Kentucky Division for Air Quality
2014 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

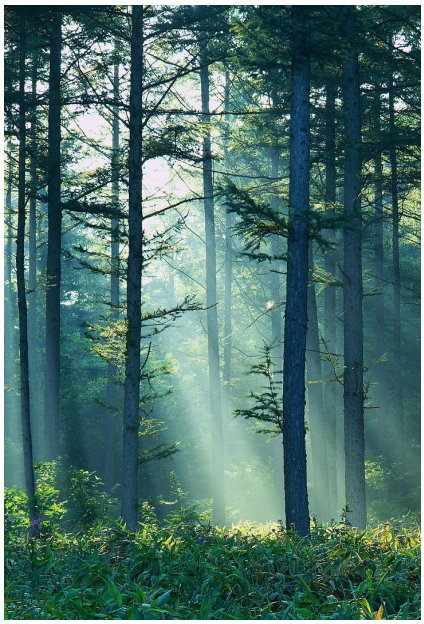
FROM THE DIRECTOR

Dear Reader,

On behalf of the Division for Air Quality (DAQ), I want to thank you for taking the time to review the division's 2014 Annual Report, which details the division's mission, function, and commitment to protecting human health and the environment.

Kentucky's continued trend of air quality improvement is evident in the charts found in the Technical Services Branch section of this report. These achievements are only obtained through:

- developing effective regulations and control strategies by our Program Planning Branch;
- issuing appropriate permits containing all applicable requirements by the Permit Review Branch; and
- inspecting sources of air emissions and enforcing emission limitations by the Field Operations Branch.



Our collective success and the accomplishments of each branch are dependent on our administrative support staff, who provide the necessary resources and support to carry out DAQ's mission and obligations.

Air quality in Kentucky has improved dramatically in the past several decades. For example, coal-fired power plants emitted approximately 1.5 million tons of sulfur dioxide (SO_2) in 1976. In comparison, SO_2 emissions from Kentucky coal-fired power plants in 2013 totaled only 188,114 tons. After the federal Mercury and Air Toxics Standards are implemented and enforced, the division is projecting annual emissions of SO_2 from coal-fired power plants to be further reduced to less than 100,000 tons.

This significant decrease in SO_2 emissions is good news, but there's still more work to be done. In 2013, two air monitoring sites exceeded the 1-hour SO_2 National Ambient Air Quality Standard (NAAQS). These two monitoring sites have been significantly impacted by coal-fired power plants, one of which has since shut down while the other facility is upgrading its air pollution control equipment. The division projects that each of these sites will attain the NAAQS in the near future and prior to the statutory deadline.

I am also pleased to report that Kentucky is meeting the NAAQS for particulate matter, lead, carbon monoxide, and nitrogen oxides. It should also be noted that all of the 26 ozone monitors operated in the Commonwealth recorded ozone concentrations well below the NAAQS in 2013.

Finally, I would be remiss if I do not acknowledge and thank our previous director, John Lyons, for his dedicated service to the division. After leading DAQ for 12 years, Lyons now leads the Cabinet's efforts to guide climate policy. In a memo to Cabinet staff, Secretary Peters announced the promotion of Mr. Lyons saying, "I believe it is important that we have someone at the Cabinet who can help study and recommend strategies for Kentucky as the federal process moves forward. I firmly believe that John Lyons is the person to lead that effort." We congratulate John and look forward to working with him to address the significant air quality issues related to pending climate policies.

Again, thank you for your interest and review of the Division for Air Quality's 2014 Annual Report. If you have questions, comments, or additional information requests, please do not hesitate to contact us.

Sincerely,

Sean Alteri

Sean Alteri
Director

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INTRODUCTION

The Division for Air Quality (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 164 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 FY 2013 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.

Tactic 2.3: Provide technical assistance to regulated entities.

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 offroad 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

Originally operating out of the state health department, the Kentucky Air Pollution Control Commission was the state's first air pollution control program, in operation as early as the 1940s. Today, as in its beginning, air pollution control is divided among a hierarchy of state, federal, and local programs.

Federal Authority

The CAA authorizes two permitting programs at the federal level. The New Source Review (NSR) program has been around since 1975 and requires extensive review of applications for major new or modified air contaminant sources prior to issuance of construction permits. Title V of the 1990 CAA Amendments authorized for the first time a federally enforceable operating permit program.

Local Authority

KRS 224 recognizes the right of counties to develop their own air pollution control districts. 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.

Environmental inspector Jennifer Brown works with one of DAQ's $PM_{2.5}$ monitors. (Photo: DAQ)

Major Actions Affecting Climate Change Policy in FY 2014

On June 25, 2013, the Obama administration released the President's Climate Action Plan, which outlined three elements to combat climate change: (1) cut carbon pollution in America, (2) prepare the United States for the impacts of climate change, and (3) lead international efforts to address global climate change. To address carbon pollution in America, the plan targets the promotion of renewable energy coupled with cutting carbon pollution from power plants.

In September 2013, with pending federal climate policies in the works, the Energy and Environment Cabinet (EEC) appointed DAQ Director John Lyons to a new position as assistant secretary for climate policy. Under Lyons' direction, EEC and DAQ staff worked hard to guide EPA in the development of rules for existing power plants to minimize economic impact on Kentucky and other manufacturing states that rely on affordable electricity.

EPA has identified six key greenhouse gases (GHGs), so-called because of their heat-trapping potential. Those gases are listed below, in order from the highest to lowest emissions:

- Carbon dioxide (CO_2)
- Methane (CH_4)
- Nitrous Oxide (N_2O)
- Hydrofluorocarbons (HFC)
- Perfluorochemicals (PFC)
- Sulfur Hexafluoride (SF_6)

On Sept. 20, 2013, EPA issued the first of two major proposed rulemakings to reduced greenhouse gas (GHG) emissions from power plants. To address New Source Performance Standards (NSPS), EPA issued the Proposed Rule for New Sources under CAA Section 111(b). The NSPS proposal was published in the Federal Register on Jan. 8, 2014, and applies only to ***new*** gas-fired and coal-fired power plants.

Photo: USDA NRCS

The proposed rule sets the following carbon emission limits:

1,000 lbsCO_2/MWh for natural gas-fired power plants

1,100 lbsCO_2/MWh for coal-fired power plants

In comments submitted to EPA about the NSPS 111 (b) rule, the EEC made the following points:

- The rule would require partial carbon capture and storage (CCS) for coal-fired power plants. CCS has not been adequately demonstrated on a commercial scale.
- The emission standard for coal is unreasonable. EEC recommended a standard that can be achieved using supercritical coal and ultimately with ultra-supercritical coal technology. Such technology enables higher efficiency and lower emissions per megawatt.
- EPA did not consider costs and economic impacts.
- The rulemaking constitutes a significant energy action and inappropriately sets energy policy.

The second half of EPA's carbon limiting proposals for power plants came on June 2, 2014. On that date, EPA issued the Proposed Rule for Existing Sources under CAA Section 111(d). The rule was published in the Federal Register on June 18, 2014.

This rule addresses carbon pollution from *existing* fossil-fueled power plants, setting state-specific targets that are meant to reflect each state's existing resource mix and other factors. Nationwide, the proposal aims for an 18 percent reduction in GHG emissions by 2030, using a 2012 emissions baseline. For Kentucky, EPA proposes an interim goal of 1,844 lbsCO_2/MWh to be met by 2020 with an ultimate target of 1,763 lbsCO_2/MWh by 2030.

Photo: USDA NRCS

2013 Kentucky GHG Emissions

Although Kentucky and other states are not required to report GHG emissions on behalf of facilities, DAQ's Emissions Inventory section has collected GHG data when available through existing AP-42 emission factors. AP-42 emission factors are the numbers that industry and air quality agencies use to calculate emission rates in cases where other data are not available.

In calendar year 2012, data was collected for Kentucky emissions of carbon dioxide (96,327,381 tons annual emissions reported), methane (112,560 tons annual emissions reported), and nitrous oxide (3,736 tons annual emissions reported). In sum, there were 90,581,859 metric tons of CO_{2e} reported in calendar year 2013.

The 111(d) rule establishes guidelines for states to follow in developing their plans, allowing a range of options such as energy efficiency and fuel switching to enable compliance.

EPA will receive comments on the 111(d) rule until Oct. 16, 2014. At the time of publication of this report, DAQ and EEC staff was studying the 1,700-page 111(d) proposal, meeting with stakeholders, and preparing comments on behalf of the Commonwealth.

Final rules for existing, new and modified/ reconstructed sources are scheduled to be issued June 1, 2015. After that, states will have until June 30, 2016 to submit Section 111(d) implementation plans for existing sources. EPA requires the plan to be "quantifiable, enforceable, and permanent" and reductions must be verifiable and non-duplicative. If a state fails to submit – or if EPA disapproves – then EPA will issue a federal plan.

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. DAQ's Environmental Education Specialist Roberta Burnes served as KAEE's vice president and board member during FY 2014, and also presented at the annual conference.

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. (Former) DAQ Director John Lyons served on the KCFC board in FY 2014. DEP participates 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 (EE) is an essential tool in promoting environmental stewardship. The division utilizes EE in numerous ways to increase awareness of air quality and its importance in our lives, and to encourage positive actions that protect the air we breathe. DAQ's EE programs promote critical thinking skills that enable individuals to make informed decisions about environmental issues.

DAQ's EE program reaches a diverse audience across the Commonwealth including students, teachers, firefighters, emergency management, asthma educators, businesses, and solid waste coordinators. In addition to the division's full-time EE Specialist, field office staff assist with regional outreach programs as requested. DAQ operates a toll-free Education Hotline to request educational materials or outreach: 800-928-0047.

Environmental Education Training

DAQ's EE specialist coordinates outreach and communications for the division. However, there are times during the year when requests for outreach far exceed the ability of one person to fulfill them. For this reason, DAQ held a special training for staff from regional field offices who had expressed interest in providing occasional outreach during busy times of the year. The training was led by Roberta Burnes, DAQ EE specialist, and Elizabeth Schmitz, executive director of the Kentucky Environmental Education Foundation.

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

Environmental Education Outreach

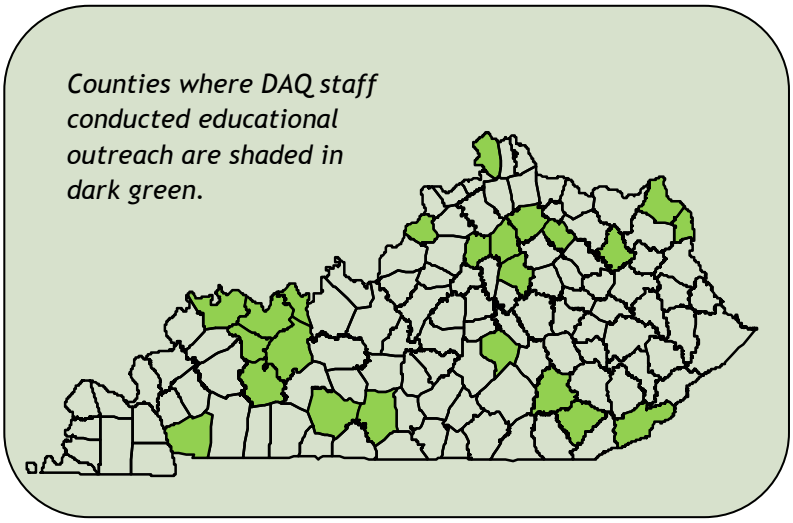
The division's EE program continues to reach thousands of Kentuckians each year, and 2014 was no exception. EE programs reached 11,088 people in 21 counties during FY 2014. This is a significant increase over previous years due to several factors:

- Ten field staff attended a two-day communications and outreach training prior to the busy spring outreach season. This enables DAQ to extend its reach into the community and attend several new events in April and May.
- Staff attended an increased number of schoolwide science fairs and field days in FY 2014.
- Staff also attended several fire association meetings and one statewide training school.

Staff visited the following counties in FY 2014:

Barren	Harlan	Nicholas
Boone	Harrison	Ohio
Boyd	Henderson	Oldham
Daviess	Knox	Rowan
Fayette	Laurel	Scott
Franklin	Lincoln	Trigg
Greenup	McLean	Warren
Hancock	Muhlenberg	

Figure 1 (Page 8) shows the numbers for each major audience reached by DAQ's outreach. School programs were the largest segment of our audience with 4,520 students reached. The majority of these students (3,334) received direct, face-to-face contact with DAQ staff presenting educational programs about air quality and energy. DAQ staff also set up hands-on displays at school science fairs and festivals, reaching an additional 1,125 students. Most students in DAQ's educational programs are upper elementary to middle school-aged.



General public programs drew the second -largest audience (4,110) as DAQ staff participated in several large festivals in the spring, including:

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

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

Earth Day Celebrations

Division staff attend several large Earth Day festivals across Kentucky every spring. This year, DAQ was a sponsor of the Energy and Environment Cabinet's Earth Day celebration in Frankfort. This event was held on the lawn of the Old State House and attracted several hundred people.

Earth Day outreach in FY 2014 focused on the connection between transportation and air quality. Children and adults learned how to check their tire pressure, why engine idling is bad for engines and bad for the air, and how to maximize fuel economy through eco-driving techniques. DEP's Chevy Volts were on display as well.

Ellie Shera, age 11, learns about the connection between proper tire pressure and air quality at the EEC Earth Day celebration. (Photo: DAQ)

Air Quality Awareness Week

The first week in May is National Air Quality Awareness Week. Since properly inflated tires can improve fuel economy and reduce emissions, DAQ held a tire pressure clinic for DEP employees. More than 60 people attended to have their tires checked and inflated to proper pressure.

Brennen Shera, age 5, learns how to use a tire pressure gauge at the EEC Earth Day celebration in Frankfort. (Photo: DAQ)

Open Burning

Illegal open burning continues to be a serious health concern in Kentucky. According to the EPA, backyard burning is now the leading quantified source of airborne dioxins in the U.S. Dioxins are clinically confirmed cancer-causing pollutants.

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 Spanish-language version is also available.
- DAQ has established an open burning hotline (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.

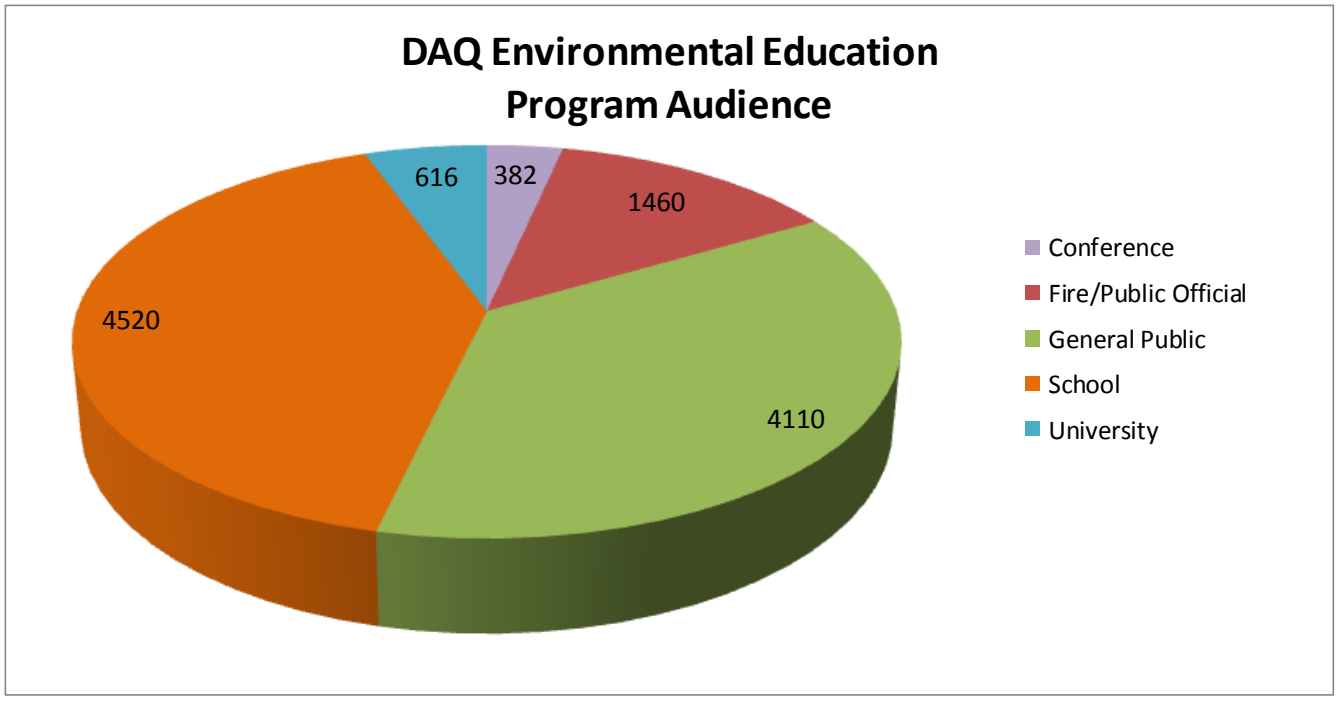


Figure 1: The Division for Air Quality's environmental education programs reached more than 11,000 people during FY 2014. School and public programs comprised 77 percent of the audience.

DAQ Environmental Technologist Chris Ewing and EE Specialist Roberta Burnes share air quality information at the Climate Change and Livability conference held last spring. (Photo: DAQ)

- Staff partners with local fire departments across Kentucky, providing training about the open burning regulation to 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.

- Three posters educate about the health hazards associated with burning trash. The posters are displayed in state parks, local government offices, and other public places across the Commonwealth.

- Staff attends several school and public programs and festivals throughout the year, distributing information about open burning to thousands of people.

DAQ Field Inspector Ashley Adams talks with fire fighters about open burning at a state fire school conference. (Photo: DAQ)

- 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 the open burning brochure.

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

- Open burning education is also included in articles, press releases, radio interviews, and on DAQ's Facebook page. Digital copies of open burning resources are available on the division's website, but the public may also request hard copies of posters and brochures by calling DAQ's education hotline at 800-928-0047.

Indoor Air Quality

Indoor air quality (IAQ) is not regulated by the division. Nevertheless, DAQ receives numerous calls and requests for information about IAQ, ranging from mold to radon. For this reason, DAQ partnered with the University of Kentucky Cooperative Extension Service to create a new indoor air quality publication for the general public. The publication includes a checklist and strategies for troubleshooting IAQ challenges in the home.

Green Fleets of the Bluegrass

On Dec. 17, 2013, DEP was recognized as the Greenest State Fleet by Kentucky Clean Fuels Coalition (KCFC). The award was presented at historic Boone Tavern in Berea where DEP staff arrived in green fleet style driving one of the department's Chevrolet Volts.

DEP has been a member of the KCFC Green Fleet program since 2011 and now holds the highest fleet rating by KCFC. The Division for Air Quality continues to coordinate the department's participation in the program. As a Green Fleets member, DEP strategically manages its fleet and now operates fewer conventional vehicles and drives a larger percentage of "green" miles. DEP works to ensure the vehicles are consistently maintained for longer vehicle lifetimes.

Over the past year, the average fleet miles per gallon increased to just over 19. DEP's fleet currently consists of 255 passenger vehicles, including four plug-in electric and 27 hybrid vehicles. In addition, DAQ began work on an idle-reduction initiative. Static cling decals with an idle-reduction message are now displayed in all fleet vehicles to remind drivers to avoid unnecessary idling.

DEP's fleet efficiency standards are part of the 2007 Governor's Energy Plan, which aims for a 50 percent improvement in fuel economy by 2025. All of these efforts add up to substantial savings and significant benefits for the environment.

Above: New static cling decals encourage drivers and the public to reduce unnecessary vehicle idling.

Above: EE Specialist Roberta Burnes explains how a hybrid-electric vehicle works to students at Jones Middle School in Boone County (Photo: Jones Middle School) . Right: One of DEP's Volts and charging station. (Photo: DAQ)

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 are located in eight regional offices, 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 109 air monitoring units located at 32 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.

For a map of DAQ's regional field offices, see Page 104 of this report.

"The Field Operations Branch welcomed several new staff last year, while maintaining a high level of inspections and responding to air quality complaints. Field staff completed more than 3900 inspections and responded to more than 1500 complaints."

Kevin Flowers
Field Operations
Branch Manager

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:

· Number of major stationary source inspections conducted (Figure 3, see Page 13);
· Number of minor stationary source inspections conducted (Figure 4, see Page 13);
· Compliance rate of stationary source inspections (Figure 5, see Page 14);
· Rate of compliance with 401 KAR 63:005 - open burning (Figure 7, see Page 16);
· Rate of compliance with 401 KAR 63:010 - fugitive emissions (Figure 8, see Page 16); and
· Rate of compliance with 401 KAR 53:010 - odor (Figures 9-10, see Page 17)
· Number of asbestos inspections conducted (Figure 11, see Page 18)

In calendar year 2013, FOB staff completed 3,949 compliance inspections of various types at mostly permitted sources (major Title V, minor); 89 percent of inspected sources were found to be compliant (Figure 6). 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 3) are located in areas of the state with a higher number of major permitted facilities, which include power plants, manufacturing facilities and chemical processing plants. The regional offices with more inspections for minor sources tend to be located in areas of the state with a smaller population base, leading to more minor pollution sources, such as auto body/ paint shops, dry cleaners, non-coal mineral processing facilities, and coal-mining related activities (Figure 4).

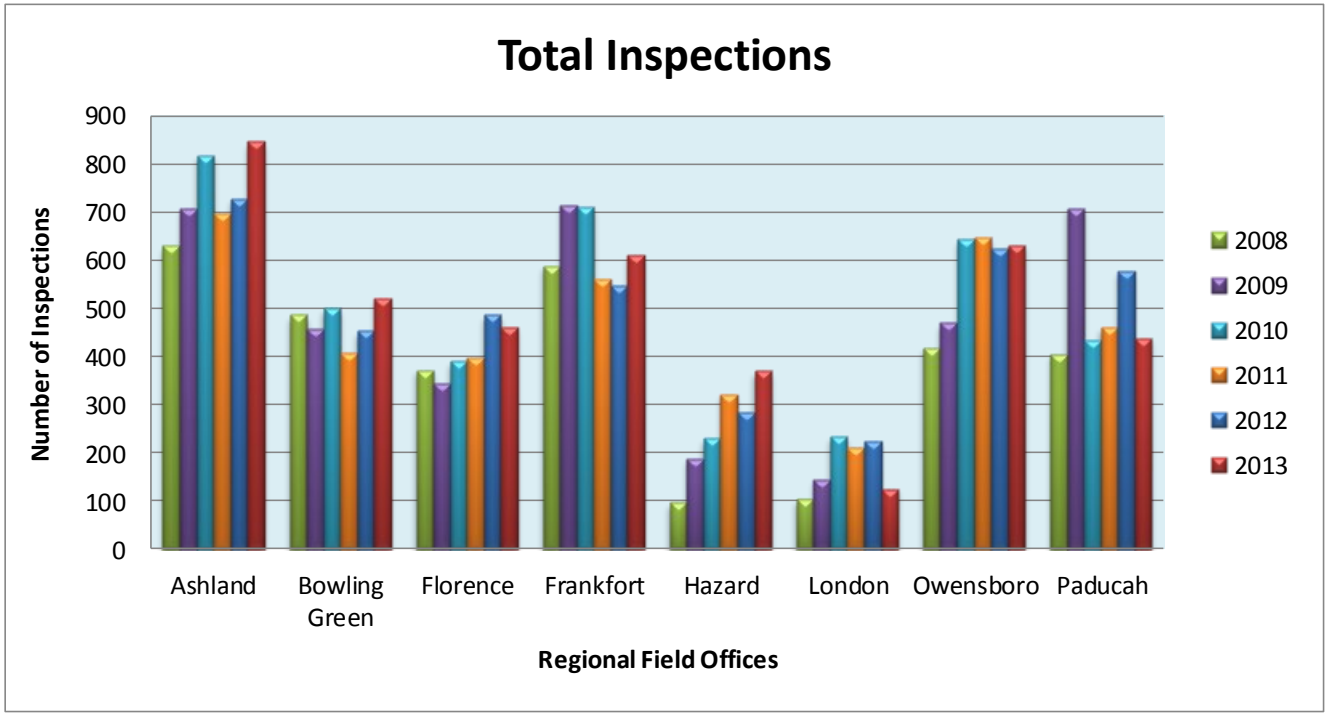


Figure 2: The total number of inspections at regulated facilities may vary based on vacancies in staffing or staff tenure in a particular office.

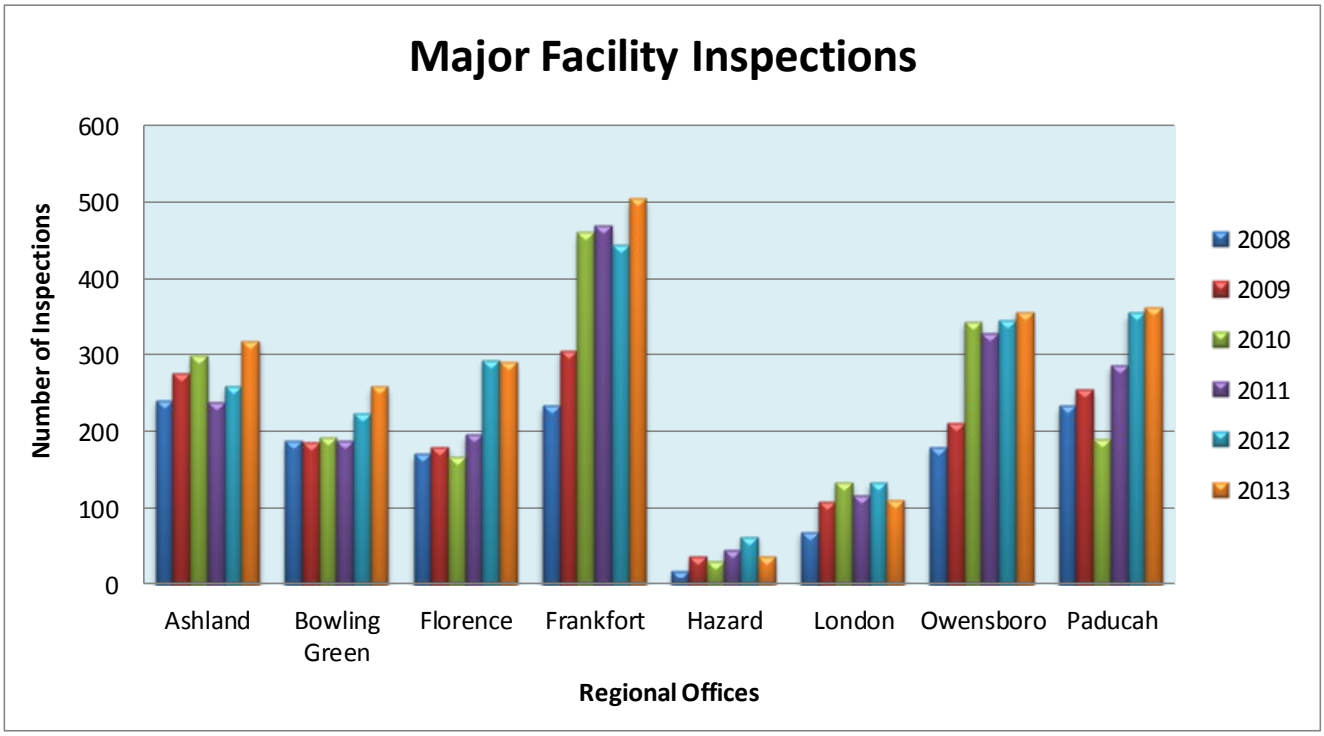


Figure 3: Number of major stationary facility inspections in Kentucky. The regional offices with more inspections are located in areas of the state with more major permitted facilities. Major permitted facilities include power plants, manufacturing facilities and chemical processing plants.

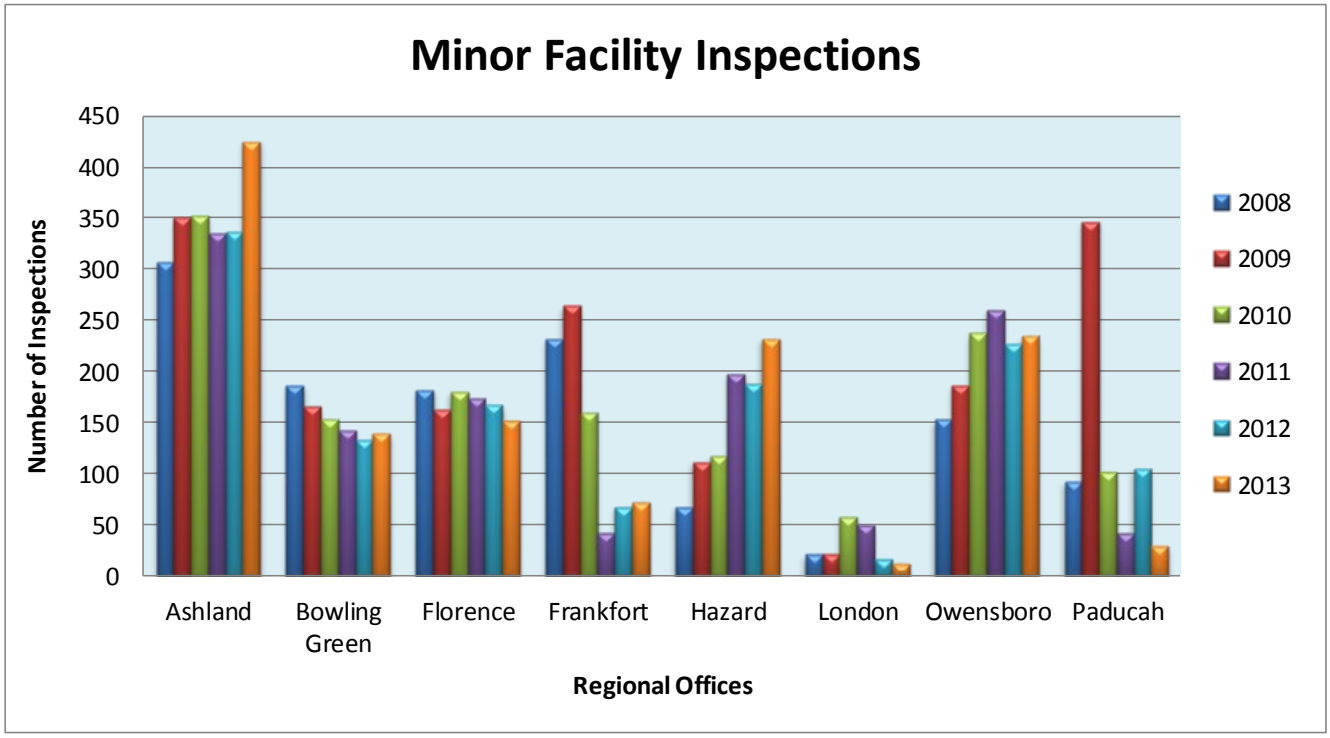


Figure 4: Number of minor stationary source inspections. Minor pollution sources include auto body paint shops, dry cleaners, and non-coal mineral processing facilities.

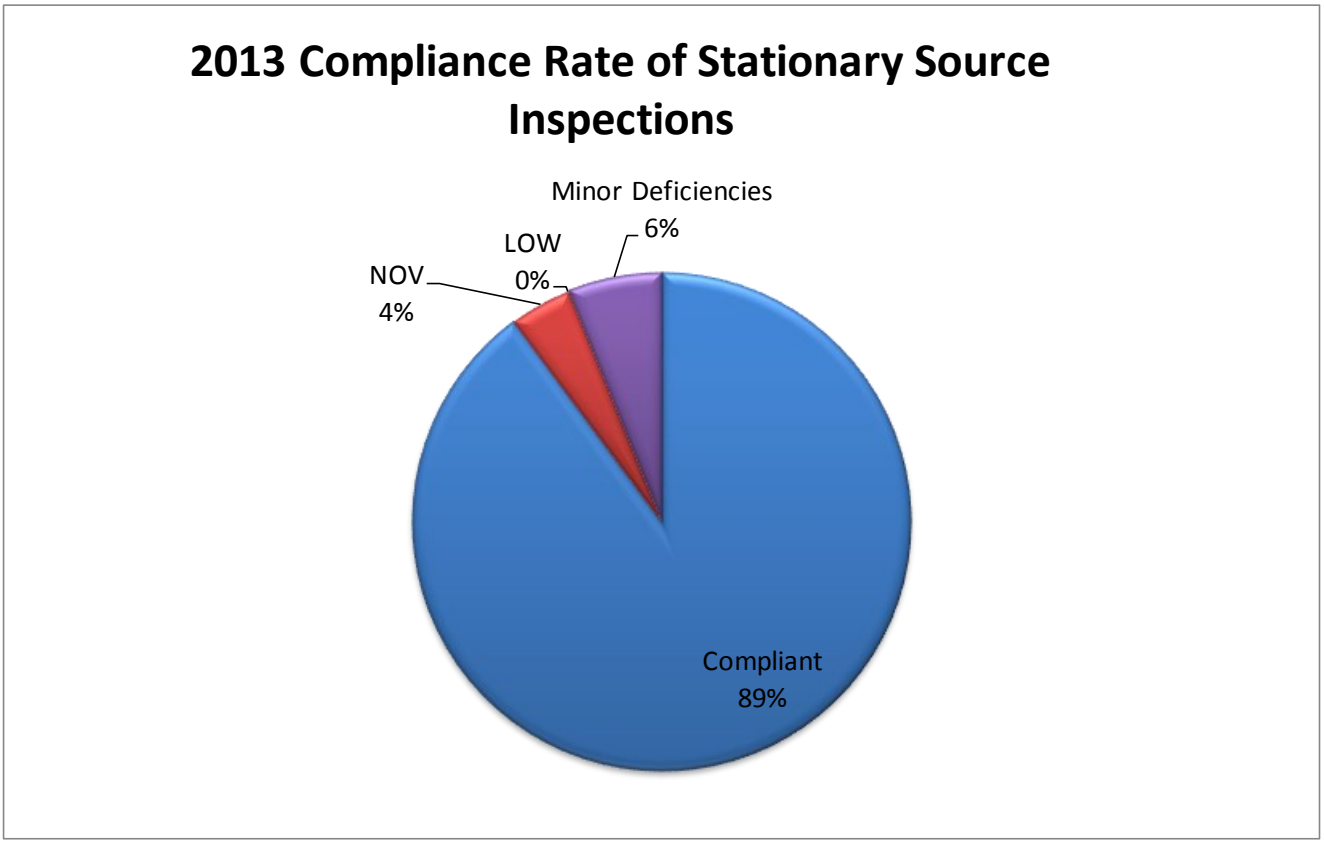


Figure 5: The compliance rate of regulated stationary sources inspected by field office staff in 2013 was 89 percent. Notices of Violation (NOV) were issued to 4 percent of Kentucky's stationary sources, while Letters of Warning (LOW) were below 1 percent. About 6 percent of violations were considered non-recurrent minor violations or violations that were quickly corrected, eliminating the need for any formal enforcement action.

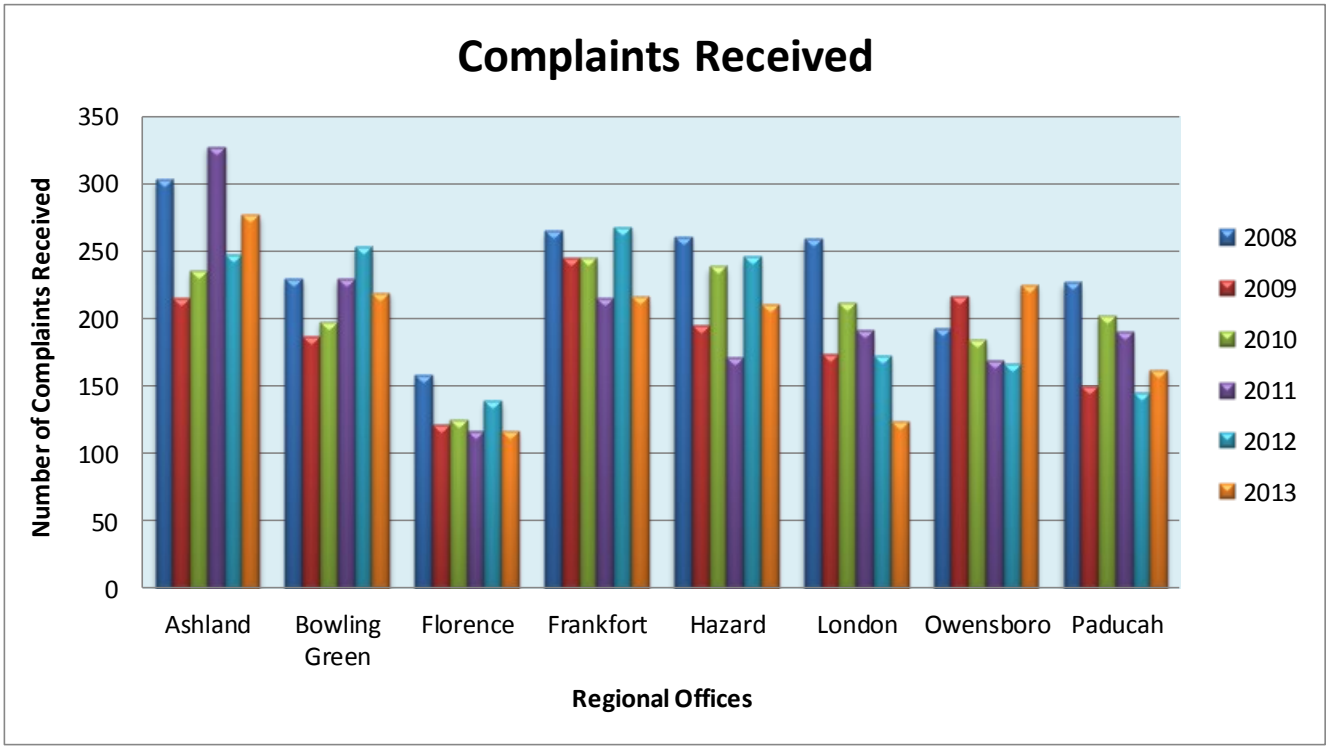


Figure 6: The numbers of complaints received during the last six years including open burning, fugitive emissions, odor, and asbestos complaints.

Complaint Investigations

Investigating complaints continues to consume a significant portion of field office staff time. In 2013, field office inspectors received a total of 1,551 complaints resulting in 1,406 field investigations (Figure 6).

The 1,406 complaint investigations combined with the 3,949 facility inspections resulted in the issuance of 437 Notices of Violation and 51 referrals to the Division of Enforcement for additional enforcement action. Data on the numbers of complaints and violations resulting from investigations are included in Figures 7, 9, and 10. The majority of complaints were about open burning, fugitive emissions, and odor.

Burning illegal materials like tires, trash and demolition debris releases toxic chemicals and particulate matter into the air. (Photo: DAQ)

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.

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

The division received 660 complaints about open burning in 2013. Of those, 46 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 respond to citizen complaints of open burning or discover them in the course of other duties. Kentucky does not have a statewide open burn permit program, so total number of actual open burns is unknown.

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

Field inspector Courtney Shattuck demonstrates the use of a Nasal Ranger, which is used to determine whether an odor exceeds the threshold determined by Kentucky's odor regulation. (Photo: DAQ)

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.

Odor complaints are regulated under 401 KAR 401 53:010. Odor complaints continue to vary through the years, with the number of odor complaints peaking in 2008 (492) as compared to 345 complaints in 2013 (Figure 9). The overall violation rate is low, though it has increased in recent years. In 2013, 19 odor violations were cited out of 345 complaints. This represents a 2.5 percent increase over 2012 (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.

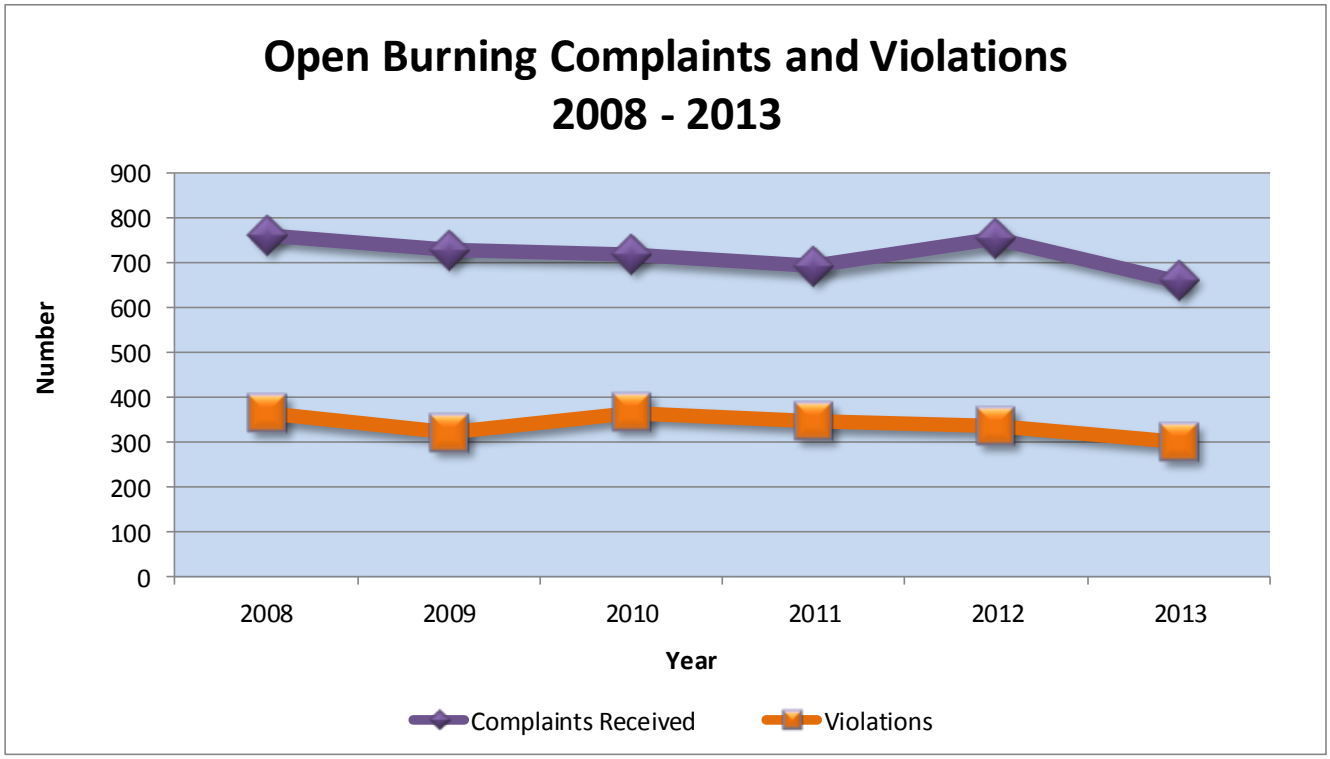


Figure 7: Complaints received about open burning, and violations cited after investigation. 46 percent of open burning complaints resulted in violations in 2013. Education and outreach campaigns targeting illegal open burning may be responsible for a gradual downward trend in open burning complaints.

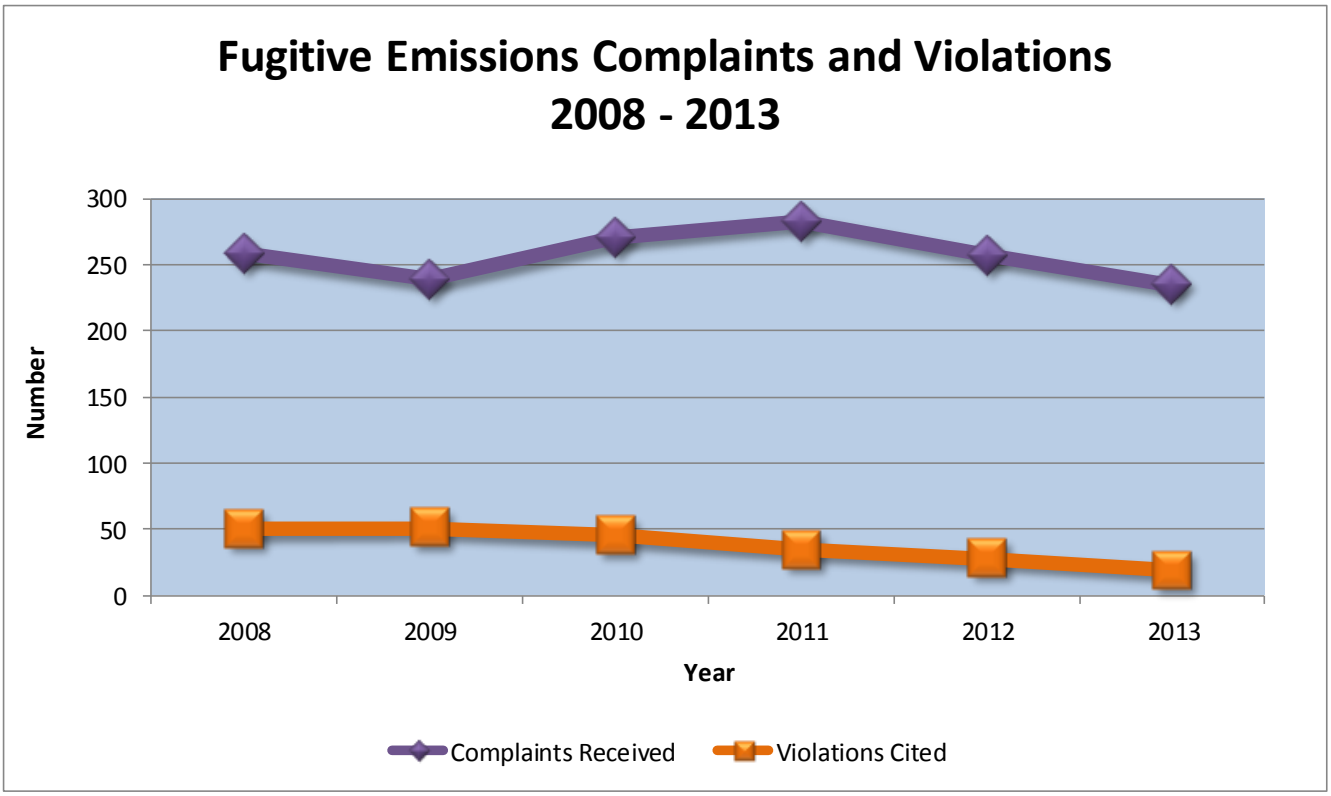


Figure 8: Complaints received about fugitive emissions and violations cited after investigation. The percentage of fugitive emissions violations per complaint reached an all-time low in 2013; only 8 percent of complaints resulted in violations.

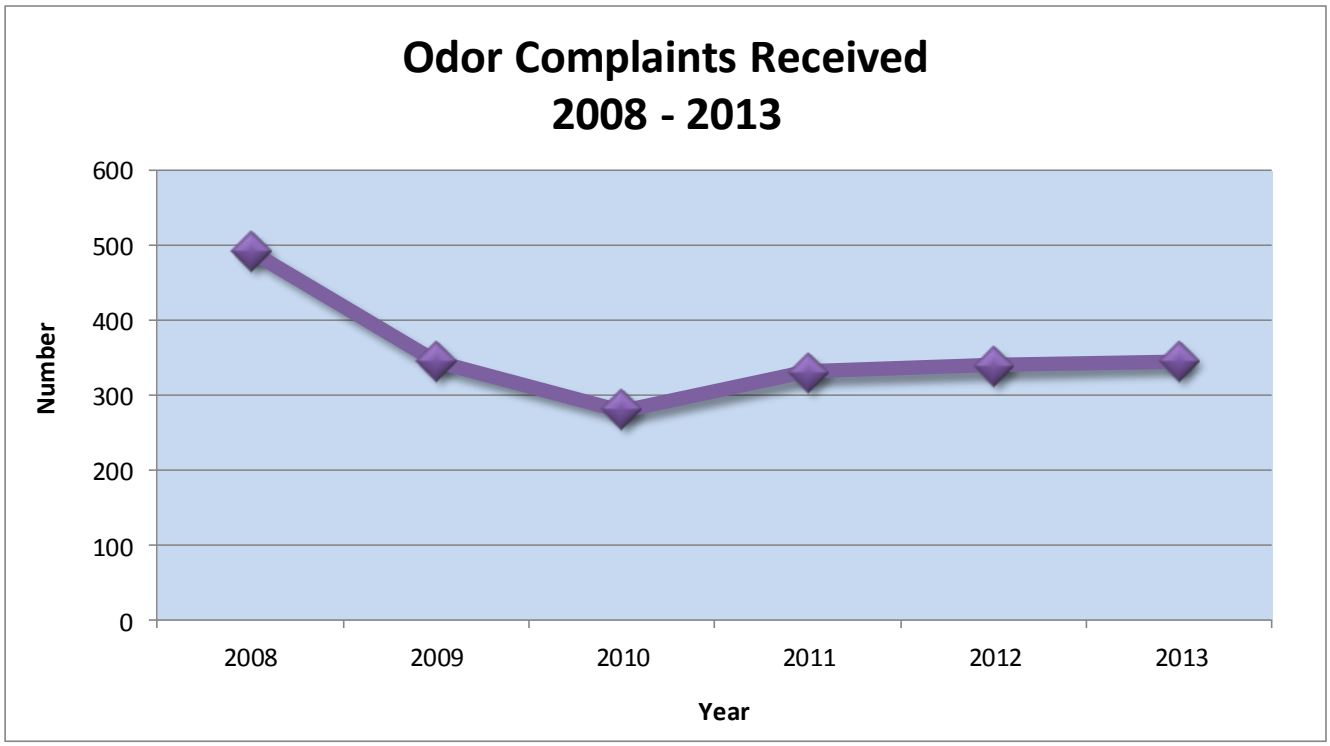


Figure 9: The number of odor complaints have varied throughout the years, with a peak experienced in 2008. Odor violations are documented when an inspector can smell the odor through a scentometer or nasal ranger, which dilutes the ambient air at a ratio of seven to one.

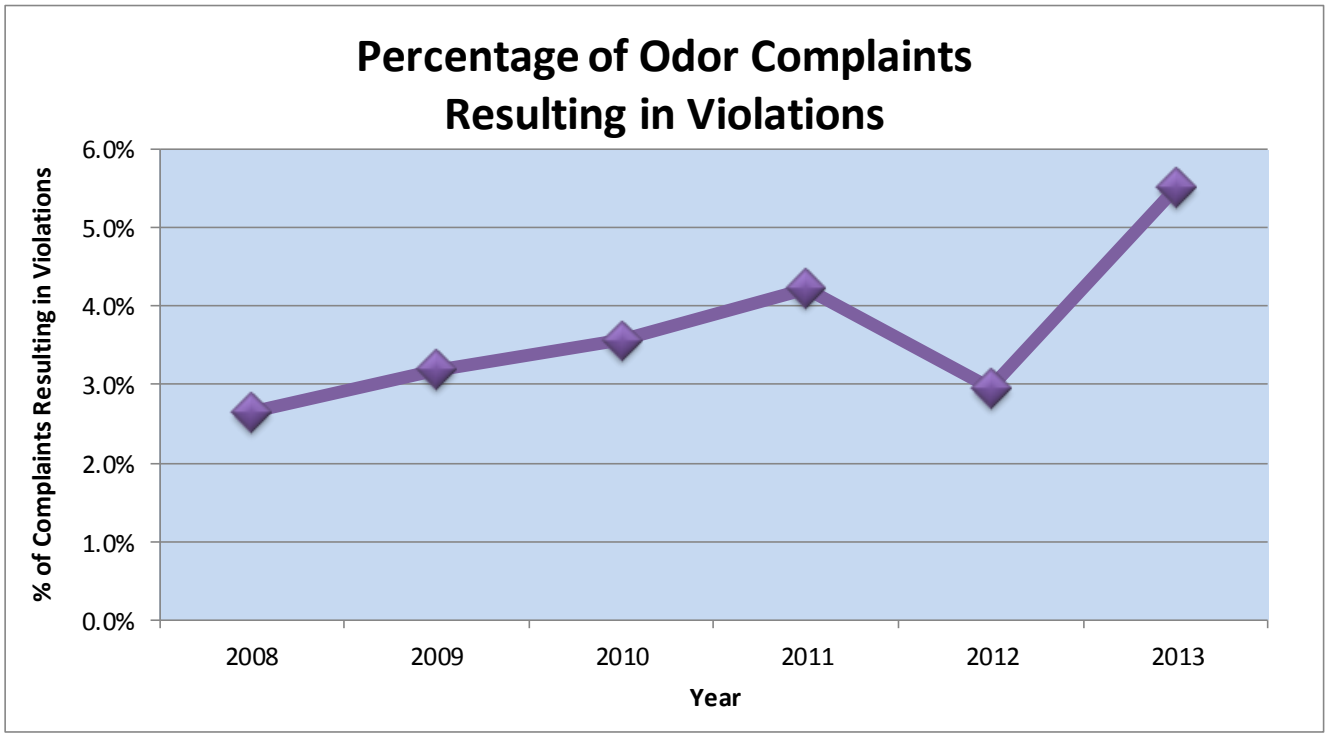


Figure 10: Percentage of odor violations per odor complaint received. The violation rate is very low but is increasing overall.

DAQ's Asbestos Inspection Program

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

Undisturbed asbestos material can be safely maintained if it is kept in good condition. However, without proper precautions, renovations, demolitions, and even routine maintenance can cause asbestos-containing materials to release microscopic asbestos fibers into the air we breathe. Before renovating or demolishing a structure, it must be 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 an accredited professional using state-of-the-art work practices.

Asbestos removals associated with renovations and demolitions are regulated by the division under the National Emission Standards for Hazardous Air Pollutants (NESHAP). Division regulations also require schools to have their buildings thoroughly checked for asbestos under the Asbestos Hazard Emergency Response Act (AHERA). The surveyed results must be documented in a management plan that describes how all asbestos materials in the school's buildings will be managed safely. Compliance with the asbestos regulations is overseen by the Field Support Section and inspectors from the regional offices.

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.

In the case of AHERA inspections, the division's compliance oversight strategy has evolved from a records review approach to an actual site inspection/records verification process. Awareness has increased within the regulated community with respect to notifying the division about asbestos removals that need to be inspected, and within the general public, who file complaints about potential violations of the regulatory program. In 2013, the compliance rate for NESHAP was 81 percent (Figure 12) while the compliance rate for AHERA was 68 percent (Figure 13).

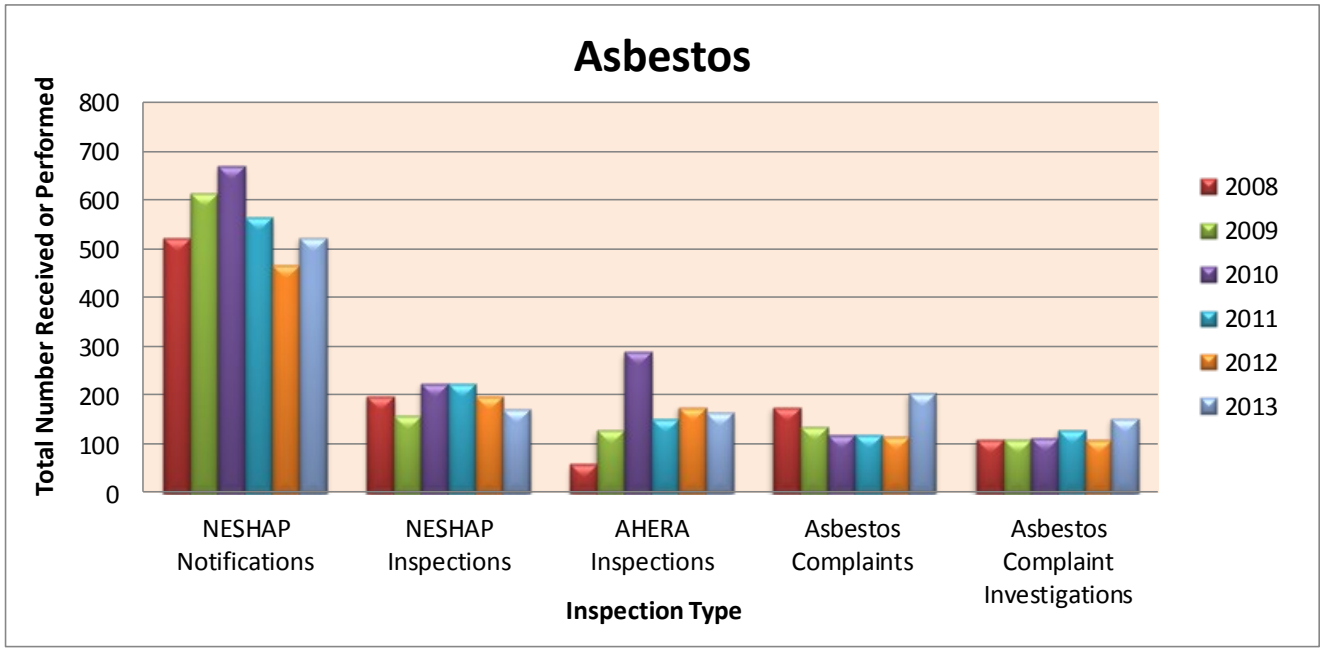


Figure 11: The number of NESHAP notifications varies from year to year but the number of NESHAP inspections tends to be fairly consistent. In recent years AHERA inspections have increased due to increased emphasis on AHERA inspections by management. In 2013, there were more asbestos notifications, complaints, and investigations than in recent years.

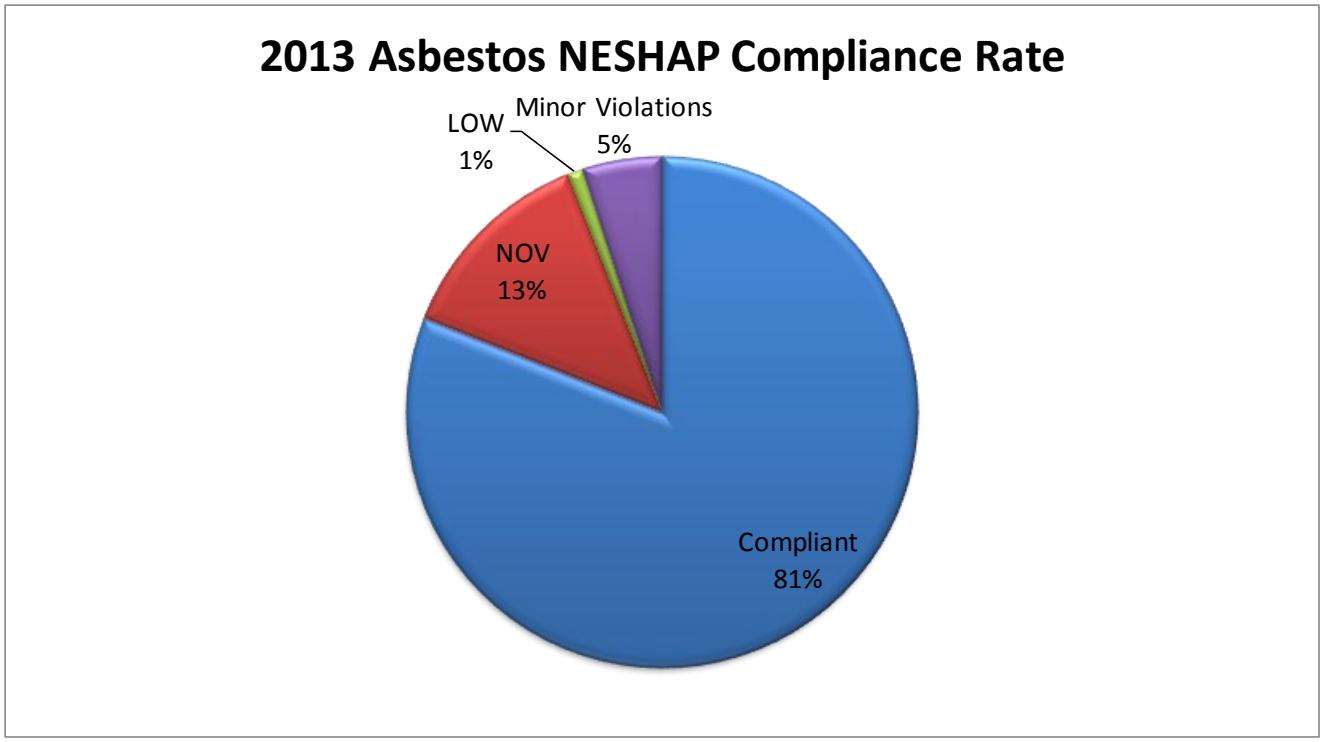


Figure 12: Compliance rate of asbestos removal and/or demolition operations regulated under the National Emission Standards for Hazardous Air Pollutants (NESHAP).

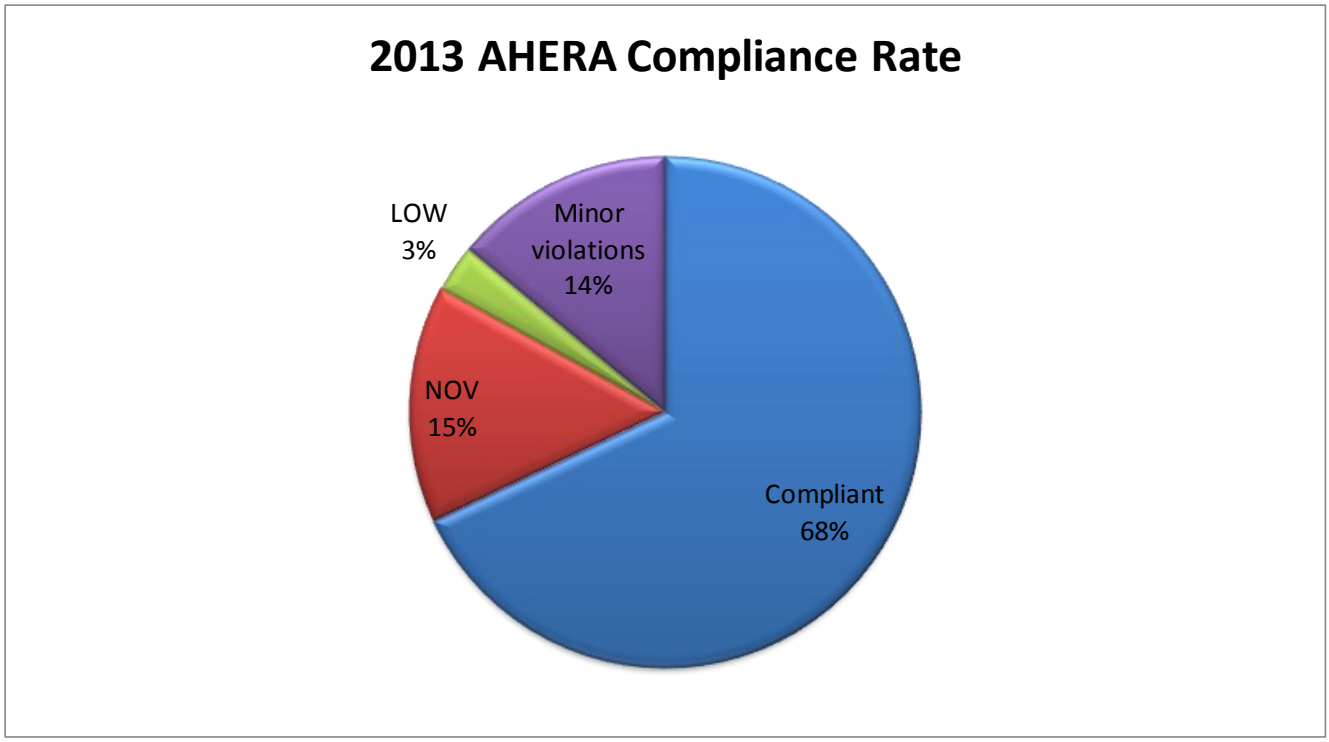


Figure 13 : Compliance rate of school inspections for asbestos under the Asbestos Hazard Emergency Response Act (AHERA). The lower percentage of compliance with the AHERA program (68 percent) as compared to the NESHAP (81 percent) is possibly due to lack of AHERA training for school staff or frequent turnover of staff responsible for implementing the program. This is one reason DAQ has increased its inspection oversight in an effort to improve the compliance rate.

PERMIT REVIEW

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

- Chemical Section
- Combustion Section
- Minerals Section
- Surface Coating Section
- Metallurgy Section
- Air Toxics Section

"DAQ's Permit Review Branch works hard to issue permits in a timely manner while incorporating increasingly complex regulations."

Rick Shewekah
Permit Review
Branch Manager

Figure 14 (Page 21) shows the number of permits issued by section for the years 2008-2013. In calendar year 2013, PRB issued 450 permits. Nine of these were considered major economic development projects, which the division worked on in partnership with the Cabinet for Economic Development.

The division began implementing the permit backlog reduction plan in 2006. Since that time, the backlog of permits beyond the regulatory time frame (RTF) has remained at a manageable level.

At the close of Fiscal Year 2014, PRB had 187 pending applications in-house. Only 48 of the applications were beyond RTF.

The following charts highlight DAQ success in the following measures for permit backlogs:

- The total number of permits pending (Figure 16, see Page 22).
- The total number of permits pending that exceed RTF (Figure 16, see Page 22).
- A comparison between numbers of new applications versus completed reviews (Figure 15, see Page 21).
- The on-going percentage of permit reviews that exceed and are within RTF (Figure 17, see Page 23).

Air Toxics Program

The EPA's Toxic Release Inventory database provides a means of tracking emissions of toxics, including HAPs. Figures 18-19 (Page 24) represent the trends in hazardous air pollutant emissions over the 2008-2012 period. Figures 20-21 (Page 25) show the total statewide HAP releases in Kentucky from 2008 through 2012. More information can be found at http://www.epa.gov/TRI/.

In FY 2014, the Air Toxics 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.

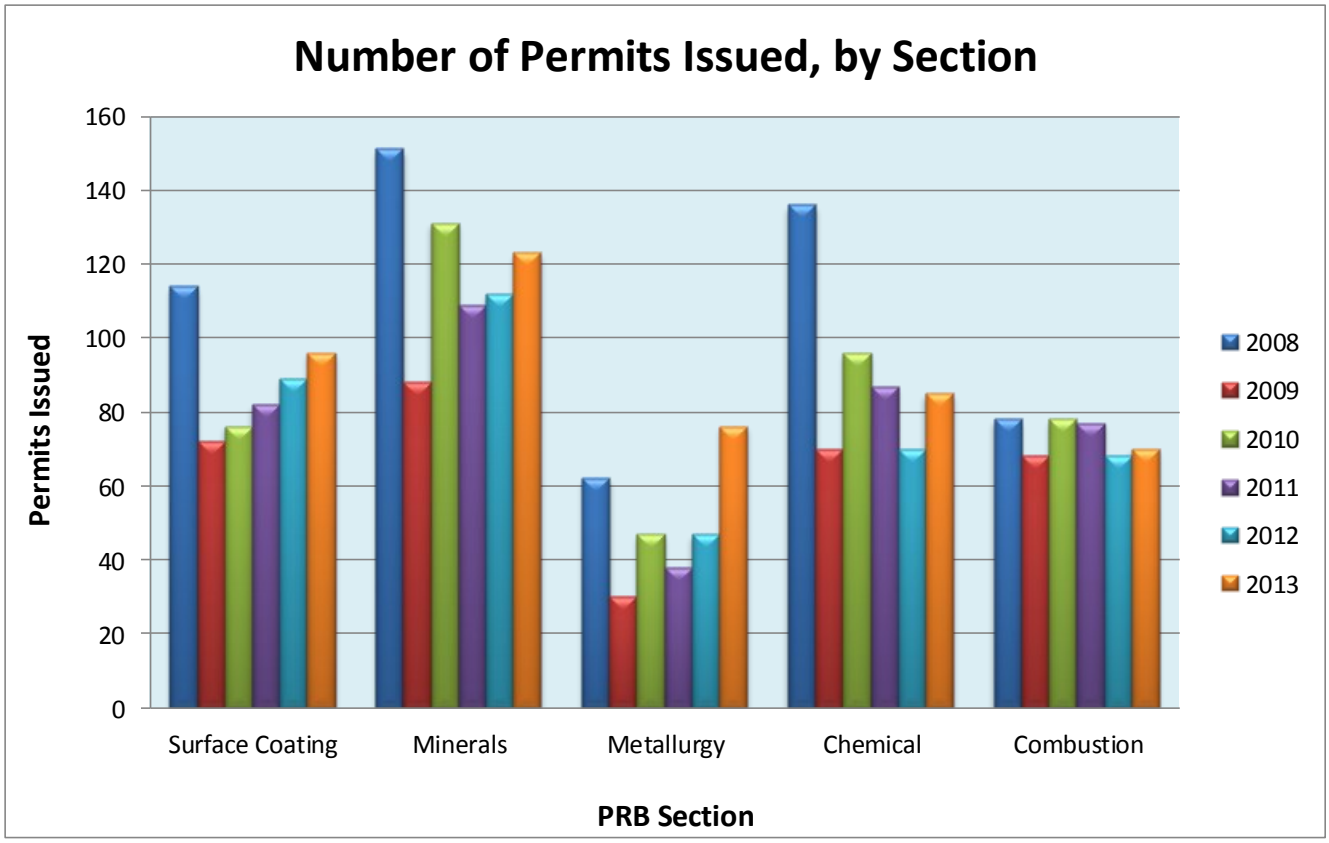


Figure 14: In calendar year 2013, the division issued 450 permits, depicted here by section category. The minerals section issued the highest number of permits followed by surface coating and chemical sections.

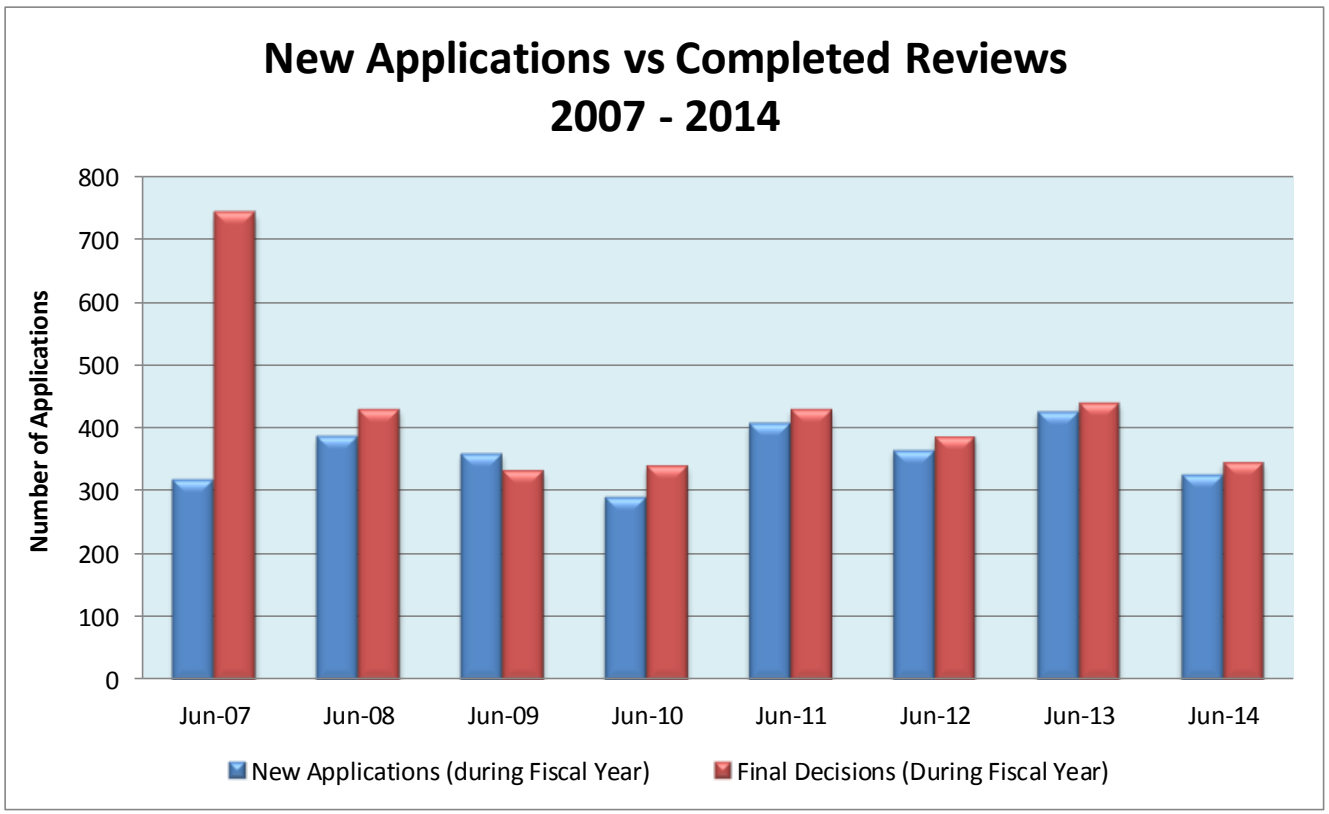


Figure 15: In 2007, PRB made an aggressive effort to eliminate the longstanding permit backlog. Completed reviews (final decisions) far exceeded new applications as the backlog was reduced. Since then, the numbers of completed permits versus new applications have stayed at a manageable level.

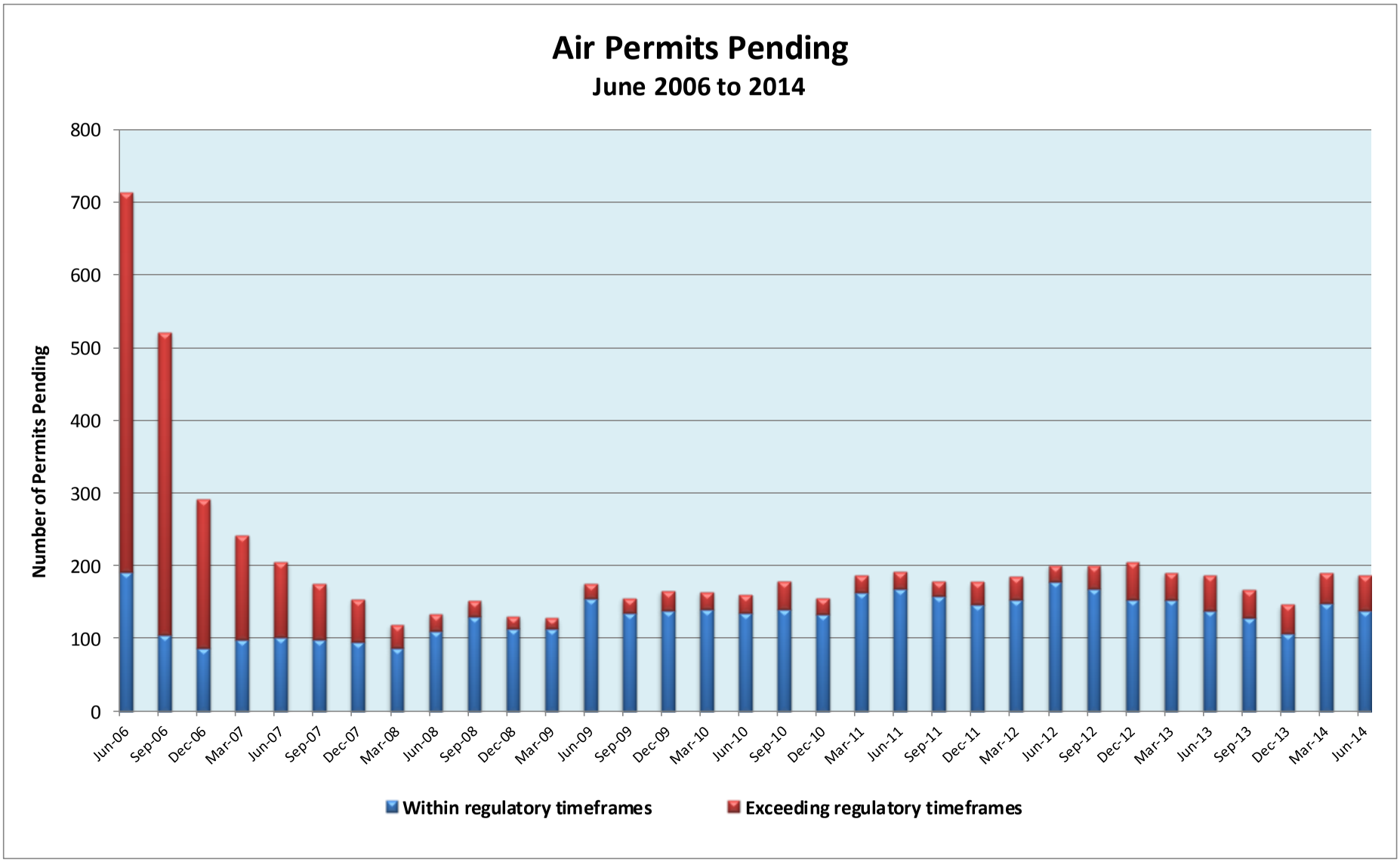


Figure 16: From June 2006 to June 2014, the Permit Review Branch has greatly reduced the amount of permit applications pending a final permit issuance as well as the percent of air permit applications that are beyond the Regulatory Time Frame (RTF), the allotted time for the complete permitting process. In June 2006, 521 of 716 pending permits were beyond RTF. By June of 2014, only 48 of the 187 pending permit applications were beyond RTF.

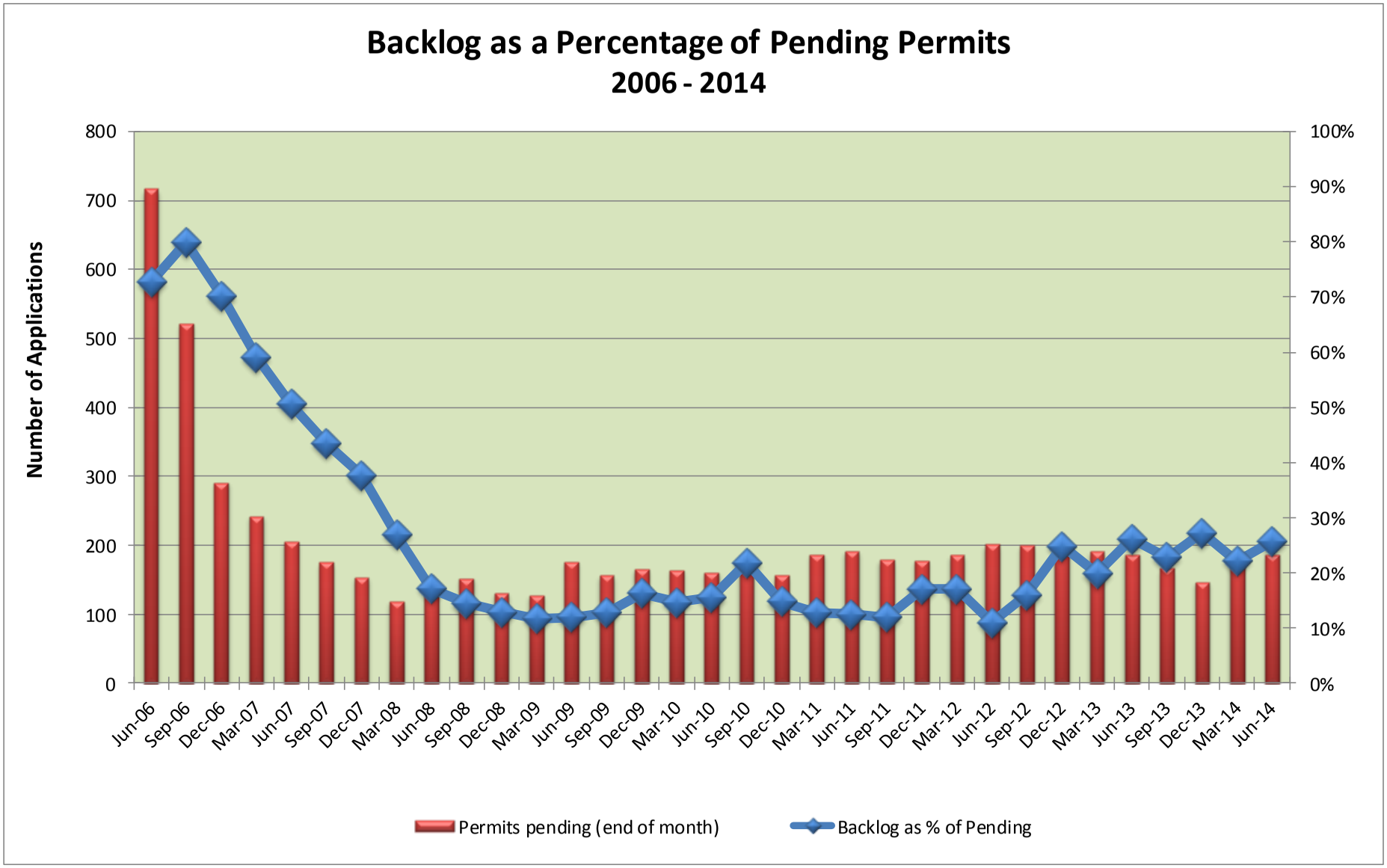


Figure 17: DAQ has significantly reduced the permit backlog since June 2006, at which time the division had 716 applications in-house. The current number of pending applications represents a 74 percent reduction since that time.

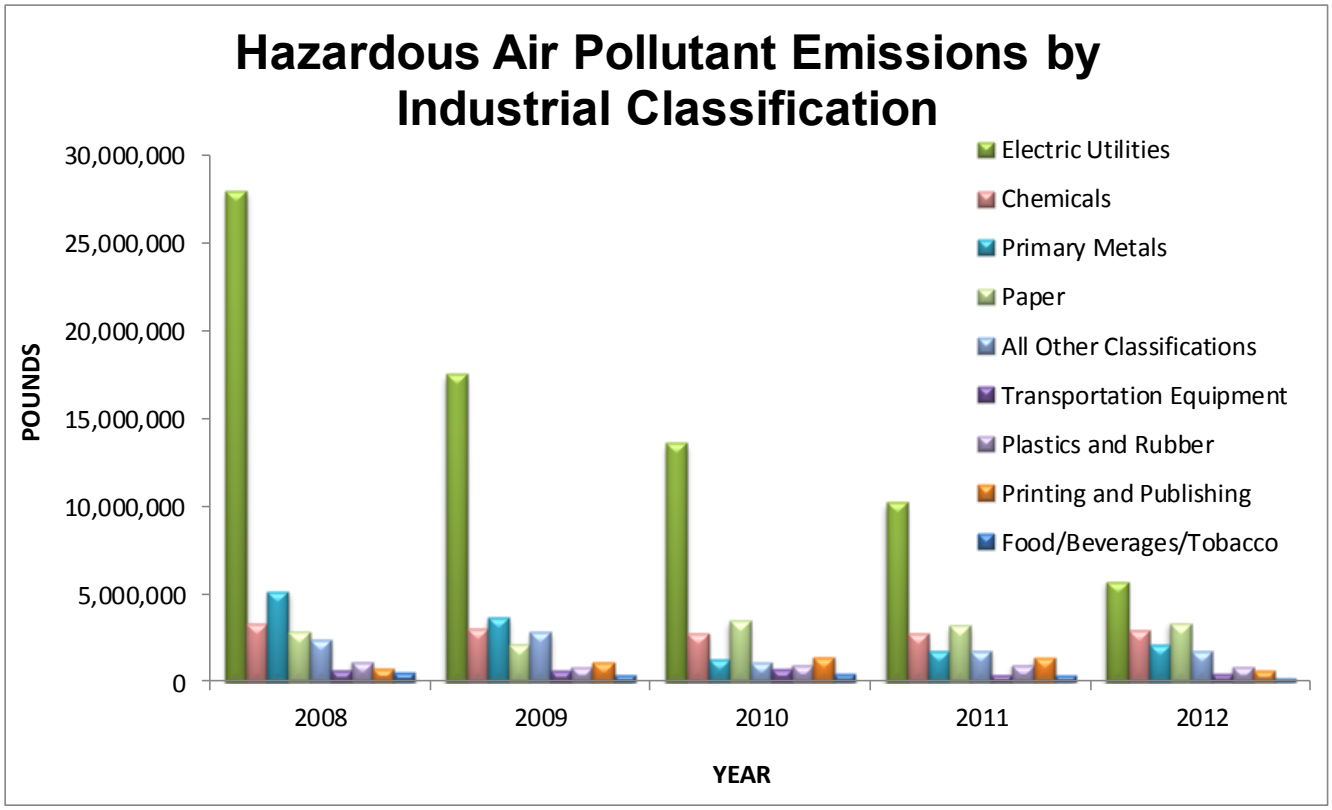


Figure 18: Toxic emissions in Kentucky from 2008-2012 by industrial classification.

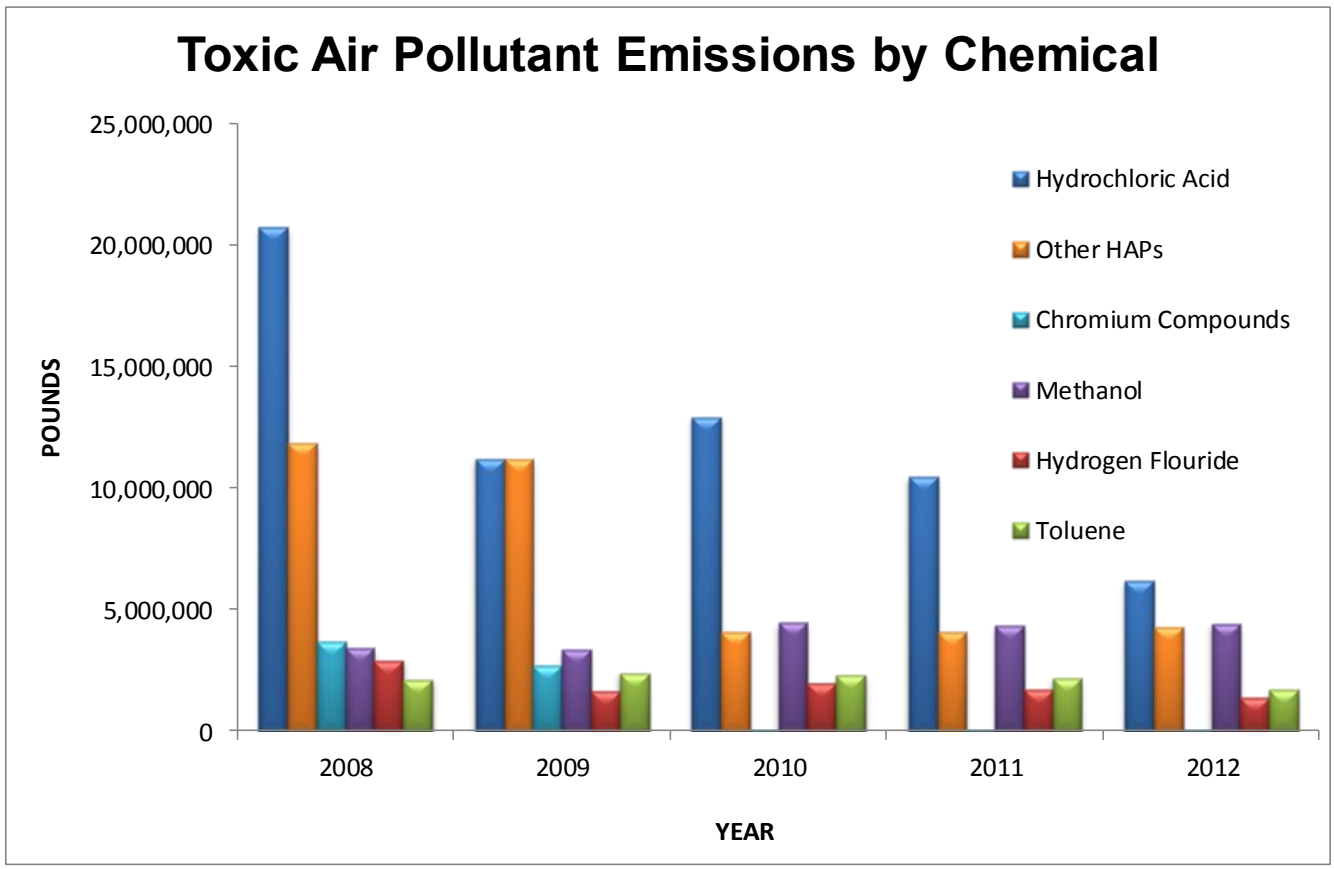


Figure 19: Emissions for selected individual chemicals. Data source: EPA Toxic Release Inventory.

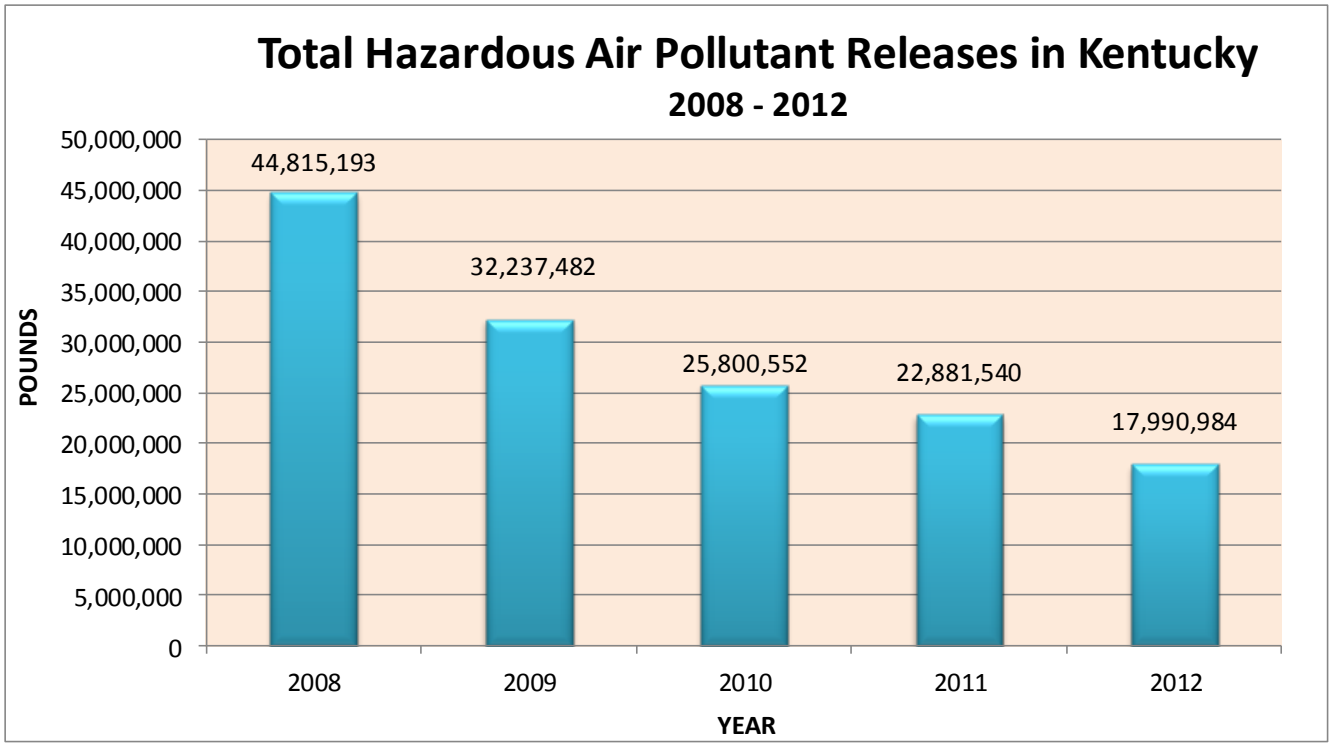


Figure 20: Total HAP releases in Kentucky, 2008-2012. As of 2008, sulfuric acid is not considered a HAP under the Clean Air Act and is no longer included as a HAP in emissions data. Data Source: EPA Toxic Release Inventory.

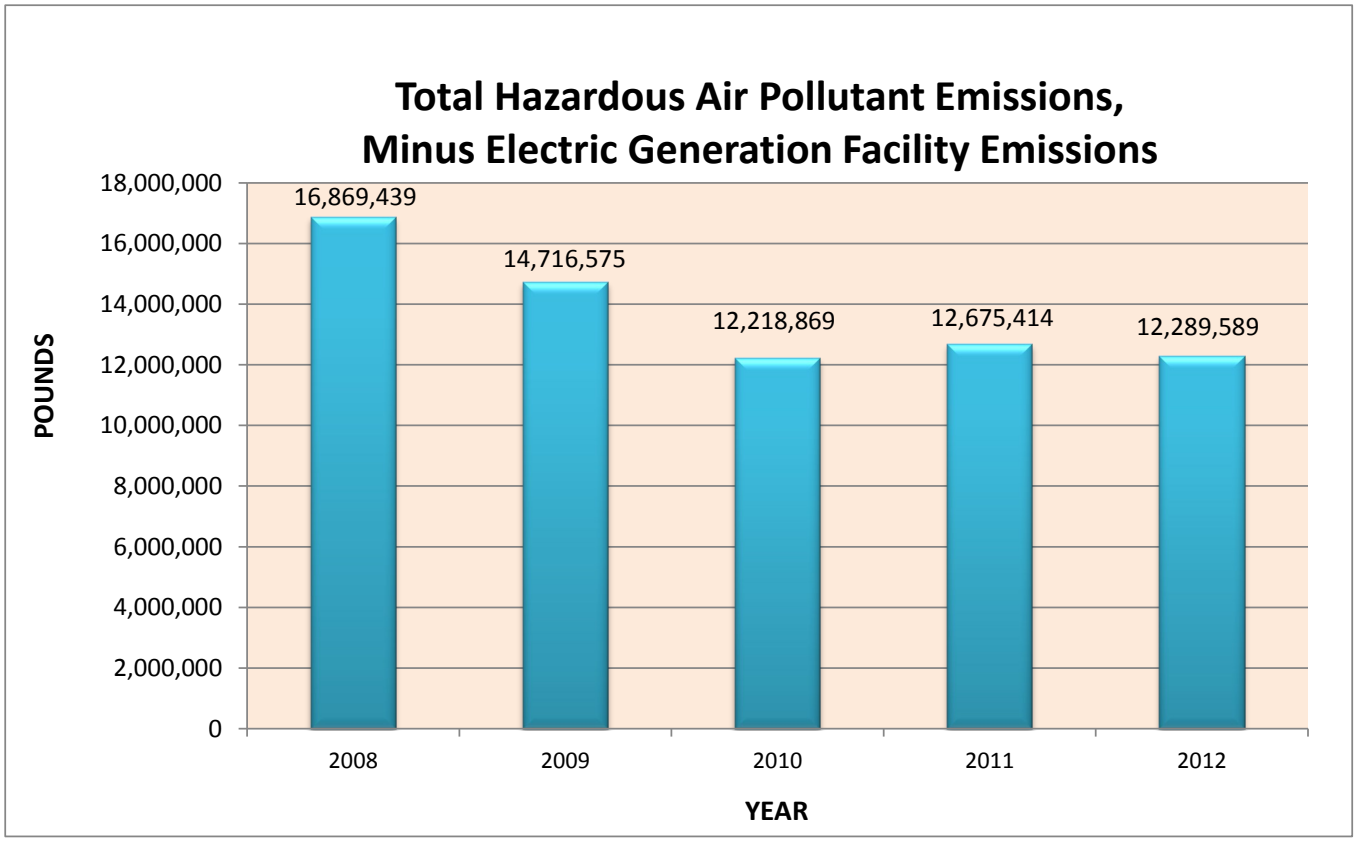


Figure 21: Total HAP releases in Kentucky, 2008-2012, minus electric generation facilities. With the influence of electric generation facilities removed, a downward trend in emissions from all other HAP-emitting sectors is clearly evident, dropping from over 25 million pounds in 2001 to less than 13 million pounds in 2012. Data Source: EPA Toxic Release Inventory.

PROGRAM PLANNING & ADMINISTRATION

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

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

The FY 2014 operating budget was structured to cover all operating costs, salaries and benefits, and equipment needed for the division. All programs were evaluated to reduce cost in specific areas due to the current economic status of our state and federal funding sources.

Joy Moll
Administration Section Supervisor

Fiscal Management

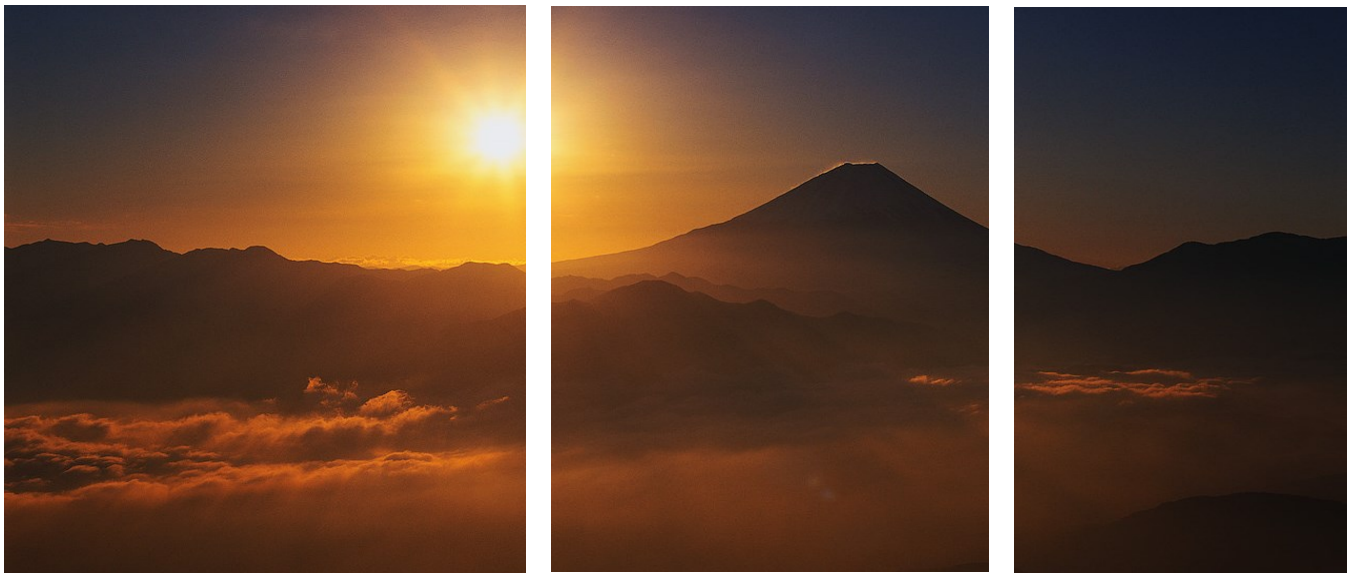
The division operates primarily on Title V emissions fees and federal grant funds. Funding under the Title V program (mandated by the CAA) is through air pollutant emission fees assessed to air pollution sources in the state that meet specific criteria. Further authorized in Kentucky by state statute, 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 will be 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. At the same time, 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 22 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 2014 is provided in Figure 23. In addition to Title V air emission fees, the division receives funds from:

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

During FY 2014, the division operated with 10 percent less personnel and fewer resources. In FY 2015 Title V emission fees are projected to exceed the federal presumptive amount for the fourth year in a row in order to meet costs associated with maintaining that program and a high level of customer service.



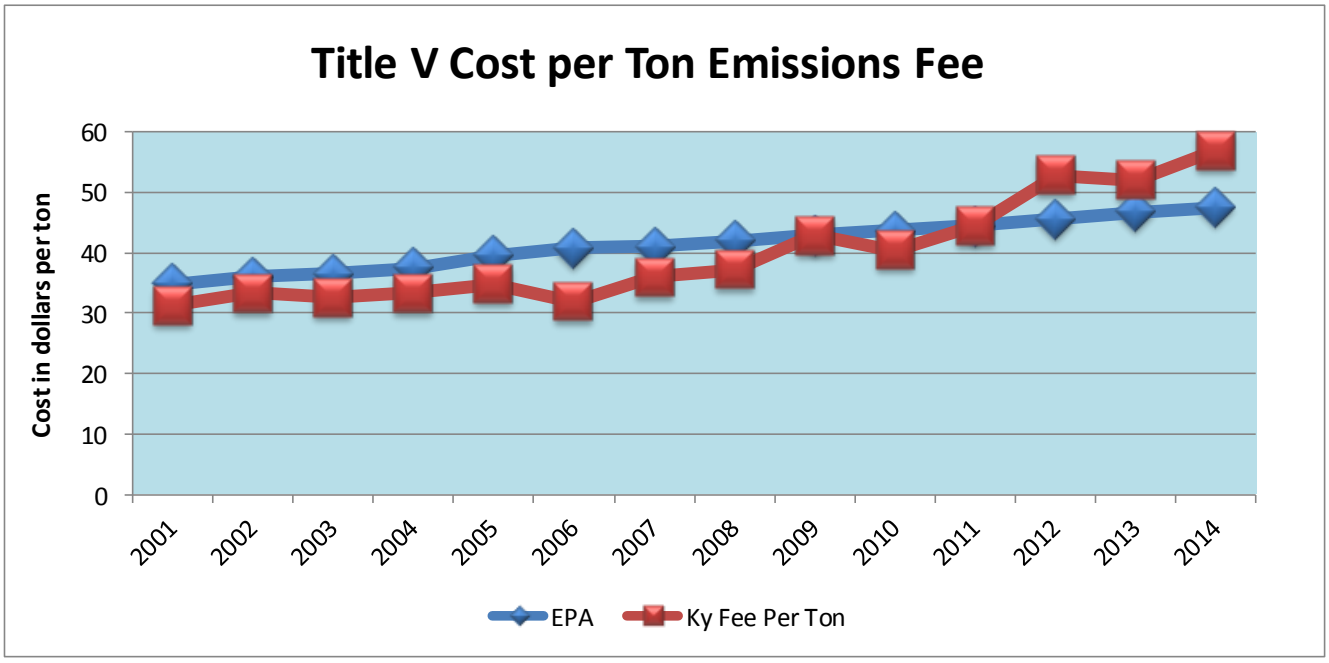


Figure 22: Title V Emission Fees Collected. DAQ surveys regulated entities to determine actual tons emitted by those sources and charges them a standard cost per ton, according to Clean Air Act and state statute protocol. This chart compares Kentucky's actual fees with EPA's "Presumptive Minimum," which is a suggested minimum fee per ton that states should charge.

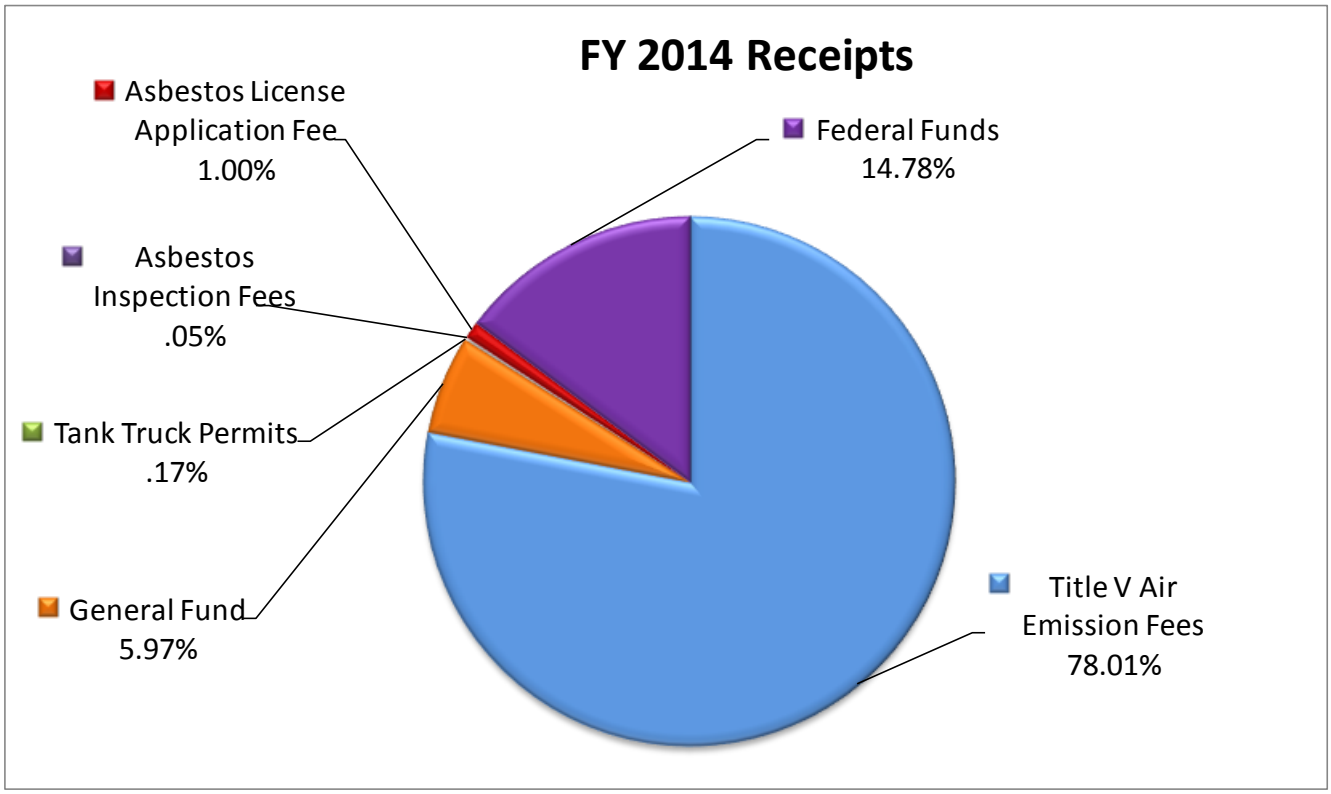


Figure 23: Division for Air Quality FY 2014 Receipts. The division operates primarily on Title V emission fees and federal grant funds. Other funds are derived from non-state insurance recovery, proceeds from recyclable sales, and proceeds from asset sales.

Annual Emissions Inventory

The emissions inventory section surveys nearly 1,200 plants per year to determine actual air pollutant emissions for the previous year. Figure 24 shows the emissions inventory for 2012; at the time of publication of this report, data for calendar year 2013 was still being verified. It takes approximately eleven months to verify and complete the previous year's inventory.

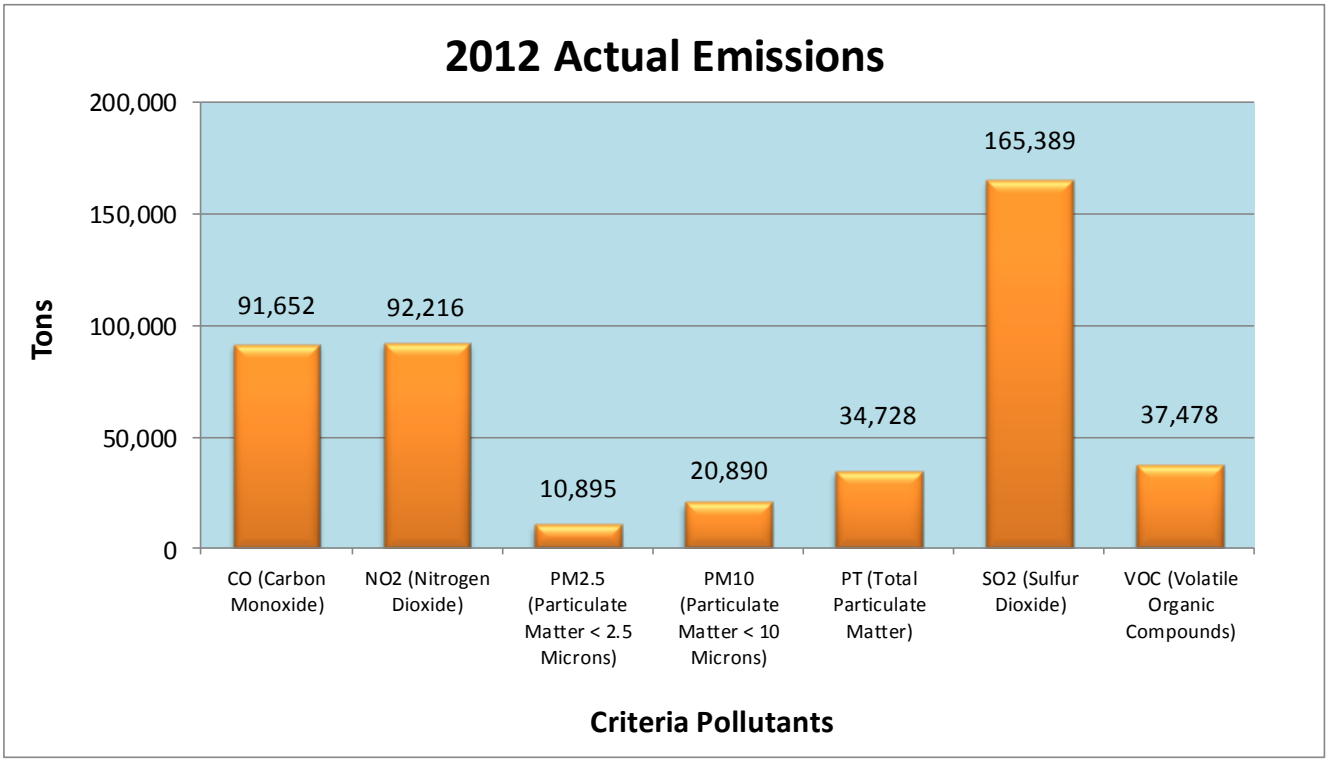


Figure 24: Actual tons of pollutants emitted by surveyed, regulated entities in Kentucky for the calendar year 2012. Although DAQ receives inventory emission data at the beginning of each calendar year, it takes approximately nine months to verify and complete the inventory.

Regulation Development

The Regulation Development Section drafts and adopts regulations to control air pollution in the state. Regulations can either 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.

From July 2013 through June 2014, the Regulatory Development Section continued researching and drafting several regulation packages on behalf of the division.

In addition, Federal Registers that were relevant to the activities of the division were reviewed and extensive comments to be submitted to the public docket were compiled on one major federal regulatory proposed action. In April 2014, the EEC submitted comments to the EPA's reissuance of the proposed *Standards of Performance for Greenhouse Gas Emissions from New stationary Sources: Electric Utility Generating Units (EGUs)*. The proposed standards were published Jan. 8, 2014 in the *Federal Register* and are mandated by the President's *Climate Action Plan and Executive Order,* released in June 2013. In its comments, the Cabinet requested that EPA withdraw its proposal and consider setting the emission standard for the performance of

new EGUs at 1,700 lbsCO_2/MWh limit for the coal-fired boilers, regardless of the combustion technology employed. While not in the specific range for which EPA is requesting comment, this limit would accomplish significant CO_2 emission reductions (19 percent) as compared to the annual average of 2,100 lbsCO_2/MWh for the current U.S. coal-fired EGU fleet. The Cabinet's comments were submitted to the public docket on April 22, 2014.

On June 18, 2014, EPA published two proposed rules in the Federal Register that also affected electric utility generating units: *Carbon Pollution Emission Guidelines for Existing Stationary Sources: Electric Utility Generating Units* and *Carbon Pollution Standards for Modified and Reconstructed Stationary Sources: Electric Utility Generating Units.* At the time of publication and through the end of June 2014, the division was in the process of reviewing the extensive proposal and formulating comments.

In preparation of planned amendments to the division's permitting forms, a stakeholder group facilitated by the Regulatory Development Section met on Feb. 26, 2014. Several suggestions were made during the meeting that will assist the division in finalizing the draft amendments. In addition, several technical amendments to the state air quality regulations were made by the Legislative Research Commission at the request of the division.

State Implementation Plan

The State Implementation Plan (SIP) is a state-specific plan to ensure attainment and maintenance of the various National Ambient Air Quality Standards (NAAQS) within a state or region. 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.

The following section summarizes grant programs that support the SIP, 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 92.

Kentucky Clean Diesel Grant Program

Last year, the Division for Air Quality continued to administer the Kentucky Clean Diesel Grant Program funded by a federal grant through the Diesel Emissions Reduction Act. The grant was used to further reduce diesel emissions in the vehicle fleets of Kentucky schools and local governments.

In 2013, Crittenden County Board of Education and Louisville Metro Government were awarded the grant funding. Crittenden County used the funding to retrofit 14 diesel school buses with emissions-capturing devices and to fund 25% of the cost to replace one old diesel school bus with a new propane school bus – the first propane-powered bus for student transportation in the state. Louisville Metro Government used the funding to retrofit two diesel refuse haulers with emissions-capturing devices.

Additional funds became available in the fall of 2013 and Crittenden County Board of Education was once again selected to receive funding to aide their project to reduce diesel emissions from their bus fleet. The division is funding 25% of the purchase of four new propane school buses to replace four old (1993-94) diesel school buses that have no emissions-capturing devices. These four propane buses will decrease nitrogen oxides emissions by 98% and particulate matter emissions by 100% as compared to the diesel buses being replaced and will also result in an estimated $13,000 in fuel and maintenance savings for the school district.

One of Crittenden County's new propane-powered school buses. (Photo: Wayne Winters)

Since 2008, the Kentucky Clean Diesel Grant program has resulted in the following lifetime reductions of emissions:

- 216 tons of nitrogen oxides
- 15 tons of particulate matter
- 21 tons of hydrocarbons
- 108 tons of carbon monoxide
- 193 tons of carbon dioxide

Ozone

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 75 ppb. The portions are approximately the northern half of each county. If the area does not meet the standard by July 2015, the Clean Air Act has provisions in it that could change the classification to moderate nonattainment.

Fine Particulate Matter

EPA finalized the change in the annual PM 2.5 standard from 15 $\mu g/m^3$ to 12.0 $\mu g/m^3$, calculated on an annual average effective March 18, 2013. By letter dated Dec. 5, 2013, Kentucky provided recommendations for designations. All counties with certified air monitoring data were recommended to be designated as attainment. The remainder of the state (those counties that do not have certified monitor data) was recommended to be designated as attainment/unclassifiable. No areas of Kentucky were recommended to be designated as nonattainment. EPA will provide a response to Kentucky's initial recommendations in August 2014.

Nitrogen Dioxide

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

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

Sulfur Dioxide

The 2010 primary SO_2 standard is a 1-hour standard of 75 ppb.

Effective Oct. 4, 2013, a portion of Campbell County and a portion of Jefferson County were designated nonattainment for the SO_2 standard. The most significant emissions source in the Jefferson County nonattainment area is the Louisville Gas & Electric Company Mill Creek Generating Station. Currently, L.G & E is upgrading its scrubber technology to reduce SO_2 emissions and bring the area into compliance.

The most significant SO_2 emissions source in the Campbell County area is the Duke Energy, Walter C. Beckjord Generating Station facility, which is located approximately 10 miles east of the violating monitor in Clermont County, Ohio. This 60- year-old plant has six coal/steam units with no SO_2 controls, and is likely the major contributor to the violating monitor's design value. The Beckjord facility is scheduled to close in the near future, which should remedy the violations at this monitoring site.

Visibility

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

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

As required by the Clean Air Act and Regional Haze Rule, the division has developed a draft Kentucky Regional Haze Five-Year Periodic Report, which evaluates progress being made toward meeting the reasonable progress goals for visibility established in the Kentucky Regional Haze SIP for Mammoth Cave National Park. On June 27, 2013, the division submitted the report to the Federal Land Managers for review and comment. Additionally, the division provided a copy to EPA for review and comment. The division addressed comments provided by the FLMs and EPA during the 60-day consultation period and on April 16, 2014, submitted a proposed SIP revision that included a pre-hearing draft of Kentucky's Regional Haze Periodic Report to EPA for review and for public comment. After addressing the public comments received during the public comment period, the division will submit a final report to EPA for approval.

Good Visibility Day
Visual Range: 144 miles

Bad Visibility Day
Visual Range: 16 miles

Left: Regional haze affects visibility over large regions including national parks, forests, and wilderness areas. These photos show the Houchins River Valley at Mammoth Cave National Park. (Photos: National Park Service Air Resources Division.)

TECHNICAL SERVICES

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

- Source sampling to ensure compliance
- Operation of a state-wide air monitoring network
- Data analysis and quality assurance

Source Sampling

Facilities throughout the Commonwealth are required by federal regulations, state regulations, permits, and/or division directives 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.

In 2013, the Source Sampling Section received 353 Compliance and Relative Accuracy Test Audit (RATA) test protocols by Kentucky facilities; 219 tests were scheduled compliance tests and 112 were scheduled RATA tests. The section received 17 cancellations during 2013 resulting in a total of 314 tests scheduled, as seen in Figure 25. The section observed 161 (73.5 percent) of the 219 scheduled compliance tests. Additionally, the Source Sampling Section received 303 RATA and Compliance test reports and completed 275 technical reviews of those reports, as seen in Figure 26.

The Source Sampling Section also successfully completed a plan to eliminate a backlog of compliance-test air flat file reports. Air flat file reports are generated for all compliance demonstrations, and then a subset of those files are reported to the EPA's Air Facility Subsystem (AFS) by the FOB. The AFS tracks compliance monitoring and enforcement actions for facilities regulated under the CAA's Stationary Source Program. Flat file reporting requirements were triggered in 2013 with the completion of a backlog reduction plan for compliance test report reviews. Ultimately, the backlog reduction plan required TSB staff to generate 540 air flat files for compliance test reports completed in 2013 or earlier.

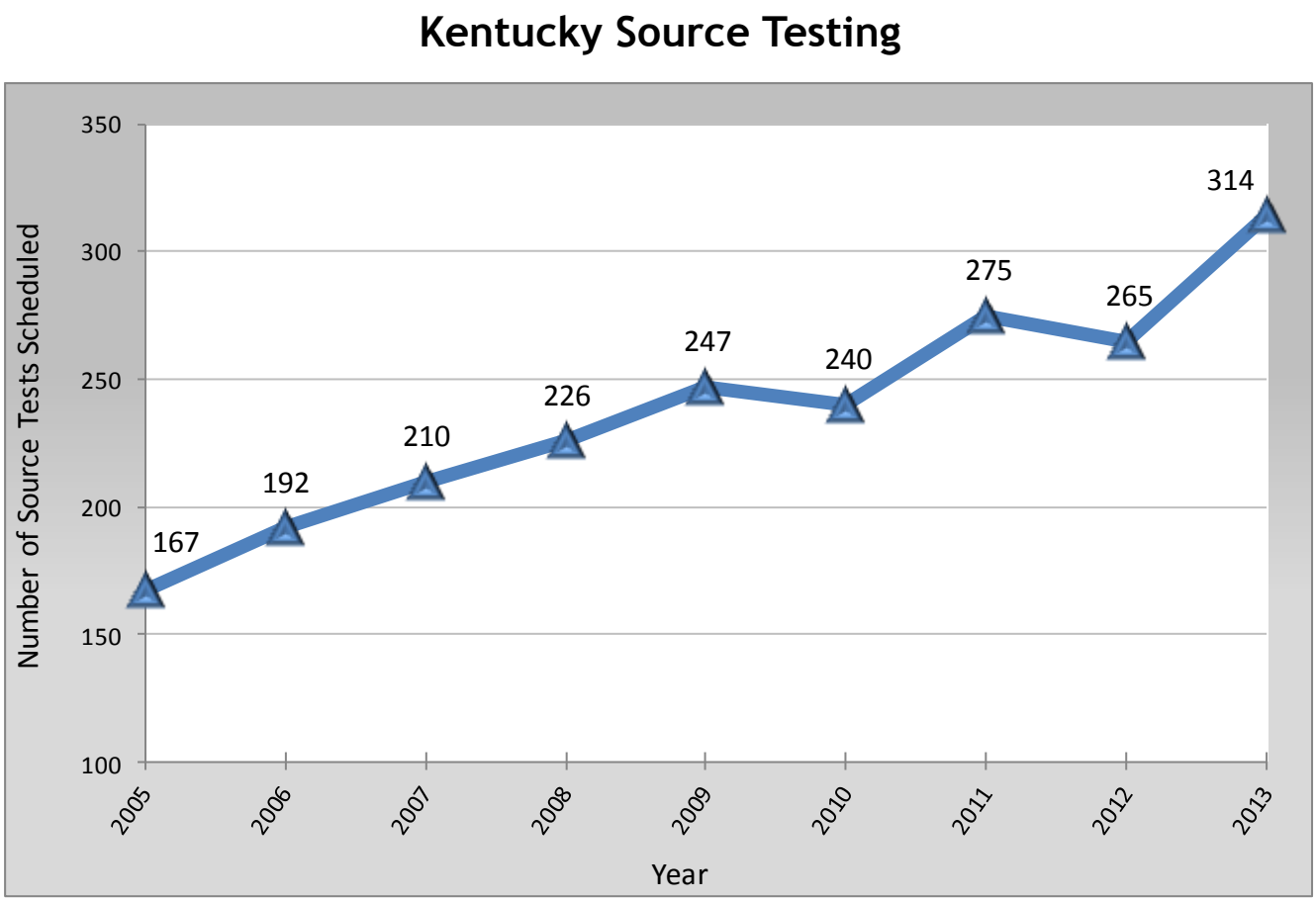


Figure 25: The last eight years have shown an increase in source testing throughout the state.

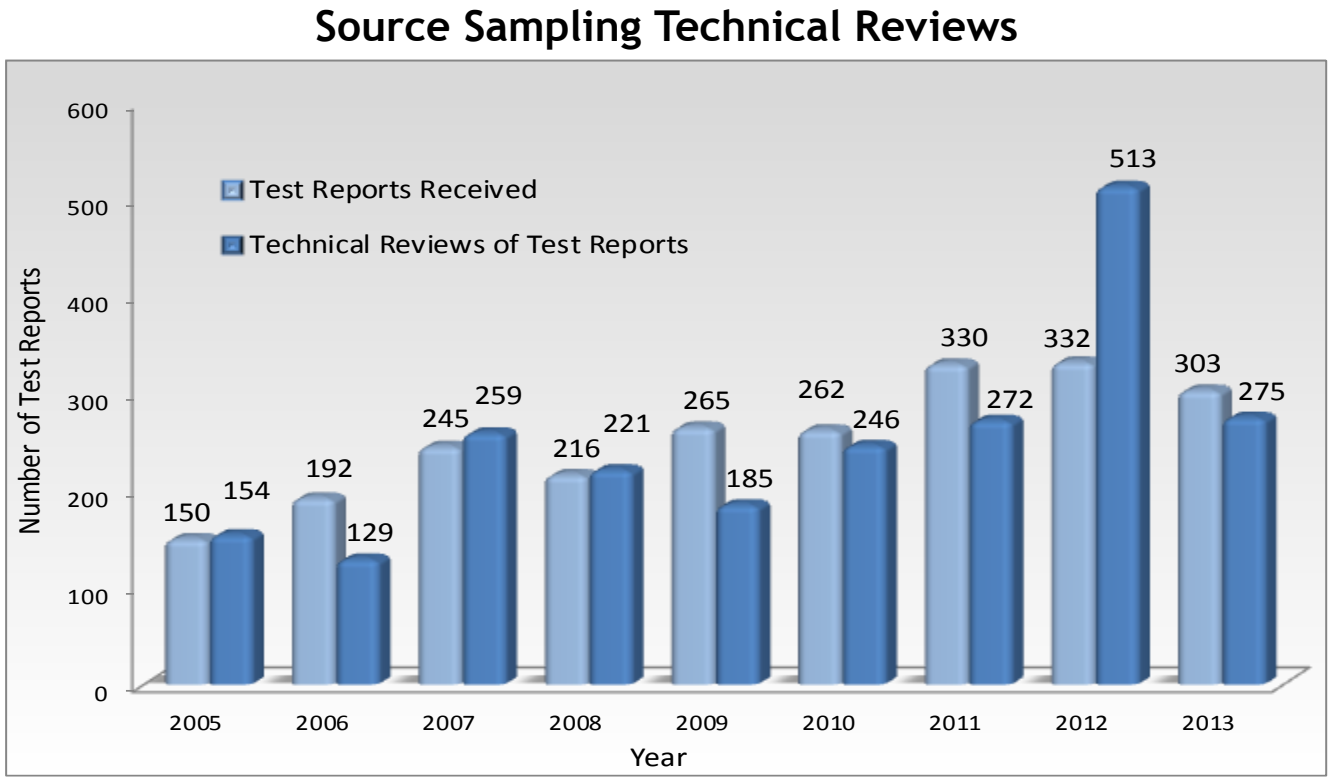


Figure 26: The Source Sampling Section successfully completed 275 technical reviews of source test report data in 2013.

Ambient Air Monitoring Network

The particulate matter sampling platform at the Grayson Lake ambient air monitoring station collects $PM_{2.5}$ and PM_{10} samples. A meteorological tower can be seen in the background. (Photo: DAQ)

Since July 1967, the Technical Services Branch (TSB) has operated an air quality monitoring network in Kentucky. The 2013 network included 39 monitoring stations in 27 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 2013 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 38-81 of this Annual Report contain tables and graphs that summarize the concentrations of pollutants measured in Kentucky during the calendar 2013 year, as well as 2013 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 heat and solar radiation shield of a $PM_{2.5}$ speciation sampler houses three canisters that are used to collect samples of particulate matter having a diameter of 2.5 microns or less. These sample canisters are sent to a laboratory for chemical analysis. (Photo: DAQ)

Regulations require that annual network plans be representative of a fiscal year (July-June); however, attainment decisions are typically based upon the data available within a calendar year (January-December). Thus, 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 36 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 2013 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 83. For a complete listing of the current NAAQS, see Appendix F beginning on Page 92.

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

Data Quality Assurance

TSB assures quality and validates all ambient data collected by the monitors and samplers in the network. Upon completing its review of 2013 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.

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 30 SOPs in the DAQ library. In 2013, TSB staff drafted one new SOP and finalized revisions to three additional SOPs.

In 2013, personnel within the TSB conducted a total of 358 performance audits of the division's air monitoring equipment. Performance audits also were conducted on monitors operated by Mammoth Cave National Park, Louisville Metro Air Pollution Control District, and the University of Louisville, as well as monitors operated by local industry. 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 147 instrument service trips in the field and repaired an additional 81 monitors in-house in 2013. The TSB completed a multi-year project to upgrade the telemetry system at each air monitoring station in the commonwealth. Telemetry is the automated communications process that allows for the transmission and reception of data. The project required software upgrades for all monitoring station computers, as well as the replacement of all analog modems with digital cellular-routers. The upgrades provide faster network communications and allow TSB staff to remotely connect and control any continuous analyzer at a site.

In June 2013, TSB successfully installed and implemented a new filter weighing system, called an "auto-handler", in the division's particulate matter weigh-laboratory. While maintained and operated by an analyst, the system 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.

TSB continues to implement a training program, which focuses on providing division air monitoring staff with the foundation necessary to collect and analyze ambient air data. In addition to routine training, the TSB conducted two training sessions for division personnel on Quality Assurance Project Plans, also known as "QAPPs." QAPPs are documents that describe the quality assurance procedures, quality control specifications, and other technical activities that must be implemented to ensure that the results of a particular project meets its intended goals within a set of specifications. In 2013, the TSB conducted three trainings for LMAPCD personnel, which involved a combination of presentations and hands-on activities. TSB staff also participated in a number of local and national workgroups and presented at numerous conferences and meetings during the year.

This $PM_{2.5}$ filter is weighed before and after air sampling. (Photo: DAQ)

Environmental technologist Ashley Bedel loads DAQ's Autohandler with $PM_{2.5}$ filters for weighing. (Photo: DAQ)

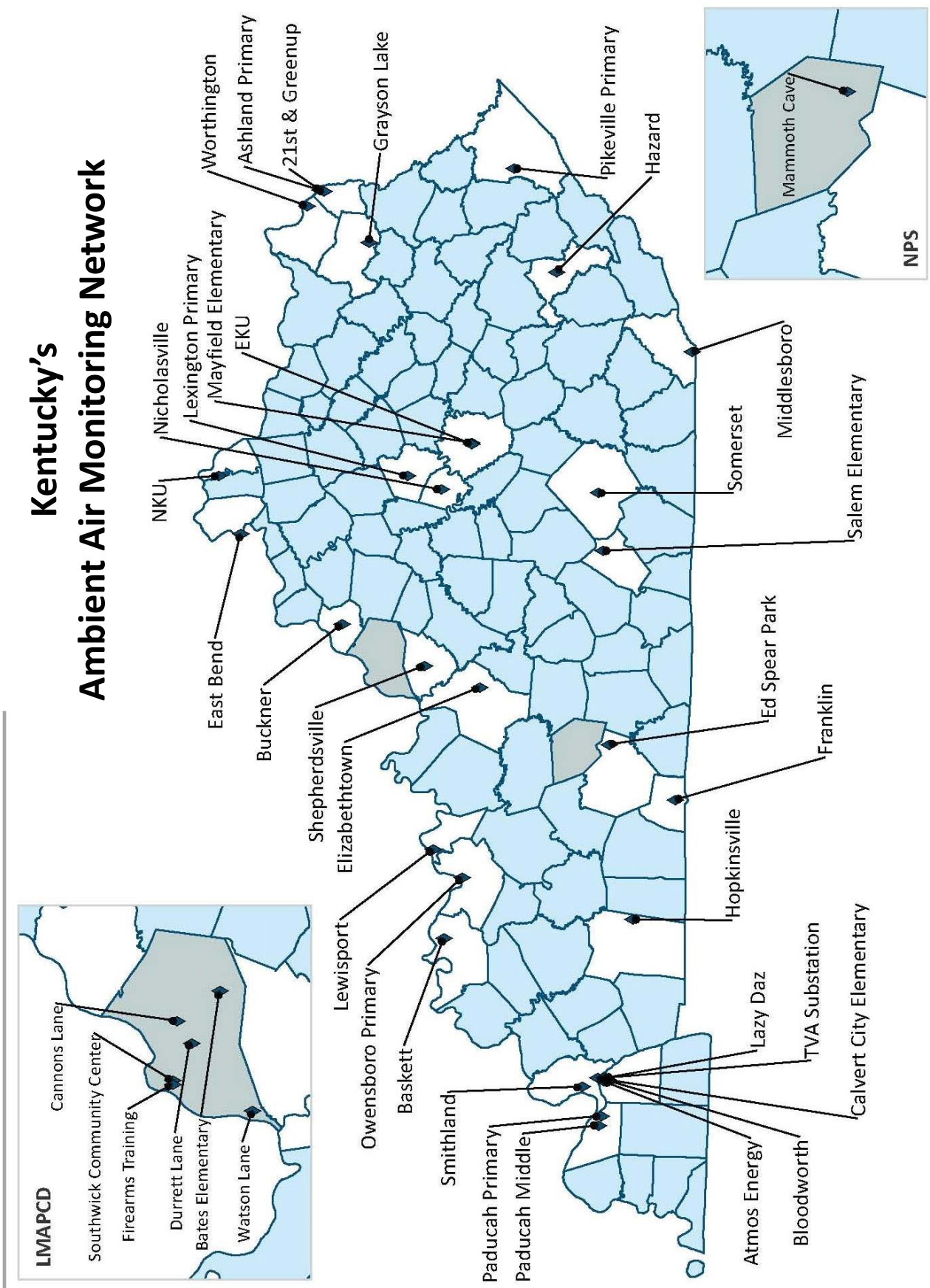


Figure 27: The KDAQ, NPS, and Louisville Metro Air Pollution Control District monitoring network. Insets show the Louisville Metro Air Pollution Control District's and National Park Service's monitoring networks.

Metropolitan Statistical Area	Site Count	PM2.5	Cont. PM2.5	PM10	Cont. PM10	SO2	NO2	NOy	CO	O3	Pb	VOC	Car-bonyl	PAH	PM2.5 Spec	Carbon Spec	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[P]				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		1
Lexington-Fayette, KY [(AQI)]	2	1	1[i]	1[m]		2[P,i]	1[r40,i]			2[i]		1	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[n,i]	5[i]					1[U]	1[U]	1	5
Owensboro, KY	2	1	1[i]			1[i]	1[i]			2[i]								1
Micropolitan Statistical Area																		
Paducah, KY-IL	4	1	1[i]	1		1[P,i]	1[i]			2[i]		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	4			1[m]								5[C]						1
Perry County	1	1	1							1								1
Pike County	1	2[C]	1[i]							1[i]								
Russell County	1										1							
Simpson County	1									1								1
KDAQ Totals	32	18	10	8	0	9	5	0	0	22	4	10	4	1	3	3	1	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	**39**	**23**	**15**	**9**	**4**	**13**	**7**	**2**	**3**	**26**	**4**	**10**	**4**	**1**	**4**	**4**	**2**	**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.

2013 Carbon Monoxide Ambient Air Monitoring Network
(Louisville Metro Air Pollution Control District and National Park Service)

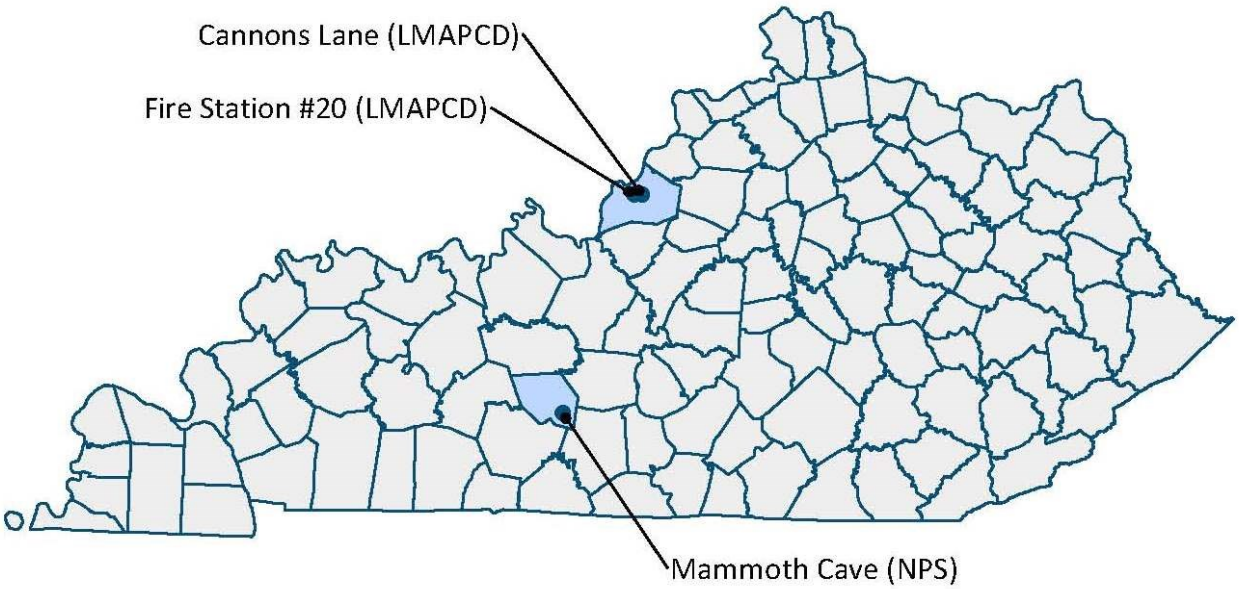


Figure 28: Carbon monoxide monitoring in Kentucky is currently only conducted by the Louisville Metro Air Pollution Control District and the National Park Service. Jefferson County historically has had higher levels of CO than elsewhere in the state, perhaps due to the high levels of vehicle traffic in the area.

Statewide Averages for Carbon Monoxide

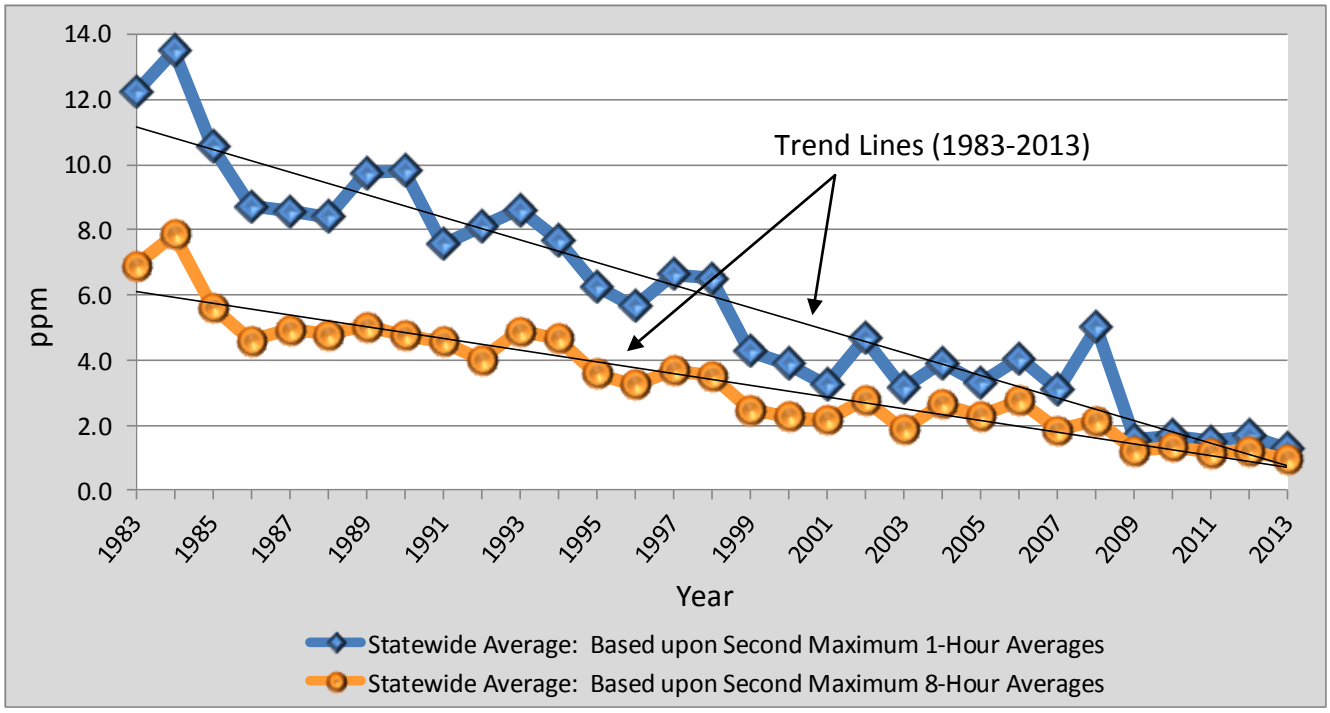


Figure 29: Statewide averages for CO monitoring indicate pollution reductions.

Carbon Monoxide Results

There were no exceedances of the CO standards in 2013. 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 2013, 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.

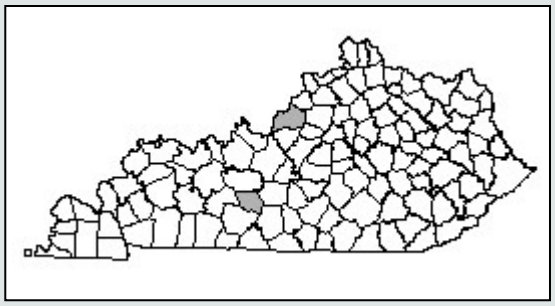
Statewide and regional carbon monoxide levels have declined substantially since 1980, primarily due to improved emission controls on motor vehicles. Due to the substantial drop in monitored levels, carbon monoxide monitoring was discontinued statewide in 2003, except for Jefferson County. The 2003 statewide discontinuation of CO monitors accounts for the uptrend from 2003 to 2008, as seen in Figure 31, 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 – 2013

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> 9.0
Edmondson[1]	Alfred Cook Rd Mammoth Cave	21-061-0501	7998	0.3	0.3	0	0.3	0.3	0
Jefferson[2]	2730 Cannons Ln Louisville	21-111-0067	8489	1.8	1.6	0	1.4	1.1	0
Jefferson[2]	1735 Bardstown Rd Louisville	21-111-1019	8333	2.0	1.9	0	1.5	1.4	0

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

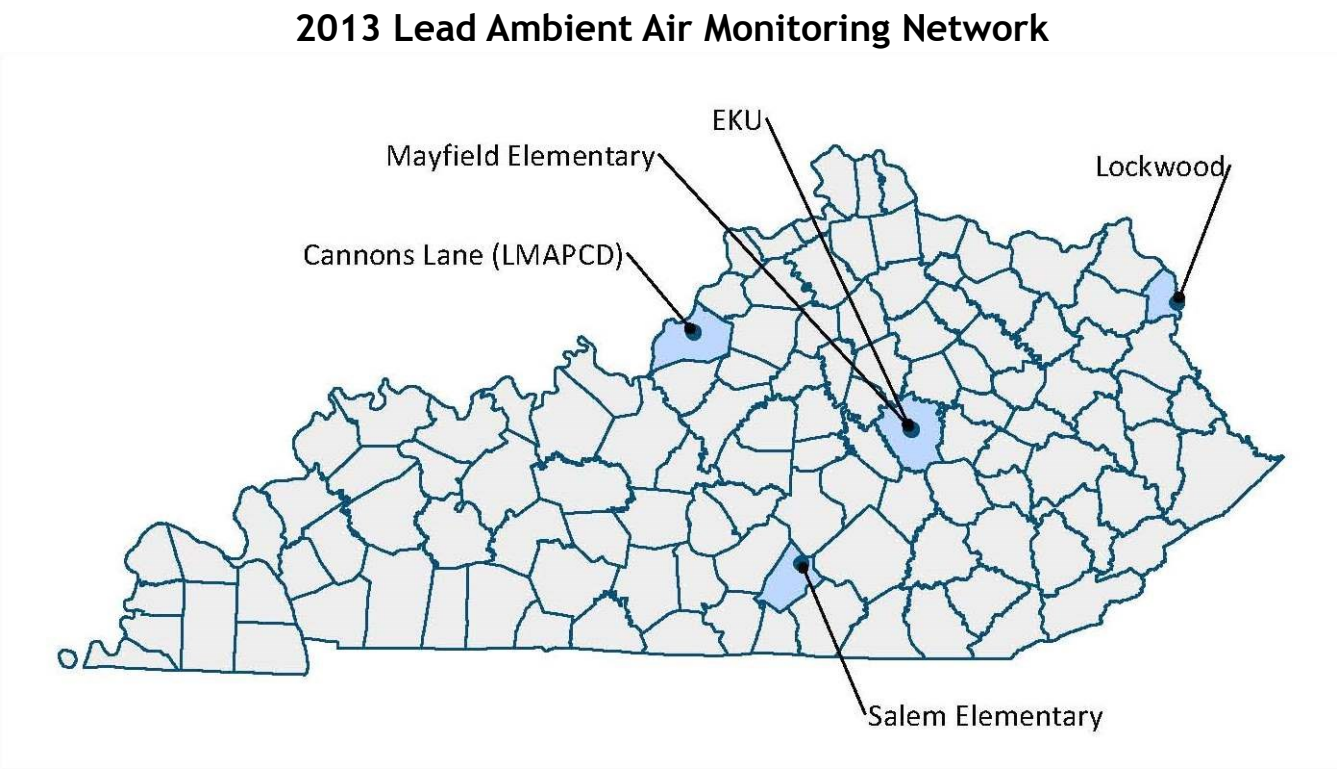


Figure 30: Lead monitoring locations in Kentucky.

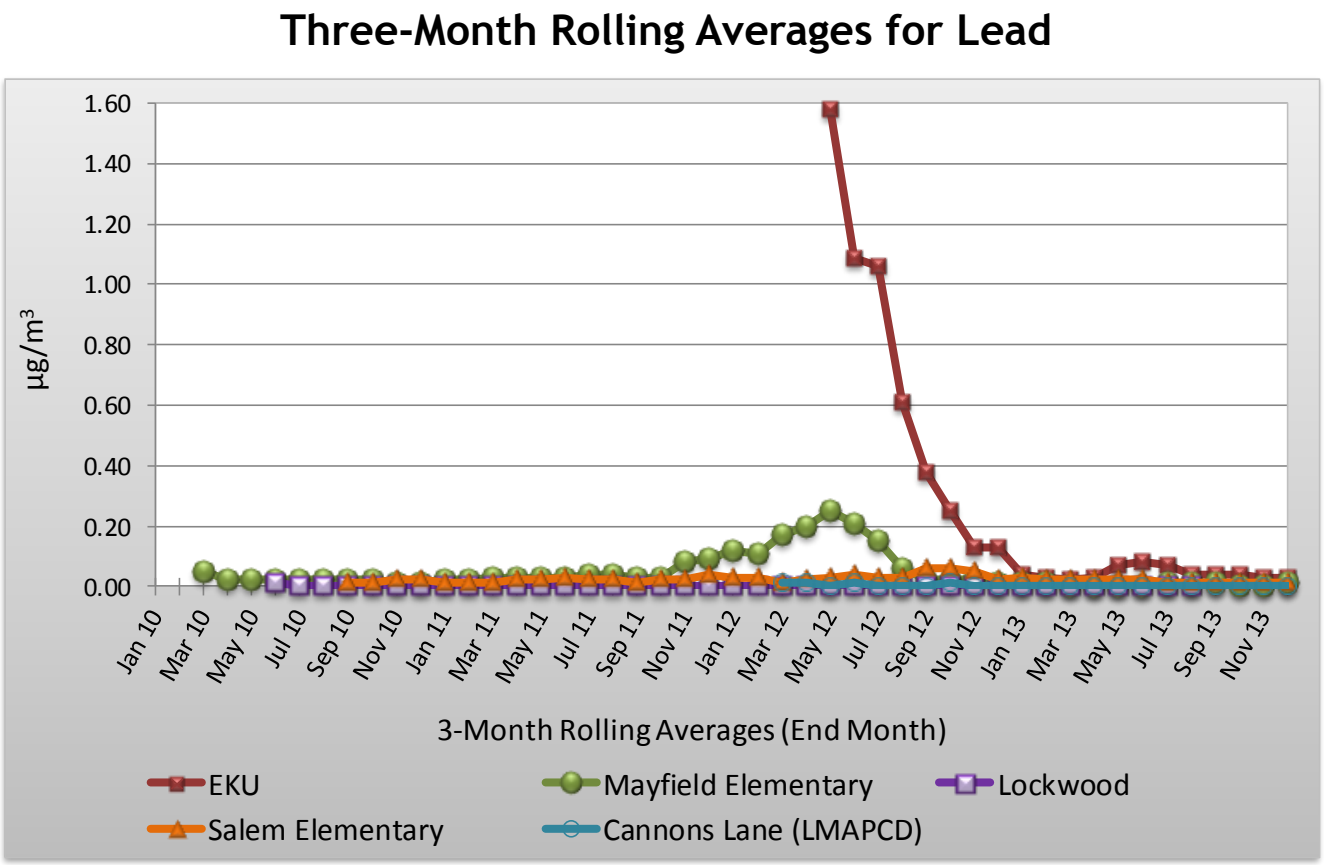


Figure 31: Three-month rolling averages for lead by site. Each three-month average is plotted on the month that the three-month period ended. Monitoring data is only available for 2010-2013.

Lead Results

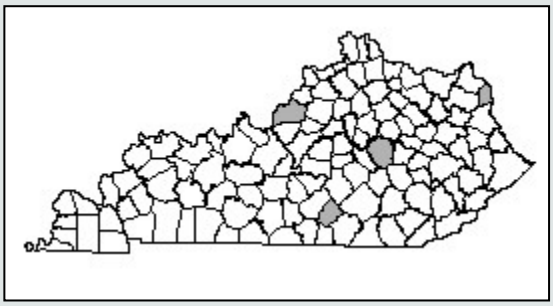
In 2012, the Mayfield Elementary and Eastern Kentucky University sites in Richmond were affected by a compliance issue with a single stationary source. Lead monitors at the two sites registered multiple three-month rolling averages above the 0.15 µg/m^3 NAAQS standard. The compliance issue was resolved, and monitoring data shows that lead concentrations have steadily decreased since that time. Resultantly, all three-month rolling averages recorded at both sites in 2013 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 – 2013

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
Boyd	Lockwood Estates Catlettsburg	21-019-0016	38 *	0.00	0.00	0.00	0.00	0
Jefferson[1] NCore	2730 Cannons Ln Louisville	21-111-0067	54	0.00	0.00	0.00	0.00	0
Madison	Mayfield Elem, Bond St Richmond	21-151-0003	57	0.01	0.01	0.01	0.01	0
Madison	EKU, Van Hoose Dr Richmond	21-151-0005	57	0.08	0.07	0.07	0.04	0
Russell	1409 S. Highway 76 Russell Springs	21-207-0001	60	0.03	0.02	0.02	0.02	0

[1] **Monitor operated by the Louisville Metro Air Pollution Control District.**
NCore **Samples collected with a low-volume manual PM10 sampler and analyzed via x-ray fluorescence.**
* **Incomplete dataset. The mean does not satisfy summary criteria.**

NITROGEN DIOXIDE (NO_2)

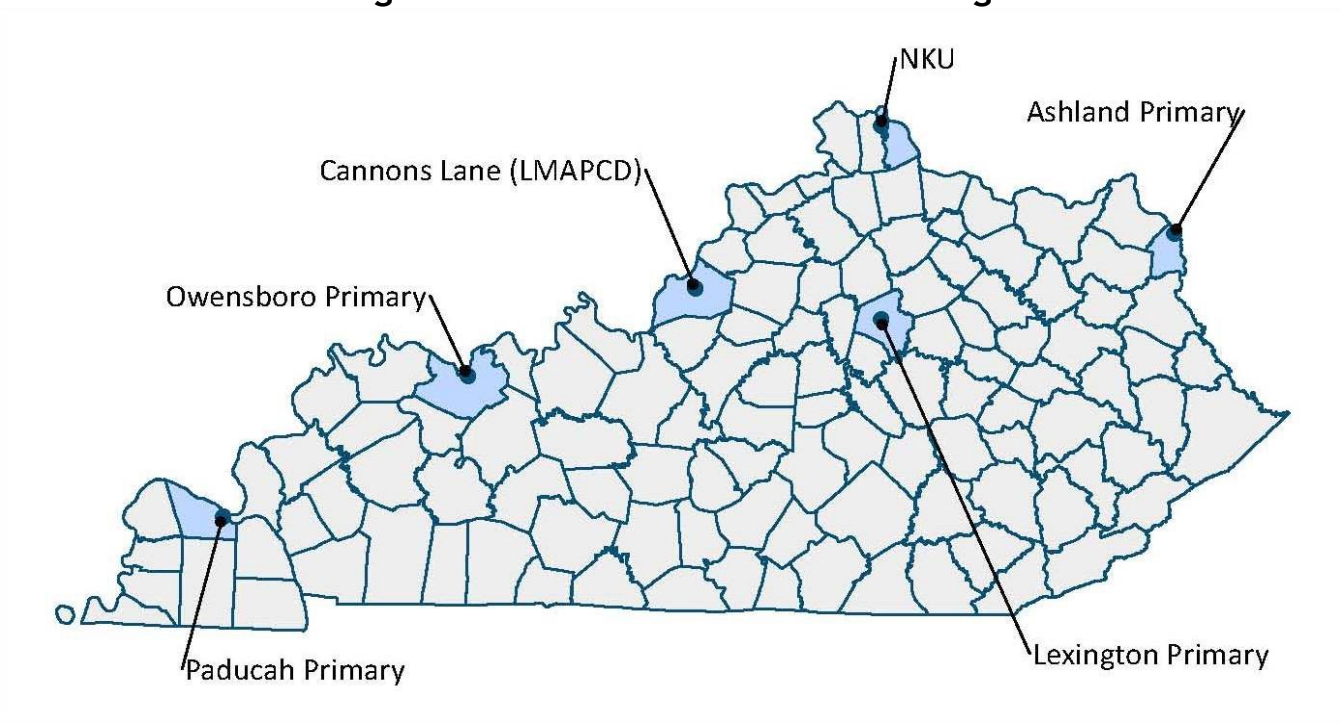


Figure 32: Nitrogen dioxide monitoring locations in Kentucky.

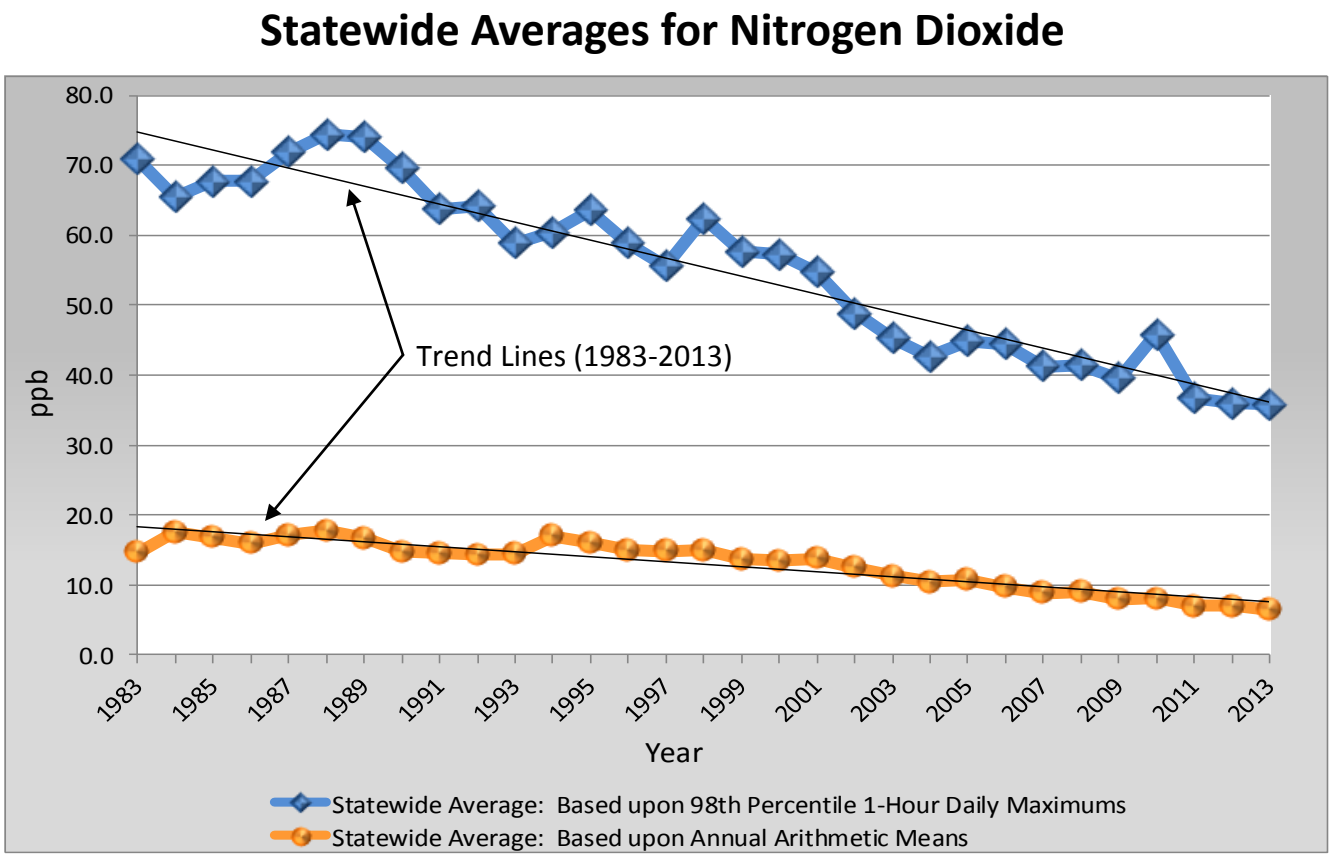


Figure 33: Statewide averages for nitrogen dioxide monitoring indicate pollution reductions.

Nitrogen Dioxide Results

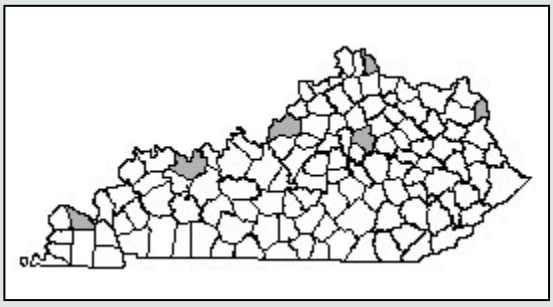
There were no exceedances of the NO_2 standard in 2013. There have been no recorded exceedances of a NO_2 NAAQS since the inception of sampling in 1970. Statewide nitrogen dioxide levels show a steady downward trend, primarily due to the use of pollution control devices on motor vehicles, power plants, and industrial boilers. In 2013, the division and the LMAPCD operated six 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 – 2013

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	8161	36.0	34.0	0	5.57
Campbell	524A John Hill Rd Highland Heights	21-037-3002	8213	39.0	37.0	0	4.51
Daviess	US60 & Pleasant Valley Rd Owensboro	21-059-0005	8085	54.0	35.0	0	4.82
Fayette	650 Newtown Pike Lexington	21-067-0012	8199	51.0	48.0	0	7.35
Jefferson[1]	2730 Cannons Ln Louisville	21-111-0067	8457	51.3	46.5	0	10.93
McCracken	2901 Powell Street Paducah	21-145-1024	8191	41.0	36.0	0	5.68

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

NO_2 Criteria Pollutant Multi-Year Summary Report – 2013
98th Percentile Daily 1-Hour Maximum, 3-Year Average

County	Site Address	AQS-ID	98th Percentile Daily Maximum 1-Hr Averages				
			2011	2012	2013	3-Yr Avg	Obs > 100
Boyd	2924 Holt Street Ashland	21-019-0017	30.0 *	30.0	30.0	30 *	0
Campbell	524A John Hill Road Highland Heights	21-037-3002	28.0	29.0	33.0	30	0
Daviess	US 60 & Pleasant Valley Rd Owensboro	21-059-0005	33.0	31.0	31.0	32	0
Fayette	650 Newtown Pike Lexington	21-067-0012	47.0	45.0	44.0	45	0
Jefferson[1]	2730 Cannons Lane Louisville	21-111-0067	45.1	44.8	42.5	44	0
McCracken	2901 Powell Street Paducah	21-145-1024	37.0	36.0	34.0	36	0

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

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

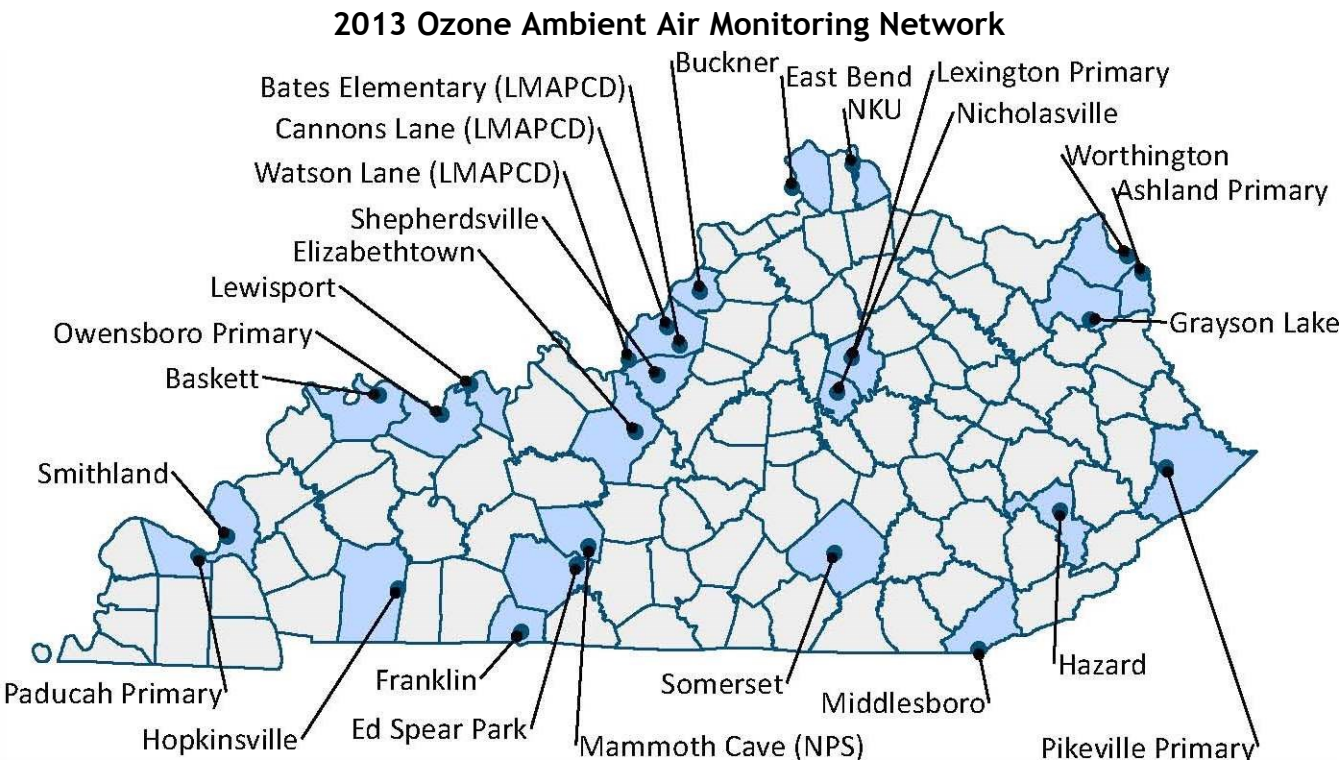


Figure 34: Ozone monitoring locations in Kentucky.

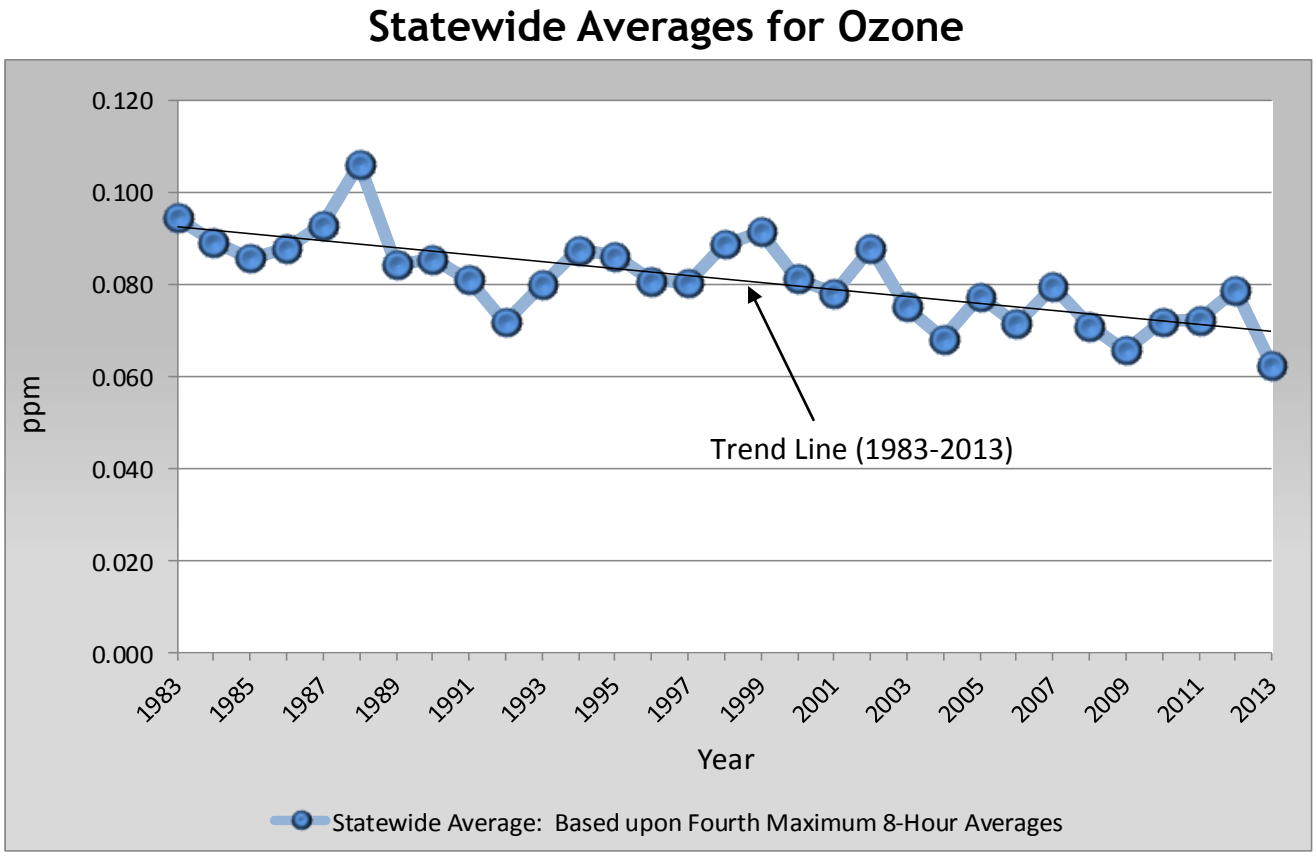


Figure 35: Statewide averages for ozone monitoring indicate pollution reductions.

Ozone Results

In 2013, there were only three daily maximum eight-hour averages that were greater than 0.075 ppm, which is a vast improvement from 2012 when Kentucky recorded 174 daily maximum eight-hour averages above 0.075 ppm. Resultantly, 2013 data shows that there were no sites that recorded fourth highest daily maximums in exceedance of the eight-hour standard. In 2013, DAQ, the National Park Service at Mammoth Cave, and the LMAPCD operated a total of 26 ozone monitors in Kentucky.

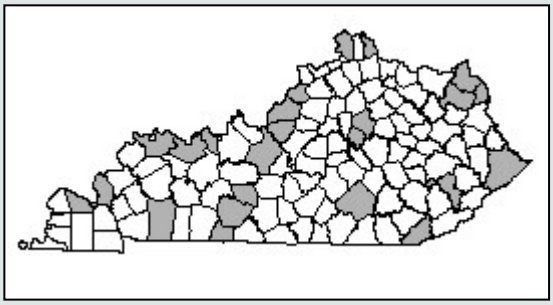
Generally, there has been a decline in ozone levels over the past 25 years based on one-hour data. This downward trend is the result of emission controls on vehicles and a regional strategy controlling NO_x emissions from large stationary internal combustion engines, large boilers and turbines used in 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 – 2013

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	244	0.063	0.062	0.061	0.058	0
Boone	KY 338 & Lower River East Bend	21-015-0003	244	0.071	0.062	0.060	0.059	0
Boyd	2924 Holt Street Ashland	21-019-0017	245	0.076	0.067	0.066	0.065	1
Bullitt	2nd & Carpenter St Shepherdsville	21-029-0006	242	0.072	0.065	0.065	0.064	0
Campbell	524A John Hill Rd NKU	21-037-3002	245	0.079	0.076	0.072	0.072	2
Carter	Camp Webb Grayson Lake	21-043-0500	243	0.069	0.065	0.065	0.062	0
Christian	10800 Pilot Rock Hopkinsville	21-047-0006	239	0.071	0.067	0.066	0.062	0

Values in red represent an exceedance of the NAAQS.

Ozone Criteria Pollutant Summary Report – 2013 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	245	0.068	0.068	0.066	0.066	0
Edmonson[1]	Alfred Cook Rd Mammoth Cave	21-061-0501	241	0.072	0.068	0.067	0.063	0
Fayette	650 Newtown Pike Lexington	21-067-0012	243	0.064	0.062	0.061	0.060	0
Greenup	Scott & Center St Worthington	21-089-0007	245	0.071	0.067	0.062	0.060	0
Hancock	2nd & Caroline Lewisport	21-091-0012	245	0.067	0.066	0.063	0.063	0
Hardin	801 North Miles St Elizabethtown	21-093-0006	243	0.067	0.063	0.062	0.062	0
Henderson	Baskett Fire Dept. Baskett	21-101-0014	241	0.069	0.068	0.067	0.066	0
Jefferson[2]	7601 Bardstown Rd Louisville	21-111-0027	243	0.069	0.065	0.064	0.064	0
Jefferson[2]	7201 Watson Lane Louisville	21-111-0051	231	0.068	0.066	0.065	0.064	0
Jefferson[2]	2730 Cannons Lane Louisville	21-111-0067	239	0.069	0.068	0.066	0.065	0
Jessamine	DOT, Etter Drive Nicholasville	21-113-0001	236	0.063	0.062	0.061	0.061	0
Livingston	DOT 811 US 60E Smithland	21-139-0003	240	0.073	0.066	0.065	0.065	0
McCracken	2901 Powell Street Paducah	21-145-1024	245	0.070	0.067	0.065	0.064	0
Oldham	DOT, 3995 Morgan Buck-ner	21-185-0004	242	0.073	0.065	0.064	0.064	0
Perry	Perry Co Horse Park Hazard	21-193-0003	245	0.063	0.060	0.060	0.058	0
Pike	101 North Mayo Trail Pikeville	21-195-0002	243	0.063	0.061	0.056	0.055	0
Pulaski	Clifty Street Somerset	21-199-0003	243	0.064	0.062	0.061	0.061	0
Simpson	DOT, HWY 1008 Franklin	21-213-0004	235	0.060	0.060	0.059	0.059	0
Warren	Ed Spear Park Smiths Grove	21-227-0009	234	0.063	0.062	0.062	0.060	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 – 2013
8-hour 4th Maximum, 3-year Average

County	Site Address	AQS-ID	4th Maximum 8-hr Average			
			2011	2012	2013	3-Yr Avg
Bell	34th & Dorchester Middlesboro	21-013-0002	0.062	0.066	0.058	0.062
Boone	KY 338 & Lower River Road East Bend	21-015-0003	0.070	0.074	0.059	0.067
Boyd	2924 Holt Street Ashland	21-019-0017	0.070	0.074	0.065	0.069
Bullitt	2nd & Carpenter Streets Shepherdsville	21-029-0006	0.072	0.080	0.064	0.072
Campbell	524A John Hill Highland Heights	21-037-3002	0.080	0.084	0.072	0.078
Carter	Camp Webb Grayson Lake	21-043-0500	0.066	0.071	0.062	0.066
Christian	10800 Pilot Rock Road Hopkinsville	21-047-0006	0.070	0.075	0.062	0.069
Daviess	US 60 & Pleasant Valley Rd Owensboro	21-059-0005	0.080	0.087	0.066	0.077
Edmonson[1]	Alfred Cook Road Mammoth Cave	21-061-0501	0.071	0.081	0.063	0.071
Fayette	650 Newtown Pike Lexington	21-067-0012	0.075	0.078	0.060	0.071
Greenup	Scott & Center Streets Worthington	21-089-0007	0.071	0.076	0.060	0.069
Hancock	2nd & Caroline Streets Lewisport	21-091-0012	0.075	0.081	0.063	0.073
Hardin	801 North Miles Street Elizabethtown	21-093-0006	0.069	0.079	0.062	0.070
Henderson	Baskett Fire Dept Baskett	21-101-0014	0.077	0.087	0.066	0.076
Jefferson[2]	7601 Bardstown Road Louisville	21-111-0027	0.081	0.086	0.064	0.077
Jefferson[2]	7201 Watson Lane Louisville	21-111-0051	0.082	0.081	0.064	0.075
Jefferson[2]	2730 Cannons Lane Louisville	21-111-1021	0.082	0.090	0.065	0.079
Jessamine	DOT, Etter Drive Nicholasville	21-113-0001	0.072	0.077	0.061	0.070
Livingston	DOT, 811 US 60 East Smithland	21-139-0003	0.071	0.087	0.065	0.074

Ozone Criteria Pollutant Multi-Year Summary Report - 2013 Continued
8-hour 4th Maximum, 3-year Average

County	Site Address	AQS-ID	4th Maximum 8-hr Average			
			2011	2012	2013	3-Yr Avg
McCracken	2901 Powell Street Paducah	21-145-1024	0.071	0.087	0.064	0.074
Oldham	DOT, 3995 Morgan Rd Buckner	21-185-0004	0.090	0.092	0.064	0.082
Perry	Perry County Horse Park Hazard	21-193-0003	0.063	0.070	0.058	0.063
Pike	101 North Mayo Trail Pikeville	21-195-0002	0.066	0.068	0.055	0.063
Pulaski	Clifty Street Somerset	21-199-0003	0.067	0.075	0.061	0.067
Simpson	DOT, Hwy 1008 Franklin	21-213-0004	0.071	0.071	0.059	0.067
Warren	Ed Spear Park Smiths Grove	21-227-0009	---	0.058 *	0.060	0.062 *

[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.

2013 Particulate Matter ($PM_{2.5}$) Ambient Air Monitoring Network

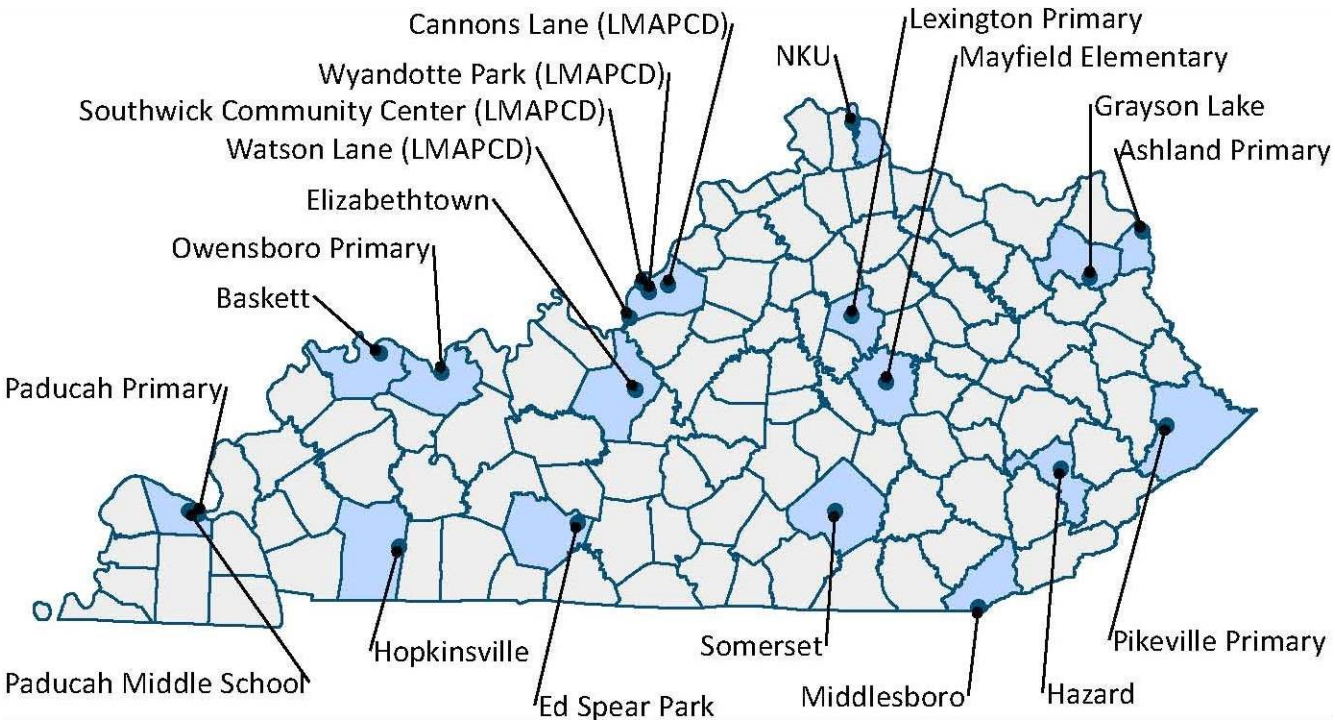


Figure 36: $PM_{2.5}$ monitoring locations in Kentucky.

Statewide Averages for $PM_{2.5}$

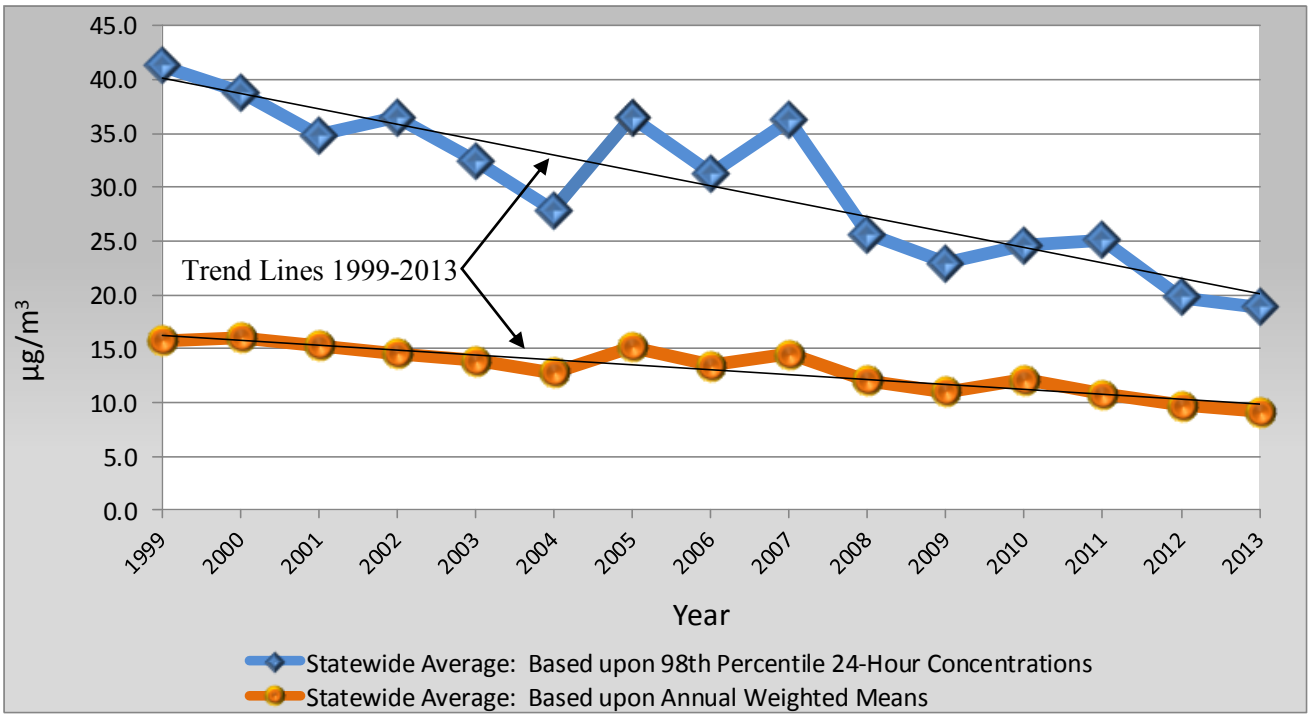


Figure 37: Statewide averages for $PM_{2.5}$ monitoring indicate pollution reductions.

$PM_{2.5}$ Results

There were no exceedances of either the 24-hour or annual $PM_{2.5}$ standards in 2013. Furthermore, no sampler exceeded either the three-year 24-hour standard or the three-year annual standard, during the 2011-2013 averaging period. This is a significant accomplishment. In 2013, DAQ and LMAPCD operated FRM-type samplers for NAAQS comparisons at 20 sites in 16 counties.

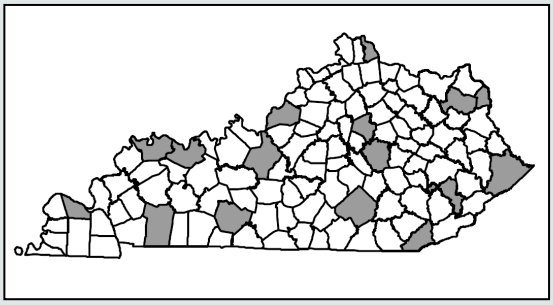
Generally, statewide $PM_{2.5}$ levels declined during the 1999-2013 time period.

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 – 2013

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	21.7	16.5	15.7	15.2	0	9.07
Boyd	2924 Holt Street Ashland	21-019-0017	118	21.9	19.8	19.5	19.2	0	9.12
Campbell	524A John Hill Rd Highland Heights	21-037-3002	116	24.2	22.4	21.6	20.9	0	9.56
Carter	Camp Webb Grayson Lake	21-043-0500	113	19.4	16.1	14.1	13.9	0	7.53
Christian	10800 Pilot Rock Hopkinsville	21-047-0006	113	24.7	23.3	21.6	20.5	0	9.77
Daviess	US60 & Pleasant Valley Rd Owensboro	21-059-0014	121	23.8	22.4	22.2	21.0	0	10.18

$PM_{2.5}$ Criteria Pollutant Summary Report – 2013 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	21.0	20.6	20.0	19.4	0	9.36
Hardin	801 North Miles Street Elizabethtown	21-093-0006	121	23.3	21.5	20.5	20.0	0	9.84
Henderson	Basket Fire Dept. Baskett	21-101-0014	109	28.3	26.0	21.6	20.8	0	10.58
Jefferson[1]	37th & Southern Avenue Louisville	21-111-0043	103	21.4	19.6	18.8	18.6	0	9.69 *
Jefferson[1]	1032 Beecher Avenue Louisville	21-111-0044	105	22.9	22.0	20.6	18.7	0	9.95 *
Jefferson[1]	7201 Watson Lane Louisville	21-111-0051	99	22.8	19.8	19.3	18.7	0	9.68 *
Jefferson[1]	2730 Cannons Lane Louisville	21-111-0067	105	22.3	20.0	19.2	18.1	0	9.35 *
McCracken	342 Lone Oak Road Paducah	21-145-1004	68	23.0	21.0	17.5	16.8	0	10.03 *
McCracken	2901 Powell Street Paducah	21-145-1024	47	23.4	20.0	19.5	18.7	0	10.94 *
Madison	Mayfield School Richmond	21-151-0003	113	20.2	16.9	16.7	16.5	0	8.15
Perry	Perry County Horse Park Hazard	21-193-0003	10	12.2	9.2	8.2	6.7	0	5.91 *
Pike	101 North Mayo Trail Pikeville	21-195-0002	118	16.1	14.2	14.0	13.9	0	7.80
Pulaski	305 Clifty Street Somerset	21-199-0003	118	19.9	18.7	17.6	17.0	0	8.78
Warren	Ed Spear Park Smiths Grove	21-227-0009	113	20.1	19.6	19.3	19.0	0	9.78

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

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

$PM_{2.5}$ Criteria Pollutant Multi-Year Summary Report – 2013
24-Hour 98th Percentile, 3-Year Average

County	Site	AQS-ID	24-Hour, 98th Percentile			
			2011	2012	2013	3-Yr Avg
Bell	34th & Dorchester Middlesboro	21-013-0002	26.0	19.8	16.5	21
Boyd	2924 Holt Street Ashland	21-019-0017	22.5	22.4	19.5	21
Campbell	524A John Hill Highland Heights	21-037-3002	25.8	20.7	21.6	23
Carter	Camp Webb Grayson Lake	21-043-0500	19.6	17.6	14.1	17
Christian	10800 Pilot Rock Road Hopkinsville	21-047-0006	23.2	19.6	21.6	21
Daviess	US60 and Pleasant Valley Rd Owensboro	21-059-0005	27.2	22.3	22.2	24
Fayette	650 Newtown Pike Lexington	21-067-0012	24.0	19.1	20.0	21
Hardin	801 North Miles Street Elizabethtown	21-093-0006	24.7	20.0 *	20.5	22 *
Henderson	Baskett Fire Dept Baskett	21-101-0014	26.2	20.2	21.6	23
Jefferson[1]	37th & Southern Avenue Louisville	21-111-0043	29.6	---	18.8 *	24 *
Jefferson[1]	1032 Beecher Avenue Louisville	21-111-0044	26.8	---	20.6 *	24 *
Jefferson[1]	7201 Watson Lane Louisville	21-111-0051	31.3	---	19.8 *	25 *
Jefferson[1]	2730 Cannons Lane Louisville	21-111-0067	27.0	---	19.2 *	17 *
McCracken	342 Lone Oak Road Paducah	21-145-1004	23.2	19.3	21.0 *	21 *
McCracken	2901 Powell Street Paducah	21-145-1024	---	---	23.4 *	23 *
Madison	Mayfield School Richmond	21-151-0003	21.8	17.5	16.7	19
Perry	Perry County Horse Park Hazard	21-193-0003	---	---	12.2 *	12 *
Pike	101 North Mayo Trail Pikeville	21-195-0002	23.7	18.9	14.0	19
Pulaski	305 Clifty Street Somerset	21-199-0003	---	19.9	17.6	19 *
Warren	Ed Spear Park Smiths Grove	21-227-0009	---	19.0 *	19.3	19 *

[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 – 2013
Annual Weighted Mean, 3-Year Average

County	Site	AQS-ID	Annual Weighted Mean			
			2011	2012	2013	3-Yr Avg
Bell	34th & Dorchester Middlesboro	21-013-0002	10.6	10.3	9.1	10.0
Boyd	2924 Holt Street Ashland	21-019-0017	10.4	10.2	9.1	9.9
Campbell	524A John Hill Highland Heights	21-037-3002	10.3	9.7	9.6	9.9
Carter	Camp Webb Grayson Lake	21-043-0500	8.6	8.3	7.5	8.1
Christian	10800 Pilot Rock Road Hopkinsville	21-047-0006	11.2	9.9	9.8	10.3
Daviess	US60 and Pleasant Valley Rd Owensboro	21-059-0005	12.1	10.8	10.2	11.0
Fayette	650 Newtown Pike Lexington	21-067-0012	10.3	9.8	9.4	9.8
Hardin	801 North Miles Street Elizabethtown	21-093-0006	10.6	11.7 *	9.8	10.7 *
Henderson	Baskett Fire Dept. Baskett	21-101-0014	11.0	10.4	10.6	10.7
Jefferson[1]	37th & Southern Avenue Louisville	21-111-0043	12.1	---	9.6 *	10.9 *
Jefferson[1]	1032 Beecher Avenue Louisville	21-111-0044	12.3	---	9.9 *	11.1 *
Jefferson[1]	7201 Watson Lane Louisville	21-111-0051	11.8	---	9.7 *	10.8 *
Jefferson[1]	2730 Cannons Lane Louisville	21-111-0067	11.5	---	9.3 *	10.4 *
McCracken	342 Lone Oak Road Paducah	21-145-1004	10.4	10.0	10.0 *	10.1 *
McCracken	2901 Powell Street Paducah	21-145-1024	---	---	10.9 *	10.9 *
Madison	Mayfield School Richmond	21-151-0003	9.2	8.8	8.2	8.7
Perry	Perry County Horse Park Hazard	21-193-0003	---	---	5.9 *	5.9 *
Pike	101 North Mayo Trail Pikeville	21-195-0002	9.5	9.2	7.8	8.8
Pulaski	305 Clifty Street Somerset	21-199-0003	---	9.6 *	8.8	9.2 *
Warren	Ed Spear Park Smiths Grove	21-227-0009	---	10.4 *	9.7	10.0 *

[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.

2013 Particulate Matter ($PM_{2.5}$) Speciation
Ambient Air Monitoring Network

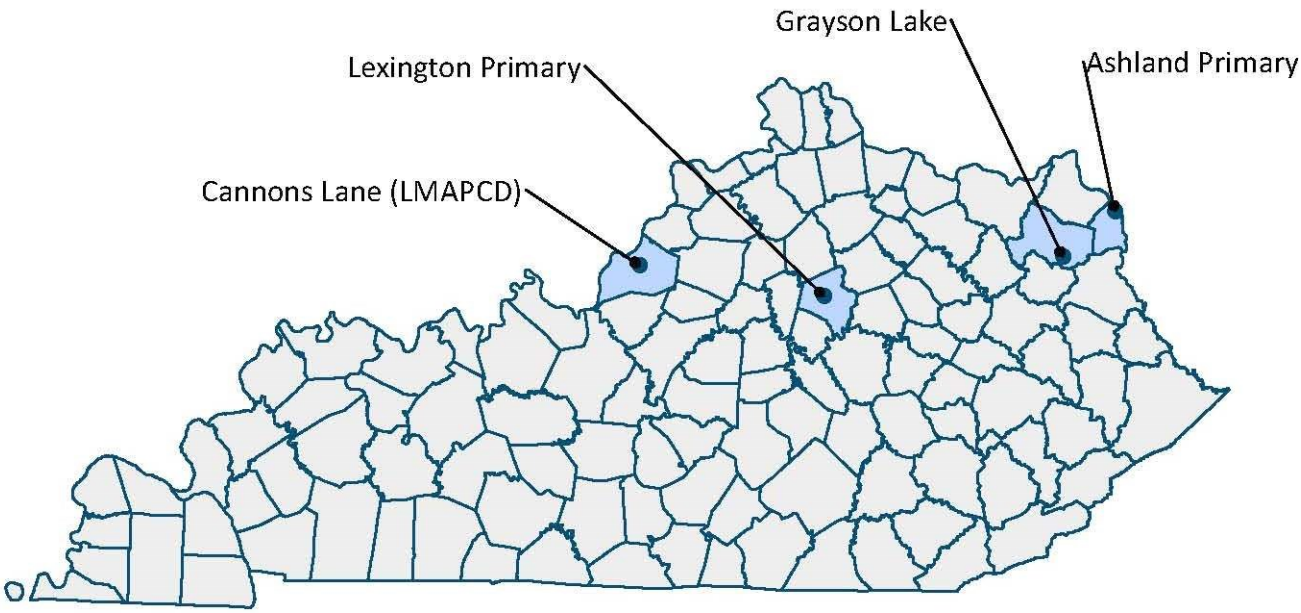


Figure 38: $PM_{2.5}$ speciation monitoring locations in Kentucky.

$PM_{2.5}$ 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 2013, 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 are 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 2013. 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.

2013 $PM_{2.5}$ Speciation: Average Distributions of Major Species

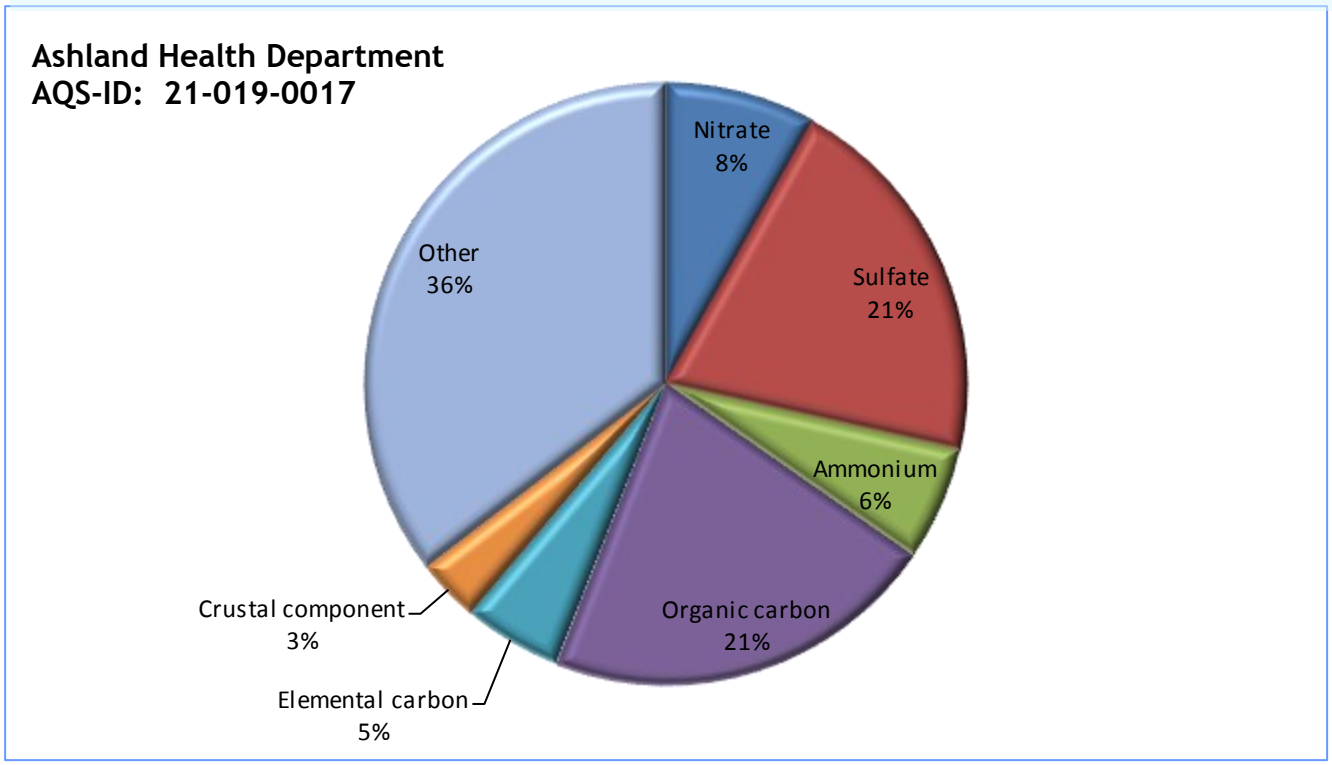


Figure 39: Average species distribution of major elements from the Ashland Health Department $PM_{2.5}$ speciation monitor (AQS I.D.: 21-019-0017). "Other" represents a combined percentage of mixed components not characterized as major elements or crustal components.

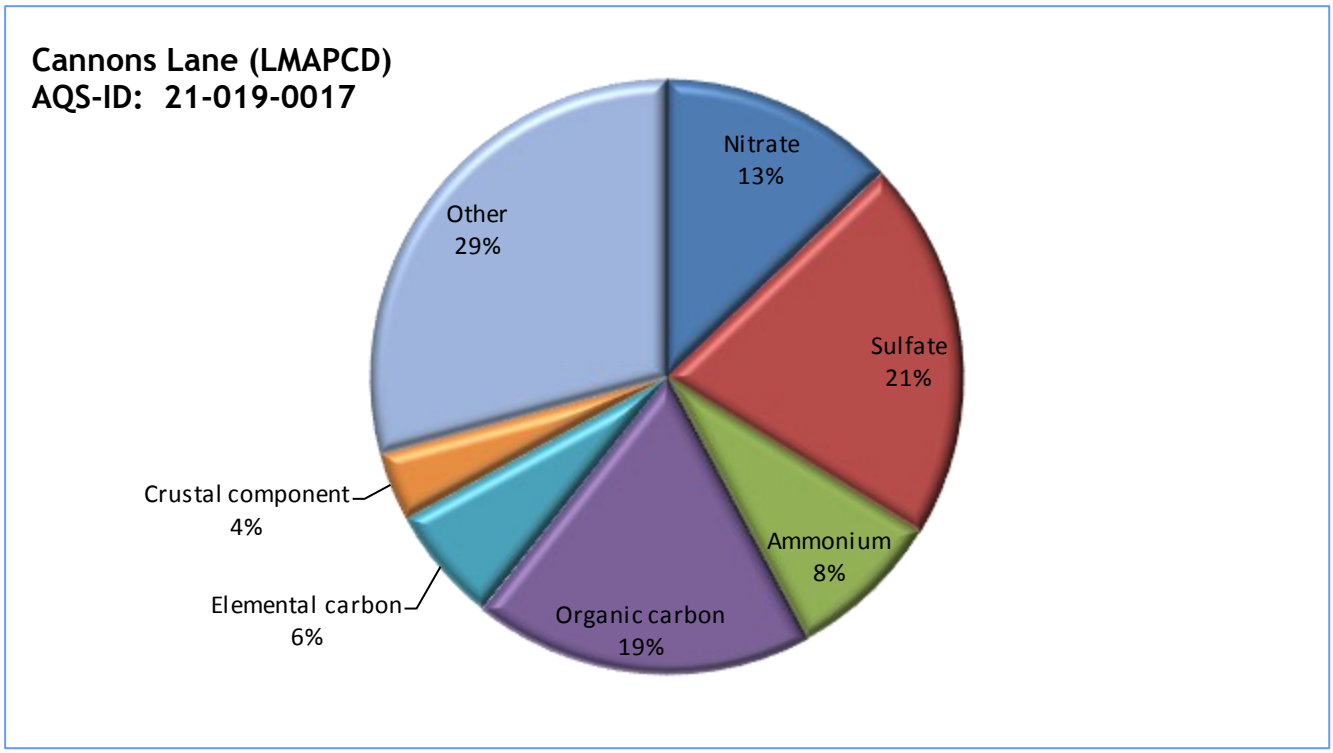


Figure 40: Average species distribution of major elements from the Louisville Metropolitan Air Pollution Control District $PM_{2.5}$ speciation monitor at the Cannons Lane site (AQS I.D.: 21-111-0067). "Other" represents a combined percentage of mixed components not characterized as major elements or crustal components.

2013 $PM_{2.5}$ Speciation: Average Distributions of Major Species

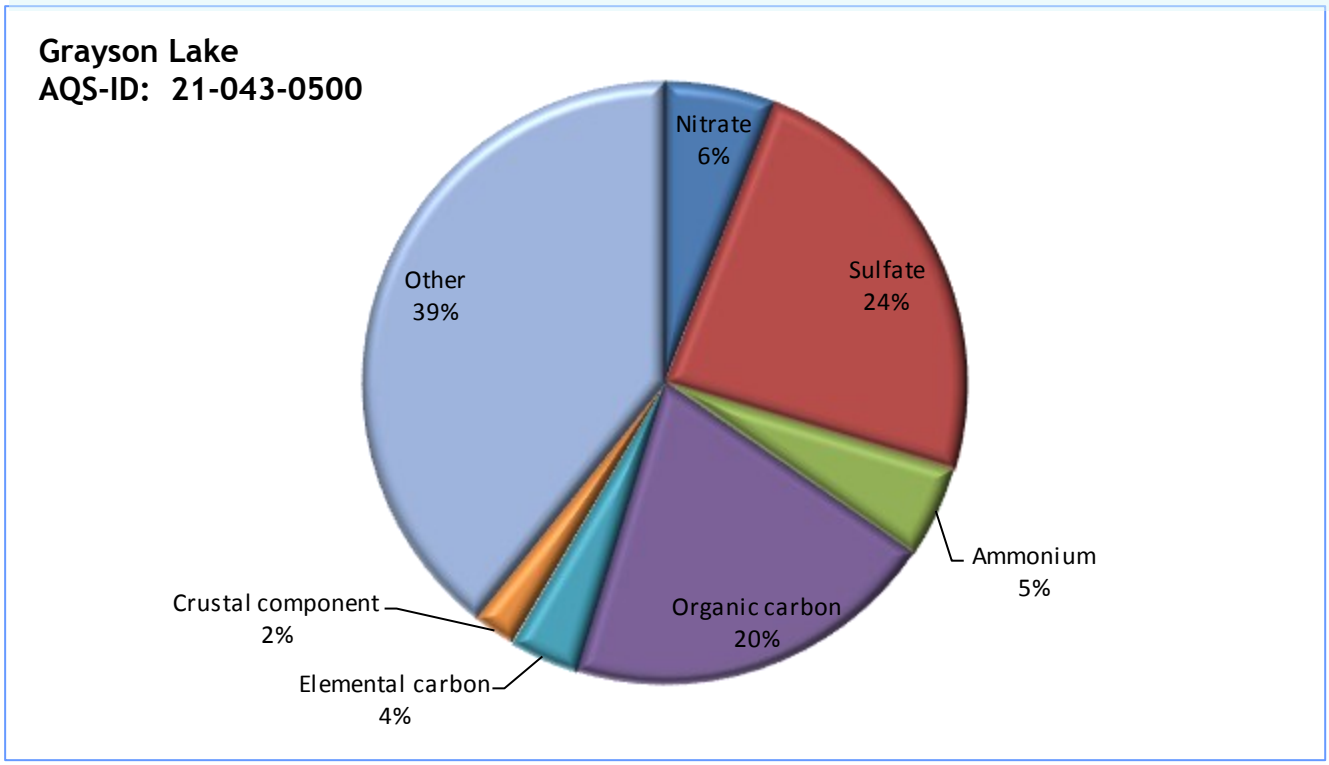


Figure 41: Average species distribution of major elements from the Grayson Lake $PM_{2.5}$ speciation monitor (AQS I.D.: 21-043-0500). "Other" represents a combined percentage of mixed components not characterized as major elements or crustal components.

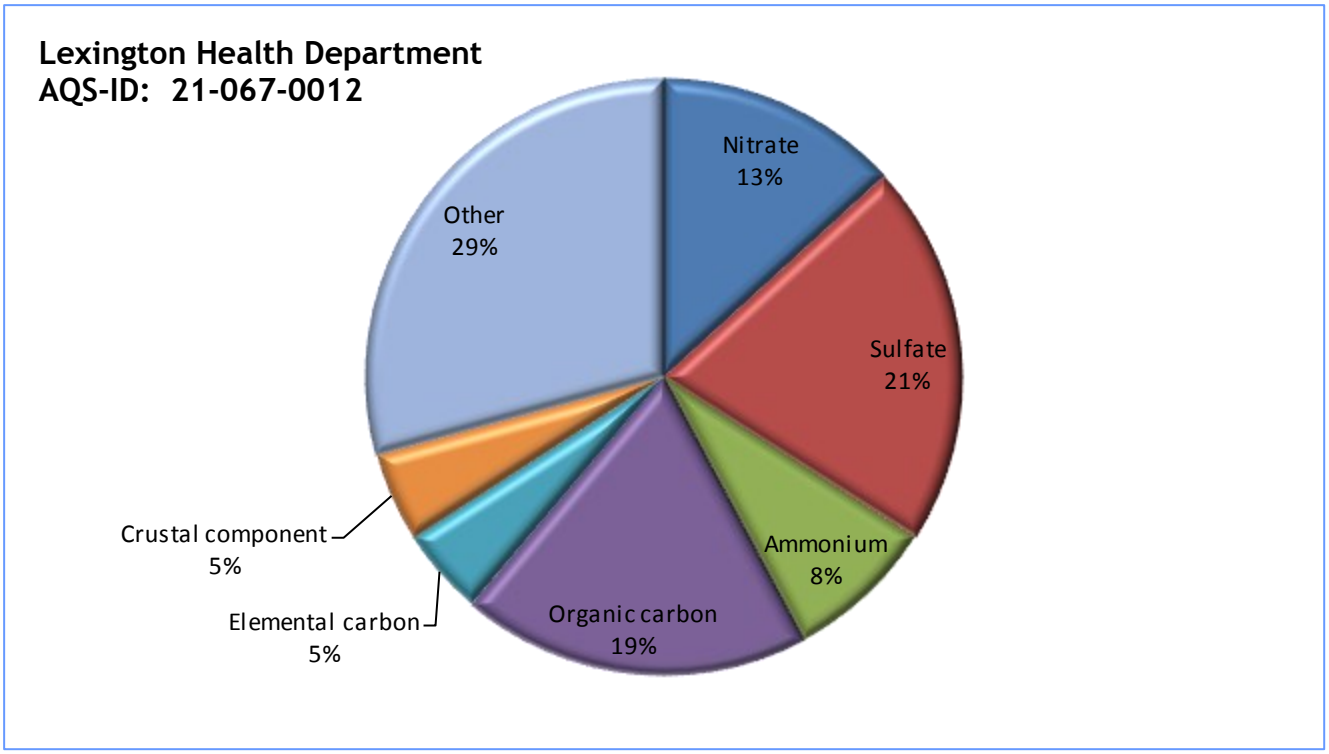


Figure 42: Average species distribution of major elements from the Lexington Health Department $PM_{2.5}$ speciation monitor (AQS I.D.: 21-067-0012). "Other" represents a combined percentage of mixed components not characterized as major elements or crustal components.

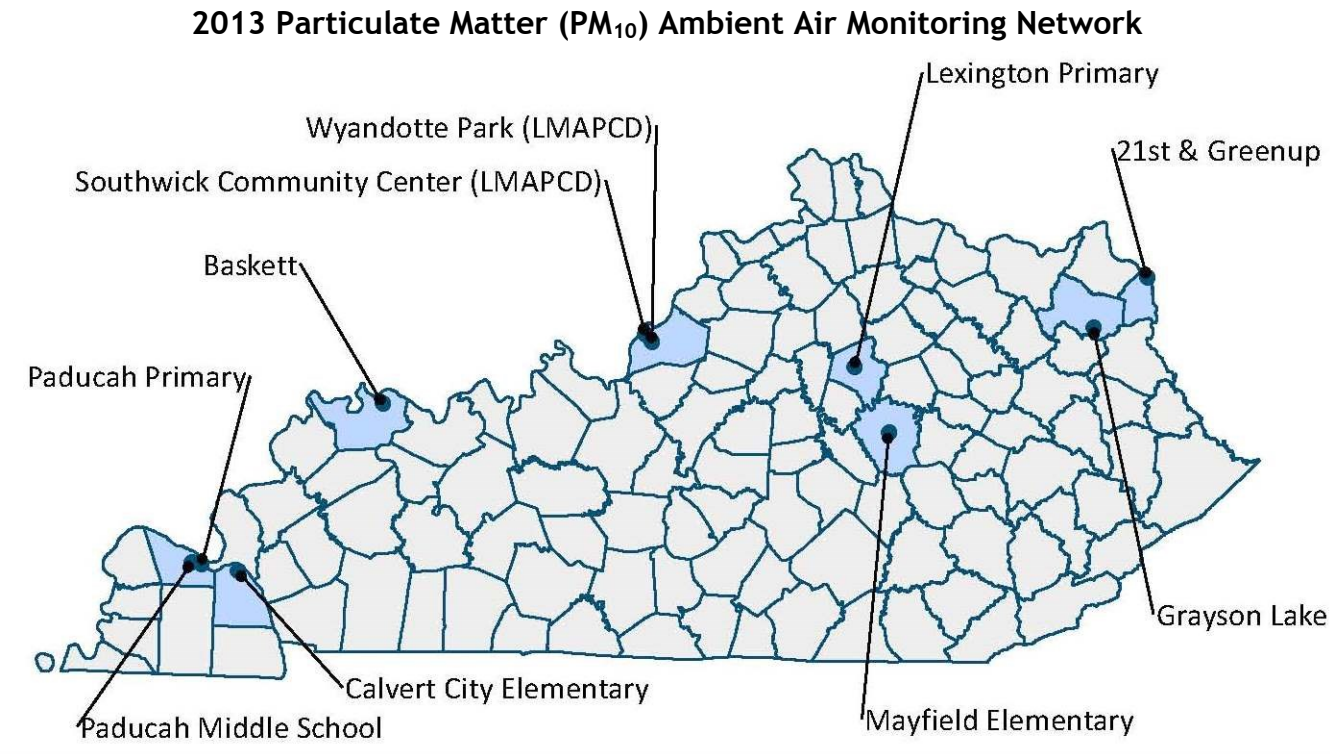


Figure 43: PM_{10} monitoring locations in Kentucky.

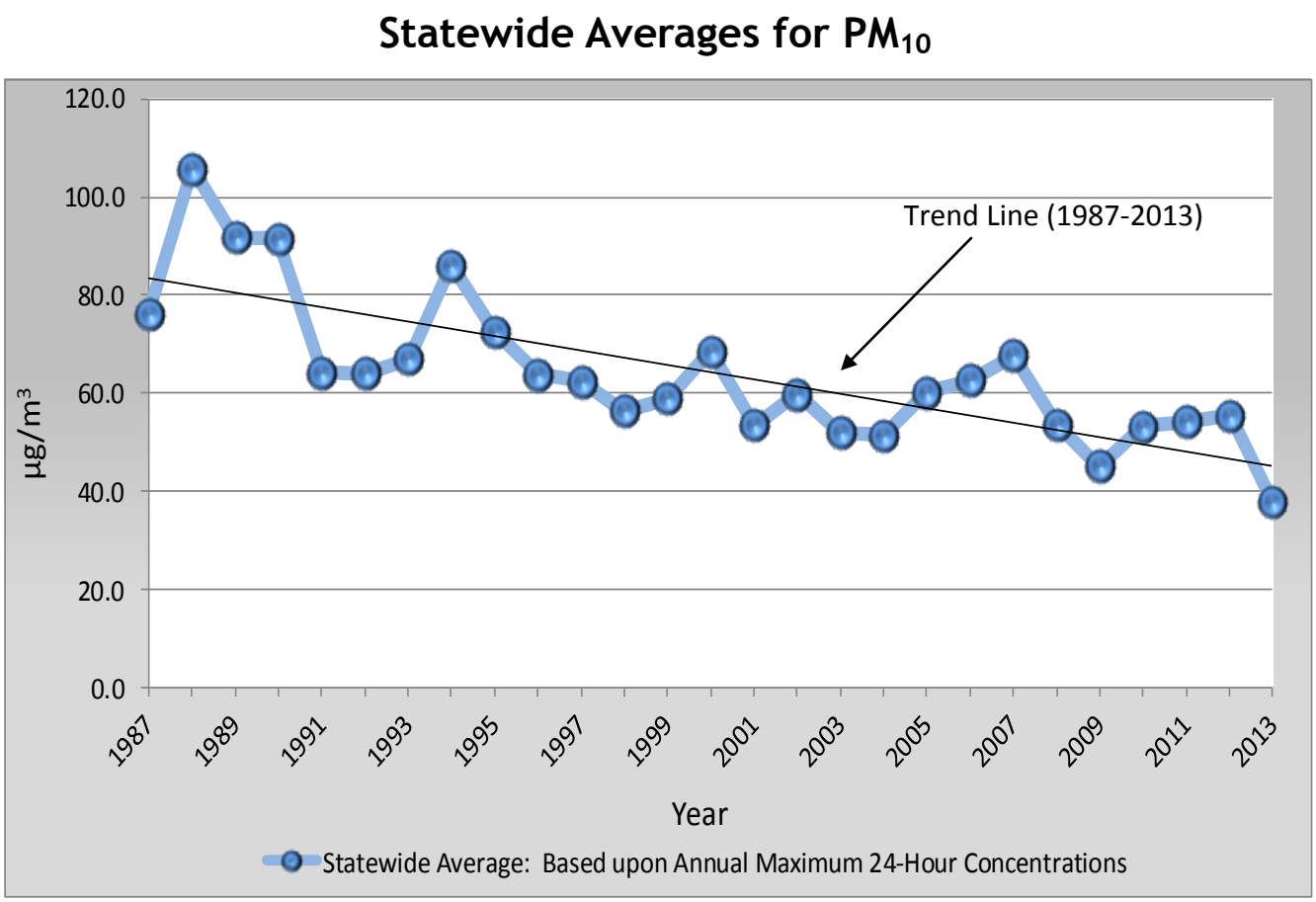


Figure 44: Statewide averages for PM_{10} monitoring indicate pollution reductions.

PM_{10} Results

In 2013, the DAQ and the LMAPCD operated a combined network of nine 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.

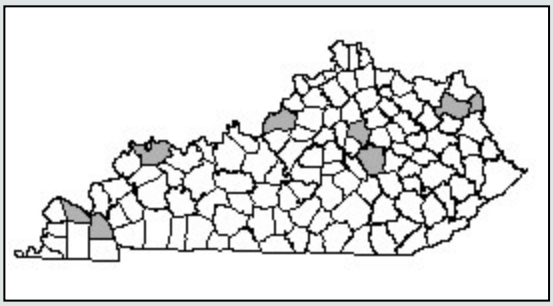
There were no exceedances of the annual PM_{10} standard in 2013. The last exceedance of the standard occurred on March 22, 2012, at the Ashland site (21-019-0002), which is located next to a metals recycler. Prior to 2012, only two previous exceedances of the PM_{10} NAAQS have been recorded. One of 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 – 2013

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



County	Site	AIRS-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	284	77	74	65	60	0	0	20.9
Carter	Camp Webb Grayson Lake	21-043-0500	58	17	17	16	15	0	0	10.2
Fayette	650 Newtown Pike Lexington	21-067-0012	53	40	25	24	24	0	0	15.7
Henderson	Baskett Fire Dept. Baskett	21-101-0014	60	27	25	24	24	0	0	14.3
Jefferson[1]	37th & Southern Ave Louisville	21-111-0043	8300	39	36	35	34	0	0	16.9

PM_{10} Criteria Pollutant Summary Report – 2013 Continued

County	Site	AIRS-ID	# Obs	24-hour Average				Act Obs > 150	Exp Obs > 150	Mean
				1st Max	2nd Max	3rd Max	4th Max			
Jefferson[1]	1032 Beecher Ave Louisville	21-111-0044	8548	40	34	33	33	0	0	15.9
McCracken	342 Lone Oak Rd Paducah	21-145-1004	35	33	28	28	28	0	0	17.6 *
McCracken	2901 Powell Street Paducah	21-145-1024	23	39	32	30	30	0	0	20.0 *
Marshall	24 Main Street Calvert City	21-157-0018	58	24	23	22	22	0	0	13.3

PM_{10} Criteria Pollutant Summary Report – 2013
Estimated Number of Annual Exceedances, Expected 3-Year Average

County	Site	AIRS-ID	Estimated Number of Exceedances			
			2011	2012	2013	Expected 3-Year Avg
Boyd	21st & Greenup Ashland	21-019-0002	0	6.5	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 *
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
McCracken	342 Lone Oak Rd Paducah	21-145-1004	0	0	0 *	0 *
McCracken	2901 Powell Street Paducah	21-145-1024	---	---	0 *	0 *
Marshall	24 Main Street 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.

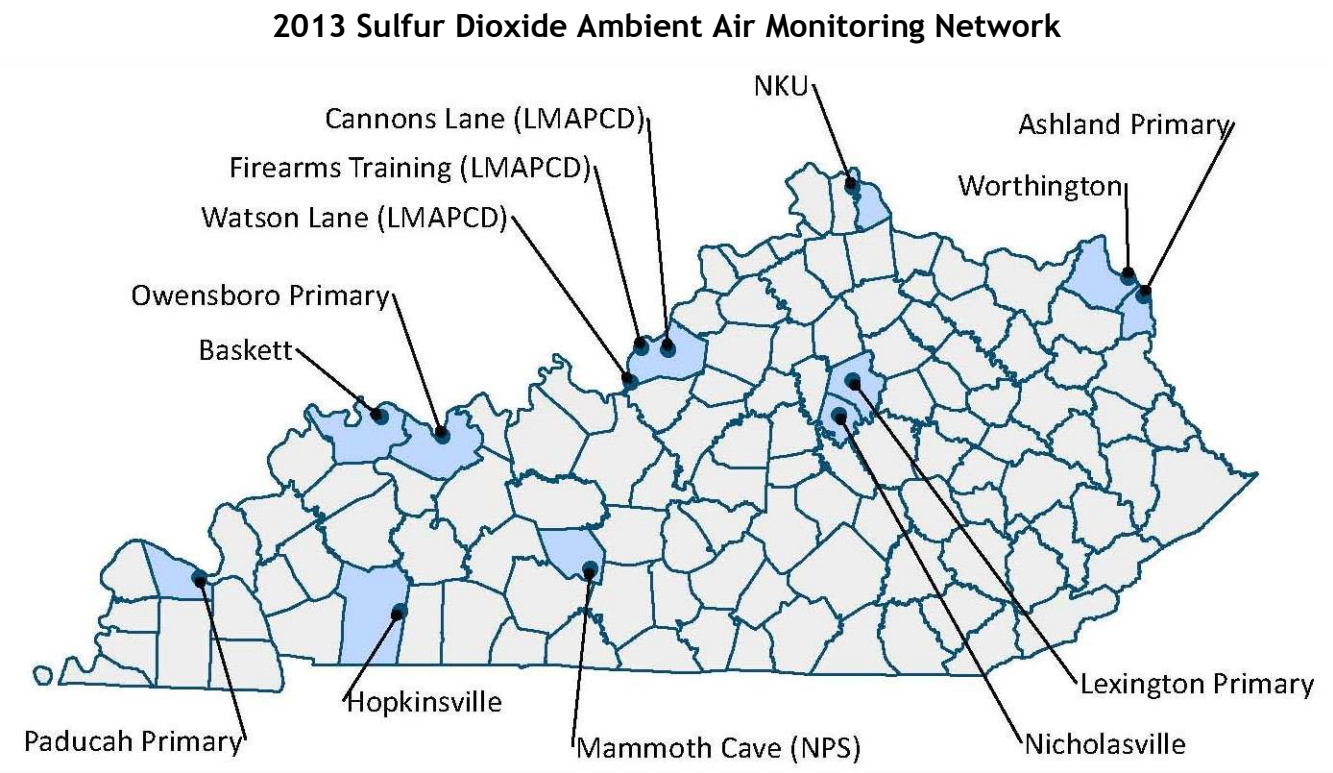


Figure 45: Sulfur dioxide monitoring locations in Kentucky.

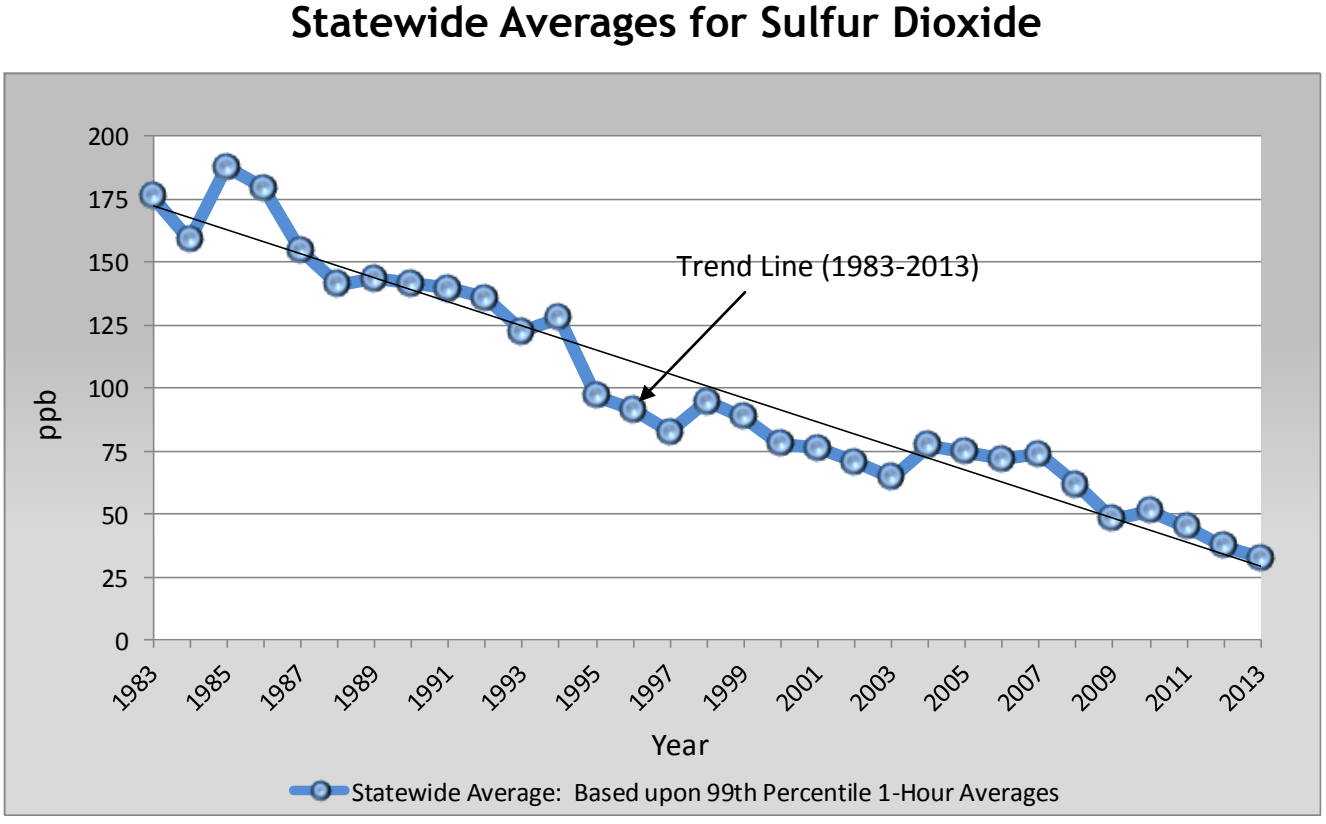


Figure 46: Statewide averages for SO_2 monitoring indicate pollution reductions.

Sulfur Dioxide Results

In 2013, the division, the NPS at Mammoth Cave, and LMAPCD operated 13 SO_2 monitors in Kentucky. Three sites recorded daily maximum one-hour averages greater than 75 ppb, but only two sites were 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.

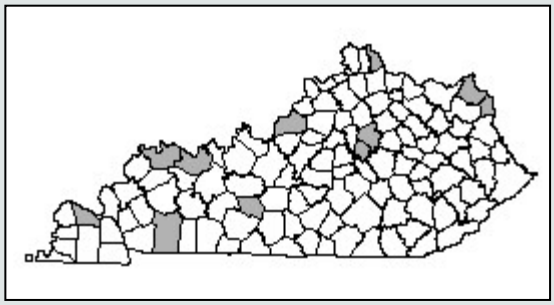
Statewide and regional sulfur dioxide levels have declined over the past twenty years. The SO_2 allowances component of the Acid Rain Program provides an opportunity for electric utilities to participate in a market-based trade of SO_2 emissions. An electric utility that is participating in the trading 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 - 2013

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	8695	25.0	20.0	0	4.9	4.5	0
Campbell	524A John Hill Rd Highland Heights	21-037-3002	8679	125.0	125.0	3	23.1	21.1	0
Christian	10800 Pilot Rock Rd Hopkinsville	21-047-0006	8445	18.0	17.0	0	5.3	3.4	0

SO_2 Criteria Pollutant Summary Report – 2013 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	8607	78.0	61.0	1	14.2	9.7	0
Edmonson[1]	Alfred Cook Road Mammoth Cave	21-061-0501	8116	24.5	12.8	0	3.4	2.8	0
Fayette	650 Newtown Pike Lexington	21-067-0012	8522	32.0	14.0	0	3.3	3.0	0
Greenup	Scott & Center St. Worthington	21-089-0007	8713	18.0	13.0	0	4.9	4.8	0
Henderson	Baskett Fire Dept. Baskett	21-101-0014	8534	62.0	30.0	0	9.5	8.7	0
Jefferson[2]	7201 Watson Lane Louisville	21-111-0051	8674	172.7	158.6	18	42.7	26.5	0
Jefferson[2]	2730 Cannons Lane Louisville	21-111-0067	8546	31.9	27.5	0	7.0	6.9	0
Jefferson[2]	4201 Algonquin Pkwy Louisville	21-111-1041	8402	48.0	42.6	0	10.3	10.0	0
Jessamine	KYDOT, Etter Drive Nicholasville	21-113-0001	8531	29.0	27.0	0	3.0	2.8	0
McCracken	2901 Powell Street Paducah	21-145-1024	8674	20.0	19.0	0	3.6	3.0	0

[1] Monitor operated by the National Park Service.

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

Values in red represent an exceedance of the NAAQS.

SO_2 Criteria Pollutant Multi-Year Summary Report – 2013
Daily Maximum 1-hour 99th Percentile, 3-Year Average

County	Site Address	AQS-ID	Daily Maximum 1-Hr Average 99th Percentile			
			2011	2012	2013	3-Year Avg
Boyd	2924 Holt Street Ashland	21-019-0017	33	13	16	21
Campbell	524A John Hill Rd Highland Heights	21-037-3002	109	85	71	88
Christian	10800 Pilot Rock Rd Hopkinsville	21-047-0006	---	14 *	11	13 *
Daviess	US60 & Pleasant Valley Rd Owensboro	21-059-0005	40	37	45	41
Edmonson[1]	Alfred Cook Road Mammoth Cave	21-061-0501	12	9	11	10
Fayette	650 Newtown Pike Lexington	21-067-0012	23	15	12	17
Greenup	Scott & Center Streets Worthington	21-089-0007	49	14	12	25
Henderson	Baskett Fire Dept. Baskett	21-101-0014	30	23	28	27
Jefferson[2]	7201 Watson Lane Louisville	21-111-0051	114	147	117	126
Jefferson[2]	2730 Cannons Lane Louisville	21-111-0067	51	31	27	36
Jefferson[2]	4201 Algonquin Pkwy Louisville	21-111-1041	35	35 *	37	36 *
Jessamine	KYDOT, Etter Drive Nicholasville	21-113-0001	16	13	18	16
McCracken	2901 Powell Street Paducah	21-145-1024	27	24	18	23

[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.

2013 Hazardous Air Pollutant Ambient Air Monitoring Network

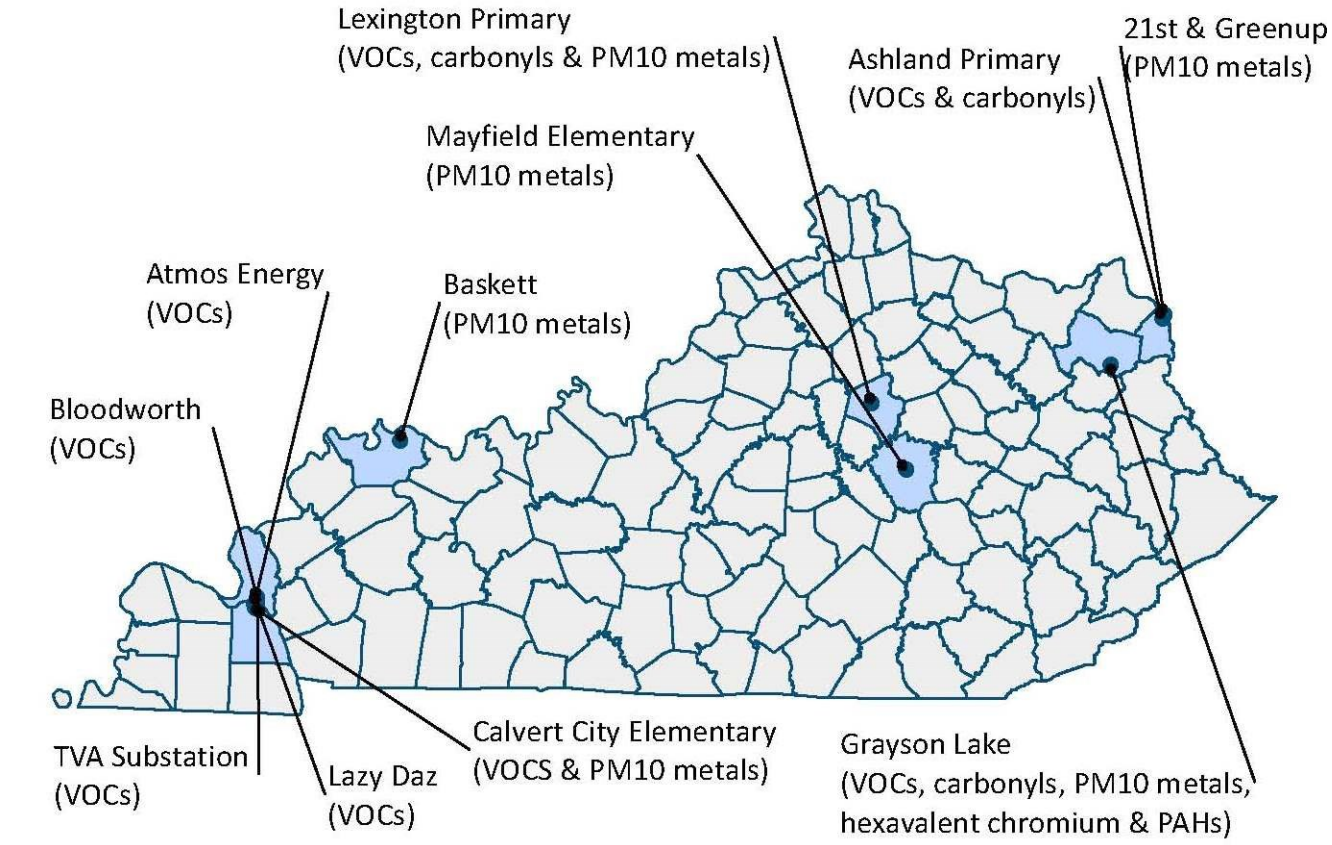


Figure 47: Hazardous air pollutant monitoring locations in Kentucky.

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 2013, 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 19 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), polycyclic aromatic hydrocarbons (PAH), and hexavalent chromium (Cr^{6+}). The compounds are sampled using the following media:

- Carbonyls: Dinitrophenylhydrazine (DNPH) adsorbent cartridges
- PM_{10} metals: Teflon® filters
- VOCs: passivated SUMMA canisters
- 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 19 NATTS pollutants of interest are 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 - 2013

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	2.26	1.28	1.23	1.12	0.66
Carter	Camp Webb Grayson Lake	21-043-0500	61	0.75	0.74	0.73	0.71	0.38
Fayette	650 Newtown Pike Lexington	21-067-0012	61	1.79	1.57	1.49	1.33	0.82

Air Toxics Summary Report - 2013

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	7.72	4.87	3.84	3.67	1.87
Carter	Camp Webb Grayson Lake	21-043-0500	61	3.44	2.79	2.28	2.15	1.07
Fayette	650 Newtown Pike Lexington	21-067-0012	61	6.77	6.54	6.22	5.50	2.37

Metals

Air Toxics Summary Report - 2013

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	60	12.60	9.05	6.87	5.62	2.11
Carter	Camp Webb Grayson Lake	21-043-0500	58	18.60	3.11	2.38	2.29	1.05
Fayette	650 Newtown Pike Lexington	21-067-0012	53	3.67	2.24	2.15	2.08	1.10
Henderson	Baskett Fire Dept. Baskett	21-101-0014	60	5.99	3.01	2.14	1.77	0.73
Marshall	24 Main Street Calvert City	21-157-0018	56	9.16	6.99	1.8	1.57	0.87

Air Toxics Summary Report - 2013

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	60	5.97	4.52	3.70	3.28	1.24
Carter	Camp Webb Grayson Lake	21-043-0500	58	2.07	1.48	1.22	1.08	0.48
Fayette	650 Newtown Pike Lexington	21-067-0012	53	2.53	1.57	1.38	1.28	0.68
Henderson	Baskett Fire Dept. Baskett	21-101-0014	60	6.37	2.07	1.96	1.91	0.82
Marshall	24 Main Street Calvert City	21-157-0018	56	3.28	2.07	1.58	1.43	0.61

Metals

Air Toxics Summary Report - 2013

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	60	0.05	0.05	0.04	0.04	0.02
Carter	Camp Webb Grayson Lake	21-043-0500	58	0.02	0.01	0.01	0.01	0.01
Fayette	650 Newtown Pike Lexington	21-067-0012	53	0.09	0.09	0.08	0.05	0.01
Henderson	Baskett Fire Dept. Baskett	21-101-0014	60	0.09	0.08	0.03	0.03	0.01
Marshall	24 Main Street Calvert City	21-157-0018	56	0.03	0.03	0.02	0.02	0.01

Air Toxics Summary Report - 2013

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	60	5.05	2.36	1.76	0.98	0.40
Carter	Camp Webb Grayson Lake	21-043-0500	58	0.28	0.20	0.20	0.19	0.09
Fayette	650 Newtown Pike Lexington	21-067-0012	53	0.49	0.21	0.17	0.16	0.10
Henderson	Baskett Fire Dept. Baskett	21-101-0014	60	0.55	0.54	0.51	0.40	0.12
Marshall	24 Main Street Calvert City	21-157-0018	56	0.31	0.29	0.26	0.25	0.09

Metals

Air Toxics Summary Report - 2013

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	60	8.51	8.44	6.62	5.49	2.26
Carter	Camp Webb Grayson Lake	21-043-0500	58	0.59	0.35	0.34	0.33	0.08
Fayette	650 Newtown Pike Lexington	21-067-0012	53	1.62	1.00	0.79	0.74	0.29
Henderson	Baskett Fire Dept. Baskett	21-101-0014	60	1.53	0.58	0.54	0.53	0.19
Marshall	24 Main Street Calvert City	21-157-0018	56	1.94	1.48	1.10	0.98	0.29

Air Toxics Summary Report - 2013

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	60	40.50	23.10	19.80	19.05	8.27
Carter	Camp Webb Grayson Lake	21-043-0500	58	4.81	4.66	3.98	3.36	1.66
Fayette	650 Newtown Pike Lexington	21-067-0012	53	13.1	8.21	6.56	5.13	2.61
Henderson	Baskett Fire Dept. Baskett	21-101-0014	60	8.59	6.67	5.12	4.98	2.16
Marshall	24 Main Street Calvert City	21-157-0018	56	9.20	8.31	6.68	4.54	2.1

Metals

Air Toxics Summary Report - 2013

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	60	56.00	55.60	53.60	53.10	19.87
Carter	Camp Webb Grayson Lake	21-043-0500	58	8.67	7.86	6.71	5.92	2.53
Fayette	650 Newtown Pike Lexington	21-067-0012	53	31.00	12.20	12.00	10.40	5.64
Henderson	Baskett Fire Dept. Baskett	21-101-0014	60	12.80	10.30	8.76	8.27	4.02
Marshall	24 Main Street Calvert City	21-157-0018	56	9.87	8.95	8.18	8.09	3.85

Air Toxics Summary Report - 2013

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	60	21.20	17.10	5.49	5.30	2.40
Carter	Camp Webb Grayson Lake	21-043-0500	58	1.42	1.34	1.20	1.03	0.34
Fayette	650 Newtown Pike Lexington	21-067-0012	53	4.53	2.88	2.63	1.41	0.59
Henderson	Baskett Fire Dept. Baskett	21-101-0014	60	4.11	1.96	1.90	1.47	0.61
Marshall	24 Main Street Calvert City	21-157-0018	56	2.14	0.96	0.84	0.82	0.42

Volatile Organic Compounds

Air Toxics Summary Report - 2013

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	0.088	0.074	0.073	0.066	0.026
Carter	Camp Webb Grayson Lake	21-043-0500	61	0.057	0.042	0.040	0.033	0.019
Fayette	650 Newtown Pike Lexington	21-067-0012	45	0.084	0.054	0.051	0.050	0.030 *
Livingston	763 Bloodworth Rd Smithland	21-139-0004	59	4.540	3.650	3.260	1.030	0.285
Marshall	TVA Substation Calvert City	21-157-0014	61	9.690	9.400	1.650	1.490	0.463
Marshall	Atmos Energy Calvert City	21-157-0016	61	0.294	0.115	0.096	0.094	0.029
Marshall	563 East Fifth St Calvert City	21-157-0018	61	5.570	0.117	0.090	0.086	0.117
Marshall	4237 Gilbertsville Calvert City	21-157-0019	60	9.450	5.540	0.506	0.253	0.295

*** Incomplete dataset.**

Volatile Organic Compounds

Air Toxics Summary Report - 2013

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	0.077	0.074	0.050	0.050	0.027
Carter	Camp Webb Grayson Lake	21-043-0500	61	0.028	0.027	0.022	0.021	0.002
Fayette	650 Newtown Pike Lexington	21-067-0012	45	0.044	0.034	0.033	0.032	0.018 *
Livingston	763 Bloodworth Rd Smithland	21-139-0004	59	5.920	0.260	0.093	0.058	0.129
Marshall	TVA Substation Calvert City	21-157-0014	61	0.421	0.393	0.125	0.122	0.046
Marshall	Atmos Energy Calvert City	21-157-0016	61	0.049	0.048	0.044	0.042	0.022
Marshall	563 East Fifth St Calvert City	21-157-0018	61	0.078	0.038	0.037	0.033	0.021
Marshall	4237 Gilbertsville Calvert City	21-157-0019	60	0.061	0.058	0.056	0.045	0.024

*** Incomplete dataset.**

Volatile Organic Compounds

Air Toxics Summary Report - 2013

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	0.147	0.143	0.13	0.128	0.104
Carter	Camp Webb Grayson Lake	21-043-0500	61	0.156	0.148	0.134	0.132	0.106
Fayette	650 Newtown Pike Lexington	21-067-0012	45	0.150	0.133	0.127	0.125	0.104 *
Livingston	763 Bloodworth Rd Smithland	21-139-0004	59	3.760	0.264	0.159	0.150	0.177
Marshall	TVA Substation Calvert City	21-157-0014	61	0.366	0.348	0.206	0.18	0.126
Marshall	Atmos Energy Calvert City	21-157-0016	61	0.149	0.139	0.136	0.127	0.106
Marshall	563 East Fifth St Calvert City	21-157-0018	61	0.136	0.131	0.130	0.128	0.106
Marshall	4237 Gilbertsville Hwy Calvert City	21-157-0019	60	0.204	0.147	0.132	0.130	0.108

*** Incomplete dataset.**

Volatile Organic Compounds

Air Toxics Summary Report - 2013

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	0.030	0.030	0.029	0.029	0.018
Carter	Camp Webb Grayson Lake	21-043-0500	61	0.038	0.034	0.03	0.027	0.019
Fayette	650 Newtown Pike Lexington	21-067-0012	45	0.031	0.030	0.029	0.027	0.019 *
Livingston	763 Bloodworth Rd Smithland	21-139-0004	59	3.810	3.310	1.810	1.370	0.314
Marshall	TVA Substation Calvert City	21-157-0014	61	27.300	4.770	3.320	3.320	0.918
Marshall	Atmos Energy Calvert City	21-157-0016	61	0.459	0.382	0.375	0.209	0.073
Marshall	563 East Fifth St Calvert City	21-157-0018	61	0.440	0.371	0.221	0.183	0.059
Marshall	4237 Gilbertsville Hwy Calvert City	21-157-0019	60	2.77	1.790	0.866	0.545	0.172

*** Incomplete dataset.**

Volatile Organic Compounds

Air Toxics Summary Report - 2013

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

County	Site	AQS-ID	# Obs	1st max	2nd max	3rd max	4th max	Annual Mean
Boyd	2924 Holt Street Ashland	21-019-0017	61	0.030	0.030	0.026	0.024	0.010
Carter	Camp Webb Grayson Lake	21-043-0500	61	0.017	0.013	0.013	0.012	0.003
Fayette	650 Newtown Pike Lexington	21-067-0012	45	0.070	0.020	0.020	0.017	0.009 *
Livingston	763 Bloodworth Rd Smithland	21-139-0004	59	0.022	0.015	0.014	0.013	0.006
Marshall	TVA Substation Calvert City	21-157-0014	61	0.091	0.023	0.017	0.016	0.007
Marshall	Atmos Energy Calvert City	21-157-0016	61	0.040	0.027	0.020	0.020	0.008
Marshall	563 East Fifth St Calvert City	21-157-0018	61	0.019	0.019	0.015	0.015	0.007
Marshall	4237 Gilbertsville Hwy Calvert City	21-157-0019	60	0.111	0.019	0.018	0.015	0.009

*** Incomplete dataset.**

Volatile Organic Compounds

Air Toxics Summary Report - 2013

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	0.007	0.007	0.006	0.004	0.000
Carter	Camp Webb Grayson Lake	21-043-0500	61	0.009	0.008	0.007	0.006	0.001
Fayette	650 Newtown Pike Lexington	21-067-0012	45	0.009	0.008	0.007	0.006	0.001 *
Livingston	763 Bloodworth Rd Smithland	21-139-0004	59	0.009	0.009	0.009	0.008	0.002
Marshall	TVA Substation Calvert City	21-157-0014	61	0.009	0.008	0.008	0.008	0.001
Marshall	Atmos Energy Calvert City	21-157-0016	61	0.008	0.008	0.008	0.008	0.001
Marshall	563 East Fifth St Calvert City	21-157-0018	61	0.010	0.009	0.008	0.008	0.001
Marshall	4237 Gilbertsville Hwy Calvert City	21-157-0019	60	0.009	0.009	0.009	0.009	0.002

*** Incomplete dataset.**

Volatile Organic Compounds

Air Toxics Summary Report - 2013

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	0.009	ND	ND	ND	0.000
Carter	Camp Webb Grayson Lake	21-043-0500	61	0.008	ND	ND	ND	0.000
Fayette	650 Newtown Pike Lexington	21-067-0012	45	0.014	0.012	0.011	ND	0.001 *
Livingston	763 Bloodworth Rd Smithland	21-139-0004	59	0.027	0.009	0.009	0.009	0.001
Marshall	TVA Substation Calvert City	21-157-0014	61	0.111	0.044	0.022	0.021	0.004
Marshall	Atmos Energy Calvert City	21-157-0016	61	0.030	0.023	0.015	0.014	0.002
Marshall	563 East Fifth St Calvert City	21-157-0018	61	0.015	0.008	ND	ND	0.000
Marshall	4237 Gilbertsville Hwy Calvert City	21-157-0019	60	0.010	0.010	0.008	ND	0.000

*** Incomplete dataset.**
ND= Analyte not detected.

Volatile Organic Compounds

Air Toxics Summary Report - 2013

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	ND	ND	ND	ND	0.000
Carter	Camp Webb Grayson Lake	21-043-0500	61	ND	ND	ND	ND	0.000
Fayette	650 Newtown Pike Lexington	21-067-0012	45	0.010	0.007	ND	ND	0.000 *
Livingston	763 Bloodworth Rd Smithland	21-139-0004	59	1.780	0.501	0.388	0.179	0.069
Marshall	TVA Substation Calvert City	21-157-0014	61	2.370	1.270	0.386	0.288	0.113
Marshall	Atmos Energy Calvert City	21-157-0016	61	1.950	1.910	1.600	1.460	0.232
Marshall	563 East Fifth St Calvert City	21-157-0018	61	0.154	0.072	0.053	0.052	0.014
Marshall	4237 Gilbertsville Hwy Calvert City	21-157-0019	60	0.336	0.145	0.140	0.127	0.026

*** Incomplete dataset.**
ND= Analyte not detected.

Volatile Organic Compounds

Air Toxics Summary Report - 2013

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	13.600	0.997	0.821	0.567	0.474
Carter	Camp Webb Grayson Lake	21-043-0500	61	0.860	0.481	0.403	0.320	0.152
Fayette	650 Newtown Pike Lexington	21-067-0012	45	0.509	0.379	0.354	0.344	0.208 *
Livingston	763 Bloodworth Rd Smithland	21-139-0004	59	0.901	0.894	0.733	0.498	0.211
Marshall	TVA Substation Calvert City	21-157-0014	61	2.000	1.450	1.260	1.150	0.323
Marshall	Atmos Energy Calvert City	21-157-0016	61	0.341	0.339	0.288	0.281	0.167
Marshall	563 East Fifth St Calvert City	21-157-0018	61	0.353	0.294	0.287	0.270	0.155
Marshall	4237 Gilbertsville Hwy Calvert City	21-157-0019	60	0.949	0.537	0.470	0.439	0.195

*** Incomplete dataset.**

Polycyclic Aromatic Hydrocarbons

Air Toxics Summary Report - 2013

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	184.00	60.10	56.30	37.90	18.74
Acenapthene (TSP)	58	1.220	1.090	0.861	0.712	0.349
Acenapthtylene (TSP)	58	1.740	0.500	0.330	0.202	0.096
Fluorene (TSP)	58	2.850	2.640	1.950	1.690	0.729
Phenanthrene (TSP)	58	4.830	4.750	3.120	3.090	1.731
Anthracene (TSP)	58	0.308	0.266	0.192	0.169	0.087
Retene (TSP)	58	1.200	0.359	0.349	0.291	0.118
Fluoranthene (TSP)	58	1.290	1.280	1.140	1.100	0.572
Pyrene (TSP)	58	0.725	0.659	0.585	0.518	0.294
Chrysene (TSP)	58	0.366	0.360	0.345	0.276	0.080
Benzo (a) anthracene (TSP)	58	0.195	0.176	0.138	0.111	0.026
Benzo (b) fluoranthene (TSP)	58	0.644	0.577	0.403	0.309	0.102
Benzo (k) fluoranthene (TSP)	58	0.156	0.133	0.106	0.063	0.019
Benzo (e) pyrene (TSP)	58	0.281	0.262	0.188	0.188	0.044
Dibenzo (a, h) anthracene (TSP)	58	0.047	0.046	0.044	0.038	0.004
Indeno (1,2,3-cd) pyrene (TSP)	58	0.342	0.287	0.214	0.145	0.045

Hexavalent Chromium

Air Toxics Summary Report - 2013

Site: Camp Webb-Grayson Lake, Boyd County

AQS ID: 21-043-0500

Method: Ashless cellulose filters; IC UV-VIS

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
Hexavalent Chromium	30	0.0262	0.0230	0.0195	0.0151	0.0028 *

*** Incomplete dataset.**

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
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.

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.

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.

CRITERIA POLLUTANTS, Cont'd.

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.

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 through a catalytic converter that converts the NO_2 in the sample to NO. The second air stream then reacts with ozone, providing a total measurement of nitrogen oxides (NO_x) in the sample.

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

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.

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.

On May 27, 2008, the EPA adopted a new 8-hour standard set at 0.075 ppm. On Sept. 16, 2009, EPA notified the Court of its decision to initiate a rulemaking to reconsider the 2008 ozone standard. However, on Sept. 16, 2011, the EPA announced their plans to implement the 2008 ozone NAAQS of 0.075 ppm.

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.

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 data.

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.

Health and Environmental Impacts

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

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

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.

Health and Environmental Impacts

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

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

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

How is SO_2 monitored?

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

Division for Air Quality
Regional Office Boundaries

air.ky.gov

Environmental Emergency, 24-hour; (502) 564-2380 or (800) 928-2380
Open burn complaints: 888-BURNLAW (888-287-6529)

Florence Region
Clay Redmond, Supervisor
8020 Veterans Memorial Dr., Suite 110
Florence, KY 41042
(859) 525-4923
Fax: (859) 525-4157

Frankfort Region
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APPENDIX D: GLOSSARY OF ABBREVIATIONS

AHERA Asbestos Hazard Emergency Response Act

AQI Air Quality Index

BACT Best Available Control Technology

CAA Clean Air Act

CO Carbon Monoxide

CO_2 Carbon Dioxide

CPT Cost per Ton

CSAPR Cross-State Air Pollution Rule

DAQ Division for Air Quality

DEP Department for Environmental Protection

DERA Diesel Emissions Reduction Act

EEC Energy and Environment Cabinet

EGU Electric Generating Unit

EPA Environmental Protection Agency

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).

ACKNOWLEDGMENTS

Governor Steven L. Beshear **Secretary Leonard K. Peters**

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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