires safe handling, removal (when applicable), and disposal of asbestos from facilities (everything except for single private homes).

Nonattainment The official designation for an area that does not meet the National Ambient Air Quality Standard set by the U.S. EPA for a particular pollutant.

Notification Required reporting by facilities of regulated activities. For example, facilities are required to notify DAQ of certain air emission releases or upcoming asbestos disturbance (removal/demolition activities).

Potential to Emit (PTE) The maximum capacity of a stationary source to emit under its physical and operational design.

Primary Standard A National Ambient Air Quality Standard which establishes limits on specific criteria pollutants to protect public health, including the health of sensitive populations such as children, asthmatics, and the elderly.

Promulgate To officially announce, publish, make known to the public; to formally announce a statute or decision by the court.

Secondary Standard A National Ambient Air Quality Standard which establishes limits on specific criteria pollutants to protect public welfare, including protection against decreased visibility, damage to animals, crops, vegetation, and buildings.

Speciation The process of determining the physical and chemical makeup of pollutants such as particulate matter, which may be composed of droplets and particles of various compounds.

Stationary Source An emission source that does not move, also known as a point source. Stationary sources include factories, power plants, cement plants, and quarries.

Synthetic Minor A facility that has the Potential to Emit (PTE) that could exceed major Title V thresholds, but they have agreed to control emissions below major threshold. Synthetic minors include conditional major facilities.

Title V Any source that has the PTE of greater than 100 Tons of criteria pollutants or 10/25 TPY of a single HAP or any combined HAP.

Toxic Air Pollutant A subset of the pollutants listed as Hazardous Air Pollutants by the U.S. EPA.

Volatile Organic Compounds A class of organic (carbon-containing) compounds that vaporize (become a gas) at room temperature. VOCs are a major component of ground-level ozone pollution. Common sources include paints, solvents, coatings, and inks.

APPENDIX F: NATIONAL AMBIENT AIR QUALITY STANDARDS (NAAQS)

POLLUTANT	MAXIMUM CONCENTRATION	
	Primary Standard	Secondary Standard
Carbon Monoxide		
8-Hour Average	9 ppm (1)	----------
1-Hour Average	35 ppm (1)	----------
Lead		
Rolling 3-Month Average	0.15 µg/m^3 (2)	Same as primary
Nitrogen Dioxide		
Annual Average	53 ppb (3)	Same as primary
1-Hour Average	100 ppb (4)	----------
Particulate Matter (measured as PM_{10})		
24-Hour Average	150 µg/m^3 (5)	Same as primary
Particulate Matter (measured as $PM_{2.5}$)		
Annual Average	12.0 µg/m^3 (6)	15.0 µg/m^3 (6)
24-Hour Average	35 µg/m^3 (7)	Same as primary
Ozone		
8-Hour Average	0.070 ppm (8)	Same as primary
Sulfur Dioxide		
1-Hour Average	75 ppb (9)	----------
3-Hour Average	----------	0.5 ppm (1)

The National Ambient Air Quality Standard determines what levels of each pollutant are acceptable in terms of protecting human health (primary standard) and public welfare (secondary standard).

Understanding the National Ambient Air Quality Standards

The federal Clean Air Act (42 U.S.C. 7401-7671), as amended by the U.S. Congress in 1970, 1977, and 1990, directs the U.S. Environmental Protection Agency to establish National Ambient Air Quality Standards defining maximum allowable ambient (outdoor) concentrations for criteria pollutants. Through the Clean Air Act, the Environmental Protection Agency established federal standards for six criteria air pollutants that are considered harmful to human health and the environment. Known as the National Ambient Air Quality Standards or "NAAQS" (pronounced "nacks"), the standards establish limits for each of the criteria pollutants. The term "criteria pollutants" derives from the requirement that EPA must set criteria or standards for each pollutant in the table on page 85.

There are two standard goal levels for each of the criteria pollutants. The Primary Standard is designed to protect the public health. The Secondary Standard is designed to protect public welfare. Welfare includes damage to plants and animals, impairment of visibility, and property damage.

Units of measure in the chart are micrograms of pollutants per cubic meter of air ($\mu g/m^3$), parts of pollutants per million (ppm) parts of air, and parts-per-billion (ppb) parts of air.

Footnotes:

(1) Not to be exceeded more than once per year.

(2) In addition to the 2008 lead standard (final rule signed Oct. 15, 2008), the 1978 lead standard (1.5 $\mu g/m^3$ as a quarterly average) also remains in effect until one year after an area is designated for the 2008 standard.

(3) The official level of the annual NO_2 standard is 0.053 ppm, equal to 53 ppb, which is shown here for the purpose of clearer comparison to the 1-hour standard.

(4) To attain this standard, the 3-year average of the 98th percentile of the daily maximum 1-hour average at each monitor within an area must not exceed 100 ppb (effective Jan. 22, 2010).

(5) The estimated number of exceedances must be equal to or less than one, on average over 3 years.

(6) To attain this standard, the 3-year average of weighted annual means must not exceed 12.0 $\mu g/m^3$ (final rule signed on Dec. 14, 2013; rule effective on March 18, 2013). The previous primary standard was set to 15.0 $\mu g/m^3$, as a 3-year average of annual weighted means, and was instead retained as a secondary standard.

(7) To attain this standard, the 3-year average of the 98th percentile of 24-hour concentrations at each population-oriented monitor within an area must not exceed 35 $\mu g/m^3$.

(8) To attain this standard, the weighted 3-year average of the fourth-highest daily maximum 8-hour average ozone concentrations measured at each monitor within an area over each year must not exceed 0.070 ppm (effective December 28, 2015).

(9) To attain this standard, the 3-year average of the 99th percentile of the daily maximum 1-hour average at each monitor within an area must not exceed 75 ppb (final rule signed June 22, 2010).