Kentucky Division for Air Quality
2015 Annual Report

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

KENTUCKY DIVISION FOR AIR QUALITY

Kentucky UNBRIDLED SPIRIT

FROM THE DIRECTOR

Dear Readers,

On behalf of the Division for Air Quality, I want to thank you for your interest in the Division's FY 2015 Annual Report. The Annual Report details the Division's mission, function, and commitment to protecting human health and the environment. I hope you find the report to be informative and educational, fulfilling the Division's mission of timely dissemination of accurate and useful information.

Over the past two decades, ambient air monitoring data have continued to demonstrate Kentucky's air quality improvement -- and 2015 is no exception. Other than one sulfur dioxide monitor in Jefferson County, every monitor in Kentucky is recording compliance with the health-based National Ambient Air Quality Standards (NAAQS). This good news means that Kentuckians are breathing cleaner, healthier air.

Every day, Kentuckians are making energy-wise decisions that positively impact air quality. Lifestyle choices such as carpooling, reducing the number of errands and trips, and using energy-efficient appliances all reduce our collective impact on air quality. Individually, each of us has the power to improve our Commonwealth.

In the Clean Air Act, Congress declares that "economic growth will occur in a manner consistent with the preservation of existing clean air resources." During the past year, the Division for Air Quality authorized construction of several beneficial economic development projects, including expansions at Toyota and the Corvette plant. The Division provided the construction authorization only after an in-depth engineering analysis and application of the best available control technologies. Environmental protection and economic growth are not mutually exclusive, and the Division is proud to promote economic development projects that comply with Clean Air Act requirements.

During the coming year, the Division will continue to build upon its success in permitting and compliance assurance. In addition, the Division will face the challenges of implementing a revised ozone NAAQS, evaluating the Clean Power Plan, and addressing the transport of emissions associated with power plants. These tasks are daunting; however, the Division is fully staffed and ready for the challenges ahead.

Again, thank you for your interest and review of the Division for Air Quality's 2015 Annual Report. If you have questions, comments, or additional information requests, please do not hesitate to contact us.

Sean Alteri

Director

Kentucky Division for Air Quality
Annual Report
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INTRODUCTION

This report details the accomplishments of the Division for Air Quality (DAQ) during the state Fiscal Year (FY) 2015, which runs from July 1, 2014 - June 30, 2015. DAQ is one of six divisions in the Department for Environmental Protection (DEP), which is housed in the Energy and Environment Cabinet (EEC).

The mission of DAQ is 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.*

As the third largest division in DEP with 171 staff positions, DAQ oversees a diverse air quality program that encompasses monitoring, regulation development, compliance with federal air quality standards, permitting regulated facilities and environmental education.

Creating effective partnerships with air pollution sources and the public enables DAQ to carry out its goal of protecting human health and the environment by achieving and maintaining acceptable air quality. DAQ strives to assist Kentucky's citizens and businesses in a satisfactory manner by responding to complaints, requests, and permit actions quickly and thoroughly. In addition to serving individuals and businesses, the division works to ensure that the federal Clean Air Act is met by working with county and city governments to ensure local compliance with (attainment of) the National Ambient Air Quality Standards (NAAQS), which are set by the Environmental Protection Agency (EPA).

Each year the cabinet produces a strategic plan to be implemented by each department in the upcoming fiscal year. The objectives and tactics from DAQ's portion of the Fiscal Year 2015 (FY 2015) strategic plan are included below:

Objective 1 – Ensure programs adhere to federal and state statutory and regulatory requirements.

Tactic 1.1: Attain and maintain the National Ambient Air Quality Standards.

Tactic 1.2: Review and revise state air quality regulations and policies.

Tactic 1.3: Assess source emissions annually through the Emission Inventory System.

Tactic 1.4: Ensure air quality programs are fiscally and administratively viable.

Tactic 1.5: Ensure programs are legally sound.

Objective 2 – Ensure permits are protective of Kentucky's air quality.

Tactic 2.1: Issue appropriate, lawful permits in a timely manner.

Tactic 2.2: Conduct air quality modeling to assess source impacts on air quality.

Objective 3 – Monitor Kentucky's Air Quality.

Tactic 3.1: Operate a statewide ambient air monitoring network.

Tactic 3.2: Ensure data accuracy and integrity of the ambient air monitoring network.

Tactic 3.3: Administer the source sampling program.

Tactic 3.4: Assess statewide source emission impacts in Kentucky and across state boundaries.

Objective 4 – Assure compliance and enforce air quality standards.

Tactic 4.1: Inspect sources of air pollution.

Tactic 4.2: Conduct enforcement actions regarding air quality regulations.

Tactic 4.3: Respond to air quality complaints.

Tactic 4.4: Administer the asbestos program.

Objective 5 – Participate in programs that improve Kentucky's air quality.

Tactic 5.1: Participate in programs that reduce mobile and off road emissions.

Tactic 5.2: Partner with other state agencies to reduce air quality emissions.

Tactic 5.3: Educate the public on Kentucky air quality issues.

Tactic 5.4: Foster networking through regional and national partnerships.

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 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.

NETWORKING & PARTNERSHIPS

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.

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.

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.

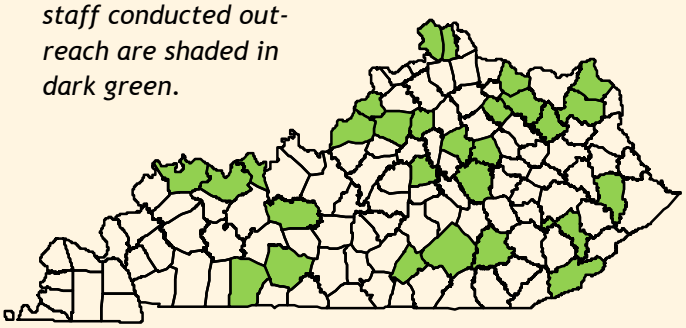
ENVIRONMENTAL EDUCATION

Environmental Education Outreach

The Division's EE program continues to reach thousands of Kentuckians each year. Numbers were lower in 2015, due primarily to severe winter weather which hampered travel and caused numerous school closings and event cancelations. Nevertheless, DAQ's EE programs reached 8950 people in 28 counties during FY 2015.

Environmental education (EE) is an essential tool in promoting environ-mental stewardship. DAQ's EE program reaches a diverse audience across the Commonwealth including students, teachers, firefighters, asthma educators, businesses, and solid waste coordinators.

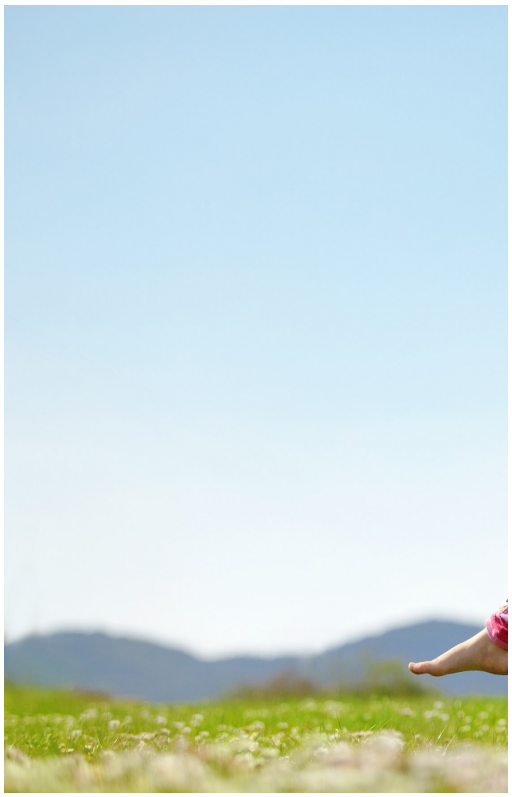
Counties where DAQ staff conducted out-reach are shaded in dark green.

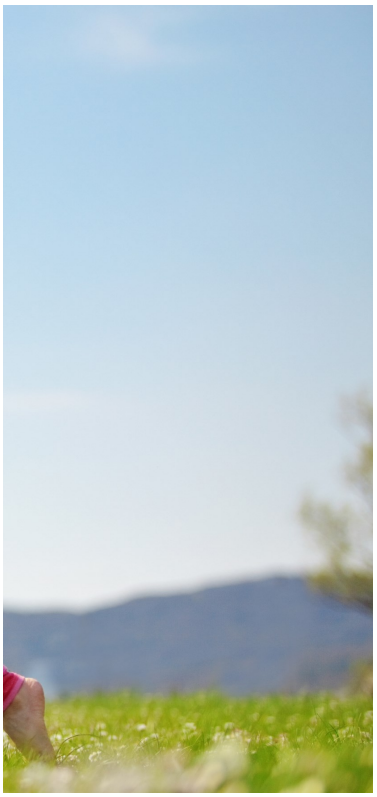


DAQ staff provide presentations on outdoor and indoor air quality, transportation and idle reduction, health and environmental impacts of air pollution, energy conservation, and Kentucky's open burning regulation.

Figure 1 (Page 5) shows the numbers for each major audience reached by DAQ's outreach. General public programs drew the largest audience (3,765) as DAQ staff participated in several large festivals in the spring, including:

- Apple Festival, Owensboro
- Reforest Frankfort
- Arbor Day, Lexington
- Earth Day, Frankfort
- Earth Day, Somerset Community College





DAQ staff conducted educational outreach in the following counties during FY 2015:

Boone	Hancock	Nicholas
Carter	Harlan	Oldham
Clark	Henderson	Perry
Daviess	Jefferson	Pulaski
Fayette	Kenton	Rowan
Fleming	Laurel	Russell
Floyd	Logan	Shelby
Franklin	Madison	Warren
Grayson	Mason	
Greenup	Mercer	

School programs were the second-largest segment of our audience with 3,621 students reached. 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.

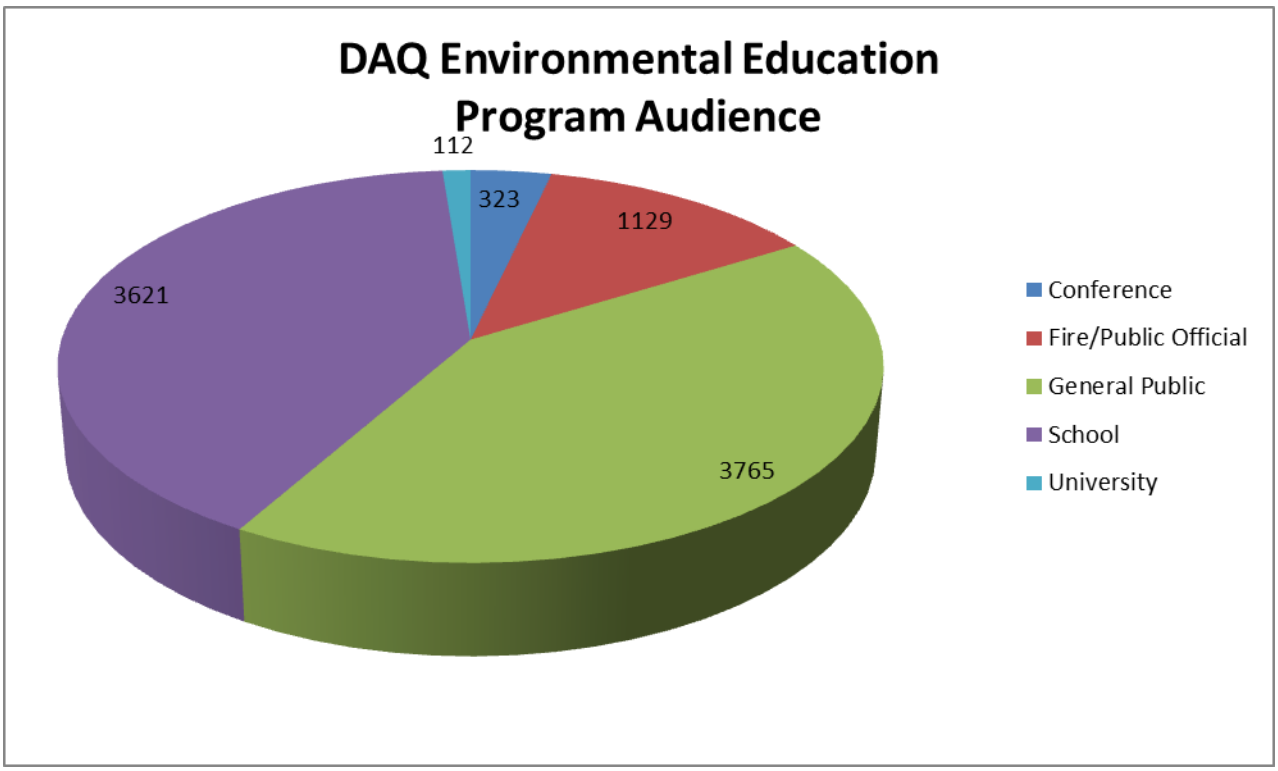


Figure 1: The Division for Air Quality's environmental education programs reached 8950 people during FY 2015. School and public programs comprised 82 percent of the audience.

Air Quality Awareness Week

The first week in May is National Air Quality Awareness Week. This year, the Division released a daily web-based air quality quiz. Quizzes explored historical air quality events, health issues, and even the chemistry of air quality. Hundreds of Kentucky teachers and students took the quizzes as well as state employees and the general public.

Open Burning

Illegal open burning continues to be a serious health concern in Kentucky. Kentucky's open burning regulation (401 KAR 63:005) specifies what can and cannot be open burned. Still, there is an ongoing need to increase awareness of the regulation, particularly in rural areas where there is a long tradition of open burning. 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 plain English. A recently-updated Spanish-language version is also available.

- DAQ has established an open burning phone line (888-BURN-LAW) to call for information about what can and cannot be legally burned. Callers may also report suspected illegal burning anonymously. Field staff investigates every complaint received.

The DAQ EE program includes:
- Teacher training
- Classroom and camp programs
- Public events and festivals
- Firefighter education
- School bus driver trainings (idle reduction)
- Community groups, forums, and 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

- In FY 2015, staff provided open burning awareness trainings to more than 1100 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 radio spots, a PowerPoint presentation, posters, and PDFs of the open burning brochure in English and Spanish.

English and Spanish-language versions of DAQ's open burning brochure explain Kentucky's open burning regulation in easy-to-understand terms.

The Field Operations Branch (FOB) is the largest branch of the division and is currently staffed by 64 employees. The majority of FOB field staff is located in eight regional field offices (see map on page 82 of this report) and have the following primary duties:

1) Complete unannounced inspections to ensure that permitted facilities and non-permitted entities maintain compliance with federal and/or state air quality regulations;
2) 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
3) Investigate air quality complaints received from the general public and other sources each year.

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 8);
- Number of major stationary facility inspections conducted (Figure 4, see Page 9);
- Number of minor stationary facility inspections conducted (Figure 5, see Page 9);
- Rate of compliance with 401 KAR 63:005 - open burning (Figure 7, see Page 11);
- Rate of compliance with 401 KAR 63:010 - fugitive emissions (Figure 8, see Page 12);
- Rate of compliance with 401 KAR 53:010 - odor (Figures 9-10, see Page 13); and
- Number of asbestos inspections conducted (Figure 11, see Page 14)

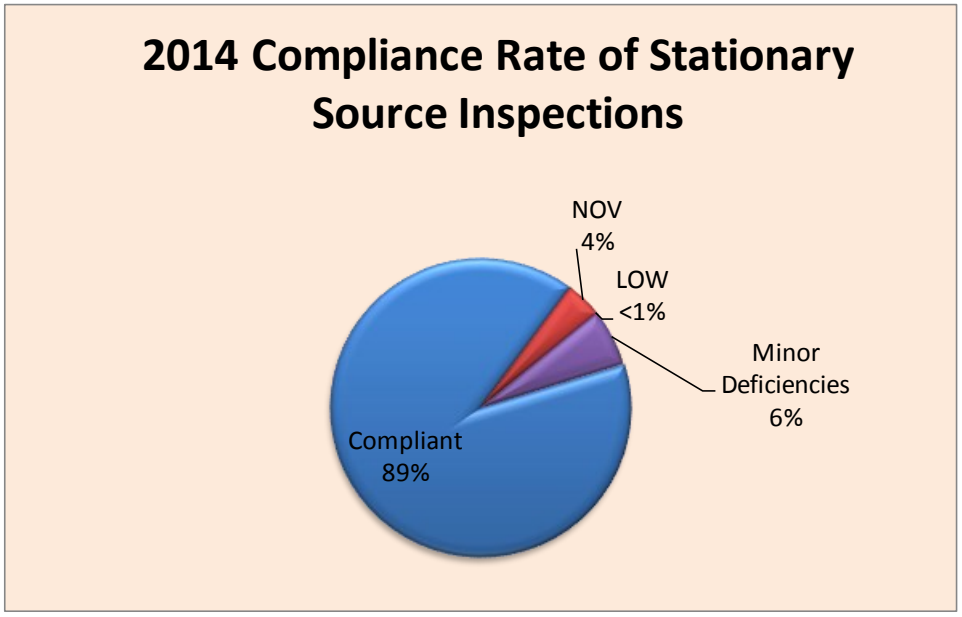


Figure 2: The compliance rate of regulated stationary sources inspected by field office staff in 2014 was 89 percent. Notices of Violation (NOV) were issued to 4 percent of Kentucky's stationary sources, while Letters of Warning (LOW) were below 1 percent. About 6 percent of violations were considered non-recurrent minor violations or violations that were quickly corrected, eliminating the need for any formal enforcement action.

In calendar year 2014, FOB staff completed 3,804 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 (Figure 5) tend to be located in areas of the state with a smaller population base, leading to more minor pollution sources, such as auto body/paint shops, dry cleaners, non-coal mineral processing facilities, and coal-mining related activities.

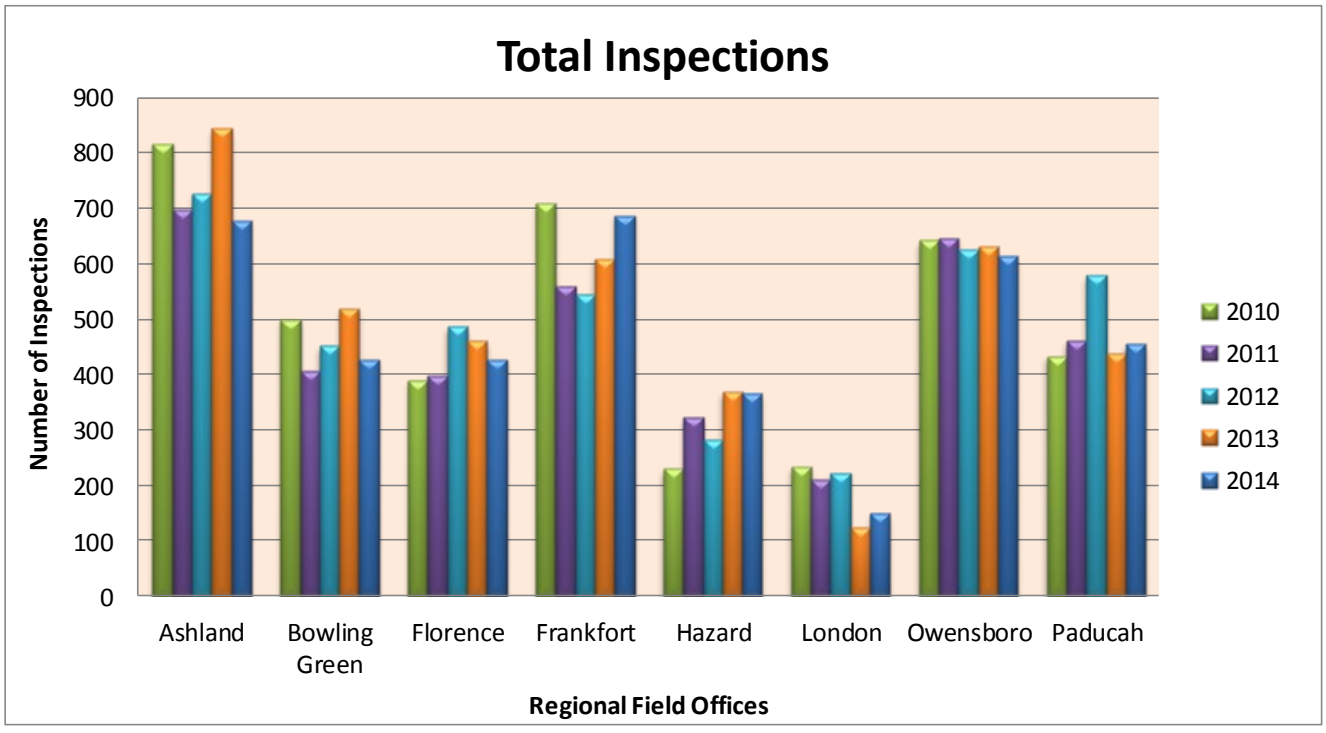


Figure 3: The total number of inspections at regulated facilities.

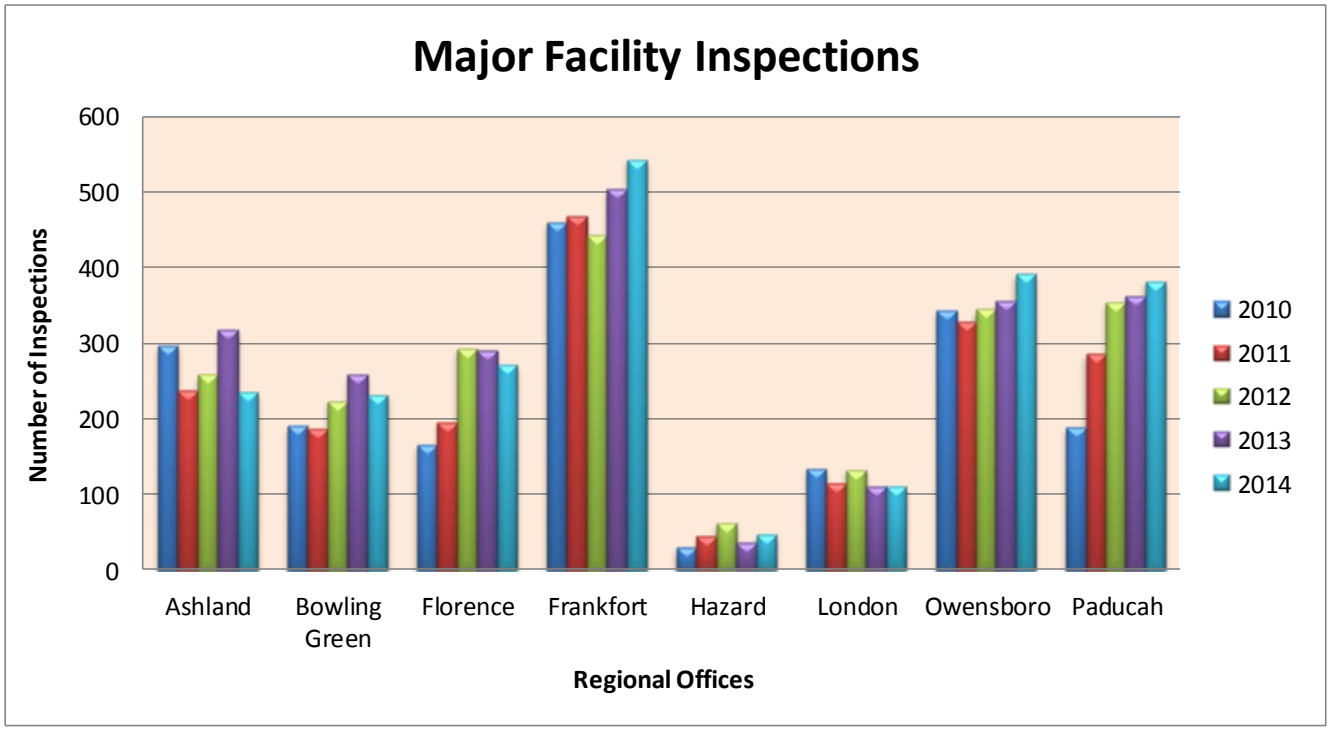


Figure 4: Number of major stationary facility inspections in Kentucky. The regional offices with more inspections are located in areas of the state with more major permitted facilities. Major permitted facilities include power plants, manufacturing facilities and chemical processing plants.

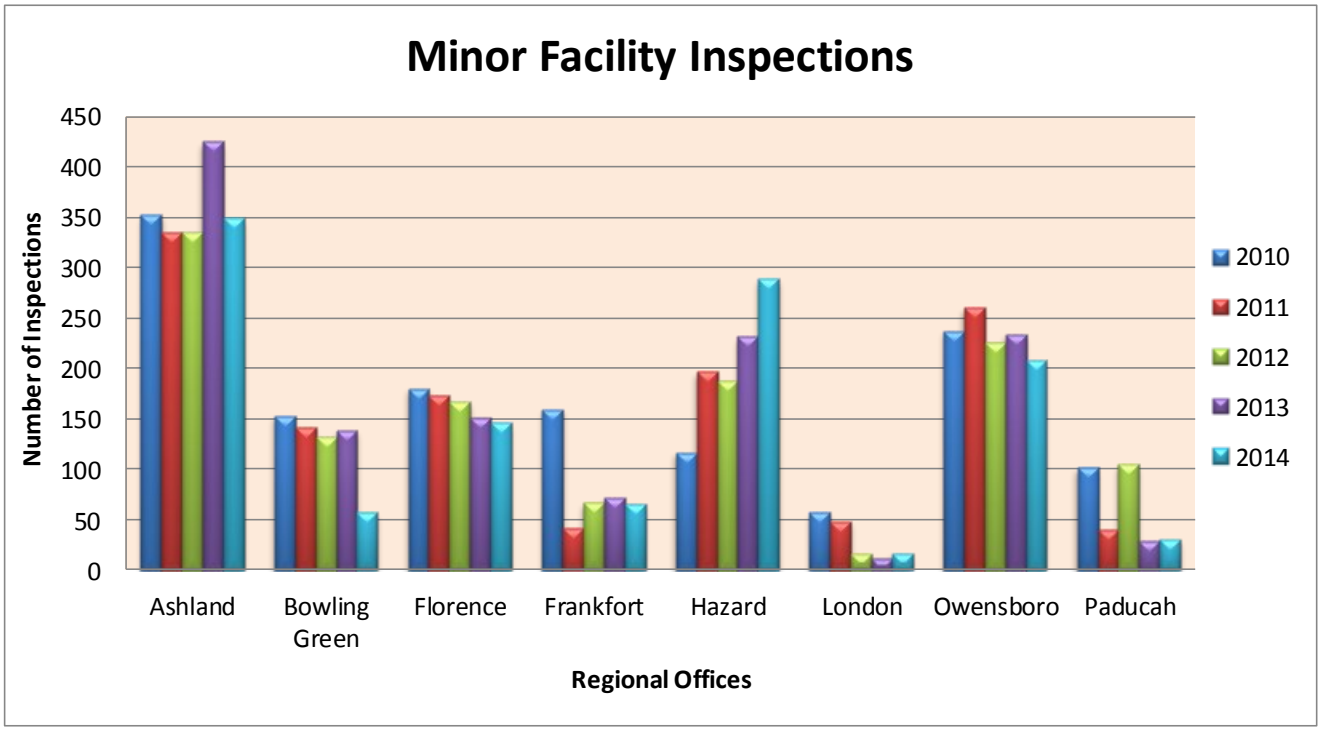


Figure 5: Number of minor stationary source inspections. Minor pollution sources include auto body paint shops, dry cleaners, and non-coal mineral processing facilities.

Complaint Investigations

Investigating complaints consumes a significant portion of field office staff time. In 2014, field office inspectors received a total of 1,518 complaints resulting in 1,472 field investigations (Figure 6). Data on the 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.

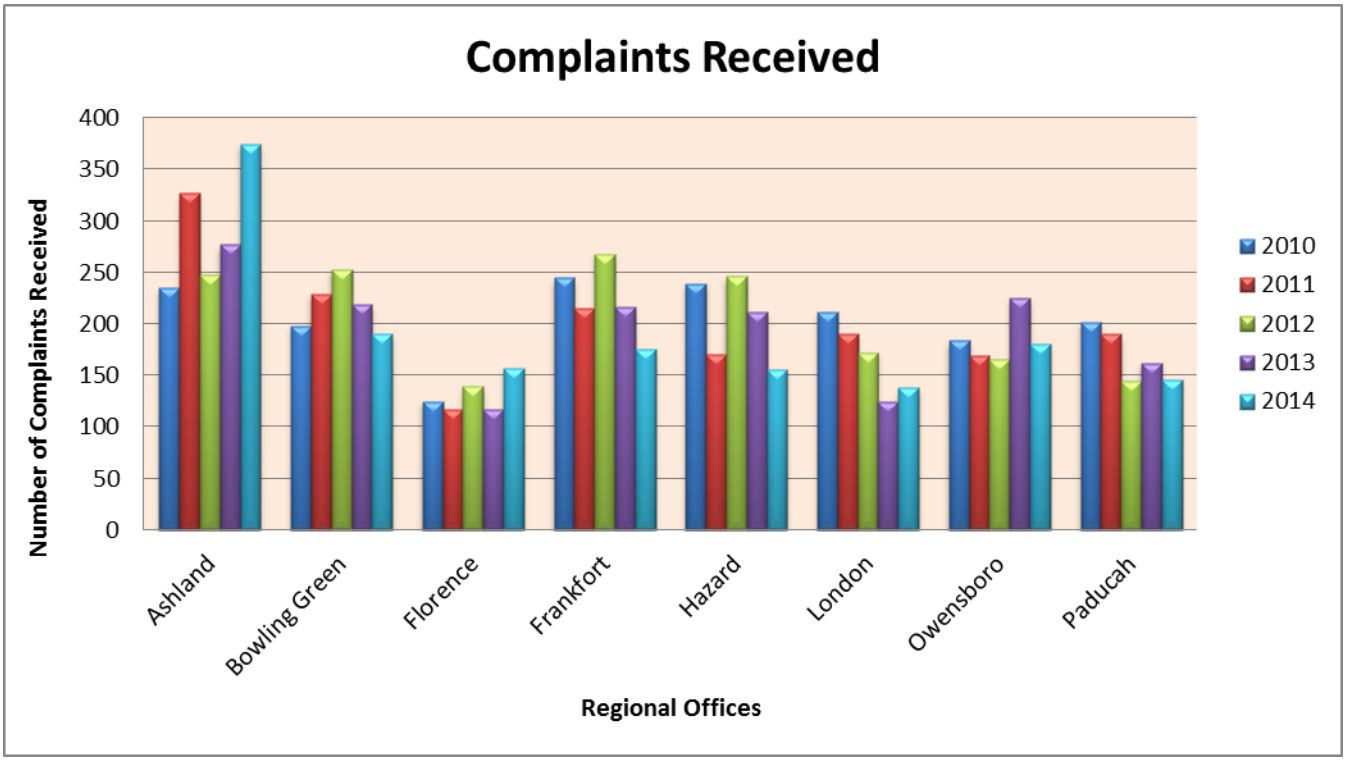


Figure 6: The numbers of complaints received during the last six years including open burning, fugitive emissions, odor, and asbestos complaints.

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

The division received 586 complaints about open burning in calendar year 2014. Of those, 51 percent were determined to be in violation 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.

Burning illegal materials releases toxic chemicals and particulate matter into the air. (Photo: Shutterstock)

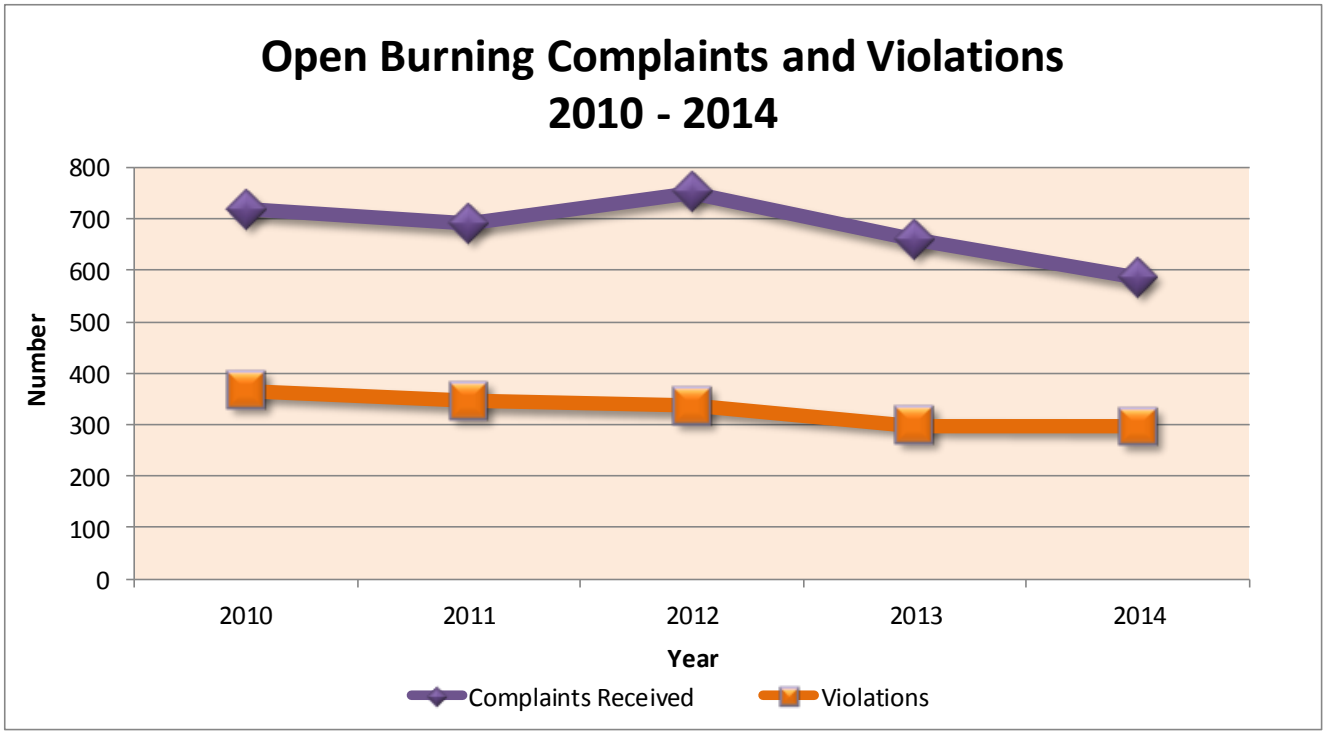


Figure 7: Complaints received about open burning, and violations cited after investigation. 51 percent of open burning complaints resulted in violations in 2014. Education and outreach campaigns targeting illegal open burning may be responsible for the overall downward trend in open burning complaints.

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 from land clearing for construction. State regulation requires control measures to reduce fugitive emissions and their impact on air quality. (Photo: Shutterstock)

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

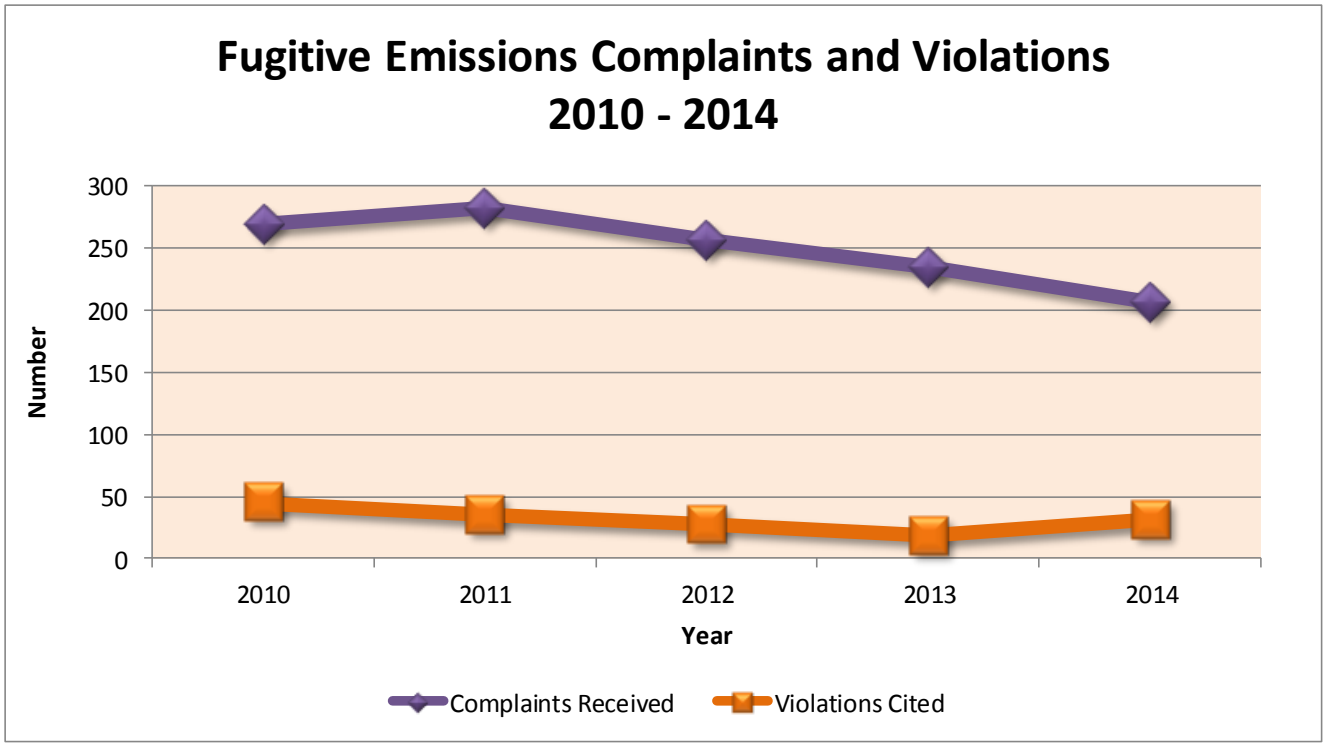
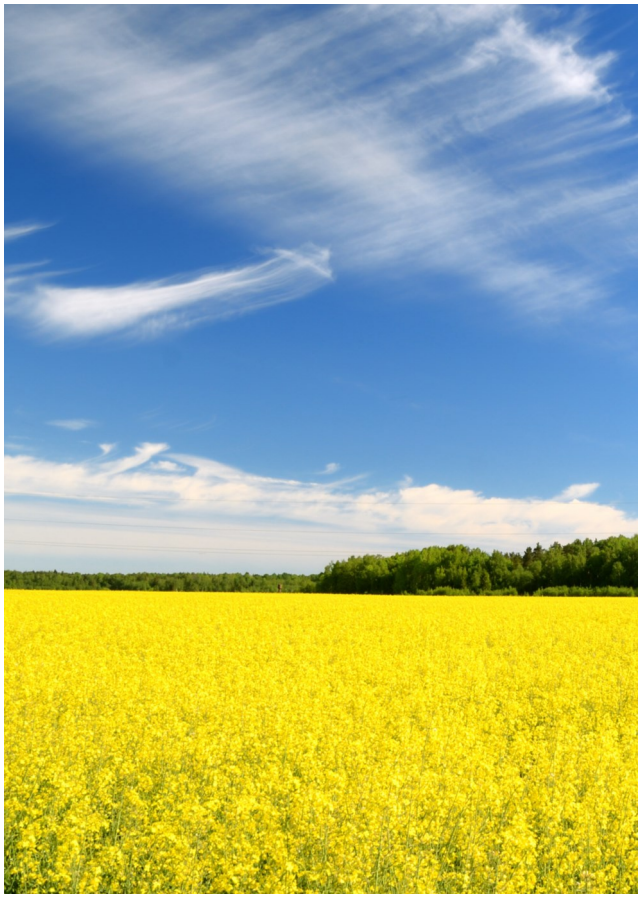


Figure 8: Fugitive Emissions Complaints and Violations. The percentage of fugitive emission violations cited per complaint received peaked in 2010 and has decreased annually until 2014. Dry conditions contribute to the formation of fugitive dust.



Kentucky also has an ***odor standard*** that is identified in 401 KAR 53:010. When an odor complaint is received, DAQ staff investigate using a device called a "scentometer". This device mixes one volume unit of ambient air with 7 volume units of odorless (filtered) air. The resulting mixture must have no detectable odor in order to comply with the regulation. If an inspector detects an odor using one of these devices at a 7-to-1 dilution, a violation of the odor standard is documented.

Odor complaints steadily increased from 2010 to 2013 but increased by approximately 100 complaints in 2014. The overall violation rate is low, though it has increased in recent years. In 2014, 40 odor violations were cited out of 448 complaints. This represents a 3.4 percent increase over 2013 (Figure 10).

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.

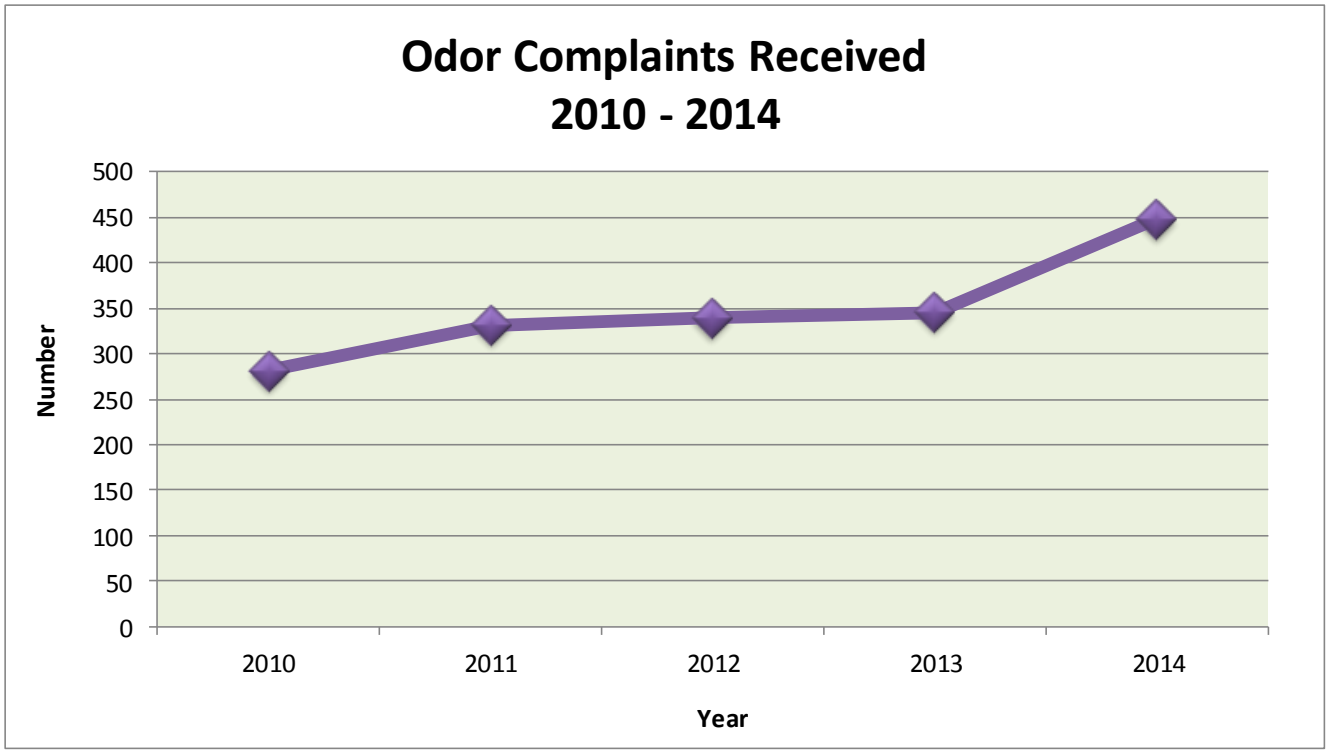


Figure 9: Odor Complaints Received. The number of odor complaints remained fairly constant from 2010 to 2013, but increased in 2014. Odor violations are documented when an inspector can smell the odor through a scentometer, which dilutes the ambient air at a ratio of seven to one.

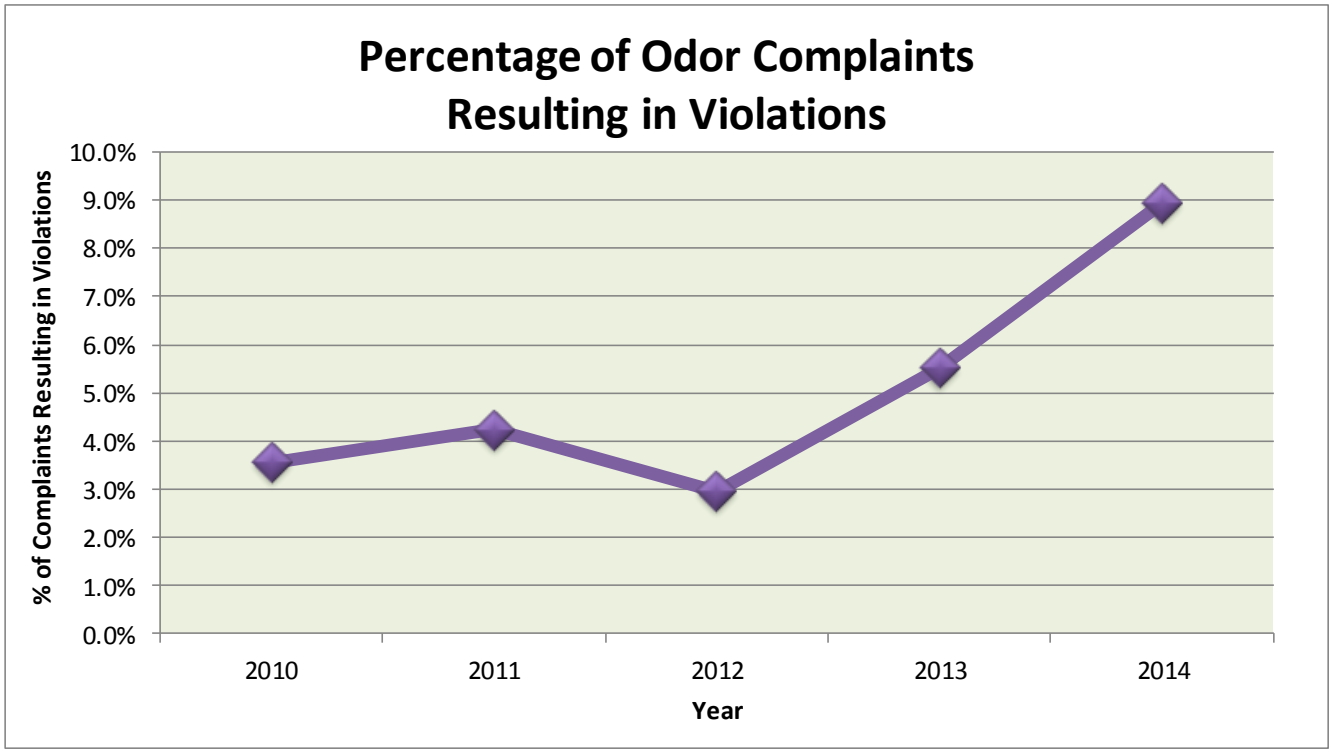


Figure 10: Percentage of Odor Complains Resulting in Violations. The overall violation rate is very low but has increased in recent years. Strong and steady odors are often required to document a violation of the Kentucky odor standard. Many odors not rising to the level of a violation are, nevertheless, corrected through cooperative efforts between the inspector and responsible party.

DAQ's Asbestos Inspection Program

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

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.

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 Divisions 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 2014, the compliance rate for NESHAP was 88 percent (Figure 12) and the compliance rate for AHERA was 81 percent (Figure 13).

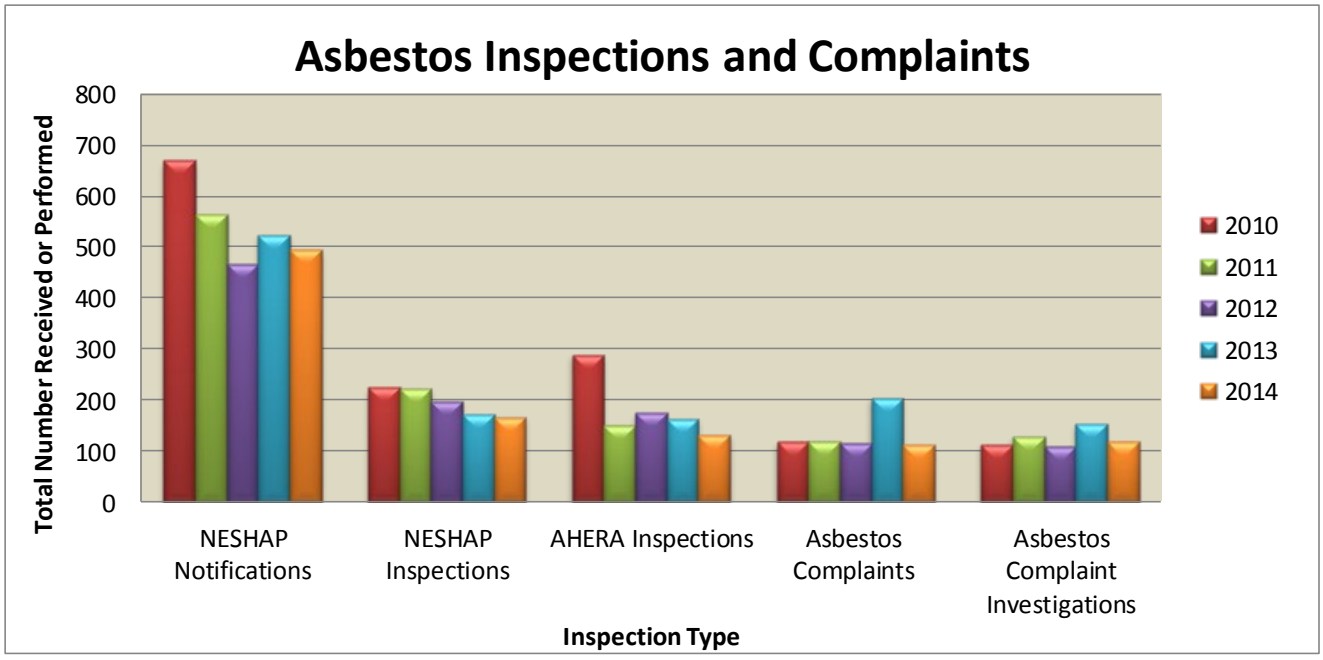


Figure 11: NESHAP notifications and inspections and AHERA inspections, complaints, and investigations.

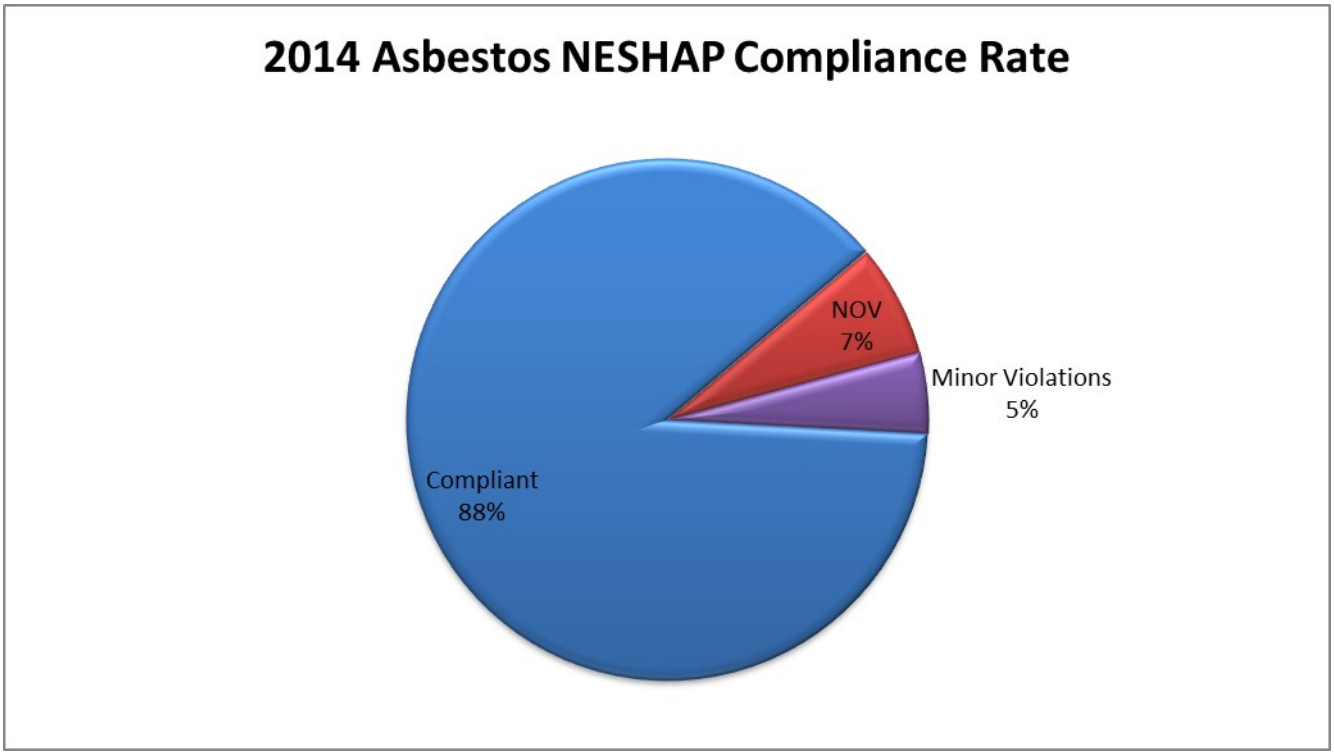


Figure 12: Compliance rate of asbestos removal and/or demolition operations regulated under the National Emission Standards for Hazardous Air Pollutants (NESHAP).

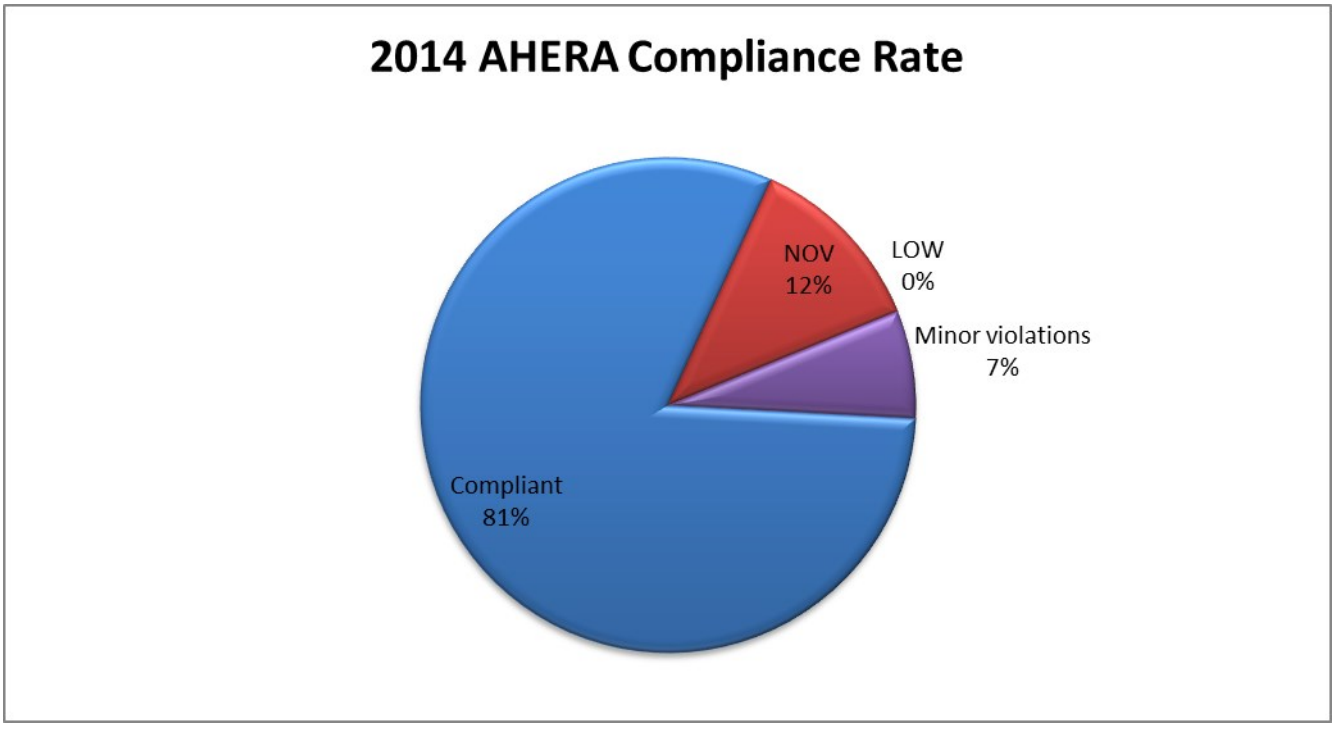


Figure 13 : Compliance rate of school inspections for asbestos under the Asbestos Hazard Emergency Response Act (AHERA).

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 14 (Page 17) shows the number of permits issued by section for the years 2010-2014. In calendar year 2014, PRB issued 368 permits. Eight 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 2015, PRB had 196 pending applications in-house. Only 44 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 2015, the Air Dispersion Modeling Section completed 51 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.

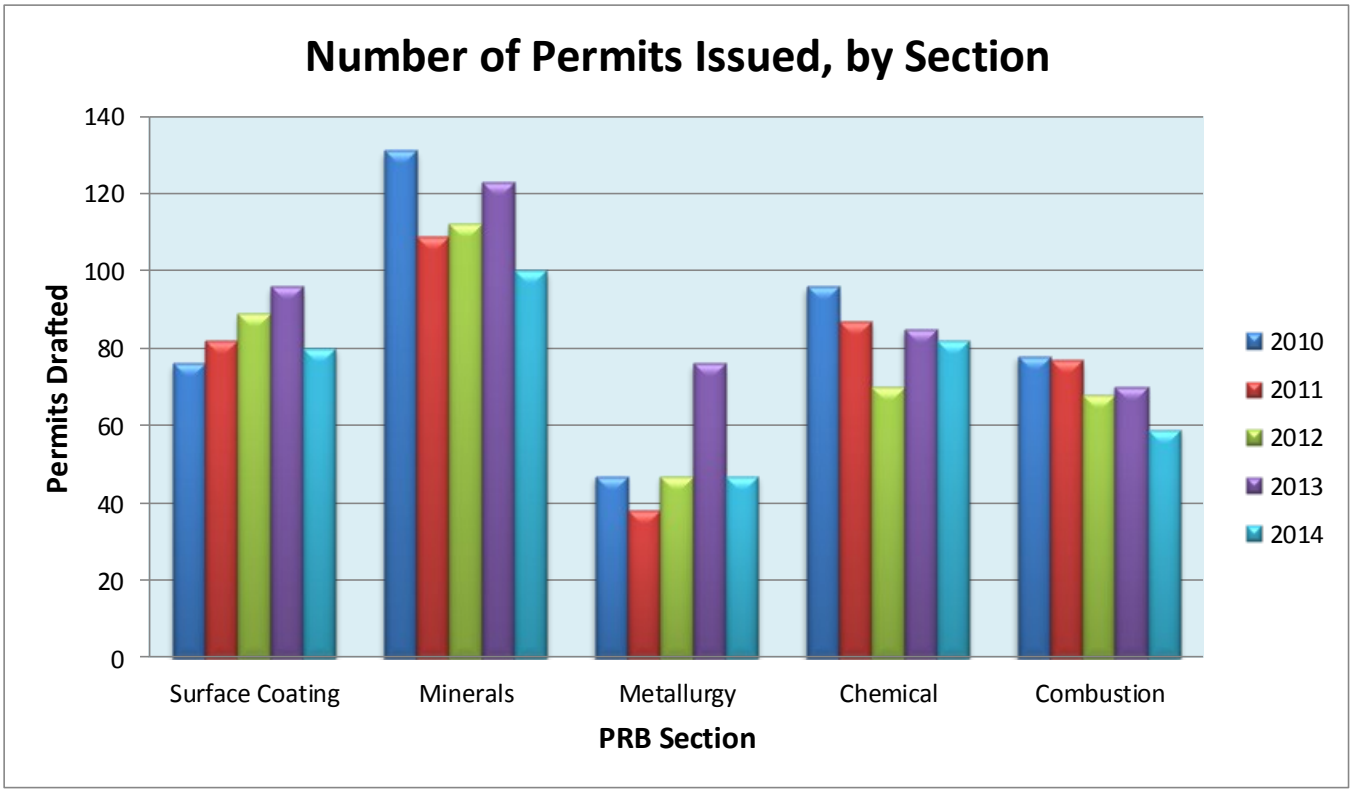


Figure 14: In calendar year 2014, the Division issued 368 permits, depicted here by section category.

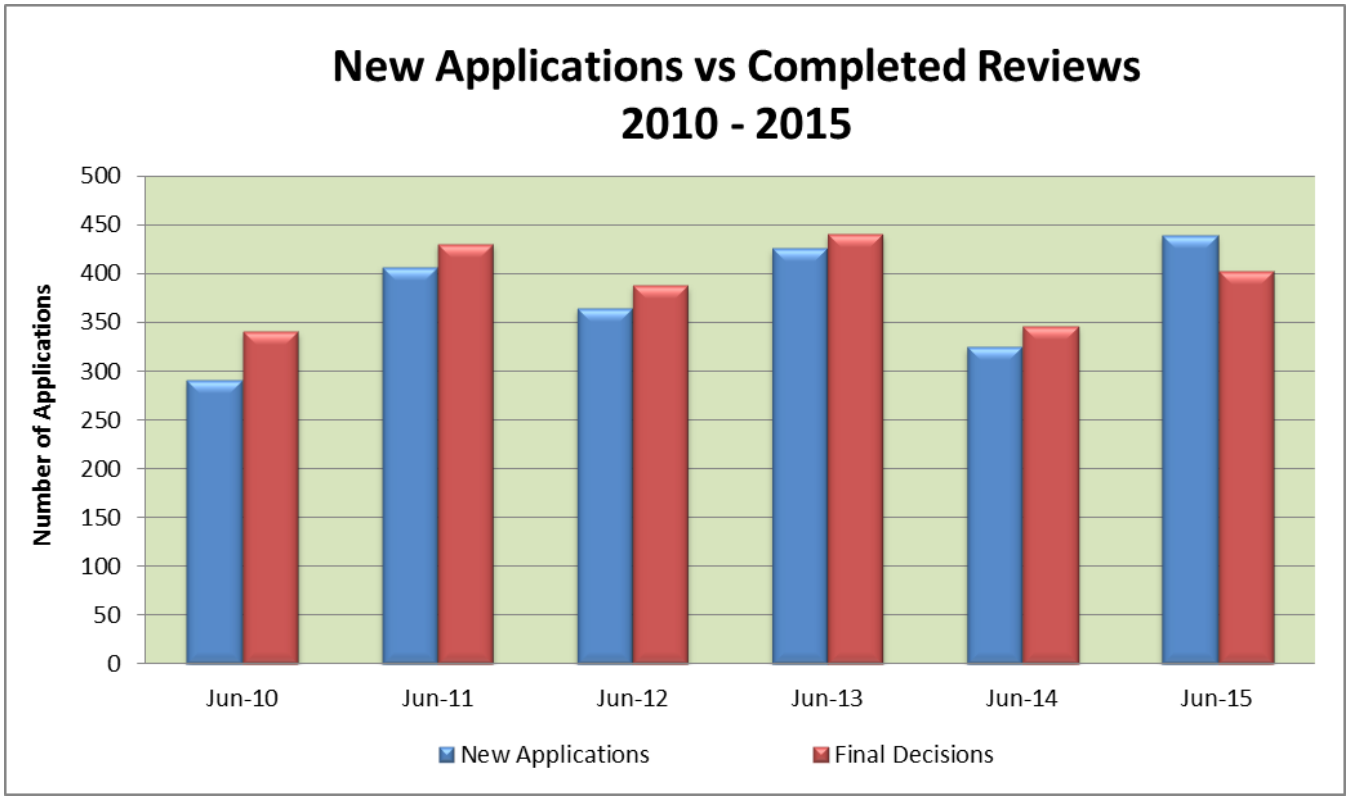


Figure 15: Numbers of completed permits versus new applications during each fiscal year.

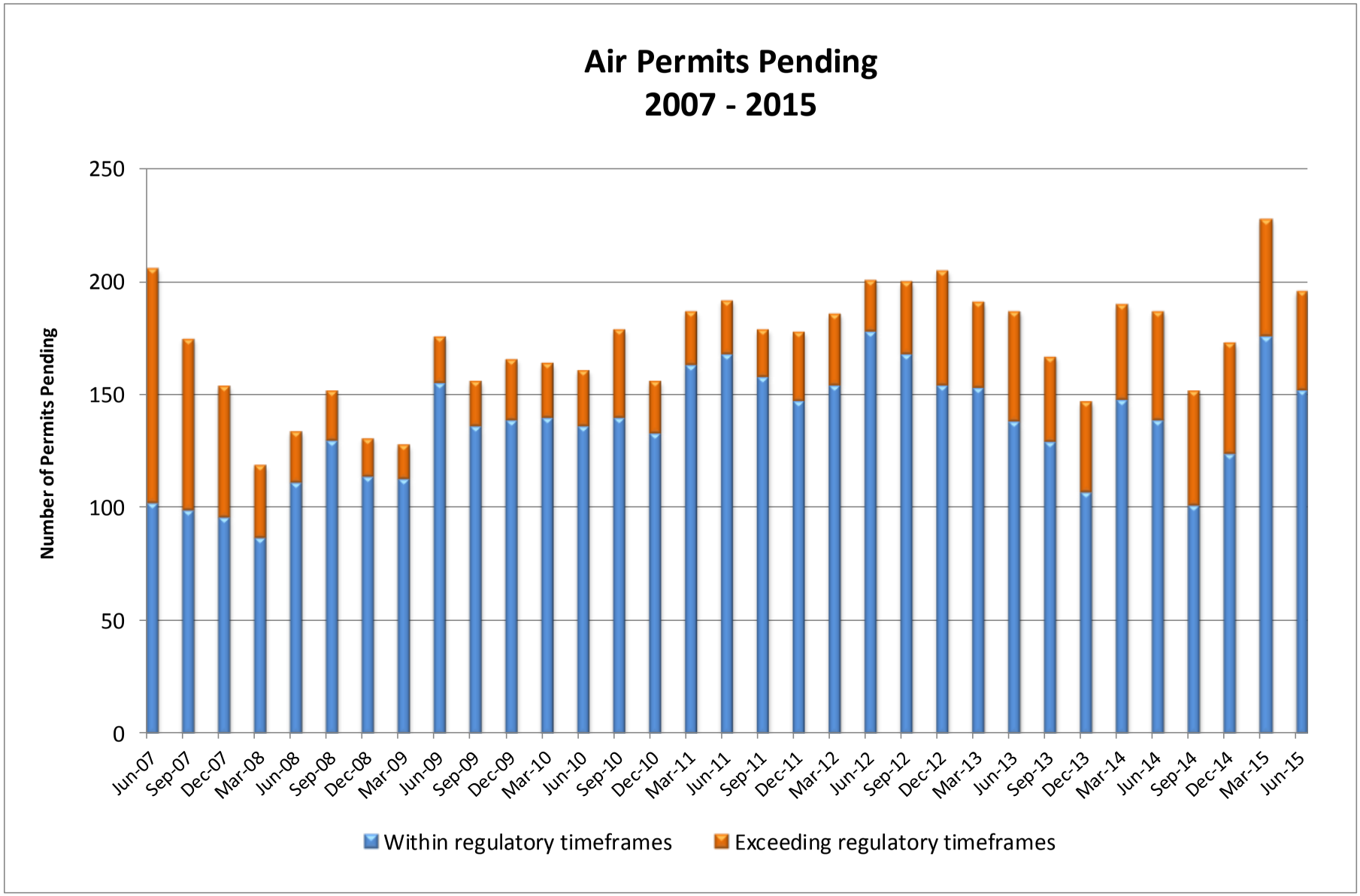


Figure 16: From June 2007 to June 2015, the Permit Review Branch has greatly reduced the amount of permit applications pending a final permit issuance as well as the percent of air permit applications that are beyond the Regulatory Time Frame (RTF), the allotted time for the complete permitting process. 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.

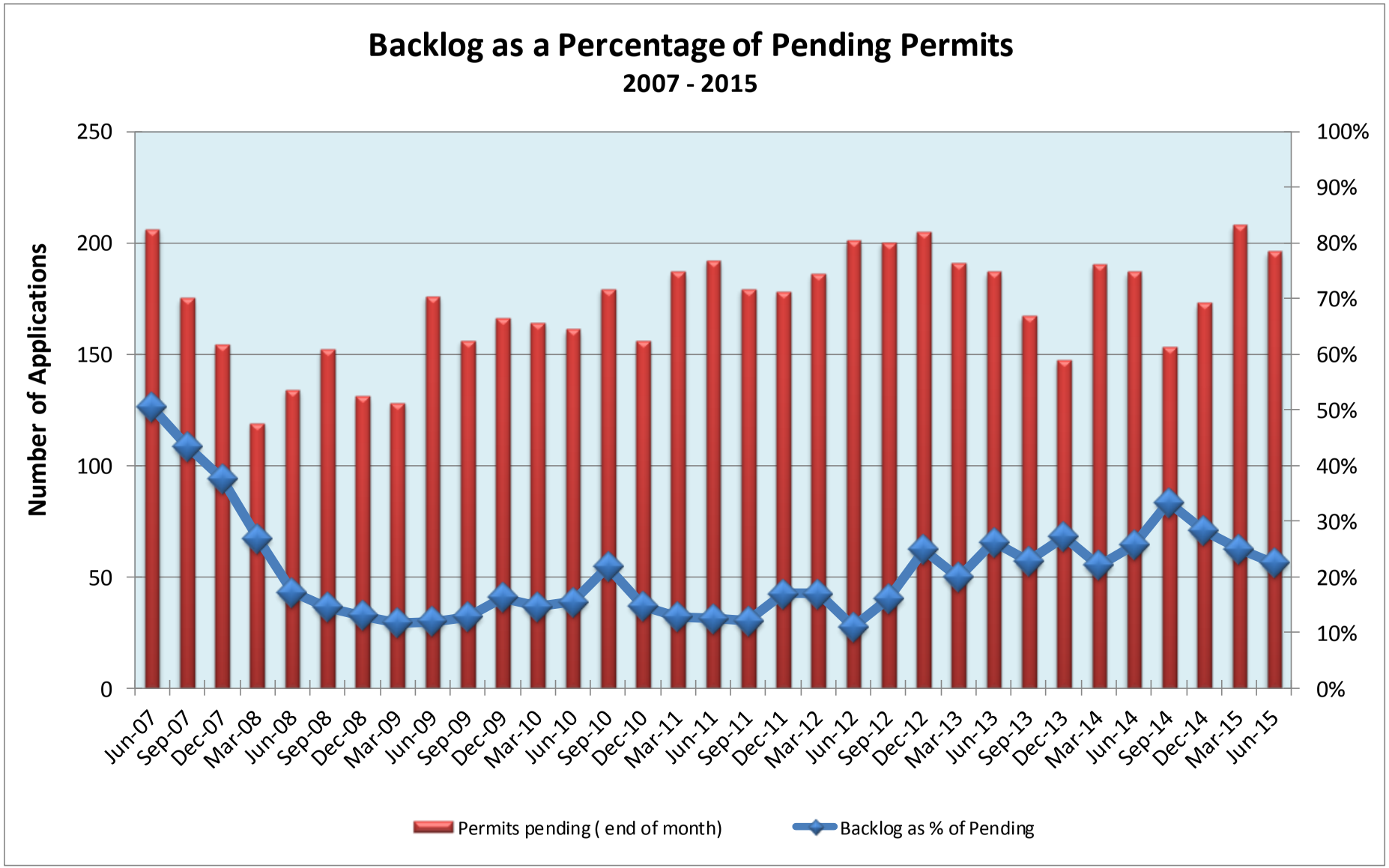


Figure 17: DAQ has significantly reduced the permit backlog since June 2006, at which time the Division had 716 applications in-house. The current number of pending applications represents a 72 percent reduction since that time.

PROGRAM PLANNING & ADMINISTRATION

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

· Fiscal management
· Annual emissions inventory
· Regulation development
· State implementation plan

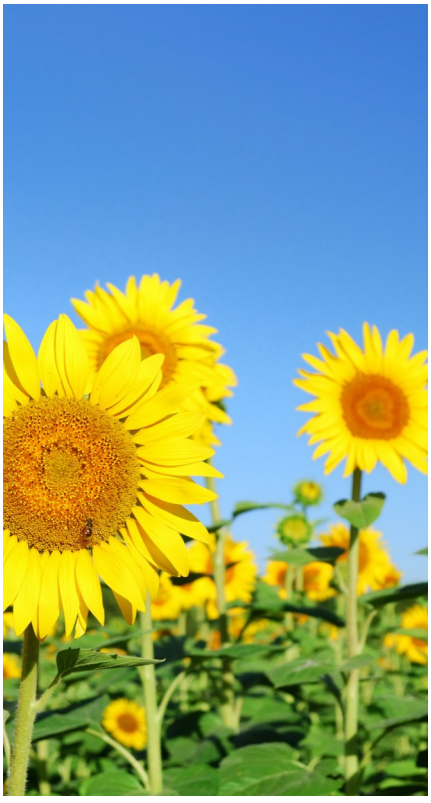
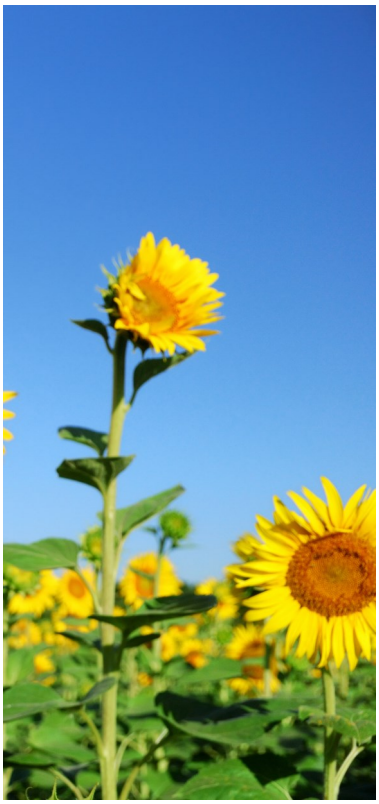
Fiscal Management

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 that are emitted in Kentucky will be 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, 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 18 shows the comparison between the EPA presumptive minimum and the actual cost per ton that the Division has charged.

A breakdown of the Division's revenue for FY 2015 is provided in Figure 19. In addition to Title V air emission fees, the Division receives funds from:

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

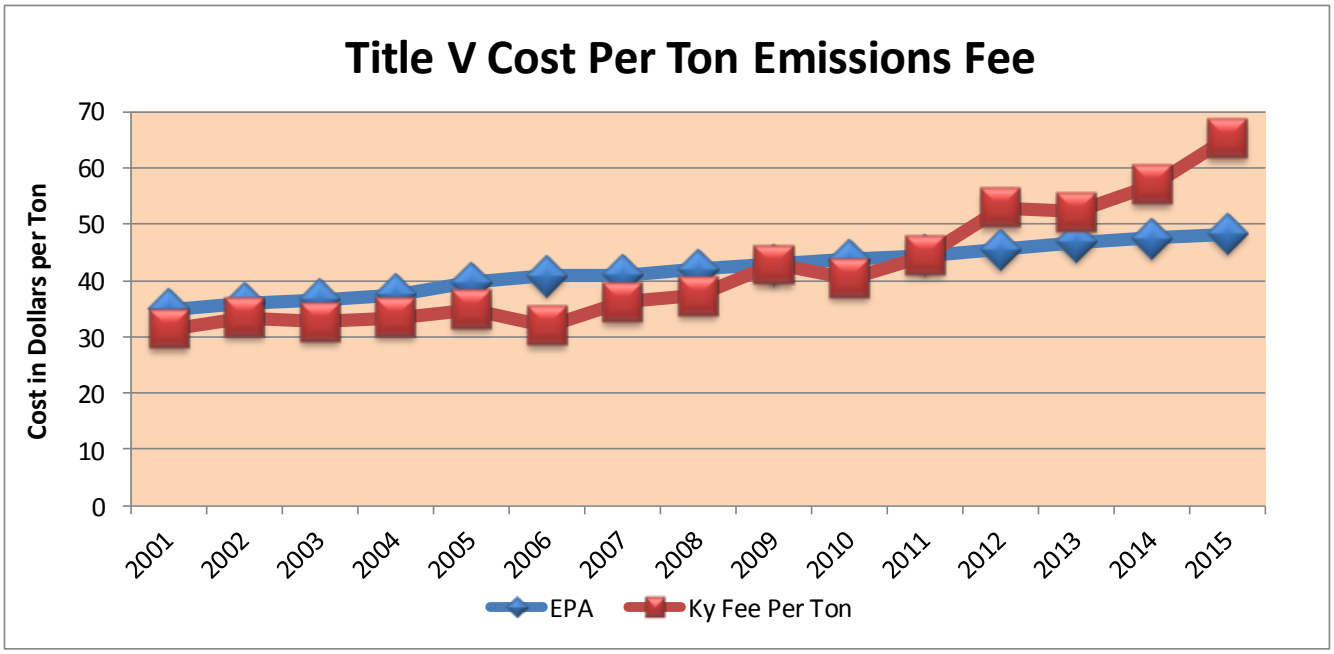


Figure 18: Title V Emission Fees Collected. DAQ surveys regulated entities to determine actual tons emitted by those sources and charges them a standard cost per ton, according to Clean Air Act and state statute protocol. This chart compares Kentucky's actual fees with EPA's "Presumptive Minimum," which is a suggested minimum fee per ton that states should charge.

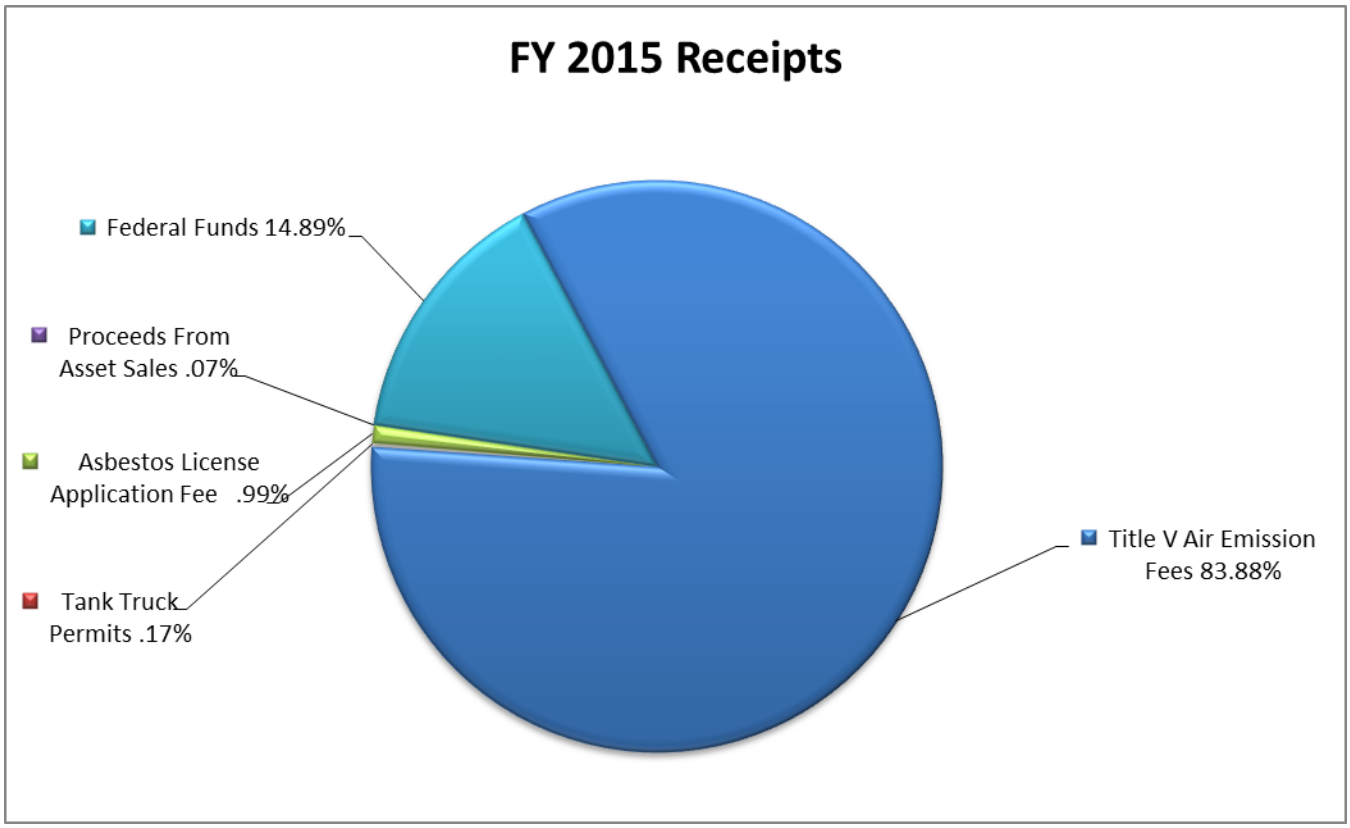


Figure 19: Division for Air Quality FY 2015 Receipts. The Division operates primarily on Title V emission fees and federal grant funds. Other funds are derived from non-state insurance recovery, proceeds from recyclable sales, and proceeds from asset sales.

During FY 2015, the Division made strides to fully staff positions lost during the past fiscal year. The addition of these new staff members will allow the Division to reach an even higher level of customer service and also ensure that the integrity of the air pollution control program in Kentucky is not compromised.

Emissions Inventory

The Kentucky Emissions Inventory System is designed to document and track actual and potential air pollutant emissions. The data is then used to develop air quality control strategies 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 and 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 up to date and useable by the Administration Section for billing calculations; the Program Evaluation Section for developing and evaluating 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 year. Figure 20 shows the emissions inventory for 2013; at the time of publication of this report, data for calendar year 2014 was still being verified. It takes approximately nine months to verify and complete the inventory for the previous year.

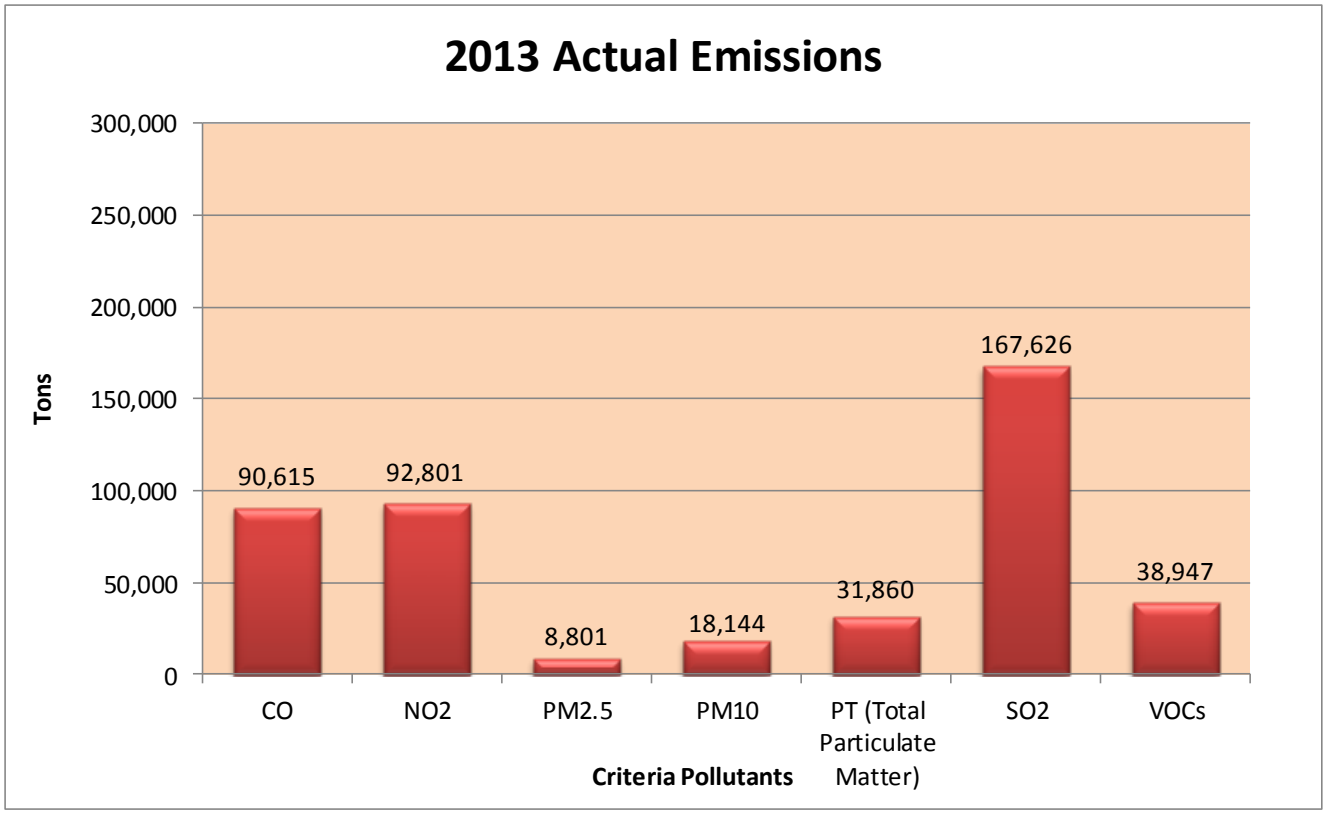


Figure 20: Actual tons of pollutants emitted by surveyed, regulated entities in Kentucky for the calendar year 2013. Although DAQ receives inventory emission data at the beginning of each calendar year, it takes approximately nine months to verify and complete the inventory.

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 21 below shows GHG emissions data from 2010 through 2013 calendar years.

Greenhouse Gas	2010 Actual Emissions (tons)	2011 Actual Emissions (tons)	2012 Actual Emissions (tons)	2013 Actual Emissions (tons)
Carbon Dioxide	113,373,350	115,588,860	106,395,292	96,288,161
Methane	39,205	45,772	51,417	112,528
Nitrous Oxide	4,305	4,127	4,001	3,736
CO2e (metric tonnes)	104,808,124	106,893,062	98,624,914	90,545,487
CO2e (tons)	115,531,185	117,829,437	108,715,363	99,809,319

Figure 21: Kentucky greenhouse gas emissions, 2010-2013. In 2013, methane emissions from 13 landfills were reported for the first time, accounting for an additional 54,605 tons of methane. 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 2014 through June 2015, the Regulatory Development Section continued researching and drafting several regulation packages on behalf of the Division.

In addition, 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 the following:

- On July 14, 2014, comments were submitted regarding the proposed *Data Requirements Rule for the 1-Hour Sulfur Dioxide (SO_2) Primary National Ambient Air Quality Standard (NAAQS)* for State Implementation Plan (SIP) submissions to meet the requirements for Section 110(a)(1) of the Clean Air Act for the 2010 SO_2 NAAQS;
- On October 16, 2014, comments were submitted regarding the proposed rulemaking for the *Carbon Pollution Standards for Modified and Reconstructed Stationary Sources: Electric Utility Generating Units (EGUs);*
- On November 5, 2014, comments were submitted regarding the proposed rule *Revisions to Ambient Monitoring Quality Assurance and Other Requirements*;
- On November 26, 2014, comments were submitted regarding the proposed rule *Carbon Pollution Emission Guidelines for Existing Stationary Sources: Electric Utility Generating Units*; and
- On March 16, 2015, the comments were submitted regarding the *National Ambient Air Quality Standards for Ozone: Proposed Rule* to the EPA.

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), drafting regulations related to the decommissioning of Stage II Controls in gasoline dispensing facilities in northern Kentucky, 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, attainment/nonattainment 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 86.

Ozone (O_3)

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

On July 20, 2012, the northern Kentucky counties of Boone, Campbell, and Kenton were designated as partial

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. The Division, in coordination with Ohio, is preparing a 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.

On December 17, 2014, the EPA published *National Ambient Air Quality Standards for Ozone: Proposed Rule* in the Federal Register. The proposal revises the level of the primary Ozone NAAQS from the current level of 0.075 ppm to within the range of 0.065 ppm to 0.070 ppm. As of the publication of the report, the rule was not final. The EPA is under court order to finalize the rule by October 2015.

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

Effective March 18, 2013, the EPA finalized the change in the annual $PM_{2.5}$ standard from 15 µg/m^3 to 12.0 µg/m^3, 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.

On August 19, 2014, the EPA notified Kentucky that the northern portions of Boone, Campbell and Kenton counties would be designated as nonattainment, indicating that the emissions from that area contributed to the violating monitor in Hamilton County, Ohio. Through a series of letters and additional documentation sent to the EPA, as well as certified monitoring data from Ohio indicating the previously violating monitor is in compliance, the EPA published final designations on April 7, 2015. The final action designated the Kentucky portion of the Cincinnati-Hamilton, OH-KY area as unclassifiable/attainment.

In the same August 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 designated the Kentucky portion of the Louisville, KY-IN area as unclassifiable.

As required by the CAA, Kentucky is currently preparing the Infrastructure SIP package for the 2012 $PM_{2.5}$ NAAQS, due to the EPA by December 14, 2015.

Nitrogen Dioxide (NO_2)

On January 22, 2010, the EPA revised the standard for nitrogen dioxide (NO_2). The new standard is set at a 1-hour level of 100 parts per billion (ppb). A February 17, 2012 Federal Register designated all areas in Kentucky as unclassifiable/attainment.

Near-road monitors were required in Louisville and northern Kentucky (operated by Ohio) by January 1, 2014. These monitors are now in place and operational.

Sulfur Dioxide (SO_2)

On June 22, 2010, the EPA revised the NAAQS for sulfur dioxide (SO_2). This standard had not been changed since 1971 and the EPA was required under a judicial consent decree to review the primary standard. The new standard is set at a 1-hour level

of 75 ppb. On July 13, 2011, the EPA announced the proposed secondary standard which addresses public welfare. The rule was finalized on April 3, 2012.

Effective October 4, 2013, a portion of Campbell County and a portion of Jefferson County were designated nonattainment for the 2010 SO_2 NAAQS. The Division and LMAPCD are working with the facility to reduce SO_2 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 to the EPA for approval for the northern Kentucky portion of the nonattainment area. Certified monitoring data demonstrates that the area is now in compliance with the 2010 SO_2 NAAQS. The Duke Energy, Walter C. Beckjord Generating Station facility was the most significant source of emissions contributing to the violating monitor. As of October 1, 2014, the Beckjord facility permanently shut down. The Division, in coordination with Ohio, is preparing a redesignation package for submittal to the EPA, requesting revision of the designation of the Kentucky portion of the area from nonattainment to attainment for the 2010 SO_2 NAAQS.

In response to a March 2, 2015 court order, the EPA notified states of the next round of 2010 SO_2 designations. These designations are areas associated with 68 power plants and newly monitored violations. On March 20, 2015, the EPA notified Kentucky that two power plants were identified for this next round of designations. Kentucky is reviewing the sources identified by the EPA. States may submit updated recommendations and supporting information for area designations to the EPA no later than September 18, 2015.

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 the EPA for approval on September 17, 2014. As of the publication of this report, the EPA has not taken any action on Kentucky's 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 2014, the Source Sampling Section received 378 Compliance and Relative Accuracy Test Audit (RATA) test protocols by Kentucky facilities; 212 tests were scheduled compliance tests and 120 were scheduled RATA tests. The section reviewed all protocols for compliance tests that were received. The section received 30 cancellations during 2014 resulting in a total of 302 tests scheduled, as seen in Figure 22. The section observed 169 (90 percent) of the 188 scheduled compliance tests that were performed. Additionally, the Source Sampling Section received 374 RATA and Compliance test reports and completed 403 technical reviews of test reports, as seen in Figure 23.

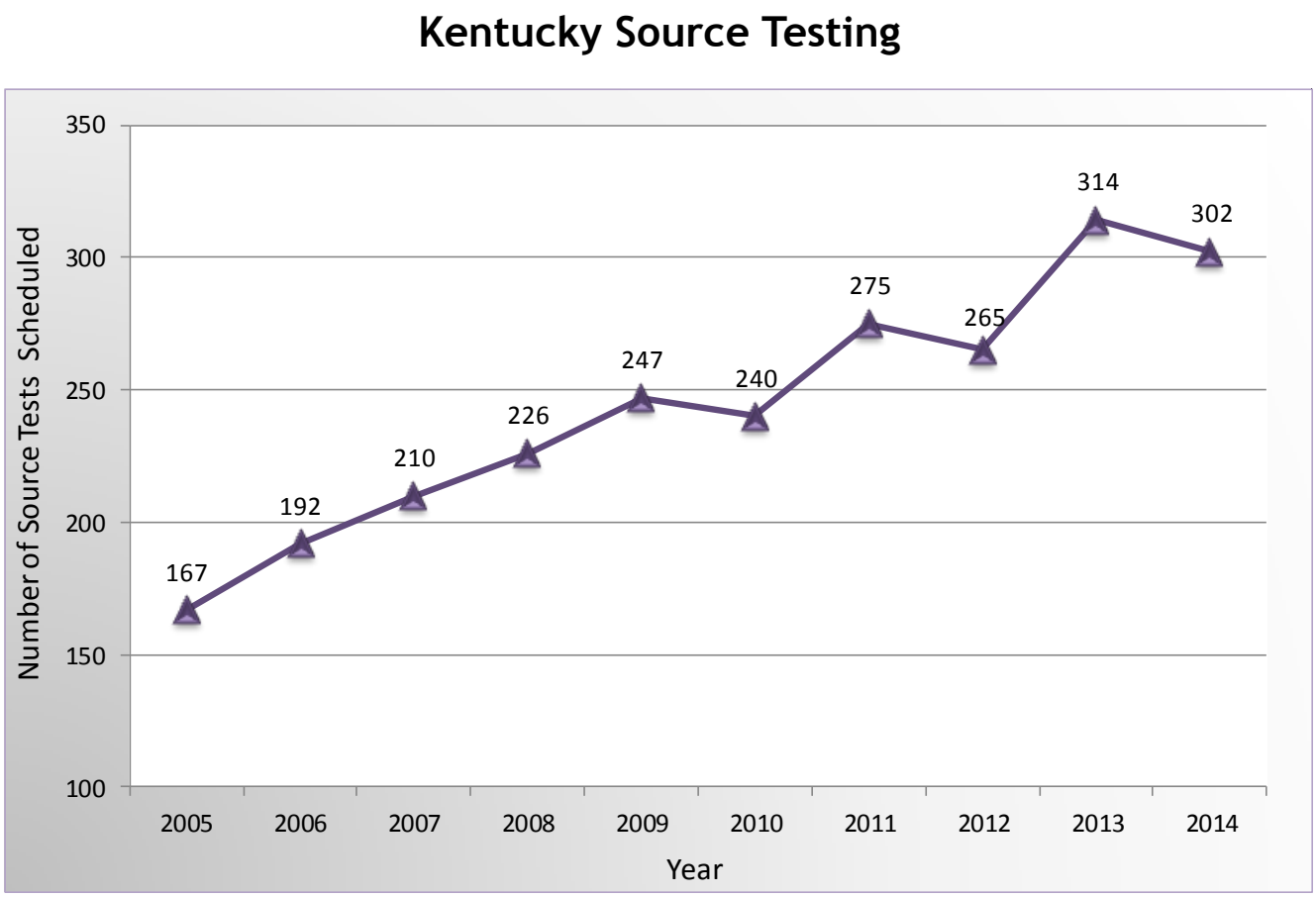


Figure 22: The last nine years have shown an overall increase in source testing throughout the state.

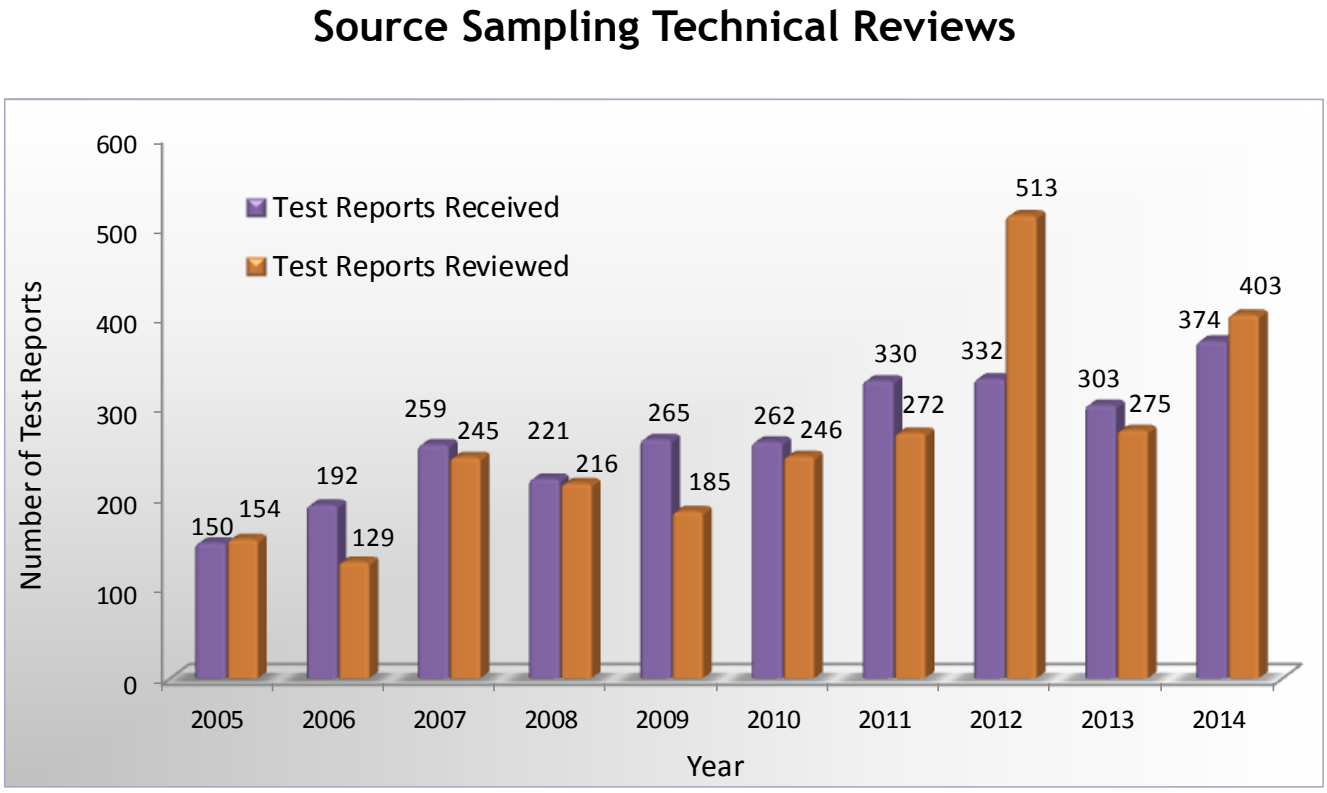


Figure 27: The Source Sampling Section successfully completed 403 technical reviews of source test report data in 2014.

Ambient Air Monitoring Network

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

Kentucky has operated an ambient air monitoring network since 1967. The 2014 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 2014 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 33-75 of this Annual Report contain tables and graphs that summarize the concentrations of pollutants measured in Kentucky during the calendar 2014 year, as well as 2014 design values. A **design value** is a calculated metric that is used to determine compliance with each particular NAAQS. For many pollutants, a design value is calculated for each year and then averaged over a three-year period before being compared to a standard. However, some design values use alternate intervals of time for the calculation. For example, lead uses a 3-month rolling average and one of the two primary NAAQS for nitrogen dioxide uses an annual average.

The actual number of sites in operation in a calendar year may differ slightly from the network represented in the Network Plan. The network map on Page 31 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 2014 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 77. For a complete listing of the current NAAQS, see Appendix F beginning on Page 86.

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.

Inspectors trudged through heavy snows to reach the Grayson Lake monitoring station last winter. (Photo: DAQ)

Data Quality Assurance

TSB assures quality and validates all ambient data collected by the monitors and samplers in the network. Upon completing its review of 2014 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, as well as the quality control measures taken to ensure the accuracy of that data, and the number of annual performance evaluations completed. The information obtained in the annual data certification request is available to the public through open records requests.

Environmental engineering assistant Frough Sherwani conducts a performance audit of a gas monitor. (Photo: DAQ)

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 four active and current QAPPs, as well as 29 SOPs in the DAQ library. In 2014, TSB staff drafted one new SOP and finalized revisions to five additional SOPs.

In 2014, personnel within the TSB conducted a total of 390 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 41 technical systems audits were performed to ensure that operational procedures at each site were followed.

TSB staff also completed a total of 135 instrument service trips in the field and repaired an additional 142 monitors in-house in 2014. During the year, the TSB implemented a new electronic data acquisition system, which allows for faster collection of data from continuous monitors in the field.

TSB continues to operate a particulate matter weigh-laboratory. 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 and the temperature and humidity within the weigh-laboratory are monitored with National Institute of Standards and Technology (NIST) traceable equipment to document environmental compliance.

Electronic technician Troy Chilton readies one of DAQ's air monitors for deployment in the field. (Photo: DAQ)

TSB continues to implement a robust training program, which focuses on providing Division air monitoring staff with the foundation necessary to collect and analyze ambient air data. In 2014, the TSB also provided training to LMAPCD personnel on ambient air monitoring equipment, data-handling, and data-validation. Additionally, TSB staff provided hands-on $PM_{2.5}$ sampler training during the 2014 EPA Region 4 Ambient Air Monitoring Managers meeting in Athens, Georgia. TSB staff continue to participate in a number of local and national workgroups. Staff presented at numerous conferences, workshops, and meetings during the year.

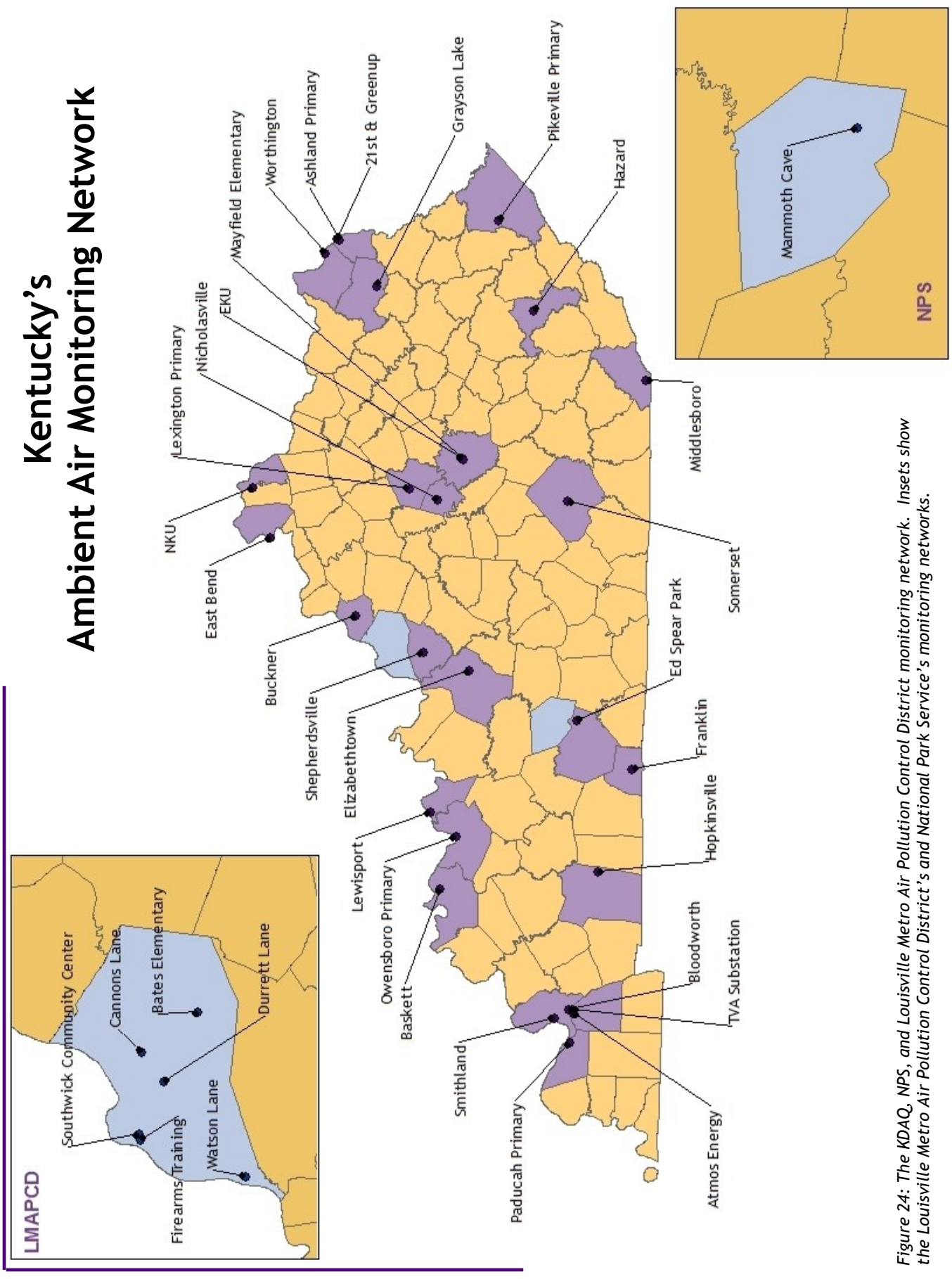


Figure 24: The KDAQ, NPS, and Louisville Metro Air Pollution Control District monitoring network. Insets show the Louisville Metro Air Pollution Control District's and National Park Service's monitoring networks.

Metropolitan Statistical Area	Site Count	PM2.5	Continuous PM2.5	PM10	Continuous PM10	SO2	NO2	NOy	CO	O3	Pb	VOC	Carbonyl	PAH	PM2.5 Speciation	Carbon Speciation	Rad-Net	Met
Bowling Green, KY	2	2[C]	2[i]			1		1	1	2[i]								1
Cincinnati-Middletown, OH-KY-IN [(AQI)]	2	1	1[i]			1[P,i]	1[i]			2[i]								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[i]		1			1	1		1
Lexington-Fayette, KY [(AQI)]	2	1	1[i]	1[m]		2[P,i]	1[r40,i]			2[i]		1			1	1	1	1
Louisville-Jefferson County, KY-IN [(AQI)]	8	5[n,C]	4[i,B,*]	1[Lead]	4[i,C,B]	3[P,i]	2[n,i]	1	2[ni]	5[i]					1[U]	1[U]	1	5[n]
Owensboro, KY	2	1	1[i]			1[i]	1[i]			2[i]								1
Micropolitan Statistical Area																		
Paducah, KY-IL	2	1	1[i]	2[m]		1[P,i]	1[i]			2[i]		1					1	1
Somerset, KY	1	1								1								
Middlesboro, KY	1	1								1								1
Richmond-Berea, KY	2	1									3							
Not in a CBSA																		
Carter County	1	1[X]		2[C,m]						1		2[D]	2[D]	1	1	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	3	3	2	11
LMAPCD Totals	6	5	4	1	4	3	2	1	2	3	0	0	0	0	1	1	1	4
NPS Totals	1	0	1	0	0	1	0	1	1	1	0	0	0	0	0	0	0	1
TOTALS	**34**	**23**	**15**	**9**	**4**	**12**	**7**	**2**	**3**	**26**	**3**	**8**	**2**	**1**	**4**	**4**	**3**	**16**

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=AQI Monitors Required in CBSA; i=AQI 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

2014 Carbon Monoxide Ambient Air Monitoring Network
(Louisville Metro Air Pollution Control District and National Park Service)

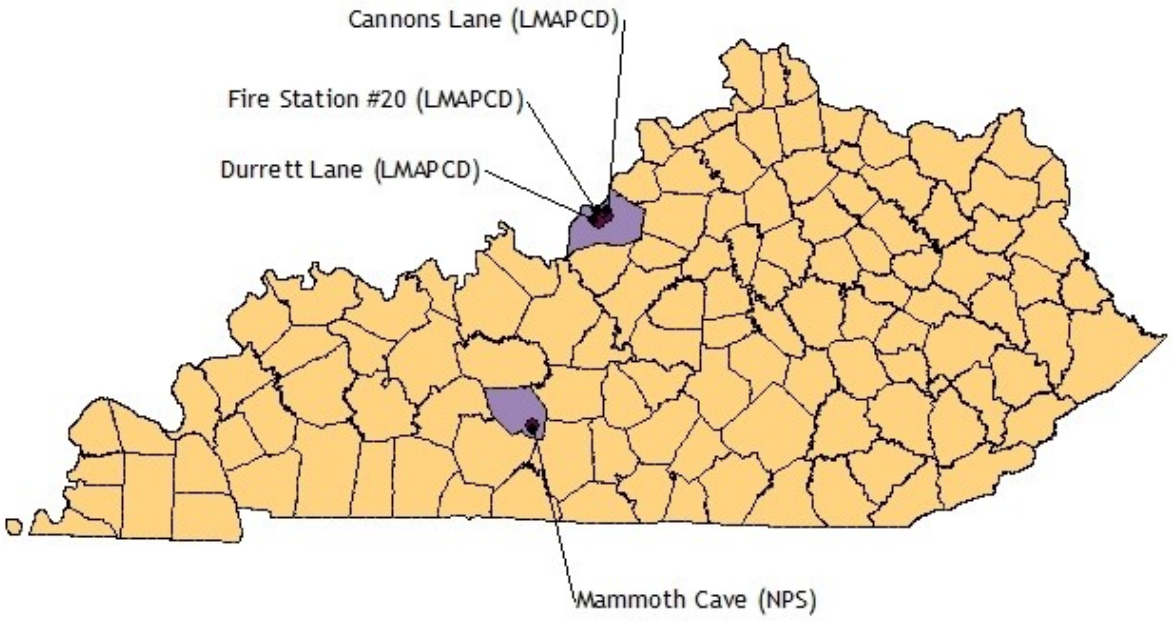


Figure 25: Carbon monoxide monitoring in Kentucky is currently only conducted by the Louisville Metro Air Pollution Control District and the National Park Service. Jefferson County historically has had higher levels of CO than elsewhere in the state, perhaps due to the high levels of vehicle traffic in the area.

Statewide Averages for Carbon Monoxide

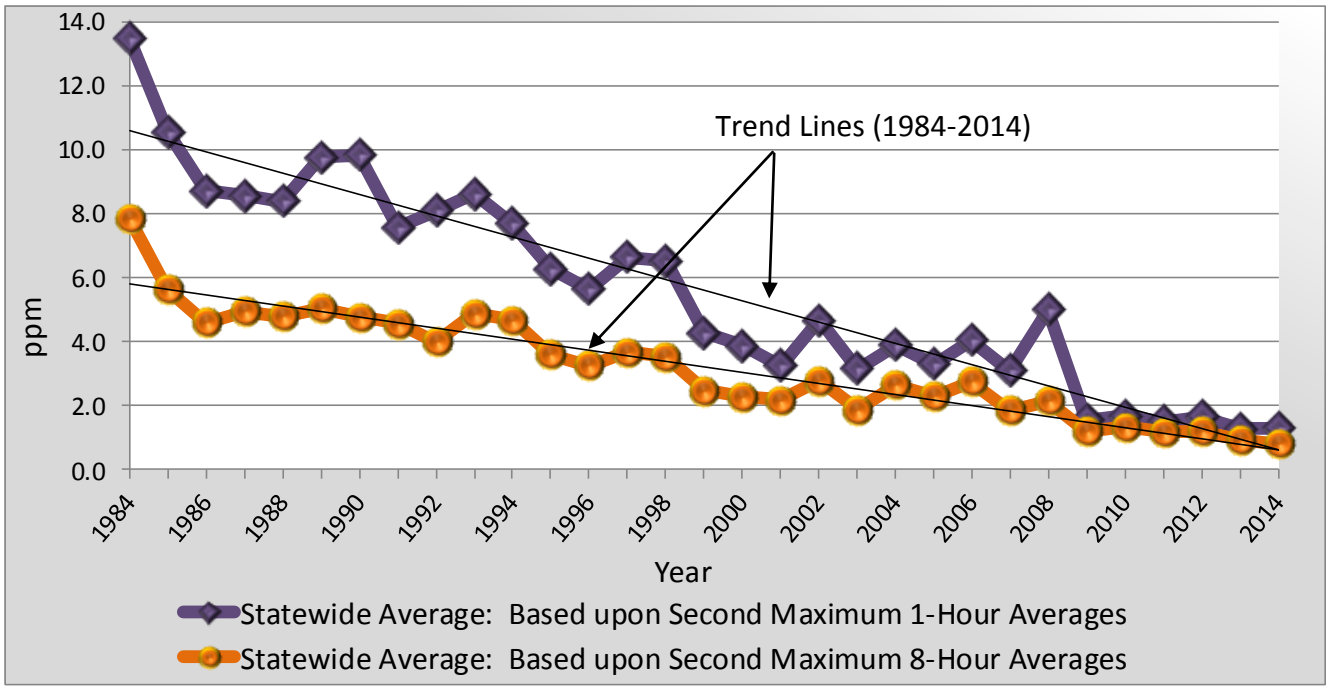


Figure 26: Statewide averages for CO monitoring indicate pollution reductions.

Carbon Monoxide Results

There were no exceedances of the CO standards in 2014. 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 2014, 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.

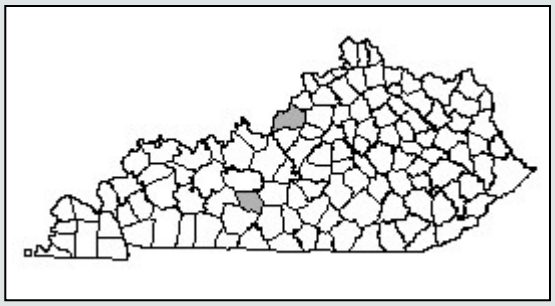
Statewide and regional carbon monoxide levels have declined substantially since 1980, primarily due to improved emission controls on motor vehicles. Due to the substantial drop in monitored levels, carbon monoxide monitoring was discontinued statewide in 2003, except for Jefferson County. The 2003 statewide 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 – 2014

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



County	Site Address	AQS-ID	# Obs	1-Hr Averages			8-Hr Averages		
				1st max	2nd max	Obs> 35.0	1st max	2nd max	Obs> 9
Edmondson[1]	Alfred Cook Rd Mammoth Cave	21-061-0501	7824	0.3	0.3	0	0.3	0.3	0
Jefferson[2]	2730 Cannons Ln Louisville	21-111-0067	7494	1.3	1.3	0	1.1	0.9	0
Jefferson[2]	1517 Durrett Lane Louisville	21-111-0075	8153	2.1	1.5	0	1.1	1.1	0
Jefferson[2]	1735 Bardstown Rd Louisville	21-111-1019	656 *	4.0	2.1	0	1.5	1.0	0

[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.**

2014 Lead Ambient Air Monitoring Network

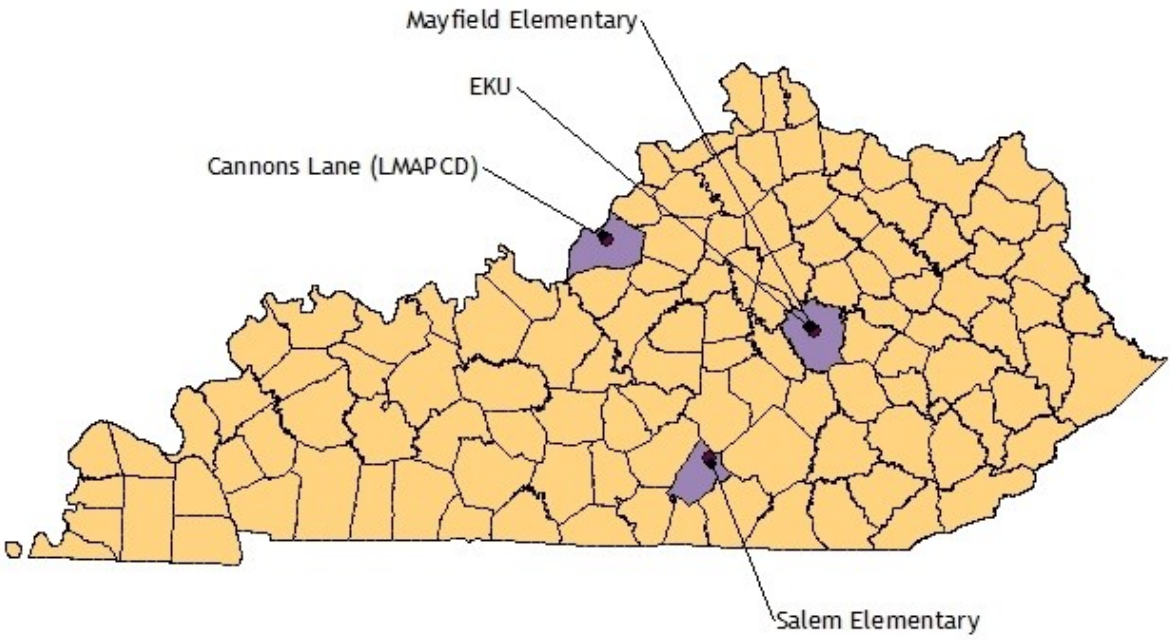


Figure 27: Lead monitoring locations in Kentucky.

Three-Month Rolling Averages for Lead

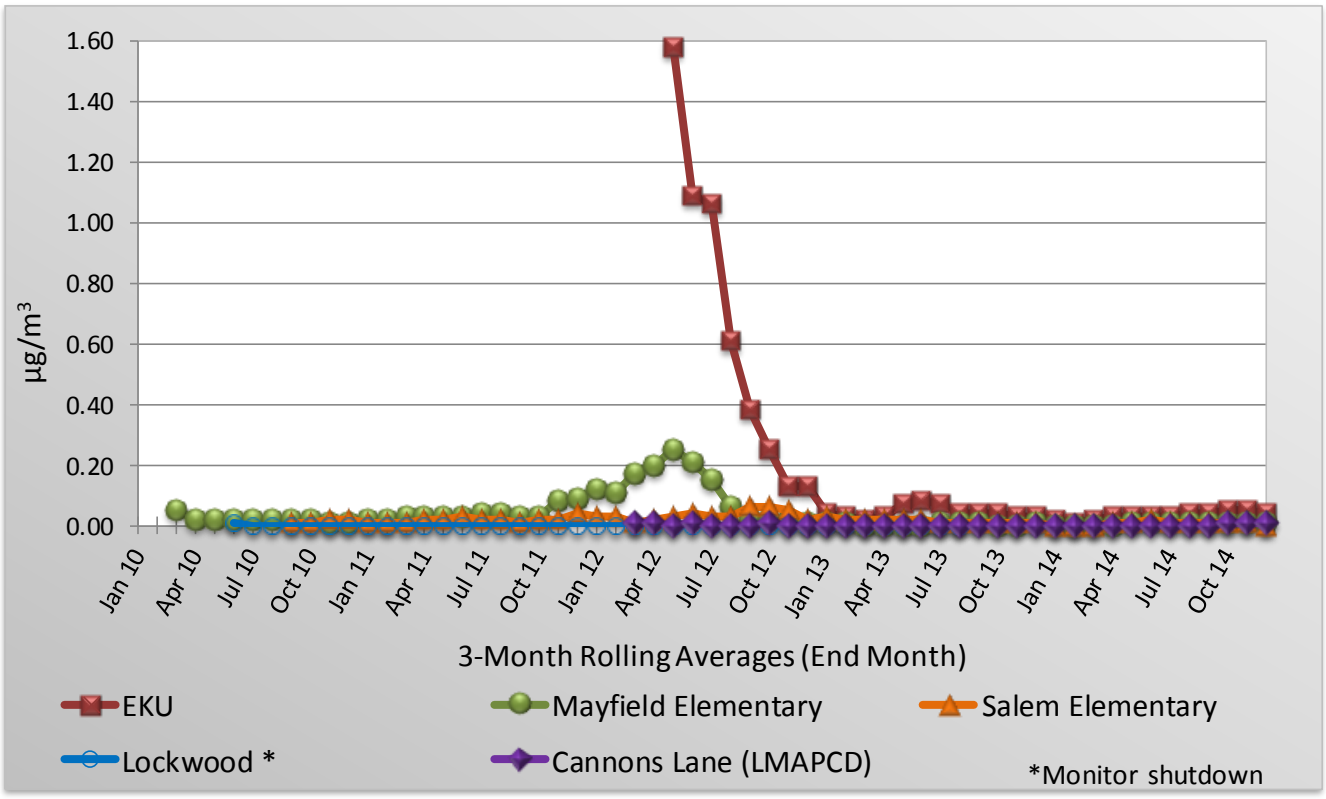


Figure 28: Three-month rolling averages for lead for each site in operation since 2010. Each three-month average is plotted on the month that the three-month period ended. Monitoring data is only available for 2010-2014.

Lead Results

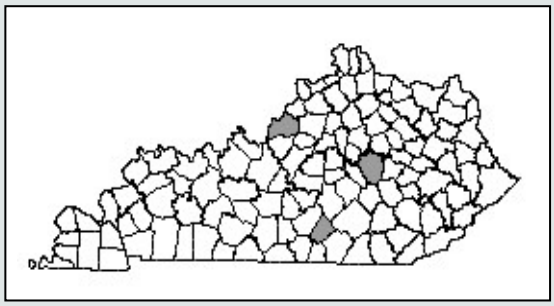
In 2012, the Mayfield Elementary and Eastern Kentucky University sites in Richmond were affected by a compliance issue with a single stationary source. Lead monitors at the two sites registered multiple three-month rolling averages above the 0.15 µg/m^3 NAAQS standard. The compliance issue was resolved, and monitoring data shows that lead concentrations have steadily decreased since that time. Resultantly, all three-month rolling averages recorded at both sites in 2014 were below the level of the NAAQS. All other sites in the Commonwealth continue to record concentrations below the level of the NAAQS.

National Ambient Air Quality Standards for Lead

Primary NAAQS:	Rolling 3-month average not to exceed 0.15 µg/m^3
Secondary NAAQS:	Same as primary standard

Criteria Pollutant Summary Report – 2014

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



County	Site Address	AQS-ID	# Obs	Rolling 3- Month Average				
				1st max	2nd max	3rd max	4th max	Obs > 0.15
Jefferson[1] NCore	2730 Cannons Ln Louisville	21-111-0067	59	0.01	0.01	0.01	0.00	0
Madison	Mayfield Elem, Bond St Richmond	21-151-0003	58	0.01	0.01	0.01	0.01	0
Madison	EKU, Van Hoose Dr Richmond	21-151-0005	80	0.05	0.05	0.04	0.04	0
Russell	1409 S. Highway 76 Russell Springs	21-207-0001	61	0.02	0.01	0.01	0.01	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.

2014 Nitrogen Dioxide Ambient Air Monitoring Network

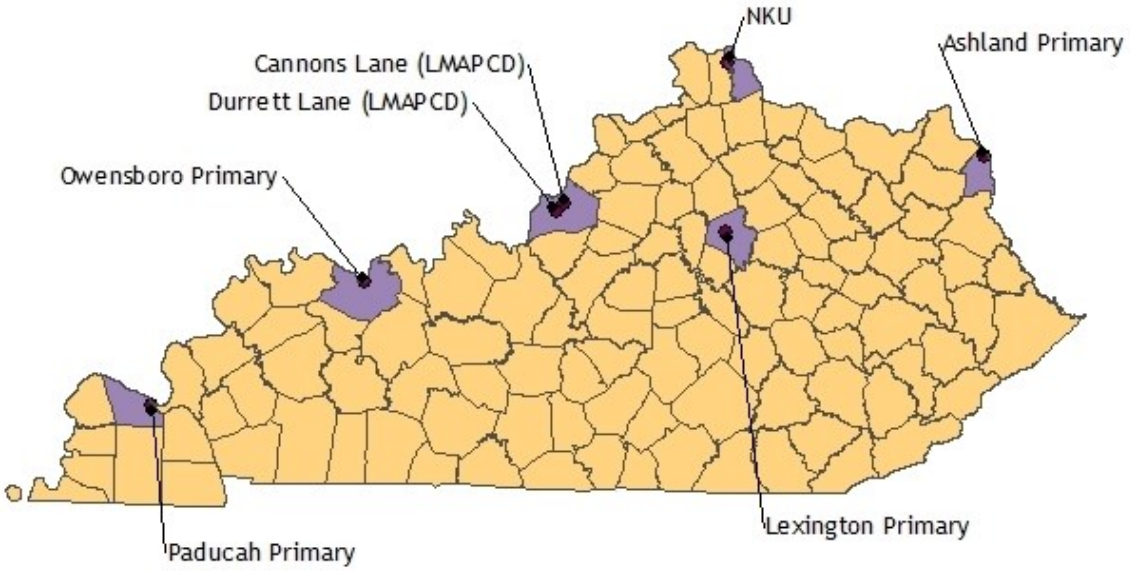


Figure 29: Nitrogen dioxide monitoring locations in Kentucky.

Statewide Averages for Nitrogen Dioxide

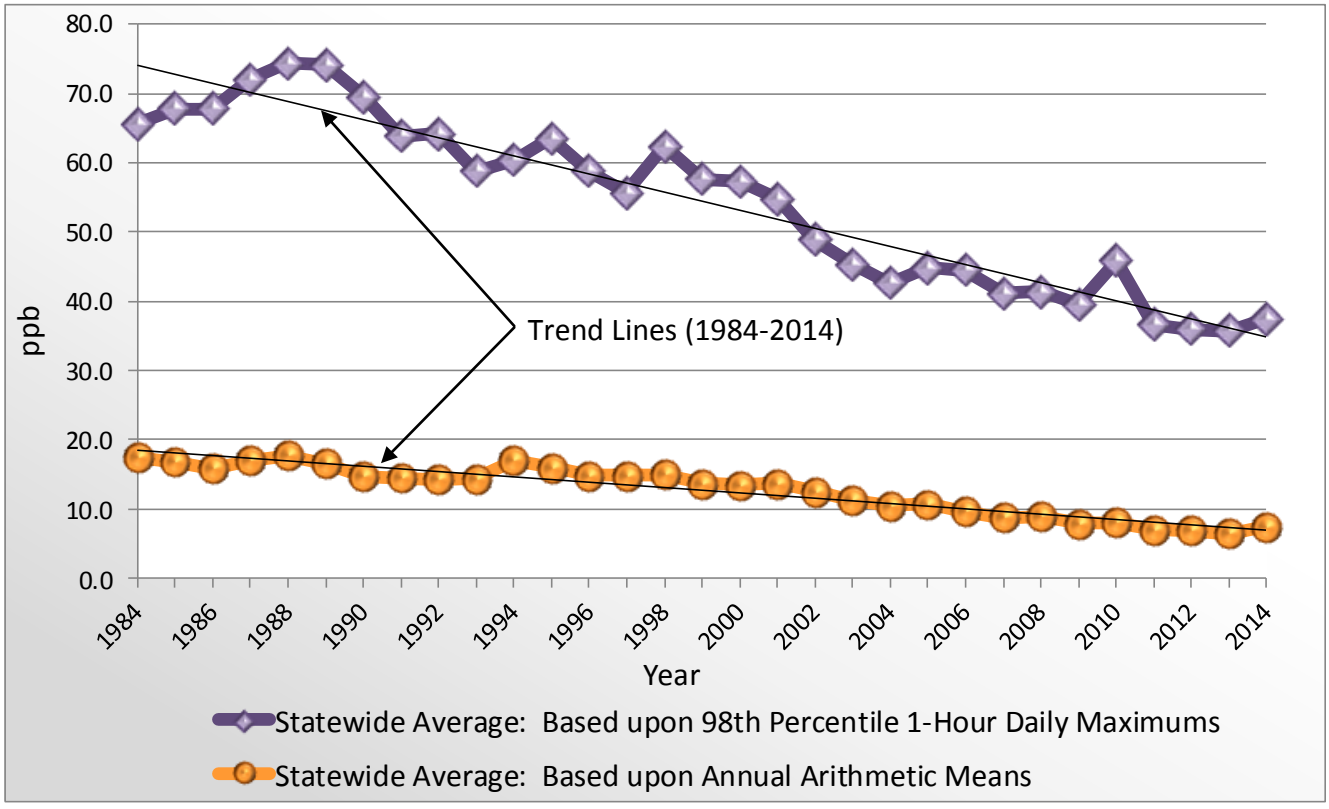


Figure 30: Statewide averages for nitrogen dioxide monitoring indicate pollution reductions.

Nitrogen Dioxide Results

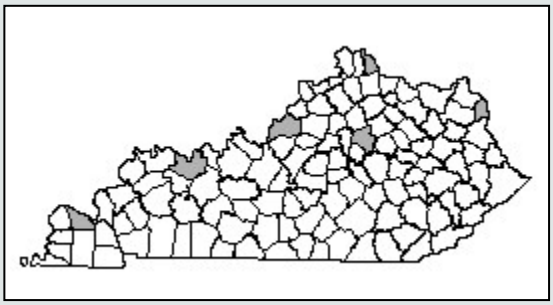
There were no exceedances of the NO_2 standard in 2014. There have been no recorded exceedances of a NO_2 NAAQS since the inception of sampling in 1970. Overall, statewide nitrogen dioxide levels show a steady downward trend, primarily due to the use of pollution control devices on motor vehicles, power plants, and industrial boilers. In 2014, 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 – 2014

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



County	Site Address	AQS-ID	# Obs	1-Hr Daily Maximum			Annual Mean
				1st max	2nd max	Obs > 100	
Boyd	2924 Holt Street Ashland	21-019-0017	8183	41.0	40.0	0	5.90
Campbell	524A John Hill Rd Highland Heights	21-037-3002	8233	40.0	35.0	0	4.29
Daviess	US60 & Pleasant Valley Rd Owensboro	21-059-0005	8290	42.0	39.0	0	5.31
Fayette	650 Newtown Pike Lexington	21-067-0012	8296	48.0	48.0	0	6.74
Jefferson[1]	2730 Cannons Ln Louisville	21-111-0067	4464	74.6	64.4	0	11.26 *
Jefferson[1]	1517 Durrett Ln Louisville	21-111-0075	5297	69.8	52.7	0	13.12 *
McCracken	2901 Powell Street Paducah	21-145-1024	8297	54.0	42.0	0	5.75

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

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

NO_2 Criteria Pollutant Multi-Year Summary Report – 2014
98th Percentile Daily 1-Hour Maximum, 3-Year Average

County	Site Address	AQS-ID	98th Percentile Daily Maximum 1-Hr Averages				
			2012	2013	2014	3-Yr Avg	Obs > 100
Boyd	2924 Holt Street Ashland	21-019-0017	30.0	30.0	32.0	31	0
Campbell	524A John Hill Road Highland Heights	21-037-3002	29.0	33.0	31.0	31	0
Daviess	US 60 & Pleasant Valley Rd Owensboro	21-059-0005	31.0	31.0	31.0	31	0
Fayette	650 Newtown Pike Lexington	21-067-0012	45.0	44.0	39.0	43	0
Jefferson[1]	2730 Cannons Ln Louisville	21-111-0067	---	42.5*	48.6*	46*	0
Jefferson[1]	1517 Durrett Ln Louisville	21-111-0075	---	---	44.5*	45*	0
McCracken	2901 Powell Street Paducah	21-145-1024	36.0	34.0	36.0	35	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

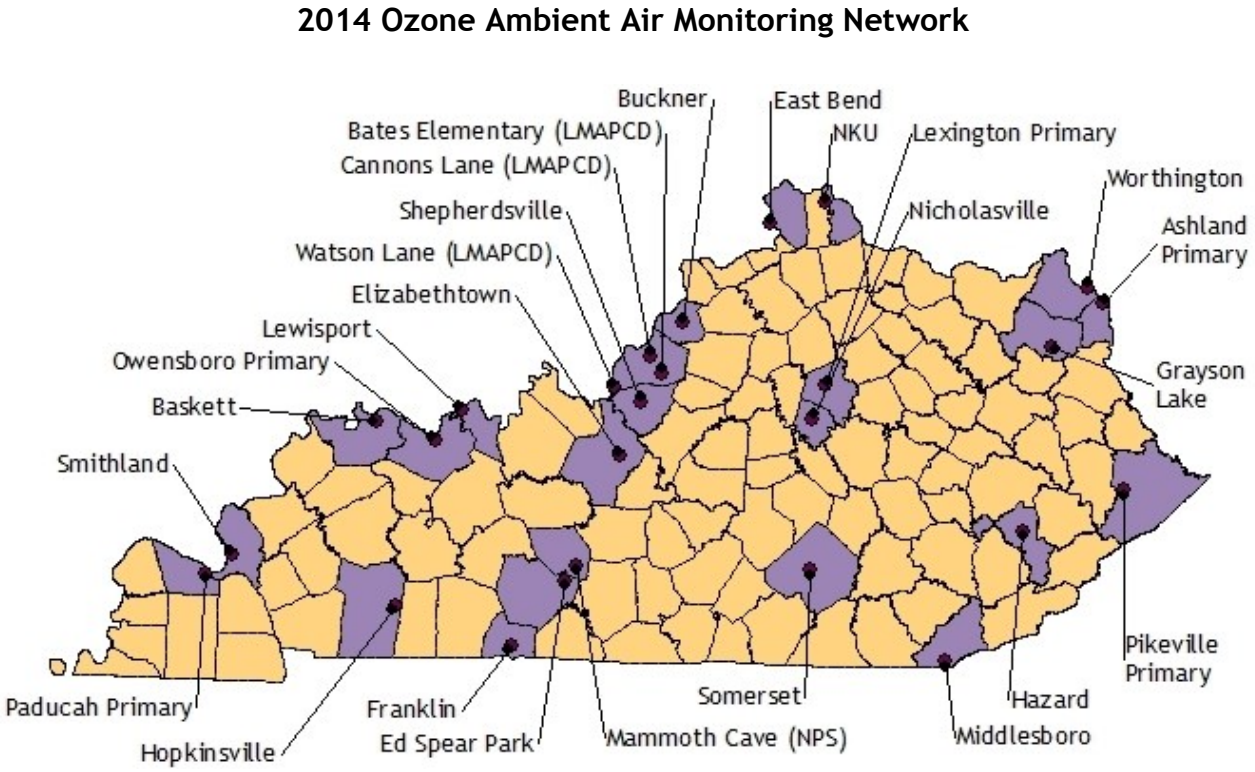


Figure 31: Ozone monitoring locations in Kentucky.

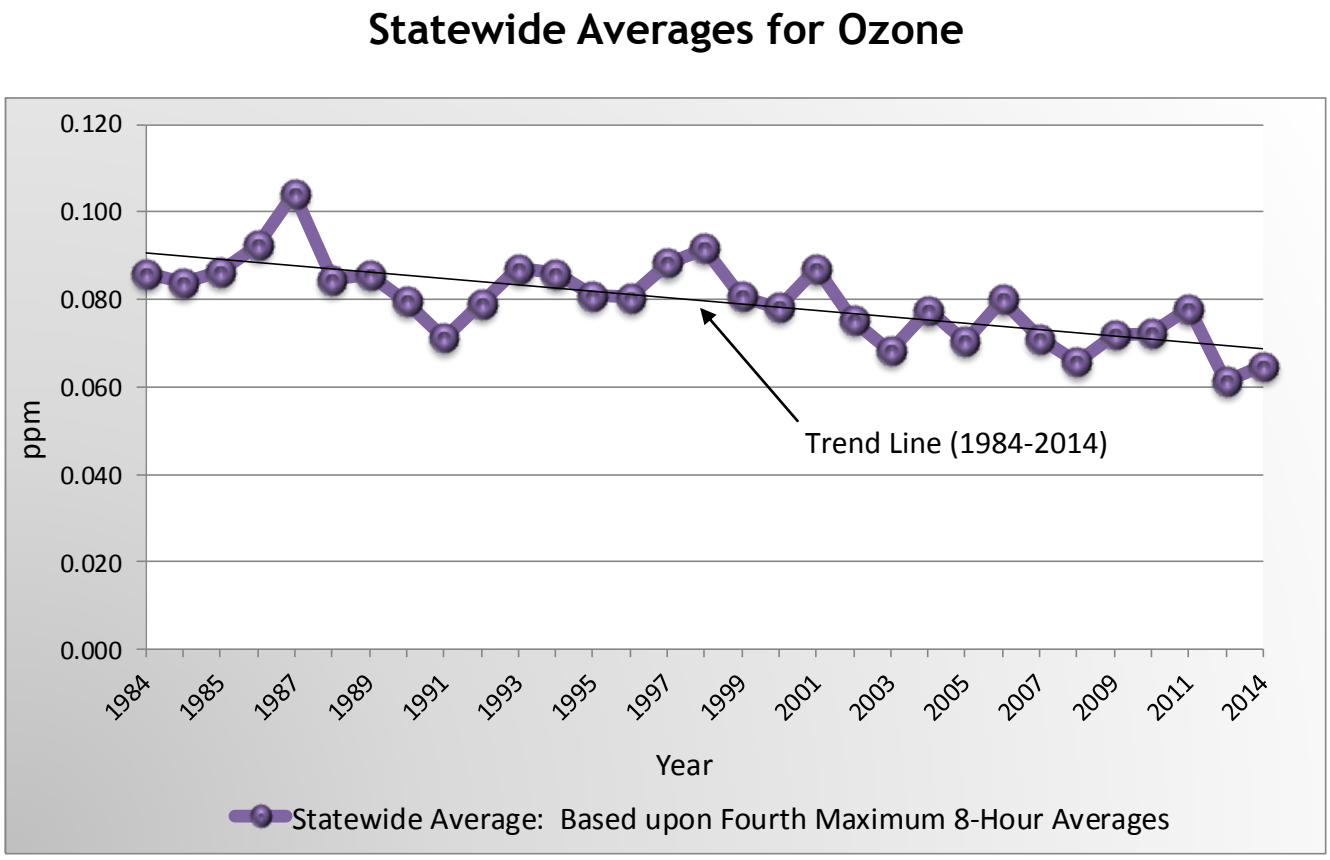


Figure 32: Statewide averages for ozone monitoring indicate pollution reductions.

Ozone Results

In 2014, there were only four daily maximum eight-hour averages that were greater than 0.075 ppm. Resultantly, 2014 data shows that there were no sites that recorded fourth highest daily maximums in exceedance of the eight-hour standard. In 2014, DAQ, LMAPCD, and the National Park Service at Mammoth Cave operated a total of 26 ozone monitors in Kentucky.

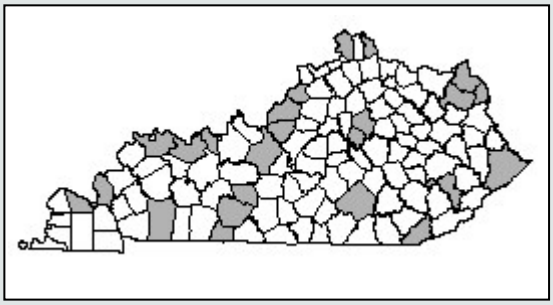
Generally, there has been a decline in ozone levels over the past 25 years based on one-hour data. This downward trend is the result of emission controls on vehicles and a regional strategy controlling NO_x emissions from large stationary internal combustion engines, large boilers and turbines used in 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
Secondary NAAQS:	Same as Primary Standard

Criteria Pollutant Summary Report – 2014

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



County	Site Address	AQS-ID	Valid Days	Daily Maximum 8-Hr Average				
				1st max	2nd max	3rd max	4th max	Obs> 0.075
Bell	34th & Dorchester Middlesboro	21-013-0002	235	0.068	0.064	0.062	0.062	0
Boone	KY 338 & Lower River East Bend	21-015-0003	245	0.064	0.064	0.062	0.062	0
Boyd	2924 Holt Street Ashland	21-019-0017	245	0.075	0.067	0.065	0.065	0
Bullitt	2nd & Carpenter St Shepherdsville	21-029-0006	221	0.074	0.066	0.065	0.065	0
Campbell	524A John Hill Rd Highland Heights	21-037-3002	242	0.074	0.074	0.072	0.071	0
Carter	Camp Webb Grayson Lake	21-043-0500	243	0.067	0.063	0.060	0.060	0
Christian	10800 Pilot Rock Hopkinsville	21-047-0006	245	0.067	0.066	0.065	0.065	0

Values in red represent an exceedance of the NAAQS.

Ozone Criteria Pollutant Summary Report – 2014 Continued

County	Site Address	AQS-ID	Valid Days	Daily Maximum 8-Hr Average				
				1st max	2nd max	3rd max	4th max	Obs> 0.075
Daviess	US60 & Pleasant Valley Owensboro	21-059-0005	237	0.070	0.065	0.065	0.064	0
Edmonson[1]	Alfred Cook Rd Mammoth Cave	21-061-0501	238	0.067	0.066	0.066	0.065	0
Fayette	650 Newtown Pike Lexington	21-067-0012	241	0.06	0.065	0.065	0.065	0
Greenup	Scott & Center St Worthington	21-089-0007	243	0.067	0.066	0.063	0.061	0
Hancock	2nd & Caroline Lewisport	21-091-0012	235	0.072	0.068	0.067	0.066	0
Hardin	801 North Miles St Elizabethtown	21-093-0006	218	0.064	0.064	0.064	0.062	0
Henderson	Baskett Fire Dept. Baskett	21-101-0014	240	0.070	0.069	0.069	0.069	0
Jefferson[2]	7601 Bardstown Rd Louisville	21-111-0027	244	0.071	0.069	0.068	0.065	0
Jefferson[2]	7201 Watson Lane Louisville	21-111-0051	238	0.083	0.081	0.070	0.069	2
Jefferson[2]	2730 Cannons Lane Louisville	21-111-0067	241	0.093	0.076	0.074	0.070	2
Jessamine	DOT, Etter Drive Nicholasville	21-113-0001	244	0.067	0.065	0.064	0.064	0
Livingston	DOT 811 US 60E Smithland	21-139-0003	245	0.069	0.068	0.066	0.065	0
McCracken	2901 Powell Street Paducah	21-145-1024	245	0.068	0.067	0.065	0.065	0
Oldham	DOT, 1601 S Hwy 393 Buckner	21-185-0004	245	0.071	0.069	0.068	0.068	0
Perry	Perry Co Horse Park Hazard	21-193-0003	245	0.065	0.064	0.061	0.061	0
Pike	101 North Mayo Trail Pikeville	21-195-0002	245	0.068	0.066	0.065	0.063	0
Pulaski	Clifty Street Somerset	21-199-0003	245	0.070	0.064	0.064	0.063	0
Simpson	DOT, HWY 1008 Franklin	21-213-0004	245	0.066	0.064	0.063	0.063	0
Warren	Ed Spear Park Smiths Grove	21-227-0009	239	0.070	0.065	0.065	0.063	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.

Ozone Criteria Pollutant Multi-Year Summary Report – 2014
8-hour 4th Maximum, 3-year Average

County	Site Address	AQS-ID	4th Maximum 8-hr Average			
			2012	2013	2014	3-Yr Avg
Bell	34th & Dorchester Middlesboro	21-013-0002	0.066	0.058	0.062	0.062
Boone	KY 338 & Lower River Road East Bend	21-015-0003	0.074	0.059	0.062	0.065
Boyd	2924 Holt Street Ashland	21-019-0017	0.074	0.065	0.065	0.068
Bullitt	2nd & Carpenter Streets Shepherdsville	21-029-0006	0.080	0.064	0.065	0.069
Campbell	524A John Hill Highland Heights	21-037-3002	0.084	0.072	0.071	0.075
Carter	Camp Webb Grayson Lake	21-043-0500	0.071	0.062	0.060	0.064
Christian	10800 Pilot Rock Road Hopkinsville	21-047-0006	0.075	0.062	0.065	0.067
Daviess	US 60 & Pleasant Valley Rd Owensboro	21-059-0005	0.087	0.066	0.064	0.072
Edmonson[1]	Alfred Cook Road Mammoth Cave	21-061-0501	0.081	0.063	0.065	0.069
Fayette	650 Newtown Pike Lexington	21-067-0012	0.078	0.060	0.065	0.067
Greenup	Scott & Center Streets Worthington	21-089-0007	0.076	0.060	0.061	0.065
Hancock	2nd & Caroline Streets Lewisport	21-091-0012	0.081	0.063	0.066	0.070
Hardin	801 North Miles Street Elizabethtown	21-093-0006	0.079	0.062	0.062	0.067*
Henderson	Baskett Fire Dept Baskett	21-101-0014	0.087	0.066	0.069	0.074
Jefferson[2]	7601 Bardstown Road Louisville	21-111-0027	0.086	0.064	0.065	0.071
Jefferson[2]	7201 Watson Lane Louisville	21-111-0051	0.081	---	0.069	0.075*
Jefferson[2]	2730 Cannons Lane Louisville	21-111-1021	0.090	0.038*	0.070	0.066*
Jessamine	DOT, Etter Drive Nicholasville	21-113-0001	0.077	0.061	0.064	0.067
Livingston	DOT, 811 US 60 East Smithland	21-139-0003	0.087	0.064	0.065	0.072

Ozone Criteria Pollutant Multi-Year Summary Report - 2014 Continued
8-hour 4th Maximum, 3-year Average

County	Site Address	AQS-ID	4th Maximum 8-hr Average			
			2012	2013	2014	3-Yr Avg
McCracken	2901 Powell Street Paducah	21-145-1024	0.087	0.064	0.065	0.072
Oldham	DOT, 1601 S Hwy 393 Buckner	21-185-0004	0.092	0.064	0.068	0.074
Perry	Perry County Horse Park Hazard	21-193-0003	0.070	0.058	0.061	0.063
Pike	101 North Mayo Trail Pikeville	21-195-0002	0.068	0.055	0.063	0.062
Pulaski	Clifty Street Somerset	21-199-0003	0.075	0.061	0.063	0.066
Simpson	DOT, Hwy 1008 Franklin	21-213-0004	0.071	0.059	0.063	0.064
Warren	Ed Spear Park Smiths Grove	21-227-0009	0.079*	0.060	0.063	0.067*

[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.
--- Monitoring not conducted / Data not available
Values in red represent an exceedance of the NAAQS.

2014 Particulate Matter ($PM_{2.5}$) Ambient Air Monitoring Network

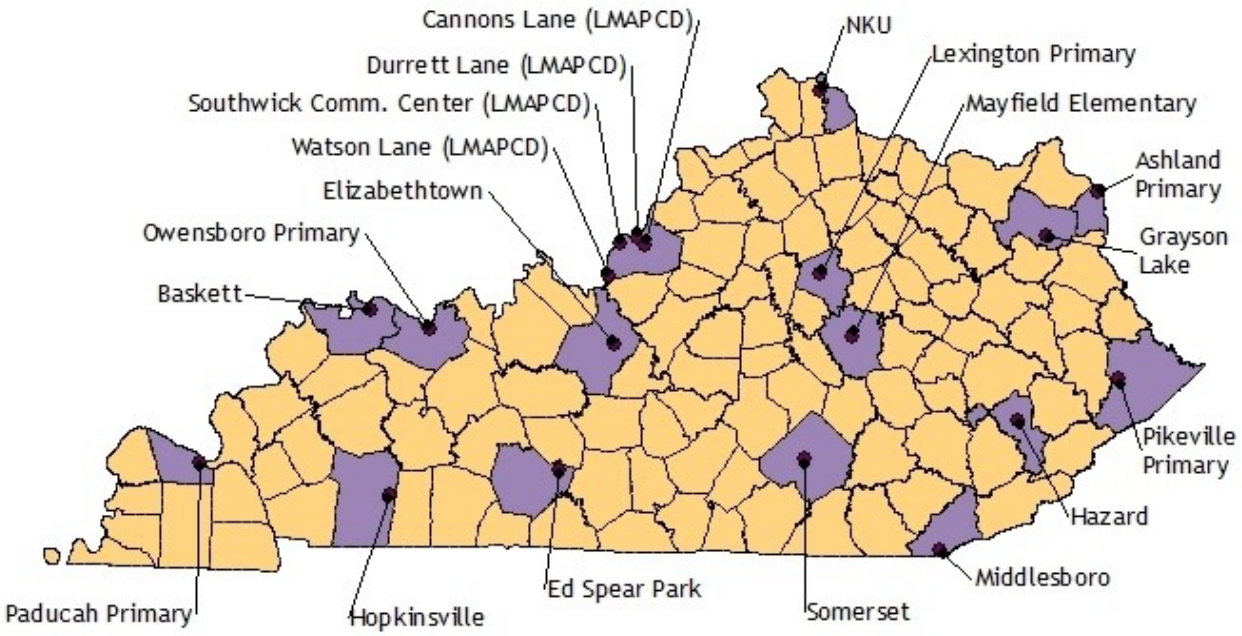


Figure 33: $PM_{2.5}$ monitoring locations in Kentucky.

Statewide Averages for $PM_{2.5}$

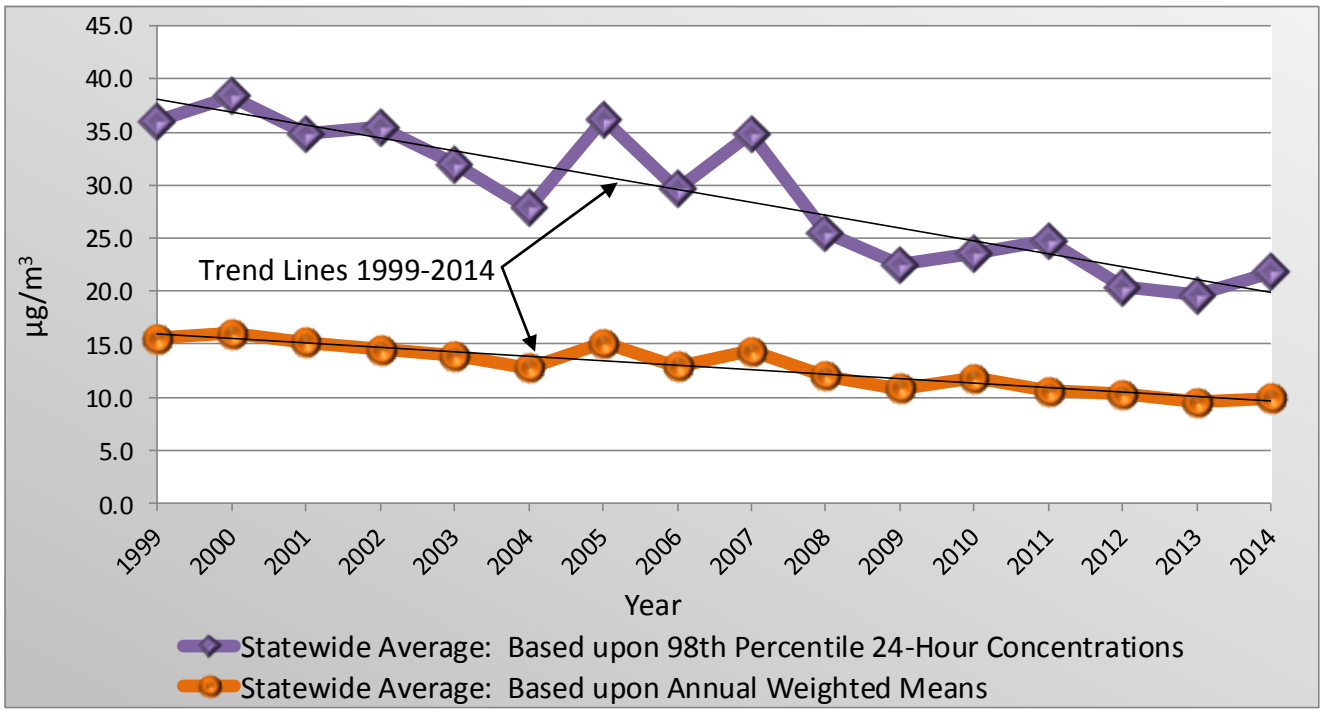


Figure 34: Statewide averages for $PM_{2.5}$ monitoring indicate pollution reductions.

$PM_{2.5}$ Results

There were no exceedances of either the 24-hour or annual $PM_{2.5}$ standards in 2014. Furthermore, no sampler exceeded either the three-year 24-hour standard or the three-year annual standard, during the 2012-2014 averaging period. This is a significant accomplishment. In 2014, DAQ and LMAPCD operated FRM-type samplers for NAAQS comparisons at 19 sites in 16 counties.

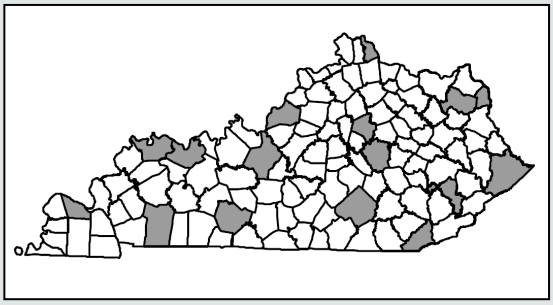
Generally, statewide $PM_{2.5}$ levels declined during the 1999-2014 time period.

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

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

Criteria Pollutant Summary Report – 2014

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



County	Site	AQS-ID	# Obs	24-Hour Average					Wtd-Mean
				1st max	2nd max	3rd max	4th max	Obs> 35	
Bell	34th & Dorchester Middlesboro	21-013-0002	60	22.6	16.6	15.6	15.4	0	8.97
Boyd	2924 Holt Street Ashland	21-019-0017	119	25.9	20.6	20.3	18.7	0	9.33
Campbell	524A John Hill Rd Highland Heights	21-037-3002	116	25.6	25.4	23.2	20.9	0	9.68
Carter	Camp Webb Grayson Lake	21-043-0500	114	23.6	21.0	19.7	17.2	0	7.97
Christian	10800 Pilot Rock Hopkinsville	21-047-0006	106	27.2	25.4	23.4	20.6	0	10.12*
Daviess	US60 & Pleasant Valley Rd Owensboro	21-059-0014	122	30.6	26.2	25.7	24.9	0	11.04

$PM_{2.5}$ Criteria Pollutant Summary Report – 2014 Continued

County	Site	AQS-ID	# Obs	24-Hour Average					Wtd-Mean
				1st max	2nd max	3rd max	4th max	Obs> 35	
Fayette	650 Newtown Pike Lexington	21-067-0012	116	23.7	23.6	21.8	21.6	0	9.42
Hardin	801 North Miles Street Elizabethtown	21-093-0006	114	27.4	24.4	22.5	22.0	0	10.36
Henderson	Basket Fire Dept. Baskett	21-101-0014	117	27.3	25.5	25.3	23.8	0	10.82
Jefferson[1]	37th & Southern Avenue Louisville	21-111-0043	121	43.6	26.1	24.3	23.8	0	10.93
Jefferson[1]	7201 Watson Lane Louisville	21-111-0051	120	34.7	33.6	26.0	25.1	0	11.86
Jefferson[1]	2730 Cannons Lane Louisville	21-111-0067	114	26.8	25.6	25.0	23.5	0	10.42
Jefferson[1]	1517 Durrett Lane Louisville	21-111-0075	116	50.0	27.6	26.0	25.6	1	11.98
McCracken	2901 Powell Street Paducah	21-145-1024	118	24.9	23.0	22.6	22.6	0	10.40
Madison	Mayfield School Richmond	21-151-0003	110	22.4	22.1	17.3	16.7	0	8.51
Perry	Perry County Horse Park Hazard	21-193-0003	57	16.5	14.9	14.2	14.1	0	8.41
Pike	101 North Mayo Trail Pikeville	21-195-0002	118	24.5	22.9	18.6	17.7	0	8.57
Pulaski	305 Clifty Street Somerset	21-199-0003	122	28.3	24.2	21.8	20.7	0	9.27
Warren	Ed Spear Park Smiths Grove	21-227-0009	116	25.1	22.5	20.7	20.0	0	9.42

[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 – 2014
24-Hour 98th Percentile, 3-Year Average

County	Site	AQS-ID	24-Hour, 98th Percentile			
			2012	2013	2014	3-Yr Avg
Bell	34th & Dorchester Middlesboro	21-013-0002	19.8	16.5	16.6	18
Boyd	2924 Holt Street Ashland	21-019-0017	22.4	19.5	20.3	21
Campbell	524A John Hill Highland Heights	21-037-3002	20.7	21.6	23.2	22
Carter	Camp Webb Grayson Lake	21-043-0500	17.6	14.1	19.7	17
Christian	10800 Pilot Rock Road Hopkinsville	21-047-0006	19.6	21.6	23.4*	22
Daviess	US60 and Pleasant Valley Rd Owensboro	21-059-0005	22.3	22.2	25.7	23
Fayette	650 Newtown Pike Lexington	21-067-0012	19.1	20.0	21.8	20
Hardin	801 North Miles Street Elizabethtown	21-093-0006	20.0*	20.5	22.5	21*
Henderson	Baskett Fire Dept Baskett	21-101-0014	20.2	21.6	25.3	22
Jefferson[1]	37th & Southern Avenue Louisville	21-111-0043	24.1*	24.0	24.3	24*
Jefferson[1]	7201 Watson Lane Louisville	21-111-0051	26.3*	23.5	26.2	25*
Jefferson[1]	2730 Cannons Lane Louisville	21-111-0067	23.2	22.3	23.9	23
Jefferson[1]	1517 Durrett Lane Louisville	21-111-0075	---	---	26.0	26*
McCracken	2901 Powell Street Paducah	21-145-1024	---	23.4*	22.6	23*
Madison	Mayfield School Richmond	21-151-0003	17.5	16.7	17.3	17
Perry	Perry County Horse Park Hazard	21-193-0003	---	12.2*	14.9	14*
Pike	101 North Mayo Trail Pikeville	21-195-0002	18.9	14.0	18.6	17
Pulaski	305 Clifty Street Somerset	21-199-0003	19.9*	17.6	21.8	20
Warren	Ed Spear Park Smiths Grove	21-227-0009	19.0*	19.3	20.7	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 – 2014
Annual Weighted Mean, 3-Year Average

County	Site	AQS-ID	Annual Weighted Mean			
			2012	2013	2014	3-Yr Avg
Bell	34th & Dorchester Middlesboro	21-013-0002	10.3	9.1	9.0	9.4
Boyd	2924 Holt Street Ashland	21-019-0017	10.2	9.1	9.3	9.5
Campbell	524A John Hill Highland Heights	21-037-3002	9.7	9.6	9.7	9.6
Carter	Camp Webb Grayson Lake	21-043-0500	8.3	7.5	8.0	7.9
Christian	10800 Pilot Rock Road Hopkinsville	21-047-0006	9.9	9.8	10.1*	9.9
Daviess	US60 and Pleasant Valley Rd Owensboro	21-059-0005	10.8	10.2	11.0	10.7
Fayette	650 Newtown Pike Lexington	21-067-0012	9.8	9.4	9.4	9.5
Hardin	801 North Miles Street Elizabethtown	21-093-0006	11.7*	9.8	10.2	10.6*
Henderson	Baskett Fire Dept. Baskett	21-101-0014	10.4	10.6	10.8	10.6
Jefferson[1]	37th & Southern Avenue Louisville	21-111-0043	12.3*	11.7	11.0	11.7*
Jefferson[1]	7201 Watson Lane Louisville	21-111-0051	13.3*	12.0	12.2	12.5*
Jefferson[1]	2730 Cannons Lane Louisville	21-111-0067	12.3	10.7	10.9	11.3
Jefferson[1]	1517 Durrett Lane Louisville	21-111-0075	---	---	12.0	12.0*
McCracken	2901 Powell Street Paducah	21-145-1024	---	10.9*	10.4	10.7*
Madison	Mayfield School Richmond	21-151-0003	8.8	8.2	8.5	8.5
Perry	Perry County Horse Park Hazard	21-193-0003	---	5.9*	8.4	7.2*
Pike	101 North Mayo Trail Pikeville	21-195-0002	9.2	7.8	8.5	8.5
Pulaski	305 Clifty Street Somerset	21-199-0003	9.6*	8.8	9.3	9.2
Warren	Ed Spear Park Smiths Grove	21-227-0009	10.4*	9.7	9.3	9.8*

[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.

PARTICULATE MATTER ($PM_{2.5}$) SPECIATION

2014 Particulate Matter ($PM_{2.5}$) Speciation
Ambient Air Monitoring Network

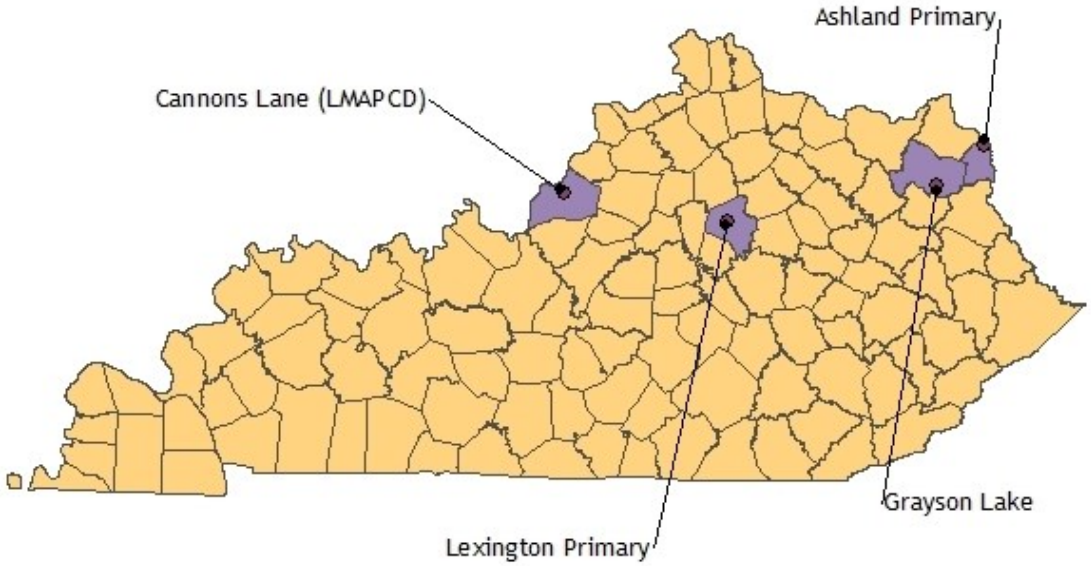


Figure 35: $PM_{2.5}$ speciation monitoring locations in Kentucky.

$PM_{2.5}$ 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. 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 2014, the Kentucky Division for Air Quality operated a network of three Speciation Trends Network monitors and the Louisville Metro Air Pollution Control District operated one monitor. The sites were strategically located to address different types of land-use ranging from heavy industrial, urban, and rural. The charts on the following pages provide a visual representation of the major components of speciation data collected at each site during 2014. The data suggests that particulates identified as non-crustal 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.

2014 $PM_{2.5}$ Speciation: Average Distributions of Major Species

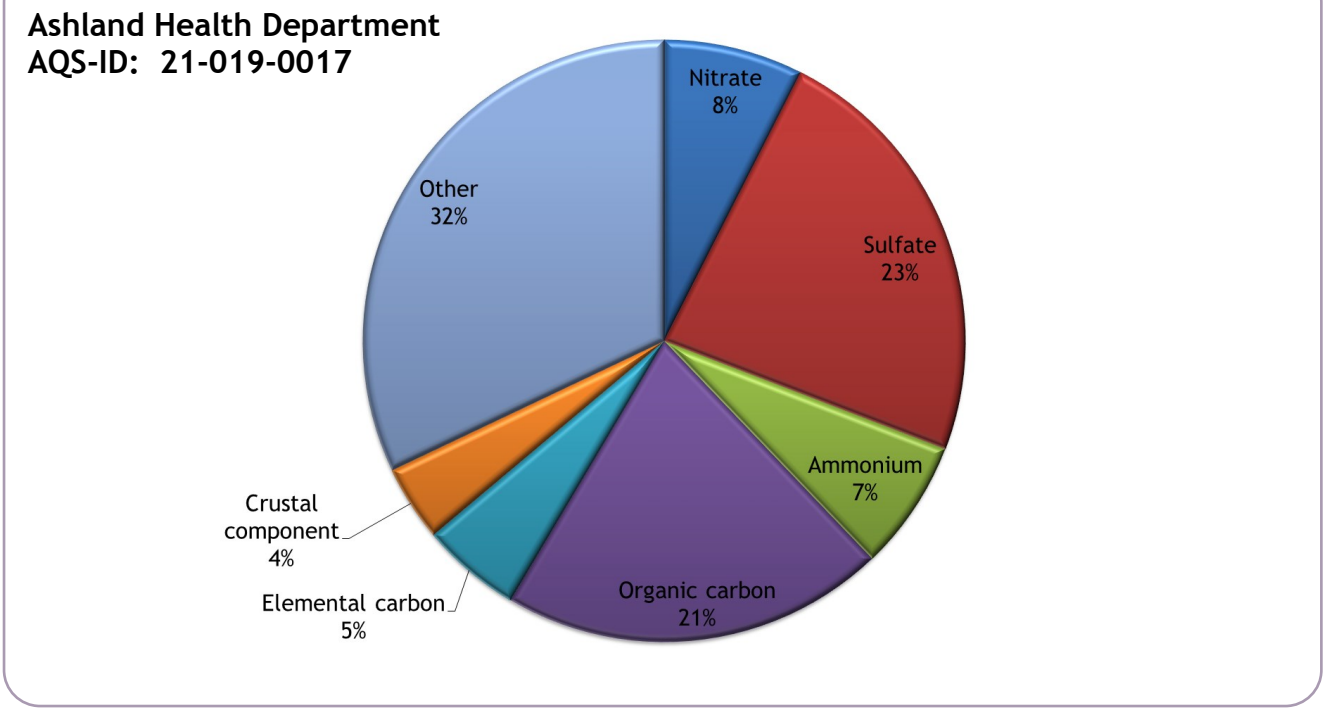


Figure 36: Average species distribution of major elements from the Ashland Health Department $PM_{2.5}$ speciation monitor (AQS I.D.: 21-019-0017). "Other" represents a combined percentage of mixed components not characterized as major elements or crustal components.

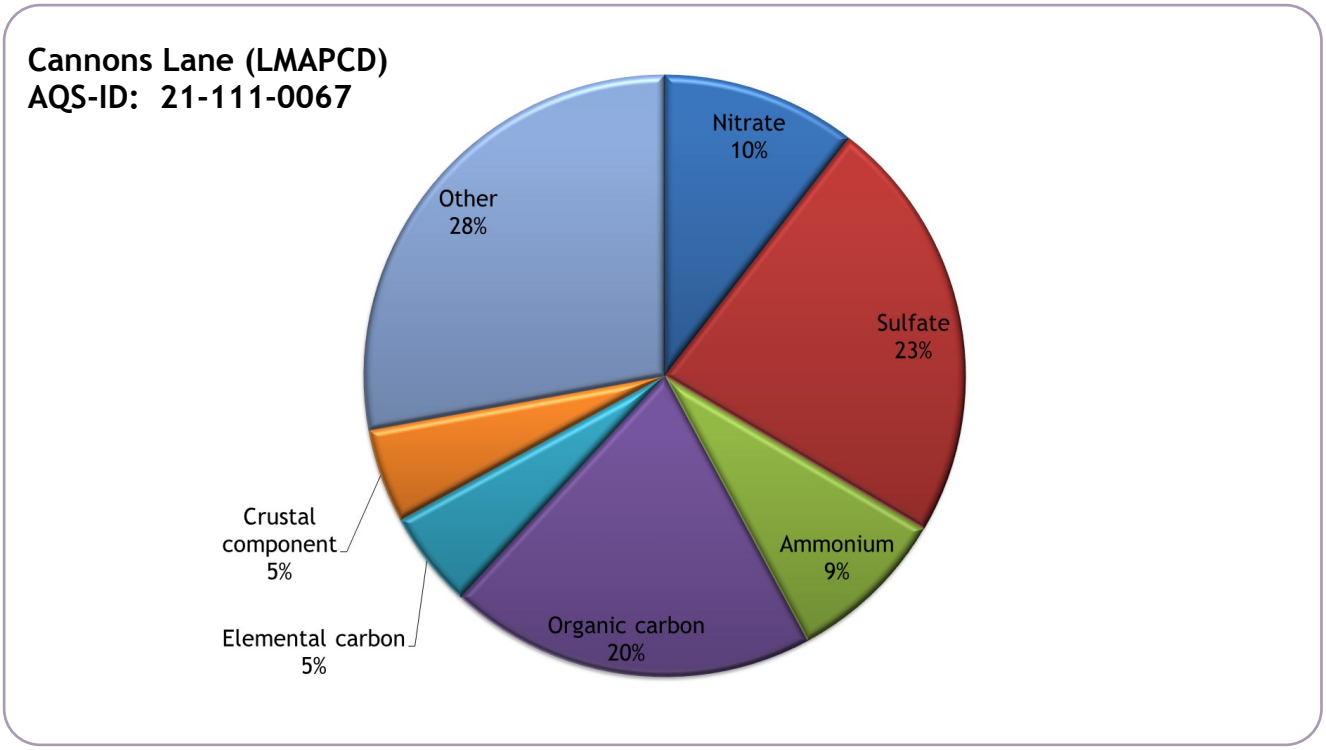


Figure 37: Average species distribution of major elements from the Louisville Metropolitan Air Pollution Control District $PM_{2.5}$ speciation monitor at the Cannons Lane site (AQS I.D.: 21-111-0067). "Other" represents a combined percentage of mixed components not characterized as major elements or crustal components.

2014 $PM_{2.5}$ Speciation: Average Distributions of Major Species

Grayson Lake
AQS-ID: 21-043-0500

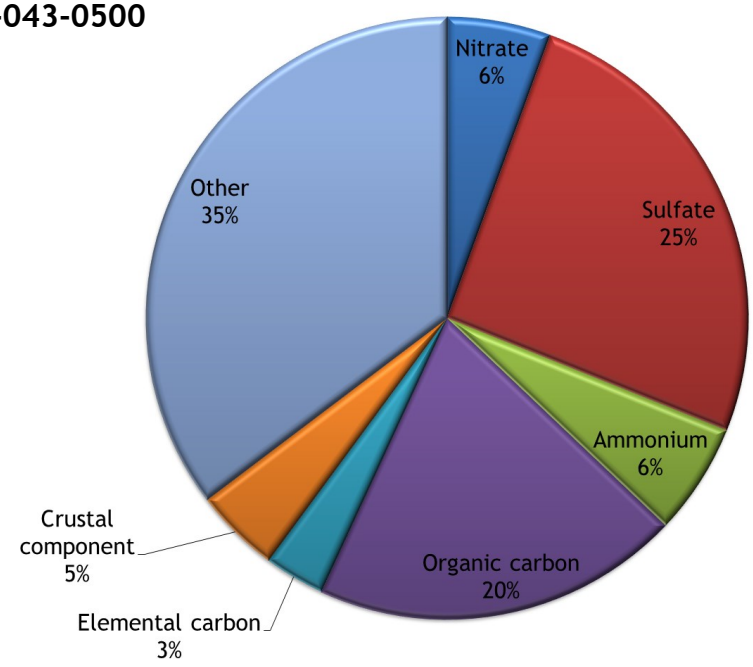


Figure 38: Average species distribution of major elements from the Grayson Lake $PM_{2.5}$ speciation monitor (AQS I.D.: 21-043-0500). "Other" represents a combined percentage of mixed components not characterized as major elements or crustal components.

Lexington Health Department
AQS-ID: 21-067-0012

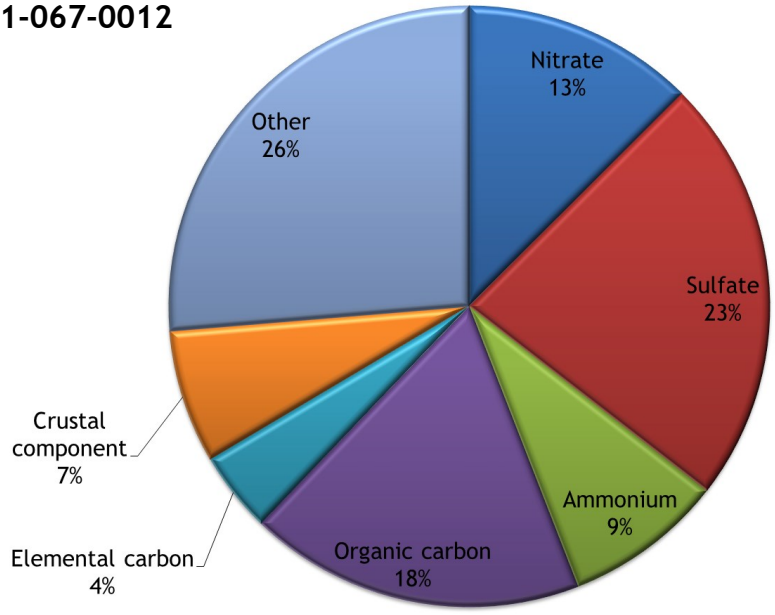


Figure 39: Average species distribution of major elements from the Lexington Health Department $PM_{2.5}$ speciation monitor (AQS I.D.: 21-067-0012). "Other" represents a combined percentage of mixed components not characterized as major elements or crustal components.

2014 Particulate Matter (PM_{10}) Ambient Air Monitoring Network

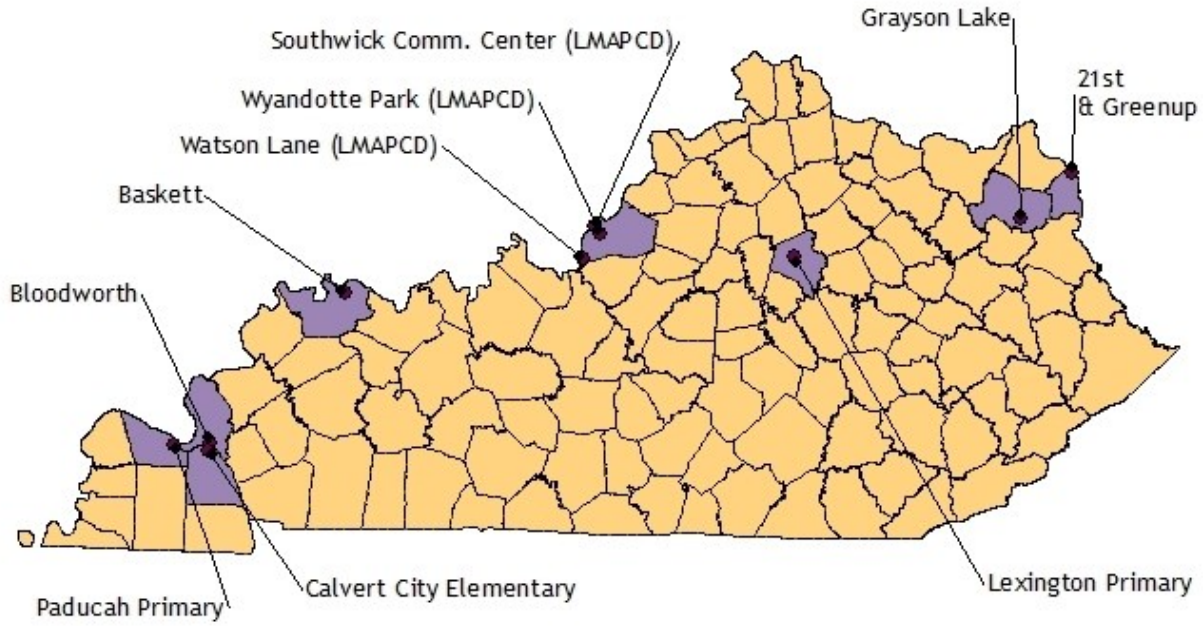


Figure 40: PM_{10} monitoring locations in Kentucky.

Statewide Averages for PM_{10}

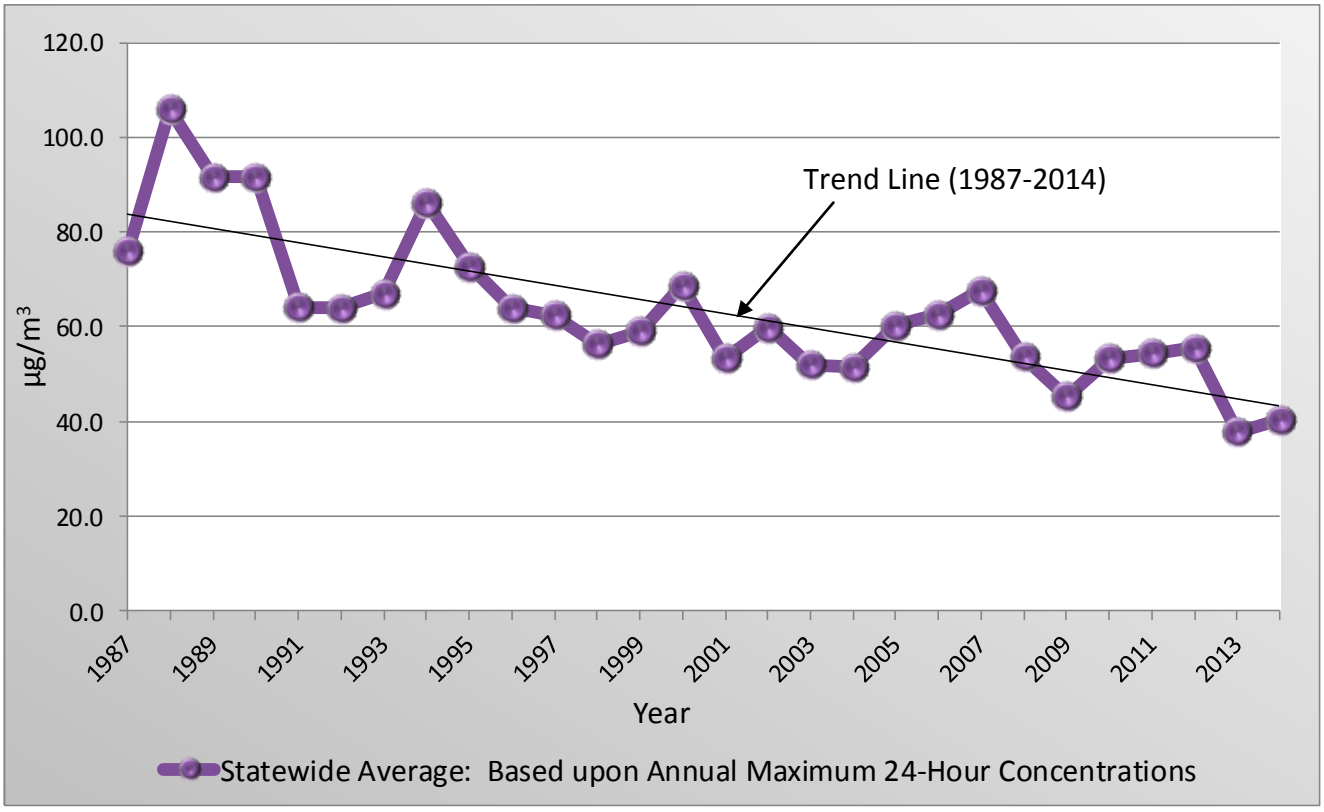


Figure 41: Statewide averages for PM_{10} monitoring indicate pollution reductions.

PM_{10} Results

In 2014, the DAQ and the LMAPCD operated a combined network of ten PM_{10} intermittent and continuous samplers in Kentucky. The annual PM_{10} standard is attained when the expected number of days per year with a 24-hour concentration greater than 150 ug/m^3 is less than or equal to one, when averaged over a three-year period. When a site collects samples everyday, the expected number of exceedances is equal to the number of actual exceedances. However, when the sampling frequency does not occur everyday, the number of days expected to be greater 150 ug/m^3 is obtained via a calculation. Poor data recovery can also impact the expected number of exceedances per year.

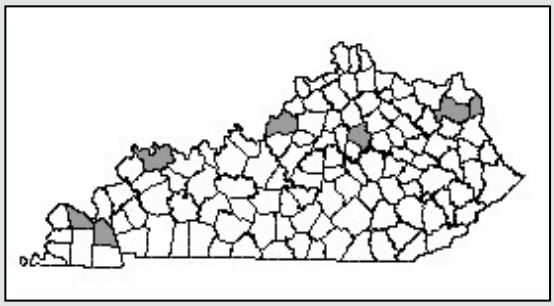
There were no exceedances of the annual PM_{10} standard in 2014. The last exceedance of the standard occurred on March 22, 2012, at the Ashland site (21-019-0002), which is located next to a metals recycler. Prior to 2012, only two previous exceedances of the PM_{10} NAAQS have been recorded. One of those exceedances occurred at a different Ashland site (21-019-0003) on Aug. 27, 1990, when a 24-hour concentration of 182 µg/m^3 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/m^3.

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

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

Criteria Pollutant Summary Report – 2014

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



County	Site	AQS-ID	# Obs	24-hour Average				Act Obs > 150	Exp Obs > 150	Mean
				1st Max	2nd Max	3rd Max	4th Max			
Boyd	21st & Greenup Ashland	21-019-0002	59	38	36	36	35	0	0	19.0
Carter	Camp Webb Grayson Lake	21-043-0500	58	24	18	17	16	0	0	10.2
Fayette	650 Newtown Pike Lexington	21-067-0012	56	32	29	26	25	0	0	15.6
Henderson	Baskett Fire Dept. Baskett	21-101-0014	59	36	35	28	28	0	0	17.0
Jefferson[1]	37th & Southern Ave Louisville	21-111-0043	8233	78	59	44	42	0	0	18.1*
Jefferson[1]	1032 Beecher Ave Louisville	21-111-0044	347	18	16	14	12	0	0	10.7*

PM_{10} Criteria Pollutant Summary Report – 2014 Continued

County	Site	AQS-ID	# Obs	24-hour Average				Act Obs > 150	Exp Obs > 150	Mean
				1st Max	2nd Max	3rd Max	4th Max			
Jefferson[1]	7201 Watson Ln Louisville	21-111-0051	7582	80	54	53	51	0	0	18.4*
Livingston	763 Bloodworth Rd Smithland	21-139-0004	12	23	18	18	14	0	0	12.2*
McCracken	2901 Powell Street Paducah	21-145-1024	59	34	34	33	32	0	0	18.1
Marshall	563 East Fifth Ave Calvert City	21-157-0018	41	40	29	29	28	0	0	16.7*

PM_{10} Criteria Pollutant Summary Report – 2014
Estimated Number of Annual Exceedances, Expected 3-Year Average

County	Site	AQS-ID	Estimated Number of Exceedances			
			2012	2013	2014	Expected 3-Year Avg
Boyd	21st & Greenup Ashland	21-019-0002	6.5	0	0	2.2
Carter	Camp Webb Grayson Lake	21-043-0500	0	0	0	0
Fayette	650 Newtown Pike Lexington	21-067-0012	0	0	0	0
Henderson	Baskett Fire Dept Baskett	21-101-0014	0	0	0	0
Jefferson[1]	37th & Southern Ave Louisville	21-111-0043	0	0	0*	0*
Jefferson[1]	1032 Beecher Ave Louisville	21-111-0044	0	0	0*	0*
Jefferson[1]	7201 Watson Ln Louisville	21-111-0051	---	---	0*	0*
Livingston	763 Bloodworth Rd Smithland	21-139-0004	---	---	0*	0*
McCracken	2901 Powell Street Paducah	21-145-1024	---	0*	0	0*
Marshall	563 East Fifth Ave Calvert City	21-157-0018	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

Values in red represent an exceedance of the NAAQS.

SULFUR DIOXIDE (SO_2)

2014 Sulfur Dioxide Ambient Air Monitoring Network

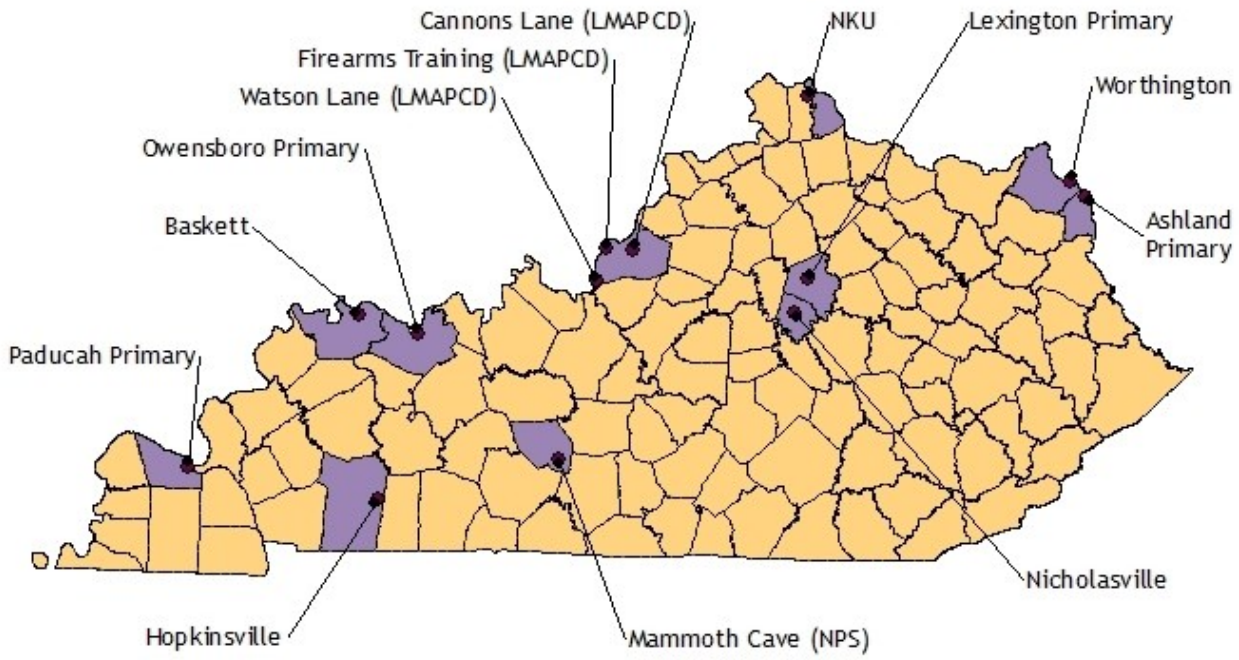


Figure 42: Sulfur dioxide monitoring locations in Kentucky.

Statewide Averages for Sulfur Dioxide

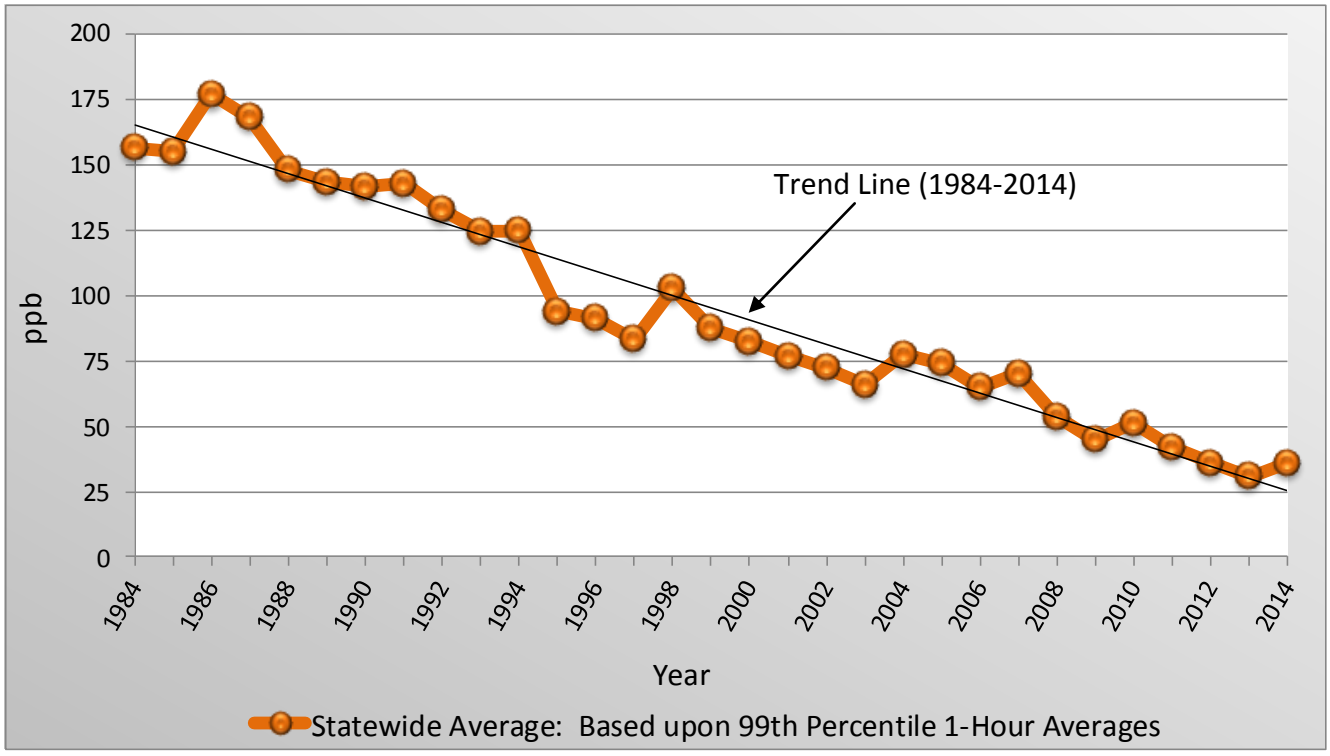


Figure 43: Statewide averages for SO_2 monitoring indicate pollution reductions.

Sulfur Dioxide Results

In 2014, the Division, the NPS at Mammoth Cave, and LMAPCD operated 13 SO_2 monitors in Kentucky. Two sites recorded daily maximum one-hour averages greater than 75 ppb. Of those two sites, one is currently in violation of the NAAQS, based upon the three-year average of 99th percentile daily maximum one-hour concentrations.

On June 22, 2010, the EPA promulgated a new primary SO_2 NAAQS. The NAAQS was set to 75 ppb, measured as the three-year average of the 99th percentile of the daily maximum one-hour averages. The EPA revoked the original 24-hour and annual NAAQS standards. Prior to the establishment of the new NAAQS, there had been no exceedances of a SO_2 standard since November 1981, when the monitor at a Louisville site (21-111-0032) recorded a 24-hour average of 0.159 ppm.

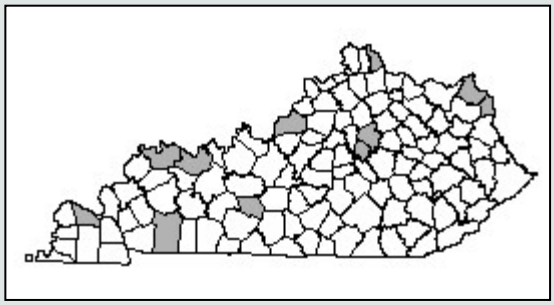
Statewide and regional sulfur dioxide levels have declined over the past twenty years. The SO_2 allowances component of the Acid Rain Program provides an opportunity for electric utilities to participate in a market-based trade of SO_2 emissions. An electric utility that is participating in the trading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

National Ambient Air Quality Standards for Sulfur Dioxide

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

Criteria Pollutant Summary Report - 2014

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



County	Site Address	AQS-ID	# Obs	Daily Maximum 1-Hr Avg			Annual Maximum 3-Hr Block Avg		
				1st max	2nd max	Obs > 75	1st max	2nd max	Obs > 500
Boyd	2924 Holt Street Ashland	21-019-0017	8693	51.0	24.0	0	5.4	4.9	0
Campbell	524A John Hill Rd Highland Heights	21-037-3002	8673	93.0	72.0	1	18.8	13.8	0
Christian	10800 Pilot Rock Rd Hopkinsville	21-047-0006	7244	31.0	21.0	0	9.6	8.8	0

SO_2 Criteria Pollutant Summary Report – 2014 Continued

County	Site Address	AQS-ID	# Obs	Daily Maximum 1-Hr Avg			Annual Maximum 3-Hr Block Avg		
				1st max	2nd max	Obs > 75	1st max	2nd max	Obs > 500
Daviess	US60 & Pleasant Valley Owensboro	21-059-0005	8703	65.0	59.0	0	10.6	9.6	0
Edmonson[1]	Alfred Cook Road Mammoth Cave	21-061-0501	8042	16.9	15.3	0	7.0	4.0	0
Fayette	650 Newtown Pike Lexington	21-067-0012	8715	28.0	20.0	0	6.5	5.0	0
Greenup	Scott & Center St. Worthington	21-089-0007	8695	23.0	18.0	0	8.0	6.2	0
Henderson	Baskett Fire Dept. Baskett	21-101-0014	8694	38.0	37.0	0	8.1	7.2	0
Jefferson[2]	7201 Watson Lane Louisville	21-111-0051	8686	182.4	155.2	26	28.0	26.7	0
Jefferson[2]	2730 Cannons Lane Louisville	21-111-0067	8555	36.3	31.5	0	11.8	8.5	0
Jefferson[2]	4201 Algonquin Pkwy Louisville	21-111-1041	8371	50.8	44.7	0	17.1	7.6	0
Jessamine	KYDOT, Etter Drive Nicholasville	21-113-0001	8710	19.0	15.0	0	6.5	4.0	0
McCracken	2901 Powell Street Paducah	21-145-1024	8588	38.0	23.0	0	5.7	5.3	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.

SO_2 Criteria Pollutant Multi-Year Summary Report – 2014
Daily Maximum 1-hour 99th Percentile, 3-Year Average

County	Site Address	AQS-ID	Daily Maximum 1-Hr Average 99th Percentile			
			2012	2013	2014	3-Year Avg
Boyd	2924 Holt Street Ashland	21-019-0017	13	16	19	16
Campbell	524A John Hill Rd Highland Heights	21-037-3002	85	71	61	72
Christian	10800 Pilot Rock Rd Hopkinsville	21-047-0006	14*	11	17*	14*
Daviess	US60 & Pleasant Valley Rd Owensboro	21-059-0005	37	45	48	43
Edmonson[1]	Alfred Cook Road Mammoth Cave	21-061-0501	9	11	11	10
Fayette	650 Newtown Pike Lexington	21-067-0012	15	12	13	13
Greenup	Scott & Center Streets Worthington	21-089-0007	14	12	16	14
Henderson	Baskett Fire Dept. Baskett	21-101-0014	23	28	29	27
Jefferson[2]	7201 Watson Lane Louisville	21-111-0051	147	93*	149	130*
Jefferson[2]	2730 Cannons Lane Louisville	21-111-0067	---	27*	29	28*
Jefferson[2]	4201 Algonquin Pkwy Louisville	21-111-1041	35*	37*	42	38*
Jessamine	KYDOT, Etter Drive Nicholasville	21-113-0001	13	18	15	15
McCracken	2901 Powell Street Paducah	21-145-1024	24	18	20	21

[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.
--- Monitoring not conducted / Data not available
Values in red represent an exceedance of the NAAQS.

2014 Hazardous Air Pollutant Ambient Air Monitoring Network

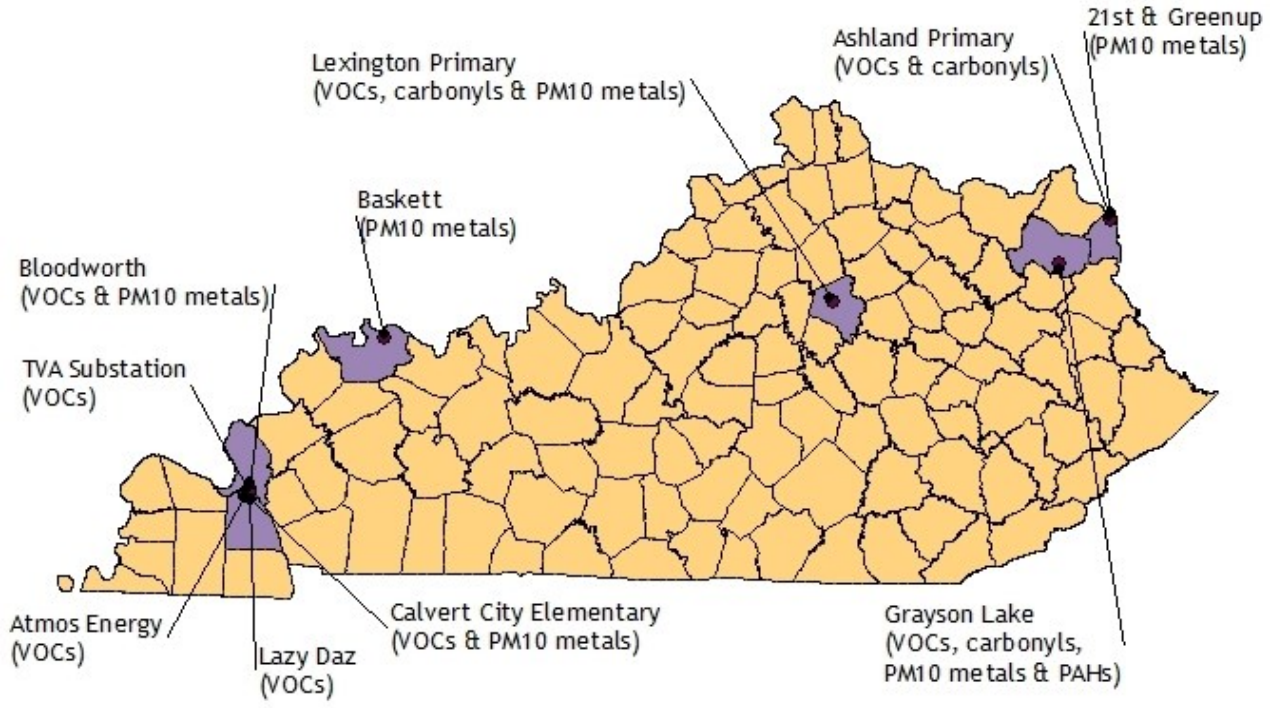


Figure 44: Hazardous air pollutant monitoring locations in Kentucky.

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 2014, the Division operated 11 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
- PM_{10} metals: Teflon® filters
- PAHs: polyurethane foam (PUF)/XAD-2® sorbent
- Cr^{6+}: 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 - 2014

Pollutant: Acetaldehyde
Method: TO-11A; Carbonyl sampler with DPNH cartridges
Data Interval: 24-hour
Units: Parts-per-billion (ppb)

County	Site	AQS-ID	# Obs	1st max	2nd max	3rd max	4th max	Annual Mean
Boyd	2924 Holt Street Ashland	21-019-0017	61	1.49	1.19	1.16	1.05	0.69
Carter	Camp Webb Grayson Lake	21-043-0500	61	0.99	0.90	0.82	0.77	0.48
Fayette	650 Newtown Pike Lexington	21-067-0012	55	1.54	1.35	1.30	1.29	0.86

Air Toxics Summary Report - 2014

Pollutant: Formaldehyde
Method: TO-11A; Carbonyl sampler with DPNH cartridges
Data Interval: 24-hour
Units: Parts-per-billion (ppb)

County	Site	AQS-ID	# Obs	1st max	2nd max	3rd max	4th max	Annual Mean
Boyd	2924 Holt Street Ashland	21-019-0017	61	4.91	4.55	4.34	4.23	1.86
Carter	Camp Webb Grayson Lake	21-043-0500	61	4.08	2.72	2.63	2.57	1.22
Fayette	650 Newtown Pike Lexington	21-067-0012	55	20.90	4.65	4.63	3.97	2.56

Metals

Air Toxics Summary Report - 2014

Pollutant: Antimony

Method: IO-3.5; Metals low volume PM_{10} monitor

Data Interval: 24-hour

Units: Nanograms per cubic meter (ng/m^3)

County	Site	AQS-ID	# Obs	1st max	2nd max	3rd max	4th max	Annual Mean
Boyd	21st & Greenup Ashland	21-019-0002	59	11.00	8.09	6.57	6.37	2.120
Carter	Camp Webb Grayson Lake	21-043-0500	56	1.61	1.46	1.41	1.22	0.608
Fayette	650 Newtown Pike Lexington	21-067-0012	56	2.85	2.74	2.62	2.32	1.122
Henderson	Baskett Fire Dept. Baskett	21-101-0014	58	2.76	2.48	1.56	1.42	0.734
Livingston	763 Bloodworth Rd Smithland	21-139-0004	12	0.89	0.85	0.64	0.62	0.464*
Marshall	563 East Fifth St Calvert City	21-157-0018	41	3.60	1.46	0.92	0.91	0.618

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

Air Toxics Summary Report - 2014

Pollutant: Arsenic

Method: IO-3.5; Metals low volume PM_{10} monitor

Data Interval: 24-hour

Units: Nanograms per cubic meter (ng/m^3)

County	Site	AQS-ID	# Obs	1st max	2nd max	3rd max	4th max	Annual Mean
Boyd	21st & Greenup Ashland	21-019-0002	59	10.10	3.58	3.29	3.24	1.150
Carter	Camp Webb Grayson Lake	21-043-0500	56	1.53	1.27	1.09	0.87	0.401
Fayette	650 Newtown Pike Lexington	21-067-0012	56	1.88	1.86	1.27	1.20	0.675
Henderson	Baskett Fire Dept. Baskett	21-101-0014	58	3.36	2.83	2.45	1.96	0.852
Livingston	763 Bloodworth Rd Smithland	21-139-0004	12	0.88	0.65	0.65	0.63	0.415*
Marshall	563 East Fifth St Calvert City	21-157-0018	41	1.75	1.65	1.31	1.13	0.549

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

Metals

Air Toxics Summary Report - 2014

Pollutant: Beryllium

Method: IO-3.5; Metals low volume PM_{10} monitor

Data Interval: 24-hour

Units: Nanograms per cubic meter (ng/m^3)

County	Site	AQS-ID	# Obs	1st max	2nd max	3rd max	4th max	Annual Mean
Boyd	21st & Greenup Ashland	21-019-0002	59	0.06	0.05	0.05	0.05	0.010
Carter	Camp Webb Grayson Lake	21-043-0500	56	0.03	0.03	0.02	0.02	0.008
Fayette	650 Newtown Pike Lexington	21-067-0012	56	0.06	0.04	0.04	0.04	0.015
Henderson	Baskett Fire Dept. Baskett	21-101-0014	58	0.06	0.06	0.05	0.05	0.017
Livingston	763 Bloodworth Rd Smithland	21-139-0004	12	0.02	0.02	0.02	0.01	0.010*
Marshall	563 East Fifth St Calvert City	21-157-0018	41	0.07	0.04	0.02	0.02	0.012

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

Air Toxics Summary Report - 2014

Pollutant: Cadmium

Method: IO-3.5; Metals low volume PM_{10} monitor

Data Interval: 24-hour

Units: Nanograms per cubic meter (ng/m^3)

County	Site	AQS-ID	# Obs	1st max	2nd max	3rd max	4th max	Annual Mean
Boyd	21st & Greenup Ashland	21-019-0002	59	0.77	0.73	0.63	0.60	0.240
Carter	Camp Webb Grayson Lake	21-043-0500	56	0.37	0.30	0.24	0.22	0.077
Fayette	650 Newtown Pike Lexington	21-067-0012	56	0.33	0.14	0.13	0.13	0.075
Henderson	Baskett Fire Dept. Baskett	21-101-0014	58	0.28	0.28	0.23	0.19	0.102
Livingston	763 Bloodworth Rd Smithland	21-139-0004	12	0.31	0.15	0.10	0.09	0.087*
Marshall	563 East Fifth St Calvert City	21-157-0018	41	0.22	0.16	0.15	0.13	0.078

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

Metals

Air Toxics Summary Report - 2014

Pollutant: Chromium

Method: IO-3.5; Metals low volume PM_{10} monitor

Data Interval: 24-hour

Units: Nanograms per cubic meter (ng/m^3)

County	Site	AQS-ID	# Obs	1st max	2nd max	3rd max	4th max	Annual Mean
Boyd	21st & Greenup Ashland	21-019-0002	59	20.20	17.00	14.60	13.10	8.150
Carter	Camp Webb Grayson Lake	21-043-0500	56	14.30	14.00	11.80	11.00	6.909
Fayette	650 Newtown Pike Lexington	21-067-0012	56	11.30	11.20	10.40	10.10	6.166
Henderson	Baskett Fire Dept. Baskett	21-101-0014	58	13.80	12.40	11.40	10.50	5.703
Livingston	763 Bloodworth Rd Smithland	21-139-0004	12	7.93	6.03	5.75	5.71	4.790*
Marshall	563 East Fifth St Calvert City	21-157-0018	41	11.90	11.20	11.00	10.30	7.064

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

Air Toxics Summary Report - 2014

Pollutant: Lead

Method: IO-3.5; Metals low volume PM_{10} monitor

Data Interval: 24-hour

Units: Nanograms per cubic meter (ng/m^3)

County	Site	AQS-ID	# Obs	1st max	2nd max	3rd max	4th max	Annual Mean
Boyd	21st & Greenup Ashland	21-019-0002	59	20.7	18.6	17.8	16.0	6.43
Carter	Camp Webb Grayson Lake	21-043-0500	56	3.9	3.3	3.1	2.7	1.43
Fayette	650 Newtown Pike Lexington	21-067-0012	56	8.7	6.1	6.0	3.9	2.13
Henderson	Baskett Fire Dept. Baskett	21-101-0014	58	6.0	3.8	3.3	3.0	1.80
Livingston	763 Bloodworth Rd Smithland	21-139-0004	12	2.7	2.4	2.2	2.1	1.49*
Marshall	563 East Fifth St Calvert City	21-157-0018	41	4.7	4.1	3.4	3.0	1.70

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

Metals

Air Toxics Summary Report - 2014

Pollutant: Manganese

Method: IO-3.5; Metals low volume PM_{10} monitor

Data Interval: 24-hour

Units: Nanograms per cubic meter (ng/m^3)

County	Site	AQS-ID	# Obs	1st max	2nd max	3rd max	4th max	Annual Mean
Boyd	21st & Greenup Ashland	21-019-0002	59	67.50	54.30	46.40	42.10	18.280
Carter	Camp Webb Grayson Lake	21-043-0500	56	24.80	16.10	12.30	9.56	3.915
Fayette	650 Newtown Pike Lexington	21-067-0012	56	15.90	15.60	14.60	13.00	5.925
Henderson	Baskett Fire Dept. Baskett	21-101-0014	58	14.80	1360	11.20	10.40	5.558
Livingston	763 Bloodworth Rd Smithland	21-139-0004	12	14.50	8.95	7.99	4.55	4.858*
Marshall	563 East Fifth St Calvert City	21-157-0018	41	22.30	13.90	12.00	9.29	5.543

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

Air Toxics Summary Report - 2014

Pollutant: Nickel

Method: IO-3.5; Metals low volume PM_{10} monitor

Data Interval: 24-hour

Units: Nanograms per cubic meter (ng/m^3)

County	Site	AQS-ID	# Obs	1st max	2nd max	3rd max	4th max	Annual Mean
Boyd	21st & Greenup Ashland	21-019-0002	59	9.87	9.25	8.62	8.50	2.240
Carter	Camp Webb Grayson Lake	21-043-0500	56	1.56	1.37	1.12	0.88	0.409
Fayette	650 Newtown Pike Lexington	21-067-0012	56	0.207	1.23	1.00	0.98	0.581
Henderson	Baskett Fire Dept. Baskett	21-101-0014	58	2.42	2.38	1.90	1.64	0.723
Livingston	763 Bloodworth Rd Smithland	21-139-0004	12	1.14	0.68	0.57	0.53	0.416*
Marshall	563 East Fifth St Calvert City	21-157-0018	41	1.79	1.26	1.19	0.92	0.547

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

Volatile Organic Compounds

Air Toxics Summary Report - 2014

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

County	Site	AQS-ID	# Obs	1st max	2nd max	3rd max	4th max	Annual Mean
Boyd	2924 Holt Street Ashland	21-019-0017	61	0.080	0.054	0.054	0.047	0.026
Carter	Camp Webb Grayson Lake	21-043-0500	56	0.034	0.031	0.030	0.030	0.017
Fayette	650 Newtown Pike Lexington	21-067-0012	58	0.077	0.068	0.068	0.061	0.030
Livingston	763 Bloodworth Rd Smithland	21-139-0004	60	2.22	0.387	0.314	0.218	0.078
Marshall	TVA Substation Calvert City	21-157-0014	58	2.660	1.240	1.060	0.575	0.176
Marshall	Atmos Energy Calvert City	21-157-0016	61	0.304	0.198	0.182	0.110	0.039
Marshall	563 East Fifth St Calvert City	21-157-0018	46	0.210	0.149	0.095	0.086	0.037
Marshall	4237 Gilbertsville Calvert City	21-157-0019	56	0.428	0.256	0.160	0.109	0.048

Volatile Organic Compounds

Air Toxics Summary Report - 2014

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

County	Site	AQS-ID	# Obs	1st max	2nd max	3rd max	4th max	Annual Mean
Boyd	2924 Holt Street Ashland	21-019-0017	61	0.056	0.054	0.054	0.053	
Carter	Camp Webb Grayson Lake	21-043-0500	56	0.070	0.026	0.025	0.023	
Fayette	650 Newtown Pike Lexington	21-067-0012	58	0.049	0.045	0.045	0.043	
Livingston	763 Bloodworth Rd Smithland	21-139-0004	60	0.462	0.325	0.083	0.070	
Marshall	TVA Substation Calvert City	21-157-0014	58	0.960	0.304	0.233	0.226	
Marshall	Atmos Energy Calvert City	21-157-0016	61	0.163	0.071	0.057	0.057	
Marshall	563 East Fifth St Calvert City	21-157-0018	46	0.073	0.056	0.052	0.044	
Marshall	4237 Gilbertsville Calvert City	21-157-0019	56	0.173	0.076	0.069	0.048	

Volatile Organic Compounds

Air Toxics Summary Report - 2014

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

County	Site	AQS-ID	# Obs	1st max	2nd max	3rd max	4th max	Annual Mean
Boyd	2924 Holt Street Ashland	21-019-0017	61	0.138	0.123	0.118	0.116	0.102
Carter	Camp Webb Grayson Lake	21-043-0500	56	0.124	0.118	0.115	0.114	0.096
Fayette	650 Newtown Pike Lexington	21-067-0012	58	0.122	0.118	0.117	0.113	0.097
Livingston	763 Bloodworth Rd Smithland	21-139-0004	60	0.365	0.354	0.299	0.148	0.116
Marshall	TVA Substation Calvert City	21-157-0014	58	0.486	0.453	0.356	0.340	0.139
Marshall	Atmos Energy Calvert City	21-157-0016	61	0.192	0.187	0.157	0.131	0.108
Marshall	563 East Fifth St Calvert City	21-157-0018	46	0.173	0.165	0.140	0.132	0.111
Marshall	4237 Gilbertsville Hwy Calvert City	21-157-0019	56	0.343	0.214	0.138	0.130	0.112

Air Toxics Summary Report - 2014

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

County	Site	AQS-ID	# Obs	1st max	2nd max	3rd max	4th max	Annual Mean
Boyd	2924 Holt Street Ashland	21-019-0017	61	0.026	0.025	0.024	0.024	0.018
Carter	Camp Webb Grayson Lake	21-043-0500	56	0.024	0.023	0.023	0.023	0.016
Fayette	650 Newtown Pike Lexington	21-067-0012	58	0.052	0.030	0.029	0.026	0.019
Livingston	763 Bloodworth Rd Smithland	21-139-0004	60	2.740	1.340	0.884	0.820	0.199
Marshall	TVA Substation Calvert City	21-157-0014	58	6.750	5.940	5.210	5.030	0.887
Marshall	Atmos Energy Calvert City	21-157-0016	61	1.090	0.590	0.590	0.541	0.142
Marshall	563 East Fifth St Calvert City	21-157-0018	46	0.496	0.451	0.433	0.393	0.121
Marshall	4237 Gilbertsville Hwy Calvert City	21-157-0019	56	2.780	1.330	0.999	0.890	0.238

Volatile Organic Compounds

Air Toxics Summary Report - 2014

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

County	Site	AQS-ID	# Obs	1st max	2nd max	3rd max	4th max	Annual Mean
Boyd	2924 Holt Street Ashland	21-019-0017	61	0.373	0.052	0.024	0.021	
Carter	Camp Webb Grayson Lake	21-043-0500	56	0.013	0.011	0.010	0.010	
Fayette	650 Newtown Pike Lexington	21-067-0012	58	0.126	0.054	0.022	0.021	
Livingston	763 Bloodworth Rd Smithland	21-139-0004	60	0.024	0.016	0.014	0.013	
Marshall	TVA Substation Calvert City	21-157-0014	58	0.054	0.042	0.031	0.026	
Marshall	Atmos Energy Calvert City	21-157-0016	61	0.027	0.027	0.027	0.018	
Marshall	563 East Fifth St Calvert City	21-157-0018	46	0.047	0.046	0.016	0.014	
Marshall	4237 Gilbertsville Hwy Calvert City	21-157-0019	56	0.035	0.031	0.027	0.022	

Air Toxics Summary Report - 2014

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

County	Site	AQS-ID	# Obs	1st max	2nd max	3rd max	4th max	Annual Mean
Boyd	2924 Holt Street Ashland	21-019-0017	61	0.006	0.005	ND	ND	ND
Carter	Camp Webb Grayson Lake	21-043-0500	56	0.009	0.008	0.006	ND	ND
Fayette	650 Newtown Pike Lexington	21-067-0012	58	0.011	0.007	0.007	0.007	0.001
Livingston	763 Bloodworth Rd Smithland	21-139-0004	60	0.012	0.011	0.009	0.009	0.002
Marshall	TVA Substation Calvert City	21-157-0014	58	0.015	0.012	0.012	0.012	0.002
Marshall	Atmos Energy Calvert City	21-157-0016	61	0.010	0.010	0.010	0.009	0.001
Marshall	563 East Fifth St Calvert City	21-157-0018	46	0.010	0.008	0.008	0.007	0.001
Marshall	4237 Gilbertsville Hwy Calvert City	21-157-0019	56	0.011	0.010	0.009	0.009	0.001

ND= Analyte not detected.

Volatile Organic Compounds

Air Toxics Summary Report - 2014

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

County	Site	AQS-ID	# Obs	1st max	2nd max	3rd max	4th max	Annual Mean
Boyd	2924 Holt Street Ashland	21-019-0017	61	ND	ND	ND	ND	ND
Carter	Camp Webb Grayson Lake	21-043-0500	56	ND	ND	ND	ND	ND
Fayette	650 Newtown Pike Lexington	21-067-0012	58	0.011	0.010	0.009	0.007	0.001
Livingston	763 Bloodworth Rd Smithland	21-139-0004	60	0.036	0.033	0.020	0.014	0.003
Marshall	TVA Substation Calvert City	21-157-0014	58	0.044	0.022	0.020	0.018	0.004
Marshall	Atmos Energy Calvert City	21-157-0016	61	0.038	0.019	0.018	0.017	0.004
Marshall	563 East Fifth St Calvert City	21-157-0018	46	0.023	0.022	0.020	0.017	0.003
Marshall	4237 Gilbertsville Hwy Calvert City	21-157-0019	56	0.020	0.016	0.014	0.014	0.002

ND= Analyte not detected.

Volatile Organic Compounds

Air Toxics Summary Report - 2014

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

County	Site	AQS-ID	# Obs	1st max	2nd max	3rd max	4th max	Annual Mean
Boyd	2924 Holt Street Ashland	21-019-0017	61	0.010	0.004	ND	ND	ND
Carter	Camp Webb Grayson Lake	21-043-0500	56	0.016	0.005	0.005	ND	ND
Fayette	650 Newtown Pike Lexington	21-067-0012	58	0.018	0.007	0.004	ND	0.001
Livingston	763 Bloodworth Rd Smithland	21-139-0004	60	0.657	0.441	0.163	0.158	0.054
Marshall	TVA Substation Calvert City	21-157-0014	58	9.320	2.140	0.491	0.432	0.284
Marshall	Atmos Energy Calvert City	21-157-0016	61	2.910	2.850	1.660	1.510	0.300
Marshall	563 East Fifth St Calvert City	21-157-0018	46	0.235	0.209	0.112	0.101	0.031
Marshall	4237 Gilbertsville Hwy Calvert City	21-157-0019	56	0.464	0.424	0.324	0.238	0.050

ND= Analyte not detected.

Volatile Organic Compounds

Air Toxics Summary Report - 2014

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

County	Site	AQS-ID	# Obs	1st max	2nd max	3rd max	4th max	Annual Mean
Boyd	2924 Holt Street Ashland	21-019-0017	61	3.880	0.542	0.467	0.407	0.270
Carter	Camp Webb Grayson Lake	21-043-0500	56	0.458	0.265	0.239	0.233	0.132
Fayette	650 Newtown Pike Lexington	21-067-0012	58	0.333	0.322	0.296	0.288	0.194
Livingston	763 Bloodworth Rd Smithland	21-139-0004	60	0.876	0.807	0.659	0.612	0.193
Marshall	TVA Substation Calvert City	21-157-0014	58	3.100	1.040	0.924	0.775	0.316
Marshall	Atmos Energy Calvert City	21-157-0016	61	0.578	0.454	0.421	0.399	0.193
Marshall	563 East Fifth St Calvert City	21-157-0018	46	0.431	0.403	0.343	0.329	0.176
Marshall	4237 Gilbertsville Hwy Calvert City	21-157-0019	56	0.962	0.667	0.520	0.464	0.220

Polycyclic Aromatic Hydrocarbons

Air Toxics Summary Report - 2014

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

Pollutant	# Obs	1st max	2nd max	3rd max	4th max	Annual Mean
Napthalene (TSP)	58	49.200	42.400	38.600	25.800	13.678
Acenapthene (TSP)	58	0.950	0.942	0.825	0.796	0.299
Acenapthtylene (TSP)	58	0.278	0.254	0.176	0.135	0.035
Fluorene (TSP)	58	1.410	1.400	1.240	1.120	0.236
Phenanthrene (TSP)	58	3.480	3.150	3.070	3.010	1.647
Anthracene (TSP)	58	0.192	0.165	1.480	0.142	0.056
Fluoranthene (TSP)	58	2.090	1.240	1.060	1.040	0.537
Pyrene (TSP)	58	1.910	0.931	0.766	0.754	0.330
Chrysene (TSP)	58	0.827	0.432	0.304	0.217	0.083
Coronene (TSP)	58	0.183	0.093	0.085	0.083	0.016
Benzo (a) anthracene (TSP)	58	0.509	0.376	0.121	0.105	0.036
Benzo (b) fluoranthene (TSP)	58	0.931	0.509	0.438	0.324	0.102
Benzo (k) fluoranthene (TSP)	58	0.226	0.205	0.112	0.072	0.020
Benzo (e) pyrene (TSP)	58	0.405	0.264	0.197	0.154	0.047
Dibenzo (a, h) anthracene (TSP)	58	0.087	0.053	0.020	0.019	0.003
Indeno (1,2,3-cd) pyrene (TSP)	58	0.542	0.278	0.230	0.184	0.057

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 $\mu g/m^3$ to 0.15 $\mu g/m^3$. Unlike the other NAAQS pollutants that monitor for area-wide impacts, the lead NAAQS required state, tribal, and local agencies to monitor near sources that emit more than one ton of lead per year. The division identified three sources that emitted over one ton of lead annually and began monitoring near the sources in 2010. In December 2010, the EPA released a new set of monitoring requirements. The new monitoring rule requires lead monitoring near sources that emit more than 0.5 tons per year. The new rule also requires lead monitoring at sites designated as NCore in core-based statistical areas with populations greater than 500,000. LMAPCD operates one such NCore site.

Health and Environmental Impacts
Ingestion of lead is the first major pathway of exposure. Inhalation is the second leading pathway of exposure for lead. Only 20 percent to 70 percent of ingested lead is absorbed into the body whereas almost all of the lead inhaled is absorbed into the body. Children absorb lead into their system faster than an adult.
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.

Ozone (O_3)

Ozone (O_3) 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
The current primary standard for ozone is an 8-hour standard set at 75 ppb. However, on November 25, 2014, EPA proposed updating the primary standard to a range between 65 - 70 ppb. The new standard is expected to be finalized by Oct. 1, 2015.

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

How is O_3 monitored?
Ozone is typically monitored from March 1st through Oct. 31st each year, when meteorological conditions are most conducive to the formation of ozone; however, the LMAPCD NCore site collects ozone data year-round. Analyzers, which operate continuously, monitor ozone by using the ultraviolet photometry method. In this method, ambient air is drawn into a sample cell and a beam of ultraviolet light is passed through the cell. Ozone absorbs ultraviolet light and a decrease in the intensity of the light indicates the presence of ozone. The intensity of the light is first measured with no ozone present to determine a reference value. An ambient sample is then introduced and the intensity of the resultant light is measured by an ultraviolet detector. The amount of light absorbed by the sample indicates the level of ozone present. Data from the analyzers are transmitted into an automated data storage system.

Particulate Matter ($PM_{2.5}$)

Particulate matter ($PM_{2.5}$) 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 $\mu g/m^3$, and a 24-hour standard set at 35 $\mu g/m^3$. The secondary standard to protect public welfare is an annual standard set at 15 $\mu g/m^3$.

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

How is $PM_{2.5}$ monitored?
The division currently operates continuous Tapered Element Oscillating Microbalance (TEOM) monitors, continuous Federal Equivalent Monitor (FEM) Beta Attenuation Monitors (BAM), and manual intermittent Federal Reference Method (FRM) and FEM samplers. However, only the FRM and FEM manual intermittent samplers are used for comparisons to the NAAQS. The BAM and 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

CRITERIA POLLUTANTS, Cont'd.

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
- Elemental Carbon
- Crustal Component (trace elements, fine soil)
- Other ($PM_{2.5}$ mass unaccounted for by analytical methods)

Particulate Matter (PM_{10})

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

Current PM_{10} Standard
The current NAAQS for PM10 (both primary and secondary) is a 24-hour standard set at 150 $\mu g/m^3$. The estimated number of exceedances must be equal to or less than one, on average, over 3 years.

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

Particulate matter can soil and damage a wide range of man-made items such as building surfaces. PM_{10} damages vegetation by interfering with plant photosynthesis due to the formation of a film on leaves that

CRITERIA POLLUTANTS, Cont'd.

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 SO2 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.

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air.ky.gov

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APPENDIX D: GLOSSARY OF ABBREVIATIONS

AHERA Asbestos Hazard Emergency Response Act

AQI Air Quality Index

BACT Best Available Control Technology

CAA Clean Air Act

CO Carbon Monoxide

CO_2 Carbon Dioxide

CPT Cost per Ton

CSAPR Cross-State Air Pollution Rule

DAQ Division for Air Quality

DEP Department for Environmental Protection

DERA Diesel Emissions Reduction Act

EEC Energy and Environment Cabinet

EGU Electric Generating Unit

EPA Environmental Protection Agency

GHG Greenhouse Gas

HAP Hazardous Air Pollutant

HPV High Priority Violation

KAR Kentucky Administrative Regulation

KORA Kentucky Open Records Act

KRS Kentucky Revised Statute

LMAPCD Louisville Metropolitan Air Pollution Control District

LOW Letter of Warning

MACT Maximum Achievable Control Technology

NAAQS National Ambient Air Quality Standard

NATTS National Air Toxics Trends Stations

NESHAP National Emission Standard for Hazardous Air Pollutants

NO_x Nitrogen Oxides

NOV Notice of Violation

NPS National Park Service

NSR New Source Review

O_3 Ozone

Pb Lead

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

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

PTE Potential to Emit

QAPP Quality Assurance Project Plan

RATA Relative Accuracy Test Audit

RTF Regulatory Time Frame

SEDC Southeast Diesel Collaborative

SIP State Implementation Plan

SO_2 Sulfur Dioxide

SOP Standard Operating Procedure

TEMPO Tools for Environmental Management and Protection Organizations

TPY Tons per year

TRI Toxics Release Inventory

VISTAS Visibility Improvement State and Tribal Association of the Southeast

VOC Volatile Organic Compound

APPENDIX E: GLOSSARY OF TERMS

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

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

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

Air Toxics See Toxic Air Pollutant.

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

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

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

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

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

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

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

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

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

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

Inspection A scheduled determination of compliance with an existing regulation.

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

Major Source A stationary source that emits and 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 When an area 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 PM_{10})		
24-Hour Average	150 µg/m^3 (5)	Same as primary
Particulate Matter (measured as $PM_{2.5}$)		
Annual Average	12.0 µg/m^3 (6)	15.0 µg/m^3 (6)
24-Hour Average	35 µg/m^3 (7)	Same as primary
Ozone		
8-Hour Average	0.075 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 at left.

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

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

Footnotes:

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

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

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

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

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

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

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

(8) To attain this standard, the weighted 3-year average of the fourth-highest daily maximum 8-hour average ozone concentrations measured at each monitor within an area over each year must not exceed 0.075 ppm (effective May 27, 2008).

(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).

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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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