

Kentucky Division for Air Quality *2016 Annual Report*



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





Dear Reader,

On behalf of the Division for Air Quality, I want to thank you for your interest in the Division's FY 2016 Annual Report. The Annual Report details the Division's work to complete its mission, administer its functions, and assure our commitment to protecting human health and the environment from July 1, 2015 through June 30, 2016. I hope you find the report to be informative and educational, while recognizing the creation and maintenance of our successful, effective partnerships with air pollution sources and the public.

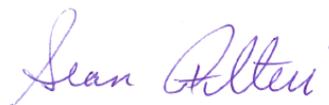
Fiscal Year 2016 served as a transition year for the Division for Air Quality. After the gubernatorial election in November 2015, we welcomed the new administration and leadership of the executive branch. In the Spring of 2016, the Division joined the rest of the Energy and Environment Cabinet in relocating to our new home at 300 Sower Blvd. Our new home, a beautiful five-story building, sits atop one of the highest points in Frankfort and achieves the status of LEED Silver certification. If you work or live outside of Frankfort and have yet to visit the 300 Building, I encourage you to stop by for a tour the next time you are in town. I predict that you will be impressed by its location, design, and many energy-saving features.

It is always helpful to look back to gain perspective regarding Kentucky's air quality. Ambient air monitoring data documents the story of steady and significant improvement. This improvement is a direct result of

reduced air pollution. For example, emissions of sulfur dioxide (SO₂) from Kentucky coal-fired power plants totaled 1.5 million tons in 1976. In 2015, those emissions had dropped to 131,696 tons - a remarkable 91 percent reduction. This decrease is all the more dramatic considering Kentucky's population and economy have grown significantly during that same time period. New air pollution control technologies, improved vehicle fuel economy, and a growing emphasis on energy efficiency have all contributed to cleaner air.

In closing, I would like to extend my sincere thanks and gratitude to the leadership of the Executive Branch, members of the General Assembly, and every citizen of the Commonwealth who supported us during this past year. Again, thank you for your interest and review of the Division's 2016 Annual Report. If you have questions, comments, or additional information requests, please do not hesitate to contact us.

Sean Alteri
Director



The Division for Air Quality's new home at 300 Sower Blvd. Photos: DAQ



Kentucky Division for Air Quality Annual Report Fiscal Year 2016

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Welcome to the FY 2016 Annual Report of the Kentucky Division for Air Quality (DAQ). This report details DAQ's accomplishments from July 1, 2015 - June 30, 2016.



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
- 166 staff based in Frankfort and 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)
- Environmental education





Air quality staff in Louisville prepare to launch monitoring instruments with balloons in 1958. Photo: LMAPCD

A Brief History of Air Pollution Control in Kentucky

In 1952, the Kentucky legislature passed KRS chapter 77, which authorized the creation of county-level air pollution control districts. Then in 1966, the Kentucky Air Pollution Control Commission became the state's first air pollution control program 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 1955 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. Jefferson County (Louisville Metro Air Pollution Control District, or LMAPCD) has maintained a local air pollution control program since the late 1940s, while activities in the rest of Kentucky 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.



DAQ staff works with ozone monitoring equipment in the 1970's. Photo: DAQ

Division staff participates 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 subcommittees and groups. The most notable organizations that the Division routinely engages are below:

- AAPCA:** The Association of Air Pollution Control Agencies was formed in early 2013, representing 17 states: Alabama, Florida, Indiana, Kentucky, Louisiana, Mississippi, Nebraska, New Mexico, Nevada, North Dakota, Ohio, Pennsylvania, Tennessee, Texas, Virginia, West Virginia and Wyoming. AAPCA's main goal is to provide a technical forum for members and promote efficient and effective programs to implement the CAA. DAQ director Sean Alteri served as AAPCA's assistant director during FY 2016.
- 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. KAGC's goal is to improve and enhance the expertise, public image, morale and effectiveness of governmental communicators and the work of federal, state and local agencies. DAQ education specialist Roberta Burnes served on KAGC's board of directors in 2016.
- 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.
- NACAA:** The National Association of Clean Air Agencies represents air pollution control agencies in 45 states and territories and over 116 major metropolitan areas across the United States. The association serves to encourage the exchange of information among air pollution control officials, to enhance communication and cooperation among federal, state, and local regulatory agencies, and to promote good management of our air resources.
- 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.

ENVIRONMENTAL EDUCATION

Environmental Education Outreach

The Division's EE program continues to reach thousands of Kentuckians each year. During FY 2016, DAQ's EE programs reached 6309 people in 24 counties.

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

Figure 1 (Page 5) shows the numbers for each major audience reached by DAQ's outreach. School programs drew the largest audience (3,400) 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.

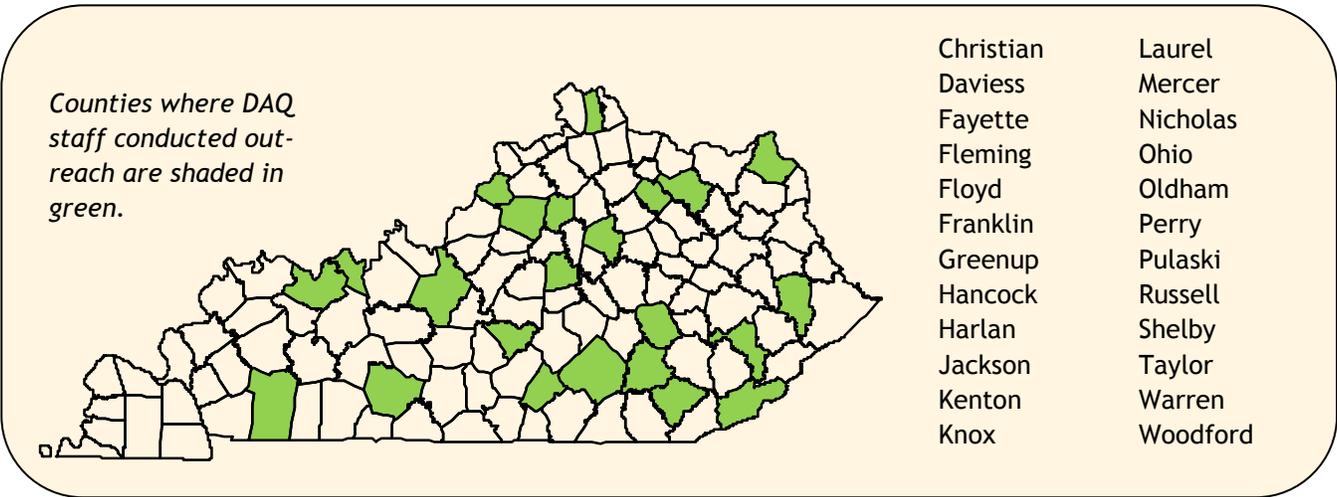
Public programs drew the second-largest audience (2,006) as DAQ staff participated in several large spring festivals, including:

- Reforest Frankfort
- Earth Day, Frankfort
- Earth Day, Somerset Community College
- Earth Day, Hopkinsville

DAQ's environmental education specialist joined the Kentucky Association of Governmental Communicators board of directors in 2015.



DAQ staff conducted educational outreach in the following counties during FY 2016:



Air Quality Awareness Week

The first week in May is National Air Quality Awareness Week. This year, the Division again distributed daily air quality quizzes through email and social media. Quizzes explored historical air quality events, health issues, and taking action to improve air quality. Hundreds of Kentucky teachers and students took the quizzes as well as state employees and the general public.

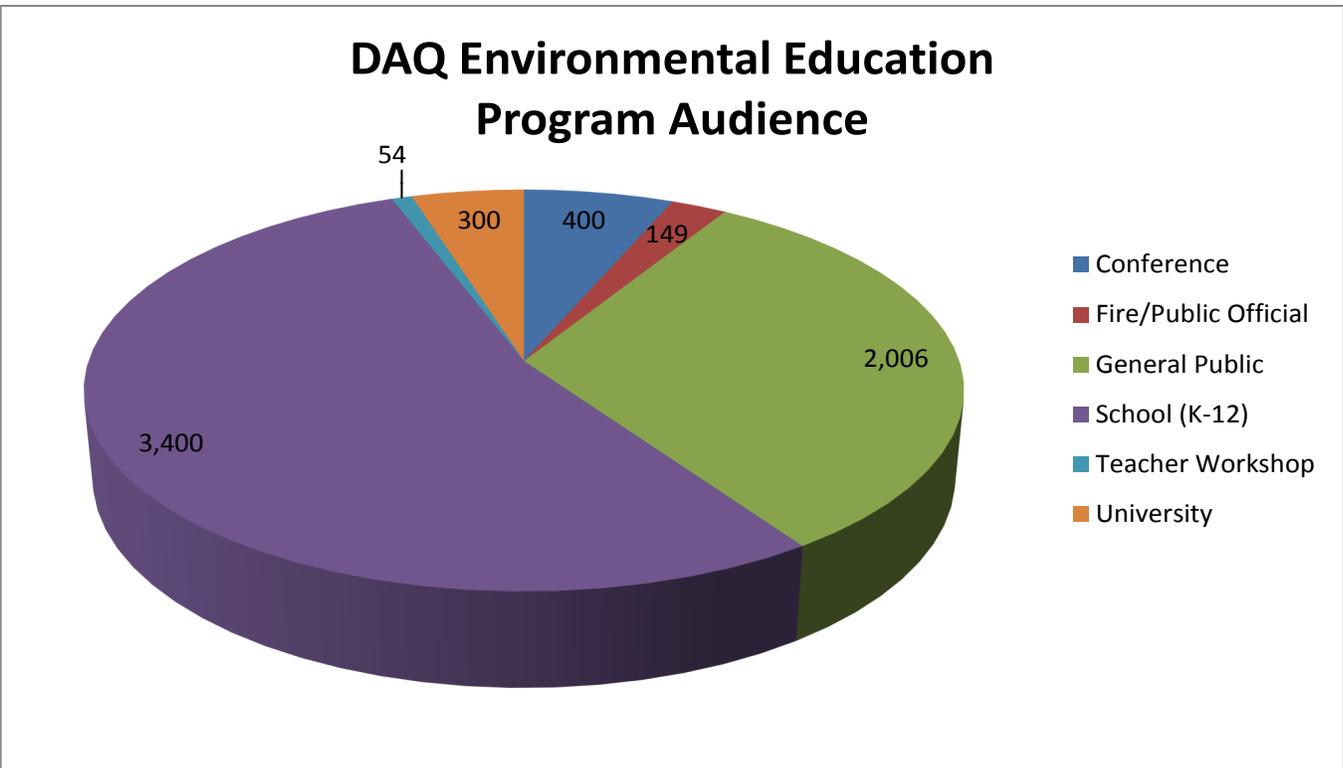


Figure 1: The Division for Air Quality’s environmental education programs reached 6,309 people during FY 2016.

No Drive-Thru Crew

DAQ partnered with a team of students from SCAPA Bluegrass who participated in the 2016 Lexus Eco Challenge. Known as the “No Drive-Thru Crew”, the students chose the goal of reducing emissions from idling vehicles by encouraging customers at restaurants to skip the drive-thru and walk into the business instead. DAQ supported the students’ efforts with resources and incentives for participants. The No Drive-Thru Crew went on to win first place in the Air/Climate Challenge, and later won first place again in the Final Challenge, earning the students a total of \$25,000 in scholarship grants.



Pictured here are Morgan Buckner and Mary Beth Matocha, two members of the No Drive-Thru Crew. Photo: DAQ



(Above) DAQ staff Eliza Bodkin and Emma Moreo explore the properties of air with students at the Fayette County Science Fair. (Right) Environmental education specialist Roberta Burnes talks air quality with students at Lloyd Memorial High School in Kenton County. Photos: DAQ

The DAQ EE program includes:

- Teacher training
- Classroom and camp programs
- Public events and festivals
- Firefighter education
- Community forums & conferences
- Media outreach

DAQ EE program topic areas include:

- Air pollution sources & monitoring
- Open burning and waste reduction
- Energy conservation
- Climate change
- Indoor air quality
- Idle reduction
- Fuel economy and alternative fuels
- Hybrid-electric vehicles



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.
- In FY 2016, staff provided open burning awareness trainings to 149 public officials including firefighters and solid waste coordinators who often witness illegal burning first-hand. 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.

In June 2016, the Energy & Environment Cabinet made the decision to retire most toll-free hotline numbers, including 888-BURN-LAW. Air quality complaints will now be directly routed to the Division's complaints coordinator, Diana Davidson, at 502-782-6592. The 24-hour environmental emergency hotline (800-928-2380) will remain active.

Air Quality for Educators Workshop

In partnership with the U.S. Fish & Wildlife Service and the Kentucky Environmental Education Council, DAQ presented a summer teacher workshop at the Wolf Creek National Fish Hatchery. Participants learned about the history of air pollution control, properties of air, engineering and designing solutions to air pollution, and how air quality and energy are connected. Teachers also gained hands-on experience with activities and lesson plans that they could take back to their classrooms. Activities were correlated to Kentucky's Core Academic Standards.



Educators explored air quality connections at a teacher workshop in July 2015. Photo: DAQ



*Bushy lichens such as this one are especially sensitive to sulfate and nitrate pollution.
Photo: DAQ*

Lichen Biomonitoring Workshops

How do natural systems respond to air pollution? That is the guiding question in a new citizen science lichen Biomonitoring project in Eastern Kentucky. The program is a partnership between Eastern Kentucky University, Pine Mountain Settlement School, and the Division for Air Quality.

During FY 2016, three citizen science workshops were held at Pine Mountain. Division staff helped participants understand the basics of air quality monitoring and how air pollutants affect lichens. Afterwards, participants learned how to identify lichens in forest study plots and to categorize them according to sensitivity to air pollutants. The long-term project will provide data and insight on how forest communities in Eastern Kentucky are responding to improvements in air quality.

The Field Operations Branch (FOB) is the largest branch of the Division and is currently staffed by 67 employees. The majority of FOB field staff is located in eight regional field 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 98 air monitoring units located at 27 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.

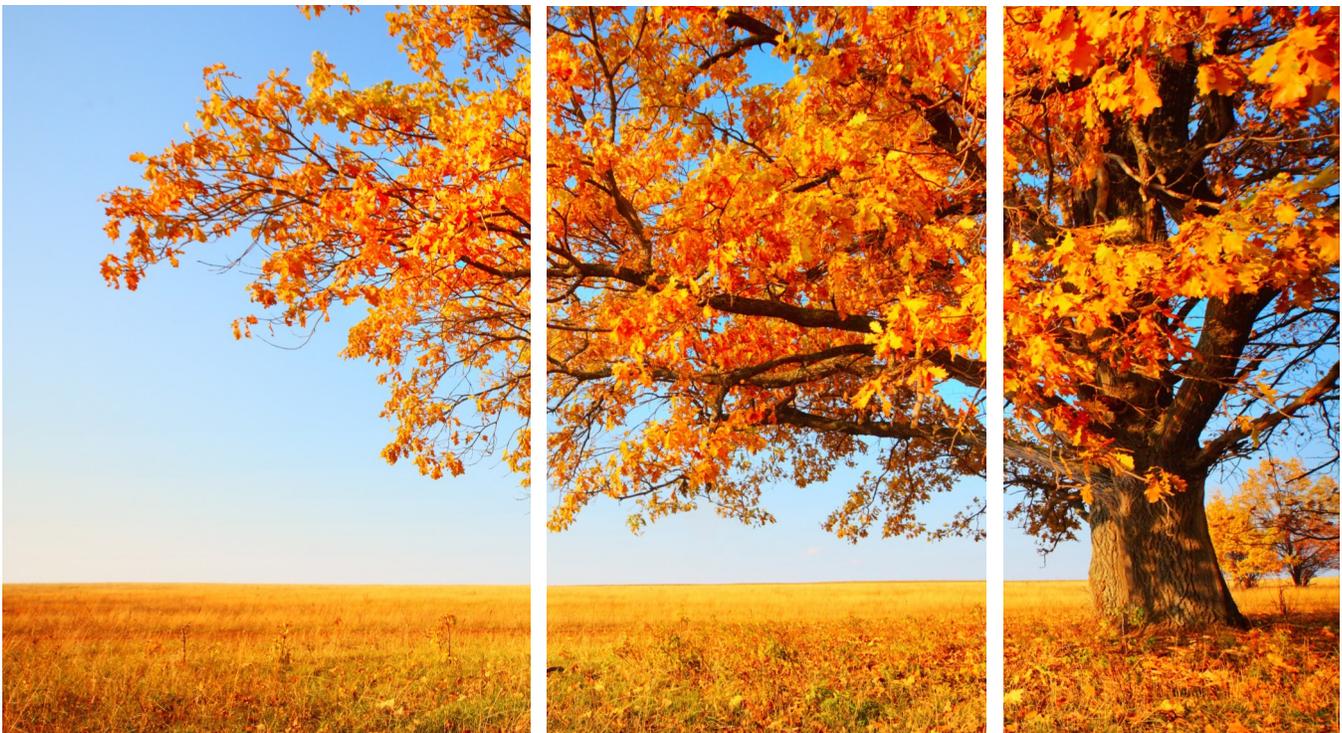
For a map of DAQ's regional field offices, see Page 83 of this report.

Inspections

One of the primary duties of the FOB is to inspect sources of air pollution for compliance with air quality regulations and if applicable, permit conditions. The measures for the success of FOB's compliance-monitoring program are:

- Compliance rate of stationary source inspections (Figure 2, see Page 9)
- Number of major stationary source inspections conducted (Figure 4, see Page 10)
- Number of minor stationary source inspections conducted (Figure 5, see Page 10)
- Rate of compliance with 401 KAR 63:005 - open burning (Figure 7, see Page 12)
- Rate of compliance with 401 KAR 63:010 - fugitive emissions (Figure 8, see Page 13)
- Rate of compliance with 401 KAR 53:010 - odor (Figure 10, see Page 14)
- Number of asbestos inspections conducted (Figure 12, see Page 15)

In calendar year 2015, FOB staff completed 3,431 compliance inspections of various types at mostly permitted sources (major Title V, minor); 89 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, dry cleaners, non-coal mineral processing facilities, and coal-mining related activities (Figure 5).

2015 Compliance Rate of Stationary Source Inspections

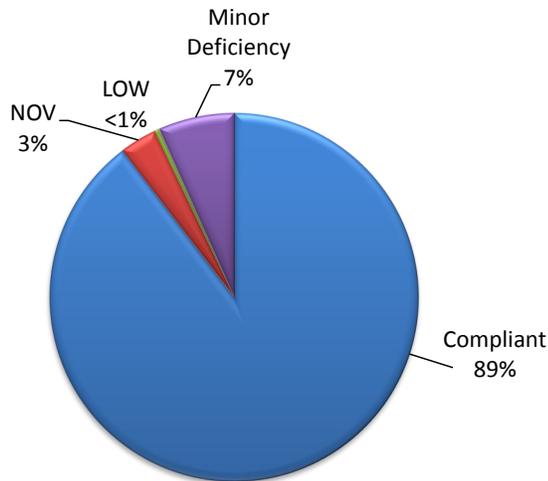


Figure 2 (left): The compliance rate of regulated stationary sources inspected by field office staff in 2015 was 89 percent. Notices of Violation (NOV) were issued to 3 percent of Kentucky's stationary sources, while Letters of Warning (LOW) were below 1 percent. About 7 percent of violations were considered non-recurrent minor violations or violations that were quickly corrected, eliminating the need for any formal enforcement action.

Total Inspections

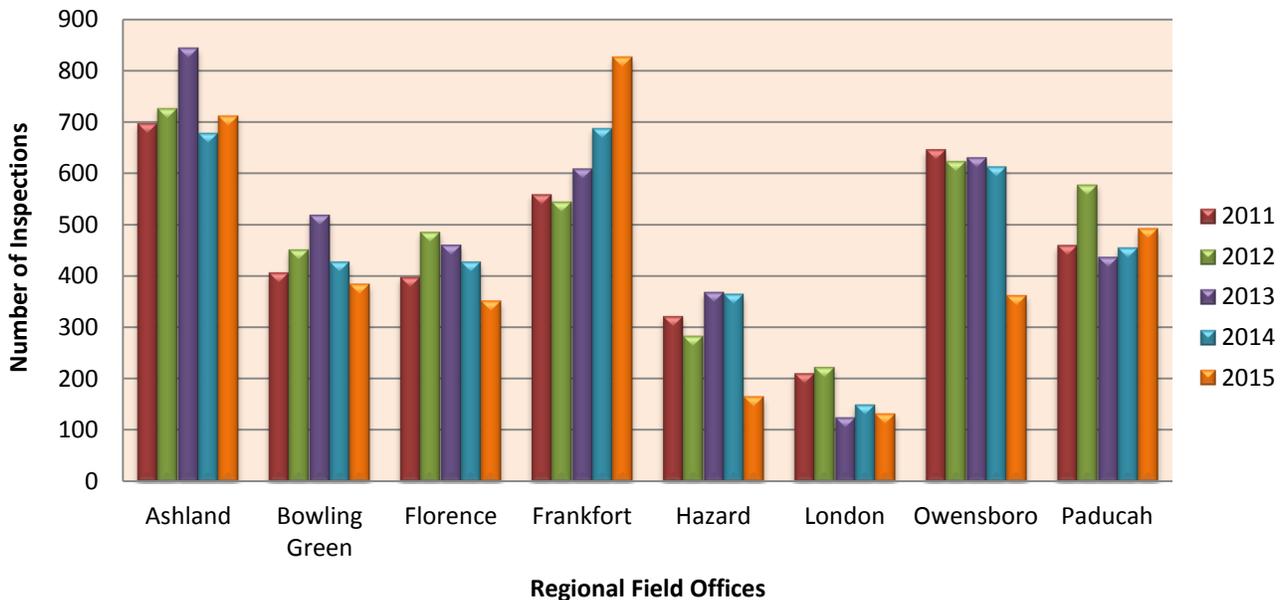


Figure 3: The total number of inspections at regulated facilities.

Major Facility Inspections

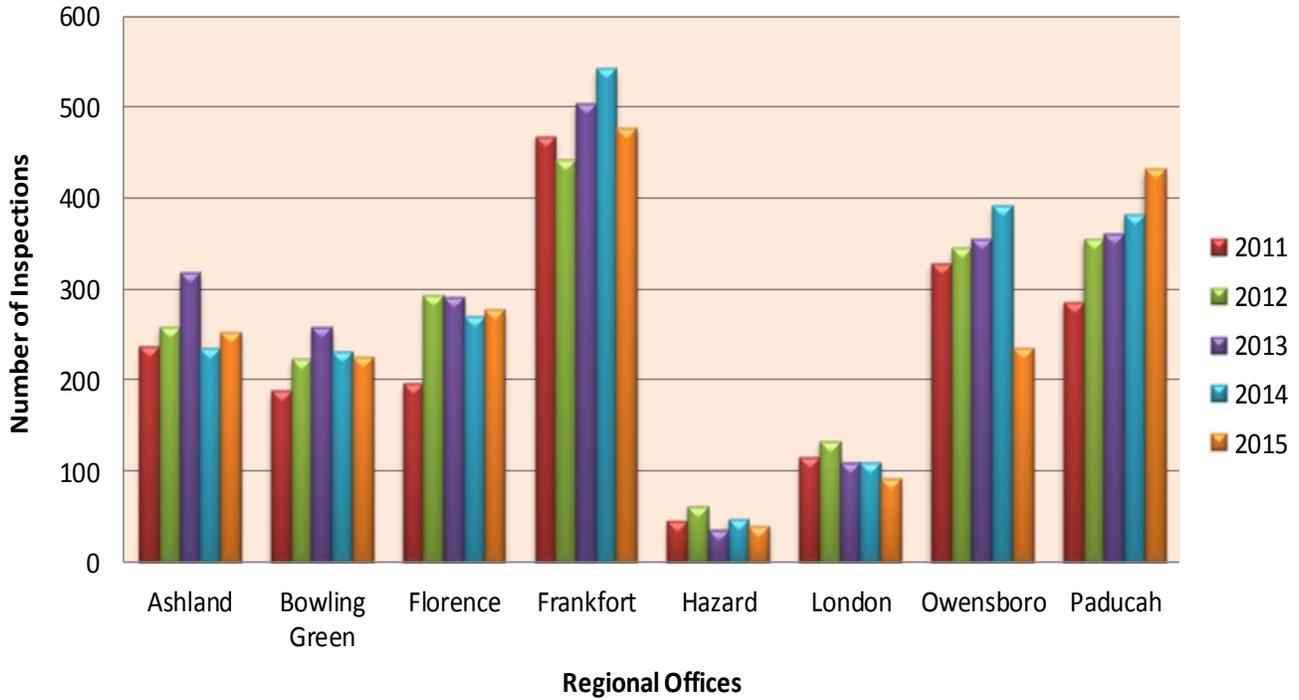


Figure 4: Number of major stationary facility inspections in Kentucky. The regional offices with more inspections are located in areas of the state with more major permitted facilities. Major permitted facilities include power plants, manufacturing facilities and chemical processing plants.

Minor Facility Inspections

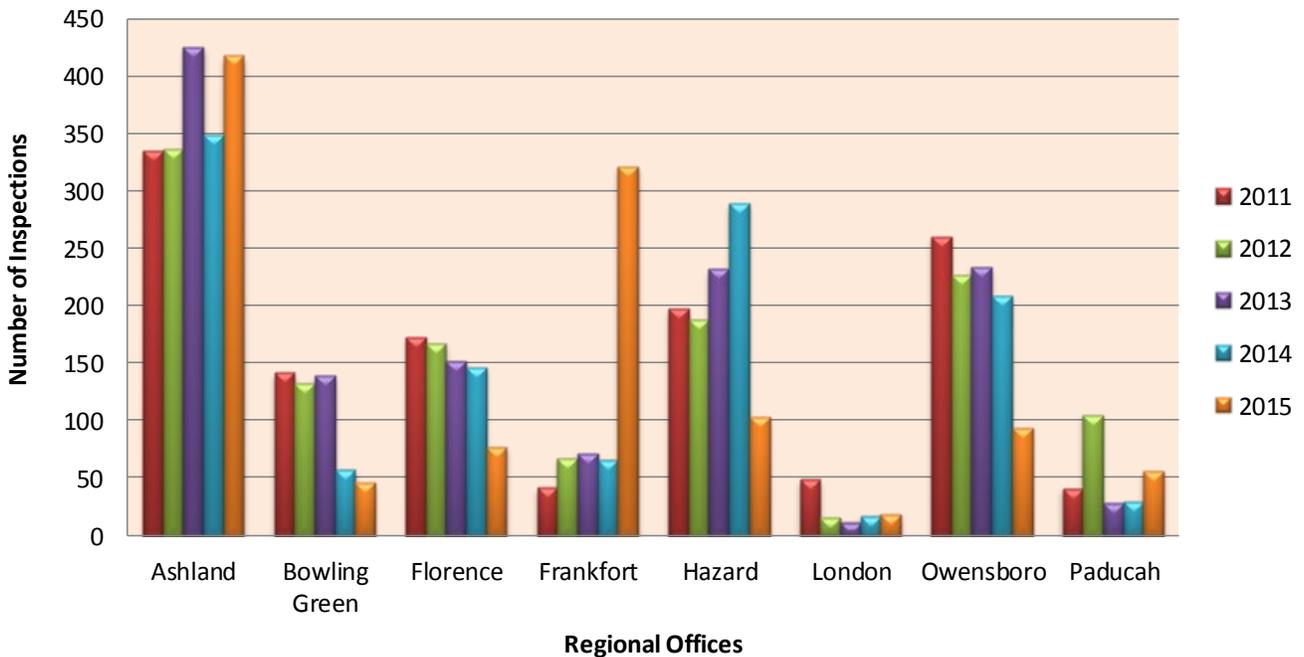


Figure 5: Number of minor stationary source inspections. Minor pollution sources include auto body paint shops, dry cleaners, and both coal and non-coal mineral processing facilities.

Complaint Investigations

Investigating complaints consumes a significant portion of field staff time. In 2015, DAQ received a total of 1,485 complaints resulting in 1,522 field investigations (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.

In 2015-2016, the Division received a high number of complaint calls regarding odor at Big Run landfill in Boyd County. As a result, DAQ began tracking the numbers of individual calls relating to odor at Big Run (see Figure 11).

Complaint Categories

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.



Burning illegal materials releases toxic chemicals and particulate matter into the air.

The Division received 563 complaints about open burning in calendar year 2015. 49 percent of these complaints resulted in Notices of Violation (NOV) of the open burning regulation (Figure 7). The violation rates for illegal open burning continue to be high, since staff only responds to citizen complaints of open burning or discover them in the course of other duties. 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 (gravel, feed grain, etc.) 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.



Fugitive emissions from land clearing for construction. State regulation requires control measures to reduce fugitive emissions and their impact on air quality.

Odor complaints are regulated under 401 KAR 401 53:010. DAQ receives complaints concerning odor on an almost daily basis (Figure 9). The majority of complaints in 2014 and 2015 were about odor issues at Big Run landfill near Ashland and at other landfills. The increase in NOV's issued for odors (Figure 10) were also due to landfill related issues. In many instances, odors not rising to the level of a violation are corrected through cooperative efforts between the Division and the responsible party.

Complaints Received

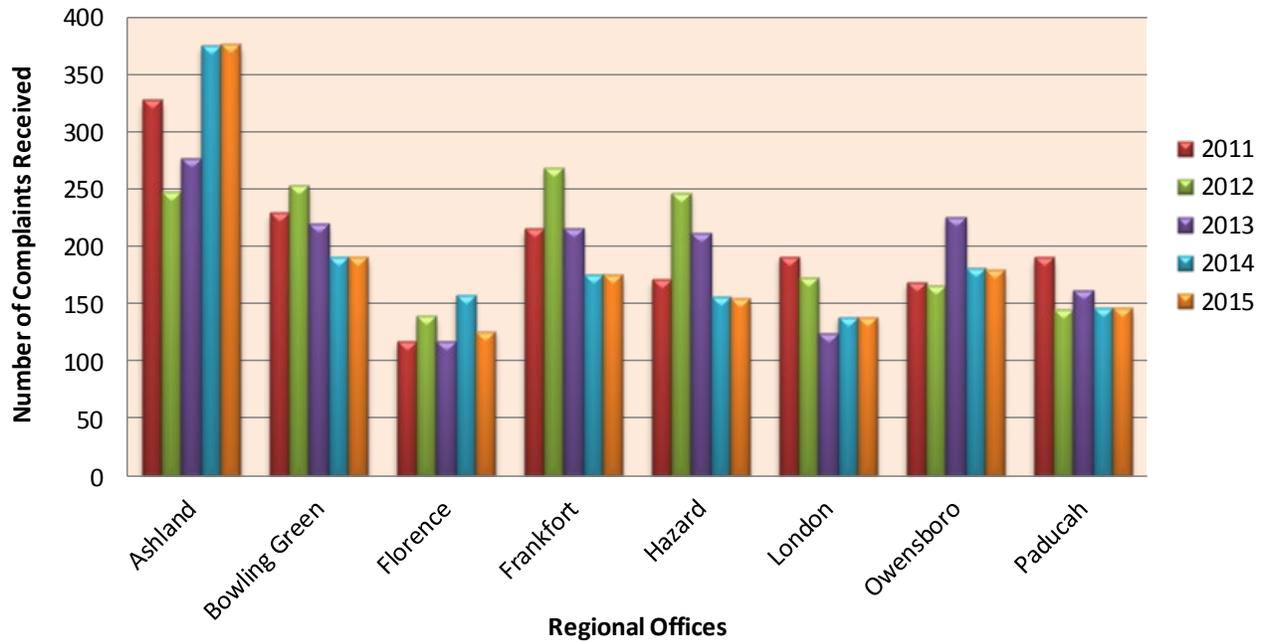


Figure 6: The numbers of complaints received during the last five years including open burning, fugitive emissions, odor, and asbestos complaints. Note that a “complaint” represents a single air quality incident about which one or more calls have been received.

Open Burning Complaints and Violations 2011 - 2015

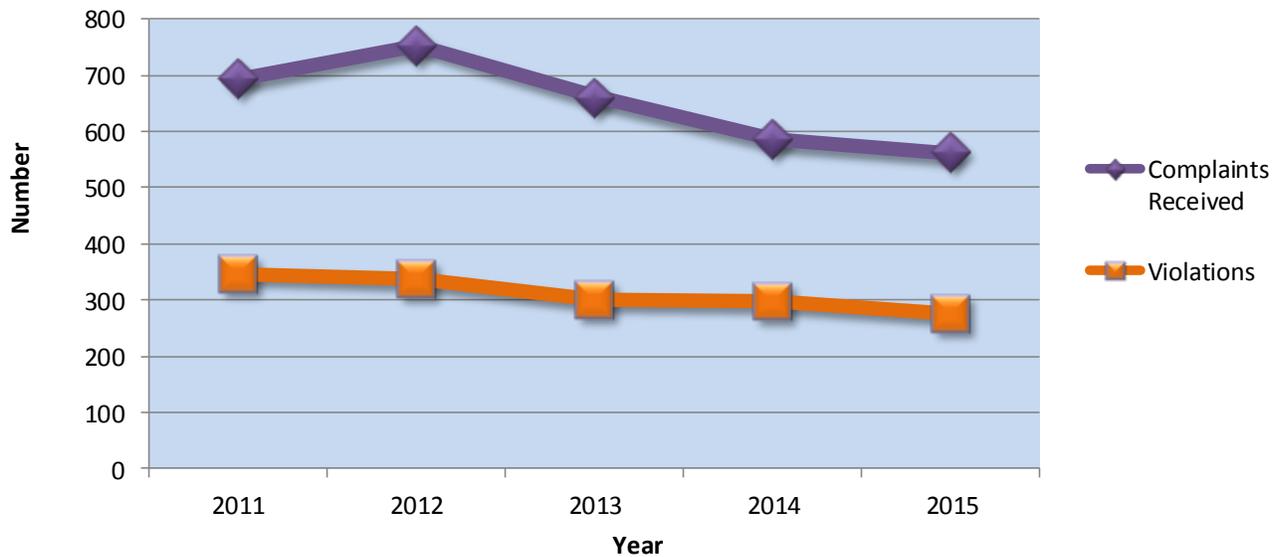


Figure 7: Complaints received about open burning and violations cited after investigation. 49 percent of open burning complaints resulted in violations in 2015. Education and outreach campaigns targeting illegal open burning may be responsible for the overall downward trend in open burning complaints.

Fugitive Emissions Complaints and Violations 2011 - 2015

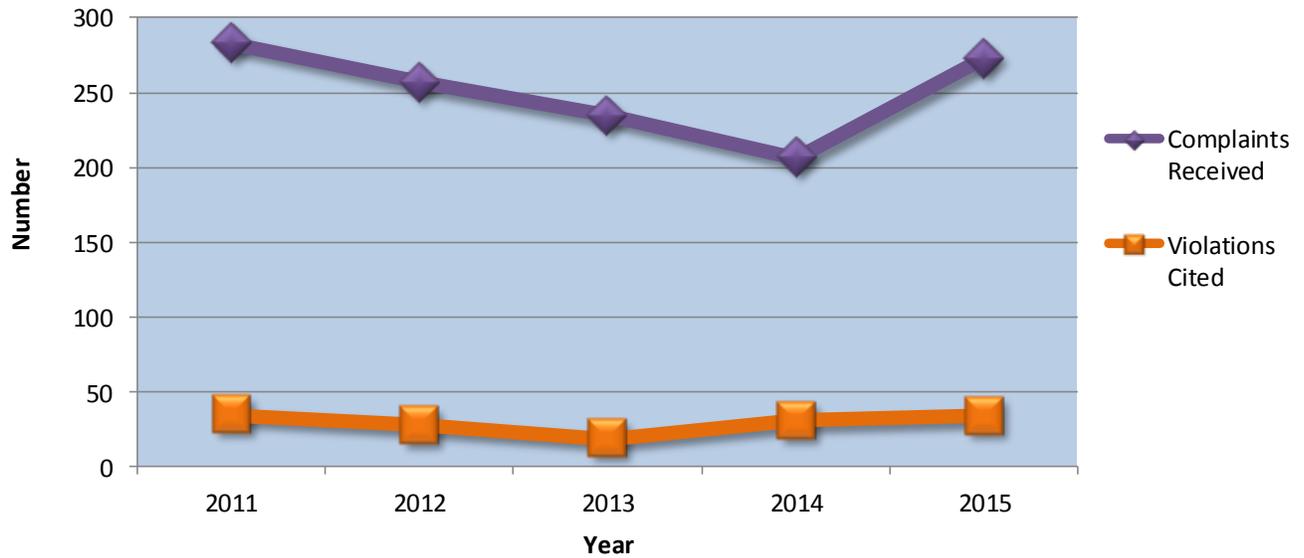


Figure 8: Fugitive Emissions Complaints and Violations.

Odor Complaints Received 2011 - 2015

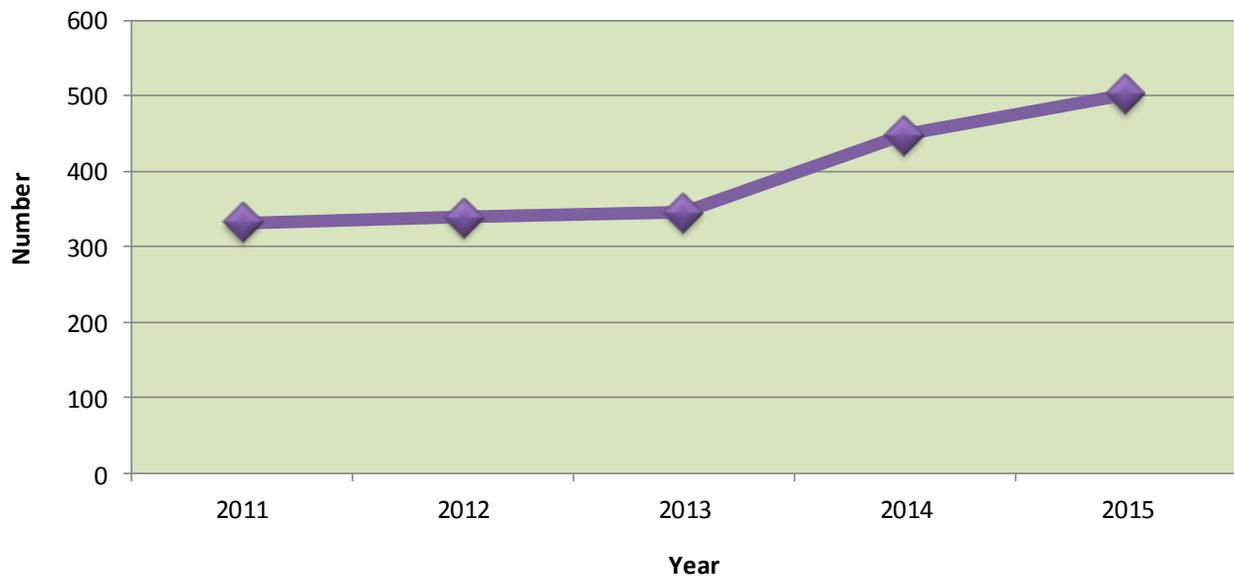


Figure 9: Odor Complaints Received. Note that a “complaint” may represent multiple calls about a single odor incident. Odor violations are documented when an inspector can smell the odor through a scentometer, which dilutes the ambient air at a ratio of seven to one.

Percentage of Odor Complaints Resulting in Violations

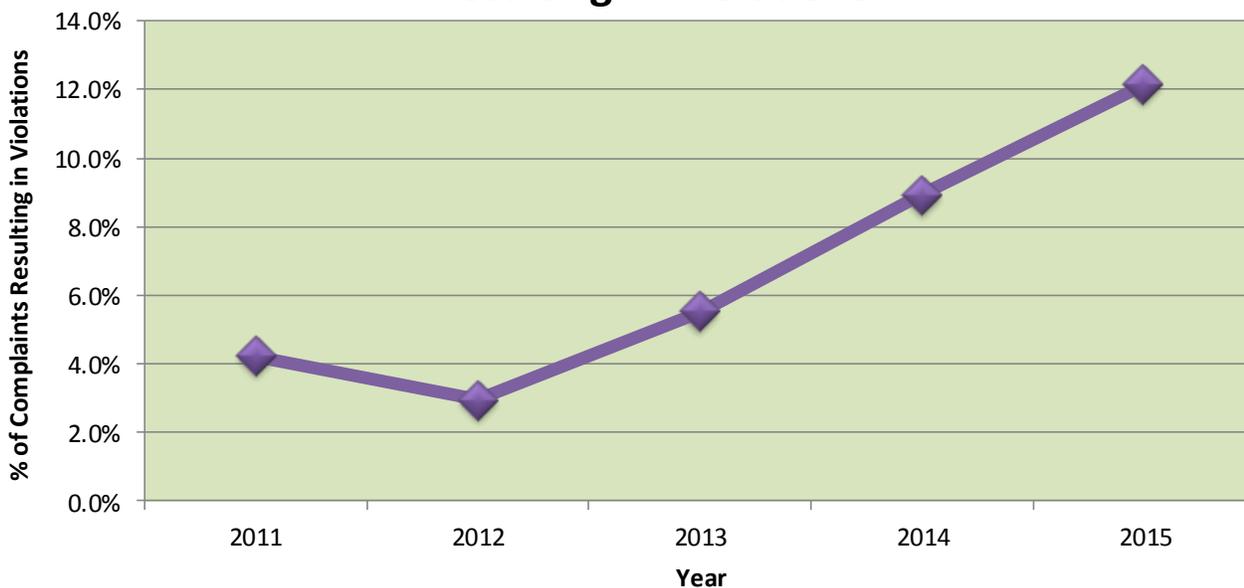


Figure 10: Percentage of Odor Complaints Resulting in Violations. Strong and steady odors are often required to document a violation of the Kentucky odor standard. Many odors not rising to the level of a violation are, nevertheless, corrected through cooperative efforts between the inspector and responsible party.

The Big Run Landfill in Boyd County was the focus of the highest-profile odor case in 2015. The Division worked with local officials, citizens groups, and the facility to reach an agreement that changed the operations at the landfill significantly. The number of odor complaints and odor violations related to this landfill has dropped steadily in 2016, which indicates the agreement and changes are working to reduce the odor impact to the citizens of Boyd County.

Daily Odor Complaint Calls 2016

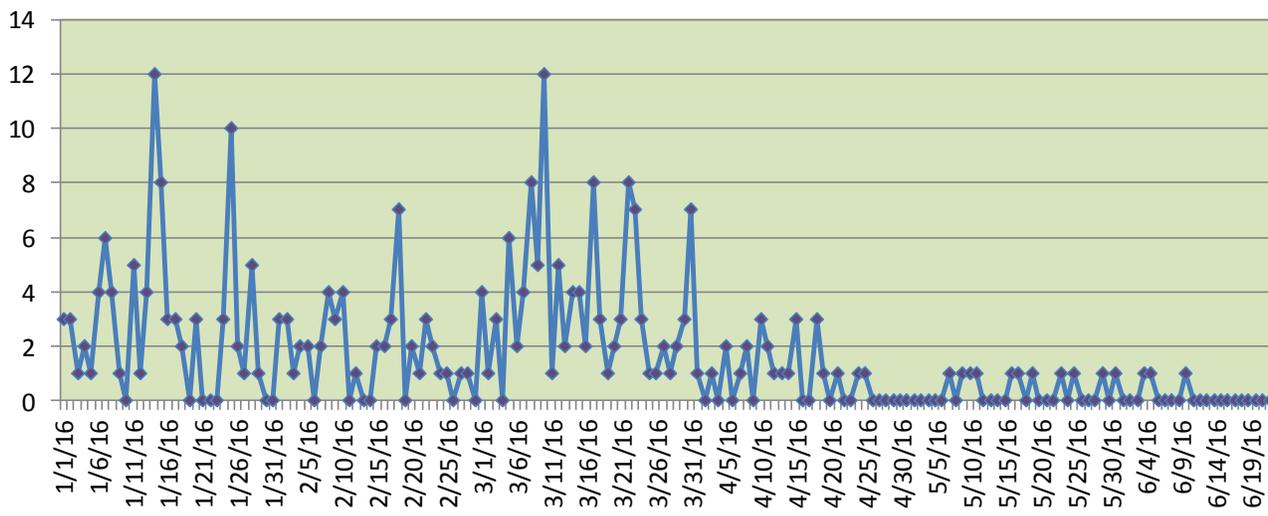
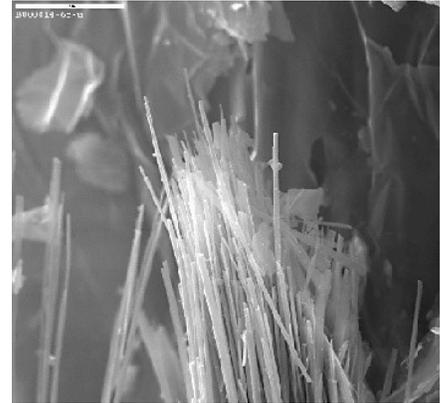


Figure 11: Daily complaint calls to DAQ about odor near Big Run Landfill in Boyd County peaked in late 2015 and gradually decreased after operational changes were made at the facility.

DAQ's Asbestos Inspection Program

Undisturbed asbestos material can be safely maintained if kept in good condition. Without proper precautions, however, renovations, demolitions, and even routine maintenance can cause asbestos-containing materials to release microscopic fibers into the air we breathe. Before renovating or demolishing a structure, it must be thoroughly surveyed for asbestos by an accredited professional. If 160 square, 260 linear, or 35 cubic feet or more of friable asbestos will be removed over a year's time, the removal must be done by a certified contractor following state and federal regulations.



Scanning electron micrograph of asbestos fibers. (Photo: U.S. Geological Survey/U.S. EPA)

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 2015, the compliance rate for NESHAP was 79 percent (Figure 13) and the compliance rate for AHERA was 69 percent (Figure 14).

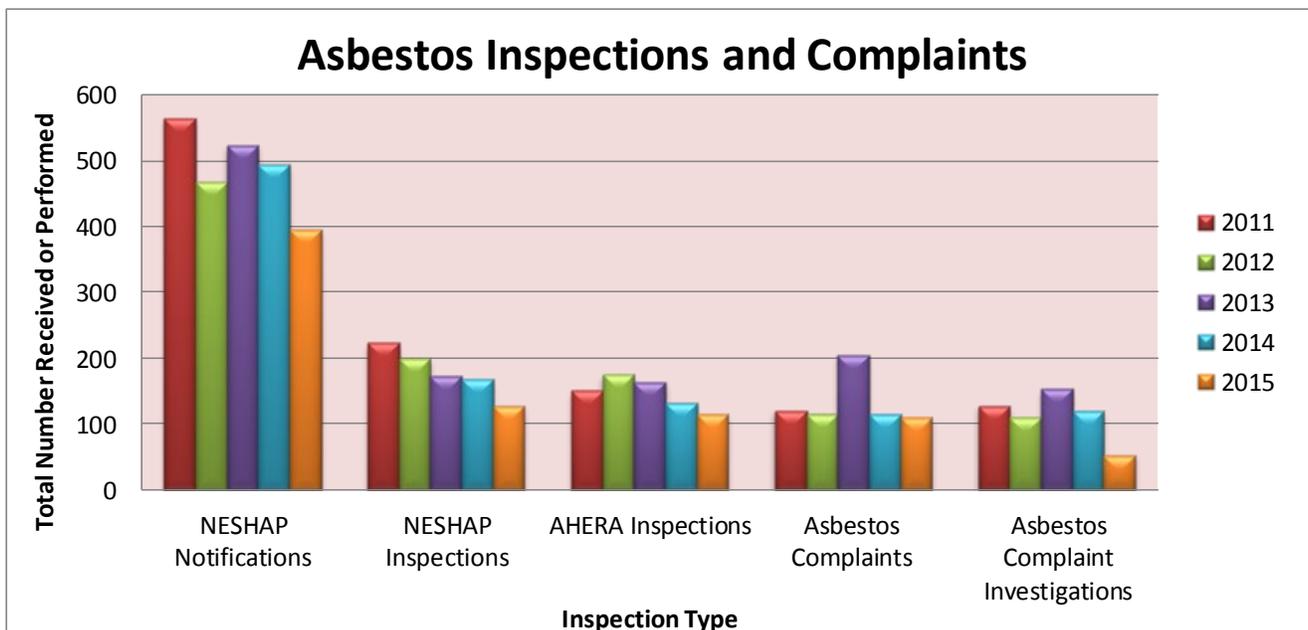


Figure 12: NESHAP notifications and inspections and AHERA inspections, complaints, and investigations.

2015 Asbestos NESHAP Compliance Rate

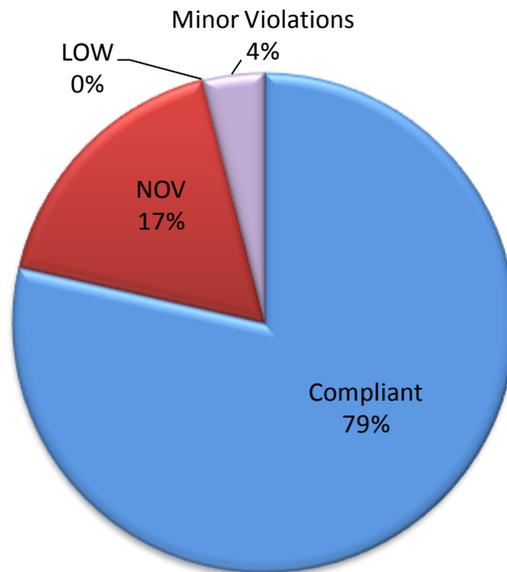


Figure 13: Compliance rate of asbestos removal and/or demolition operations regulated under the National Emission Standards for Hazardous Air Pollutants (NESHAP).

2015 AHERA Compliance Rate

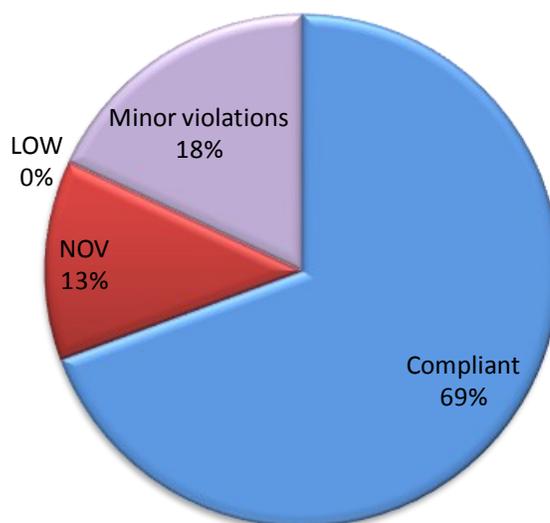


Figure 14: Compliance rate of school inspections for asbestos under the Asbestos Hazard Emergency Response Act (AHERA).

PERMIT REVIEW

The Permit Review Branch (PRB) is divided into the following specialized sections:

- Chemical Section
- Combustion Section
- Minerals Section
- Surface Coating Section
- Metallurgy Section
- Air Dispersion Modeling
- Permit Support

Figure 15 (Page 18) shows the number of permits issued by section for the years 2011-2015. In calendar year 2015, PRB issued 450 permits. Five of these were considered major economic development projects, which the Division worked on in partnership with the Cabinet for Economic Development.

At the close of Fiscal Year 2016, PRB had 249 pending applications in-house. Only 59 of the applications were beyond regulatory timeframe.

Air Dispersion Modeling

The EPA's Toxic Release Inventory database provides a means of tracking emissions of toxics, including HAPs. More information can be found at <http://www.epa.gov/TRI/>.

In FY 2016, the Air Dispersion Modeling Section completed 56 air toxics assessments. The section frequently uses modeling to refine the initial estimates from screening analyses performed by the PRB. These refined modeling runs have yielded data which has been used to verify, adjust or establish limits in permits, justify permit conditions, and protect public health and air quality.



Number of Permits Issued, by Section

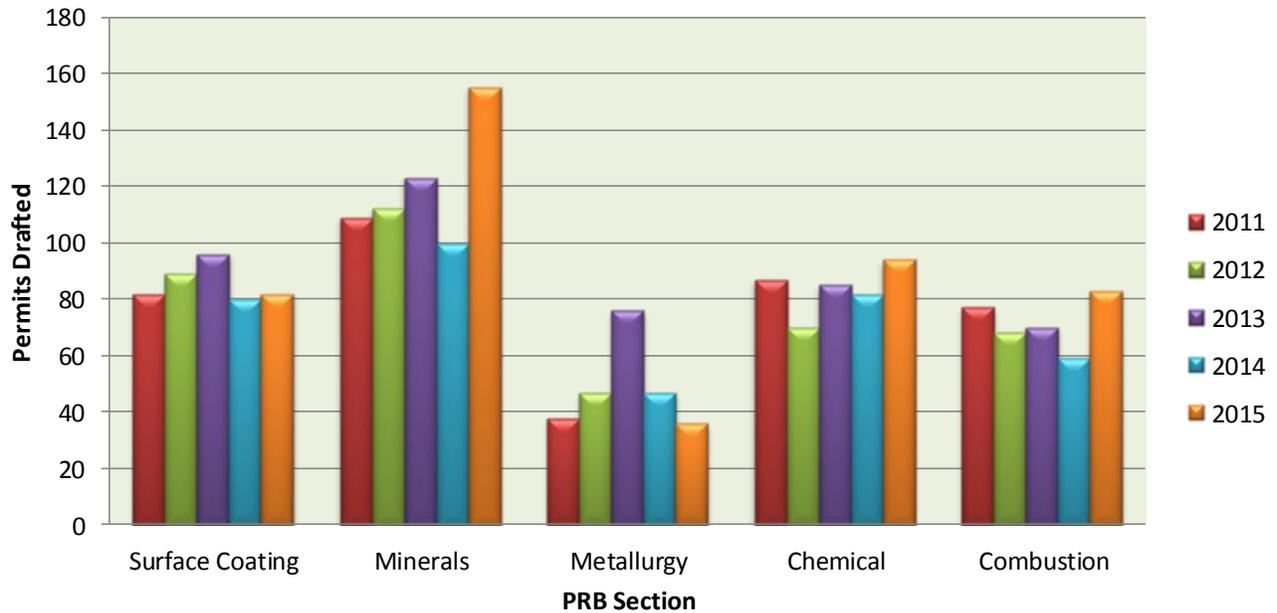


Figure 15: This chart shows the number of permits issued by section category in calendar years 2011-2015. In calendar year 2015, the Division issued 450 permits.

New Applications vs Completed Reviews 2011 - 2016

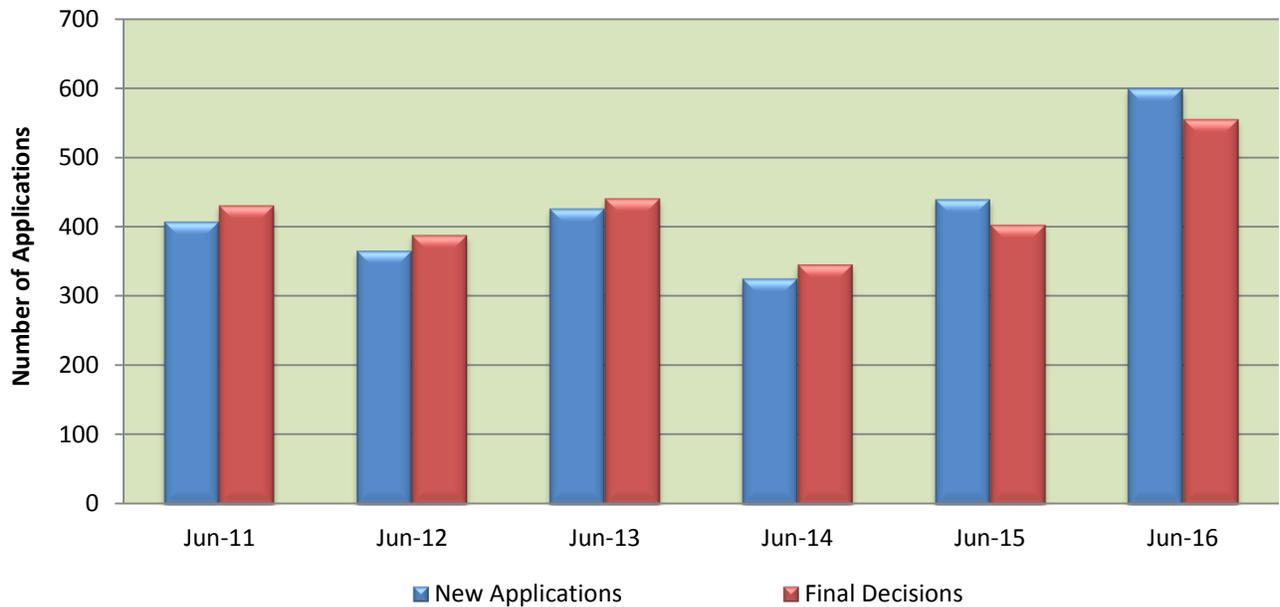


Figure 16: Numbers of completed permits versus new applications during each fiscal year, 2011-2016.

Air Permits Pending June 2008 to June 2016

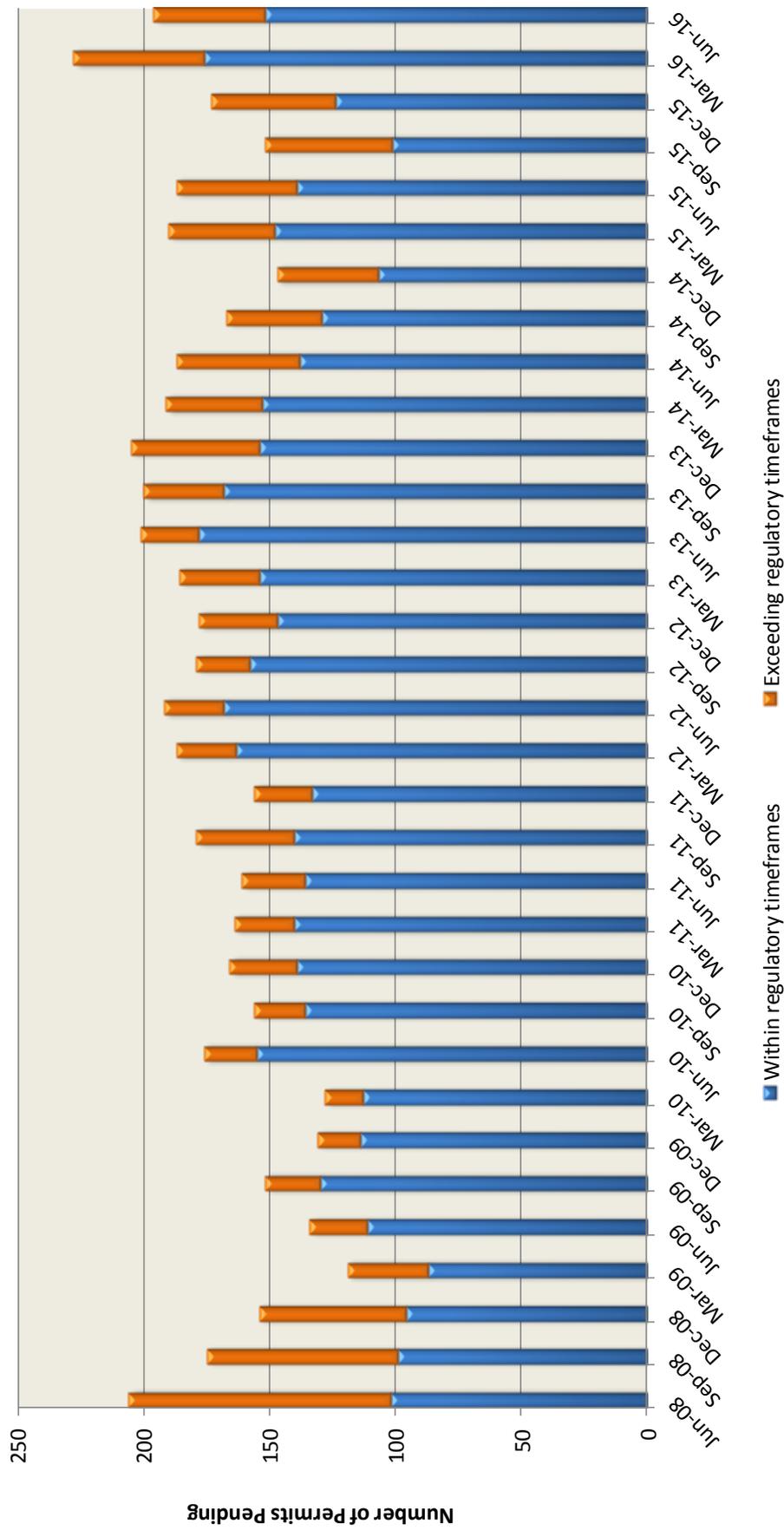


Figure 17: From June 2007 to June 2016, the Permit Review Branch has greatly reduced the amount of permit applications pending a final permit issuance as well as the percent of air permit applications that are beyond the Regulatory Time Frame (RTF), the allotted time for the complete permitting process. In June 2006, 521 of 716 pending permits were beyond RTF. By June of 2015, only 44 of the 196 pending permit applications were beyond RTF.

Backlog as a Percentage of Pending Permits June 2008 to June 2016

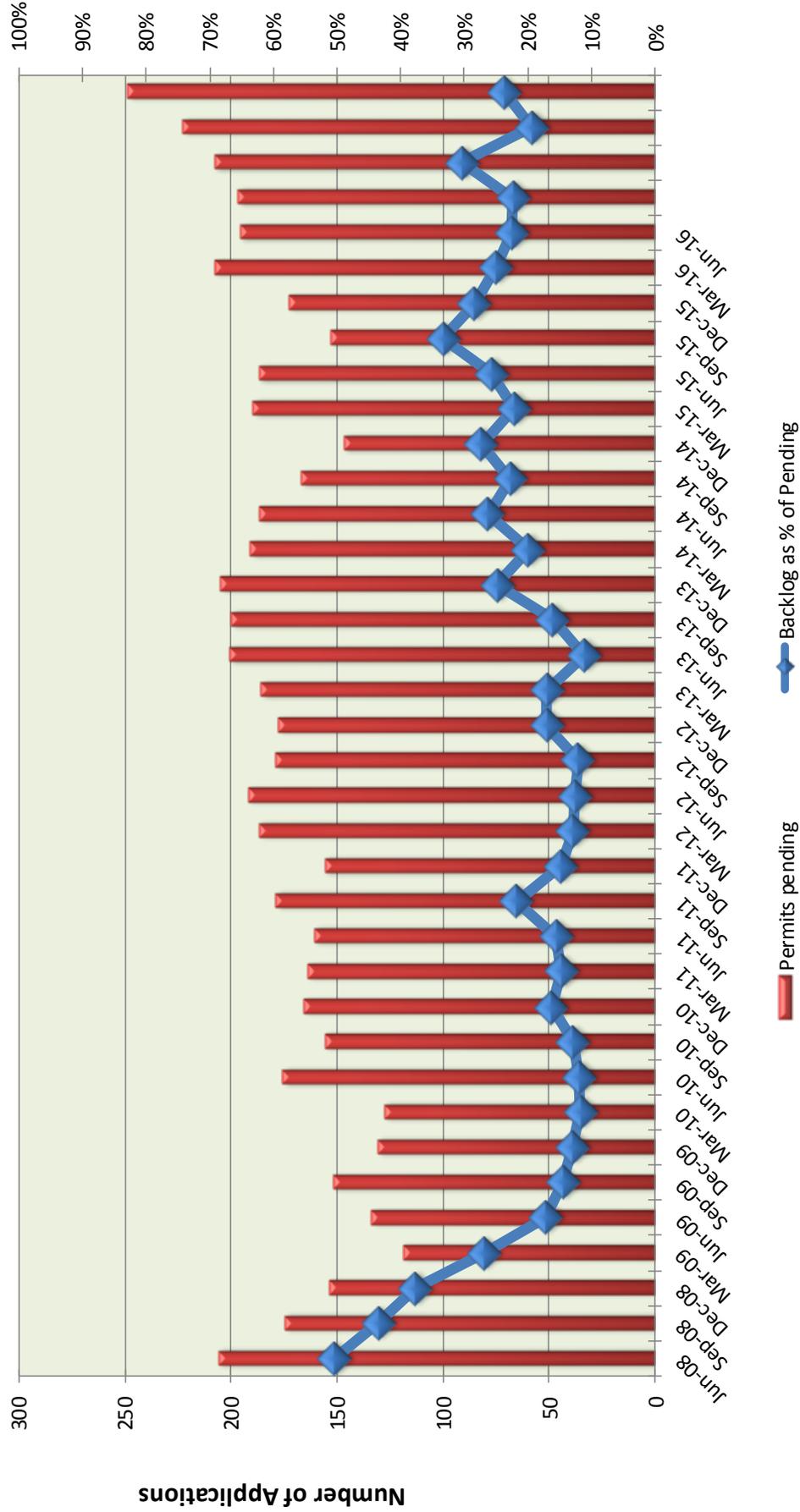


Figure 18: DAQ has significantly reduced the permit backlog since June 2006, at which time the Division had 716 applications in-house. The current number of pending applications represents a 72 percent reduction since that time.

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 CAA) is through air pollutant emission fees assessed to 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 within the Title V program will then be issued a bill based on that per ton cost. Concurrently, the 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*, or the minimum fee, that an agency should charge to fully fund the Title V program. Figure 19 shows the comparison between the EPA presumptive minimum and the actual cost per ton that the Division has charged.

For the sixth year in a row, the FY 2017 Title V emission fees are projected to exceed the federal presumptive minimum amount in order to meet costs associated with maintaining that program and a high level of customer service.



Title V Cost Per Ton Emissions Fee

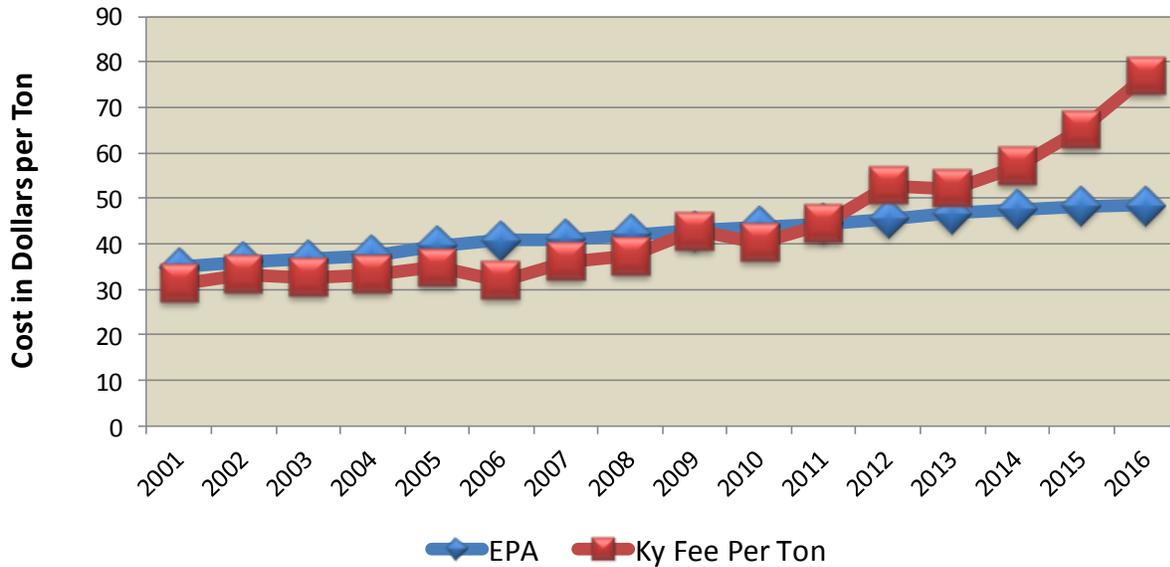


Figure 19: Title V Emission Fees Collected. This chart compares Kentucky's actual fees with EPA's "Presumptive Minimum," which is a suggested minimum fee per ton that states should charge.

A breakdown of the Division's revenue for FY 2016 is provided in Figure 20 below. In addition to Title V air emission fees, the Division receives funds from federal grant programs, tank truck permits, and asbestos license and inspection fees.

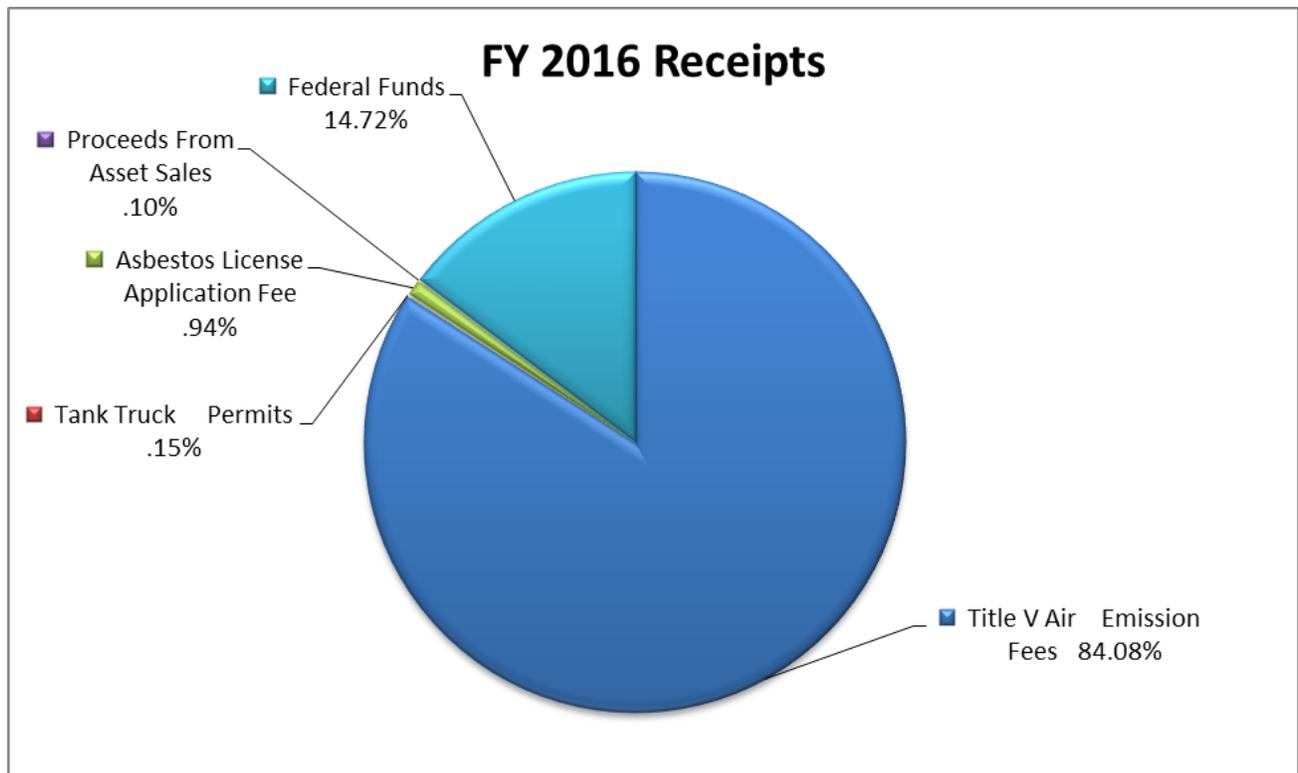


Figure 20: Division for Air Quality FY 2016 Receipts. The Division operates primarily on Title V emission fees and federal grant funds. Other funds are derived from non-state insurance recovery, proceeds from recyclable sales, and proceeds from asset sales.

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 when necessary. 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 additional large 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 2014; at the time of publication of this report, data for calendar year 2015 was still being verified. It takes approximately nine months to verify and complete the inventory for the previous year.

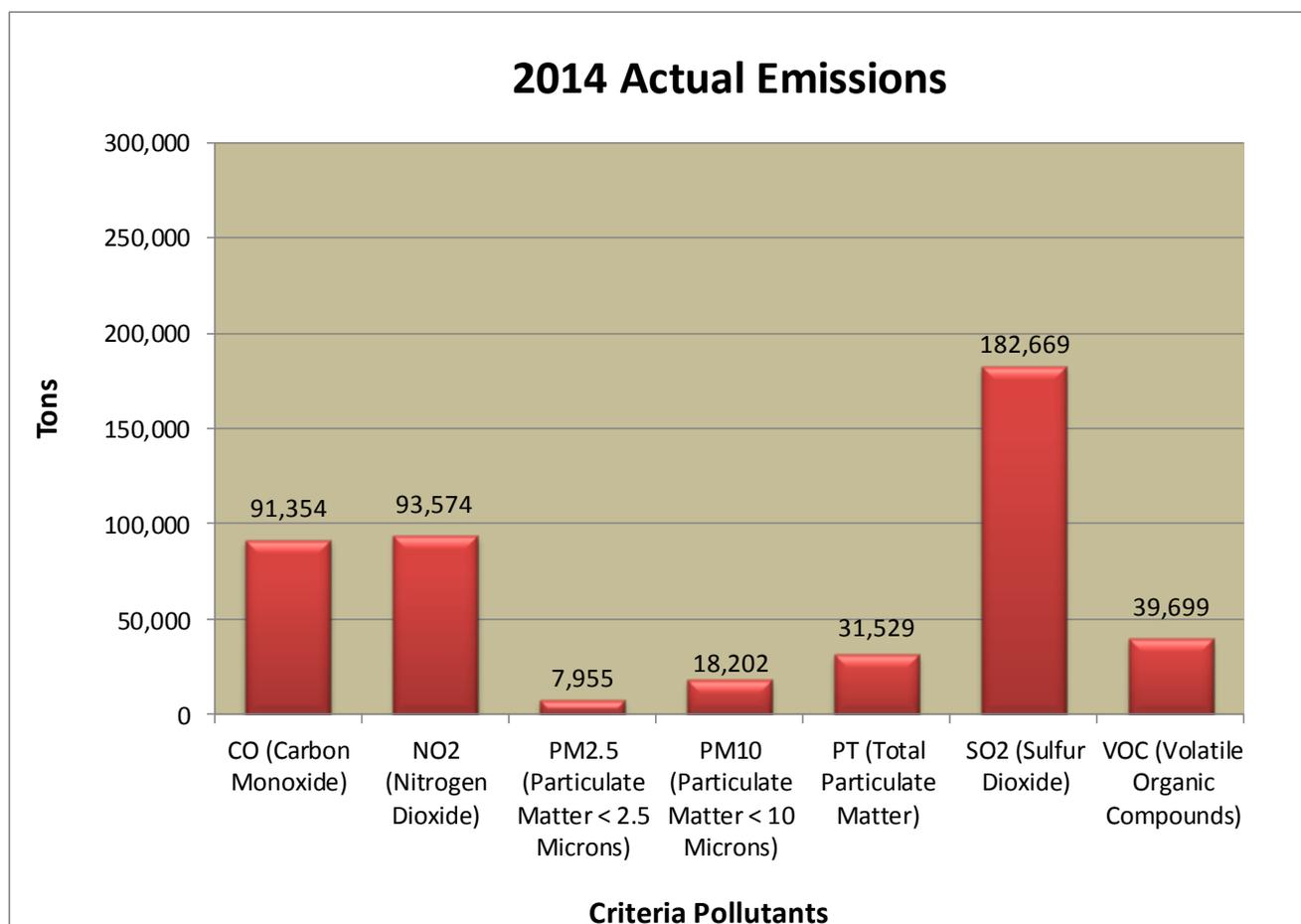


Figure 21: Actual tons of pollutants emitted by surveyed, regulated entities in Kentucky for the calendar year 2014. Although DAQ receives inventory emission data at the beginning of each calendar year, it takes approximately nine months to verify and complete the inventory.

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.

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 below shows GHG emissions data from 2010 through 2014 calendar years.

| Greenhouse Gas | 2010 Actual Emissions (tons) | 2011 Actual Emissions (tons) | 2012 Actual Emissions (tons) | 2013 Actual Emissions (tons) | 2014 Actual Emissions (tons) |
|-----------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|
| Carbon Dioxide | 113,373,350 | 115,588,860 | 106,395,292 | 96,288,161 | 100,438,102 |
| Methane | 39,205 | 45,772 | 51,417 | 112,528 | 100,197 |
| Nitrous Oxide | 4,305 | 4,127 | 4,001 | 3,736 | 3,810 |
| CO ₂ e (metric tonnes) | 104,808,124 | 106,893,062 | 98,624,914 | 90,545,487 | 94,096,177 |
| CO ₂ e (tons) | 115,531,185 | 117,829,437 | 108,715,363 | 99,809,319 | 103,723,251 |

Figure 22: Kentucky greenhouse gas emissions, 2010-2014. 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.

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 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 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 2015 through June 2016, the Regulatory Development Section filed the following administrative regulations:

- September 15, 2015, 401 KAR 59:174. Stage II controls at gasoline dispensing facilities, amended to eliminate requirements for Stage II equipment at new gasoline dispensing facilities and to establish procedures for decommissioning Stage II equipment at existing facilities;
- April 14, 2016, 401 KAR 51:010. Attainment status designations, amended to update the description and attainment status of areas in Kentucky in regard to new or revised national primary and secondary ambient air quality standards; and

- April 14, 2016, 401 KAR 53:010. Ambient air quality standards, amended to update the standards to reflect changes to the National Ambient Air Quality Standards that have been promulgated by EPA since the regulation was last revised.

Federal Registers relevant to the activities of the Division were reviewed and comments were compiled and submitted to the EPA on several major federal regulatory proposed actions, including:

- On Oct. 16, 2015, comments were submitted regarding the proposed *Air Quality Model Guidelines: Enhancements to the AERMOD Dispersion Modeling System and Incorporation of Approaches to address Ozone and Fine Particulate matter; Revisions*;
- On Oct. 23, 2015, comments were submitted regarding the *Notice of Data Availability (NODA) of the Environmental Protection Agency's Updated Ozone Transport Modeling Data for the 2008 Ozone National Ambient Air Quality Standard (NAAQS)*;
- On Jan. 21, 2016, comments were submitted regarding the proposed *Federal Plan Requirements for Greenhouse Gas Emissions from Electric Utility Generating Units constructed on or before Jan. 8, 2014; Model Trading Rules Amendments to Framework Regulations*;
- On Feb. 1, 2016, comments were submitted regarding the proposed *EPA's Treatment of Data Influenced by Exceptional Events*;
- On Feb. 1, 2016, comments were submitted regarding the *Cross-State Air Pollution Rule Update for the 2008 Ozone NAAQS*; and
- On Feb. 29, 2016, comments were submitted regarding the proposed *Revisions to Public Notice Provisions in Clean Air Act Permitting Programs*.

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), as well as 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 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 who 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 87.

Ozone (O₃)

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 July 20, 2012, portions of the Kentucky counties of Boone, Campbell, and Kenton were designated as nonattainment for the 2008 8-hour ozone standard of 0.075 ppm. The portions are approximately the northern half of each county. Although Kentucky did not have a violating monitor, the EPA determined that emissions from those partial counties were contributing to the violating monitor located in Hamilton County, Ohio. On May 4, 2016, EPA determined that the Cincinnati-Hamilton, OH-KY-IN area attained the 2008 Ozone NAAQS by the July 20, 2015 attainment date. A public hearing was scheduled for June 21, 2016, to receive comments on the proposed redesignation package for submittal to the EPA, requesting revision to the designation of the Kentucky portion of the area from nonattainment to attainment for the 2008 Ozone NAAQS. The hearing was cancelled due to no request, but written comments were received from the EPA. The Division is preparing a response to comments document and final submittal package for this redesignation request was submitted to EPA in August 2016.

On Oct. 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. State recommendations for designations of attainment/nonattainment for areas within Kentucky are due to EPA by Oct. 1, 2016.



Fine Particulate Matter (PM₁₀ and PM_{2.5})

Effective March 18, 2013, the EPA finalized the change in the annual PM_{2.5} standard from 15 µg/m³ to 12.0 µg/m³, as calculated on an annual average. In a letter to the EPA, dated Dec. 5, 2013, Kentucky 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.

In an Aug. 19, 2014 letter, the EPA notified Kentucky that Jefferson County and a portion of Bullitt County would be designated as nonattainment, indicating that the emissions from that area contributed to the violating monitor in Clark County, Indiana. Through a series of letters and additional documentation sent to the EPA, in addition to certified monitoring data from Indiana indicating the previously violating monitor was in compliance, the EPA published final designations on April 7, 2015. The final action changed the designation for the Kentucky portion of the Louisville, KY-IN area from nonattainment to unclassifiable.

On Feb. 8, 2016, the Kentucky Energy and Environment Cabinet submitted a final SIP certification letter to EPA certifying that

Kentucky's existing SIP for the 2012 PM_{2.5} standard contains the provisions of Section 110 of the CAA that address the requirements for implementing the 2012 PM_{2.5} NAAQS. A public hearing regarding the revision was scheduled for December 10, 2015 in Frankfort, Kentucky. However, no request for a public hearing was received and the hearing was canceled. Written comments were received during the 30-day comment period. The final package submitted to EPA included a response to comments document.

Nitrogen Dioxide (NO₂)

On Feb. 9, 2010, the EPA strengthened the standard for nitrogen dioxide (NO₂). The new standard is set at a 1-hour level of 100 parts per billion (ppb). A Feb. 17, 2012 Federal Register designated all areas in Kentucky as unclassifiable/attainment.

Sulfur Dioxide (SO₂)

On June 22, 2010, the EPA strengthened the NAAQS for sulfur dioxide (SO₂). 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 Oct. 4, 2013, a portion of Campbell County and a portion of Jefferson County were designated nonattainment for the 2010 SO₂ NAAQS. To date, the most significant emissions source remaining in the Jefferson County nonattainment area is CEMEX. The Division and LMAPCD are working with the facility to reduce SO₂ emissions and bring the area into compliance. The Division and LMAPCD are preparing a redesignation package to be submitted to the EPA.

On March 31, 2015, Kentucky submitted a request for a Clean Data Determination (CDD) to the EPA for approval for the northern Kentucky portion of the nonattainment area. Certified monitoring data shows that the area is in compliance with the 2010 SO₂ NAAQS. As of the publication of this document, EPA has not acted on the CDD request. The Division submitted a redesignation package to the EPA on February 22, 2016, requesting designation of the Kentucky portion of the area be revised from nonattainment to attainment for the 2010 SO₂ NAAQS.

EPA notified Kentucky by letter, on March 20, 2015, that two power plants were identified for the next round of SO₂ designations: DB Wilson Generating Station in Ohio County, and John S. Cooper Power Station, located in Pulaski County. Kentucky responded with a letter on September 16, 2015, recommending that both areas be designated as attainment. EPA notified the cabinet by letter on June 30, 2016, that they would be designating Ohio and Pulaski Counties as unclassifiable.

As part of the 2010 SO₂ Data Requirements Rule (DRR), the Division reviewed sources in the state that emit 2,000 tpy or more of SO₂. On June 20, 2016, the Cabinet submitted a letter to EPA, as required by the DRR, identifying 16 sources, and the method of characterization to be used based on the DRR. Facilities to be characterized using new ambient air monitoring must have monitors installed and operating by Jan. 1, 2017. States must submit documentation for facilities to be characterized by modeling or facilities taking federally-enforceable emissions limits to EPA by Jan. 13, 2017.

Lead (Pb)

The EPA revised the NAAQS for lead to $0.15 \mu\text{g}/\text{m}^3$ in November of 2008. In an action final on Dec. 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 Jan. 5, 2015, the EPA proposed to retain the current lead NAAQS of $0.15 \mu\text{g}/\text{m}^3$. As of the publication of this report, no final rule has been published.

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 Clean Air Act 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 this 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 Clean Air Act and Regional Haze Rule, the Division submitted a final SIP revision that included Kentucky’s Regional Haze 5-Year Periodic Report to EPA for approval on Sept. 17, 2014. Kentucky’s Regional Haze SIP provides an evaluation of progress toward goals for visibility improvement in Kentucky’s Class I area Mammoth Cave National Park and other Class I areas in surrounding states. As documented in the report, significant progress has already been made. Based on SO_2 emission reductions and more recent monitored visibility improvements, Kentucky is already meeting its 2018 visibility goals for Mammoth Cave National Park. Furthermore, the Commonwealth is well on track to meet its 2028 visibility goals and will not hinder a Class I area outside of Kentucky from meeting their visibility goals.

As of the publication of this report, the EPA has not taken any action on Kentucky’s Sept. 2014 submittal.



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 FOB and PRB, 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 2015, the Source Sampling Section received 373 Compliance and Relative Accuracy Test Audit (RATA) test protocols by Kentucky facilities; 214 tests were scheduled compliance tests and 159 were scheduled RATA tests. The section reviewed all protocols for compliance tests that were received. The section received 16 cancellations during 2015 resulting in a total of 337 tests scheduled, as seen in Figure 23. The section observed 150 (92 percent) of the 173 scheduled compliance tests that were performed. Additionally, the Source Sampling Section received 343 RATA and Compliance test reports and completed 326 technical reviews of test reports, as seen in Figure 24.



Kentucky Source Testing

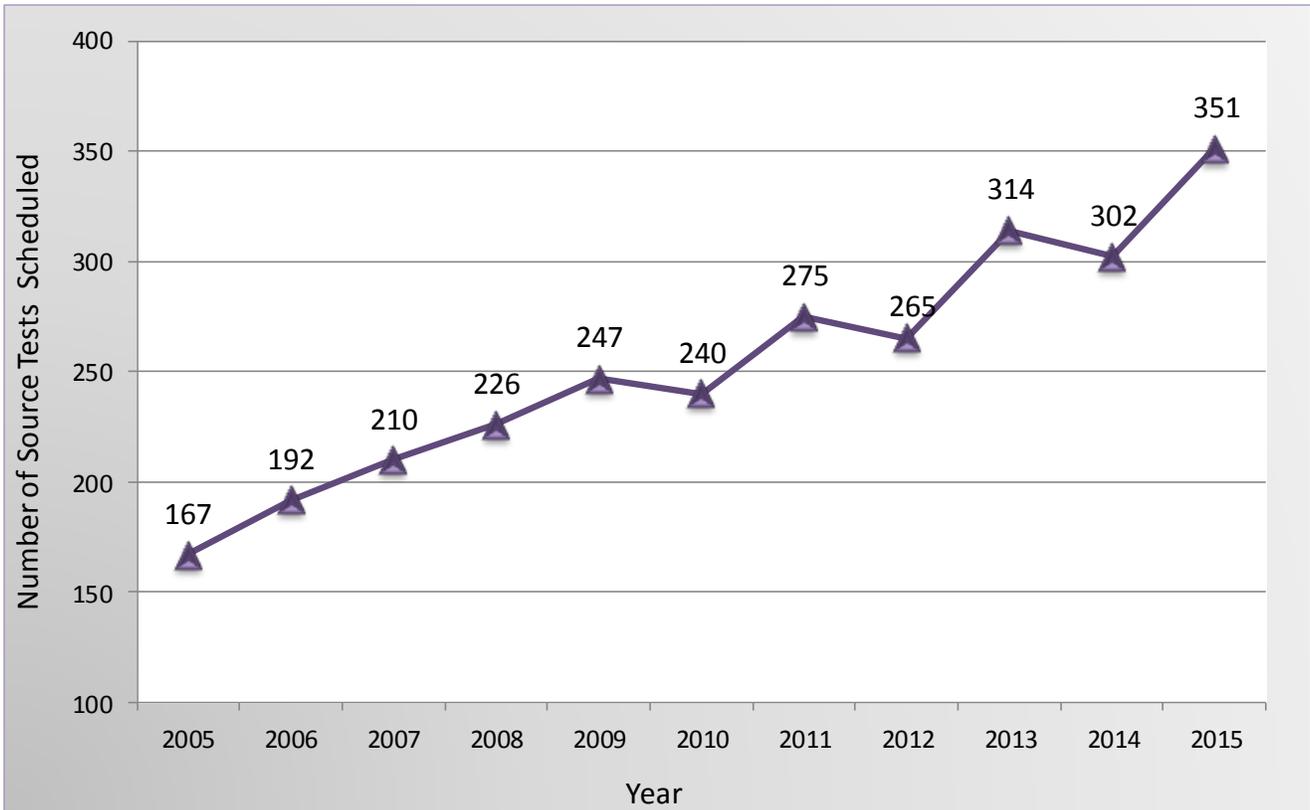


Figure 23: The last ten years have shown an overall increase in source testing throughout the state.

Source Sampling Technical Reviews



Figure 24: The Source Sampling Section successfully completed 326 technical reviews of source test report data in 2015.

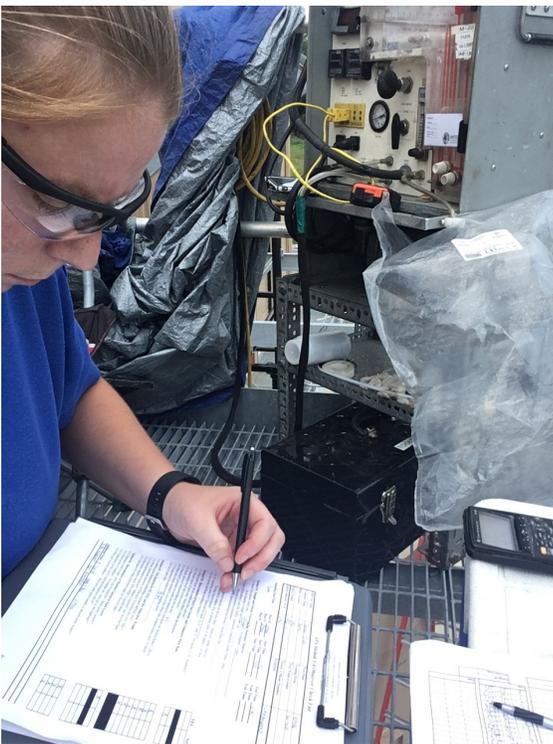
Ambient Air Monitoring Network

Kentucky has operated an ambient air monitoring network since 1967. The 2015 network included 34 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. Each year, the site locations are reviewed 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 2015 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 35-76 of this Annual Report contain tables and graphs that summarize the concentrations of pollutants measured in Kentucky during the calendar 2015 year, as well as 2015 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.



Environmental engineer assistant Jessica Dixon observes a source stack test. (Photo: DAQ)



Environmental scientist Joe Boggs checks one of the air monitors at the Grayson Lake monitoring station. (Photo: DAQ)

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 33 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 2015 Ambient Air Monitoring Network Plan.

It's 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.

For specific information on criteria pollutant health effects, sampling, and analysis, see Appendix B: Criteria Pollutants beginning on Page 78. For a complete listing of the current NAAQS, see Appendix F beginning on Page 87.

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 2015 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. There are two active and current QAPPs, as well as 29 SOPs, in the DAQ library. In 2015, TSB staff finalized revisions to one SOP.

In 2015, personnel within the TSB conducted a total of 424 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 37 technical systems audits were performed to ensure that operational procedures at each site were followed.



Environmental scientist James Mullins conducts a performance audit of a gas monitor. (Photo: DAQ)



(Photo: DAQ)

TSB staff also completed a total of 120 instrument service trips in the field and repaired an additional 130 monitors in-house in 2015. Acceptance testing was conducted on 16 newly purchased instruments, in order to ensure that stated specifications were met by the manufacturer. During the year, the TSB installed a new instrument shelter at one site and repaired existing shelters at several additional sites.

TSB continued operations of a particulate matter weigh-laboratory throughout 2015. While maintained and operated by an analyst, weighing of filters is largely automated, allowing multiple $PM_{2.5}$ and PM_{10} filters to undergo gravimetric (mass) analysis within a single weigh session. Each filter is analyzed in accordance with EPA-approved methods; the temperature and humidity within the weigh-laboratory are monitored with National Institute of Standards and Technology (NIST) traceable equipment to document environmental compliance.

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 numerous conferences, workshops, and meetings during the year.

Kentucky's Ambient Air Monitoring Network

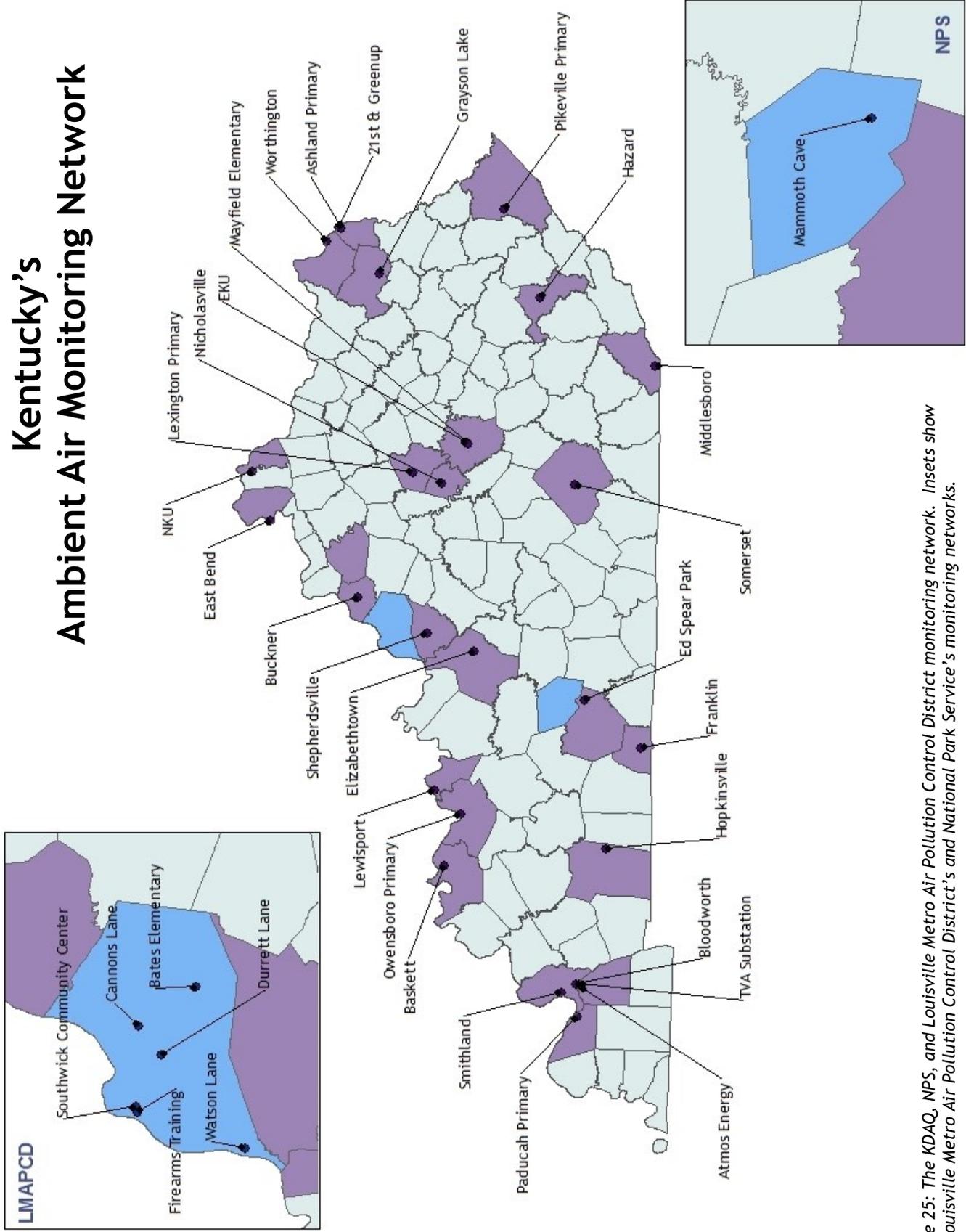


Figure 25: The KDAQ, NPS, and Louisville Metro Air Pollution Control District monitoring network. Insets show the Louisville Metro Air Pollution Control District's and National Park Service's monitoring networks.

2015 MONITORS BY CORE-BASED STATISTICAL AREA

| Metropolitan Statistical Area | Site Count | PM2.5 | Continuous PM2.5 | PM10 | Continuous PM10 | SO2 | NO2 | NOy | CO | O3 | Pb | VOC | Carbonyl | PAH | PM2.5 Speciation | Carbon Speciation | Rad-Met Net |
|--|------------|------------------|--------------------|-------------------|------------------|------------------|--------------------|----------|-----------------|----------------|----------|----------------|----------------|----------|------------------|-------------------|----------------|
| Bowling Green, KY | 2 | 2 ^c | 2 ⁱ | | | 1 | | 1 | 1 | 2 ^j | | | | | | | 1 |
| Cincinnati-Middletown, OH-KY-IN (AQI) | 2 | 1 | 1 ⁱ | | | 1 ^{p,i} | 1 ⁱ | | | 2 ^j | | | | | | | 1 |
| Clarksville, TN-KY | 1 | 1 ^x | | | | | | | | 1 | | | | | | | 1 |
| Elizabethtown, KY | 1 | 2 ^c | 1 | | | | | | | 1 | | | | | | | |
| Evansville, IN-KY | 1 | 1 | 1 | 1 ^m | | 1 ^p | | | | 1 | | | | | | | |
| Huntington-Ashland, WV-KY-OH (AQI) | 3 | 1 | 1 ⁱ | 2 ^{c,m} | | 2 ⁱ | 1 ⁱ | | | 2 ^j | 1 | | | | | | 1 |
| Lexington-Fayette, KY (AQI) | 2 | 1 | 1 ⁱ | 1 ^m | | 2 ^{p,i} | 1 ^{r40,i} | | | 2 ^j | 1 | | | | | 1 ^u | 1 |
| Louisville-Jefferson County, KY-IN (AQI) | 8 | 5 ^{n,c} | 4 ^{i,b,*} | 1 ^{Lead} | 3 ^{i,b} | 3 ^{p,i} | 2 ^{n,i} | 1 | 2 ⁿⁱ | 5 ⁱ | | | | | 1 ^u | 1 ^u | 6 ⁿ |
| Owensboro, KY | 2 | 1 | 1 ⁱ | | | 1 ⁱ | 1 ⁱ | | | 2 ^j | | | | | | | 1 |
| Micropolitan Statistical Area | | | | | | | | | | | | | | | | | |
| Paducah, KY-IL | 2 | 1 | 1 ⁱ | 2 ^m | | 1 ^{p,i} | 1 ⁱ | | | 2 ^j | 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 ^p | 2 ^p | 1 | | | 1 |
| Marshall County | 2 | | | | | | | | | | | 3 ^c | | | | | |
| Perry County | 1 | 1 | 1 | | | | | | | 1 | | | | | | | 1 |
| Pike County | 1 | 2 ^c | 1 ⁱ | | | | | | | 1 ⁱ | | | | | | | |
| Simpson County | 1 | | | | | | | | | 1 | | | | | | | 1 |
| KDAQ Totals | 27 | 18 | 10 | 8 | 0 | 8 | 5 | 0 | 0 | 22 | 3 | 8 | 2 | 1 | 0 | 0 | 2 |
| LMAPCD Totals | 6 | 5 | 4 | 1 | 3 | 3 | 2 | 1 | 2 | 3 | 0 | 0 | 0 | 0 | 1 | 1 | 1 |
| NPS Totals | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| TOTALS | 34 | 23 | 15 | 9 | 3 | 12 | 7 | 2 | 3 | 26 | 3 | 8 | 2 | 1 | 1 | 1 | 3 |

Tallies are equal to the actual number of monitors present. Superscripts represent additional information about the network. P=PWEI Monitor; r40=RA-40 Monitor; n=Near-Road Monitor; X= Regional PM2.5 Transport or Background Monitor; B=Continuous BAM; * =BAM Eligible for NAAQS Comparisons; AQI=AQ Monitors Required in CBSA; i=AQ Reported; m= PM10 Filter Analyzed for Metals; Lead=PM10 Filter Analyzed for Lead; C=Collocated Monitors ; D= Duplicate Channels; U= Additional Monitor Used for Weekend and Holiday Sampling

**2015 Carbon Monoxide Ambient Air Monitoring Network
(Louisville Metro Air Pollution Control District and National Park Service)**

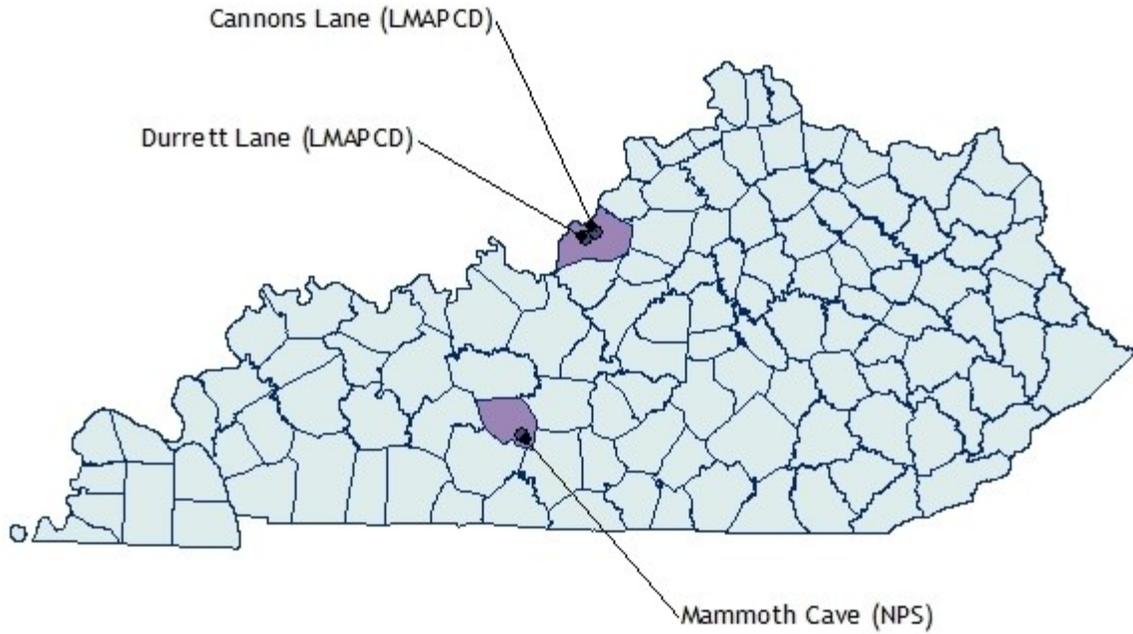


Figure 26: Carbon monoxide monitoring in Kentucky is currently only conducted by the Louisville Metro Air Pollution Control District and the National Park Service. Jefferson County historically has had higher levels of CO than elsewhere in the state, perhaps due to the high levels of vehicle traffic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

Statewide Averages for Carbon Monoxide

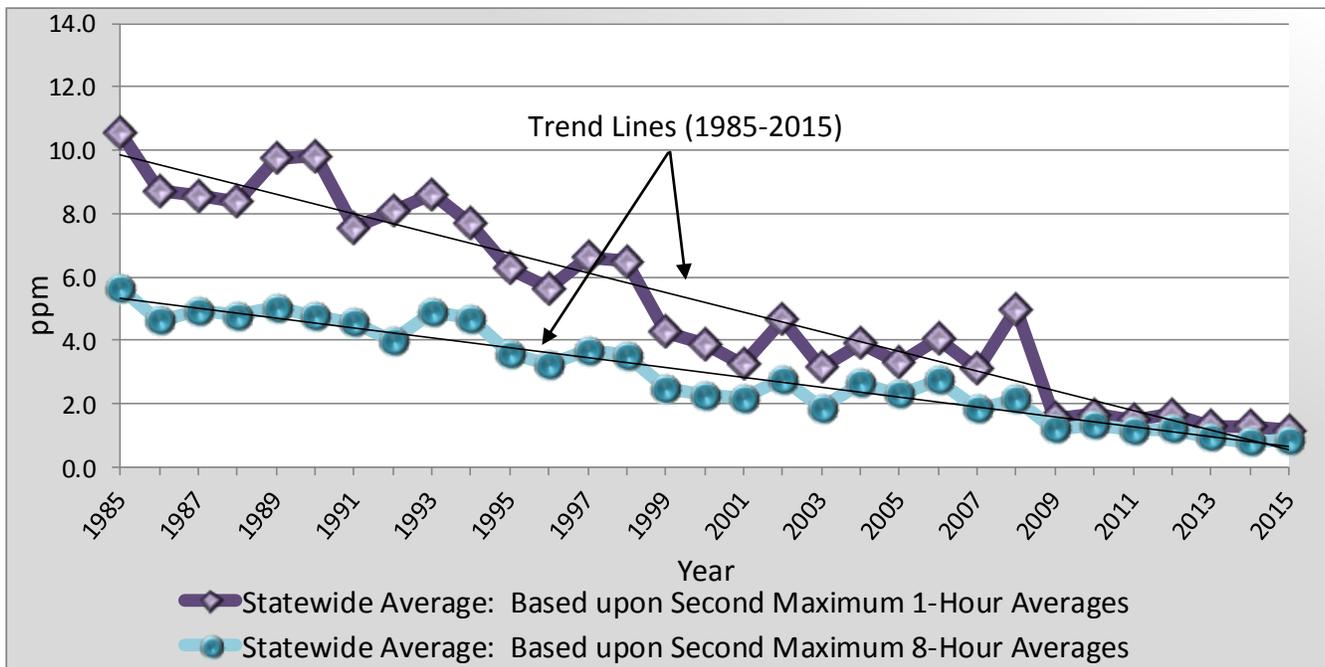


Figure 27: Statewide averages for CO monitoring indicate pollution reductions.

Carbon Monoxide Results

There were no exceedances of the CO standards in 2015. 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 2015, 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.

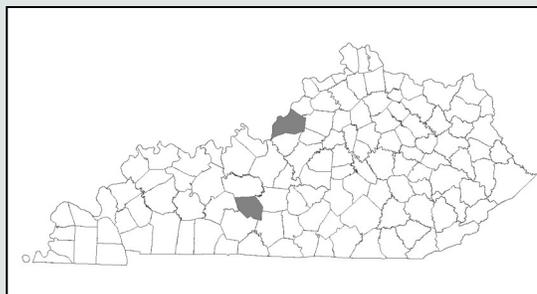
National Ambient Air Quality Standards for Carbon Monoxide

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 - 2015

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 | | |
|------------------------|---------------------------------|-------------|-------|---------------------|---------------------|-----------|---------------------|---------------------|--------|
| | | | | 1 st max | 2 nd max | Obs> 35.0 | 1 st max | 2 nd max | Obs> 9 |
| Edmonson ¹ | Alfred Cook Rd Mammoth Cave | 21-061-0501 | 8003 | 0.3 | 0.3 | 0 | 0.3 | 0.2 | 0 |
| Jefferson ² | 2730 Cannons Ln Louisville | 21-111-0067 | 6247 | 1.5 | 1.4 | 0 | 1.1 | 1.0 | 0 |
| Jefferson ² | 1517 Durrett Lane Louisville | 21-111-0075 | 7145 | 1.8 | 1.8 | 0 | 1.6 | 1.4 | 0 |

¹ Monitor operated by the National Park Service.

² Monitor operated by the Louisville Metro Air Pollution Control District.

2015 Lead Ambient Air Monitoring Network

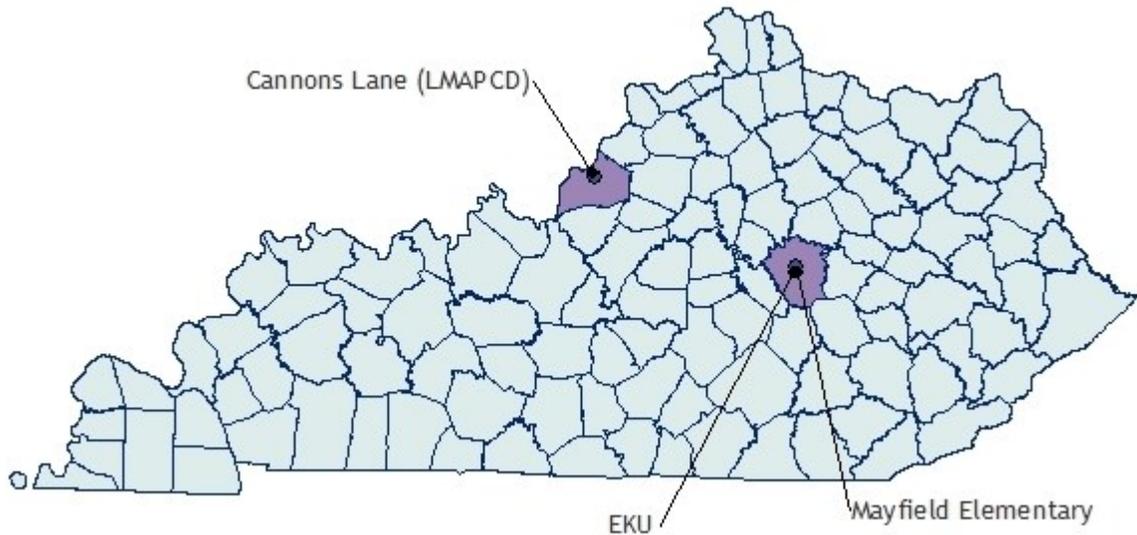


Figure 28: Lead monitoring locations in Kentucky.

Three-Month Rolling Averages for Lead

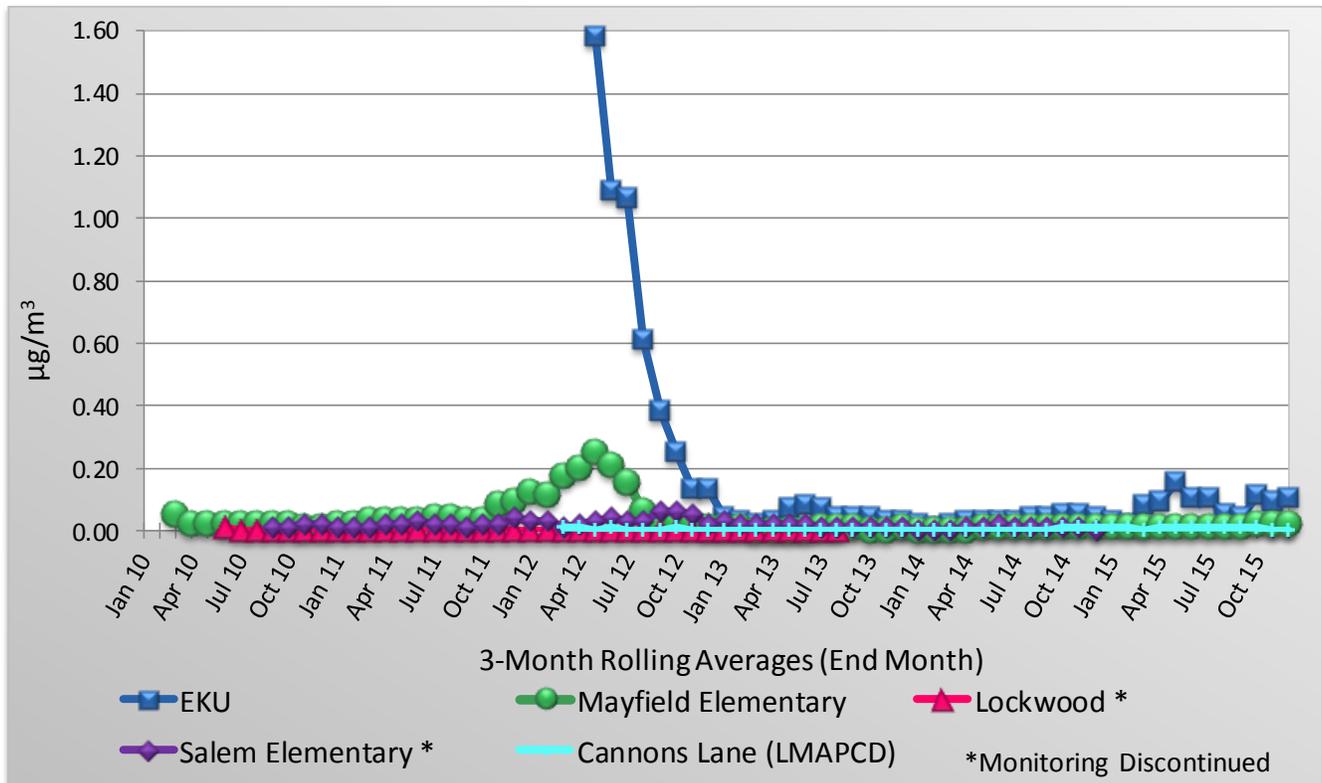


Figure 29: Three-month rolling averages for lead for each site in operation since 2010. Each three-month average is plotted on the month that the three-month period ended. Monitoring data is only available for 2010-2015.

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 $0.15 \mu\text{g}/\text{m}^3$ NAAQS standard. The compliance issue was resolved, and monitoring data shows that lead concentrations have steadily decreased since that time. Resultantly, there were no exceedances of the three-month rolling NAAQS in 2015.

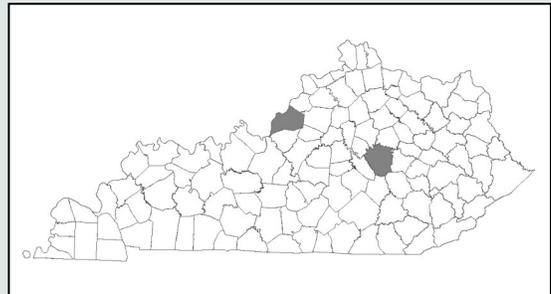
National Ambient Air Quality Standards for Lead

Primary NAAQS: Rolling 3-month average not to exceed $0.15 \mu\text{g}/\text{m}^3$

Secondary NAAQS: Same as primary standard

Criteria Pollutant Summary Report - 2015

Pollutant: Lead
Method: High volume sampler; Inductively Coupled Plasma-Mass Spectroscopy
Data Interval: 24-hour
Units: Micrograms per cubic meter ($\mu\text{g}/\text{m}^3$)



| County | Site Address | AQS-ID | # Obs | Rolling 3-Month Average | | | | |
|------------------------------|------------------------------------|-------------|-------|-------------------------|---------------------|---------------------|---------------------|------------|
| | | | | 1 st max | 2 nd max | 3 rd max | 4 th max | Obs > 0.15 |
| Jefferson ¹ NCore | 2730 Cannons Ln Louisville | 21-111-0067 | 60 | 0.01 | 0.01 | 0.01 | 0.00 | 0 |
| Madison | Mayfield Elem, Bond St Richmond | 21-151-0003 | 52 | 0.02 | 0.02 | 0.01 | 0.01 | 0 |
| Madison | EKU, Van Hoose Dr Richmond | 21-151-0005 | 54 | 0.15 | 0.11 | 0.10 | 0.10 | 0 |

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

NCore Samples collected with a low-volume manual PM_{10} sampler and analyzed via x-ray fluorescence.

2015 Nitrogen Dioxide Ambient Air Monitoring Network

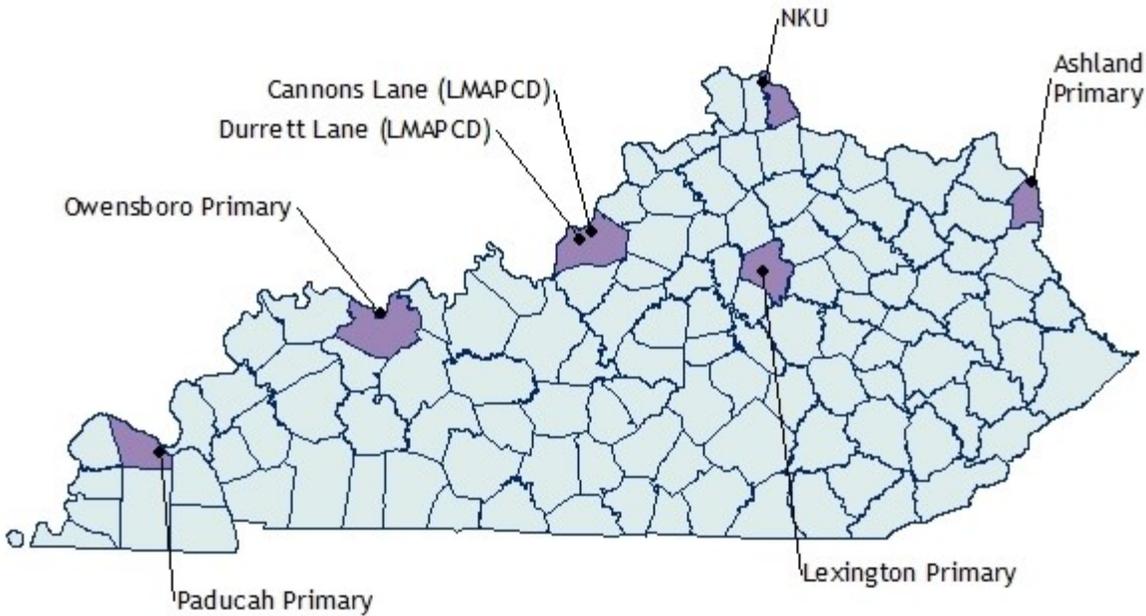


Figure 30: Nitrogen dioxide monitoring locations in Kentucky.

Statewide Averages for Nitrogen Dioxide

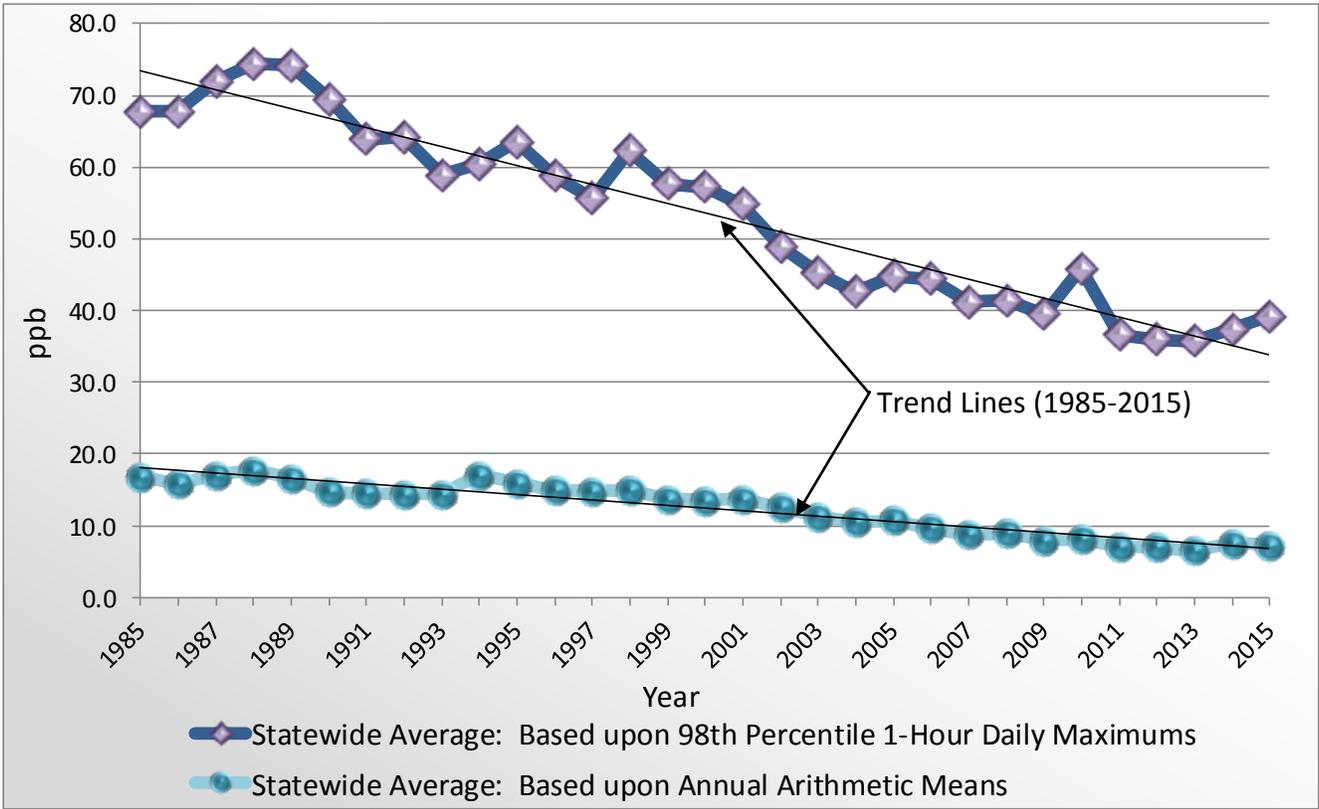


Figure 31: Statewide averages for nitrogen dioxide monitoring indicate pollution reductions.

Nitrogen Dioxide Results

There were no exceedances of the NO₂ standard in 2015. There have been no recorded exceedances of a NO₂ 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 2015, the Division and the LMAPCD operated seven nitrogen dioxide monitors in Kentucky.

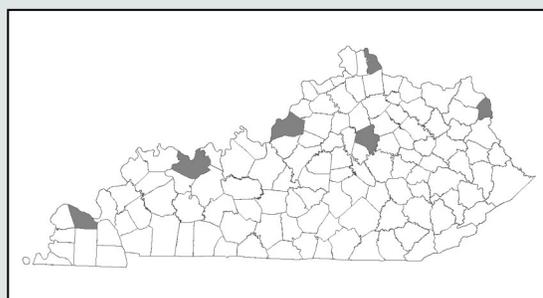
National Ambient Air Quality Standards for Nitrogen Dioxide

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 - 2015

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 |
|------------------------|--|-------------|-------|---------------------|---------------------|-----------|-------------|
| | | | | 1 st max | 2 nd max | Obs > 100 | |
| Boyd | 2924 Holt Street Ashland | 21-019-0017 | 8299 | 38.0 | 38.0 | 0 | 5.99 |
| Campbell | 524A John Hill Rd Highland Heights | 21-037-3002 | 8180 | 39.0 | 36.0 | 0 | 3.90 |
| Daviess | US60 & Pleasant Valley Rd Owensboro | 21-059-0005 | 8308 | 38.0 | 37.0 | 0 | 4.31 |
| Fayette | 650 Newtown Pike Lexington | 21-067-0012 | 8118 | 47.0 | 46.0 | 0 | 6.69 |
| Jefferson ¹ | 2730 Cannons Ln Louisville | 21-111-0067 | 6946 | 51.1 | 50.5 | 0 | 8.81 |
| Jefferson ¹ | 1517 Durrett Ln Louisville | 21-111-0075 | 7468 | 55.2 | 53.4 | 0 | 15.71 |
| McCracken | 2901 Powell Street Paducah | 21-145-1024 | 8123 | 50.0 | 46.0 | 0 | 6.04 |

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

NO₂ Criteria Pollutant Multi-Year Summary Report - 2015
98th Percentile Daily 1-Hour Maximum, 3-Year Average

| County | Site Address | AQS-ID | 98th Percentile Daily Maximum 1-Hr Averages | | | | |
|------------------------|---|-------------|--|-------|------|-------------|--------------|
| | | | 2013 | 2014 | 2015 | 3-Yr Avg | Obs > 100 |
| Boyd | 2924 Holt Street Ashland | 21-019-0017 | 30.0 | 32.0 | 35.0 | 32 | 0 |
| Campbell | 524A John Hill Road Highland Heights | 21-037-3002 | 33.0 | 31.0 | 32.0 | 32 | 0 |
| Daviess | US 60 & Pleasant Valley Rd Owensboro | 21-059-0005 | 31.0 | 31.0 | 33.0 | 32 | 0 |
| Fayette | 650 Newtown Pike Lexington | 21-067-0012 | 44.0 | 39.0 | 41.0 | 41 | 0 |
| Jefferson ¹ | 2730 Cannons Ln Louisville | 21-111-0067 | 42.5* | 48.6* | 44.0 | 45* | 0 |
| Jefferson ¹ | 1517 Durrett Ln Louisville | 21-111-0075 | --- | 44.5* | 50.2 | 47* | 0 |
| McCracken | 2901 Powell Street Paducah | 21-145-1024 | 34.0 | 36.0 | 39.0 | 36 | 0 |

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

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

--- Monitoring not conducted / Data not available

2015 Ozone Ambient Air Monitoring Network

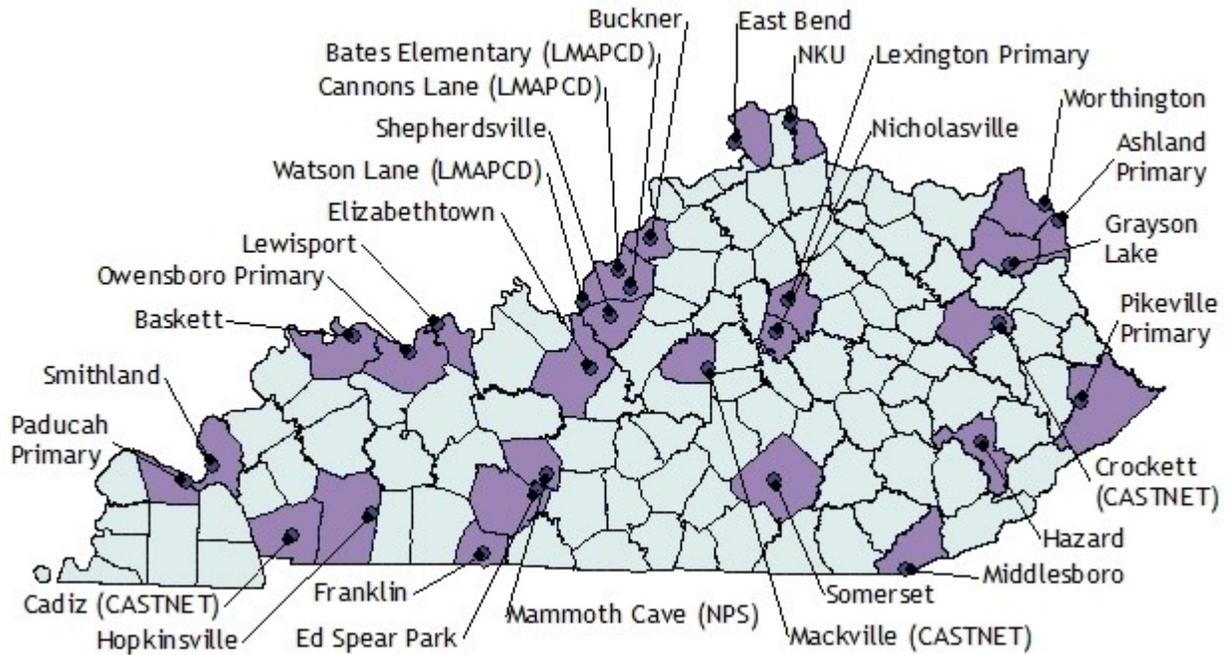


Figure 32: Ozone monitoring locations in Kentucky.

Statewide Averages for Ozone

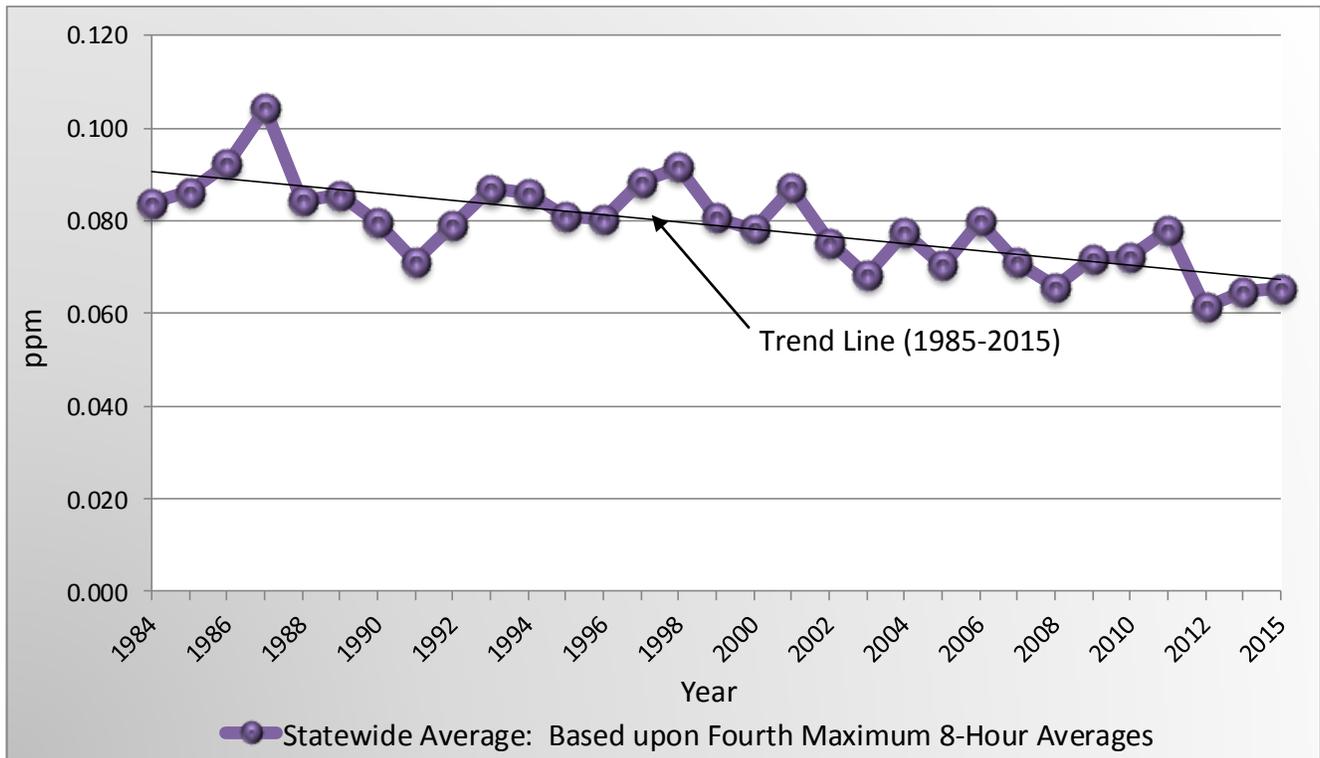


Figure 33: Statewide averages for ozone monitoring indicate pollution reductions.

Ozone Results

In 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. Only one site, located in Jefferson County, recorded a fourth highest daily maximum in exceedance of the eight-hour standard of 0.075 ppm. In 2015, 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 a part of an independent network of CASTNET monitors.

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.

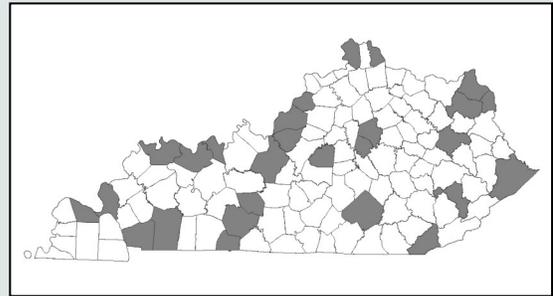
National Ambient Air Quality Standards for Ozone

Primary NAAQS: 3-year average of the 4th highest daily maximum 8-hr concentration not to exceed 0.075 ppm (Note: NAAQS was lowered to 0.070 effective December 2015)

Secondary NAAQS: Same as Primary Standard

Criteria Pollutant Summary Report - 2015

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 | | | | |
|-----------|---|-------------|------------|----------------------------|---------------------|---------------------|---------------------|-------------|
| | | | | 1 st max | 2 nd max | 3 rd max | 4 th max | Obs > 0.075 |
| Bell | 34 th & Dorchester Middlesboro | 21-013-0002 | 239 | 0.063 | 0.062 | 0.061 | 0.059 | 0 |
| Boone | KY 338 & Lower River East Bend | 21-015-0003 | 244 | 0.071 | 0.069 | 0.062 | 0.062 | 0 |
| Boyd | 2924 Holt Street Ashland | 21-019-0017 | 241 | 0.073 | 0.072 | 0.071 | 0.069 | 0 |
| Bullitt | 2 nd & Carpenter St Shepherdsville | 21-029-0006 | 241 | 0.073 | 0.073 | 0.070 | 0.067 | 0 |
| Campbell | 524A John Hill Rd Highland Heights | 21-037-3002 | 244 | 0.079 | 0.078 | 0.077 | 0.071 | 3 |
| Carter | Camp Webb Grayson Lake | 21-043-0500 | 235 | 0.062 | 0.062 | 0.061 | 0.061 | 0 |
| Christian | 10800 Pilot Rock Hopkinsville | 21-047-0006 | 235 | 0.066 | 0.065 | 0.063 | 0.062 | 0 |
| Daviess | US60 & Pleasant Valley Owensboro | 21-059-0005 | 243 | 0.071 | 0.067 | 0.067 | 0.065 | 0 |

Values in red represent an exceedance of the NAAQS.

Ozone Criteria Pollutant Summary Report - 2015 Continued

| County | Site Address | AQS-ID | Valid Days | Daily Maximum 8-Hr Average | | | | |
|------------------------------------|---|-------------|------------|----------------------------|---------------------|---------------------|---------------------|------------|
| | | | | 1 st max | 2 nd max | 3 rd max | 4 th max | Obs> 0.075 |
| Edmonson ¹ | Alfred Cook Rd Mammoth Cave | 21-061-0501 | 237 | 0.067 | 0.066 | 0.065 | 0.063 | 0 |
| Fayette | 650 Newtown Pike Lexington | 21-067-0012 | 234 | 0.080 | 0.079 | 0.072 | 0.071 | 2 |
| Greenup | Scott & Center St Worthington | 21-089-0007 | 240 | 0.070 | 0.068 | 0.067 | 0.066 | 0 |
| Hancock | 2 nd & Caroline Lewisport | 21-091-0012 | 244 | 0.075 | 0.075 | 0.073 | 0.071 | 0 |
| Hardin | 801 North Miles St Elizabethtown | 21-093-0006 | 244 | 0.072 | 0.070 | 0.068 | 0.066 | 0 |
| Henderson | Baskett Fire Dept. Baskett | 21-101-0014 | 237 | 0.071 | 0.071 | 0.069 | 0.067 | 0 |
| Jefferson ² | 7601 Bardstown Rd Louisville | 21-111-0027 | 201 | 0.082 | 0.081 | 0.078 | 0.071 | 3 |
| Jefferson ² | 7201 Watson Lane Louisville | 21-111-0051 | 225 | 0.078 | 0.069 | 0.069 | 0.069 | 1 |
| Jefferson ² | 2730 Cannons Lane Louisville | 21-111-0067 | 241 | 0.095 | 0.089 | 0.086 | 0.076 | 4 |
| Jessamine | DOT, Wilson Drive Nicholasville | 21-113-0001 | 241 | 0.072 | 0.069 | 0.068 | 0.066 | 0 |
| Livingston | DOT, US 60E Smithland | 21-139-0003 | 242 | 0.072 | 0.066 | 0.065 | 0.063 | 0 |
| McCracken | 2901 Powell Street Paducah | 21-145-1024 | 243 | 0.075 | 0.066 | 0.064 | 0.063 | 0 |
| Morgan ³ CASTNET | State Hwy 437 West Liberty | 21-175-9991 | 242 | 0.066 | 0.065 | 0.064 | 0.064 | 0 |
| Oldham | DOT, 1601 S Hwy 393 Buckner | 21-185-0004 | 188 | 0.079 | 0.077 | 0.075 | 0.073 | 2 |
| Perry | Perry Co Horse Park Hazard | 21-193-0003 | 240 | 0.064 | 0.060 | 0.059 | 0.057 | 0 |
| Pike | 101 North Mayo Trail Pikeville | 21-195-0002 | 241 | 0.063 | 0.061 | 0.061 | 0.058 | 0 |
| Pulaski | Clifty Street Somerset | 21-199-0003 | 237 | 0.064 | 0.062 | 0.062 | 0.062 | 0 |
| Simpson | DOT, HWY 1008 Franklin | 21-213-0004 | 208 | 0.071 | 0.069 | 0.069 | 0.067 | 0 |
| Trigg ³ CASTNET | 5720 Old Dover Road Cadiz | 21-221-9991 | 234 | 0.061 | 0.061 | 0.060 | 0.060 | 0 |
| Warren | Ed Spear Park Smiths Grove | 21-227-0009 | 211 | 0.065 | 0.064 | 0.063 | 0.061 | 0 |
| Washington ³ CASTNET | 542 Weasley-Miller Road Harrodsburg | 21-229-9991 | 235 | 0.070 | 0.069 | 0.069 | 0.064 | 0 |

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 - 2015
8-hour 4th Maximum, 3-year Average

| County | Site Address | AQS-ID | 4 th Maximum 8-hr Average | | | |
|------------------------|---|-------------|--------------------------------------|-------|-------|----------|
| | | | 2013 | 2014 | 2015 | 3-Yr Avg |
| Bell | 34 th & Dorchester Middlesboro | 21-013-0002 | 0.058 | 0.062 | 0.059 | 0.059 |
| Boone | KY 338 & Lower River Road East Bend | 21-015-0003 | 0.059 | 0.062 | 0.062 | 0.061 |
| Boyd | 2924 Holt Street Ashland | 21-019-0017 | 0.065 | 0.065 | 0.069 | 0.066 |
| Bullitt | 2 nd & Carpenter Streets Shepherdsville | 21-029-0006 | 0.064 | 0.065 | 0.067 | 0.065 |
| Campbell | 524A John Hill Highland Heights | 21-037-3002 | 0.072 | 0.071 | 0.071 | 0.071 |
| Carter | Camp Webb Grayson Lake | 21-043-0500 | 0.062 | 0.060 | 0.061 | 0.061 |
| Christian | 10800 Pilot Rock Road Hopkinsville | 21-047-0006 | 0.062 | 0.065 | 0.062 | 0.063 |
| Daviess | US 60 & Pleasant Valley Rd Owensboro | 21-059-0005 | 0.066 | 0.064 | 0.065 | 0.065 |
| Edmonson ¹ | Alfred Cook Road Mammoth Cave | 21-061-0501 | 0.063 | 0.065 | 0.063 | 0.063 |
| Fayette | 650 Newtown Pike Lexington | 21-067-0012 | 0.060 | 0.065 | 0.071 | 0.065 |
| Greenup | Scott & Center Streets Worthington | 21-089-0007 | 0.060 | 0.061 | 0.066 | 0.062 |
| Hancock | 2 nd & Caroline Streets Lewisport | 21-091-0012 | 0.063 | 0.066 | 0.071 | 0.066 |
| Hardin | 801 North Miles Street Elizabethtown | 21-093-0006 | 0.062 | 0.062 | 0.066 | 0.063 |
| Henderson | Baskett Fire Dept Baskett | 21-101-0014 | 0.066 | 0.069 | 0.067 | 0.067 |
| Jefferson ² | 7601 Bardstown Road Louisville | 21-111-0027 | 0.064 | 0.065 | 0.071 | 0.066 |
| Jefferson ² | 7201 Watson Lane Louisville | 21-111-0051 | --- | 0.069 | 0.069 | 0.069* |
| Jefferson ² | 2730 Cannons Lane Louisville | 21-111-1021 | 0.038* | 0.070 | 0.076 | 0.061* |
| Jessamine | DOT, Etter Drive Nicholasville | 21-113-0001 | 0.061 | 0.064 | 0.066 | 0.063 |
| Livingston | DOT, 811 US 60 East Smithland | 21-139-0003 | 0.064 | 0.065 | 0.063 | 0.064 |

Ozone Criteria Pollutant Multi-Year Summary Report - 2015 Continued
8-hour 4th Maximum, 3-year Average

| County | Site Address | AQS-ID | 4 th Maximum 8-hr Average | | | |
|------------------------------------|--|-------------|--------------------------------------|-------|-------|----------|
| | | | 2013 | 2014 | 2015 | 3-Yr Avg |
| McCracken | 2901 Powell Street Paducah | 21-145-1024 | 0.064 | 0.065 | 0.063 | 0.064 |
| Oldham | DOT, 1601 S Hwy 393 Buckner | 21-185-0004 | 0.064 | 0.068 | 0.064 | 0.062 |
| Morgan ³ CASTNET | State Hwy 437 West Liberty | 21-175-9991 | 0.058 | 0.064 | 0.073 | 0.068 |
| Perry | Perry County Horse Park Hazard | 21-193-0003 | 0.058 | 0.061 | 0.057 | 0.058 |
| Pike | 101 North Mayo Trail Pikeville | 21-195-0002 | 0.055 | 0.063 | 0.058 | 0.058 |
| Pulaski | Clifty Street Somerset | 21-199-0003 | 0.061 | 0.063 | 0.062 | 0.062 |
| Simpson | DOT, Hwy 1008 Franklin | 21-213-0004 | 0.059 | 0.063 | 0.067 | 0.063 |
| Trigg ³ CASTNET | 5720 Old Dover Road Cadiz | 21-221-9991 | 0.064 | 0.066 | 0.060 | 0.063 |
| Warren | Ed Spear Park Smiths Grove | 21-227-0009 | 0.060 | 0.063 | 0.061 | 0.061 |
| Washington ³ CASTNET | 542 Weasley-Miller Road Harrodsburg | 21-229-9991 | 0.064 | 0.065 | 0.064 | 0.064 |

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.

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

--- Monitoring not conducted / Data not available

Values in red represent an exceedance of the NAAQS.

2015 Particulate Matter (PM_{2.5}) Ambient Air Monitoring Network

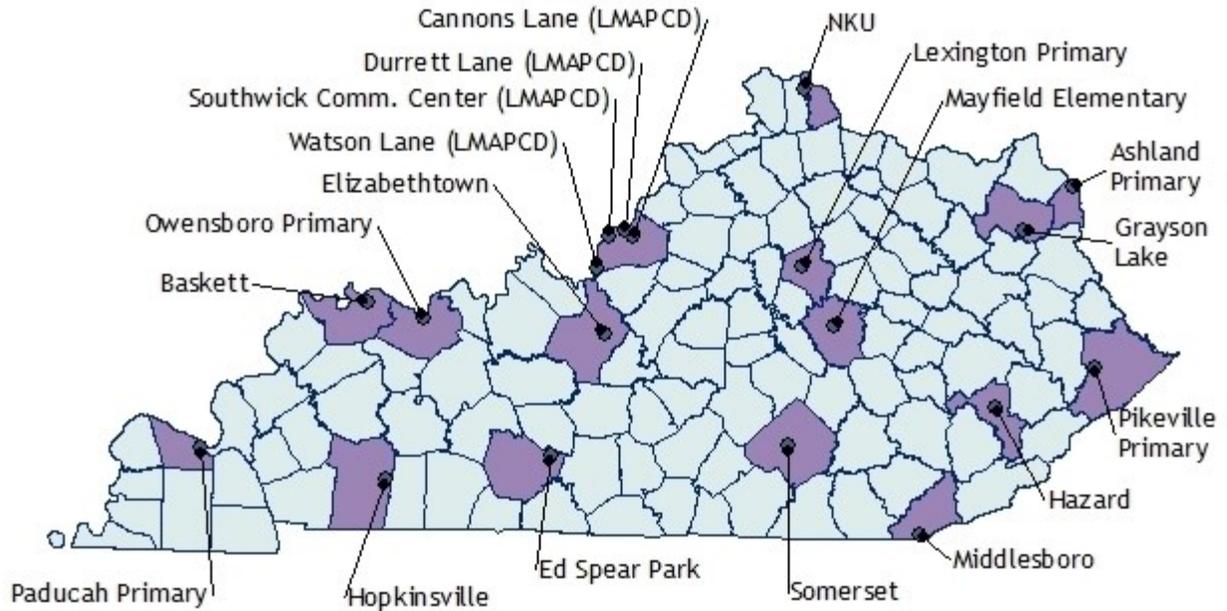


Figure 34: PM_{2.5} monitoring locations in Kentucky.

Statewide Averages for PM_{2.5}

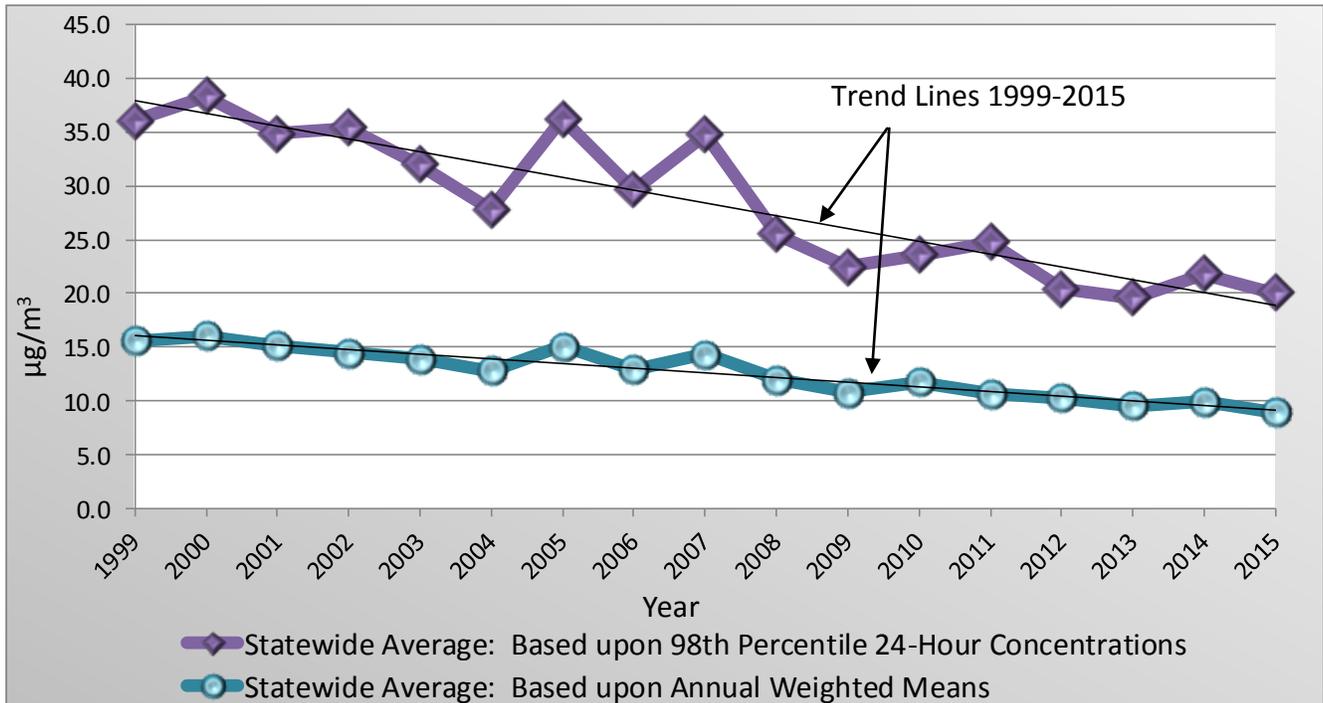


Figure 35: Statewide averages for PM_{2.5} monitoring indicate pollution reductions.

PM_{2.5} Results

In 2015, DAQ and LMAPCD operated FRM-type samplers for NAAQS comparisons at 19 sites. Two sites, both located in Jefferson County, recorded 24-hour concentrations above the level of the NAAQS. However, there were no exceedances of either the 24-hour or annual PM_{2.5} standards in 2015. Furthermore, no sampler exceeded either the three-year 24-hour standard or the three-year annual standard during the 2013-2015 averaging period. This is a significant accomplishment. Generally, statewide PM_{2.5} levels declined during the 1999-2015 time period.

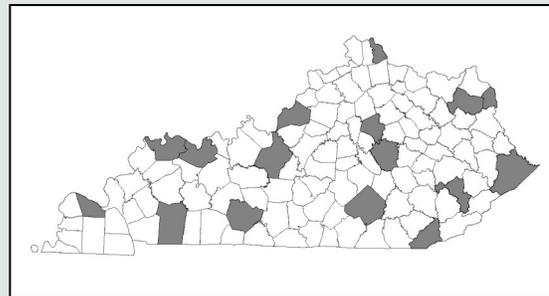
National Ambient Air Quality Standards for Particulate Matter PM_{2.5}

Primary NAAQS: 3-year average of the annual weighted mean not to exceed 12.0 µg/m³
 3-year average of the 98th percentile of 24-hour concentrations not to exceed 35 µg/m³

Secondary NAAQS: 3-year average of the annual weighted mean not to exceed 15.0 µg/m³
 3-year average of the 98th percentile of 24-hour concentrations not to exceed 35 µg/m³

Criteria Pollutant Summary Report - 2015

Pollutant: Particulate Matter PM_{2.5}
Method: Gravimetric
Data Interval: 24-hour
Units: Micrograms per cubic meter (µg/m³)



| County | Site | AQS-ID | # Obs | 24-Hour Average | | | | | Wtd-Mean |
|-----------|---|-------------|-------|---------------------|---------------------|---------------------|---------------------|----------|----------|
| | | | | 1 st max | 2 nd max | 3 rd max | 4 th max | Obs > 35 | |
| Bell | 34 th & Dorchester Middlesboro | 21-013-0002 | 55 | 22.8 | 19.3 | 17.0 | 16.5 | 0 | 8.74* |
| Boyd | 2924 Holt Street Ashland | 21-019-0017 | 121 | 25.8 | 24.7 | 23.5 | 21.8 | 0 | 8.75 |
| Campbell | 524A John Hill Rd Highland Heights | 21-037-3002 | 108 | 28.6 | 22.5 | 22.0 | 20.3 | 0 | 9.35* |
| Carter | Camp Webb Grayson Lake | 21-043-0500 | 117 | 21.2 | 20.8 | 19.8 | 17.9 | 0 | 7.30 |
| Christian | 10800 Pilot Rock Hopkinsville | 21-047-0006 | 113 | 24.5 | 24.1 | 22.2 | 19.8 | 0 | 9.12 |
| Daviess | US60 & Pleasant Valley Rd Owensboro | 21-059-0014 | 115 | 23.3 | 22.3 | 21.6 | 19.7 | 0 | 9.68 |

PM_{2.5} Criteria Pollutant Summary Report - 2015 Continued

| County | Site | AQS-ID | # Obs | 24-Hour Average | | | | | Wtd-Mean |
|------------------------|---|-------------|-------|---------------------|---------------------|---------------------|---------------------|----------|----------|
| | | | | 1 st max | 2 nd max | 3 rd max | 4 th max | Obs > 35 | |
| Fayette | 650 Newtown Pike Lexington | 21-067-0012 | 102 | 21.0 | 20.5 | 18.6 | 17.8 | 0 | 8.59 |
| Hardin | 801 North Miles Street Elizabethtown | 21-093-0006 | 113 | 24.2 | 23.8 | 20.5 | 20.0 | 0 | 9.22 |
| Henderson | Basket Fire Dept. Baskett | 21-101-0014 | 105 | 30.2 | 24.6 | 20.2 | 19.2 | 0 | 9.52 |
| Jefferson ¹ | 37th & Southern Avenue Louisville | 21-111-0043 | 120 | 50.2 | 30.6 | 23.5 | 21.1 | 1 | 9.62 |
| Jefferson ¹ | 7201 Watson Lane Louisville | 21-111-0051 | 115 | 36.2 | 32.7 | 25.8 | 24.3 | 1 | 9.40 |
| Jefferson ¹ | 2730 Cannons Lane Louisville | 21-111-0067 | 116 | 25.1 | 22.6 | 21.6 | 21.5 | 0 | 8.57 |
| Jefferson ¹ | 1517 Durrett Lane Louisville | 21-111-0075 | 115 | 26.0 | 25.1 | 22.1 | 20.3 | 0 | 10.01 |
| McCracken | 2901 Powell Street Paducah | 21-145-1024 | 107 | 31.0 | 22.3 | 21.7 | 19.7 | 0 | 9.33* |
| Madison | Mayfield School Richmond | 21-151-0003 | 110 | 21.6 | 16.0 | 15.6 | 15.3 | 0 | 7.62 |
| Perry | Perry County Horse Park Hazard | 21-193-0003 | 28 | 25.6 | 16.3 | 16.3 | 16.3 | 0 | 8.37 |
| Pike | 101 North Mayo Trail Pikeville | 21-195-0002 | 110 | 27.0 | 17.6 | 16.6 | 16.6 | 0 | 7.62 |
| Pulaski | 305 Clifty Street Somerset | 21-199-0003 | 113 | 23.8 | 19.6 | 18.7 | 18.7 | 0 | 8.13 |
| Warren | Ed Spear Park Smiths Grove | 21-227-0009 | 112 | 24.3 | 19.3 | 18.5 | 18.5 | 0 | 8.44 |

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 - 2015
24-Hour 98th Percentile, 3-Year Average

| County | Site | AQS-ID | 24-Hour, 98 th Percentile | | | |
|------------------------|--|-------------|--------------------------------------|-------|-------|----------|
| | | | 2013 | 2014 | 2015 | 3-Yr Avg |
| Bell | 34 th & Dorchester Middlesboro | 21-013-0002 | 16.5 | 16.6 | 19.3* | 17 |
| Boyd | 2924 Holt Street Ashland | 21-019-0017 | 19.5 | 20.3 | 23.5 | 21 |
| Campbell | 524A John Hill Highland Heights | 21-037-3002 | 21.6 | 23.2 | 22.0* | 22 |
| Carter | Camp Webb Grayson Lake | 21-043-0500 | 14.1 | 19.7 | 19.8 | 18 |
| Christian | 10800 Pilot Rock Road Hopkinsville | 21-047-0006 | 21.6 | 23.4* | 22.2 | 22 |
| Daviess | US60 and Pleasant Valley Rd Owensboro | 21-059-0005 | 22.2 | 25.7 | 21.6 | 23 |
| Fayette | 650 Newtown Pike Lexington | 21-067-0012 | 20.0 | 21.8 | 18.6 | 20 |
| Hardin | 801 North Miles Street Elizabethtown | 21-093-0006 | 20.5 | 22.5 | 20.5 | 21 |
| Henderson | Baskett Fire Dept Baskett | 21-101-0014 | 21.6 | 25.3 | 20.2 | 22 |
| Jefferson ¹ | 37 th & Southern Avenue Louisville | 21-111-0043 | 24.0 | 24.3 | 22.3 | 24 |
| Jefferson ¹ | 7201 Watson Lane Louisville | 21-111-0051 | 23.5 | 26.2 | 22.8 | 24 |
| Jefferson ¹ | 2730 Cannons Lane Louisville | 21-111-0067 | 22.3 | 23.9 | 21.7 | 23 |
| Jefferson ¹ | 1517 Durrett Lane Louisville | 21-111-0075 | --- | 26.0 | 22.1 | 24* |
| McCracken | 2901 Powell Street Paducah | 21-145-1024 | 23.4* | 22.6 | 21.7* | 23* |
| Madison | Mayfield School Richmond | 21-151-0003 | 16.7 | 17.3 | 15.6 | 17 |
| Perry | Perry County Horse Park Hazard | 21-193-0003 | 12.2* | 14.9 | 16.3 | 14* |
| Pike | 101 North Mayo Trail Pikeville | 21-195-0002 | 14.0 | 18.6 | 16.6 | 16 |
| Pulaski | 305 Clifty Street Somerset | 21-199-0003 | 17.6 | 21.8 | 18.7 | 19 |
| Warren | Ed Spear Park Smiths Grove | 21-227-0009 | 19.3 | 20.7 | 18.5 | 20 |

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

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

--- Monitoring not conducted / Data not available

PM_{2.5} Criteria Pollutant Multi-Year Summary Report - 2015
Annual Weighted Mean, 3-Year Average

| County | Site | AQS-ID | Annual Weighted Mean | | | |
|------------------------|--|-------------|----------------------|-------|------|----------|
| | | | 2013 | 2014 | 2015 | 3-Yr Avg |
| Bell | 34 th & Dorchester Middlesboro | 21-013-0002 | 9.1 | 9.0 | 8.7* | 8.9 |
| Boyd | 2924 Holt Street Ashland | 21-019-0017 | 9.1 | 9.3 | 8.8 | 9.1 |
| Campbell | 524A John Hill Highland Heights | 21-037-3002 | 9.6 | 9.7 | 9.4* | 9.5 |
| Carter | Camp Webb Grayson Lake | 21-043-0500 | 7.5 | 8.0 | 7.3 | 7.6 |
| Christian | 10800 Pilot Rock Road Hopkinsville | 21-047-0006 | 9.8 | 10.1* | 9.1 | 9.7 |
| Daviess | US60 and Pleasant Valley Rd Owensboro | 21-059-0005 | 10.2 | 11.0 | 9.7 | 10.3 |
| Fayette | 650 Newtown Pike Lexington | 21-067-0012 | 9.4 | 9.4 | 8.6 | 9.1 |
| Hardin | 801 North Miles Street Elizabethtown | 21-093-0006 | 9.8 | 10.2 | 9.2 | 9.8 |
| Henderson | Baskett Fire Dept. Baskett | 21-101-0014 | 10.6 | 10.8 | 9.5 | 10.3 |
| Jefferson ¹ | 37 th & Southern Avenue Louisville | 21-111-0043 | 11.7 | 11.0 | 10.4 | 11.3 |
| Jefferson ¹ | 7201 Watson Lane Louisville | 21-111-0051 | 12.0 | 12.2 | 10.4 | 11.7 |
| Jefferson ¹ | 2730 Cannons Lane Louisville | 21-111-0067 | 10.7 | 10.9 | 9.5 | 10.5 |
| Jefferson ¹ | 1517 Durrett Lane Louisville | 21-111-0075 | --- | 12.0 | 10.0 | 11.0* |
| McCracken | 2901 Powell Street Paducah | 21-145-1024 | 10.9* | 10.4 | 9.3* | 10.2* |
| Madison | Mayfield School Richmond | 21-151-0003 | 8.2 | 8.5 | 7.6 | 8.1 |
| Perry | Perry County Horse Park Hazard | 21-193-0003 | 5.9* | 8.4 | 8.4 | 7.6* |
| Pike | 101 North Mayo Trail Pikeville | 21-195-0002 | 7.8 | 8.5 | 7.6 | 8.0 |
| Pulaski | 305 Clifty Street Somerset | 21-199-0003 | 8.8 | 9.3 | 8.1 | 8.7 |
| Warren | Ed Spear Park Smiths Grove | 21-227-0009 | 9.7 | 9.3 | 8.4 | 9.1 |

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

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

--- Monitoring not conducted / Data not available

Values in red represent an exceedance of the NAAQS.

2015 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 which 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 2015. That site is operated by the Louisville Metro Air Pollution Control District in Jefferson County.

The chart on the following page provides a visual representation of the major components of speciation data collected in 2015. The data suggests that particulates identified as non-crystal species and other elements, along with sulfates 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. Organic carbon comes from a combination of mobile and stationary combustion sources.

2015 PM_{2.5} Speciation: Average Concentration of Major Species

Cannons Lane (LMAPCD)
AQS-ID: 21-111-0067

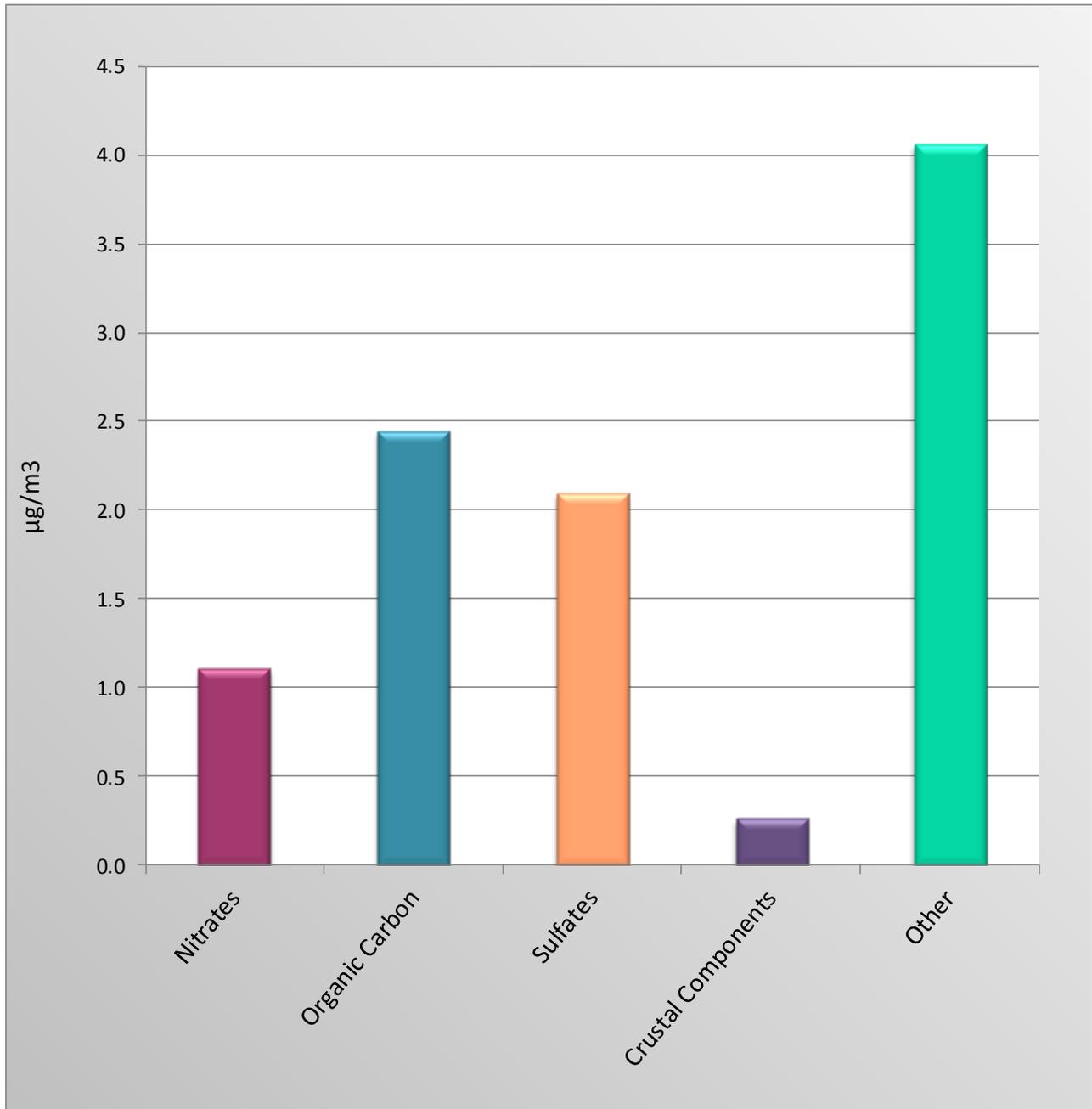


Figure 37: Average species distribution of major elements from the Louisville Metropolitan Air Pollution Control District PM_{2.5} speciation monitor at the Cannons Lane site (AQS I.D.: 21-111-0067). "Other" represents a combination of trace compounds with individual concentrations too small to graphically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

2015 Particulate Matter (PM₁₀) Ambient Air Monitoring Network

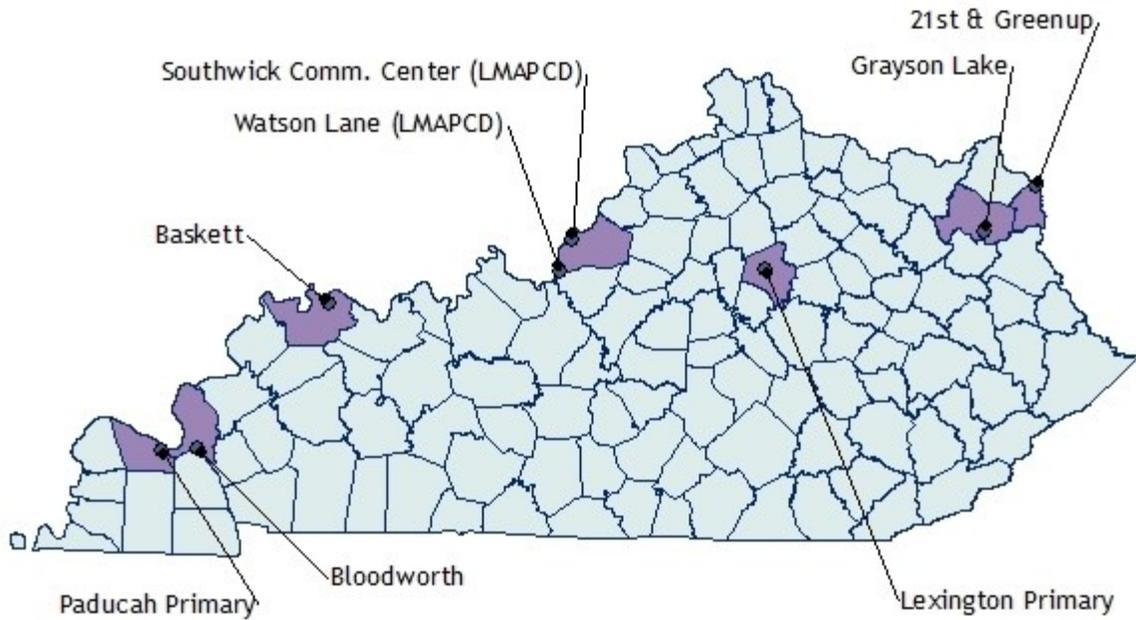


Figure 38: PM₁₀ monitoring locations in Kentucky.

Statewide Averages for PM₁₀

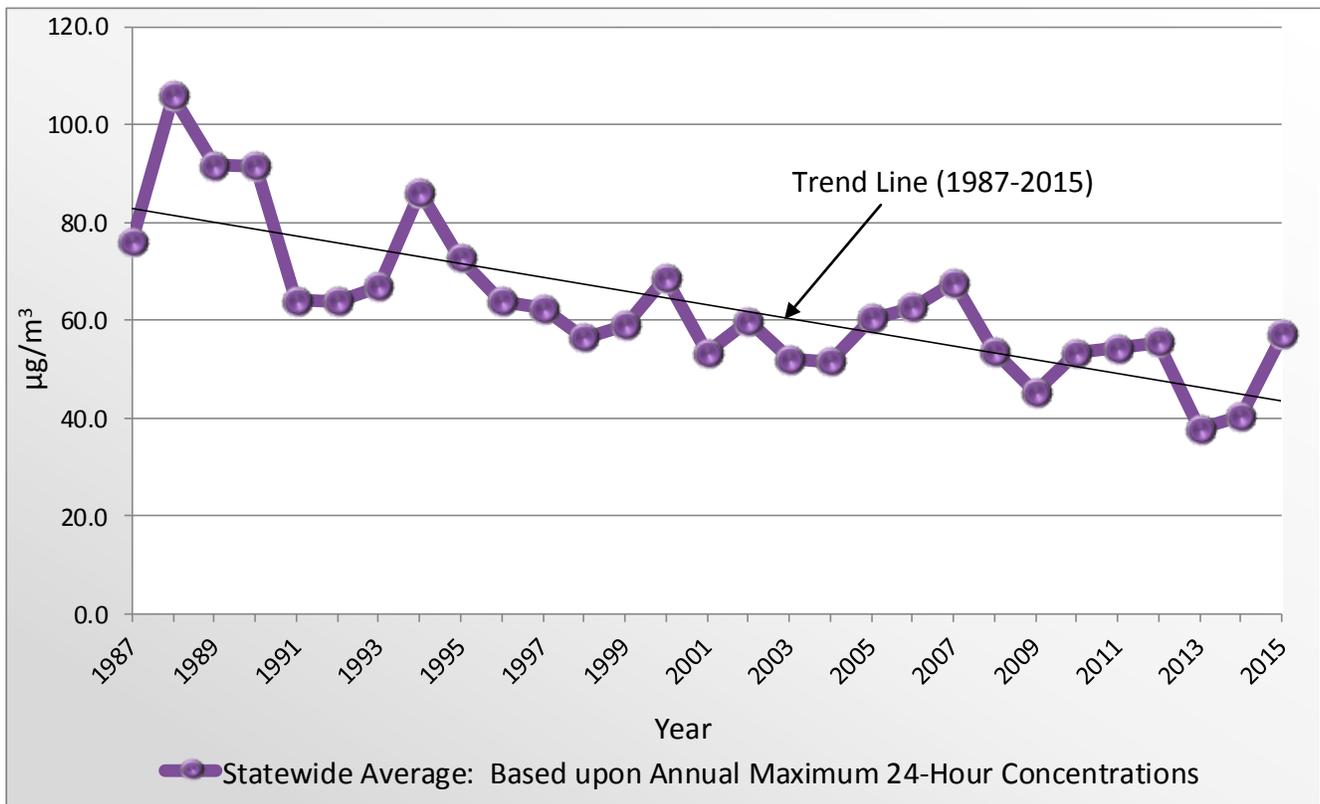


Figure 39: Statewide averages for PM₁₀ monitoring indicate pollution reductions.

PM₁₀ Results

In 2015, the DAQ and the LMAPCD operated a combined network of eight PM₁₀ intermittent and continuous samplers in Kentucky. The annual PM₁₀ standard is attained when the expected number of days per year with a 24-hour concentration greater than 150 µg/m³ 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 µg/m³ 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 PM₁₀ standard in 2015. 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 PM₁₀ NAAQS have been recorded. One of those exceedances occurred at a different Ashland site (21-019-0003) on Aug. 27, 1990, when a 24-hour concentration of 182 µg/m³ was measured. The only other exceedance occurred on Jan. 7, 2000, at a Louisville site (21-111-0043) where a 24-hour sample measured 152 µg/m³.

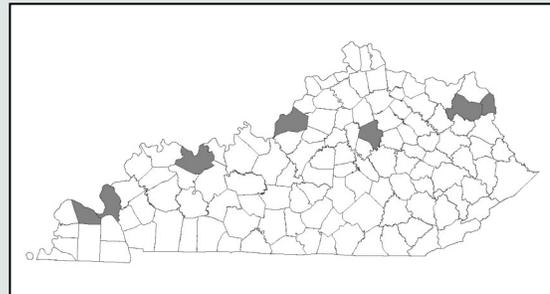
National Ambient Air Quality Standards for Particulate Matter (PM₁₀)

Primary NAAQS: Expected number of days with a maximum 24-hour concentration greater than 150 µg/m³ must be less than or equal to one, on average over three years.

Secondary NAAQS: Same as Primary Standard

Criteria Pollutant Summary Report - 2015

Pollutant: Particulate Matter PM₁₀
Method: Gravimetric
Data Interval: 24-hour
Units: Micrograms per cubic meter (µg/m³) (25°C)



| County | Site | AQS-ID | # Obs | 24-hour Average | | | | Act Obs > 150 | Exp Obs > 150 | Mean |
|------------------------|--|-------------|-------|---------------------|---------------------|---------------------|---------------------|---------------|---------------|------|
| | | | | 1 st Max | 2 nd Max | 3 rd Max | 4 th Max | | | |
| Boyd | 21st & Greenup Ashland | 21-019-0002 | 55 | 58 | 56 | 49 | 40 | 0 | 0 | 22.8 |
| Carter | Camp Webb Grayson Lake | 21-043-0500 | 56 | 53 | 25 | 23 | 21 | 0 | 0 | 11.0 |
| Fayette | 650 Newtown Pike Lexington | 21-067-0012 | 56 | 60 | 57 | 32 | 26 | 0 | 0 | 15.6 |
| Henderson | Baskett Fire Dept. Baskett | 21-101-0014 | 57 | 50 | 33 | 33 | 30 | 0 | 0 | 16.9 |
| Jefferson ¹ | 37 th & Southern Ave Louisville | 21-111-0043 | 8488 | 64 | 51 | 45 | 40 | 0 | 0 | 17.3 |

PM₁₀ Criteria Pollutant Summary Report - 2015 Continued

| County | Site | AQS-ID | # Obs | 24-hour Average | | | | Act Obs > 150 | Exp Obs > 150 | Mean |
|------------------------|--------------------------------|-------------|-------|------------------------|------------------------|------------------------|------------------------|---------------------|---------------------|-------|
| | | | | 1 st Max | 2 nd Max | 3 rd Max | 4 th Max | | | |
| Jefferson ¹ | 7201 Watson Ln Louisville | 21-111-0051 | 8646 | 51 | 50 | 49 | 45 | 0 | 0 | 16.6 |
| Livingston | 763 Bloodworth Rd Smithland | 21-139-0004 | 51 | 68 | 34 | 32 | 29 | 0 | 0 | 16.0* |
| McCracken | 2901 Powell Street Paducah | 21-145-1024 | 59 | 64 | 39 | 38 | 33 | 0 | 0 | 18.4 |

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

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

--- Monitoring not conducted / Data not available

PM₁₀ Criteria Pollutant Summary Report - 2015 Estimated Number of Annual Exceedances, Expected 3-Year Average

| County | Site | AQS-ID | Estimated Number of Exceedances | | | |
|------------------------|---|-------------|---------------------------------|------|------|------------------------|
| | | | 2013 | 2014 | 2015 | 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 | 37 th & Southern Ave Louisville | 21-111-0043 | 0 | 0 | 0 | 0 |
| Jefferson ¹ | 7201 Watson Ln Louisville | 21-111-0051 | --- | 0* | 0 | 0* |
| Livingston | 763 Bloodworth Rd Smithland | 21-139-0004 | --- | 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.

--- Monitoring not conducted / Data not available

2015 Sulfur Dioxide Ambient Air Monitoring Network

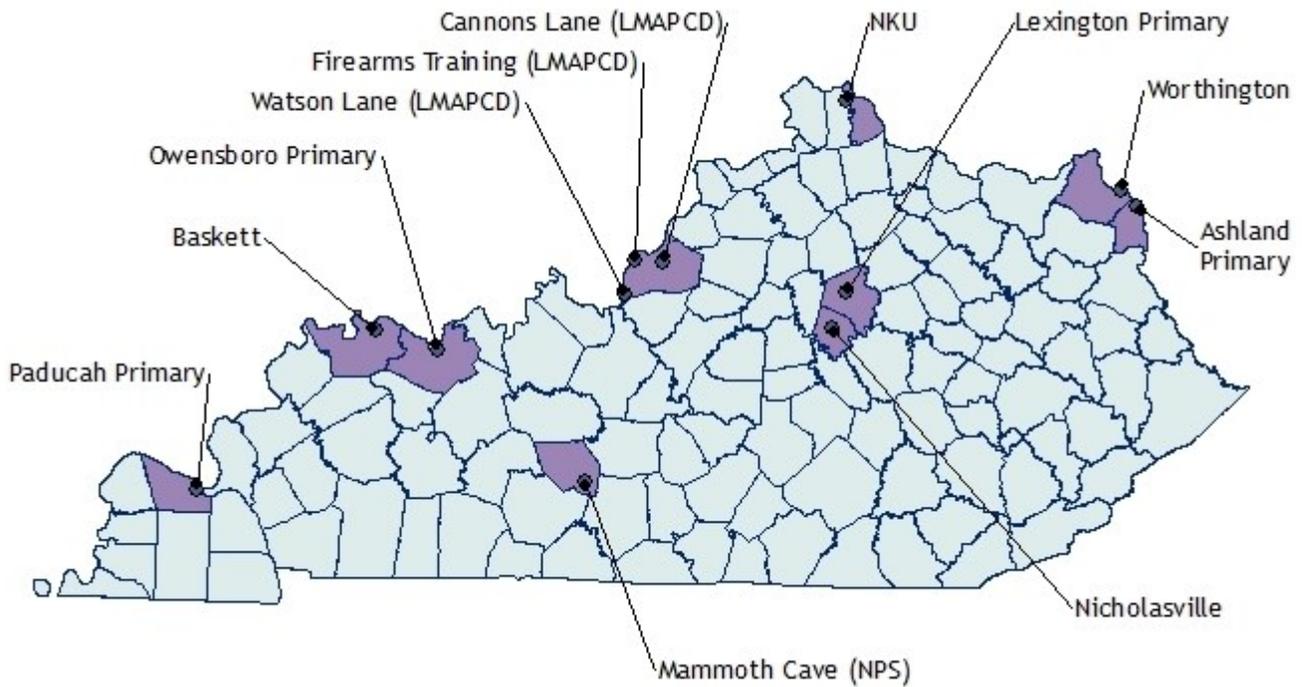


Figure 40: Sulfur dioxide monitoring locations in Kentucky.

Statewide Averages for Sulfur Dioxide

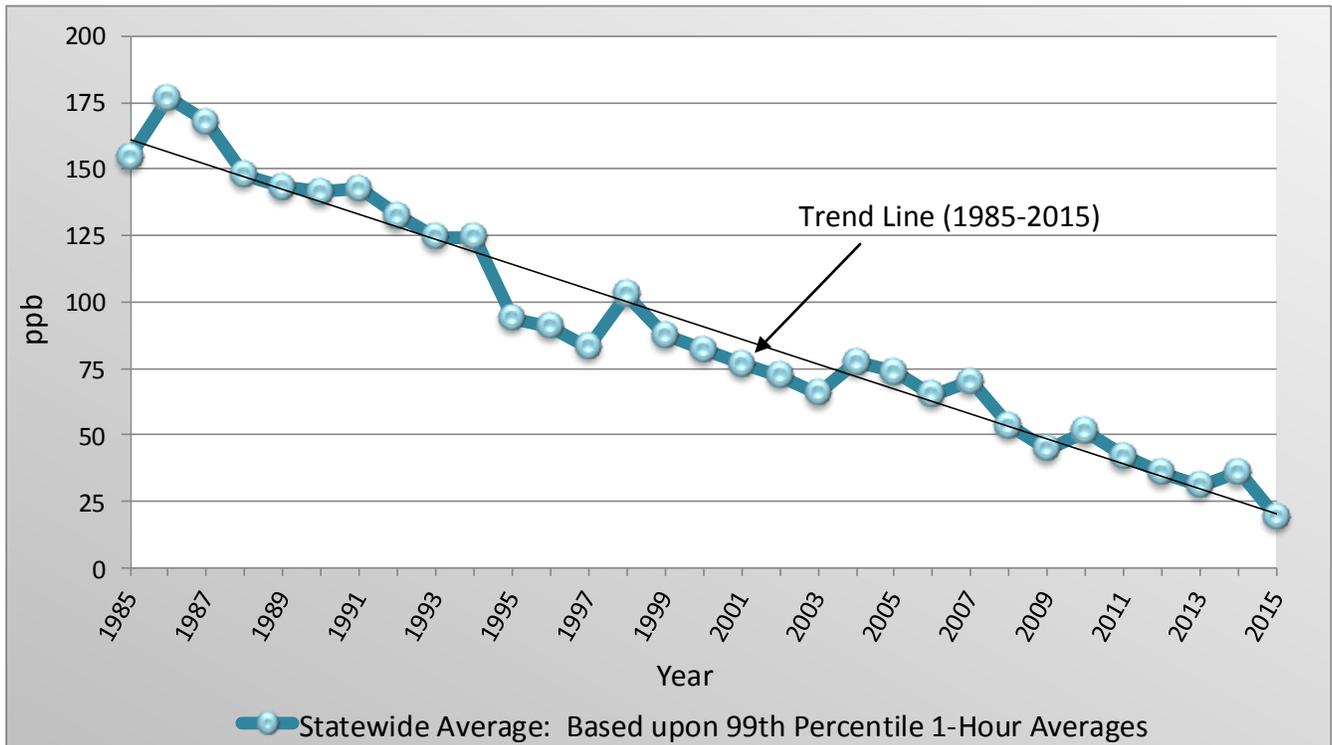


Figure 41: Statewide averages for SO₂ monitoring indicate significant pollution reductions.

Sulfur Dioxide Results

In 2015, the Division, the NPS at Mammoth Cave, and LMAPCD operated 12 SO₂ monitors in Kentucky. One site, located in Jefferson County, recorded a daily maximum one-hour average greater than 75 ppb. The site is also currently in violation of the one-hour NAAQS, based upon the three-year average of 99th percentile daily maximum one-hour concentrations.

Statewide and regional sulfur dioxide levels have declined over the past twenty years. The SO₂ allowances component of the Acid Rain Program provides an opportunity for electric utilities to participate in a market-based trade of SO₂ emissions. An electric utility that is participating in the trading program is required to continually monitor emissions for SO₂, 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 SO₂ concentrations.

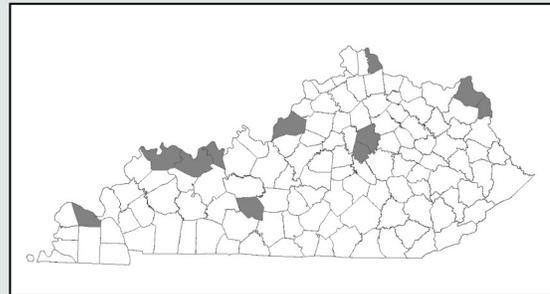
National Ambient Air Quality Standards for Sulfur Dioxide

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 - 2015

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 | | |
|-----------------------|---------------------------------------|-------------|-------|------------------------|---------------------|----------|-------------------------------|---------------------|-----------|
| | | | | 1 st max | 2 nd max | Obs > 75 | 1 st max | 2 nd max | Obs > 500 |
| Boyd | 2924 Holt Street Ashland | 21-019-0017 | 8428 | 38.0 | 15.0 | 0 | 19.6 | 10.6 | 0 |
| Campbell | 524A John Hill Rd Highland Heights | 21-037-3002 | 8368 | 34.0 | 24.0 | 0 | 26.6 | 18.3 | 0 |
| Daviess | US60 & Pleasant Valley Owensboro | 21-059-0005 | 7162 | 64.0 | 46.0 | 0 | 42.0 | 29.3 | 0 |
| Edmonson ¹ | Alfred Cook Road Mammoth Cave | 21-061-0501 | 8134 | 9.9 | 7.9 | 0 | 7.3 | 5.9 | 0 |

SO₂ Criteria Pollutant Summary Report - 2015 Continued

| County | Site Address | AQS-ID | # Obs | Daily Maximum 1-Hr Avg | | | Annual Maximum 3-Hr Block Avg | | |
|------------------------|-------------------------------------|-------------|-------|------------------------|---------------------|----------|-------------------------------|---------------------|-----------|
| | | | | 1 st max | 2 nd max | Obs > 75 | 1 st max | 2 nd max | Obs > 500 |
| Fayette | 650 Newtown Pike Lexington | 21-067-0012 | 8313 | 14.0 | 14.0 | 0 | 8.0 | 7.6 | 0 |
| Greenup | Scott & Center St. Worthington | 21-089-0007 | 8422 | 4.0 | 27.0 | 0 | 20.3 | 17.0 | 0 |
| Henderson | Baskett Fire Dept. Baskett | 21-101-0014 | 8435 | 30.0 | 26.0 | 0 | 15.6 | 14.3 | 0 |
| Jefferson ² | 7201 Watson Lane Louisville | 21-111-0051 | 8224 | 129.9 | 64.3 | 1 | 79.7 | 48.7 | 0 |
| Jefferson ² | 2730 Cannons Lane Louisville | 21-111-0067 | 8224 | 23.0 | 21.6 | 0 | 16.5 | 16.4 | 0 |
| Jefferson ² | 4201 Algonquin Pkwy Louisville | 21-111-1041 | 8262 | 32.1 | 28.3 | 0 | 22.0 | 20.1 | 0 |
| Jessamine | KYDOT, Etter Drive Nicholasville | 21-113-0001 | 8432 | 22.0 | 11.0 | 0 | 13.6 | 7.6 | 0 |
| McCracken | 2901 Powell Street Paducah | 21-145-1024 | 7771 | 19.0 | 18.0 | 0 | 15.3 | 10.0 | 0 |

¹ Monitor operated by the National Park Service.

² Monitor operated by the Louisville Metro Air Pollution Control District.

Values in red represent an exceedance of the NAAQS.

SO₂ Criteria Pollutant Multi-Year Summary Report - 2015
Daily Maximum 1-hour 99th Percentile, 3-Year Average

| County | Site Address | AQS-ID | Daily Maximum 1-Hr Average 99 th Percentile | | | |
|------------------------|--|-------------|---|------|------|------------|
| | | | 2013 | 2014 | 2015 | 3-Year Avg |
| Boyd | 2924 Holt Street Ashland | 21-019-0017 | 16 | 19 | 12 | 16 |
| Campbell | 524A John Hill Rd Highland Heights | 21-037-3002 | 71 | 61 | 18 | 50 |
| Daviess | US60 & Pleasant Valley Rd Owensboro | 21-059-0005 | 45 | 48 | 27* | 40* |
| Edmonson ¹ | Alfred Cook Road Mammoth Cave | 21-061-0501 | 11 | 11 | 7 | 10 |
| Fayette | 650 Newtown Pike Lexington | 21-067-0012 | 12 | 13 | 9 | 11 |
| Greenup | Scott & Center Streets Worthington | 21-089-0007 | 12 | 16 | 13 | 14 |
| Henderson | Baskett Fire Dept. Baskett | 21-101-0014 | 28 | 29 | 19 | 25 |
| Jefferson ² | 7201 Watson Lane Louisville | 21-111-0051 | 93* | 149 | 54 | 99* |
| Jefferson ² | 2730 Cannons Lane Louisville | 21-111-0067 | 27* | 29 | 19 | 25* |
| Jefferson ² | 4201 Algonquin Pkwy Louisville | 21-111-1041 | 37* | 42 | 25 | 35 |
| Jessamine | KYDOT, Etter Drive Nicholasville | 21-113-0001 | 18 | 15 | 10 | 14 |
| McCracken | 2901 Powell Street Paducah | 21-145-1024 | 18 | 20 | 15* | 18 |

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.

HAZARDOUS AIR POLLUTANTS

2015 Hazardous Air Pollutant Ambient Air Monitoring Network

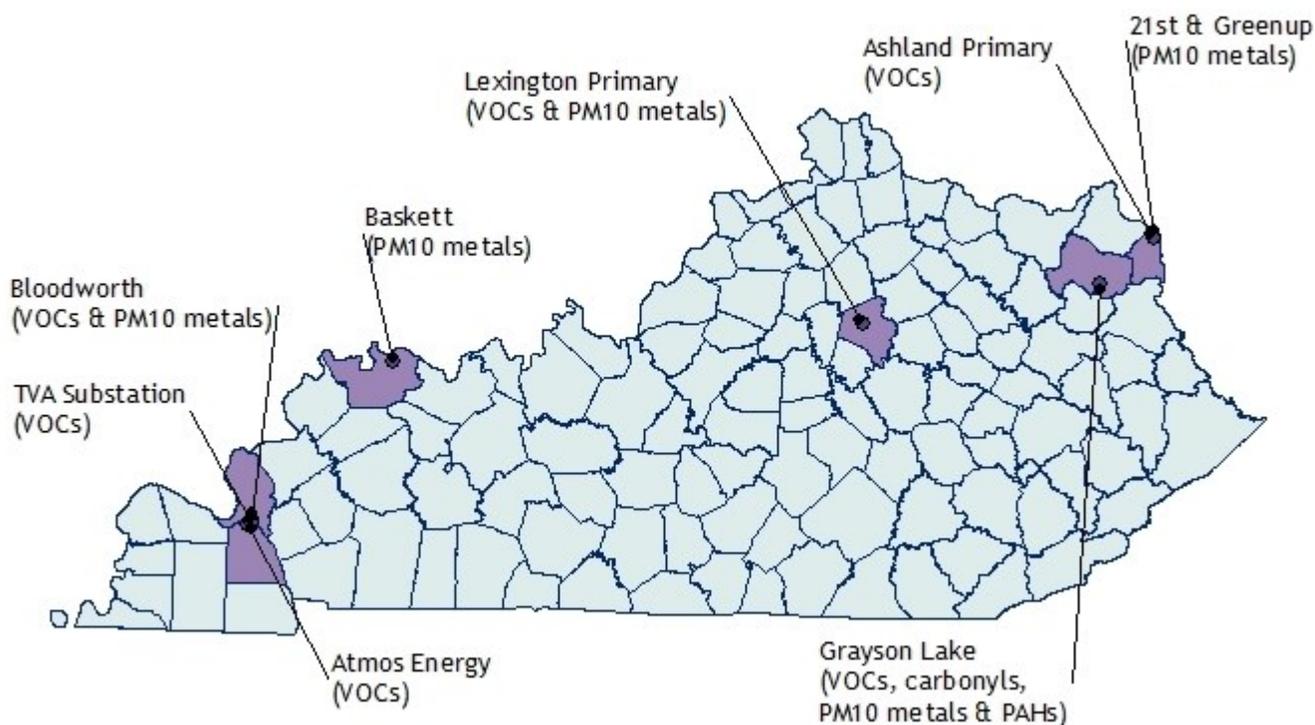


Figure 42: Hazardous air pollutant monitoring locations in Kentucky.

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 2015, the Division operated eight 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 required hazardous air pollutants that are to be monitored in the National Air Toxics Trends study.

HAPS can be subdivided into five 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
- PM₁₀ metals: Teflon[®] filters
- PAHs: polyurethane foam (PUF)/XAD-2[®] sorbent
- Cr⁶⁺: Bicarbonate-impregnated ashless cellulose filter

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 - 2015

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 | 1 st max | 2 nd max | 3 rd max | 4 th max | Annual Mean |
|---------------------|-------|---------------------|---------------------|---------------------|---------------------|-------------|
| Formaldehyde | 60 | 3.7 | 3.3 | 2.9 | 2.7 | 1.43 |
| Acetaldehyde | 60 | 2.2 | 1.6 | 1.6 | 1.5 | 0.96 |
| Propionaldehyde | 55 | 0.7 | 0.6 | 0.5 | 0.4 | 0.25* |
| Butyraldehyde | 60 | 0.4 | 0.32 | 0.30 | 0.29 | 0.17 |
| Isovaleraldehyde | 60 | 0.0 | 0.0 | 0.0 | 0.0 | 0.00 |
| Hexanaldehyde | 60 | 0.5 | 0.4 | 0.3 | 0.3 | 0.10 |
| Valeraldehyde | 57 | 0.2 | 0.2 | 0.2 | 0.2 | 0.08 |
| Crotonaldehyde | 60 | 3.8 | 3.0 | 2.6 | 2.6 | 0.72 |
| Acetone | 60 | 4.6 | 4.4 | 4.1 | 3.7 | 1.92 |
| Methyl ethyl ketone | 59 | 0.9 | 0.8 | 0.7 | 0.7 | 0.37 |
| Benzaldehyde | 56 | 0.6 | 0.2 | 0.2 | 0.2 | 0.10* |
| Tolualdehydes | 60 | 0.0 | 0.0 | 0.0 | 0.0 | 0.00 |
| Tolualdehydes | 58 | 0.6 | 0.5 | 0.4 | 0.4 | 0.17 |

Metals

Air Toxics Summary Report - 2015

Pollutant: Antimony
Method: IO-3.5; Metals low volume PM₁₀ monitor
Data Interval: 24-hour
Units: Nanograms per cubic meter (ng/m³)

| County | Site | AQS-ID | # Obs | 1 st max | 2 nd max | 3 rd max | 4 th max | Annual Mean |
|------------|-----------------------------|-------------|-------|---------------------|---------------------|---------------------|---------------------|-------------|
| Boyd | 21st & Greenup Ashland | 21-019-0002 | 55 | 12.8 | 12.5 | 10.1 | 6.4 | 2.40 |
| Carter | Camp Webb Grayson Lake | 21-043-0500 | 56 | 6.0 | 3.4 | 3.3 | 2.3 | 0.91 |
| Fayette | 650 Newtown Pike Lexington | 21-067-0012 | 56 | 10.9 | 6.0 | 4.0 | 3.0 | 1.54 |
| Henderson | Baskett Fire Dept. Baskett | 21-101-0014 | 56 | 3.0 | 1.7 | 1.3 | 1.2 | 0.63 |
| Livingston | 763 Bloodworth Rd Smithland | 21-139-0004 | 51 | 8.4 | 2.6 | 1.2 | 1.0 | 0.71 |

Air Toxics Summary Report - 2015

Pollutant: Arsenic
Method: IO-3.5; Metals low volume PM₁₀ monitor
Data Interval: 24-hour
Units: Nanograms per cubic meter (ng/m³)

| County | Site | AQS-ID | # Obs | 1 st max | 2 nd max | 3 rd max | 4 th max | Annual Mean |
|------------|-----------------------------|-------------|-------|---------------------|---------------------|---------------------|---------------------|-------------|
| Boyd | 21st & Greenup Ashland | 21-019-0002 | 55 | 7.4 | 3.80 | 3.40 | 3.40 | 1.38 |
| Carter | Camp Webb Grayson Lake | 21-043-0500 | 56 | 2.0 | 1.6 | 1.0 | 0.9 | 0.53 |
| Fayette | 650 Newtown Pike Lexington | 21-067-0012 | 56 | 5.0 | 1.5 | 1.5 | 1.4 | 0.81 |
| Henderson | Baskett Fire Dept. Baskett | 21-101-0014 | 56 | 3.2 | 3.0 | 2.7 | 2.5 | 0.97 |
| Livingston | 763 Bloodworth Rd Smithland | 21-139-0004 | 51 | 1.6 | 1.2 | 1.2 | 1.1 | 0.57 |

Metals

Air Toxics Summary Report - 2015

Pollutant: Beryllium
Method: IO-3.5; Metals low volume PM₁₀ monitor
Data Interval: 24-hour
Units: Nanograms per cubic meter (ng/m³)

| County | Site | AQS-ID | # Obs | 1 st max | 2 nd max | 3 rd max | 4 th max | Annual Mean |
|------------|-----------------------------|-------------|-------|---------------------|---------------------|---------------------|---------------------|-------------|
| Boyd | 21st & Greenup Ashland | 21-019-0002 | 55 | 0.10 | 0.10 | 0.10 | 0.10 | 0.010 |
| Carter | Camp Webb Grayson Lake | 21-043-0500 | 56 | 0.10 | 0.02 | 0.01 | 0.01 | 0.004 |
| Fayette | 650 Newtown Pike Lexington | 21-067-0012 | 56 | 0.11 | 0.04 | 0.04 | 0.03 | 0.011 |
| Henderson | Baskett Fire Dept. Baskett | 21-101-0014 | 56 | 0.09 | 0.05 | 0.04 | 0.04 | 0.014 |
| Livingston | 763 Bloodworth Rd Smithland | 21-139-0004 | 51 | 0.13 | 0.06 | 0.03 | 0.02 | 0.011 |

Air Toxics Summary Report - 2015

Pollutant: Cadmium
Method: IO-3.5; Metals low volume PM₁₀ monitor
Data Interval: 24-hour
Units: Nanograms per cubic meter (ng/m³)

| County | Site | AQS-ID | # Obs | 1 st max | 2 nd max | 3 rd max | 4 th max | Annual Mean |
|------------|-----------------------------|-------------|-------|---------------------|---------------------|---------------------|---------------------|-------------|
| Boyd | 21st & Greenup Ashland | 21-019-0002 | 55 | 1.80 | 1.20 | 1.00 | 0.80 | 0.320 |
| Carter | Camp Webb Grayson Lake | 21-043-0500 | 56 | 0.85 | 0.26 | 0.25 | 0.24 | 0.101 |
| Fayette | 650 Newtown Pike Lexington | 21-067-0012 | 56 | 0.36 | 0.30 | 0.30 | 0.25 | 0.090 |
| Henderson | Baskett Fire Dept. Baskett | 21-101-0014 | 56 | 0.40 | 0.35 | 0.24 | 0.22 | 0.102 |
| Livingston | 763 Bloodworth Rd Smithland | 21-139-0004 | 51 | 0.41 | 0.14 | 0.14 | 0.13 | 0.077 |

Metals

Air Toxics Summary Report - 2015

Pollutant: Chromium
Method: IO-3.5; Metals low volume PM₁₀ monitor
Data Interval: 24-hour
Units: Nanograms per cubic meter (ng/m³)

| County | Site | AQS-ID | # Obs | 1 st max | 2 nd max | 3 rd max | 4 th max | Annual Mean |
|------------|-----------------------------|-------------|-------|---------------------|---------------------|---------------------|---------------------|-------------|
| Boyd | 21st & Greenup Ashland | 21-019-0002 | 55 | 12.90 | 11.80 | 9.40 | 8.80 | 5.540 |
| Carter | Camp Webb Grayson Lake | 21-043-0500 | 56 | 16.40 | 7.46 | 6.84 | 6.16 | 3.107 |
| Fayette | 650 Newtown Pike Lexington | 21-067-0012 | 56 | 7.26 | 7.08 | 6.93 | 6.53 | 3.205 |
| Henderson | Baskett Fire Dept. Baskett | 21-101-0014 | 56 | 8.17 | 6.88 | 6.34 | 6.32 | 3.200 |
| Livingston | 763 Bloodworth Rd Smithland | 21-139-0004 | 51 | 11.60 | 11.20 | 8.52 | 5.30 | 3.695 |

Air Toxics Summary Report - 2015

Pollutant: Lead
Method: IO-3.5; Metals low volume PM₁₀ monitor
Data Interval: 24-hour
Units: Nanograms per cubic meter (ng/m³)

| County | Site | AQS-ID | # Obs | 1 st max | 2 nd max | 3 rd max | 4 th max | Annual Mean |
|------------|-----------------------------|-------------|-------|---------------------|---------------------|---------------------|---------------------|-------------|
| Boyd | 21st & Greenup Ashland | 21-019-0002 | 55 | 0.0414 | 0.0303 | 0.0294 | 0.0202 | 0.00880 |
| Carter | Camp Webb Grayson Lake | 21-043-0500 | 56 | 0.0087 | 0.0041 | 0.0036 | 0.0030 | 0.00157 |
| Fayette | 650 Newtown Pike Lexington | 21-067-0012 | 56 | 0.0107 | 0.0062 | 0.0056 | 0.0041 | 0.00208 |
| Henderson | Baskett Fire Dept. Baskett | 21-101-0014 | 56 | 0.0079 | 0.0045 | 0.0042 | 0.0036 | 0.00165 |
| Livingston | 763 Bloodworth Rd Smithland | 21-139-0004 | 51 | 0.0041 | 0.0038 | 0.0031 | 0.0030 | 0.00154 |

Metals

Air Toxics Summary Report - 2015

Pollutant: Manganese
Method: IO-3.5; Metals low volume PM₁₀ monitor
Data Interval: 24-hour
Units: Nanograms per cubic meter (ng/m³)

| County | Site | AQS-ID | # Obs | 1 st max | 2 nd max | 3 rd max | 4 th max | Annual Mean |
|------------|-----------------------------|-------------|-------|---------------------|---------------------|---------------------|---------------------|-------------|
| Boyd | 21st & Greenup Ashland | 21-019-0002 | 55 | 117.0 | 81.8 | 69.9 | 55.1 | 25.05 |
| Carter | Camp Webb Grayson Lake | 21-043-0500 | 56 | 36.0 | 9.1 | 7.3 | 6.1 | 3.54 |
| Fayette | 650 Newtown Pike Lexington | 21-067-0012 | 56 | 39.0 | 20.2 | 13.1 | 11.7 | 6.40 |
| Henderson | Baskett Fire Dept. Baskett | 21-101-0014 | 56 | 33.1 | 16.7 | 16.2 | 14.0 | 5.62 |
| Livingston | 763 Bloodworth Rd Smithland | 21-139-0004 | 51 | 47.1 | 26.2 | 19.7 | 19.5 | 7.13 |

Air Toxics Summary Report - 2015

Pollutant: Nickel
Method: IO-3.5; Metals low volume PM₁₀ monitor
Data Interval: 24-hour
Units: Nanograms per cubic meter (ng/m³)

| County | Site | AQS-ID | # Obs | 1 st max | 2 nd max | 3 rd max | 4 th max | Annual Mean |
|------------|-----------------------------|-------------|-------|---------------------|---------------------|---------------------|---------------------|-------------|
| Boyd | 21st & Greenup Ashland | 21-019-0002 | 55 | 10.6 | 7.2 | 5.5 | 4.6 | 2.20 |
| Carter | Camp Webb Grayson Lake | 21-043-0500 | 56 | 2.3 | 1.0 | 0.5 | 0.5 | 0.32 |
| Fayette | 650 Newtown Pike Lexington | 21-067-0012 | 56 | 2.5 | 1.8 | 0.9 | 0.9 | 0.49 |
| Henderson | Baskett Fire Dept. Baskett | 21-101-0014 | 56 | 3.4 | 2.1 | 2.1 | 1.3 | 0.60 |
| Livingston | 763 Bloodworth Rd Smithland | 21-139-0004 | 51 | 3.4 | 1.4 | 1.3 | 1.2 | 0.53 |

Volatile Organic Compounds

Air Toxics Summary Report - 2015

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

| County | Site | AQS-ID | # Obs | 1 st max | 2 nd max | 3 rd max | 4 th max | Annual Mean |
|------------|--------------------------------|-------------|----------|------------------------|------------------------|------------------------|------------------------|----------------|
| Boyd | 2924 Holt Street Ashland | 21-019-0017 | 60 | 0.29 | 0.23 | 0.22 | 0.22 | 0.115 |
| Carter | Camp Webb Grayson Lake | 21-043-0500 | 60 | 0.18 | 0.14 | 0.14 | 0.12 | 0.059 |
| Fayette | 650 Newtown Pike Lexington | 21-067-0012 | 53 | 0.34 | 0.29 | 0.28 | 0.24 | 0.103* |
| Livingston | 763 Bloodworth Rd Smithland | 21-139-0004 | 59 | 0.66 | 0.48 | 0.44 | 0.41 | 0.111 |
| Marshall | TVA Substation Calvert City | 21-157-0014 | 60 | 7.04 | 4.48 | 3.84 | 3.78 | 0.648 |
| Marshall | Atmos Energy Calvert City | 21-157-0016 | 59 | 0.54 | 0.46 | 0.42 | 0.28 | 0.111 |

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

Volatile Organic Compounds

Air Toxics Summary Report - 2015

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

| County | Site | AQS-ID | # Obs | 1 st max | 2 nd max | 3 rd max | 4 th max | Annual Mean |
|------------|--------------------------------|-------------|----------|------------------------|------------------------|------------------------|------------------------|----------------|
| Boyd | 2924 Holt Street Ashland | 21-019-0017 | 60 | 0.05 | 0.05 | 0.05 | 0.05 | 0.032 |
| Carter | Camp Webb Grayson Lake | 21-043-0500 | 60 | 0.07 | 0.04 | 0.03 | 0.03 | 0.022 |
| Fayette | 650 Newtown Pike Lexington | 21-067-0012 | 53 | 0.05 | 0.04 | 0.04 | 0.04 | 0.025* |
| Livingston | 763 Bloodworth Rd Smithland | 21-139-0004 | 59 | 0.05 | 0.05 | 0.04 | 0.04 | 0.026 |
| Marshall | TVA Substation Calvert City | 21-157-0014 | 60 | 0.68 | 0.21 | 0.18 | 0.13 | 0.053 |
| Marshall | Atmos Energy Calvert City | 21-157-0016 | 59 | 0.06 | 0.06 | 0.04 | 0.04 | 0.027 |

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

Volatile Organic Compounds

Air Toxics Summary Report - 2015

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

| County | Site | AQS-ID | # Obs | 1 st max | 2 nd max | 3 rd max | 4 th max | Annual Mean |
|------------|--------------------------------|-------------|----------|------------------------|------------------------|------------------------|------------------------|----------------|
| Boyd | 2924 Holt Street Ashland | 21-019-0017 | 60 | 0.12 | 0.12 | 0.12 | 0.12 | 0.099 |
| Carter | Camp Webb Grayson Lake | 21-043-0500 | 60 | 0.13 | 0.12 | 0.12 | 0.11 | 0.099 |
| Fayette | 650 Newtown Pike Lexington | 21-067-0012 | 54 | 0.12 | 0.12 | 0.12 | 0.12 | 0.100* |
| Livingston | 763 Bloodworth Rd Smithland | 21-139-0004 | 59 | 0.20 | 0.18 | 0.13 | 0.12 | 0.107 |
| Marshall | TVA Substation Calvert City | 21-157-0014 | 60 | 0.59 | 0.40 | 0.40 | 0.27 | 0.135 |
| Marshall | Atmos Energy Calvert City | 21-157-0016 | 59 | 0.22 | 0.13 | 0.12 | 0.12 | 0.107 |

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

Volatile Organic Compounds

Air Toxics Summary Report - 2015

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

| County | Site | AQS-ID | # Obs | 1 st max | 2 nd max | 3 rd max | 4 th max | Annual Mean |
|------------|--------------------------------|-------------|----------|------------------------|------------------------|------------------------|------------------------|----------------|
| Boyd | 2924 Holt Street Ashland | 21-019-0017 | 60 | 0.06 | 0.06 | 0.05 | 0.05 | 0.037 |
| Carter | Camp Webb Grayson Lake | 21-043-0500 | 60 | 0.05 | 0.05 | 0.05 | 0.04 | 0.030 |
| Fayette | 650 Newtown Pike Lexington | 21-067-0012 | 53 | 0.05 | 0.05 | 0.05 | 0.05 | 0.032* |
| Livingston | 763 Bloodworth Rd Smithland | 21-139-0004 | 59 | 2.86 | 2.34 | 1.52 | 1.35 | 0.354 |
| Marshall | TVA Substation Calvert City | 21-157-0014 | 60 | 11.90 | 10.06 | 9.80 | 9.42 | 1.816 |
| Marshall | Atmos Energy Calvert City | 21-157-0016 | 59 | 2.46 | 0.79 | 0.79 | 0.77 | 0.201 |

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

Volatile Organic Compounds

Air Toxics Summary Report - 2015

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

| County | Site | AQS-ID | # Obs | 1 st max | 2 nd max | 3 rd max | 4 th max | Annual Mean |
|------------|--------------------------------|-------------|----------|------------------------|------------------------|------------------------|------------------------|----------------|
| Boyd | 2924 Holt Street Ashland | 21-019-0017 | 60 | 0.10 | 0.07 | 0.07 | 0.06 | 0.028 |
| Carter | Camp Webb Grayson Lake | 21-043-0500 | 60 | 0.03 | 0.03 | 0.02 | 0.02 | 0.006 |
| Fayette | 650 Newtown Pike Lexington | 21-067-0012 | 53 | 0.08 | 0.07 | 0.06 | 0.05 | 0.020* |
| Livingston | 763 Bloodworth Rd Smithland | 21-139-0004 | 59 | 0.05 | 0.03 | 0.03 | 0.02 | 0.009 |
| Marshall | TVA Substation Calvert City | 21-157-0014 | 60 | 0.03 | 0.03 | 0.03 | 0.03 | 0.012 |
| Marshall | Atmos Energy Calvert City | 21-157-0016 | 59 | 0.08 | 0.05 | 0.05 | 0.04 | 0.020 |

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

Volatile Organic Compounds

Air Toxics Summary Report - 2015

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 | 1 st max | 2 nd max | 3 rd max | 4 th max | Annual Mean |
|------------|--------------------------------|-------------|----------|------------------------|------------------------|------------------------|------------------------|----------------|
| Boyd | 2924 Holt Street Ashland | 21-019-0017 | 60 | 0.02 | 0.02 | 0.02 | 0.02 | 0.002 |
| Carter | Camp Webb Grayson Lake | 21-043-0500 | 60 | 0.02 | 0.01 | 0.01 | 0.01 | 0.002 |
| Fayette | 650 Newtown Pike Lexington | 21-067-0012 | 53 | 0.02 | 0.02 | 0.01 | 0.01 | 0.001* |
| Livingston | 763 Bloodworth Rd Smithland | 21-139-0004 | 59 | 0.02 | 0.02 | 0.02 | 0.02 | 0.004 |
| Marshall | TVA Substation Calvert City | 21-157-0014 | 60 | 0.02 | 0.02 | 0.01 | 0.01 | 0.002 |
| Marshall | Atmos Energy Calvert City | 21-157-0016 | 59 | 0.02 | 0.02 | 0.02 | 0.02 | 0.004 |

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

Volatile Organic Compounds

Air Toxics Summary Report - 2015

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

| County | Site | AQS-ID | # Obs | 1 st max | 2 nd max | 3 rd max | 4 th max | Annual Mean |
|------------|--------------------------------|-------------|----------|------------------------|------------------------|------------------------|------------------------|----------------|
| Boyd | 2924 Holt Street Ashland | 21-019-0017 | 60 | 0.02 | 0.02 | 0.02 | ND | 0.001 |
| Carter | Camp Webb Grayson Lake | 21-043-0500 | 60 | 0.02 | 0.02 | ND | ND | 0.001 |
| Fayette | 650 Newtown Pike Lexington | 21-067-0012 | 53 | 0.10 | 0.05 | 0.02 | 0.02 | 0.004* |
| Livingston | 763 Bloodworth Rd Smithland | 21-139-0004 | 59 | 0.03 | 0.02 | 0.02 | 0.02 | 0.003 |
| Marshall | TVA Substation Calvert City | 21-157-0014 | 60 | 0.05 | 0.04 | 0.03 | 0.03 | 0.005 |
| Marshall | Atmos Energy Calvert City | 21-157-0016 | 59 | 0.016 | 0.09 | 0.06 | 0.04 | 0.008 |

* Incomplete dataset. The mean does not satisfy summary criteria.
 ND= Non Detect

Volatile Organic Compounds

Air Toxics Summary Report - 2015

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

| County | Site | AQS-ID | # Obs | 1 st max | 2 nd max | 3 rd max | 4 th max | Annual Mean |
|------------|--------------------------------|-------------|----------|------------------------|------------------------|------------------------|------------------------|----------------|
| Boyd | 2924 Holt Street Ashland | 21-019-0017 | 60 | 0.02 | 0.02 | 0.01 | 0.01 | 0.002 |
| Carter | Camp Webb Grayson Lake | 21-043-0500 | 60 | 0.01 | 0.01 | 0.01 | 0.01 | 0.001 |
| Fayette | 650 Newtown Pike Lexington | 21-067-0012 | 53 | 0.02 | 0.02 | 0.01 | 0.01 | 0.001* |
| Livingston | 763 Bloodworth Rd Smithland | 21-139-0004 | 59 | 0.44 | 0.38 | 0.34 | 0.32 | 0.081 |
| Marshall | TVA Substation Calvert City | 21-157-0014 | 60 | 1.95 | 1.41 | 1.20 | 1.06 | 0.231 |
| Marshall | Atmos Energy Calvert City | 21-157-0016 | 59 | 5.00 | 3.04 | 2.84 | 2.80 | 0.539 |

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

Volatile Organic Compounds

Air Toxics Summary Report - 2015

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

| County | Site | AQS-ID | # Obs | 1 st max | 2 nd max | 3 rd max | 4 th max | Annual Mean |
|------------|--------------------------------|-------------|----------|------------------------|------------------------|------------------------|------------------------|----------------|
| Boyd | 2924 Holt Street Ashland | 21-019-0017 | 60 | 5.24 | 2.94 | 2.84 | 2.72 | 1.462 |
| Carter | Camp Webb Grayson Lake | 21-043-0500 | 60 | 1.66 | 1.61 | 1.45 | 1.36 | 0.733 |
| Fayette | 650 Newtown Pike Lexington | 21-067-0012 | 53 | 2.06 | 1.75 | 1.70 | 1.63 | 0.952* |
| Livingston | 763 Bloodworth Rd Smithland | 21-139-0004 | 59 | 2.50 | 1.94 | 1.85 | 1.84 | 1.055 |
| Marshall | TVA Substation Calvert City | 21-157-0014 | 60 | 10.26 | 9.96 | 8.16 | 7.74 | 1.974 |
| Marshall | Atmos Energy Calvert City | 21-157-0016 | 59 | 12.84 | 10.44 | 10.26 | 5.08 | 1.797 |

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

Polycyclic Aromatic Hydrocarbons

Air Toxics Summary Report - 2015

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/m³) (25 C)

| Pollutant | # Obs | 1 st max | 2 nd max | 3 rd max | 4 th max | Annual Mean |
|---------------------------------|-------|---------------------|---------------------|---------------------|---------------------|-------------|
| Napthalene (TSP) | 59 | 50.10 | 39.30 | 34.20 | 33.40 | 16.79 |
| Acenaphthene (TSP) | 59 | 1.66 | 1.04 | 0.79 | 0.67 | 0.16 |
| Acenaphthylene (TSP) | 59 | 0.28 | 0.26 | 0.23 | 0.14 | 0.03 |
| Fluorene (TSP) | 59 | 2.69 | 1.59 | 1.52 | 1.51 | 0.46 |
| Phenanthrene (TSP) | 59 | 4.62 | 3.70 | 3.40 | 3.16 | 1.84 |
| Anthracene (TSP) | 59 | 0.18 | 0.13 | 0.11 | 0.09 | 0.05 |
| Fluoranthene (TSP) | 59 | 1.88 | 1.18 | 1.13 | 1.06 | 0.62 |
| Pyrene (TSP) | 59 | 1.10 | 0.68 | 0.61 | 0.52 | 0.32 |
| Chrysene (TSP) | 59 | 0.40 | 0.38 | 0.38 | 0.36 | 0.11 |
| Coronene (TSP) | 59 | 0.16 | 0.13 | 0.12 | 0.11 | 0.03 |
| Benzo (a) anthracene (TSP) | 59 | 0.16 | 0.13 | 0.12 | 0.11 | 0.03 |
| Benzo (b) fluoranthene (TSP) | 59 | 0.37 | 0.67 | 0.19 | 0.17 | 0.05 |
| Benzo (k) fluoranthene (TSP) | 59 | 0.52 | 0.49 | 0.44 | 0.39 | 0.11 |
| Benzo (e) pyrene (TSP) | 59 | 0.40 | 0.31 | 0.30 | 0.28 | 0.07 |
| Dibenzo (a, h) anthracene (TSP) | 59 | 0.07 | 0.06 | 0.06 | 0.05 | 0.01 |
| Indeno (1,2,3-cd) pyrene (TSP) | 59 | 0.43 | 0.29 | 0.28 | 0.27 | 0.07 |

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.

Where can I find out about the AQI?

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 the EPA's AIRNow website at airnow.gov.

Carbon Monoxide (CO)

Carbon monoxide (CO) 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 $\mu\text{g}/\text{m}^3$ to 0.15 $\mu\text{g}/\text{m}^3$. 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 three 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 originally required lead monitoring at certain urban NCore sites, the requirement has since been eliminated. However, LMAPCD still conducts lead monitoring at the NCore site in Jefferson County.

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.

CRITERIA POLLUTANTS, Cont'd.

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?

At most sites, 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).

Lead samples at the LMAPCD NCore site are collected using a manual PM_{10} sampler (in local conditions), which is an approved federal equivalent method for lead sampling. These low-volume instruments maintain a flow-rate of 16.7 liters per minute to collect a sample onto a PTFE filter. PM_{10} filters are first analyzed to obtain the mass-difference and are subsequently sent to a laboratory for lead analysis via x-ray fluorescence.

Nitrogen Dioxide (NO_2)

Nitrogen dioxide is a reddish brown gas that is produced during high temperature combustion. During combustion, nitrogen and oxygen are combined, or oxidized, 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 also 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

CRITERIA POLLUTANTS, Cont'd.

through a catalytic converter that converts the NO₂ 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 NO₂. By subtracting the second air stream NO concentration from the first stream NO_x concentration, an NO₂ value is obtained. Data from the analyzer is transmitted into an automated data storage system.

Ozone (O₃)

Ozone (O₃) 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 O₃ 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 (PM_{2.5}) 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/m³, and a 24-hour standard set at 35 µg/m³. The secondary standard to protect public welfare is an annual standard set at 15 µg/m³.

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 continuous Tapered Element Oscillating Microbalance (TEOM) monitors and manual intermittent Federal Reference Method (FRM) and (Federal Equivalent Method) FEM samplers.

CRITERIA POLLUTANTS, Cont'd.

However, only the FRM and FEM manual intermittent samplers are used for comparisons to the NAAQS. The TEOM 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 and 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} speciation monitored?

PM_{2.5} is composed of many different components or *species*. The approach to be used for chemical speciation involves both sampling and analysis of species. The target groups of chemical species include a list of analytes that consist of an array of 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. Samples are collected 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 (PM₁₀)

Particulate matter of 10 microns or less in diameter (PM₁₀) is a mixture of solid particles and liquid droplets. Some common sources of PM₁₀ are prescribed fires, construction activities, agricultural practices, and smokestacks.

Current PM₁₀ Standard

The current NAAQS for PM₁₀ (both primary and secondary) is a 24-hour standard set at 150 µg/m³. 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.

CRITERIA POLLUTANTS, Cont'd.

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 (SO_2) 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?

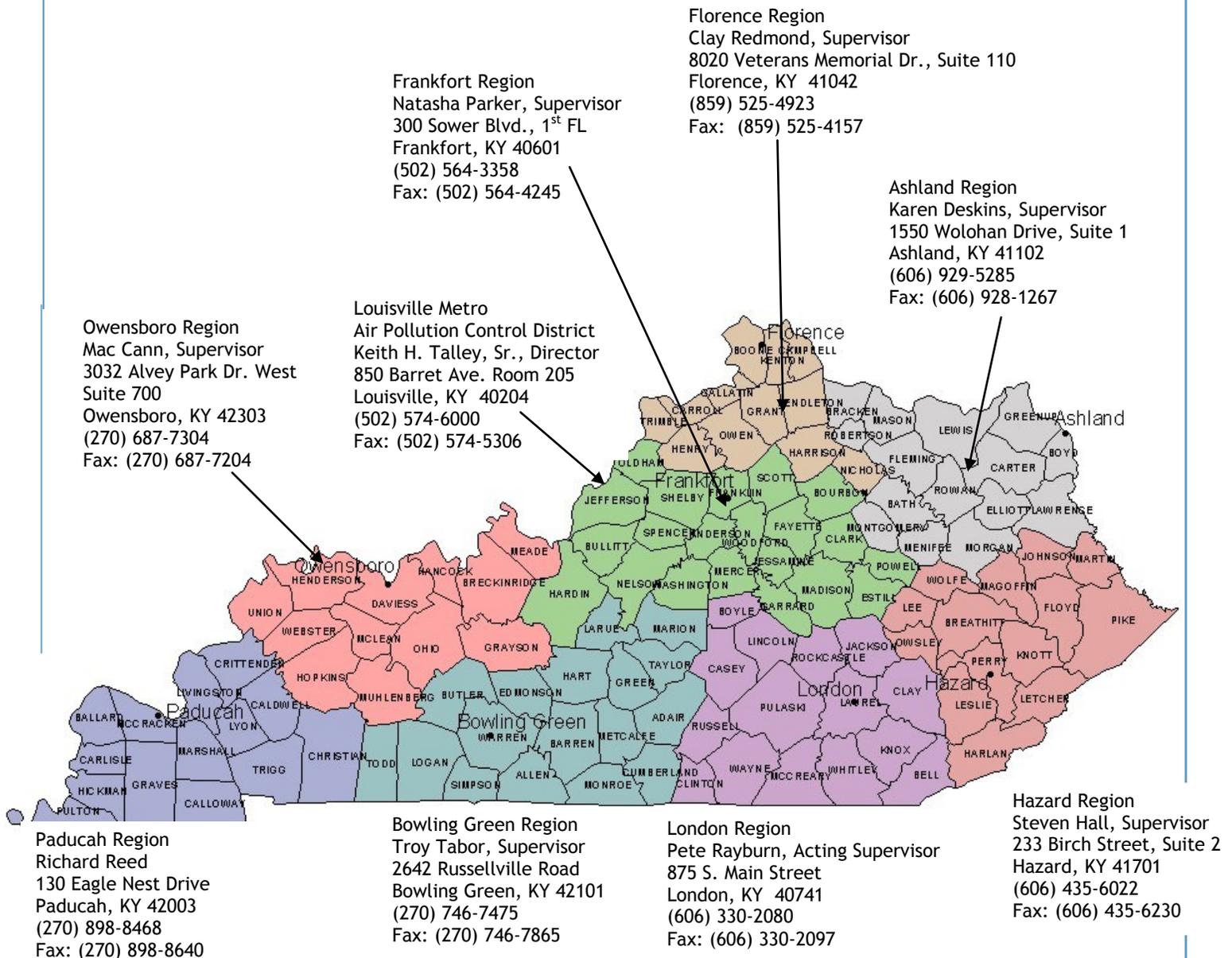
Analyzers continuously monitor SO_2 by using the ultraviolet (UV) fluorescence method. Fluorescent analyzers irradiate an ambient air sample with ultraviolet light. SO_2 molecules absorb a portion of this energy and then re-emit the energy at a characteristic wavelength of light. The light energy emitted 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.

APPENDIX C: FIELD OFFICES

Division for Air Quality Regional Office Boundaries

air.ky.gov

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



Revised: 09/01/16

APPENDIX D: GLOSSARY OF ABBREVIATIONS

| | | | |
|-----------------------|---|-------------------------|--|
| AHERA | Asbestos Hazard Emergency Response Act | NOV | Notice of Violation |
| AQI | Air Quality Index | NPS | National Park Service |
| BACT | Best Available Control Technology | NSR | New Source Review |
| CAA | Clean Air Act | O₃ | Ozone |
| CO | Carbon Monoxide | Pb | Lead |
| CO₂ | Carbon Dioxide | PM₁₀ | Particulate Matter, also known as coarse particles, measure between 2.5-10 microns in diameter |
| CPT | Cost per Ton | PM_{2.5} | Fine Particulate Matter, also known as fine particles, measuring less than 2.5 microns in diameter |
| CSAPR | Cross-State Air Pollution Rule | PTE | Potential to Emit |
| DAQ | Division for Air Quality | QAPP | Quality Assurance Project Plan |
| DEP | Department for Environmental Protection | RATA | Relative Accuracy Test Audit |
| DERA | Diesel Emissions Reduction Act | RTF | Regulatory Time Frame |
| EEC | Energy and Environment Cabinet | SEDC | Southeast Diesel Collaborative |
| EGU | Electric Generating Unit | SIP | State Implementation Plan |
| EPA | Environmental Protection Agency | SO₂ | Sulfur Dioxide |
| GHG | Greenhouse Gas | SOP | Standard Operating Procedure |
| HAP | Hazardous Air Pollutant | TEMPO | Tools for Environmental Management and Protection Organizations |
| HPV | High Priority Violation | TPY | Tons per year |
| KAR | Kentucky Administrative Regulation | TRI | Toxics Release Inventory |
| KORA | Kentucky Open Records Act | VISTAS | Visibility Improvement State and Tribal Association of the Southeast |
| KRS | Kentucky Revised Statute | VOC | Volatile Organic Compound |
| 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 | | |

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 has the potential to emit 100 tons per year or more of a regulated air pollutant.

Minor Source A stationary source that emits and 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.

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 for 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).

GLOSSARY, Cont'd.

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).

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 PTE that could exceed major Title V thresholds, but they have agreed to control emissions below major threshold. Synthetic minors includes 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.

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 PM₁₀) | | |
| 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 87.

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 ($\mu\text{g}/\text{m}^3$), 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 ($1.5 \mu\text{g}/\text{m}^3$ 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 $12.0 \mu\text{g}/\text{m}^3$ (final rule signed on Dec. 14, 2013; rule effective on March 18, 2013). The previous primary standard was set to $15.0 \mu\text{g}/\text{m}^3$, 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 $35 \mu\text{g}/\text{m}^3$.
- (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).

ACKNOWLEDGMENTS

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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Commissioner: Aaron Keatley

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